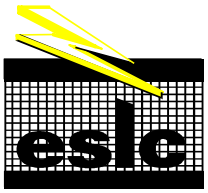
ICS

ESLCVoteNRS 071:2004

ISBN

Edition 1

AUTOMATED METER READING FOR LARGE POWER USERS



ESLCVoteNRS 071:2004

This rationalized user specification is issued by
the Technology Standardization Department (TSD), Eskom
on behalf of the
User Group given in the foreword
and is not a standard as contemplated in the Standards Act, 1993 (Act No. 29 of 1993).

Table of changes

Change No.	Date	Text affected

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Printed in the Republic of South Africa
by Standards South Africa
1 Dr Lategan Road, Groenkloof, Pretoria

Foreword

This specification was prepared on behalf of the Electricity Suppliers Liaison Committee (ESLC).

The Working Group comprised the following members:

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H Groenewald	Eskom (Pretoria Distribution)
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A Manufacturers Interest Group (MIG) was consulted on the contents of this specification and its comments were incorporated where the working group was in agreement. The MIG comprised the following members:

A Geva	Intelligent Metering System
H Hayes	Landis & Gyr S.A. (Pty) Ltd
D Henriksen	Alstom Measurements
F Hoosen	Alstom Measurements
G Mellis	Power Meter Technics (Pty) Ltd
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J Roos	Power Meter Technics (Pty) Ltd
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Introduction

With the restructuring of the Electricity Supply Industry the need for more accurate and regular information is required. To continue taking manual readings would be unfeasible as the vast quantities of data passing between departments would threaten data integrity and place a huge pressure on available resources. A possible solution to this dilemma would be the automated meter reading (AMR). Currently there is no standardization of the AMR industry in South Africa. Consequently utilities become locked into using a single supplier to source spares. This specification seeks to create an environment where it is possible to interchange AMR meters from different manufacturer's with a minimum of system changes. It specifies the requirements of the AMR meter and the Data Acquisition system. It is restricted to large power users as is defined by the utility concerned. The data needs for small power users are different and therefore do not form part of this specification.

Keywords

automated meter reading, remote metering, metering.

Contents

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AUTOMATED METER READING FOR LARGE POWER USERS

1 Scope

This specification is applicable to AMR systems in South Africa for large power users as defined by the relevant electricity supply authority and it does not cover the communication system between the AMR meter and remote master station.

NOTE An overview of an AMR system is presented in annex A.

2 Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this specification. At the time of publication, the references indicated were valid. Compilers of documents are encouraged to apply the most recent editions of the documents listed below. Information on currently valid national and international standards and specifications can be obtained from Standards South Africa.

BS 5685, *Electricity Meters.*

IEC 62052 – 11, *Electricity metering requirements: General Requirements, tests and test conditions – Part 11:Metering equipment.*

IEC 62053 – 21, *Electricity metering requirements (a.c.): Particular requirements – Part 21:Static meters for active energy (classes 1 and 2)*.

IEC 62053 – 23, *Electricity metering requirements (a.c.): Particular requirements – Part 23: Static meters for reactive energy (classes 1 and 2).*

IEC 62056 – 21, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 21: Direct local data exchange.*

IEC 62056 – 31, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 31- Use of local area networks on twisted pair with carrier signalling.*

IEC 62056 – 61, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 61 –Object Identification System (OBIS).*

NRS 057 – 2, *Electricity metering – Part 2:Minimum requirements*

3. Terms, definitions and abbreviations

For the purpose of this specification, the following terms, definitions and abbreviations apply:

3.1 Terms and definitions

active energy
integral of active power with respect to time. For the purposes of this document, the unit of measurement will be kWh

billing month
time period over which the energy registers are accumulated before they are used to generate a bill. The billing month does not necessarily correspond to a calendar month

channel
load profile data corresponding to one of the measurands such as kWh or kVAh

data acquisition system
software package capable of reading the data from all meter types for the transfer to other applications such as the billing system

demand
average kW or kVA measured during an integration period

integrating period
time period, in minutes, over which the energy readings are summed

load factor
factor that allows for the average period in which an appliance uses maximum load, derived by average load divided by the maximum demand
NOTE Power outage hours must be excluded from load factor calculations

master station
device that is capable of accessing a number of encoders and meters and transferring data from these devices. Also known as a Data Acquisition System

maximum demand
highest registered electrical demand integrated over a specified period

metering device configuration
configuration of clocks, registers and memory which can be configured in any way by the user so as to implement switching times, rate registers, display sequences, integrating periods etc. The action of changing the configuration of the device is called configuring. This definition is included to address the confusion of terms – reference is often made to “programming” the meters by the users, whereas what actually occurs is the configuration of meters. See “metering device program”

metering device program
code executing on the embedded controller or other form of processor (s) implemented in the metering device. This code is produced by the meter manufacturer and cannot be changed by the user in any way. This is usually referred to as the firmware of the meter

metering information
origin of metering information is the metering point or the point of supply. All information related to metering equipment will be referred to as metering information. The term “information” is used to include data (unprocessed information), processed and stored information. This includes the following:

a) configuration data: relates directly to the metering device itself. It uniquely describes the processing inherent in the device which converts secondary electrical quantities (voltage and current) into the required measurand. See “metering device configuration”;

b) status data: data relates to the condition of the metering device and the validity of the metering information which originates from it. It could be contained in the information presented at the site interface, or elsewhere in the metering system; and

c) metering data: refers to the measurands of energy values, (active, reactive and apparent), and the instantaneous values which may be available from the meter.

metering information manipulation system
information management system into which metering information is entered, and which is able to produce reports and manipulations on the information according to the needs of the various users of the metering system. The “metering master station” often referred to in practice is a specific implementation of this concept

non-volatile memory
medium for storage of information that retains the information in the event of loss of the auxiliary power supply for a period of at least two years

optical port
infra-red communications port

power outage recording
recording dates, times and reasons for power outages

protocol driver
software interface code to translate propriety meter code to values that the master station or data acquisition system can utilize

quality of supply
technical parameters to describe the electricity supplied to customers and that are used to determine the extent to which the needs of customers are met in the utilization of electricity

reactive energy
integral of reactive power with respect to time. For the purpose of this document, reactive energy is the energy measured in kvarh

real time clock
device that maintains to an acceptable level of accuracy, information describing the date and time of day. This information is maintained irrespective of whether power is supplied to the unit within which the clock is installed

register
term was derived from the visible dial on the face plate of the electromechanical meters, where the register provided an indication of the energy usage. In electronic meters, this term refers to the non-volatile memory locations within the metering device where similar energy usage information is stored

raw data
data that is extracted from the meter without any processing/manipulation

time of use metering
ability to record consumption according to time-dependant tariffs

total consumption
integrated electrical consumption from a specified time until the register is reset

tamper detection

means of detecting whether unauthorized individuals have accessed the meter

3.2 Abbreviations

AMR: automated meter reading

COSEM: companion specification for energy metering

DAS: data acquisition system (also known as master station)

DLMS: device language message specification

GSM: global system for mobile communications (cellular communication)

HHU: hand held units

PSTN: public switched telephone network

QOS: quality of supply

SANAS: South African national accreditation system

SAST: South African Standard Time

UPS: Uninterruptible Power Supply

4. Requirements

4.1 Requirements for the AMR meter

4.1.1 Function of the AMR meter

The function of the electronic AMR meter is basically to record and register energy consumption and provides a means to download the metering data to a data acquisition system.

4.1.2 Accuracy class

4.1.2.1 AMR meter accuracy classes and applicable standards shall be as stated in NRS 057-2.

4.1.2.2 The AMR meters shall be able to record the active and reactive energy, with the accuracy of the active energy being at least class 1 and the accuracy of the reactive energy being at least class 3, in accordance with IEC 62052-11 and IEC 62053-21. The accuracy limits of the AMR meter shall comply with the requirements specified in IEC 62052-11 and IEC 62053-21 or IEC 62053-23 for the given accuracy class claimed at the various loads and for the various influence factors.

4.1.3 Configuration and data storage of the AMR meter

The following parameters shall be stored in a non-volatile memory:

a) all configuration data;

b) all registers containing metering data; and

c) load profiles.

4.1.4 Communication protocols

4.1.4.1 DLMS/COSEM is the only protocol that has been standardized by the IEC (62056) for AMR meters. DLMS/COSEM is thus the preferred protocol for use with AMR meters. This specification shall not limit itself only to DLMS/COSEM compliant meters but at the very least the AMR meter must comply with IEC 62056 Part 21 (IEC 1107).

4.1.4.2 Communication protocols (including proprietary protocols) must be freely available to all third-party users and it is the meter manufacturers' responsibility to make sure that the AMR master station (DAS) can communicate with the meter. (The management system must be able to communicate to all AMR meters stipulated by the user).

4.1.5 Measurands and direction of power flow

4.1.5.1 The AMR meter is required to meter and register active energy, reactive energy and active and apparent demand as a minimum.

4.1.5.2 Depending on the relevant application specification the AMR meters shall be able to register the measurands in the following way:

a) Unidirectional and specified for:

1) import active energy (with reference to the customer); and

2) export, lagging reactive energy. By definition, this is the energy measured in quadrant 1, where the phase angle is lagging, and the power is consumed by the customer.

b) Bi-directional and specified for:

1) import and export active energy (with reference to the customer);

2) lagging reactive energy. By definition, this is the energy measured in quadrant 1, where the phase angle is lagging, and the power is being consumed by the customer, or quadrant 3, where the phase angle is lagging, and the power is being generated by the customer; or

c) bi-directional and specified for:

1) import active energy (with reference to the customer);

2) leading and lagging reactive energy. By definition, this is the energy measured in quadrant 1, where the phase angle is lagging and the power is being consumed by the customer, or quadrant 4, where the phase angle is leading and the power is being consumed by the customer; or

d) Bi-directional and specified for:

1) import and export active energy (with reference to the customer); and

2) leading and lagging reactive energy. By definition, this is referred to as four quadrant metering.

4.1.6 Calculation of demand

Details regarding the algorithms used in calculating active and reactive power, energy components and demand shall be supplied with each tender.

4.1.7 Load profile (mass memory)

4.1.7.1 The AMR meter shall cater for at least four channels of load profiling memory (import and export active and reactive energy) for a period of at least 100 days over a 30 min integration period.

4.1.7.2 These channels shall be user configurable depending on the needs of the installation.

4.1.7.3 The integration period shall be user configurable to cater for typical intervals of 60 min, 30 min and 15 min. The integration periods will be of block or sliding block type only, with preference for block type.

4.1.7.4 The following non-interval data shall also be stored on the AMR meter and it shall be able to retrieve this data through remote communications:

1) Energy registers (active and reactive – import and export),

2) Status alarms to verify the integrity of the data.

4.1.7.5 All data should be date and time stamped at the AMR meter.

4.1.8 Real time clock

General
The correct functioning of the metering device for complicated tariff structures requires a real time clock for the correct energy values to be added cumulatively, or to be stored separately. This section describes the requirements of this clock.

4.1.8.1 The metering system shall have a real time clock that will not drift by more than 60 s every 30 days. This clock may be synchronized to line frequency or a crystal oscillator circuit. The crystal shall be within accuracy limits for the total temperature range specification of the AMR meter.

4.1.8.2 A facility shall exist to synchronize the clock using an external source either via an input pulse and/or through remote interrogation. When the time on the AMR meter is being corrected it shall be possible to do so without resetting any other parameters in the AMR meter. The synchronization shall be indicated in the load profile if the period is longer or shorter to facilitate consumption validation.

4.1.8.3 During any loss of supply, the time of the clock shall be maintained by, for example, a crystal oscillator circuit and a back-up battery for a period of 10 days.

4.1.9 Local display

4.1.9.1 Although an AMR meter's data will be read automatically, there is still a need to display registers locally on the AMR meter for use as a check by customers and for maintenance purposes.

4.1.9.2 It shall be possible to display the contents of all relevant registers in a user defined sequence. This sequence will be flexible to cater for local tariff structures.

4.1.9.3 The display shall comply with the following requirements:

a) the display shall have anti-glare and non-blinking properties. Filters shall have a non-reflective finish and be suitable for use in direct sunlight;

b) the display intensity shall not be sensitive to variations in auxiliary supply voltage and frequency, for variations of ± 20 % for the voltage, and ± 5 % for the frequency; and

c) the resolution of the display shall comply with the requirement of BS 5685 in a way that the values on the display do not saturate and scroll over in a certain period. It is preferred that this

resolution be changed automatically depending on any instrument transformer selections but AMR meters shall allow manual changing of the resolution.

4.1.9.4 The AMR meter shall support the display of various engineering data. The following is required as a minimum:

a) voltages per phase;

b) currents per phase;

c) angle between voltage and current per phase;

d) instantaneous apparent demand;

e) number of power outages; and

f) history of configurations (time and date of last configuration).

NOTE It would be beneficial if these values can be retrieved through the remote communication media.

4.1.10 Pulsing

4.1.10.1 Output pulses shall be provided for all measurands depending on the metered quantities selected, i.e. if option (c) is selected, output pulses for import and export kWh as well as import leading and lagging, and export leading and lagging kvarh shall be supported.

4.1.10.2 A Pulse shall also be provided to indicate the end of integration period.

4.1.0.3 Additional pulses may be provided to indicate load control functionality (e.g. peak demand usage), but is not required as a minimum.

4.1.11 Communication interfaces

4.1.11.1 All AMR meters shall have an optical port compliant with IEC 62056-21. This port shall support direct configuration of the AMR meter through the meters configuration software and the manual downloading of AMR meter information.

4.1.11.2 Meters shall support modular industry standard ports for AMR meter reading via remote methods e.g. RS232, RS485, TCP/IP, etc.

4.1.11.3 Meters shall support the cascading of multiple devices to one communication media.

4.1.12 Calibration facilities

The AMR meters shall have local facilities for the calibration to be checked by the testing staff.

4.1.12.1 A configurable flashing light emitting diode (LED) shall be provided on the face-plate of the meter for each measured energy quantity for calibration purposes. This LED shall comply with IEC 62052–11. Alternatively other means of test and calibration should be according to internationally accepted standards.

4.1.12.2 The pulse rate of the LEDs shall be indicated on the face-plate of the device and shall be directly proportional to small increments in the energy measured by the device. The pulse rate shall comply with IEC 62052-11.

4.1.13 Maximum demand reset

The device shall maintain a register that contains the maximum demand over a billing month period. For this reason a demand reset switch shall be supplied as part of the metering device. The requirements of this reset switch are as follows:

4.1.13.1 The facility shall exist to manually or automatically reset the maximum demand registers at the end of the billing month. Registers for at least the previous three billing periods shall be maintained in the meter.

4.1.13.2 If the metering device has the facility to reset all the monthly registers to zero at the start of each billing month this facility shall be stated and it shall be possible to cancel this facility.

4.1.13.3 The manual reset mechanism shall be sealable with a mechanical seal. An electronic seal such as password protection mechanism shall not be acceptable. A key reset mechanism shall also not be acceptable.

4.1.13.4 It shall be possible to display the previous demand period or historical register contents on the local display.

4.1.14 Electrical requirements

4.1.14.1 General electrical requirements

4.1.14.1.1 Under normal operating conditions, windings, insulation and other components shall not reach a temperature that might adversely affect the operation or expected life of the meter.

4.1.14.1.2 Any batteries used shall have a minimum life of ten years under normal operating conditions and shall have a backup capacity of at least three years in the absence of auxiliary power.

4.1.14.1.3 The AMR meter and its incorporated auxiliary devices, if any, shall retain adequate dielectric qualities under normal conditions of use, taking into account the atmospheric influences and different voltages to which they are subjected under normal conditions of use.

4.1.14.2 Supply inputs

4.1.14.2.1 The standard reference frequency is 50 Hz ± 5 %.

4.1.14.2.2 The standard reference voltage is 110 V for 110 V 1 A and 5 A three-wire AMR meters, 63,5 V for 63,5 V 1 A and 5 A four-wire meters and 400 V for 400 V 5 A and 400 V 100 A four-wire AMR meters.

4.1.14.2.3 The standard basic current is 1 A for a 1 A meter and 5 A for a 5 A AMR meter. Whole current AMR meters shall have provision for a basic current of less than or equal to 40 A.

4.1.14.2.4 The AMR meter shall operate correctly with a maximum current input of at least 120 % of the standard basic current of the meter for current transformer connected AMR meters and at least 100 A for whole current AMR meters.

4.1.14.2.5 The AMR meter shall operate correctly with a maximum voltage input of at least 120 % of the standard reference voltage of the meter.

4.1.14.2.6 The AMR meter shall have the facility to assign two user configurable multipliers to the AMR meter readings. These will be the current transformer and the voltage transformer ratios. It shall be possible to enter non-standard ratios such as 500 V to 110 V.

4.1.14.3 AMR meter burden

4.1.14.3.1 The burden of each voltage circuit at the reference voltage, the reference temperature and reference frequency shall not exceed 2 W and 10 VA.

4.1.14.3.2 The burden of each current circuit at the reference voltage, the reference temperature and the reference frequency shall not exceed 2,5 VA.

4.1.14.3.3 If the AMR meter is supplied by an external auxiliary supply then the loss in each auxiliary voltage circuit at the reference voltage shall not exceed 4 W and 8 VA and an additional 2 W, 3 VA for every 100 V or part thereof above 240 V.

4.1.14.4 Auxiliary circuits

4.1.14.4.1 The device shall operate from either the phase voltages or from a single-phase auxiliary supply.

4.1.14.4.2 If present, the auxiliary supply shall be a nominal 110 V phase-to-phase for a 110 V AMR meter and a nominal 230 V phase-to-neutral supply for a 400 V AMR meter.

4.1.14.4.3 The AMR meter shall operate reliably with an auxiliary supply over a range of ± 20 % of the nominal voltage and a frequency of 50 Hz ± 5 %.

4.1.14.5 AMR meter connection

4.1.14.5.1 Three-phase, three-wire and three-phase four-wire meters shall be provided for three-phase networks.

4.1.14.5.2 If a three-phase three-wire AMR meter is used there shall be two metering elements.

4.1.14.5.3 If a three-phase, four-wire AMR meter is used there shall be three metering elements.

4.1.14.6 Pulse outputs

4.1.14.6.1 The AMR meter shall have potential free contacts with output pulses for retransmitting active and reactive energy. These contacts shall be fully configurable in terms of the measurand being indicated and the energy value of each pulse.

4.1.14.6.2 The energy pulses shall be provided by contacts which comply with the following minimum rating:

a) a power rating of at least 50 VA;

b) switching voltage of at least 110 V d.c. and/or 230 V a.c;

c) a life expectancy of at least 10^9 operations;

d) the pulse retransmission contacts shall be normally open contacts. It is preferred that these contacts are not commoned with each other; and

e) The energy pulse output shall have a nominal duration of 80 ms ± 20 ms.

4.1.14.6.3 The AMR meter shall further have at least two individually configurable potential free auxiliary contacts for indicating the following parameters which can be used for alarms and indicators:

a) integration period resets, and

b) active tariff rates, etc.

4.1.14.6.4 These auxiliary contacts shall comply with the following minimum rating:

a) a power rating of at least 50 VA;

b) switching voltage of at least 110 V d.c. and/or 230 V a.c; and

c) a life expectancy of at least 10^8 operations.

4.1.14.6.5 All contacts shall be bounce free.

4.1.14.6.6 All relays used for external signaling shall have a minimum isolation of 2 kV between the relay coil and the contacts.

4.1.15 Mechanical requirements

4.1.15.1 General mechanical requirements

The AMR meter shall be in accordance with IEC 62052-11, IEC 62053-21, IEC 62053-23 and the following:

4.1.15.1.1 The AMR meter shall have adequate mechanical strength and shall withstand the temperature increase that is likely to occur under normal working conditions.

4.1.15.1.2 The components of the meter shall be fastened and secured against loosening during normal operating conditions as well as during transportation and commissioning.

4.1.15.1.3 The design and construction of the meter shall minimize the risks of short-circuiting of the insulation between live parts and accessible conducting parts due to accidental loosening or unscrewing of wiring or components.

4.1.15.1.4 The AMR meter shall withstand solar radiation without impairing its function. The appearance of the equipment, and in particular the legibility of the markings, shall not be altered by prolonged exposure to solar radiation.

4.1.15.2 Case

The case shall be in accordance with IEC 62052-11, IEC 62053-21, IEC 62053-23 and the terminal arrangement shall be in accordance with BS 5685.

4.1.15.2.1 Terminal blocks shall be positioned at the base of the AMR meter.

4.1.15.2.2 All wiring to and from the AMR meter shall go through the terminal block.

4.1.15.2.3 There shall be two securing screws on each terminal for the fastening of current and voltage inputs.

4.1.15.2.4 The voltage and current terminals for whole current AMR meters shall have a bore diameter of at least 8 mm and for transformer connected AMR meters a bore diameter of at least 4 mm.

4.1.15.2.5 Auxiliary inputs and outputs may either be spring clamp terminals or screw type terminals with one securing screw.

4.1.15.2.6 The terminal blocks and screws shall be of non-ferrous metal.

4.1.15.2.7 Terminal blocks shall not be mounted directly onto a printed circuit board.

4.1.15.2.8 Terminal identification shall be clearly identified on the AMR meter and through a wiring diagram situated on the AMR meter.

4.1.15.2.9 Insulation between terminals shall be in accordance with the values in IEC 62052-11, IEC 62053-21 and IEC 62053-23.

4.1.15.2.10 The terminals, the conductor fixing screws, or the external or internal conductors shall never come into contact with metal terminal covers.

4.1.15.2.11 Any internal circuits carrying current from the current terminals of the AMR meter shall be multistrand, with a rating of at least 3 A/mm^2. Specifically, no circuits that carry current from instrumentation current transformers under normal operating conditions shall be routed by way of a printed circuit board.

4.1.15.2.12 All terminal covers shall be in accordance with IEC 62052-11, IEC 62053-21, IEC 62053-23 and the following:

a) the terminal cover shall enclose the actual terminals, the conductor fixing screws, and a suitable length of the external conductors and their insulation; and

b) when the AMR meter is installed, no access to the terminals shall be possible without breaking a mechanical seal on the cover.

4.1.15.3 Sealing

Provision shall be made for sealing the AMR meter. It is a specific requirement that separate seals be provided for on the AMR meter cover, the terminal block cover and the maximum demand reset mechanism.

4.1.15.4 Clearance and creepage distances

All clearances and creepage distances shall be in accordance with IEC 62052-11, IEC 62053-21 and IEC 62053-23.

4.1.15.5 Resistance to heat and fire

Resistance to heat and fire shall be in accordance with IEC 62052-11, IEC 62053-21 and IEC 62053-23.

4.1.15.6 Protection against the penetration of dust and water

Resistance against the penetration of dust and water shall be in accordance with all requirements for the indoor AMR meter in IEC 62052-11, IEC 62053-21 and IEC 62053-23.

The AMR meter shall specifically be protected against invasion by insects.

4.1.15.7 Protection against solar radiation

The AMR meters shall be protected against solar radiation in those cases where the AMR meters are installed inside substations and are in direct sunlight due to sunshine through glass windows and also where AMR meters are installed in AMR meter boxes with windows installed to facilitate AMR meter reading without having to open the AMR meter boxes. This applies specifically to the AMR meter display which shall also be legible in the sunlight.

4.1.15.8 Rating plates

All rating plates shall be in accordance with IEC 62052-11, IEC 62053-21, IEC 62053-23 and the following:

4.1.15.8.1 The AMR meter shall be fitted with a rating plate containing the following information:

a) auxiliary power supply voltage if present;

b) electrical termination and cabling details required under the terminal cover; and

c) all markings shall be indelible, distinct and legible on the outside of the AMR meter.

4.1.15.9 Connection diagrams and terminal markings

All connection diagrams and terminal markings shall be in accordance with IEC 62052-11, IEC 62053-21, IEC 62053-23 and the following:

4.1.15.9.1 A connection diagram shall be placed inside the terminal block cover.

4.1.15.10 Climatic conditions

All AMR meters shall perform in accordance with the requirements for the climatic conditions specified in IEC 62052-11, IEC 62053-21 and IEC 62053-23.

4.1.16 Configuration software for the AMR meter

4.1.16.1 General software requirements

4.1.16.1.1 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.

4.1.16.1.2 A list of acceptably compatible computers shall be provided for any software package offered.

4.1.16.1.3 With the expected complexity of programmable metering equipment, training shall be provided for all relevant staff by the supplier of the AMR meter. This training shall cover the installation, maintenance, and operation of the system and the configuration software.

4.1.16.1.4 Provision shall be made in the configuration software to export the raw data in a flat ASCII format suitable for incorporating into a spread sheet or similar package.

4.1.16.2 Security within the software

4.1.16.2.1 Security measures, such as a hierarchical password system shall prevent the configuration information, in the meter or the configuration software, from being changed by unauthorized personnel.

4.1.16.2.2 Three levels of security shall be provided within the software to enable the following functions:

a) read only mode whereby all the registers within the AMR meter may be read;

b) reading and programming access to the meter. (programming is described below); and

c) reading, programming and configuration access to the meter.

4.1.16.2.3 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:

a) public holidays;

b) transformer factors (CT ratio and or VT ratio);

c) output pulse values; and

d) time and date.

4.1.16.3 Tariff implementation through the software

The configuration software must cater as a minimum for all the different tariff structures applied by the users of the AMR meters. Although an AMR meter's data will be read automatically, there is still a need to configure the AMR meter to reflect the customer's tariff for use as a check by customers and for maintenance and billing purposes.

The following shall be catered for:

4.1.16.3.1 The AMR meter shall be capable of measuring and recording active and reactive energy.

4.1.16.3.2 The time definitions shall be configurable in the meter in the following way:

a) it shall be possible to set up at least three different seasons within the meter's switching schedules;

b) the AMR meter shall be able to accept day, month and year when assigning seasons and holidays;

c) each season shall provide for at least four different day types. The tariff switching will be different in each of the different days;

d) at least four different time periods shall be provided for within each day (peak, standard and off-peak) and it will be possible to switch them in any possible combination.

e) two different weekend day switching schedules shall be provided for;

f) two different types of holiday day switching schedules shall be provided for; and

h) at least sixteen holiday days shall be provided for.

4.1.16.3.3 The AMR meter shall be capable of recording active and apparent demand. The date and time of occurrence shall also be captured.

4.1.16.3.4 It shall be possible to record active and apparent demand in certain time periods, for example only during peak time or a combination of peak and standard time etc.

4.1.16.3.5 Cumulative demand values shall also be available.

4.1.16.3.6 All these values shall be displayed through the meter's display in a user defined sequence. This display sequence shall be flexible enough to enable shifting displayed values in any sequence.

4.2 Requirements of the master station

4.2.1 Function of remote master station

The function of the master station or data acquisition system is basically to automatically retrieve AMR meter data, to verify the integrity of the data, to manipulate AMR meter data to represent billing information and to store the AMR meter data for a pre-determined time.

4.2.2 Data requirements

4.2.2.1 The master station will be required to retrieve data from various AMR meters in the field. The master station software shall handle various remote devices by using compatible dialer software modules.

4.2.2.2 The master station software shall cater for various integration period lengths. Minimum requirements are: 60 min interval data, 30 min interval data, and 15 min interval data.

4.2.2.3 All the protocol drivers required to manually or remotely interrogate all available AMR devices in the RSA shall be catered for by the master station software. The protocol driver shall be able to produce the same status indicators as the proprietary software. The protocol driver shall also activate a flag to indicate the usability of the data for billing purposes while a certain flag was raised.

4.2.2.4 The AMR device manufacturer shall make all meter protocol details available to the master station software developers, for implementation without restriction, so that a protocol driver can be developed to allow communication with the instrument.

4.2.2.5 The AMR device manufacturer shall also inform the master station developers and users of any protocol upgrades. All protocol upgrades shall be backwards compatible with existing systems, e.g. the existing protocol driver.

4.2.2.6 The minimum data required from AMR devices shall be as follows:

a) Register values (total values) for:

1) AMR meter unique address (serial number)

2) total active energy (kWh) (import and export);

3) total reactive energy (kvarh) (for all four quadrants);

4) maximum demand (kVA and kW);

5) time of maximum demand;

6) date of maximum demand;

7) time of use of total energy registers;

b) Integration period values (load profile data) for:

1) active energy (kWh) (import and export);

2) reactive energy (kvarh) (for all four quadrants);

3) where the AMR meter can supply quality of supply values the DAS must be able to distinguish them as QOS values;

c) Status flags

1) time and date;
2) data integrity alarms; and
3) AMR meter error flags.

4.2.3 Data retrieval requirements

4.2.3.1 The master station software shall cater for various automatic dial out sequences. Daily, weekly and monthly dial out sequences shall be catered for and AMR devices may be assigned to any dial out sequence.

4.2.3.2 Starting time and date for dial out sequences must be user configurable.

4.2.3.3 The master station shall cater for remote communication via the PSTN service and GSM network as a minimum.

4.2.3.4 The master station shall cater for an environment for multidropping (cascading) at the remote site. Various devices shall be interrogated through the use of one communication device.

4.2.3.5 Manual uploading of meter data through the use of hand held units (HHU) and meter data files shall be catered for by the master station. The AMR meter purchaser shall make sure that AMR meter supports the HHU being used by the supply authority.

4.2.4 Remote maintenance requirements

4.2.4.1 The master station software shall cater for the automatic synchronization of time of remote AMR devices with the master station time. A time check shall be performed by the master station every time it accesses the AMR meter. A record shall be kept of any time adjustments.

4.2.5 Data verification requirements

4.2.5.1 The master station software shall cater for maximum/minimum limit setting on raw data. This will enable users to identify possible metering faults once the master station software has flagged abnormal variances.

4.2.5.2 The master station software shall cater for the verification of AMR register advances (AMR meter registers) with raw data.

4.2.5.3 The master station software shall include verification of the number of intervals uploaded from the meter to safeguard against incomplete uploads.

4.2.6 System requirements

4.2.6.1 The master station software shall operate on a server (PC) and the software shall preferably be Windows compatible.

4.2.6.2 The master station shall be supplied from an uninterruptible power supply. The UPS supply shall be without earth leakage.

4.2.6.3 No software other than the master station software and its operating software shall be allowed on the master station.

4.2.6.4 The master station's system shall be properly protected by means of passwords.

4.2.6.5 A proven disaster recovery plan shall be in place in case of master station failure.

4.2.6.6 The master station's clock shall be synchronized with Standard South African time (SAST) each day. The masters stations time shall not drift by more than 2 s per day.

4.2.6.7 The structure of the database and the data shall be exportable in a tabular form. The database needs to be a SQL standard.

4.2.6.8 The data remains the property of the supply authority and must be made available in an acceptable format upon request by an authorised individual from the supply authority.

4.2.7 System backup

4.2.7.1 The master files (AMR configurations, communications, report configurations, tariff configurations etc) shall be backed up once a month and after any changes are made on the files.

4.2.7.2 Raw data and manipulated data shall be backed up once a month.

4.2.7.3 All raw data and manipulated data shall be stored for a period of five years.

4.2.7.4 All data and software backups shall be kept in a fire proof safe with limited or controlled access.

4.2.7.5 A proven disaster recovery plan must be in place in case of master station failure.

4.2.8 Hand Held Units (HHU)

There may be instances where remote communication to AMR devices can not be achieved and manual interrogation of the AMR devices will then be required through the use of a HHU.

4.2.8.1 The master station shall accommodate the use of HHU.

4.2.8.2 The HHU shall be able to communicate with all AMR devices as implemented in the master station software.

4.2.8.3 Protocol drivers for all AMR devices must thus be available on the HHU for manual downloading.

4.2.8.4 The HHU shall cater for data retrieval from AMR devices through the use of the optical interface of the AMR device (optical eye)in accordance with IEC 62056-21 or from a industry standard communication port.

4.2.8.5 The HHU shall have sufficient memory to download multiple AMR devices. The HHU shall as a minimum be able to download at least 40 days of interval data (4 channels at 30 min intervals) of ten AMR devices.

4.2.9 Data manipulation at the master station

4.2.9.1 Raw data

4.2.9.1.1 The master station software shall retrieve the raw data from AMR devices and then use algorithms to verify the integrity of the raw data.

4.2.9.1.2 All non-verifiable or corrupt data shall be flagged.

4.2.9.1.3 The master station software shall make provision for the estimation of corrupt data only. The software shall be able to distinguish between corrupt data and data recorded during power interruptions. Estimation algorithms shall be submitted to the users or potential users of the software for scrutiny and acceptance. An audit trail should be kept on any manual intervention. The audit trail in an acceptable summarised format will be made available to the supply authority once a month.

4.2.9.1.4 The system should be designed so that it is not possible to change raw data.

4.2.10 Multiplication factors

4.2.10.1 The master station software shall make provision for the application of multiplication factors (meter constants) to raw data and store it as manipulated data.

4.2.10.2 Both raw and manipulated data shall be backed-up as in 4.2.7.

4.2.11 Data summation

The master station software shall make provision for the summation of various sets of data to provide for totalized data. Monthly and annual reports shall be made available to the supply authority in the format requested to assist with tariffs and budgeting.

4.2.12 Tariff implementation

Where the master station also functions as the billing system then the master station software shall be able to implement tariff structures.

4.2.12.1 The master station software shall make provision for tariff sequences and structures.

4.2.12.2 Where tariff application is not required by the master station, then the master station shall provide for manipulated data (summated and with multiplication factors) to a stand-alone billing system in the format required by the billing system.

4.2.13 Operational requirements

Due to the nature of this work, a dedicated technical person for the operation of the Master station is required. The duties of this person shall be as follows:

a) To configure and populate the master station with relevant AMR data;

b) To carry out a daily check and validation of all data retrieved;

c) Suspect/corrupt/missing data shall be reported on a daily basis to the responsible metering section;

d) Ensuring timeous and correct information for the billing process;

e) To log daily, in a communications register, all abnormalities on the communication reports such as power failures, metering device programming changes, lines down, lines down reported and follow-ups, etc. ;

f) To log, in the master station register, all programming changes/additions performed on the standard metering master station. Details such as date of modification, a description of action performed, reason for change, temporary or permanent change and person carrying out the change shall be logged.

g) To monitor differences between main and check recorders as well as differences between channels on a daily basis.

h) To introduce minimum/maximum limits per channel where applicable loads/configurations exist;

i) To compare raw data vs. AMR meter dial (register) data on a yearly basis;

j) To make a yearly AMR meter dial vs. metering billing report comparison to ensure correct programming of AMR device and report set-up; and

k) To keep a detailed record and flow chart of summated data for individual customers with multiple AMR devices.

4.2.14 Master station support

4.2.14.1 The suppliers of the master station software shall prove that they can support multiple AMR protocols.

4.2.14.2 They shall keep a list of all protocols supported.

4.2.14.3 They shall inform users of any protocol updates and keep track of protocol updates.

4.2.14.4 They shall ensure that all protocol updates are compatible with existing systems.

4.2.14.5 The suppliers shall provide the required training for the operation of the master station.

4.2.14.6 There should be a service level agreement between the master station service provider and the supply authority as to the intellectual property rights.

5. Tests

5.1 The manufacturer shall carry out the type tests to prove conformance to requirements as specified by IEC 62052-11 and IEC 62053-21or IEC 62053-23 at an accredited test facility.

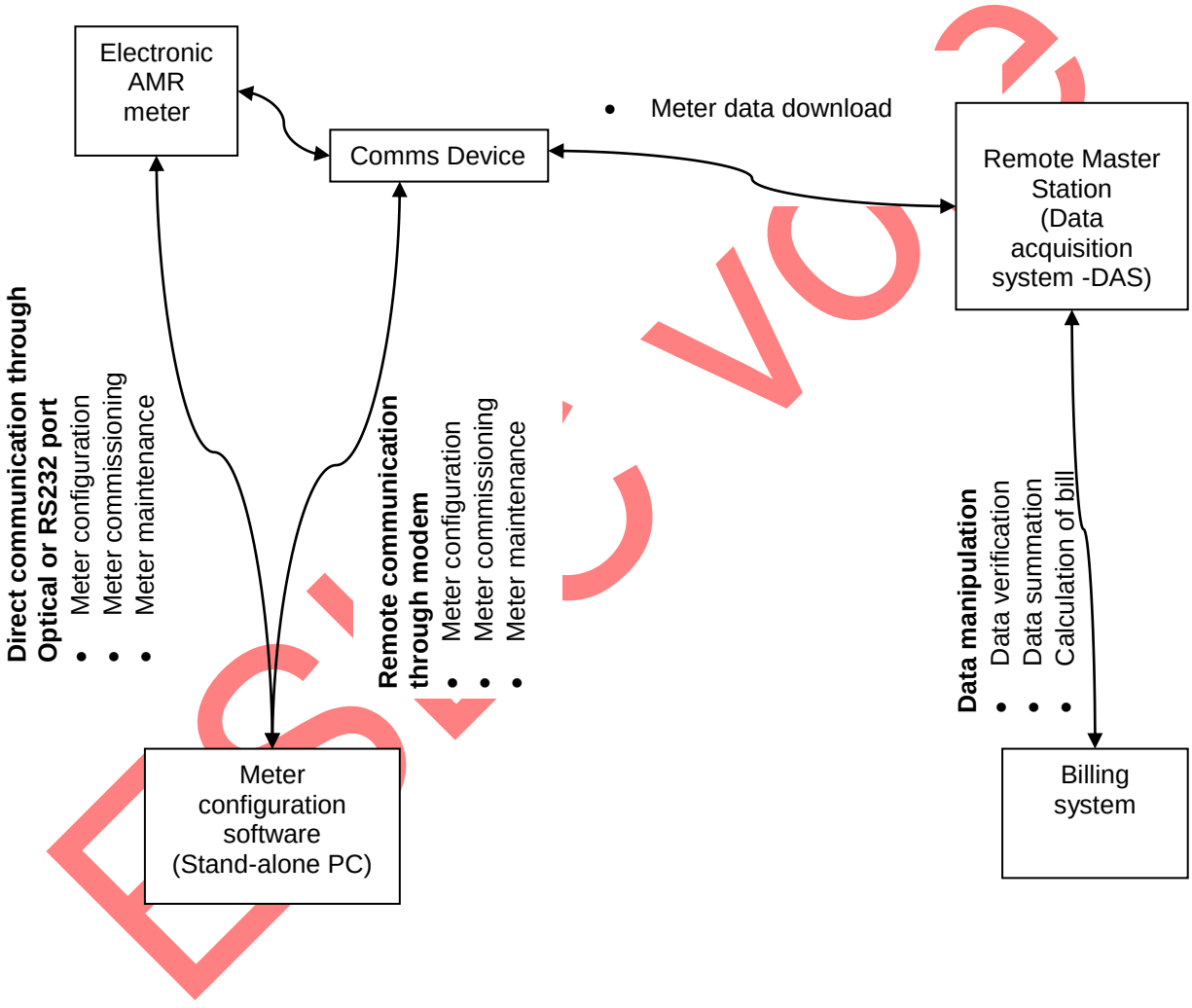
5.2 The supplier of the meters shall obtain SANS approval certificates (RCC certification) to indicate that SANS approve of the type testing in cases where the type testing was done at an international facility.

5.3 A copy of all type test certificates and details of tests performed and the SANS approval certificates shall be submitted with a tender.

Annex A
(informative)

Overview of an AMR System

Remote communication through modem



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