SLOVENSKI STANDARD
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Communication system for meters and remote reading of meters - Part 1: Data exchange

Communication system for meters and remote reading of meters - Part 1: Data exchange

Kommunikationssysteme für Zähler und deren Fernablesung - Teil 1: Datenaustausch

Systemes de communication et de télérelevé de compteurs - Partie 1 : Échange de données

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33.200	Daljinsko krmiljenje, daljinske meritve (telemetrija)	Telecontrol. Telemetering
35.100.70	Uporabniški sloj	Application layer

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Communication system for meters and remote reading of meters - Part 1: Data exchange

Systèmes de communication et de télérelevé de compteurs - Partie 1: Echange de données

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 13757-1:2002) has been prepared by Technical Committee CEN /TC 294, "Communication systems for meters and remote reading of meters", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2003, and conflicting national standards shall be withdrawn at the latest by June 2003.

Annexes A and C are normative. Annex B is informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This document describes the data exchange and communications for meters and remote reading of meters in a generic way. It is part 1 of the EN 13757 Standard. Additional parts are:

EN 13757 part 2: Physical and link layer, twisted pair baseband (M-Bus)
EN 13757 part 3: Dedicated application layer (M-Bus)
EN 13757 part 4: Wireless meter readout

The main use of part 1 is to provide a protocol specification for the Application Layer for meters.

Remark: Electricity meters are not covered with this standard, as the standardisation of remote readout of electricity meters is a task for IEC/CENELEC.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 834, *Heat cost allocators for the determination of the consumption of room heating radiators - Appliances with electrical energy supply*.

EN 1434-1, *Heat meters - Part 1 : General requirements*.

EN 1434-2, *Heat meters - Part 2 : Constructional requirements*.

EN 12405, *Gas meters - Gas volume electronic conversion devices.*.

prEN 13757-2:2002, *Communication systems for and remote reading of meters - Part 2 : Physical and link layer, twisted pair baseband (M-Bus)*.

EN 60870-5-2, *Telecontrol equipment and systems - Part 5 : Transmission protocols - Section 2 : Link transmission procedures (IEC 60870-5-2:1992).*

EN 61334-4-1 *Distribution automation using distribution line carrier systems - Part 4 : Data communication protocols - Section 1 : Reference model of the communication system (IEC 61334-4-1:1996)*.

EN 61334-4-41 *Distribution automation using distribution line carrier systems - Part 4 : Data communication protocols - Section 41 : Application protocols - Distribution line message specification (IEC 61334-4-41:1996)*.

EN 61334-6, *Distribution automation using distribution line carrier systems - Part 6 : A-XDR encoding rule (IEC 61334-6:2000)*

IEC 62056-21: 2000, *Electricity metering - Data exchange for meter reading, tariff and load control - Part 21 : Direct local data exchange*.

EN 62056-31:2000, *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 62056-31:1999)*.

IEC 62056-42, *Electricity metering - Data exchange for meter reading, tariff and load control – Part 42 : Physical layer services and procedures for connection-oriented asynchronous data exchange*.

IEC 62056-46:2002, *Electricity metering - Data exchange for meter reading, tariff and load control - Part 46 : Data link layer using HDLC - protocol*.

IEC 62056-53:2002, *Electricity metering - Data exchange for meter reading, tariff and load control – Part 53 : COSEM application layer*.

IEC 62056-61:2002, *Electricity metering - Data exchange for meter reading, tariff and load control – Part 61 : Object Identification System (OBIS)*.

IEC 62056-62:2002, *Electricity metering - Data exchange for meter reading, tariff and load control – Part 62 : Interface classes*.

ISO 1155; *Information processing -- Use of longitudinal parity to detect errors in information messages*.

ISO 1177; *Information processing -- Character structure for start/stop and synchronous character oriented transmission.*

ISO 1745; *Information processing -- Basic mode control procedures for data communication systems*.

ISO 7498-1, *Information technology - Open Systems Interconnection - Basic Reference Model : The Basic Model.*

ISO 9506-1, *Industrial automation systems - Manufacturing Message Specification - Part 1 : Service Definition.*

ISO/IEC 646; *Information technology – ISO 7-bit coded character set for information interchange.*

ISO/IEC 8649; *Information technology - Open Systems Interconnection - Service definition for the Association Control Service Element.*

ISO/IEC 8650-1; *Information technology - Open Systems Interconnection - Connection-oriented protocol for the Association Control Service Element: Protocol specification.*

ISO/IEC 8802-2, *Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 2 : Logical link control*.

ISO/IEC 8824-1, *Information technology - Abstract Syntax Notation One (ASN.1) : Specification of basic notation*.

ISO/IEC 13239, *Information technology - Telecommunications and information exchange between systems - High-level data link control (HDLC) procedures*.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions for remote readout of meters can be found in annex C of this document.

4 General description

Here follows a description of the environment that this standard is applicable to, i.e. remote readout from a metering unit in a network using a non-routed approach.

4.1 Basic vocabulary

All communications involve two sets of equipment represented by the terms **Caller** system and **Called** system. The **Caller** is the system that decides to initiate a communication with a remote system known as the **Called** party; these denominations remain valid throughout the duration of the communication.

A communication is broken down into a certain number of transactions. Each transaction is represented by a transmission from the **Transmitter** to the **Receiver**. During the sequence of transactions, the **Caller** and **Called** systems take turns to act as **Transmitter** and **Receiver**.

The terms **Client** and **Server** have the same meanings as in the DLMS model EN 61334-4-41. The **Server** is the system (meter) that acts as a VDE for the submission of all special service requests. The **Client** is the system (collecting system) that uses the Server for a specific purpose by means of one or more service requests.

The situation involving a **Caller Client** and a **Called Server** is undoubtedly the most frequent case, but a communication based on a **Caller Server** and a **Called Client** is also possible, in particular to report the occurrence of an urgent alarm.

4.2 Layered protocols

The purpose of this subclause is to explain, in a summarised way, the layered approach as proposed by CEN/TC 294.

In order to perform automatic reading of meters, CEN/TC 294 assumes a protocol stack approach. A protocol stack is divided into layers, in order to reduce the complexity of the communicating system. Each layer provides services to the layer above on the basis of the layer below.

The layered model chosen by TC/294 is the IEC 3-layer model EN 61334-4-1, which is derived from ISO - OSI 7-layer model ISO 7498-1.

The three layers of the IEC model are shown on the page below :

Layer 7	Application
Layer 2	Data link
Layer 1	Physical

Figure 1 — IEC 3-layer model

NOTE The layer numbers refers to the numbering in the ISO-OSI 7 layer model.

Layers 1 & 2 depend on the connection method used (Power Line Carrier-Low Voltage (PLC - LV), Public Switched Telephone Network (PSTN), HF radio, Twisted Pair cable (TP)). In order to have a uniform view of all types of meters, TC/294 has chosen an Application Layer that is independent of the connection method used. As a consequence, the protocol architecture, as shown below is used :

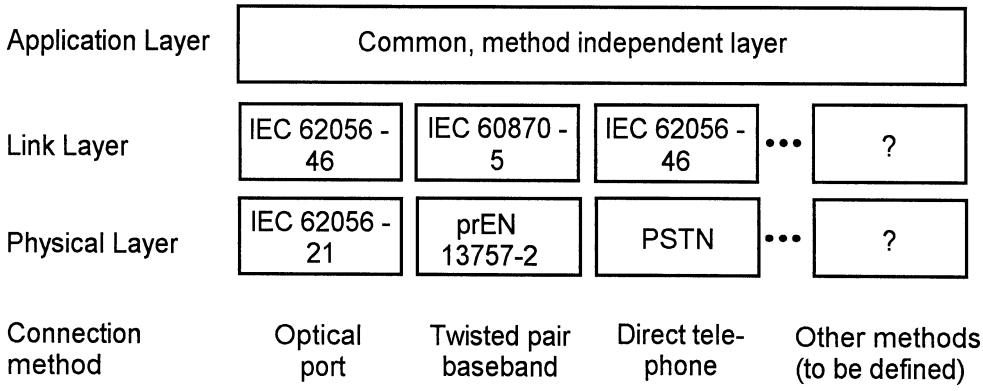

Figure 2 — Connection method independent Application Layer

This architecture allows for multiple different connection methods, while at the same time keeping a common connection method independent Application Layer. This is important as different connection methods are suited for different operating environments. The common Application Layer lowers the overall cost and complexity of a remote readout metering system.

4.3 Application Layer for Metering

The Application Layer specification is sub-divided into two parts : DLMS and LLAC.

DLMS (Distribution Line Message Specification) EN 61334-4-41 is an Application Layer specification. It permits a formal description of the communications system, in terms of its functionalities, in an object-oriented way.

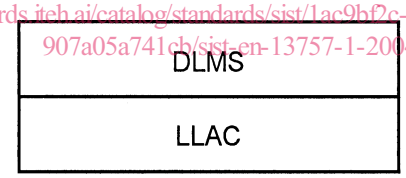

Figure 3 — Subdivision of the Application Layer

LLAC (Logical Link Access Control) specifies the remainder of the connecting method independent part of communications system. It specifies tasks like security management, handling of multiple applications, and segmentation of large data into multiple packet at lower levels. This corresponds to the Transport, Session and Presentation layers in the ISO-OSI 7-layer model ISO 7498-1.

4.4 Companion Specification

A **Companion Specification** (CS) is an extension to a generic standard. It may contain extension to the existing standard, as well as operating rules within the scope of the existing standard.

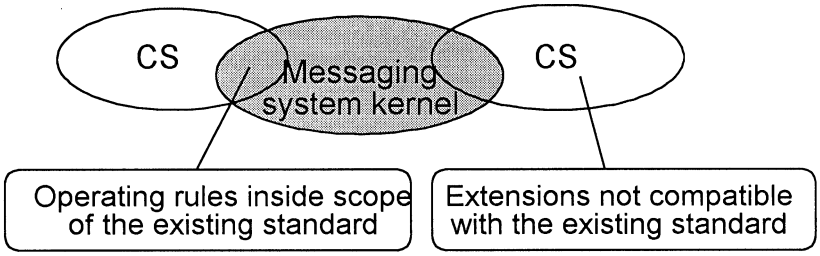

Figure 4 — Scope of Companion Specifications

DLMS is a powerful messaging system, derived from MMS, ISO 9506-1 (Manufacturing Messaging System). In order to fully adapt DLMS to the metering application, the COSEM Application Layer is based on an extended version of DLMS. These extensions are made such that there is no conflict with the current version of DLMS. This can be viewed as a **Companion Specification** (CS). The CS can be seen as a set of additional rules to DLMS, which are semantically and syntactically compatible with the DLMS kernel.

Extensions can be found in IEC 62056-53 (COSEM Application Layer).

A **Companion Specification** may go beyond pure data communication. It specifies the functionality of an application, as seen through the communication system. In the current context, this is the functionality, of the meter or meters, defined in terms of the objects contained within them (e.g. Index, ID, meter type, manufacturer, date and time, rate and even communication entities such as a phone number). This standard bases its generic functional application requirements on IEC 62056-62, Companion Specification for Energy Metering, approach. COSEM has been developed by DLMS Users Association.

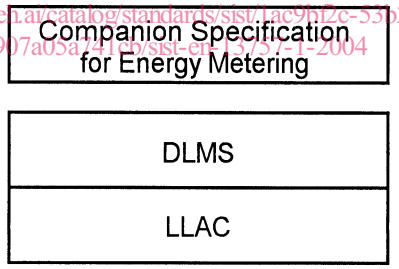

Figure 5 — Companion Specification

4.5 COSEM Basic Principles

This section describes the basic principles on which the COSEM interface classes are built. It also gives a short overview on how interface objects (instantiations of the interface classes) are used for communication purposes. Meters, support tools and other system components that follow these specifications can communicate with each other in an interoperable way.

Object modelling: For specification purposes this document uses the technique of object modelling. An object is a collection of attributes and methods.

The information of an object is organised in attributes. They represent the characteristics of an object by means of attribute values. The value of an attribute may affect the behaviour of an object. The first attribute in any object is the “logical_name”. It is one part of the identification of the object.

An object offers a number of methods to either examine or modify the values of the attributes. Objects that share common characteristics are generalised as an interface class with a class_id. Within a specific class the common characteristics (attributes and methods) are described once for all objects. Instantiations of an interface class are called COSEM objects.

Figure 6 below illustrates these terms by means of an example :

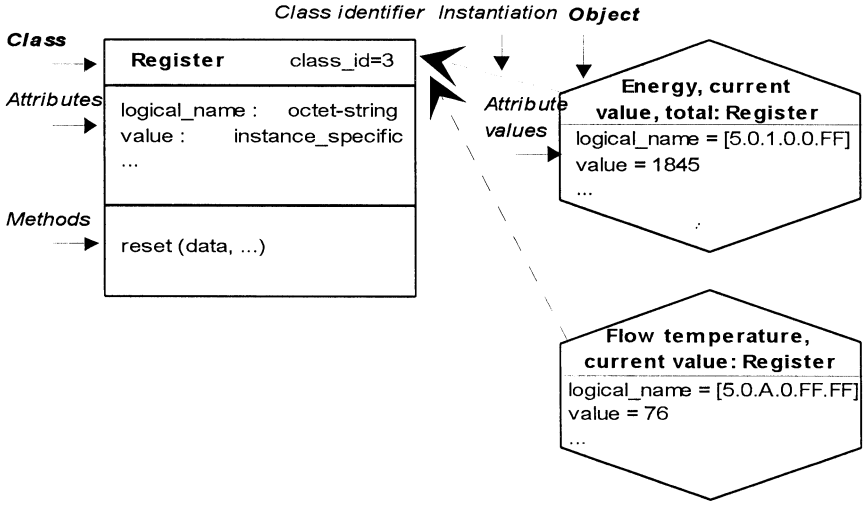

Figure 6 — An interface class and its instances

The interface class “Register” is formed by combining the features necessary to model the behaviour of a generic register (containing measured or “static” information) as seen from the client (central unit, hand held terminal). The contents of the register are identified by the attribute “logical_name”. The logical_name contains an OBIS identifier (comp.IEC 62056-61). The actual (dynamic) content of the register is carried by its “value” attribute.

Defining a specific meter means defining several specific instances of COSEM interface objects. In the example of Figure 6 the meter contains 2 registers; i.e. two specific COSEM objects of the class “Register” are instantiated. This means that specific values are assigned to the different attributes. Through the instantiation one COSEM object becomes an “Energy, current value, total register” whereas the other becomes a “Flow temperature, current value register”.

Remark

The COSEM objects (instances of interface classes) represent the behaviour of the meter as seen from the “outside”. Therefore only externally initiated changes of the value of an attribute are described (e.g. resetting the value of a register). Internally initiated changes of the attributes are not described in this model (e.g. updating the value of a register).

The fact that the external behavior of the meter is modelled in an object oriented way, does not result in a requirement of an object oriented design or implementation of actual meters.

4.6 Management of a COSEM Device

One physical unit may contain or represent multiple metering units or logical devices. Such a physical unit will have one physical communications interface but multiple metering applications. This calls for a management application inside the unit that performs communications management. This is handled by COSEM as well.

The COSEM Logical Device is a set of COSEM objects. Each Physical Device shall contain a Management Logical Device. The mandatory contents of the Management Logical Device are :

— COSEM Logical Device Name ;

— Current Association (LN or SN) object.

The Management Logical Device shall support an Application Association with lowest security level to a Public Client.

The addressing of the COSEM Logical Devices shall be provided by the addressing scheme of the lower layers of the protocols used.

4.7 Lower layers

The Lower layers cover the Physical Layer and the Link Layer. The need for multiple communications methods, causes the need for multiple different lower layers. All of the lower layers consist of a Physical Layer and a Link Layer. The requirements for the Link Layer is very often closely related to a specific Physical Layer.

In order to define full protocol stacks, which are needed for meter interchangeability, the lower layers have to be specified / selected as well. Some lower layers have been selected / adopted, and new lower layers will be added as amendments in the future when new technologies mature.

An overall diagram with all of the elements needed and their relationships is shown in Figure 7 (below).

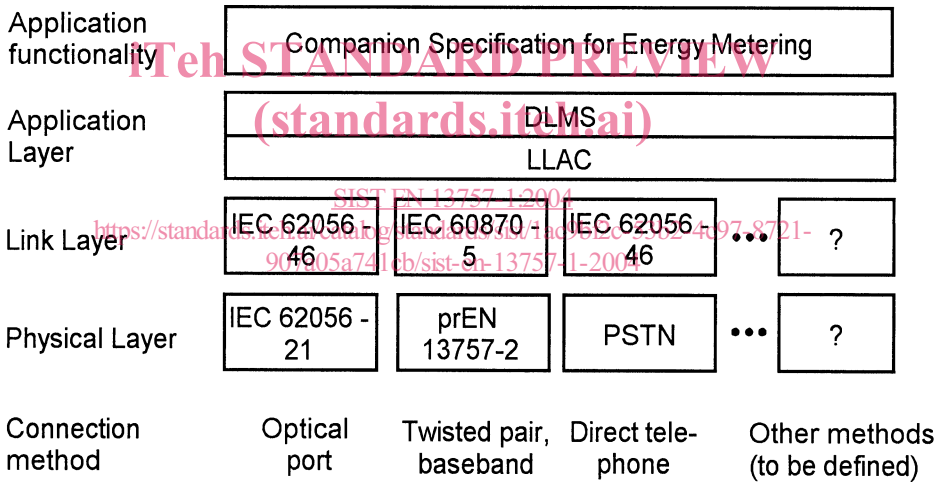

Figure 7 — Full protocol stack

As can be seen from the figure above, the Application Layer and the Application functionality remain unchanged, even if the connection method changes.

5 Network Architecture

5.1 General

This section presents a simplified architecture for remote reading of meters, concerning only the basic metering LAN.

This architecture should permit the quick introduction and installation of communicating meters, as well as the ability to extend the system afterwards. Therefore, some rules are given.