SLOVENSKI STANDARD
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Komunikacijski sistemi za merilnike in daljinsko odļ itavanje - 3. del: Posebna aplikacijska plast

Communication systems for and remote reading of meters - Part 3: Dedicated application layer

Kommunikationssysteme für Zähler und deren Fernablesung - Teil 3: Spezieller Application Layer

Systemes de communication et de télérelevé de compteurs - Partie 3: Couches d'application spéciale

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Communication systems for and remote reading of meters - Part 3: Dedicated application layer

Systèmes de communication et de télérelevé de compteurs - Partie 3: Couches d'application spéciale

Kommunikationssysteme für Zähler und deren Fernablesung - Teil 3: Spezieller Application Layer

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Foreword

This document (EN 13757-3:2004) 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of an identical text or by endorsement, at the latest by May 2005, and conflicting national standards shall be withdrawn at the latest by May 2005.

This standard consists of the following parts:

EN 13757-1, *Communication system for meters and remote reading of meters - Part 1: Data exchange.*

EN 13757-2, *Communication systems for and remote reading of meters - Part 2: Physical and link layer.*

EN 13757-3, *Communication systems for and remote reading of meters - Part 3: Dedicated application layer.*

prEN 13757-4, *Communication systems for meters and remote reading of meters - Part 4: Wireless meter readout.*

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

Introduction

This document belongs to a series of parts of EN 13757 which covers communication systems for meters and remote reading of meters. Part 1 contains generic descriptions and a communication protocol. Part 2 contains a physical and a link layer for twisted pair base band (M-Bus). Part 4 (currently an enquiry is under preparation) describes wireless communication.

The bus communication system of EN 1434–3 is commonly called M-Bus. Its application layer describes a standard especially for meter readout.

It can be used with various physical layers and with link layers and network layers which support the transmission of variable length binary transparent telegrams. Frequently the physical and link layers of EN 13757-2 (Twisted pair baseband) and prEN 13757-4 (wireless) or the alternatives described in EN 13757-1 are used.

An overview of communication systems for meters is given in EN 13757-1, which also contains further definitions.

This standard is a compatible enhancement of the 6.4 to 6.6 of the original standard EN 1434–3:1997. Besides some clarifications and implementation hints it contains optional enhancements especially for complex meters. Due to technical progress some variants (Fixed format and mode 2=high byte first) are no longer supported in this standard.

It should be noted that this standard contains only directions how data should be coded. It is beyond the task of an application layer standard to define which data will be transmitted under what conditions by which types of slaves or which data transmitted to a slave will have which reactions. Therefore adherence to this standard guarantees the coexistence and common communication and readout capability of slaves via a universal master software (covering all optional features), but not yet functional or communication interchangeabilty of meters following this standard. For several meter types and meter classes a group of remote heating users have provided such application descriptions required for full interchangeability. They are accessible via the www-server of the m-bus users group http://www.m-bus.com/files/default.html (file name: WG4N99R4.EXE (this is a self expanding .doc-file)).

1 Scope

This document applies to communication systems for meters and remote reading of meters.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13757-2:2004, *Communication systems for and remote reading of meters - Part 2: Physical and link layer.*

NOTE Further information and examples are available in the download area of http://www.m-bus.com.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Table of abbreviations

DES	Data Encryption Standard
DRH	Data Record Header
DIB	Data Information Block
DIF	Data Information Field
DIFE	Data Information Field Extensions
VIB	Value Information Block
VIF	Value Information Field
VIFE	Value Information Field Extensions
RSP_UD	Respond User Data
SND_UD	Send User Data to slave
REQ-UD	Request User Data
MDH	Manufacturer Specific Data Block
CI	Control Information Field
E	Extension Bit

3.2
hexadecimal numbers
hexadecimal numbers are designated by a following "h"

Binary numbers

4 General principles : CI-field

4.1 Overview

All application layer telegrams have variable length. The length information is part of the link layer. It shall be known to the application layer in order to properly terminate its decoding of each telegram. Each telegram starts with a one byte CI (control information) field, which distinguishes between various telegram types and application functions. It is also used to distinguish between true application layer communication and management commands for lower layers. The meaning of the remaining bytes of the telegram depends also on the value of the CI-field.

Table 1 — CI-Field codes used by the master or the slave

	Application
00h to 4Fh	reserved for DLMS-based applications
50h	application reset
51h	data send (master to slave)
52h	selection of slaves
53h	reserved
54h to 58h	reserved for DLMS-based applications
55h to 5Bh	reserved
5Ch	synchronize action
60h to 6Fh	reserved
70h	slave to master: report of application errors
71h	slave to master: report of alarms
72h	slave to master: 12 byte header followed by variable format data
73h to 77h	reserved
78h	slave to master: Variable data format response without header
79h	reserved
7Ah	slave to master: 4 byte header followed by Variable data format response
7Bh to 80h	reserved
81h	reserved for a future CEN–TC294– Radio relaying and application Layer
82h	reserved for a future CENELEC–TC205 network/application Layer
82h to 8Fh	reserved
90h to 97h	manufacturer specific (obsolete)
A0h to AFh	manufacturer specific
B0 to B7h	manufacturer specific
B8h	set baud rate to 300 baud
B9h	set baud rate to 600 baud
BAh	set baud rate to 1 200 baud
BBh	set baud rate to 2 400 baud
BCh	set baud rate to 4 800 baud
BDh	set baud rate to 9 600 baud
BEh	set baud rate to 19 200 baud
BFh	set baud rate to 38 400 baud
C0h to FFh	reserved

Note that the CI-codes 50h, 52h, 5Ch, 70h, 71h, 78h, 7Ah, 80h, 81h, A0h – AFh and B8h – BFh are optional compatible enhancements of the EN 1434-3:1997 standard. Note also that even if the functions of these optional CI-codes are not implemented in a slave the link layer protocol requires a proper link layer acknowledge of SND_UD telegrams containing any of these CI-codes.

The EN 1434–3 defined two possible data sequences in multibyte records. This standard supports only the mode where the least significant byte of a multibyte record is transmitted first.

4.2 Application reset (CI = 50h), (optional)

4.2.1 General

With the CI-Code 50h the master can release a reset of the application layer in the slaves. Each slave himself decides which parameters to change – e.g. which data output is default – after it has received such an application reset.

4.2.2 Application reset subcode (optional)

It is allowed to use optional parameters after CI = 50h. If more bytes follow, the first byte is the application reset subcode. Further bytes are ignored. The application reset subcode defines which telegram function and which subtelegram is requested by the master. The datatype of this parameter is 8 bit binary. The upper 4 bits define the telegram type or telegram application and the lower 4 bits define the number of the subtelegram (the meaning of this number is device specific). The lower four bits may be ignored for slaves which provide only a single telegram for each application. The use of the value zero for the number of the subtelegram means that all telegrams are requested.

Slaves with only one type of telegram may ignore application reset and the added parameters. The following codes can be used for the upper 4 bits of the first parameter:

Table 2 — Coding of the upper four bits of the first parameter after CI = 50h

Coding	Description	Examples
0000b	All	
0001b	User data	consumption
0010b	Simple billing	actual and fixed date values + dates
0011b	Enhanced billing	historic values
0100b	Multi tariff billing	
0101b	Instaneous values	for regulation
0110b	Load management values for management	
0111b	Reserved	
1000b	Installation and startup	bus address, fixed dates
1001b	Testing	high resolution values
1010b	Calibration	
1011b	Manufacturing	
1100b	Development	
1101b	Selftest	
1110b	Reserved	
1111b	Reserved	

Note that this table has been expanded with optional elements from the original standard.

4.3 Master to slave data send (51h) (optional)

The CI-Field code 51h is used to indicate the data send from master to slave:

Variable Data Blocks (Records)	MDH(opt)O	Opt.Mfg.specific data Opt)
variable number	1 Byte	variable number

Figure 1 — Variable Data Structure master to slave

Note that this structure is identical to the slave to master direction (see clause 5) with the exception of the fixed header which is omitted in this direction.

4.4 Slave select (52h) (optional)

The CI-Field code 52h is used for the management of the optional secondary addressing (see 11.3).

4.5 Synchronize action (CI = 5 Ch) (optional)

This CI-code can be used for synchronizing functions in slaves and masters (e.g. clock synchronization). Special actions or parameter loads may be prepared but their final execution is delayed until the reception of such a special CI-field command. No data follows this CI-code.

4.6 Report of application errors (slave to master) (CI = 70h) (optional)

For details of the report of general application errors see 8.2. For error reporting of individual data elements see 8.3.

4.7 Report of alarm status (slave to master) (CI = 71h) (optional)

For details of the report of alarm status errors see annex D.

4.8 Variable data respond (slave to master) (CI = 72h, 78h, 7Ah)

For details, see clause 5.

4.9 Baud rate switch commands B8h – BFh (otpional)

These optional commands can be used by a master to switch the baud rate of a slave. For details, see 11.2.

5 Variable Data Respond (CI = 72h, CI = 78h, CI = 7Ah)

5.1 Introduction

Data Header of variable data respond The CI-Field codes 72h, 78h, 7Ah are used to indicate the variable data structure in long frames (RSP_UD) with optional fixed header. Note that the CI-fields 78h and 7Ah are extensions from the EN 1434–3. They are recommended for new master implementations to simplify the integration of radio based communication.

Figure 2 shows the way this data is represented.

Data Header(Req.)	Variable Data Blocks (Records)	MDH(opt)O	Opt.Mfg.specific data Opt)
0 byte (CI = 78h) 4 byte (CI = 7Ah) 12 byte (CI = 72h)	variable number	1 Byte	variable number

Figure 2 — Variable Data Structure in Answer Direction

5.2 Structure of Data Header (CI = 72h)

The first twelve bytes of the user data consist of a block with a fixed length and structure (see Figure 3).

Ident. Nr.	Manufr.	Version	Device type	Access No.	Status	Signature
4 Byte	2 Byte	1 Byte	1 Byte	1 Byte	1 Byte	2 Byte

Figure 3 — Data Header CI = 72h

5.3 Structure of Data Header (CI = 7Ah)

The first four bytes of the user data consist of a block with a fixed length and structure (see Figure 4).

This CI-field is proposed for systems using the future physical and link layer standard for radio communication. In this standard the link layer address contains the information fields of the manufacturer, the device type, the version and the identification number, so that these 8 bytes from the fixed header of the CI = 72h are not required in the application layer part of a telegram.

Access No.	Status	Signature
1 Byte	1 Byte	2 Byte

Figure 4 — Data Header CI=7Ah

5.4 Identification Number

The **Identification Number** is either a fixed fabrication number or a number changeable by the customer, coded with 8 BCD packed digits (4 Byte), and which thus runs from 00000000 to 99999999. It can be preset at fabrication time with a unique number, but could be changeable afterwards, especially if in addition an unique and not changeable fabrication number (DIF = 0Ch, VIF = 78h, see 7.2) is provided.

5.5 Manufacturer identification

The field **manufacturer** is coded unsigned binary with 2 bytes. This manufacturer ID is calculated from the ASCII code of EN 62056-21 manufacturer ID (three uppercase letters) with the following formula:

$$\begin{aligned} \text{Man. ID} = {} & [\text{ASCII(1st letter)} - 64] \bullet 32 \bullet 32 \\ & + [\text{ASCII(2nd letter)} - 64] \bullet 32 \\ & + [\text{ASCII(3rd letter)} - 64] \end{aligned}$$

Note that the flag association, UK (www.dlms.com/flag) administers these three letter manufacturers ID of EN 62056-21.

5.6 Version identification

The field **version** specifies the generation or version of the meter and depends on the manufacturer. It can be used to make sure, that within each version number the identification # is unique.

5.7 Device type identification

The **device byte** is coded as follows:

Table 3 — Device type identification

Device type (previously called medium)	Code bin. Bit 7 … 0	Code hex.
Other	0000 0000	00
Oil	0000 0001	01
Electricity	0000 0010	02
Gas	0000 0011	03
Heat	0000 0100	04
Steam	0000 0101	05
Warm Water (30 °C … 90 °C)	0000 0110	06
Water	0000 0111	07
Heat Cost Allocator	0000 1000	08
Compressed Air	0000 1001	09
Cooling load meter (Volume measured at return temperature: outlet)	0000 1010	0A
Cooling load meter (Volume measured at flow temperature: inlet)	0000 1011	0B
Heat (Volume measured at flow temperature: inlet)	0000 1100	0C
Heat / Cooling load meter	0000 1101	OD
Bus / System component	0000 1110	0E
Unknown Medium	0000 1111	0F
Reserved	…	10 to 14
Hot water (≥ 90 °C)	0001 0101	15
Cold water	0001 0110	16
Dual register (hot/cold) Water meter (see NOTE)	0001 0111	17
Pressure	0001 1000	18
A/D Converter	0001 1001	19
Reserved	…	1Ah to 20h
Reserved for valve	0010 0001	21h
Reserved		22h to FFh

NOTE Such a meter registers water flow above a limit temperature in a separate register with an appropriate tariff ID.

Note that this table has been expanded with optional elements from EN 1434-3.

5.8 Access Number

The **Access Number** has unsigned binary coding, and is incremented (modulo 256) by one before or after each RSP_UD from the slave. Since it can also be used to enable private end users to detect an unwanted overfrequently readout of its consumption meters, it should not be resettable by any bus communication.

5.9 Status byte

Table 4 — Coding of the Status Field

Bit	Meaning with Bit set	Significance with Bit not set
0,1	See Table 5	See Table 5
2	Power low	Not power low
3	Permanent error	No permanent error
4	Temporary error	No temporary error
5	Specific to manufacturer	Specific to manufacturer
6	Specific to manufacturer	Specific to manufacturer
7	Specific to manufacturer	Specific to manufacturer

Table 5 — Application Errors coded with the Status Field

Status bit 1 bit 0	Application status
0 0	No Error
0 1	Application Busy
1 0	Any Application Error
1 1	Reserved

Note that more detailed error signalling can be provided by application telegrams starting with C I= 70h and/or using data records signalling even more detailed error information.

5.10 Signature field

5.10.1 General

The **Signature** is reserved for optional encryption of the application data. Such an encryption might be required for transmit only wireless meter readout. It is assumed, that each meter (or a group of meters) could have an individual encryption key. If no Encryption is used its value shall be 00 00 h.

5.10.2 Functions

— Data privacy for consumption meters values;

— detecting simulated meter transmission;

— preventing later playback of old meter values.

5.10.3 Structure of encrypted telegrams

a) The data header (CI=72h see 5.2 or CI = 7Ah see 5.3) is always unencrypted. The last word of this block is the signature word. If the following data are unencrypted, this signature word contains a zero.

b) If the transmission contains encrypted data, the high byte of this signature word contains a code for the encryption method. The code 0 signals no encryption. Currently only the encryption codes 02xxh or 03xxh (see below) are defined. The other codes are reserved. The number of encrypted bytes is contained in the low byte of the signature word. The content of this signature word had been defined in the EN 1434–3 as zero, corresponding consistently to no encrypted data.

c) The encrypted data follow directly after the signature word, thus forming the beginning of the DIF/VIF-structured part of the telegram.

5.10.4 Partial Encryption

a) If the number of encrypted bytes is less than the remaining data of the telegram, unencrypted data may follow after the encrypted data. They shall start at a record boundary, i.e. the first byte after the encrypted data will be interpreted as a DIF.

b) If a partially encrypted telegram shall contain encrypted manufacturer specific data a record with a suitable length DIF (possibly a variable length string DIF) and a VIF = 7Fh (manufacturer specific data record) shall be used instead of the usual MDH-DIF = 0Fh. This is required to enable after decryption standard DIF/VIF-decoding of a previously partially encrypted telegram containing encrypted manufacturer specific data.

5.10.5 Encryption methods

a) Encryption according to the DES (data encryption standard) as described in ANSI X3.92:1981;

b) Cipher Block Chaining (CBC)-method as described in ANSI X3.106:1983 with an initial initialization vector of zero: (Encryption Method Code = 02xxh). In this case the data records should contain the current date before the meter reading.

Note that in this case the data after the date record, i.e. especially the encrypted meter reading data change once per day even if their data content itself is constant. This prevents an undetectable later playback of stored encrypted meter readings by a hacker.

c) The "Initialization Vector IV" with length 64 bits of this standard may alternatively be defined by the first 6 bytes of the identification header in mode 1 sequence, i.e. identification number in the lowest 4 bytes followed by the manufacturer ID in the two next higher bytes and finally by the current date coded as in record structure "G" for the two highest bytes.

In this case the Encryption method is coded as "03xxh". Note that in this case all encrypted data change once per day even if the data content itself is constant. This prevents an undetectable later playback of any stored encrypted data by a hacker.

d) To simplify the verification of correct decoding and to prevent an undetected change in the identification of the not encrypted header, the encrypted part of the telegram shall contain at least together with the appropriate application layer coding (DIF and VIF) again the same identification number as in the unencrypted header;

e) Due to the mathematical nature of the DES-algorithm the encrypted length contained in the low byte of the signature word shall be an integer multiple of 8 if the high byte signals DES-Encryption. Unused bytes in the last 8-byte block shall be filled with appropriatly structured dummy data records to achieve the required record boundary at the end of the encrypted data. One or several bytes containing the filler DIF = 2Fh are suggested to fill such gaps;

f) The application of certain Encryption methods might be prohibited by local laws.