SLOVENSKI STANDARD

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Komunikacijski sistemi za merilnike - 3. del: Aplikacijski protokoli

Communication systems for meters - Part 3: Application protocols

Kommunikationssysteme für Zähler - Teil 3: Anwendungsprotokolle

Systèmes de communication pour compteurs - Partie 3 : Protocoles d'application

Ta slovenski standard je istoveten z: prEN 13757-3

ICS:

33.200	Daljinsko krmiljenje, daljinske meritve (telemetrija)	Telecontrol. Telemetering
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Communication systems for meters - Part 3: Application protocols

Systèmes de communication pour compteurs - Partie 3 : Protocoles d'application

Kommunikationssysteme für Zähler - Teil 3: Anwendungsprotokolle

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 294.

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European foreword

This document (prEN 13757-3:2023) has been prepared by Technical Committee CEN/TC 294 "Communication systems for meters", the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13757-3:2018.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document falls under Mandate EU M/441 "Standardisation mandate to CEN, CENELEC and ETSI in the field of measuring instruments for the development of an open architecture for utility meters involving communication protocols enabling interoperability" by providing the relevant definitions and methods for meter data transmission on application layer level. The M/441 Mandate is driving significant development of standards in smart metering.

EN 13757-3:2023 includes the following significant technical changes with respect to EN 13757-3:2018:

— Support of sensor devices and alarm devices in new subclause 6.5 and Table 13;

— add new Table 14 - Bit field definition of "Installation conditions";

— mark unused VIF/VIFE in Table 10 and Table 12 as deprecated;

— extend coding of message application in Table 26;

— add alternative non-metric units in Annex C;

— revision of the clock synchronisation protocol in Annex E.3.

EN 13757 is currently composed with the following parts:

— Communication systems for meters — Part 1: Data exchange;

— Communication systems for meters — Part 2: Wired M-Bus communication;

— Communication systems for meters — Part 3: Application protocols ;

— Communication systems for meters and remote reading of meters — Part 4: Wireless meter readout (Radio meter reading for operation in SRD bands);

— Communication systems for meters — Part 5: Wireless M-Bus relaying;

— Communication systems for meters — Part 7: Transport and security services ;

— *Communication systems for meters — Part 8: Adaptation Layer*;

— *CEN/TR 17167*, Communication systems for meters — Accompanying TR to *EN 13757-2*,-3 and −7, Examples and supplementary information.

Introduction

This document belongs to the EN 13757 series, which covers communication systems for meters. EN 13757-1 contains generic descriptions and a communication protocol. EN 13757-2 contains a physical and a link layer for twisted pair based Meter-Bus (M-Bus). EN 13757-4 describes wireless communication (often called wireless M-Bus or wM-Bus). EN 13757-5 describes the wireless network used for repeating, relaying and routing for the different modes of EN 13757-4. EN 13757-6 describes a twisted pair local bus for short distance (Lo-Bus). EN 13757-2 describes transport mechanism and security methods for data. The Technical Report CEN/TR 17167 contains informative annexes for EN 13757-2, EN 13757-3 and EN 13757-7.

These upper M-Bus protocol layers can be used with various Physical Layers and with Data Link Layers and Network Layers, which support the transmission of variable length binary transparent messages. Frequently, the Physical and Link Layers of EN 13757-2 (twisted pair) and EN 13757-4 (wireless) as well as EN 13757-5 (wireless with routing function) or the alternatives described in EN 13757-1 are used. These upper M-Bus protocol layers have been optimized for minimum battery consumption of meters, especially for the case of wireless communication, to ensure long battery lifetimes of the meters. Secondly, it is optimized for minimum message length to minimize the wireless channel occupancy and hence the collision rate. Thirdly, it is optimized for minimum requirements towards the meter processor regarding requirements of RAM size, code length and computational power.

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

This document concentrates on the meter communication. The meter communicates with one (or occasionally several) fixed or mobile communication partners which again might be part of a private or public network. These further communication systems might use the same or other application layer protocols, security, privacy, authentication, and management methods.

To facilitate common communication systems for CEN-meters (e.g. gas, water, thermal energy and heat cost allocators) and for electricity meters, in this standard occasionally electricity meters are mentioned. All these references are for information only and are not standard requirements. The definition of communication standards for electricity meters (possibly by a reference to CEN standards) remains solely in the responsibility of CENELEC.

NOTE 1 CEN/TR 17167:2023[1)], Annex C specifies how parts of this standard and of EN 13757-2 and EN 13757-4 can be used to implement smart meter functionalities. Similar functionalities could also be implemented using other physical and link layers.

NOTE 2 For information on installation procedures and their integration in meter management systems, see CEN/TR 17167:2023[1)], Annex D.

The European Committee for Standardization (CEN) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning Image Transfer given in Annex I and which is claimed to be relevant for the following clause(s) of this document: Clause 15.

CEN takes no position concerning the evidence, validity and scope of this patent right. The holder of this patent right has ensured CEN that they are willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with CEN. Information may be obtained from:

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CEN and CENELEC maintain online lists of patents relevant to their standards. Users are encouraged to consult the lists for the most up to date information concerning patents (ftp://ftp.cencenelec.eu/EN/IPR/Patents/IPRdeclaration.pdf).

1 Scope

This document specifies application protocols for communication systems for meters.

This document specifies application protocols, especially the M-Bus application protocol.

This document is intended to be used with the lower layer specifications determined in EN 13757-2, EN 13757-4, EN 13757-5, EN 13757-6 and EN 13757-7.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *Communication systems for meters - Part 2: Wired M-Bus communication*

EN 13757-6, *Communication systems for meters - Part 6: Local Bus*

EN 13757-7:2023, *Communication systems for meters — Part 7: Transport and security services*[1)]

ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

ISO/IEC/IEEE 60559:2011, *Information technology — Microprocessor Systems — Floating-Point arithmetic*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp/

— IEC Electropedia: available at https://www.electropedia.org/

3.1
byte
octet of bits

3.2
datagram
unit of data transferred from source to destination

Note 1 to entry: In previous versions of EN 13757-3 datagram was called telegram.

3.3
fragment
datagram of a fragmented message

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3.4
Final DIFE
additional last DIFE with the value 00h that marks a storage number as a register number

3.5
Hex-ASCII
base-16 numbers encoded as ASCII characters (‘0’–‘9’, ‘A’–‘F’)

[SOURCE: ANSI X9 TR-31:2010]

3.6
message
functional set of data transferred from source to destination

Note 1 to entry: A message may consist of one or more datagrams.

3.7
Register number
number of a predefined historical value register (like consumption value) corresponding to an OBIS value group F value

3.8
sublayer
subdivision of a layer

[SOURCE: ISO/IEC 7498-1]

4 Abbreviations and symbols

4.1 Abbreviations

ACK	Acknowledge
AES	Advanced Encryption Standard
AFL	Authentication and Fragmentation Sublayer
APL	Application Layer
ASCII	American Standard Code for Information Interchange
BCD	Binary Coded Decimal numbers
CI	Control Information field
CMD	Command
FCB	Frame count bit (see EN 13757-2)
FCV	Frame count valid bit (see EN 13757-2)
DIB	Data Information Block
DIF	Data Information Field
DIFE	Data Information Field Extensions
DLMS	Device Language Message Specification
DRH	Data Record Header

E	Extension bit
LSB	Least Significant Byte
LSBit	Least Significant Bit
MDH	Manufacturer Data Header
MSB	Most Significant Byte
MSBit	Most Significant Bit
OBIS	Object Identification System (EN 62056-6-1)
REQ-UD	Request User Data (class 1 or 2), (EN 13757-4)
RSP-UD	Respond User Data (EN 13757-4)
RSSI	Received Signal Strength Indicator
SND-NKE	Send Link Reset (EN 13757-4)
SND-UD	Send User Data (EN 13757-4)
SND-UD2	Send User Data 2 (EN 13757-4)
TPL	Transport Layer
VIB	Value Information Block
VIF	Value Information Field
VIFE	Value Information Field Extensions

4.2 Symbols

Hexadecimal numbers are designated by a following "$_{h}$".

Binary numbers are designated by a following "$_{b}$".

Decimal numbers have no suffix.

5 Selection of an application protocol

This document supports several application protocols. A specific protocol shall be chosen accordingly to the selected CI-Field described in EN 13757-7:2023[1)], 4.2. Beside the M-Bus protocol there are specific protocols described in the following clauses. Further application protocols applying DLMS/COSEM or M-Bus based usage of OBIS-type value descriptors are referenced in EN 13757-7:2023[1)], Table 2. Annex H defines translation from M-Bus type record descriptors to OBIS-type record descriptors.

The support for the different commands or protocols declared by the CI-field is optional in the meter.

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6 M-Bus protocol

6.1 General

The single datagram has a maximum length of 255 bytes. The data, together with information regarding coding, length and the type of data, is transmitted in data records in arbitrary sequence. According to EN 13757-2, the maximum space for data are 252 bytes. The effective usable space depends on the layers with variable length below the application layer and the applied header type and the encryption method. This restriction is required to enable gateways to other link- and application layers.

The M-Bus Application Layer data may consist of two segments of data. The first segment holds M-Bus data records (see 6.2). The second, optional segment, holds manufacturer specific data. (see Table 1).

Table 1 — Structure of a M-Bus APL with manufacturer specific data

APL Variable data blocks (Records)	MDH (optional)	Manufacturer specific data (optional)
Variable number	1 byte	Variable number

A Manufacturer Data Header (MDH) shall be inserted before the manufacturer specific data. The MDH is one of the characters $0F_h$ or $1F_h$. The MDH shall be omitted if there is no manufacturer specific data (see 6.5).

Unencrypted data following encrypted data shall start at a data record boundary, i.e. the first byte of unencrypted data shall be interpreted as a DIF.

Special data structures are defined in Annex F and in Annex G.

If nothing other declared then multi byte fields shall be transmitted with least significant byte first (little endian).

6.2 M-Bus data record

The structure of an M-Bus data record is shown in Table 2. The transmission order of the element is from left to right.

Table 2 — Data record structure

<table>
<tr><th>DIF</th><th>DIFE</th><th>VIF</th><th>VIFE</th><th>Data</th></tr>
<tr><td>1 byte</td><td>0 to 10 (1 byte each)</td><td>1 byte</td><td>0 to 10 (1 byte each)</td><td>0 to N bytes</td></tr>
<tr><td colspan="2">Data Information Block (DIB)</td><td colspan="2">Value Information Block (VIB)</td><td></td></tr>
<tr><td colspan="4">Data Record Header (DRH)</td><td></td></tr>
</table>

Each data record consists of a Data Record Header (DRH) and the value (data). The DRH consists of a Data Information Block (DIB) and a Value Information Block (VIB). The DIB specifies the length, type and coding of the data. The VIB specifies the unit for the data and the multiplier to use.

NOTE An application message can contain either just a single data record but also an arbitrary number of such data records in arbitrary order, each describing and containing a data element. For examples of such multi record messages see CEN/TR 17167:2023[1)], Annex A, or for further information on M-Bus see CEN/TR 17167:2023[1)], Annex C.

[1)] Under development

6.3 Data Information Block (DIB)

6.3.1 General

The DIB contains at least one byte of Data Information Field (DIF), and can be extended by a maximum of 10 Data Information Field Extensions (DIFE).

6.3.2 Data Information Field (DIF)

The coding of the DIF is shown in Table 3.

Table 3 — Data Information Field (DIF)

Bit 7	6	5	4	3	2	1	0
Extension bit (E)	LSBit of storage number	Function field		Data field: Length and coding of data			

6.3.3 Data field

The data field shows how length and coding of data shall be interpreted. Table 4 shows the allowed codes for the data field.

Table 4 — Coding of the data field

Code	LengthSize in bit	Data type
0000_b	0	No data
0001_b	8	8 bit integer/binary
0010_b	16	16 bit integer/binary
0011_b	24	24 bit integer/binary
0100_b	32	32 bit integer/binary
0101_b	32	32 bit real
0110_b	48	48 bit integer/binary
0111_b	64	64 bit integer/binary
1000_b	0	Selection for readout
1001_b	8	2 digit BCD
1010_b	16	4 digit BCD
1011_b	24	6 digit BCD
1100_b	32	8 digit BCD
1101_b	N	Variable length
1110_b	48	12 digit BCD
1111_b	—	Special functions

For a detailed description of data types, refer to Annex A “Coding of data records” (e.g. BCD = type A, Real = type H). The coding as integer/binary by default implies coding type B (signed integer). The coding may however be overridden by the settings in VIF/VIFE of the record (e.g. date/time).

Variable length:

A Code of 1101_b implies data with variable length. The length is coded in the first byte of the data, after the DRH and is named LVAR. (e.g. LVAR = 02_h shows that two bytes of data follows.)

If LVAR is used as the variable length of a wireless M-Bus data container (see CEN/TR 17167:2023[1]), Annex F) it counts the number of bytes inside the container (Table 5).

Table 5 — LVAR interpretation

Range	Data Type	Calculation
00_h–BF_h[a]	8-bit text string according to ISO/IEC 8859-1	LVAR (0 to 191) characters
$C0_h$–$C9_h$	Positive BCD number	(LVAR–C0h)*2 digits, 0 to 18 digits
$D0_h$–$D9_h$	Negative BCD number	(LVAR–D0h)*2 digits, 0 to 18 digits
$E0_h$–EF_h	Binary number	(LVAR–E0h) bytes, 0 to 15 bytes
$F0_h$–$F4_h$	Binary number	4*(LVAR–ECh) bytes, 16, 20, 24, 28, 32 bytes
$F5_h$	Binary number	48 bytes
$F6_h$	Binary number	64 bytes
Others LVAR values	Reserved	

a If a wireless M-Bus data container is used it counts the number of bytes inside the container (see also Table 12, Footnote f).

All multi byte fields following LVAR (according Table 5) shall be transmitted with Least Significant Byte first.

A Code of 1111_b implies coding for special functions as specified in Table 6.

Table 6 — DIF-coding for special functions

DIF	Function
$0F_h$	Start of manufacturer specific data structures to end of user data (see 6.5)
$1F_h$	Same meaning as DIF = $0F_h$ + more records follow in next datagram (see 6.5)
$2F_h$	Idle filler (not to be interpreted), following byte = DIF of next record
$3F_h$ to $6F_h$	Reserved
$7F_h$	Global readout request (all storage numbers, units, tariffs, function fields)

[1] Under development

6.3.4 Function field

The Function Field gives the type of value as specified in Table 7.

Table 7 — Function field

Code	Description
00_b	Instantaneous value
01_b	Maximum value
10_b	Minimum value
11_b	Value during error state

6.3.5 Storage number

Bit 6 of the DIF serves as the LSBit of the storage number of the data concerned, and the slave can in this way indicate and transmit various stored metering values or historical values of metering data. This bit is the least significant bit of the storage number and allows therefore the storage numbers 0 and 1 to be coded. If storage numbers higher than "1" are needed, following (optional) DIFE´s contain the higher bits. The storage number 0 signals a current value.

Each storage number is associated with a dedicated time point. Each data record with the same storage number refers the value to this (common) time point given by this storage number. A time/date record for each storage number can be included somewhere in the message to signal this time point associated with this storage number. This date or date/time is coded with a data record with a VIF = $E110110n_b$. Normally (but not necessarily) higher storage numbers indicate an older time point. A sequential block of storage numbers can be associated with a sequence of equidistantly spaced time points (profile). Such a block can be described by its starting time, the time spacing, the first storage number (of such a block) and the length of the block. For an example see Annex F.

Some meters require the assignment of historical values (like consumption values) to register numbers that are represented by OBIS value group F values. In this case the storage number is used to indicate the register number while the DIB shall be extended by a Final DIFE with the value 00h in order to mark the storage number as a register number. Register numbers up to 125 can be coded in this way (see Annex H.2).

6.3.6 Extension bit (E)

Bit 7, the Extension bit of the DIF, indicates when set, that additional data description follows in one or more Data Field Extension, DIFE, bytes.

6.3.7 Data Information Field Extension (DIFE)

There may be up to 10 successive DIFE bytes. The coding of the DIFE is shown in Table 8. Bit 7 (E) of a DIFE byte shows whether a further DIFE byte follows. Bit 6 is a part of the numbering of subunits. Bit 5 and 4 is a part of the numbering of the Tariff and bits 3 through 0 are a part of the Storage number. The full Storage number/Tariff/Subunit number is made up of a concatenation of the information from all of the DIFE's for a parameter.

Table 8 — Coding of the Data Information Field Extension (DIFE)

Bit	7	6	5	4	3	2	1	0
Value	Extension Bit (E)	(Device) Subunit	Tariff		Storage number			