SLOVENSKI STANDARD
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Komunikacijski sistemi za merilnike - Spremno tehnično poročilo k EN 13757-2,-3 in -7 - Primeri in dodatni podatki

Communication system for meters - Accompanying TR to EN 13757-2,-3 and -7, Examples and supplementary information

Kommunikationssysteme für Zähler - Begleitender Technischer Bericht zu EN 13757-2, -3 und -7, Beispiele und ergänzende Informationen

Systèmes de communication pour compteurs - Rapport technique accompagnant les EN 13757-2,-3 et -7 - Exemples et informations supplémentaires

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This Technical Report was approved by CEN on 6 November 2023. It has been drawn up by the Technical Committee CEN/TC 294.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (CEN/TR 17167:2023) has been prepared by Technical Committee CEN/TC 294 “Communication systems for meters”, the secretariat of which is held by DIN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TR 17167:2018.

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

CEN/TR 17167:2023 includes the following significant technical changes with respect to CEN/TR 17167:2018:

— update according new CEN rules IR3.

— update FCB usage and adding new Figure A.1 to be in line with EN 13757-2 (202x)

— add new M-Bus data container for M-Bus upper layers (77h)

— Update datagram example in (sub-)clauses F.4, F.5.4 and F.7.2.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

Introduction

This document belongs to a series of parts of EN 13757, which covers communication systems for meters and remote reading of 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 13757-3 contains detailed description of the application protocols especially the M-Bus Protocol. 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 13757–7 describes transport mechanism and security methods for data.

These upper M-Bus protocol layers can be used with various physical layers and with 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 meters and heat cost allocators) and for electricity meters, in this document 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.

Table 1 gives an overview of the annexes as well as a reference to the corresponding Annexes in the former EN 13757-3:2013 where applicable.

Table 1 — Relation between the annexes of this Technical report and EN 13757–3:2013

Annex	**Description**	**Annex in** EN 13757–3:2013
A	Datagram examples for a twisted pair M-Bus link layer	E
B	Secondary search implementation instructions	F
C	Consumer feedback for smart metering applications	L
D	Installation and registration procedures	M
E	Implementation of an M-Bus data container	N
F	Datagram examples for wired and wireless M-Bus	P
G	Implementation of Descriptors	—

1 Scope

This document contains additional information to the requirements determined in EN 13757-2, EN 13757-3 and EN 13757–7, in particular examples for the implementation, datagram examples secured by security mechanism of part 7 and additional non-normative requirements beyond meter communication itself.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

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

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

3.1
byte
octet of bits

3.2
data integrity
property that data has not been altered or destroyed in an unauthorized manner

3.3
datagram
unit of data transferred from source to destination

3.4
integrity
see data integrity

3.5
key derivation
technique by which a (potentially large) number of keys are generated (“derived”) from a single initial key and non-secret variable data with each resulting key using a non-reversible process

3.6
message
functional set of data transferred from source to destination

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

3.7
persistent key
cryptographic key which is kept for a prolonged period

3.8
security mechanism
mode of operation of a (symmetric) cryptographic algorithm

3.9
security mode
mode number in configuration field identifying a set of applied security mechanisms

3.10
security service
authenticity, confidentiality and data integrity

4 Symbols and abbreviations

4.1 Abbreviations

ACK	Acknowledge
AES	Advanced Encryption Standard
AFL	Authentication and Fragmentation Layer
APL	Application Layer
BCD	Binary Coded Decimal numbers
CBC	Cipher Block Chaining (AES mode of operation)
CF	Configuration Field
CFE	Configuration Field Extension
CI	Control Information field
CMAC	Cipher-based MAC [Source: NIST/SP 800–38B]
CMD	Command
CNF-IR	Confirm Installation Request
CTR	Counter Mode encryption algorithm (AES mode of operation)
DIB	Data Information Block
DIF	Data Information Field
DIFE	Data Information Field Extensions
DLL	Data Link Layer
ELL	Extended Link Layer
GCM	Galois/Counter Mode, an algorithm for authenticated encryption with associated data (AES mode of operation)
IV	Initialisation Vector
LSB	Least Significant Byte
MAC	Message Authentication Code

NOTE MAC is in other standards also used as an acronym for Media Access Control for data communication at the Physical Layer

MSB	Most Significant Byte
OBIS	Object Identification System (see IEC 62056–6-1)
REQ-UD	Request User Data (class 1 or 2)

RSP-UD	Respond User Data
RSSI	Received Signal Strength Indicator
SM-CG	Smart Meter Co-ordination Group
SND-IR	Send Installation Request
SND-NKE	Send Link Reset
SND-NR	Send – No Reply
SND-UD	Send User Data
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.

The concatenation of fields is indicated by the symbol “||”. E.g. 12_h || 34_h results in 1234_h.

5 Overview

The supplementary information on the requirements determined in EN 13757-2, EN 13757-3 and EN 13757–7 is provided in the annexes of this document. Table 2 gives an Overview about these Annexes.

Annexes A, B and D are only applicable to wired M-Bus solution.

Annex C describes how parts of EN 13757-2, EN 13757-3, EN 13757-4 and EN 13757–7 can be used to implement smart meter functionalities. Similar functionalities could also be implemented using other physical and link layers.

Annex D provides information on installation procedures wireless meters and their integration in meter management systems.

Annex E contains a definition of two containers to transport special data via an M-Bus data point.

Annex F provides many examples of plain and encrypted/authenticated M-Bus messages for the wired and wireless M-Bus.

Annex G defines descriptors, i.e. special M-Bus data points, which have been added to explain the purpose of other M-Bus data points.

Table 2 — Overview of the Annexes

Annex	Description	Applicable for	
		wired M-Bus	wireless M-Bus
A	Datagram examples for a twisted pair M-Bus link layer	x	
B	Secondary search implementation instructions	x	
C	Consumer feedback for smart metering applications	x	x
D	Installation and registration procedures		x
E	Implementation of an M-Bus data container	x	x
F	Datagram examples for wired and wireless M-Bus	x	x
G	Implementation of Descriptors	x	x

Annex A
(informative)

Examples

A.1 General

The following examples give the whole datagram for a twisted pair M-Bus link layer (EN 13757-2). Nevertheless, other physical and link layers (e.g. EN 13757-4) could also be used.

A.2 Example for an RSP-UD

(All values are hex.)

68 1F 1F 68	Link layer header of RSP-UD datagram (length $1F_h$ = 31d bytes)
08 02 72	C field = 08 (RSP), address 2, CI field 72h
78 56 34 12	Identification number = 12345678
24 40 01 07	Manufacturer ID = 4024_h (“PAD”), version = 1, device type = water meter
55 00 00 00	ACC = 55_h = 85d, status = 00_h, configuration field = 0000_h
03 13 15 31 00	**Data block 1:** unit 0, storage No. 0, no tariff, instantaneous volume, 12565 l (24 bit integer)
DA 02 3B 13 01	**Data block 2:** unit 0, storage No. 5, no tariff, maximum volume flow, 113 l/h (4 digit BCD)
8B 60 04 37 18 02	**Data block 3:** unit 1, storage No. 0, tariff 2, instantaneous energy, 218,37 kWh (6 digit BCD)
18 16	Checksum and stop sign

A.3 Example baud rate switch

The master switches the slave (in point-to-point connection) from now 2 400 Bd to 9 600 Bd.

(All values are hex.)

Master to slave: 68 03 03 68 53 FE BD 0E 16 with 2 400 Bd.

Slave to master: E5 with 2 400 Bd.

From that time on the slave communicates with the transmission speed 9 600 Bd, if the slave can handle 9 600 Bd, otherwise it remains at 2 400 Bd.

In bus mode this is followed within < 2 min by an acknowledged communication (i.e. SND-NKE) at 9 600 Bd.

Master to slave: 10 40 FE 3E 16.

Slave to master: E5.

A.4 Example application select with subcode

The master releases an enhanced application select to all slaves. All datagrams of the user data type are requested.

(All values are hex.)

Master to slave: 68 04 04 68 53 FE 50 10 B1 16.

Slave to master: E5.

A.5 Writing data to a slave

The master can send data to a slave using a SND-UD with CI-field 51_h, $5A_h$ or $5B_h$.

The following table shows the data structure for a write message. The order of the first three blocks in the following Table A.1 can be chosen freely, but the write only data record is at the end of the message. All records are optional.

Table A.1 — Data structure for writing data

Primary address record	Enhanced identification record	Normal data records	Write only data records

Primary address record.

The primary address record is optional and consists of three bytes:

Table A.2 — Coding of primary address

DIF = 01_h	VIF = $7A_h$	Data = Address (1 byte binary)

With this data record a primary address can be assigned to a slave in point to point connections. The master knows all the used addresses on the bus and forbids setting the address of a slave to an already used address. Otherwise, both slaves with the same address could not be read out anymore.

Enhanced identification record.

With this optional data record, the identification (secondary address) can be changed. There are two cases to be distinguished:

Data are only the identification number

Table A.3 — Coding of single identification number

DIF = $0C_h$	VIF = 79_h	Data = Identification No. (8 digit BCD)

Data are the complete identification

Table A.4 — Coding of complete secondary address

DIF = 07_h	VIF = 79_h	Data = complete ID (64 bit integer)

The data are packed exactly as in the readout header of a CI = 72 variable protocol with low byte first.

Table A.5 — Structure of secondary address

Identification no.	Manufacturer ID	Version	Device Type
4 byte	2 byte	1 byte	1 byte

Normal data records:

The data records, which can be read out with a REQ_UD2, are sent back to the slave with the received DIF and VIF and the new data contents. Additional features can be implemented using the generalized object layer (see EN 13757-3:2018, 6.4.1).

Write-only data:

Data, which cannot be read out of the slave with a normal data block, can be transmitted using the VIF = $7F_h$ for manufacturer specific coding. The DIF has a value corresponding to the type and length of data.

After receiving the SND-UD correctly without any error in data link layer, the slave answers with an acknowledgement ($E5_h$). The slave decides whether to change variables or not after a data write from the master. In case of errors in executing parts of or whole write instructions the slave can decide whether to change no variables or single correct variables. The slave can report these errors to the master in the next RSP-UD datagram using some of the methods which are described in EN 13757-3:2018, 10.3.

There are some methods for implementing write protect, for example allowing only one write after a hardware reset of the processor or enabling write if a protect disable jumper is set.

Examples (all values are hex.)

EXAMPLE 1 Set the slave to primary address 8 without changing anything else:

68 06 06 68 53 FE 51 01 7A 08 25 16

EXAMPLE 2 Set the complete identification of the slave (ID = 01020304 (BCD), Man = 4024h (PAD), Ver = 1, Dev. Type = 4 (heat):

68 0D 0D 68 53 FE 51 07 79 04 03 02 01 24 40 01 04 95 16

EXAMPLE 3 Set identification number of the slave to “12345678 (BCD)” and the 8 digit BCD-counter (unit 1 kWh) to 107 kWh.

68 0F 0F 68 53 FE 51 0C 79 78 56 34 12 0C 06 07 01 00 00 55 16

A.6 Configuring M-Bus data output

A.6.1 General

For default, the slave transmits all its data according the selected message application by an Application select protocol (see EN 13757-3:2018, Clause 7). It could be useful for some scenarios to adapt this preselected message contents by an individual selection or deselection of specific data records.

The individual selection of data records is a temporary adaption of the message content of the currently selected message application. The next applied application reset or application select (according to EN 13737-3:2018, 5.3) will clear this temporary data record selection and the meter will send the original content of the message application.

The message application 15 “User defined” is dedicated to store the individual selected data record adaptions. Contrary to the other message applications the modification remains permanently even after