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Stanovanjski in stavbni elektronski sistemi (HBES) - 5-2. del: Mediji in nivoji, odvisni od medijev - Omrežja, ki temeljijo na HBES razreda 1, zviti par

Home and Building Electronic Systems (HBES) Part 5-2: Media and media dependent layers - Network based on HBES Class 1, Twisted Pair

Elektrische Systemtechnik für Heim und Gebäude (ESHG) - Teil 5-2: Medien und medienabhängige Schichten - Netzwerk basierend auf ESHG Klasse 1, Twisted Pair

Systèmes électroniques pour les foyers domestiques et les bâtiments (HBES) - Partie 5-2: Medias et couches dépendantes des medias - Réseau basé sur HBES Classe 1, Paire Torsadée

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Home and Building Electronic Systems (HBES) Part 5-2: Media and media dependent layers - Network based on HBES Class 1, Twisted Pair

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European foreword

This document (EN 50090-5-2:2020*)* has been prepared by CLC/TC 205, “Home and Building Electronic Systems (HBES)”[1]

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2020-10-10
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2023-04-10

This document will supersede EN 50090-5-2:2004 and all of its amendments and corrigenda (if any).

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

EN 50090-5-2 is part of the EN 50090 series of European Standards, which will comprise the following parts:

— Part 1: Standardization structure;

— Part 3: Aspects of application;

— Part 4: Media independent layers;

— Part 5: Media and media dependent layers;

— Part 6: Interfaces;

— Part 7: System management;

NOTE Part 2 has been withdrawn.

[1] This document was prepared with the help of CENELEC co-operation partner KNX Association, De Kleetlaan 5, B-1831 Diegem.

Introduction

According to OSI, Physical Layers consist of the medium, the cable, the connectors, the transmission technology etc. which refers to their hardware requirements. In this document however, the status of the Physical Layer as a “communication medium” is emphasized.

1 Scope

This document defines the mandatory and optional requirements for the medium specific physical and data link layer for HBES Class 1 Twisted Pair TP1.

Data link layer interface and general definitions, which are media independent, are given in EN 50090-4-2.

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 50090-1, *Home and Building Electronic Systems (HBES) — Part 1: Standardization structure*

EN 50090-2-2, *Home and Building Electronic Systems (HBES) — Part 2-2: System overview — General technical requirements*

EN 50090-3-2, *Home and Building Electronic Systems (HBES) — Part 3-2: Aspects of application — User process for HBES Class 1*

EN 50090-4-2, *Home and Building Electronic Systems (HBES) — Part 4-2: Media independent layers — Transport layer, network layer and general parts of data link layer for HBES Class 1*

EN 50290 (series), *Communication cables*

EN 61000-4-5, *Electromagnetic compatibility (EMC) — Part 4-5: Testing and measurement techniques — Surge immunity test (IEC 61000-4-5)*

EN 61000-6-1, *Electromagnetic compatibility (EMC) — Part 6-1: Generic standards — Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1)*

EN 61000-6-2, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments (IEC 61000-6-2)*

HD 21.2 S2, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V — Part 2: Test methods (IEC 60227-2)*

HD 22.2 S2, *Rubber insulated cables of rated voltages up to and including 450/750 V — Part 2: Test methods (IEC 60245-2)*

IEC 60189-2, *Low-frequency cables and wires with PVC insulation and PVC sheath — Part 2: Cables in pairs, triples, quads and quintuples for inside installations*

IEC 60332-1, *Tests on electric cables under fire conditions — Part 1: Test on a single vertical insulated wire or cable*

IEC 60754-2, *Test on gases evolved during combustion of materials from cables — Part 2: Determination of acidity (by pH measurement) and conductivity*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 50090-1 and the following apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
HBES class 1 twisted pair type 1
physical layer specification for data and power transmission on a single twisted pair, allowing asynchronous character-oriented data transfer in a half-duplex, bi-directional communication mode, using a specifically balanced/symmetrical base-band signal coding with collision avoidance under SELV conditions

3.1.2
distributed power supply
powers the bus in a distributed way by a number of the devices connected to the line (compared to a centralized power supply)

3.1.3
logical tag extended HEE
usage of the L_Data_Extended frame dedicated to extended group addressing

3.1.4
remote powered devices
RPD
do not extract their energy for the application circuit and the bus controller from the bus but from another independent source of energy, e.g. mains

Note 1 to entry: Owing to the reduced DC power consumption of RPD, a bus line equipped with such devices requires less power from the installed Power Supply Unit (PSU). The connection of bus-controller and application to the same electrical potential reduces the effort of galvanic separation in RPD.

3.1.5
TP1 backbone couplers
15 can be used to couple up to 16 zones to a full sized TP1 network

3.1.6
TP1 backbone line
main line of the inner zone is called backbone line

3.1.7
TP1 bridge
four TP1-64 physical segments can be combined to a line by using bridges

Note 1 to entry: 256 devices can then be connected to such a line.

3.1.8
TP1 line
consists of a maximum of 256 devices, either directly connected in case of TP1-256 or separated over 4 physical segments in case of TP1-64, each with 64 devices

3.1.9
TP1 line couplers
routers that combine lines to a zone

3.1.10
TP1 logical unit
converts the serial bit stream to octets and octets to the serial bit stream, which is a serial stream of characters

3.1.11
TP1 medium access unit
converts information signals to analogue signals and vice versa, typically extracts DC power from the medium

3.1.12
TP1 main line
inner line of a zone

3.1.13
TP1 physical segment
smallest entity in the TP1 topology

Note 1 to entry: To a physical segment up to 64 devices can be connected in case of TP1–64 and 256 in case of TP1–256.

3.1.14
TP1 Polling Master
Poll_Data master
device transmitting the Poll_Data frame

3.1.15
TP1 polling slave
Poll_Data slave
device transmitting a Poll_Data character

3.1.16
TP1 router
acknowledges frames on data link layer and transmits the received frame on the other side of the router, provided the device associated with the destination address is located on the other side

3.1.17
TP1 sub-line
outer lines of a zone

3.1.18
TP1 zone
16 TP1 lines can be connected to a zone by using 15 routers

3.2 Abbreviations

AC	alternating current
ACK	acknowledge
APDU	application layer protocol data unit
AT	address type
CSMA/CA	carrier sense, multiple access with collision avoidance
CKS	checksum

DA	destination address
DC	direct current
DL TP	data link layer type twisted pair
DPS	distributed power supply
CTRL	control field
HBES Class 1	refers to simple control and command
HBES Class 2	refers to class 1 plus simple voice and stable picture transmission
HBES Class 3	refers to class 2 plus complex video transfers
IFT	inter-frame-time
LC	line coupler
LN	length
LPDU	link layer protocol data unit
LSDU	link layer service data unit
LTE-HEE	logical tag extended hee
MAU	medium attachment unit
NACK	negative acknowledge
NPCI	network layer protocol control information
NRZ	non-return-to-zero
OCP	over-current protection
PELV	protective extra low voltage
PDU	protocol data unit
PSU	power supply unit
RPD	remote powered bus devices
RUP	reverse polarity protection
SA	source address
SDU	service data unit
SELV	safety extra low voltage
TP	twisted pair
TPDU	transport layer protocol data unit
UART	universal asynchronous receiver transmitter
up	power up

4 Requirements for HBES Class 1, Twisted Pair Type 1 (TP1-64 and TP1-256)

4.1 Physical layer requirements – Overview

The Physical Layers described in this clause are called Physical Layer type twisted pair TP1-64 and twisted pair TP1-256. The main differences are shown in Table 1. TP1-256 is backwards compatible towards TP1-64. If common features of TP1-64 and TP1-256 are described, only the expression TP1 is used.

The Twisted Pair medium TP1 characteristics are:

— data and power transmission with one pair of wires;

— asynchronous character-oriented data transfer;

— half duplex bi-directional communication;

— a specifically balanced/symmetric base-band signal coding under SELV conditions.

All characteristics given in the following subclauses, for instance maximum number of devices or possible cable length per physical segment are only valid for cable complying to the requirements as shown in 4.4 and for TP1 devices of which bus power consumption does not exceed 12 mA [2)].

Table 1 — System parameters of physical layer Type TP1–64 and TP1–256

Characteristics	Description TP1–64	Description TP1–256
Medium	**Shielded twisted pair [a]**	
Topology	**Linear, star, tree or mixed**	
Baud rate	**9 600 bps**	
Device supplying	**Normal: bus powered devices - optional: remote powered devices**	
Device power consumption	**3 mA to 12 mA**	
Power Supply Unit (PSU)	**DC 30 V**	
Number of PSUs per physical segment	**Maximum 2**	
Number of connectable devices per physical segment	**Maximum 64**	**Maximum 256**
Number of addressable devices per physical segment	**Maximum 255 [b]**	**Maximum 255**
Total cable length per physical segment	**Maximum 1 000 m**	
Distance between two devices	**Maximum 700 m**	
Total number of devices in a network	**More than 65 000 (with bridges)**	**More than 65 000**
Protection against shock	**SELV (Safety Extra Low Voltage)**	
Physical signal	**Balanced/symmetric baseband signal encoding**	

a The shield is not mandatory, shielded cables with earth connection can improve noise immunity.

b In TP1–64 a physical segment can be extended with up to 3 extra physical segments, each connected to it via a bridge. Every physical segment can contain 63 devices.

Figure 1 shows the logical structure of the physical layer type TP1 entity. Every device includes one; every router and bridge is equipped with two such physical layer type TP1 entities.

The physical layer type TP1 entity consists of four blocks:

— cable (medium);

— connector, connecting a device or a bridge to the transmission medium;

— a Medium Attachment Unit (MAU);

———————

2) Fan-in model allowing devices of which the bus power consumption is higher is under consideration.

— logical unit.

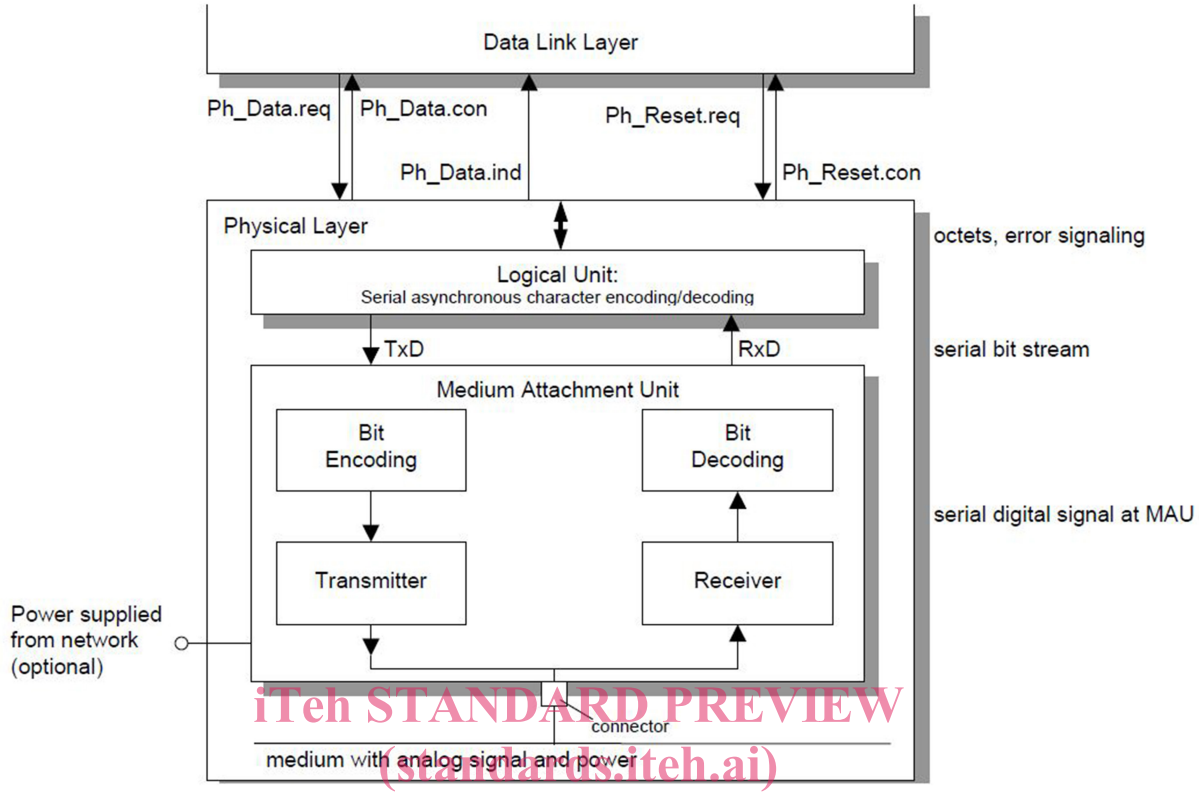

Figure 1 — Logical structure of physical layer type TP1

Figure 2 shows the relationship between the bits of an octet and the Universal Asynchronous Receiver Transmitter (UART) character data bits.

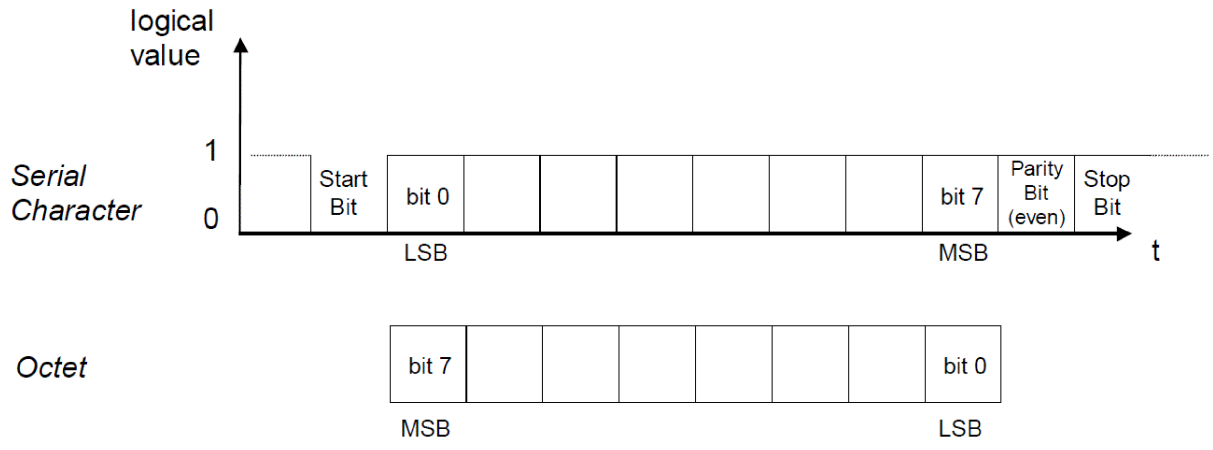

Figure 2 — Octet mapped to a serial character

4.2 Requirements for analogue bus signals

4.2.1 General

In the underneath description, U_{REF} is an internal reference voltage for the DC part of the bus voltage, used by the transmitter/receiver for evaluating the sent/received signal levels. This reference voltage is sampled before the start bit of a byte. This U_{REF} may vary with the values given in 4.2.5.

The underneath specifications classify a 0 and 1 signal on the bus: the requirements for signal generation and extraction for the transmitter and receiver respectively are defined in 4.3.2.6 and 4.3.2.7.

4.2.2 Specification of logical “1”

A logical “1” shall be regarded as the idle state of the bus, which means that the transmitter of a MAU shall be disabled during sending a “1”. The analogue signal at the bus consists normally only of the DC-part. There is no difference between sending a “1” and sending nothing. A decline of voltage during a “1” may occur, if a ‘0 bit’ was preceding. The graph shall be within the shaded areas of Figure 3.

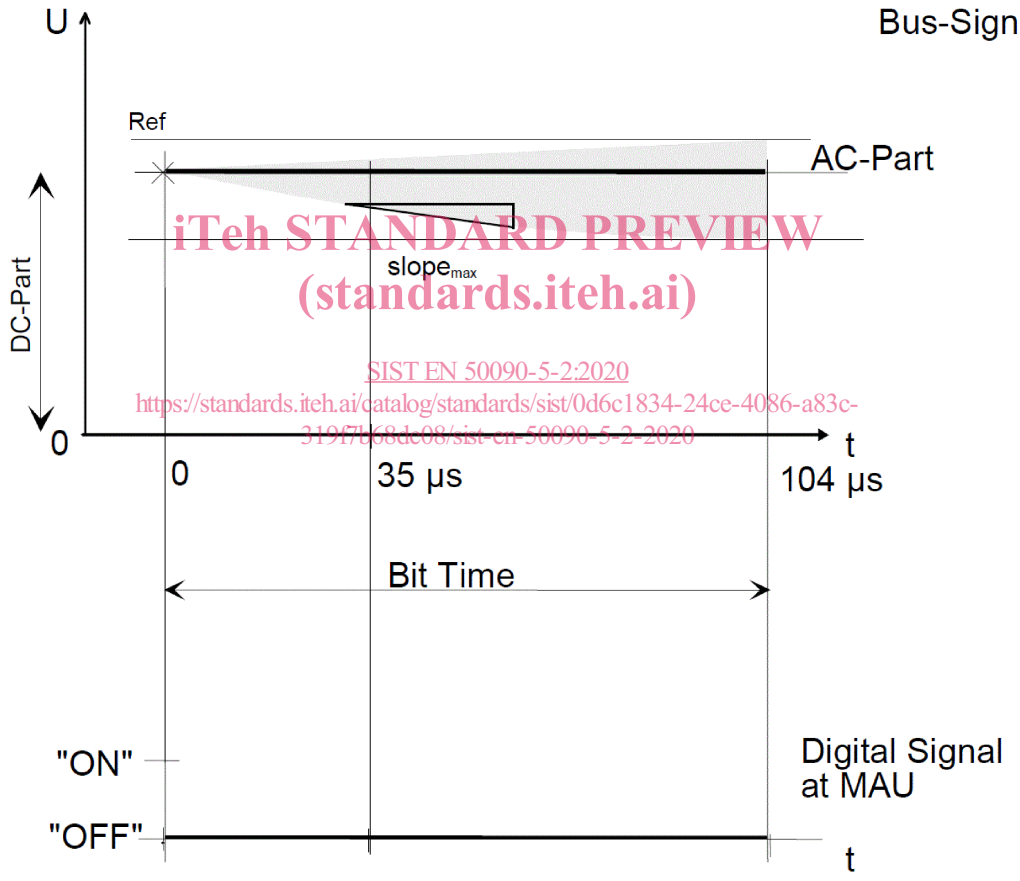

Figure 3 — “1”-Bit frame

The characteristics of a logical 1 signal shall follow the values given in Table 2.

Table 2 — Analogue and digital signal of a logical “1”

Parameter	Value
Bit-time	**104 µs**
Voltage (DC-part)	**21 to 32 V DC**
Slopes (AC-part)	**Maximum 400 mV/ms**

4.2.3 Specification of logical “0” (Single)

A logical “0” shall be a defined voltage drop (U_a) of the analogue bus signal with a duration of t_{active} (see Figure 4). During the following equalization time the voltage may be higher than the DC-part to enable recharging of energy consumed during the active part. The graph shall be within the shaded areas of Figure 4.

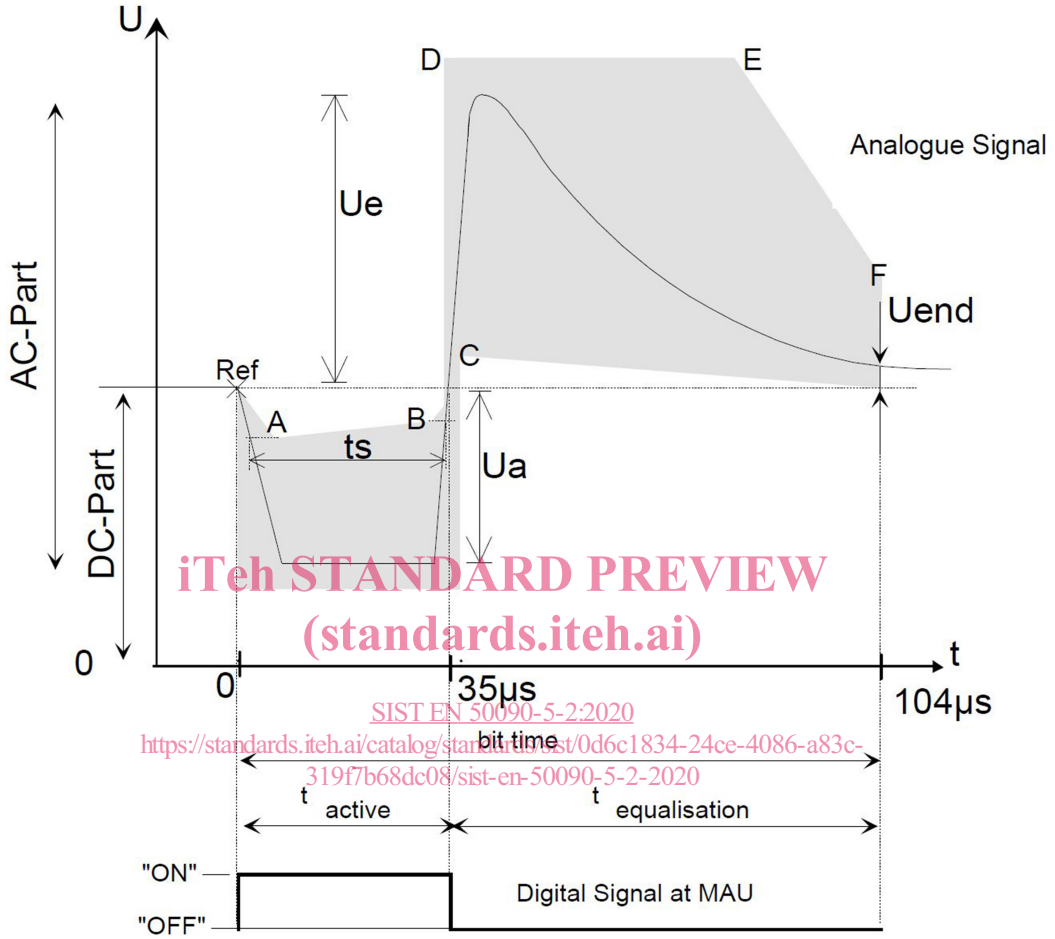

Figure 4 — “0”-Bit frame

The characteristics of a logical “0” signal shall follow the values given in Table 3.