SLOVENSKI STANDARD
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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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97.120	Avtomatske krmilne naprave za dom	Automatic controls for household use

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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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CENELEC
European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

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Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 205, Home and Building Electronic Systems (HBES) with the help of CENELEC co-operation partner Konnex Association (formerly EHBESA).
The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50090-5-2 on 2003-12-02.

This European Standard supersedes R205-009:1996.

CENELEC takes no position concerning the evidence, validity and scope of patent rights.

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Konnex Association
Neerveldstraat, 105
Twin House
B - 1200 Brussels

Tel.: + 32 2 775 85 90
Fax.: + 32 2 675 50 28
e-mail: info@konnex.org
www.konnex.org

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The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-12-01

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– latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-12-01

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

Part 1: Standardisation structure
Part 2: System overview
Part 3: Aspects of application
Part 4: Media independent layers
Part 5: Media and media dependent layers
Part 6: Interfaces
Part 7: System management
Part 8: Conformity assessment of products
Part 9: Installation requirements

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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 European Standard however, the status of the Physical Layer as a “communication medium” is emphasized.

1 Scope

This European Standard defines the mandatory and optional requirements for the medium specific physical and data link layer for HBES Class 1 Twisted Pair in its two variations called TP0 and TP1.

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

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 50090-1 [1)]	*Home and Building Electronic Systems (HBES) – Part 1: Standardisation structure*
EN 50090-2-2	*Home and Building Electronic Systems (HBES) – Part 2-2: System overview – General technical requirements*
EN 50090-3-2:2004	*Home and Building Electronic Systems (HBES) – Part 3-2: Aspects of application – User process for HBES Class 1*
EN 50090-4-2:2004	*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 50090-7-1:2004	*Home and Building Electronic Systems (HBES) – Part 7-1: System Management – Management procedures*
EN 50090-9-1:2004	*Home and Building Electronic Systems (HBES) – Part 9-1: Installation requirements – Generic cabling for HBES Class 1 Twisted Pair*
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, mod.)
EN 61000-6-2	*Electromagnetic compatibility (EMC) – Part 6-2: Generic standards - Immunity for industrial environments* (IEC 61000-6-2, mod.)
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, mod.)

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[1)] At draft stage.

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HD 22.2 S2	*Rubber insulated cables of rated voltages up to and including 450/750 V – Part 2: Test methods* (IEC 60245-2, mod.)
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 electric cables – Part 2: Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1
HBES Class 1 Twisted Pair Type 0
the Twisted Pair medium Twisted Pair Type 0 (TP0) is a 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 unbalanced/unsymmetrical base-band signal coding with collision avoidance under SELV conditions

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3.1.2
HBES Class 1 Twisted Pair Type 1
the Twisted Pair medium Twisted Pair Type 1 (TP1) is a 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

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3.1.3
distributed power supply
the bus is powered in a distributed way by a number of the devices connected to the line (compared to a centralized power supply)

3.1.4
Logical Tag Extended HEE
usage of the L_Data_Extended frame dedicated to extended group addressing

3.1.5
Remote Powered Devices
remote Powered Bus 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. 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

3.1.6
TP0 C Factor
to simplify system engineering, the supply current of a TP0 device (both power supply and bus device) is expressed by a factor "C", defined as

$$C = \frac{\text{Actual current}}{\text{Reference device supply current}}$$

The actual current can either be the one provided by a power supply or used by a device

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3.1.7
TP0 Character
11 bit set including 8 data bits, 1 check bit (odd parity bit) and two synchronisation bits (start and stop bits)

3.1.8
TP0 Distortion
percentage ratio of the deviation time between the instant a transition occurs and the ideal transition instant, and the bit duration (~208 µs); the distortion is measured for each bit of a character, starting with the start bit

3.1.9
TP0 Inter-Frame Time
time between the end of a frame (end of stop bit for the last character) and the beginning of the next frame (beginning of the start bit of the first character)

3.1.10
TP0 Line Load
percentage ratio representing the proportion of actual character transmission during a specified integration time interval

3.1.11
TP0 Odd parity bit
check bit whose value is such that there is an odd number of logic “0” within the data and parity fields

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3.1.12
TP0 Repeater
connects a primary segment to a secondary segment

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3.1.13
TP1 Backbone Couplers
15 backbone couplers can be used to couple up to 16 zones to a full sized TP1 network

3.1.14
TP1 Backbone Line
the main line of the inner zone is called backbone line

3.1.15
TP1 Bridge
four TP1-64 physical segments can be combined to a line by using bridges. To such a line 256 devices can then be connected

3.1.16
TP1 Line
a 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

3.1.17
TP1 Line Couplers
routers that combine lines to a zone are called line couplers

3.1.18
TP1 Logical Unit
converts the serial bit stream to octets and octets to the serial bit stream, which is a serial stream of characters

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3.1.19
TP1 Medium Access Unit
converts information signals to analogue signals and vice versa, typically extracts DC power from the medium

3.1.20
TP1 Main line
the inner line of a zone is called main line

3.1.21
TP1 Physical Segment
a physical segment is the smallest entity in the TP1 topology. To a physical segment up to 64 devices can be connected in case of TP1-64 and 256 in case of TP1-256

3.1.22
TP1 Polling Master
the device transmitting the Poll_Data frame is called the TP1 Polling master or Poll_Data master

3.1.23
TP1 Polling Slave
the device transmitting a Poll_Data character is called the TP1 polling slave or Poll_Data slave

3.1.24
TP1 Router
a 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

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3.1.25
TP1 Sub-line
the outer lines of a zone are called sublines or lines

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3.1.26
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

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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

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4 Requirements for HBES Class 1, Twisted Pair Type 0 (TP0)

4.1 Datagram service

4.1.1 Transmission method

4.1.1.1 Description

The following subclauses specify the valid signals on the medium and the encoding and decoding rules and the composition of characters and datagrams.

4.1.1.2 Modulation method

The open/closed circuit switching of the line shall be used as modulation technique.

4.1.1.3 Encoding rules

The line code shall be the Non-Return-to-Zero (NRZ) code using negative logic, as shown in Figure 1.

Logic “0” shall indicate the open-circuit state of the line (or idle state).

Logic “1” shall indicate closed-circuit state of the line for the duration of a bit time.

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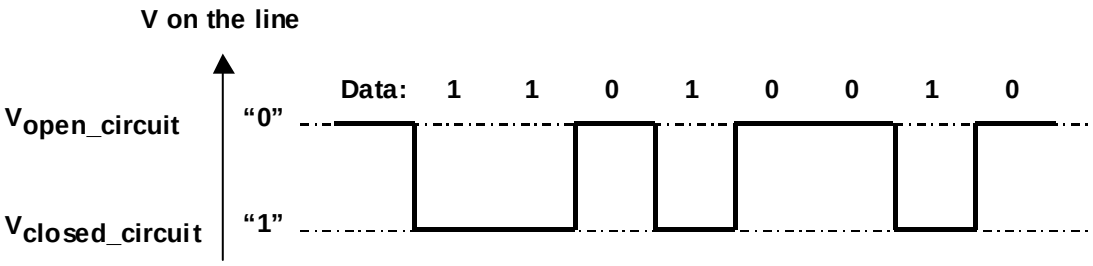

Figure 1 – NRZ line code

4.1.1.4 Bit rate

The line signal shall be transmitted at a rate of 4,8 kbit/s.

4.1.1.5 Electrical data encoding

Line open/closed-circuit modulation shall conform to the following values:

Table 1 – Electrical data encoding

	Start	Stop	Logic "0"	Logic "1"
Receiver	U < 7 V (closed)	U > 9 V (open)	U > 9 V (open)	U < 7 V (closed)
Sender	U < 1,5 V at 330 mA (closed)	I < 100 µA at 18 V (open)	I < 100 µA at 18 V (open)	U < 1,5 V at 330 mA (closed)

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Fault orientation: circuits shall be designed in such a way to avoid that the most likely failure mode of any component does not close the line.

4.1.1.6 Character format

A frame shall be sent as a character string in standard asynchronous format.

The character format is shown in Figure 2.

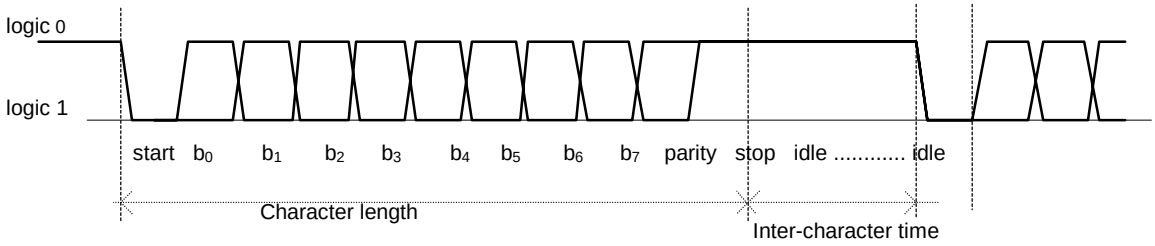

Figure 2 – Character format

Each character shall consist of one Start bit, eight Data bits b_o ... b_7, one parity bit and one Stop bit. Each data octet (b_7 (=msb), b_6 ... b_0) shall be formatted as a character and shall be sent with lsb (=b_o) first.

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The start bit shall be a Logic “1”.

The parity bit shall make an odd parity of the count of the Logic “0” values over the data bits and the Parity bit.

The stop bit shall be a Logic “0”.

4.1.1.7 Synchronisation

The bits of a character shall be transmitted as one continuous stream. The leading edge of the start bit as defined in 4.1.1.6 shall be interpreted as the start of the character and shall be used for bit and character synchronisation. The character shall end with the stop bit.

The characters in a frame (see 4.4.1) shall be sent as one stream with an inter-character time < 2,3 ms.

4.1.2 Transceiver characteristics

4.1.2.1 Description

The following subclauses specifiy the electrical and timing requirements for senders and transmitters.

4.1.2.2 Sending part

The requirements shown in Table 2 and Figure 3 shall be met:

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Table 2 – Transceiver characteristics – Sending part

Feature	Requirement
Maximum closed-circuit voltage across terminals	1,5 V at 330 mA
Maximum open-circuit leakage current	100 µA at 18 V
Maximum distortion	10 %
Rising edge	0,8 µs ≤ t_r ≤ 5 µs (see test set-up in Figure 3)
Falling edge	0,8 µs ≤ t_f ≤ 5 µs (see test set-up in Figure 3)

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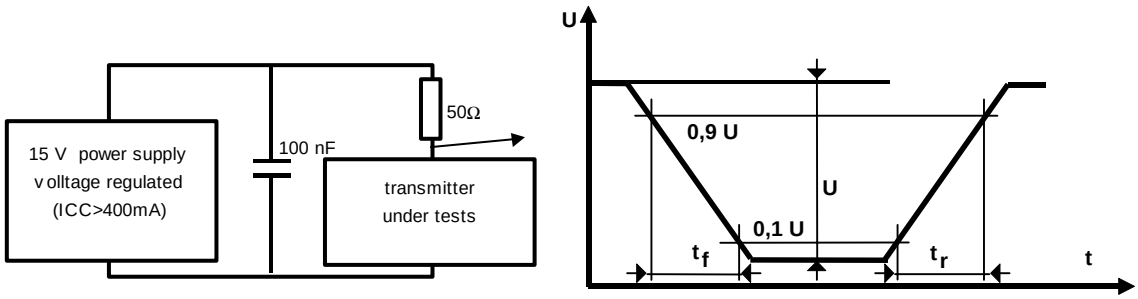

Figure 3 – Transmitter rising and falling edges

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4.1.2.3 Receiving part

The requirements shown in Table 3 shall be met:

Table 3 – Transceiver characteristics – Receiving part

Feature	Requirement
Maximum input resistance	500 kΩ
Minimum current drain per device	30 µA
Threshold voltage	8 V ± 1 V
Minimum permissible distortion	30 %

4.1.3 Physical layer services – Physical data service

This Ph-Data-service shall transfer a single octet of data between co-operating peer data link layer entities. It shall consist of three primitives:

Ph-Data.Request this primitive shall be used to transmit a single octet

Ph-Data.Confirm this primitive shall indicate to the client layer the success or otherwise of the transmission

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Ph-Data.Indication this primitive shall convey the received octet to the receiving data link layer.

Table 4 – Mandatory and optional requirements for physical layer services

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Parameter Name	Request	Indication	Confirm
Ph-SDU	Mandatory	Mandatory	Not used
Ph-Result	Not used	Mandatory	Mandatory

Parameter Ph-SDU shall contain the octet to be transmitted (values 00h to FFh) or received. It is mandatory, both in the Ph-Data.Request and Ph-Data.Indicate primitives. The physical layer, on receiving the Ph-Data.Request primitive from the data link layer, shall:

- insert a start bit before the 8 data bits,
- calculate the odd parity value and insert the parity bit after the 8 data bits,
- terminate the bit string with a stop bit and
- send the 11-bit character and monitor the line for possible collision.

Upon completion of the transmission, successful or not, the Ph-Data.Confirm primitive shall carry the Ph-Result parameter to the data link layer.

When the physical layer is not transmitting a character, it shall monitor the line for a close-circuit condition. If this condition happens, the physical layer shall start with the reception of an 11-bit character. If a character is received, the start bit, stop bit and the parity bit, shall be checked and if correct shall be discarded. The character shall be delivered to the data link layer in a Ph-Data. Indication primitive and the Ph-Result parameter shall convey the correct or incorrect reception.