

Cabled distribution systems for television, sound and interactive multimedia signals

Part 9. Interfaces for CATV/SMATV headends and similar professional equipment for DVB/MPEG-2 transport streams

The European Standard EN 50083-9 : 1997 has the status of a
British Standard

ICS 33.060.40

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee EPL/100, Audio, video and multimedia systems and equipment, to Subcommittee EPL/100/4, Cabled distribution systems, upon which the following bodies were represented:

- British Cable Makers Confederation
- British Radio and Electronic Equipment Manufacturers Association
- British Telecom
- Cable Communications Association
- Confederation of Aerial Industries
- Electricity Association
- Institution of Electrical Engineers
- Radiocommunications Agency
- Society of Cable Telecommunications Engineers

This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 August 1997

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Amendments issued since publication

Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard:
Committee reference EPL/100/4
Draft for comment 96/204959 DC

ISBN 0 580 27693 7

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National foreword

This Part of BS EN 50083 has been prepared by Subcommittee EPL/100/4, and is the English language version of EN 50083-9 : 1997, published by the European Committee for Electrotechnical Standardization (CENELEC).

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 52, an inside back cover and a back cover.

Descriptors: Telecommunications, television broadcasting, sound broadcasting, multimedia, interfaces, antenna conductors, satellite broadcasting, cables television

English version

**Cabled distribution systems for television, sound and
interactive multimedia signals
Part 9: Interfaces for CATV/SMATV headends and similar
professional equipment for DVB/MPEG-2 transport streams**

Systèmes de distribution par câbles
destinés aux signaux de radiodiffusion
sonore, de télévision et multimedia
interactifs
Partie 9: Interfaces pour les têtes de
réseaux pour antennes communautaires,
antennes collectives par satellite et
matériels professionnels analogues pour
les flux transport DVB/MPEG-2

Kabelverteilsysteme für Fernseh-, Ton-
und interaktive Multimedia-Signale
Teil 9: Schnittstellen für
CATV-/SMATV-Kopfstellen und
vergleichbare professionelle Geräte
für DVB/MPEG-2-Transportströme

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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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Ref. No. EN 50083-9:1997 E

FOREWORD

This European Standard was prepared by CENELEC Technical Committee TC 209, "Cabled distribution systems for television, sound and interactive multimedia signals" on the basis of the specification "Interfaces for CATV/SMATV Headends and similar Professional Equipment" (document: DVB-TM1449 Rev 1, 11 July 1995) [1], prepared by the DVB-TM ad hoc group on "Physical Interfaces".

The text of the European Standard was approved by CENELEC as EN 50083-9 on 1996-10-01.

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) 1997-09-01
- latest date by which national standards conflicting
with the EN have to be withdrawn (dow) 1997-09-01

For products which have complied with the relevant national standard before 1997-09-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2002-09-01.

Annexes designated "normative" are part of the body of the standard. Annexes designated "informative" are given for information only. In this standard, annexes A and B are normative and annexes C to F are informative.

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1 Scope

1.1 General

Standards of the EN 50083 series deal with cabled distribution systems for television, sound and interactive multimedia signals including equipment

- for headend-reception, processing and distribution of sound and television signals and their associated data signals and
- for processing, interfacing and transmitting all kinds of interactive multimedia signals

using all applicable transmission media.

They cover all kinds of systems like

- CATV-systems,
- MATV- and SMATV-systems,
- individual receiving systems

and all kind of equipment installed in such systems.

The extent of these standards is from the antennas, special signal source inputs to the headend or other interface points to the system up to the system outlet or the terminal input, where no system outlet exists.

1.2 Specific scope of this part 9

This standard describes physical interfaces for the interconnection of signal processing devices for professional CATV/SMATV headend equipment or for similar systems, such as in uplink stations. Especially this document specifies the transfer of DVB/MPEG-2 data signals in the standardized transport layer format between devices of different signal processing functions.

RF interfaces and interfaces to telecom networks are not covered in this document.

In addition references are made to all other parts of EN 50083 series (Cabled distribution systems for television and sound signals) and in particular for RF, video and audio interfaces to part 5: "Headend equipment".

For connections to telecom networks a special Data Communication Equipment (DCE) is necessary to adapt the serial or parallel interfaces specified in this document to the bitrates and transmission formats of the public Plesiochronic Digital Hierarchy (PDH) networks. Other emerging technologies such as Connectionless Broadband Data Services (CBDS), Synchronous Digital Hierarchy (SDH), Asynchronous Transfer Mode (ATM) etc. can be used for transmitting MPEG-2 Transport Streams (TS) between remote locations. ATM is particularly suitable for providing bandwidth on demand and it allows for high data rates.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 50083		Cabled distribution systems for television, sound and interactive multimedia signals
EN 50083-1:	1993	Part 1: Safety requirements
EN 50083-2:	1995	Part 2: Electromagnetic compatibility for equipment
EN 50083-3:	1994	Part 3: Active coaxial wideband distribution equipment
EN 50083-4:	1994	Part 4: Passive coaxial wideband distribution equipment
EN 50083-5:	1994	Part 5: Headend equipment
EN 50083-6:	1994	Part 6: Optical equipment
EN 50083-7:	1996	Part 7: System performance
EN 50083-8:		Part 8: Electromagnetic compatibility for installations (under consideration)
EN 188101	1995	FS: Single-mode dispersion unshifted (B1.1) optical fibre
EN 188201	1995	A1a graded index multimode optical fibres
EN ISO/IEC 13818-1	1995	Information Technology - Generic coding of moving pictures and associated audio information - Part 1: Systems (under consideration)
ETS 300 421	1994	Digital broadcasting for television, sound and data services - Framing structure, channel coding and modulation for 11/12 GHz satellite services
ETS 300 429	1994	Digital broadcasting for television, sound and data services - Framing structure, channel coding and modulation for cable systems
ETS 300 473	1995	Digital broadcasting systems for television, sound and data services, Satellite Master Antenna Television (SMATV) distribution systems

IEC 169-8	1978	Radio frequency connectors - Part 8: RF coaxial connectors with inner diameter of outer conductor 6,5 mm (0,25 in) with bayonet lock Characteristic impedance 50 Ω (type BNC)
IEC 793-2	1992	Optical fibres - Part 2: Product specifications
IEC 874-14	1993	Connectors for optical fibres and cables, Part 14: Sectional specification for fibre-optic connector - Type SC
ISO 2110	1989	Information technology - Data communication, 25 pole DTE/DCE interface connector and contact number assignments
ISO/IEC CD 14165-1		Fibre Channel - Part 1: Physical and signalling inter- face (FC-PH)
ITU-R Rec. BT.656-2	1994	Interfaces for digital component video signals in 525-line and 625-line television systems operating at the 4:2:2 level of recommendation ITU-R BT.601
ITU-T Rec. G.654	1993	Characteristics of a 1550 nm wavelength loss- minimized single-mode optical fibre cable (Rev 1)
ITU-T Rec. G.703	1991	Physical/electrical characteristics of hierarchical digital interfaces (Rev 1)
ITU-T Rec. G.957	1993	Optical interfaces for equipments and systems relating to the synchronous digital hierarchy

3 Terms, definitions and abbreviations

3.1 Terms and definitions

3.1.1 headend

Equipment which is connected between receiving antennas or other signal sources and the remainder of the cable distribution system to process the signals to be distributed.

NOTE: The headend may, for example, comprise antenna amplifiers, frequency converters, combiners, selectors and generators.

3.1.2 Satellite Master Antenna Television system (SMATV)

A system which is designed to provide sound and television signals to the households of a building or group of buildings.

NOTE: Two system configurations are defined in ETS 300 473 as follows:

- SMATV system A, based on transparent transmodulation of QPSK satellite signals into QAM signals to be distributed to the user
- SMATV system B, based on direct distribution of QPSK signals to the user, with two options:
 - SMATV-IF distribution in the satellite IF band (above 950 MHz)
 - SMATV-S distribution in the VHF/UHF band, for example in the extended S-band (230-470 MHz)

3.1.3 Biphase Mark

A line code which ensures DC balance, easy clock recovery and polarity freedom.

3.1.4 Transport Stream

Includes one or more programs with one or more independent time bases into a single stream. The Transport Stream is designed for use in environments where errors are likely, such as storage or transmission in lossy or noisy media.

3.1.5 Transport Packet

A packetized element of the Transport Stream. The packets are either 188 bytes or in case of using Reed Solomon FEC 204 byte in length

3.1.6 DVALID

A signal which indicates in the 204 Byte mode of a Transport Stream that the empty space is filled with dummy bytes.

3.1.7 PSYNC

A flag which indicates the beginning of a packet.

3.2 Abbreviations

8B/10B	eight to ten bit conversion
ACCP	Accumulated Phase
ACCT	Accumulated Time
ASI	Asynchronous Serial Interface
ATM	Asynchronous Transfer Mode
BER	Bit Error Rate
CBDS	Connectionless Broadband Data Services
DFB	Distributed Feedback
DJ	Deterministic Jitter
DVALID	data valid
DVB	Digital Video Broadcast
FC	FIBRE Channel
FIFO	First In First Out
FWHM	Full Width Half Max
IEC	International Electrotechnical Commission
ISO	International Standards Organisation
ITU-R	International Telecommunication Union Radiocommunication
ITU-T	International Telecommunication Union Telecommunication
LVDS	Low Voltage Differential Signalling
MPEG	Motion Picture Experts Group
MSB	Most Significant Bit
NA	not applicable
NRZ	Non-Return-to-Zero
PDH	Plesiosynchronous Digital Hierarchy
PLL	Phase Lock Loop
PMD	Physical Medium Dependent
PSYNC	Packet Synchron
QAM	Quadrature Amplitude Modulation
QPSK	Quarternary Phase Shift Keying
RD	Running Disparity
RIN	Relative Intrinsic Noise
RJ	Random Jitter
RS	Reed Solomon
SDH	Synchronous Digital Hierarchy
SMPT	Society of Motion Picture and Television Engineers
SSI	Synchronous Serial Interface
Tr	rise-time
TS	Transport Stream
UNC	Unified National Coarse Thread

NOTE: Only the abbreviations used in the English version of this part of EN 50083 are mentioned in this subclause. The German and the French versions of this part may use other abbreviations. Refer to 3.2 of each language version for details.

4 Interfaces for MPEG-2 data signals

This clause describes three interfaces for devices transmitting or receiving MPEG-2 data as Transport Packets, e.g. QPSK demodulators, QAM modulators, multiplexers, demultiplexers or telecom network adaptors. The use of any of these interfaces is optional. However, if one of these interfaces is selected, the full specification of that interface shall be implemented.

The interfaces use the 188 byte packet structure as specified in EN/ISO/IEC 13818-1 (see figure 1). Reed Solomon (RS) coded packets (204 bytes) can also be used (see figure 2). The incoming data stream shall be RS encoded as specified in ETS 300 421.

Figures 1 and 2 show the different formats of the incoming data streams. The interfaces described in this standard do not require the generation of RS error protection.

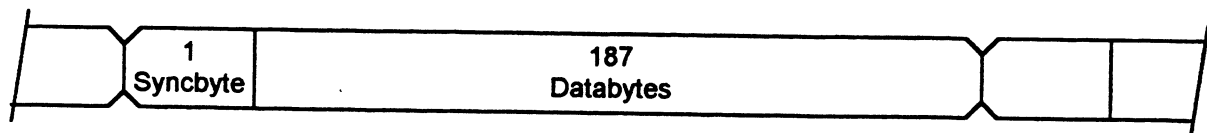


Figure 1: MPEG-2 Transport Stream (EN/ISO/IEC 13818-1)

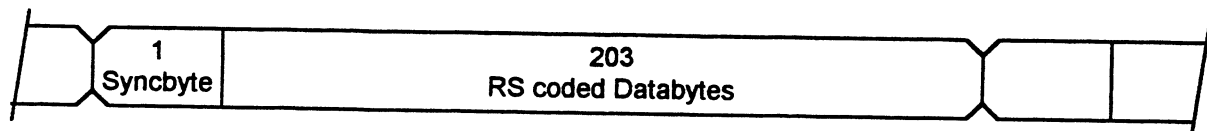


Figure 2: RS-coded MPEG-2 Transport Stream (ETS 300 421)

A synchronous parallel interface is specified to cover short or medium distances, i.e. for devices arranged near to each other. Subclause 4.1 describes the definitions for such a parallel interface derived from ITU-R Recommendation BT.656-2. Synchronous Serial Interface (SSI) which can be seen as an extension of the parallel interface, is briefly introduced in 4.2 and described in detail in annexes A and D.

Subclause 4.3 introduces the Asynchronous Serial Interface (ASI). Details of the ASI are provided in annexes B and E.

If data signals are transmitted to a headend via a telecom network or if a headend serves to insert data signals into such networks, the interface parameters valid for this network have to be met. Reference is made to ITU-T Rec. G.703 for Plesiochronic Digital Hierarchy (PDH) networks.

4.1 Synchronous parallel interface

This subclause describes an interface for a system for parallel transmission of variable data rates. The data transfer is synchronized to the byte clock of the data stream, which is the MPEG Transport Stream. Transmission links use LVDS technology, (for details concerning LVDS, see [2]) and 25 pin connections.

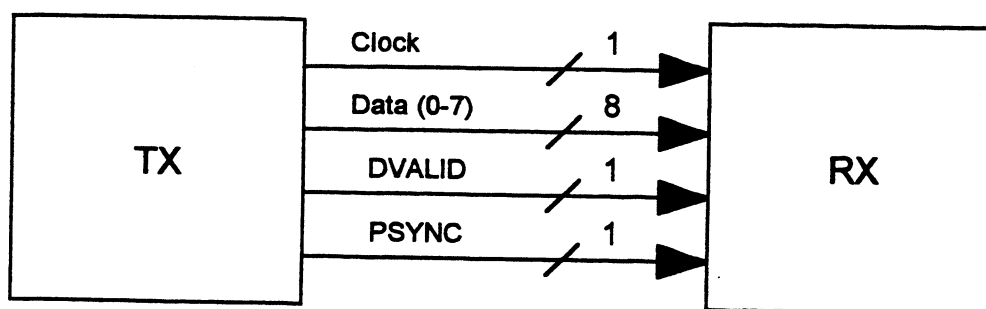


Figure 3: System for parallel transmission

The data to be transmitted are MPEG-2 Transport Packets with 188 or 204 bytes. In the case of the 204 byte packet format packets may contain a 16 bytes "empty space", a DVALID Signal serves to identify these dummy bytes. A PSYNC flag labels the beginning of a packet. The data are synchronized to the clock depending on the transmission rate.

Equipment which implements the parallel interface shall support the three transmission formats as shown in figures 4, 5 and 6.

4.1.1 Signal format

The clock, data, and synchronization signals shall be transmitted in parallel: 8 data bits together with one (MPEG-2) PSYNC signal and a DVALID signal which indicates in the 204 byte mode that the empty space is filled with dummy bytes. All signals are synchronous to the clock signal. The signals are coded in NRZ form.

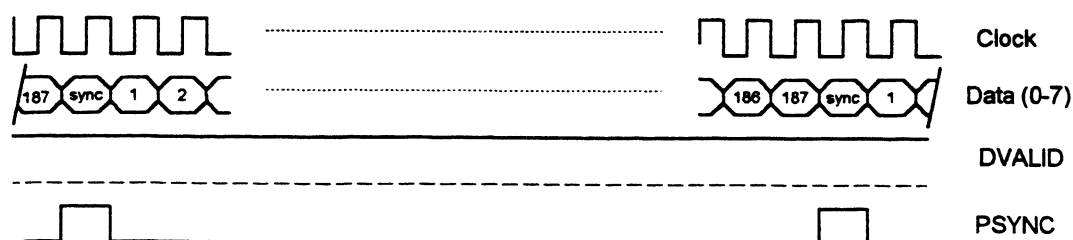


Figure 4: Transmission format with 188 Byte packets

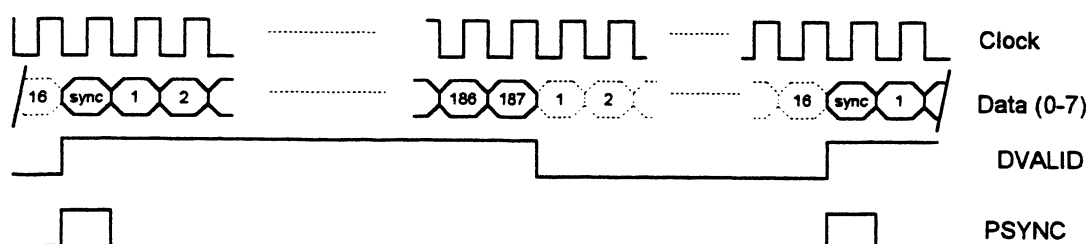


**Figure 5: Transmission format with 204 Byte packets
(188 data bytes and 16 dummy bytes)**

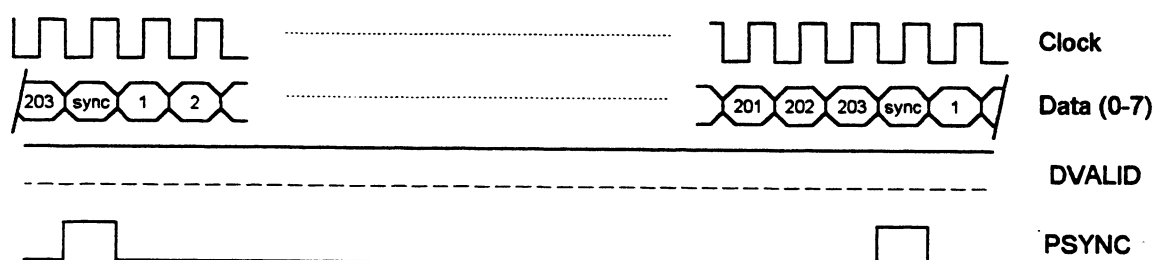


**Figure 6: Transmission format with RS-coded packets (204 Bytes)
as specified in ETS 300 421**

- Data (0-7):** Transport packet data word (8 bit: Data 0 to Data 7). Data 7 is the Most Significant Bit (MSB).
- DVALID:** active logic "1". Indicates valid data at the interface. It is constantly high in the 188 Byte Mode. In the 204 Byte Mode a low logical state indicates not to check the RS redundancy bytes.
- PSYNC:** active logic "1". Indicates the beginning of a Transport Packet by signalling the sync byte.

4.1.2 Clock signal

The clock is a square wave signal where the 0-1 transition represents the data transfer time. The clock frequency f_p depends on the transmission rate.

- The Transport Packets are transmitted without insertion of additional bytes for RS coding or padding (packet length 188 bytes):

$$f_p = f_u / 8$$

- The Transport Packets are transmitted with insertion of additional bytes for RS coding or padding (packet length 204 bytes):

$$f_p = (204 / 188) \cdot f_u / 8$$

The frequency f_u corresponds to the useful bitrate R_u of the MPEG-2 transport layer. The clock frequency f_p shall not exceed 13,5 MHz.

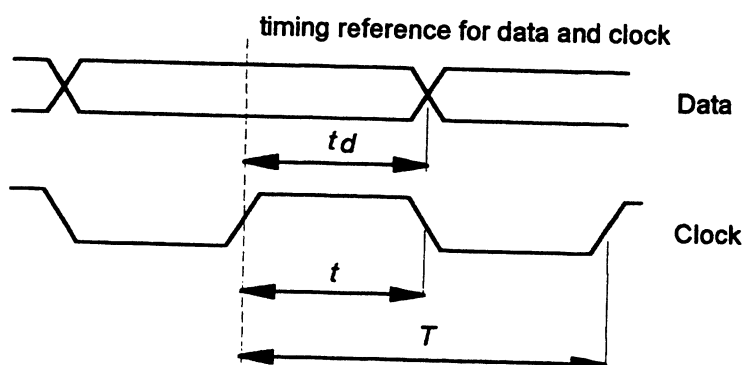


Figure 7: Clock to data timing (at source)

Clock period: $T = \frac{1}{f_p}$

Clock pulse width: $t = \frac{T}{2} \pm \frac{T}{10}$

Data hold time: $t_d = \frac{T}{2} \pm \frac{T}{10}$

4.1.3 Electrical characteristics of the interface

The interface employs eleven line drivers and eleven line receivers. Each line driver (source) has a balanced output and the corresponding line receiver (destination) a balanced input (see figure 8). The line driver and receiver shall be LVDS-compatible, i.e. they shall permit the use of LVDS for their drivers or receivers. All digital signal time intervals are measured between the half-amplitude points.

Logic convention

The terminal A of the line driver is positive with respect to the terminal B for a binary 1 and negative for a binary 0 (see figure 8).

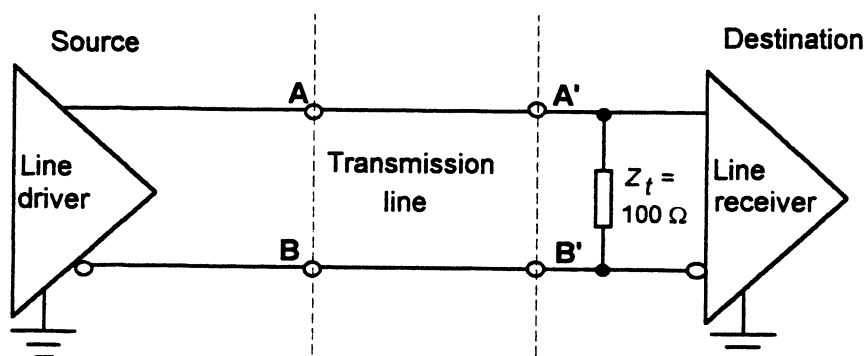


Figure 8: Line driver and line receiver interconnection

Line driver characteristics (source)

Output impedance:	100 Ω maximum
Common mode voltage:	1,125 V to 1,375 V
Signal amplitude:	247 mV to 454 mV
Rise and fall times:	less than $T / 7$, measured between the 20% and 80% amplitude points, with a 100 Ω resistive load. The difference between rise and fall times shall not exceed $T / 20$.

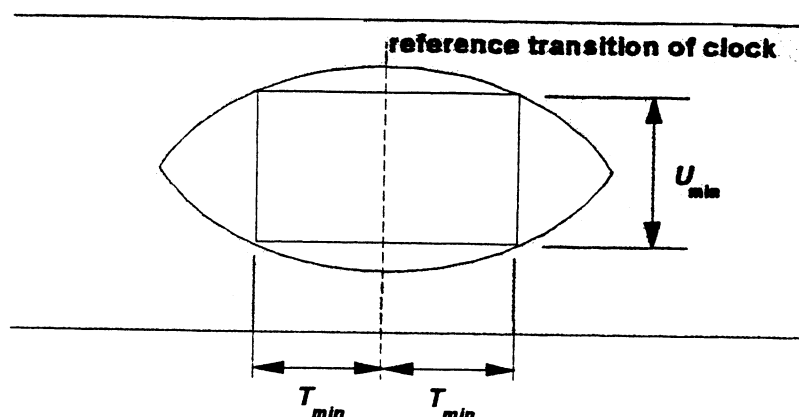
Line receiver characteristics (destination)

Input impedance:	90 Ω to 132 Ω
Maximum input signal:	2,0 V peak to peak
Minimum input signal:	100 mV peak to peak

However, the line receiver shall sense correctly the binary data when a random data signal produces the conditions represented by the eye diagramme in figure 9 at the data detection point.

Maximum common mode signal: $\pm 0,5$ V, comprising interference in the range of 0 to 15 kHz (both terminals to ground).

Differential delay: Data shall be correctly sensed when the clock-to-data differential delay is in the range between $\pm T / 3$ (see figure 9).



$$T_{min} = T / 3, \quad U_{min} = 100 \text{ mV}$$

Figure 9: Idealized eye diagramme corresponding to the minimum input signal level

4.1.4 Mechanical details of the connector

The interface uses the 25 contact type D subminiature connector specified in ISO 2110 with the contact assignment shown in table 1.

Connectors are locked together with screw lock, with male screws on the cable connector and a female threaded posts on the equipment connector. The threads are of type UNC 4-40 [3]. Cable connectors employ pin contacts and equipment connectors employ socket contacts. Shielding of the interconnecting cable and its connectors shall be employed.