

SLOVENSKI STANDARD
SIST EN 50170:2001/A2:2001
01-april-2001

Protocol implementation conformance statement for EN 50170

General purpose field communication system

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Ta slovenski standard je istoveten z: EN 50170:1996/A2:1999

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ICS:

35.100.01	Medsebojno povezovanje odprtih sistemov na splošno	Open systems interconnection in general
35.200	Vmesniška in povezovalna oprema	Interface and interconnection equipment

SIST EN 50170:2001/A2:2001

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 50170/A2

December 1999

ICS 35.100.00; 35.200

English version

General purpose field communication system

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This amendment A2 modifies the European Standard EN 50170:1996; it was approved by CENELEC on 1998-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

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 amendment exists in one official version (English). 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.

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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

Foreword

This amendment has been prepared by the German National Committee following acceptance by Technical Committee CLC/TC 65CX Fieldbus at its meeting in London on 1996-09-27 that the German Standard DIN 19 245 Part 4 fulfills the criteria for inclusion within EN 50170 and is an important step in migration towards IEC 61158.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A2 to EN 50170 on 1998-10-01.

The following dates were fixed:

- latest date by which the existence of the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2000-06-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn. (dow) 2000-06-01



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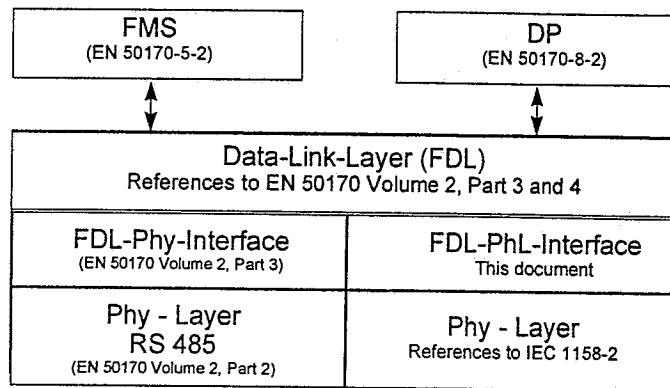
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Introduction

This amendment describes, as already announced in EN 50170 Volume 2 bus Data Transmission, a further data transmission technique, consisting of the transmission medium (Physical Medium) and the accompanying Physical Layer. The connecting Data Link Layer and the management of the Physical Layer comply to the standard EN 50170 Volume 2 bus, except for the changes and additions described in this amendment.



FMS : Fieldbus Message Specification
DP : Decentralized Periphery
FDL : Fieldbus Data Link Layer

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Figure 1: Relationship of this amendment to the standard of the EN 50170 Volume 2 bus

The interfaces to the Application Layer (FDL and FMA1/2) are specified as in EN 50170 Volume 2 bus Layer 2 Interface.

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The logical interface used between PhL and FDL is as defined in EN 50170 Volume 2 bus Data Transmission. The protocol for the bus line, access and transmission complies to EN 50170 Volume 2 bus Medium Access Methods and Transmission Protocol.

The data transmission is defined according to IEC 61158-2 which enables in addition the intrinsic safe variant in the protection class „Intrinsic Safe“ and power supply over the bus.

Regarding the Medium Attachment Unit (MAU), the following transmission rate defined in IEC 61158-2, clause 11, is used: 31,25 kbit/s, voltage mode and wire medium.

The management assigned to the Application Layer and described in EN 50170-7-2 shall take the Physical Layer variables of IEC 61158-2 and their associated ranges of values into account (see 11.4 of this document).

Applications in process automation (e.g. process industries) require a simple transmission medium (2 wire cable) in different topologies, such as line and tree. Furthermore, low power and low cost bus connections with real time behavior, i.e. with guaranteed response time, are necessary. Severe electromagnetic interference and explosive atmospheres may have to be dealt with.

This standard shall contribute to the low cost interconnection of digital field devices from different vendors in a distributed fieldbus system as well as towards ensuring reliable communication.

1 Scope

This amendment defines functional, electrical and mechanical features of a serial fieldbus system for applications in process automation (e.g. process industries). The data transmission defined in this amendment is the Physical Layer 'version 1' (31,25 kbit/s, voltage mode, wire medium) of IEC 61158-2.

2 Normative references

This amendment makes dated and undated references to specifications in other publications. These normative references are located at the respective points in the text and the publications are named accordingly. In case of fixed references, later changes or revised versions of these publications only belong to this amendment if they are integrated through changes or revised versions. For undated references the last edition is valid.

EN 50020	1995	Electrical apparatus for potentially explosive atmospheres - Intrinsic safety "I"
IEC 61158-2	1993	Fieldbus standard for use in industrial control systems Part 2: Physical layer specification and service definition (harmonized as EN 61158-2:1994)
ISO 7498	1984	Information processing systems; Open Systems Interconnection; Basic Reference Model

3 Definitions

The definitions of the standard EN 50170 Volume 2 bus and of IEC 61158-2 apply.

4 Abbreviations

Note that the Physical Layer is no longer abbreviated as "PHY", but as "PhL" in accordance with IEC 61158-2. "Ph-" is used as the prefix for service primitives.

Abbreviations used :

CRC	Cyclic Redundancy Check
DCE	Data Communication Equipment
DTE	Data Terminal Equipment
MAU	Medium Attachment Unit
MDS	Medium Dependent Sublayer
PhICI	Physical Layer Interface Control Information
Ph-	Physical-
PhL	Physical Layer
PhID	Physical Layer Interface Data
PhIDU	Physical Layer Interface Data Unit
PhPCI	Physical Layer Protocol Control Information
SDF	Start Delimiter Data Link
SDL 1	Start Delimiter 1 Data Link
SDL 2	Start Delimiter 2 Data Link
SDL 3	Start Delimiter 3 Data Link
SDL 4	Start Delimiter 4 Data Link
SDL 5	Start Delimiter 5 Data Link
TPTG	Post-transmission gap time

Refer also to IEC 61158-2 clause 4 and EN 50170-2-2, subclause 3.1.2.

5 General requirements

The same basic features of EN 50170, Volume 2 (PROFIBUS) shall apply as described in subclause 3.2 of EN 50170-2-2.

6 Characteristic features

Beside the requirements of the application field explained in subclause 3.3 of EN 50170-2-2, this amendment has to enable intrinsically safe data transmission and power supply over the bus. This results in the characteristic features described as follows:

Network topology: Linear bus, terminated at both ends, with or without stubs and branches (tree)

Medium, distances, number of stations: according to IEC 61158-2, subclause 11.2.2, rules 1 to 3, the following values shall apply:

- non-intrinsically safe fieldbus with and without power supply: 2 to 32 devices
- intrinsically safe fieldbus with power supply: limitations on the number of stations is the result of the limited electrical power that intrinsically safe circuits are able to transfer.

the distance between two stations, when the maximum number of stations is connected, is at most 1.9 km including the stubs.

Transmission speed: 31,25 kbit/s for distances up to 1 900 m

Redundancy: with second medium

Transmission characteristics: Half duplex, synchronous, self-clocking, Manchester-Biphase-L-Coding

Addressing, station types, bus access, data transfer services, frame length, data integrity: according to EN 50170-2-2, subclause 3.3

7 System overview

The specifications of this amendment are based on the architectural model, the bus access protocol and the transmission procedures as described in EN 5170 Volume 2 bus Data Link Layer.

The data transmission technique of Layer 1 (Physical Layer, PhL) is based on the rules defined in IEC 61158-2, clause 11.

The frame format builds on the synchronous Protocol Data Unit (Ph-PDU) described in clause 9 of IEC 61158-2. It consist of a Preamble, a Start Delimiter and an End Delimiter as well as the Layer 2 data (FDL-PDU). The data are coded and decoded according to the Manchester-Biphase-L-Code.

The transmission protocol of Layer 2 as well as the Layer 1 management (FMA1) are defined according to IEC 61158-2, clauses 5 and 6.

Annex A explains possible structures for repeaters, fieldbus interfaces and systems with several fieldbus lines connected to a single master station. Guidelines on a redundant central control unit and a bus analyzer/diagnostic unit are added, too. Finally, the number of connectable stations for intrinsic safe fieldbus with power supply over the bus as well as the data transfer rate and the system reaction time are calculated for an example under consideration of the frame formats that have been changed by the integration of IEC 61158-2.

8 Data transmission (Physical Medium, Physical Layer)

8.1 Electrical characteristics

The Physical Layer described in IEC 61158-2 clause 11 shall be used.

Version 1: 31,25 kbit/s, voltage mode and wire medium (intrinsically safe Physical Layer)

Repeater

An extension of line length and an increase in the number of stations may be achieved by means of bi-directional amplifiers (called repeaters, see A.1). The maximum number of repeaters between two stations is four. The following maximum values shall apply for 31,25 kbit/s and if the bus segments are in series (linear bus topology):

- 31,25 kbit/s:

1 Repeater:	3.8 km and 62 stations	
2 Repeater:	5.7 km and 92	-"- (see Figure 2)
3 Repeater:	7.6 km and 122	-"-
4 Repeater:	9.5 km and 127	-"-

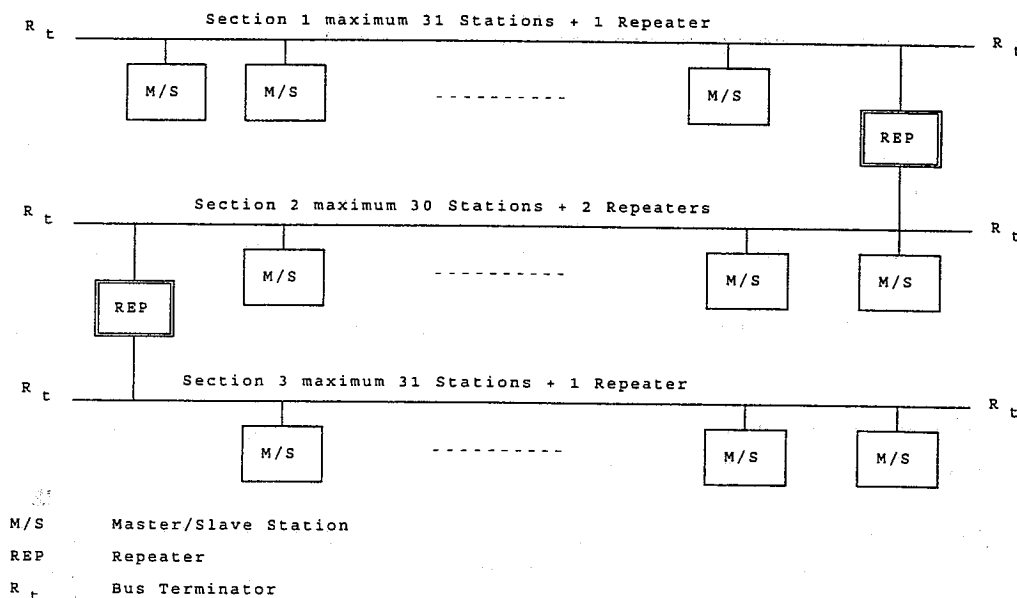


Figure 2: Repeater in linear bus topology (see Figure 2 of EN 50170-2-2)

For a tree topology of segments the following maximum values shall apply at 31,25 kbit/s:

e.g.. 5 Repeaters: 7,6 km and 127 stations

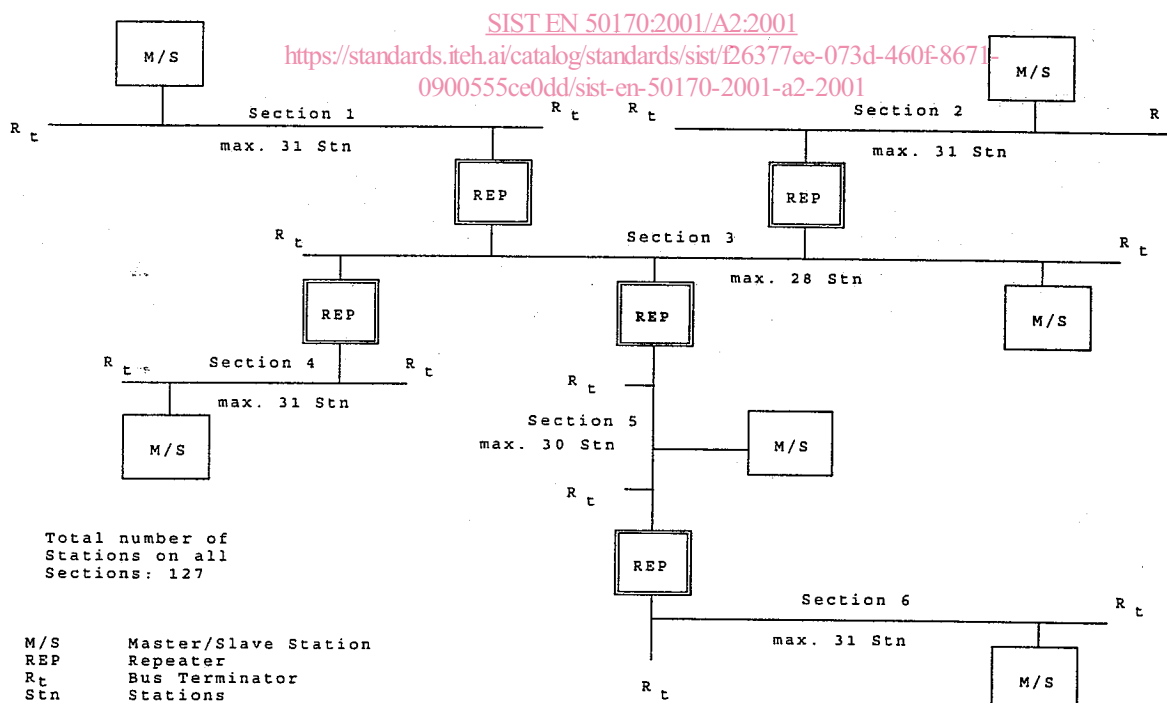


Figure 3: Repeater in Tree Topology (see Figure 3 of EN 50170-2-2)

8.2 Interface between Physical Layer (PhL) and Medium Access and Transmission Protocol (FDL)

This clause gives an abstract definition of the Ph-Data service that is provided to the FDL-Layer by the Physical Layer. The Ph-Data service is for the receipt and transmission of data (one octet at a time).

The execution of the interface and the control within a station are not fixed or stipulated.

The following service primitives have been taken unchanged from IEC 61158-2 and have been repeated for clarity:

- Ph-DATA request (class, data)
- Ph-DATA indication (class, data)
- Ph-DATA confirmation (status)

The parameter **class** specifies the Physical Layer Interface Control Information (PhICI) of the Physical Layer Interface Data Unit (PhIDU). The following values are possible for the Ph-Data request primitive:

- a) START-OF-ACTIVITY
- b) DATA
- c) END-OF-DATA-AND-ACTIVITY

For the Ph-DATA indication primitive the parameter class contains the following values:

- a) START-OF-ACTIVITY
- b) DATA
- c) END-OF-DATA
- d) END-OF-ACTIVITY
- e) END-OF-DATA-AND-ACTIVITY

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They are available to the interface between physical medium and medium access control protocol and transmission protocol.

The parameter **data** specifies the Physical Layer Interface Data (PhID) of the Physical Layer Interface Data Unit (PhIDU). It consists of an octet Physical Layer User Data which has to be sent (request) or received (indication).

The parameter **status** marks either the success or a detected failure of the transmission.

The Ph-DATA confirm primitive marks the end of a transmission. It is passed on to the FDL-controller after a transmission has been completed and it indicates thereby the Physical Layer's readiness to receive the next Ph-Data request primitive.

The Physical Layer Data service with primitives as well as the definition of the parameter values are described in IEC 61158-2, clause 5.

8.3 Redundancy of Physical Layer and Medium (optional)

To increase the reliability, a redundant transmission line is allowed by EN 50170 bus Data Transmission. Its configuration shall conform to the specifications stipulated in IEC 61158-2, subclause 11.2.2, rule 9.

In principle, the telegrams have to be sent simultaneously by several transmitters (usually more than two). A receiver is selected upon each reception. The parameter setting of the transmitter channels and the receiver channels is carried out by means of the Ph-SETVALUE request via the Physical Management Interface.

The selection of the appropriate receiver channel is carried out by Layer 2 (FDL) by watching over activity on the transmission lines independently of other stations. As described in EN 50170-2-2, subclause 4.3, the following main criteria apply for switching from a given receiver channel:

- Two or more invalid frames are received in succession.
Invalid means: invalid format and invalid CRC.
- Time-out T_{TO} expired, see subclause 9.1.7.
- No Syn Time T_{SYN} was notified during a Synchronization Interval Time T_{SYNI} , see 9.1.7.

Dependent on the execution, further switch conditions may be selected.

9 Medium access methods and transmission protocol (Data Link Layer, FDL)

The medium access method and the transmission protocol (Data Link Layer, FDL), which are described in EN 50170 Volume 2 bus Medium Access Methods and Transmission Protocol, shall apply for this amendment, except for the deviations specified in the following corresponding subclauses. Due to the extensions to the frame formats (IEC 61158-2 synchronous transmission protocol), the timer calculations have to be modified in part as described in 9.1.7.

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9.1 Transmission procedures and FDL controller

9.1.1 Token procedures

The specifications of subclause 4.1.1 of EN 50170-4-2 shall apply.

9.1.1.1 Token Passing

The specifications of subclause 4.1.1.1 of EN 50170-4-2 shall apply.

9.1.1.2 Addition and removal of stations

The specifications of subclause 4.1.1.2 of EN 50170-4-2 shall apply.

9.1.1.3 (Re)initialization of the Logical Token Ring

The specifications of subclause 4.1.1.3 of EN 50170-4-2 shall apply.

9.1.1.4 Token Rotation Time

The specifications of subclause 4.1.1.4 of EN 50170-4-2 shall apply.

9.1.1.5 Message Priorities

The specifications of subclause 4.1.1.5 of EN 50170-4-2 shall apply.