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SLOVENSKI STANDARD
SIST EN 60870-5-103:2000

01-februar-2000

Telecontrol equipment and systems - Part 5-103: Transmission protocols -- Companion standard for the informative interface of protection equipment (IEC 60870-5-103:1997)

Telecontrol equipment and systems - Part 5-103: Transmission protocols - Companion standard for the informative interface of protection equipment (IEC 60870-5-103:1997)

Fernwirkeinrichtungen und -systeme - Teil 5-103: Übertragungsprotokolle - Anwendungsbezogene Norm für die Informationsschnittstelle von Schutzeinrichtungen

Matériels et systèmes de téléconduite -- Partie 5-103: Protocoles de transmission - Norme d'accompagnement pour l'interface de communication d'information des équipements de protection

Ta slovenski standard je istoveten z: EN 60870-5-103:1998

ICS:

33.200	Daljinsko krmiljenje, daljinske meritve (telemetrija)	Telecontrol. Telemetering

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Descriptors: Telecontrol, transmission protocol, protection equipment, companion standard, informative interface

English version

Telecontrol equipment and systems
Part 5-103: Transmission protocols
Companion standard for the informative interface
of protection equipment
(IEC 60870-5-103:1997)

Matériels et systèmes de téléconduite
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l'interface de communication
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Fernwirkeinrichtungen und -systeme
Teil 5-103: Übertragungsprotokolle
Anwendungsbezogene Norm für die
Informationsschnittstelle von
Schutzeinrichtungen
(IEC 60870-5-103:1997)

This European Standard was approved by CENELEC on 1998-01-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard 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 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.

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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

The text of document 57/327/FDIS, future edition 2 of IEC 60870-5-103, prepared by IEC TC 57, Power system control and associated communications, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60870-5-103 on 1998-01-01.

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) 1998-10-01

- latest date by which the national standards conflicting
  with the EN have to be withdrawn   (dow) 1998-10-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annex ZA is normative and annexes A and B are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

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The text of the International Standard IEC 60870-5-103:1997 was approved by CENELEC as a European Standard without any modification.

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Annex ZA (normative)

Normative references to international publications
with their corresponding European publications

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 (including amendments).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60050(371)	1984	International electrotechnical vocabulary (IEV) - Chapter 371: Telecontrol	-	-
IEC 60794-1	1996	Optical fibre cables Part 1: Generic specification	-	-
IEC 60794-2	1989	Optical fibre cables Part 2: Product specifications	-	-
IEC 60870-5-1	1990	Telecontrol equipment and systems Part 5: Transmission protocols Section 1: Transmission frame formats	EN 60870-5-1	1993
IEC 60870-5-2	1992	Section 2: Link transmission procedures	EN 60870-5-2	1993
IEC 60870-5-3	1992	Section 3: General structure of application data	EN 60870-5-3	1992
IEC 60870-5-4	1993	Section 4: Definition and coding of application information elements	EN 60870-5-4	1993
IEC 60870-5-5	1995	Section 5: Basic application functions	EN 60870-5-5	1995
IEC 60874-2	1993	Connectors for optical fibres and cables - Part 2: Sectional specification for fibre optic connector-type F-SMA	-	-
IEC 60874-10	1992	Part 10: Sectional specification Fibre optic connector type BFOC/2,5	-	-
ISO/IEC 7498-1	1994	Information technology - Open systems interconnection - Basic reference model: The basic model	EN ISO/IEC 7498-1	1995

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Publication	Year	Title	EN/HD	Year
EIA RS-485		Standard for electrical characteristics of generators and receivers for use in balanced digital multipoint systems	-	-
R 32 - IEEE Standard 754				
R 64 - IEEE Standard 754				

NORME
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Première édition
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Matériels et systèmes de téléconduite –

Partie 5-103:
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Part 5-103:
Transmission protocols –
Companion standard for the informative
interface of protection equipment

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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TELECONTROL EQUIPMENT AND SYSTEMS –

Part 5-103: Transmission protocols – Companion standard for the informative interface of protection equipment

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.

3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60870-5-103 has been prepared by IEC technical committee 57: Power system control and associated communications.

The text of this standard is based on the following documents:

FDIS	Report on voting
57/327/FDIS	57/333/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

Annexes A and B are for information only.

TELECONTROL EQUIPMENT AND SYSTEMS –

Part 5-103: Transmission protocols –
Companion standard for the informative interface
of protection equipment

1 Scope and object

This section of IEC 60870-5 applies to protection equipment with coded bit serial data transmission for exchanging information with control systems. It defines a companion standard that enables interoperability between protection equipment and devices of a control system in a substation. The defined companion standard utilizes standards of the IEC 60870-5 series.

This section of IEC 60870-5 presents specifications for the informative interface of protection equipment. This standard does not necessarily apply to equipment that combines protection and control functions in the same device sharing a single communication port.

This section of IEC 60870-5 describes two methods of information exchange: the first is based on explicitly specified APPLICATION SERVICE DATA UNITS (ASDUs) and application procedures for transmission of 'standardized' messages, and the second uses generic services for transmission of nearly all possible information. The 'standardized' messages do not cover all possible protection functions, and furthermore a protection device may support only a subset of the messages specified in this standard. For interoperability purposes, in specific applications, this subset has to be specified in clause 8.

The use of predefined messages and application procedures is mandatory, if applicable. In other cases generic services shall be used. The private ranges defined in this standard are maintained for compatibility reasons; however, their use is not recommended for future applications.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 60870-5. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 60870-5 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(371): 1984, *International Electrotechnical Vocabulary – Chapter 371: Telecontrol*

IEC 60794-1: 1996, *Optical fibre cables – Part 1: Generic specification*

IEC 60794-2: 1989, *Optical fibre cables – Part 2: Product specifications*

IEC 60870-5-1: 1990, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 1: Transmission frame formats*

IEC 60870-5-2: 1992, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 2: Link transmission procedures*

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IEC 60870-5-3: 1992, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 3: General structure of application data*

IEC 60870-5-4: 1993, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 4: Definition and coding of application information elements*

IEC 60870-5-5: 1995, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 5: Basic application functions*

IEC 60874-2: 1993, *Connectors for optical fibres and cables – Part 2: Sectional specification for fibre optic connector – Type F-SMA*

IEC 60874-10: 1992, *Connectors for optical fibres and cables – Part 10: Sectional specification – Fibre optic connector type BFOC/2,5*

ISO/IEC 7498-1: 1994, *Information technology – Open System Interconnection – Basic Reference Model: The Basic Model*

EIA RS-485: *Standard for electrical characteristics of generators and receivers for use in balanced digital multipoint systems*

R 32 – IEEE Standard 754

R 64 - IEEE Standard 754

3 Definitions

For the purpose of this section of IEC 60870-5, the following definitions apply.

3.1

companion standard
a companion standard adds semantics to the definitions of the basic standard or a functional profile. This may be expressed by defining particular uses for information objects or by defining additional information objects, service procedures and parameters of the basic standard

NOTE – Companion standards do not alter the standards to which they refer, but make explicit the relationship between those used together for a specific domain of activity.

3.2
enhanced performa**nce architecture (EPA)**
a protocol reference model that provides, compared with the full seven layer architecture according to the basic reference model of ISO/IEC 7498-1, a three layer architecture for obtaining faster response times for the critical information but with service limitations

3.3
control direction
direction of transmission from the control system to the protection equipment

3.4
monitor direction
direction of transmission from the protection equipment to the control system

3.5
control system
used for the master of the communication link, i.e. the primary station according to IEC 60870-5-2

3.6
informative interface
interface of a protection equipment used to exchange data with control systems without having an impact on the protection function

3.7
tag
binary signal which is recorded and transmitted within the transmission of disturbance data

3.8
compatible range
standard range to be used by all manufacturers

3.9
private range
range that may be used by manufacturers for their own private use

3.10   Abbreviations

ΔI_L	Line differential protection
ΔI_T	Transformer differential protection
ACC	Actual channel
AR	Auto-recloser
ASC	ASCII character
ASDU	APPLICATION SERVICE DATA UNIT
APCI	APPLICATION PROTOCOL CONTROL INFORMATION
BFOC/2,5	Bayonet fibre optic connector
BS	Bitstring
CB	Circuit breaker
COL	Compatibility level
COM	Command
CONT	Continued
COT	CAUSE OF TRANSMISSION
COUNT	One bit counter of ASDUs
CP	Compound
CU	Communication unit
CP32Time2a	FOUR OCTET BINARY TIME
CP56Time2a	SEVEN OCTET BINARY TIME
dB	Decibel
DCE	Data circuit-terminating equipment
DCO	Double command
DFC	Data flow control
DPI	Double-point information
DTE	Data terminal equipment
EIA	Electronic Industries Association
EPA	Enhanced Performance Architecture
ER	Error
f	Frequency
F	Fixed point number
FAN	Fault number
F-Code	Function code
FCB	Frame count bit
FCV	Frame count bit valid
F-SMA	Type of an optical fibre connector

FT	Frame transmission format
FUN	FUNCTION TYPE
GDD	Generic data description
GEN	Generic function type
GGI	General interrogation of generic data
GI	General interrogation
GID	Generic identification data
GIN	Generic identification number
GLB	Global function type
GRC	GENERIC REPLY CODE
I	Integer
I>>	Overcurrent protection
IEC	International Electrotechnical Commission
IEV	International Electrotechnical Vocabulary
INF	INFORMATION NUMBER
INT	Interval between information elements
ISO	International Organization for Standardization
IV	Invalid
KOD	Kind of description
L	Line
LED	Light emitting diode
LPCI	LINK PROTOCOL CONTROL INFORMATION
LPDU	LINK PROTOCOL DATA UNIT
MEA	Measurand with quality descriptor
MVAL	Value of measurand
NDE	Number of descriptive elements
NDV	Number of relevant disturbance values per ASDU
NFE	Number of the ASDU first information element
NGD	Number of generic data sets
NO	Number
NOC	Number of channels
NOE	Number of information elements of a channel
NOF	Number of grid faults
NOG	Number of generic identification
NOT	Number of tags
OTEV	Other event (disturbance data recording initiated by)
OV	Overflow
P	Active power
PRM	Primary message
Q	Reactive power
RES	Reserved
RET	Relative time
RFA	Reference factor
RII	RETURN INFORMATION IDENTIFIER
RPV	Rated primary value
RSV	Rated secondary value
S	Sign
SCL	Short-circuit location
SCN	SCAN NUMBER
SDV	Single disturbance value
SIN	SUPPLEMENTARY INFORMATION
SOF	Status of fault

SU	Summer bit
SQ	Sequence of equal information elements
t(z)	Distance protection
TAP	Tag position
TM	Transmit (disturbance data)
TOO	Type of order
TOV	Type of disturbance values
TP	Trip (recorded fault)
T_{LD}	Loop delay
t_{wz}	Cycle repeat time
TYP	TYPE IDENTIFICATION
UF	Unsigned fixed point number
UI	Unsigned integer
V	Voltage
V_{EN}	Neutral voltage
VT	Voltage transformer

4 General rules

This clause provides general rules for constructing companion standards for the transmission protocol of specific control systems and protection equipment, using the IEC 60870-5 protocol.

These general rules are applied in the following subclauses.

4.1 Protocol structure

The IEC 60870-5 protocol is based on the three-layer reference model 'Enhanced Performance Architecture' (EPA), as specified in clause 4 of IEC 60870-5-3.

The physical layer uses a fibre optic or a copper-wire based system that provides binary symmetric and memoryless transmission.

The link layer consists of a number of link transmission procedures, using explicit LINK PROTOCOL CONTROL INFORMATION (LPCI), that are capable of carrying APPLICATION SERVICE DATA UNITS (ASDUs) as link user data. The link layer uses a selection of frame formats to provide the required integrity, efficiency, and convenience of transmission.

The application layer contains a number of application functions that involve the transmission of APPLICATION SERVICE DATA UNITS (ASDUs) between source and destination.

The application layer of this companion standard does not use explicit APPLICATION PROTOCOL CONTROL INFORMATION (APCI). This is implicit in the contents of the ASDU DATA UNIT IDENTIFIER and in the type of link service used.

Table 1 shows the Enhanced Performance Architecture (EPA) model and the selected standard definitions of this companion standard.

Table 1 – Selected standard provisions of this companion standard

Selected application functions of IEC 60870-5-5	User process
Selected APPLICATION SERVICE DATA UNITS of IEC 60870-5-3	Application layer
Selected application information elements of IEC 60870-5-4	(Layer 7)
Selected link transmission procedures of IEC 60870-5-2	Link layer
Selected transmission frame formats of IEC 60870-5-1	(Layer 2)
Fibre optic system based on IEC 60874-2 or IEC 60874-10 and IEC 60794-1 and IEC 60794-2 or copper-wire based system according to EIA RS-485	Physical layer (Layer 1)

4.2 Physical layer

Either a fibre optic system or a copper-wire based transmission system is used in this companion standard between the protection equipment and the control system. The interface between the data circuit-terminating equipment (DCE) and data terminal equipment (DTE) of the protection equipment, according to figure 1, is not defined within this companion standard.

NOTE – Data transmission methods which increase the exploitation of the bandwidth of a given transmission channel should be avoided, unless it can be proven that the method, that usually violates the required memoryless channel encoding principle, does not reduce the Hamming distance of the data block encoding method of the selected frame format in the link layer.
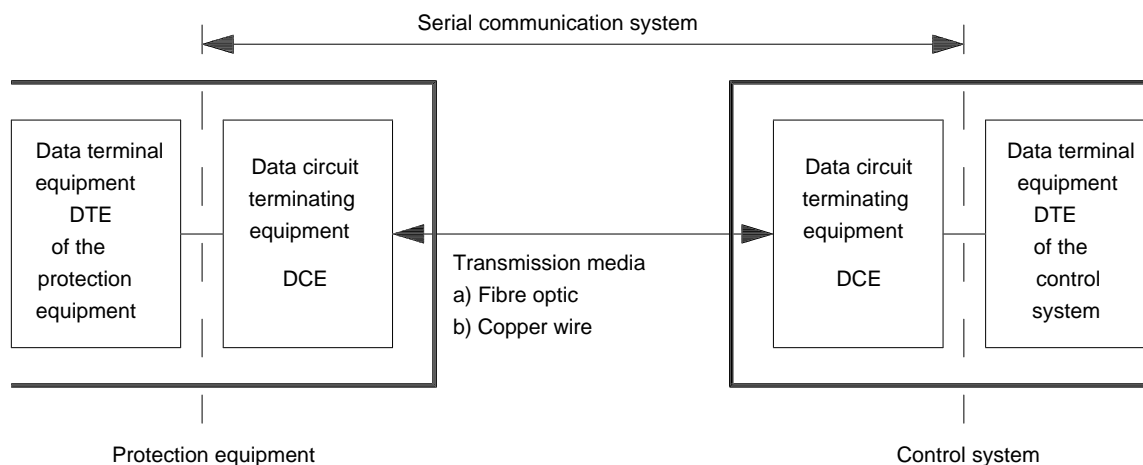
Figure 1 – Interfaces and connections of a protection equipment and a control system