SLOVENSKI STANDARD
SIST EN 60870-5-101:1997

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Telecontrol equipment and systems - Part 5: Transmission protocols - Section 101: Companion standard for basic telecontrol tasks (IEC 870-5-101:1995)

Telecontrol equipment and systems -- Part 5-101: Transmission protocols - Companion standard for basic telecontrol tasks

Fernwirkeinrichtungen und -systeme -- Teil 5-101: Übertragungsprotokolle - Anwendungsbezogene Norm für grundsätzliche Fernwirkaufgaben

Matériels et systèmes de téléconduite -- Partie 5-101: Protocoles de transmission - Norme d'accompagnement pour les tâches élémentaires de téléconduite

Ta slovenski standard je istoveten z: EN 60870-5-101:1996

ICS:

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

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English version

Telecontrol equipment and systems
Part 5: Transmission protocols
Section 101: Companion standard for basic telecontrol tasks
(IEC 870-5-101:1995)

Matériels et systèmes de téléconduite
Partie 5: Protocoles de transmission
Section 101: Norme d'accompagnement
pour les tâches élémentaires de
téléconduite
(CEI 870-5-101:1995)

Fernwirkeinrichtungen und -systeme
Teil 5: Übertragungsprotokolle
Hauptabschnitt 101:
Anwendungsbezogene Norm für
grundsätzliche Fernwirkaufgaben
(IEC 870-5-101:1995)

This European Standard was approved by CENELEC on 1995-11-28. 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

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Page 2
EN 60870-5-101:1996

Foreword

The text of document 57/221/DIS, future edition 1 of IEC 870-5-101, 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 60870-5-101 on 1995-11-28.

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) 1996-09-01

- latest date by which the national standards conflicting
  with the EN have to be withdrawn   (dow) 1996-09-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 870-5-101:1995 was approved by CENELEC as a European Standard without any modification.

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 50(371)	1984	International electrotechnical vocabulary (IEV) Chapter 371: Telecontrol	-	-
IEC 870-1-1	1988	Telecontrol equipment and systems Part 1: General considerations Section 1: General principles	-	-
IEC 870-1-3	1990	Section 3: Glossary	-	-
IEC 870-1-4	1994	Section 4: Basic aspects of telecontrol data transmission and organization of standards IEC 870-5 and IEC 870-6	-	-
IEC 870-5-1	1990	Part 5: Transmission protocols Section 1: Transmission frame formats	EN 60870-5-1	1993
IEC 870-5-2	1992	Section 2: Link transmission procedures	EN 60870-5-2	1993
IEC 870-5-3	1992	Section 3: General structure of application data	EN 60870-5-3	1992
IEC 870-5-4	1993	Section 4: Definition and coding of application information elements	EN 60870-5-4	1993
IEC 870-5-5	1995	Section 5: Basic application functions	EN 60870-5-5	1995
ITU-T Recommendation V.24	1993	List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)	-	-
ITU-T Recommendation V.28	1993	Electrical characteristics for unbalanced double-current interchange circuits	-	-
ITU-T Recommendation X.24	1988	List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) on public data networks	-	-

Seite 4
EN 60870-5-101:1996

Publikation	Jahr	Titel	EN/HD	Jahr
ITU-T Recommendation X.24	1988	List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) on public data networks	-	-
ITU-T Recommendation X.27	1988	Electrical characteristics for balanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications	-	-
R32-IEEE[1] Standard 754	-	-	-	-

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1) Institute of Electrical and Electronics Engineers, Inc.

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– 3 –

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSSION

TELECONTROL EQUIPMENT AND SYSTEMS –

Part 5: Transmission protocols –

Section 101: Companion standard for basic telecontrol tasks

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.

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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. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 870-5-101 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:

DIS	Report on voting
57/221/DIS	57/250/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.

– 7 –

TELECONTROL EQUIPMENT AND SYSTEMS –

Part 5: Transmission protocols –

Section 101: Companion standard for basic telecontrol tasks

.1 Scope and object

This section of IEC 870-5 applies to telecontrol equipment and systems with coded bit serial data transmission for monitoring and controlling geographically widespread processes. It defines a telecontrol companion standard that enables interoperability among compatible telecontrol equipment. The defined telecontrol companion standard utilizes standards of the series of documents IEC 870-5. The specifications of this standard present a functional profile or basic telecontrol tasks. Further companion standards, based on above standards are under consideration.

Standards specified in this standard are compatible with standards defined in IEC 870-5-1 up to IEC 870-5-5 (see clause 2).

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 870-5. 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 870-5 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 50(371): 1984, *International Electrotechnical Vocabulary (IEV) – Chapter 371: Telecontrol*

IEC 870-1-1: 1988, *Telecontrol equipment and systems – Part 1: General considerations – Section One: General principles*

IEC 870-1-3: 1990, *Telecontrol equipment and systems – Part 1: General considerations – Section Three: Glossary*

IEC 870-1-4: 1994, *Telecontrol equipment and systems – Part 1: General considerations – Section 4: Basic aspects of telecontrol data transmission and organization of standards of IEC 870-5 and IEC 870-6*

IEC 870-5-1: 1990, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section One: Transmission frame formats*

IEC 870-5-2: 1992, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 2: Link transmission procedures*

IEC 870-5-3: 1992, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 3: General structure of application data*

IEC 870-5-4: 1993, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 4: Definition and coding of application information elements*

IEC 870-5-5: 1995, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 5: Basic application functions*

ITU-T Recommendation V.24: 1993, *List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)*

ITU-T Recommendation V.28: 1993, *Electrical characteristics for unbalanced double-current interchange circuits*

ITU-T Recommendation X.24: 1988, *List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) on public data networks*

ITU-T Recommendation X.27: 1988, *Electrical characteristics for balanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications*

R32 – IEEE Standard 754: *The Institute of Electrical and Electronics Engineers, Inc.*

3 Definitions

For the purpose of this section of IEC 870-5, 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   **group (of information objects):** A group (of information objects) is a selection of COMMON ADDRESSES or INFORMATION ADDRESSES which is specifically defined for a particular system.

3.3   **control direction:** The direction of transmission from the controlling station to a controlled station.

3.4 **monitor direction:** The direction of transmission from a controlled station to the controlling station.

3.5 **system parameter:** A system parameter (or system-specific parameter) is valid for the complete telecontrol system which uses this companion standard. The telecontrol system consists of the entire controlled and controlling stations which may be connected via different network configurations.

3.6 **network-specific parameter:** A network-specific parameter is valid for all the stations which are connected via a particular network configuration.

3.7 **station-specific parameter:** A station-specific parameter is valid for particular stations.

3.8 **object-specific parameter:** An object-specific parameter is valid for a particular information object or a specific group of information objects.

4 General rules

This clause provides general rules for constructing companion standards for the transmission protocol of specific telecontrol systems, using the IEC 870-5 protocol.

These general rules are applied in the following subclauses.

4.1 Protocol structure

The IEC 870-5 protocol is based on the three-layer reference model "Enhanced Performance Architecture" (EPA), as specified in clause 4 of IEC 870-5-3.

The physical layer uses ITU-T recommendations that provide binary symmetric and memoryless transmission on the required medium in order to preserve the high level of data integrity of the defined block encoding method in the link layer.

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 user 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 field and in the type of link service used.

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

Selected application functions of IEC 870-5-5	User process
Selected application information elements of IEC 870-5-4	Application (layer 7)
Selected application service data units of IEC 870-5-3	
Selected link transmission procedures of IEC 870-5-2	Link (layer 2)
Selected transmission frame formats of IEC 870-5-1	
Selected ITU-T recommendations	Physical (layer 1)

Figure 1 – Selected standard provisions of the defined telecontrol companion standard

4.2 Physical layer

The companion standard specifies ITU-T recommendations which define the interfaces between data circuit terminating equipment (DCE) and data terminating equipment (DTE) of the controlling and the controlled station (see figure 2, as well as figure 2 of IEC 870-1-1).
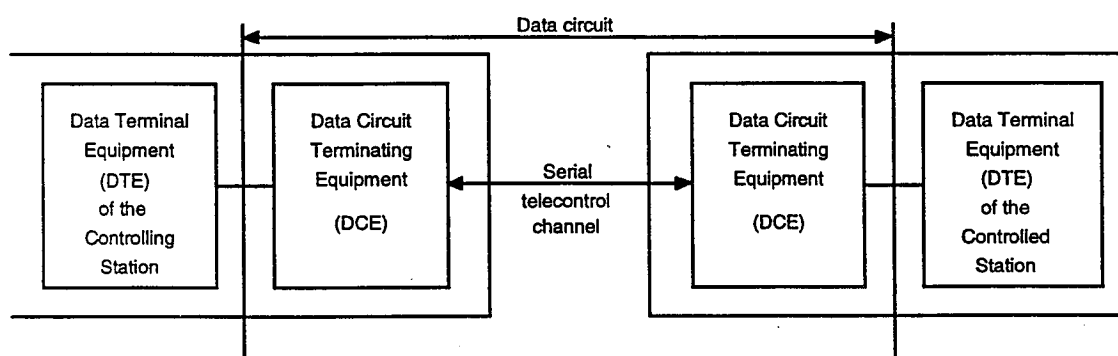

Figure 2 – Interfaces and connections of controlling and controlled stations

The standard interface between DTE and DCE is the asynchronous ITU-T V.24/ITU-T V.28 interface. The use of the required interface signals depends on the operational mode of the used transmission channel. Therefore the companion standard defines a selection of interchange circuits (signals) which may but need not be used.

NOTE – Data transmission methods that are used to increase the exploitation of the bandwith of a given transmission channel should be avoided unless it can be proven that the used method (that usually violates the required memoryless channel encoding principle) does not reduce the data integrity of the data block encoding method of the selected frame format in the link layer.

4.3 Link layer

IEC 870-5-2 offers a selection of link transmission procedures using a control field and the optional address field. Links between stations may be operated in either an unbalanced or a balanced transmission mode. Appropriate function codes for the control field are specified for both modes of operation.

If the links from a central control station (controlling station) to several outstations (controlled stations) share a common physical channel, then these links must be operated in an unbalanced mode to avoid the possibility of more than one outstation attempting to transmit on the channel at the same time. The sequence in which the various outstations are granted access to transmit on the channel is then determined by an application layer procedure in the controlling station, see 6.2 "Data acquisition by polling" in IEC 870-5-5.

The companion standard specifies whether an unbalanced or a balanced transmission mode is used, together with which link procedures (and corresponding link function codes) are to be used.

The companion standard specifies an unambiguous address (number) for each link. Each address may be unique within a specific system, or it may be unique within a group of links sharing a common channel. The latter needs a smaller address field but requires the controlling station to map addresses by channel number.

A companion standard shall specify one frame format chosen from those offered in IEC 870-5-1. The format chosen shall provide the required data integrity together with the maximum efficiency available for an acceptable level of convenience of implementation. In addition a companion standard specifies the time-out interval (T_0 or T_m) of the primary station and the maximum permitted reaction time (T_r) of the secondary station for all links (see A.1 of IEC 870-5-2 for details of link timing).

4.4 Application layer

A companion standard shall define appropriate ASDUs from a given general structure in IEC 870-5-3. These ASDUs are constructed using the definition and coding specifications for application information elements given in IEC 870-5-4.

A companion standard shall specify one chosen order of transport for application data fields (see 4.10 of IEC 870-5-4). The order (mode 1 or mode 2) may be chosen to provide the maximum overall convenience of programming for the various computers in the specific telecontrol system's stations.

4.5 User process

IEC 870-5-5 offers an assortment of basic application functions. A companion standard contains one or more instances of these functions chosen to provide the required set of input/output application procedures to suit the specific telecontrol system.

5 Physical layer

5.1 Selections from ISO and ITU-T standards

The following fixed network configurations are supported:

- point-to-point;

- multiple point-to-point;

- multipoint-star;

- multipoint-party line;

- multipoint-ring.

The subset of the ITU-T Recommendations V.24 and V.28, defined in 5.1.1, is valid.

In case of digital transmission methods using digital signal multiplexers the X.24/X.27 interface may be used for channels up to 64 kbit/s by special agreement (see 5.1.2).

In this companion standard the "Data circuit" is treated separately from the telecontrol stations because it is often implemented by separate hardware. Consequentially the companion standard includes a full specification of the DTE/DCE interface but only a requirement specification for suitable DCEs is given.

5.1.1 Unbalanced interchange circuit V.24/V.28

This companion standard specifies a subset of the ITU-T Recommendation V.24, using the signal levels specified by ITU-T Recommendation V.28.

Table 1 – Selection from V.24/V.28

Interchange circuit number	Interchange circuit name	From DCE	To DCE
102	Signal ground or common return	–	–
103	Transmitted data		X
104	Received data	X	
105 [1]	Request to send		X
106 [2]	Ready for sending	X	
107 [2]	Data set ready	X	
108 [1]	Data terminal ready		X
109 [2]	Data channel received line signal detector	X	
[1] May have constant potential.			
[2] Not mandatory. It can be used to supervise the transmission circuit.			

The standard transmission speeds may be specified for the directions of transmission and reception separately. The following choice of standard transmission speeds are supported.

The standard transmission speeds of the V.24/V.28 FSK-interface should be:

- 100 bit/s   – 200 bit/s

- 300 bit/s   – 600 bit/s

- 1,2 kbit/s