



**SLOVENSKI STANDARD**  
**SIST IEC/TR 60870-1-4:1997**  
**01-avgust-1997**

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

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Matériels et systèmes de téléconduite - Partie 1: Considérations générales - Section 4: Aspects fondamentaux de la transmission de données de téléconduite et organisation des normes CEI 870-5 et CEI 870-6

**Ta slovenski standard je istoveten z: IEC/TR 60870-1-4**

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**ICS:**

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

**SIST IEC/TR 60870-1-4:1997 en**

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**RAPPORT  
TECHNIQUE –TYPE 3  
TECHNICAL  
REPORT – TYPE 3**

**CEI  
IEC  
870-1-4**

Première édition  
First edition  
1994-07

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**Matériels et systèmes de téléconduite –**

**Partie 1:**

Considérations générales –

Section 4: Aspects fondamentaux

de la transmission de données de téléconduite

et organisation des normes CEI 870-5 et CEI 870-6

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**Telecontrol equipment and systems –**

**Part 1:**

General considerations –

Section 4: Basic aspects of telecontrol

data transmission and organization

of standards IEC 870-5 and IEC 870-6

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Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

CODE PRIX  
PRICE CODE

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## TELECONTROL EQUIPMENT AND SYSTEMS –

## Part 1: General considerations –

Section 4: Basic aspects of telecontrol data transmission  
and organization of standards IEC 870-5 and IEC 870-6

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a world-wide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation 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 of agreements of the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 3) They have the form of recommendations for international use 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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- 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.

The main task of IEC technical committees is to prepare International Standards in exceptional circumstances, a technical committee may propose the publication of a technical report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

Technical reports of types 1 and 2 are subject to review within three years of publication to decide whether they can be transformed into International Standards. Technical reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

IEC 870-1-4, which is a technical report of type 3, has been prepared by IEC technical committee 57: Power system control and associated communications.

The text of this technical report is based on the following documents:

Committee draft	Report on voting
57(SEC)128	57(SEC)162

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

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## INTRODUCTION

In the area of process control, especially in the area of telecontrol and SCADA systems, there is an increasing demand for real-time data transmission. Inherent in this type of application are requirements with respect to data integrity and guaranteed transmission time.

The applicability of a particular type of communication network with its associated protocols depends upon its ability to fulfil these requirements. This is a function of a number of factors, including:

- bandwidth;
- traffic load (normal and avalanche conditions);
- transmission quality;
- coding and encryption schemes;
- computing power of communication front-ends and nodes.

Each candidate system should be evaluated in the light of all of these factors.

In particular, approaches to telecontrol data communication based on the OSI (open-system interconnection) family of protocols (which were conceived originally for application to inter-computer communication and not for telecontrol) should be examined very carefully from this point of view.

IEC 1085 deals with the totality of telecommunications as applied to the administration and operation of electric power systems. It does not go into detail on the specific needs of telecontrol.

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IEC 870-1-1 describes the general principles of the layout and the functions of telecontrol systems. Clause 6 of that publication gives already some overviews on the transmission of telecontrol data, but both the complexity of the data transmission systems, as well as their numerous applications need a closer look. Due to this fact, a large number of different publications dealing with standardization of telecontrol protocols will be published. Therefore, it is necessary to give an overview in this report relating to the basic aspects of telecontrol data transmission.

## TELECONTROL EQUIPMENT AND SYSTEMS –

### Part 1: General considerations – Section 4: Basic aspects of telecontrol data transmission and organization of standards IEC 870-5 and IEC 870-6

#### 1 Scope and object

This technical report applies to telecontrol equipment and systems with coded bit serial data transmission for monitoring and control of geographically widespread processes.

This report is intended as a brief tutorial on transmission techniques, equipment and protocols in view of their use in telecontrol systems. It is thus intended as a guide to orient those using the standards defined in the series of IEC 870-5 and IEC 870-6. More precisely, it gives a frame of reference for evaluating solutions as well as defining and describing the key technical terms. Terms that are defined in IEC 50(371) and in IEC 870-1-3 are complemented by further definitions in clause 3 of this report.

It further provides:

- descriptions of applicable basic communication technologies;
- basic rules as to how different system layers (see clause 3) can be used together (i.e. which combinations of standards in different layers are technically coherent and which are not).

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It is not intended to recommend or impose solutions, this being the role of IEC 870-5 and IEC 870-6.

#### 2 Reference documents

IEC 50(371): 1984, *International Electrotechnical Vocabulary (IEV) – Chapter 371: Telecontrol*

IEC 50(721): 1991, *International Electrotechnical Vocabulary (IEV) – Chapter 721: Telegraphy, facsimile and data communication*

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

IEC 870-1-2: 1989, *Telecontrol equipment and systems – Part 1: General considerations – Section Two: Guide for specifications*

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

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: 199x, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 5: Basic application functions (under consideration)*

IEC 870-5-x: 199x, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section x: Telecontrol companion standards and profiles (under consideration)*

IEC 870-6-1: 199x, *Telecontrol equipment and systems – Part 6: Telecontrol protocols compatible with ISO and CCITT standards – Section 1: Application context and organization of standards (under consideration)*

IEC 870-6-2: 199x, *Telecontrol equipment and systems – Part 6: Telecontrol protocols compatible with ISO and CCITT standards – Section 2: Use of base standards (OSI layers 1-4) (under consideration)*

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IEC 870-6-3: 199x, *Telecontrol equipment and systems – Part 6: Telecontrol protocols compatible with ISO and CCITT standards – Section 3: Use of base standards (OSI layers 5-7) (under consideration)*

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IEC 870-6-4: 199x, *Telecontrol equipment and systems – Part 6: Telecontrol protocols compatible with ISO and CCITT standards – Section 4: Network management (under consideration)*

IEC 870-6-x: 199x, *Telecontrol equipment and systems – Part 6: Telecontrol protocols compatible with ISO and CCITT standards – Section x: Functional profiles (under consideration)*

ISO 2382: *Information technology – Vocabulary*

ISO 7498: 1984, *Information processing systems – Open Systems Interconnection – Basic reference model*

ISO 8072: 1986, *Information processing systems – Open Systems Interconnection – Transport service definition*

ISO/IEC 8073: 1992, *Information technology – Telecommunications and information exchange between systems – Open Systems Interconnection – Protocol for providing the connection-mode transport service*

ISO 8326: 1987, *Information processing systems – Open Systems Interconnection – Basic connection oriented session service definition*

ISO 8327: 1987, *Information processing systems – Open Systems Interconnection – Basic connection oriented session protocol specification*

ISO 8509: 1987, *Information processing systems – Open Systems Interconnection – Service conventions*

ISO 8822: 1988, *Information processing systems – Open Systems Interconnection – Connection oriented presentation service definition*

ISO 8823: 1988, *Information processing systems – Open Systems Interconnection – Connection oriented presentation protocol specification*

CCITT Recommendation R 35: 1989, Blue Book, Fascicle VII.1, *Standardization of FMVFT systems for a modulation rate of 50 bauds*

CCITT Recommendation R 36: 1989, Blue Book, Fascicle VII.1, *Coexistence of 50-baud/120-Hz channels, 100-baud/240-Hz channels, 200-baud/360-Hz or 480-Hz channels on the same voice-frequency telegraph system*

CCITT Recommendation R 37: 1989, Blue Book, Fascicle VII.1, *Standardization of FMVFT systems for a modulation rate of 100 bauds*

CCITT Recommendation R 38 A: 1989, Blue Book, Fascicle VII.1, *Standardization of FMVFT systems for a modulation rate of 200 bauds with channels spaced at 480 Hz*

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CCITT Recommendation V 11: 1989, Blue Book, Fascicle VIII.1, *Electrical characteristics for balanced double-current interchange circuits for general use with integrated circuit equipment in the field of data communications*

CCITT Recommendation V 21: 1989, Blue Book, Fascicle VIII.1, *300 bits per second duplex modem standardized for use in the general switched telephone network*

CCITT Recommendation V 22: 1989, Blue Book, Fascicle VIII.1, *1 200 bits per second duplex modem standardized for use in the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits*

CCITT Recommendation V 23: 1989, Blue Book, Fascicle VIII.1, *600/1 200-baud modem standardized for use in the general switched telephone network*

CCITT Recommendation V 24: 1989, Blue Book, Fascicle VIII.1, *List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)*

CCITT Recommendation V 26: 1989, Blue Book, Fascicle VIII.1, *2 400 bits per second modem standardized for use on 4-wire leased telephone-type circuits*

CCITT Recommendation V 27: 1989, Blue Book, Fascicle VIII.1, *4 800 bits per second modem with manual equalizer standardized for use on leased telephone-type circuits*

CCITT Recommendation V 28: 1989, Blue Book, Fascicle VIII.1, *Electrical characteristics for unbalanced double-current interchange circuits*

CCITT Recommendation V 29: 1989, Blue Book, Fascicle VIII.1, *9 600 bits per second modem standardized for use on point-to-point 4-wire leased telephone-type circuits*

CCITT Recommendation V 32: 1989, Blue Book, Fascicle VIII.1, *A family of 2-wire, duplex modems operating at data signalling rates of up to 9 600 bits/s for use on the general switched telephone network and on leased telephone-type circuits*

CCITT Recommendation X 3: 1989, Blue Book, Fascicle VIII.2, *Packet assembly/disassembly facility (PAD) in a public data network*

CCITT Recommendation X 20: 1989, Blue Book, Fascicle VIII.2, *Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for start-stop transmission services on public data networks*

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CCITT Recommendation X 21: 1989, Blue Book, Fascicle VIII.2, *Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for synchronous operation on public data networks*

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CCITT Recommendation X 21 bis: 1989, Blue Book, Fascicle VIII.2, *Use on public data networks of data terminal equipment (DTE) which is designed for interfacing to asynchronous duplex V-series modems*

CCITT Recommendation X 22: 1989, Blue Book, Fascicle VIII.2, *Multiplex DTE/DCE interface for user classes 3-6*

CCITT Recommendation X 24: 1989, Blue Book, Fascicle VIII.2, *List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) on public data networks*

CCITT Recommendation X 25: 1989, Blue Book, Fascicle VIII.2, *Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit*

CCITT Recommendation X 28: 1989, Blue Book, Fascicle VIII.2, *DTE/DCE interface for a start-stop mode data terminal equipment accessing the packet assembly/disassembly facility (PAD) in a public data network situated in the same country*

CCITT Recommendation X 29: 1989, Blue Book, Fascicle VIII.2, *Procedures for the exchange of control information and user data between a packet assembly/disassembly facility (PAD) and a packet mode DTE or another PAD*

### 3 Definition of technical terms

**3.1 balanced transmission:** Transmission method by which either data terminal equipment (DTE) of two connected stations may initiate a message transmission at any time.

**3.2 call establishment:** Sequence of events for the establishment of a data connection. [CCITT X.15/1,4]

**3.3 call release:** Sequence of events for the release of a data connection.

**3.4 circuit-switched network:** Arrangement of dedicated (time-division or space-division) switching facilities to provide telecommunication service based on circuit-switching methods. These could be a circuit-switched data network or switched telephone network.

**3.5 circuit switching:** Process that, on demand, connects two or more data terminal equipments and permits the exclusive use of a data circuit between them until the connection is released. [ISO 2382/09.05.09]

**3.6 envelope:** Group of binary digits formed by an  $n$ -byte augmented by a number of additional bits which are required for the operation of the data network. [IEV 721-19-25]

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**3.7 node:** In a data network, point where one or more functional units interconnect channels or data circuits. [ISO 2382/09.02.02]

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**3.8 packet:** Sequence of binary digits, including data and control signals, that is transmitted and switched as a composite whole.

NOTE – The data, control signals and possibly error control information are arranged in a specific format. [ISO 2382/09.06.26]

**3.9 packet assembler/disassembler (PAD):** Functional unit that enables data terminal equipments not equipped for packet switching to access a packet-switched network. [ISO 2382/09.07.20]

**3.10 packet-switched network:** Arrangement of dedicated switching facilities to provide telecommunication service based on packet-switching methods.

**3.11 packet switching:** Process of routing and transferring data by means of addressed packets so that a channel is occupied only during the transmission of a packet; upon completion of the transmission, the channel is made available for the transfer of other packets. [ISO 2382/09.05.08]

**3.12 peer-to-peer protocol:** Protocol between entities within the same layer of an open system.

**3.13 periodic data transmission:** Transmission of sets of data that are repeated at equal time intervals.