

**Telecontrol equipment and systems -  
Part 5-104: Transmission protocols -  
Network access for IEC 60870-5-101  
using standard transport profiles**

Telecontrol equipment and systems - Part 5-104:  
Transmission protocols - Network access for IEC  
60870-5-101 using standard transport profiles

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

|  |   |
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| <p>Käesolev Eesti standard EVS-EN 60870-5-104:2006 sisaldab Euroopa standardi EN 60870-5-104:2006 ingliskeelset teksti.</p> <p>Käesolev dokument on jõustatud 14.12.2006 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes.</p> <p>Standard on kättesaadav Eesti standardiorganisatsioonist.</p> | <p>This Estonian standard EVS-EN 60870-5-104:2006 consists of the English text of the European standard EN 60870-5-104:2006.</p> <p>This document is endorsed on 14.12.2006 with the notification being published in the official publication of the Estonian national standardisation organisation.</p> <p>The standard is available from Estonian standardisation organisation.</p> |
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| <p><b>Käsitlusala:</b></p> <p>This part of IEC 60870 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 IEC 60870-5 series. The specifications of this part present a combination of the application layer of IEC 60870-5-101 and the transport functions provided by a TCP/IP (Transmission Control Protocol/Internet Protocol). Within TCP/IP, various network types can be utilized, including X.25, FR (Frame Relay), ATM (Asynchronous Transfer Mode) and ISDN (Integrated Service Data Network). Using the same definitions, alternative ASDUs (Application Service Data Unit) as specified in other IEC 60870-5 companion standards (for example, IEC 60870-5-102) may be combined with TCP/IP, but this is not described further in this part.</p> | <p><b>Scope:</b></p> <p>This part of IEC 60870 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 IEC 60870-5 series. The specifications of this part present a combination of the application layer of IEC 60870-5-101 and the transport functions provided by a TCP/IP (Transmission Control Protocol/Internet Protocol). Within TCP/IP, various network types can be utilized, including X.25, FR (Frame Relay), ATM (Asynchronous Transfer Mode) and ISDN (Integrated Service Data Network). Using the same definitions, alternative ASDUs (Application Service Data Unit) as specified in other IEC 60870-5 companion standards (for example, IEC 60870-5-102) may be combined with TCP/IP, but this is not described further in this part.</p> |
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ICS 33.200

**Võtmesõnad:** companion standard, data transmission protocol, interoperability, telecontrol

English version

**Telecontrol equipment and systems  
Part 5-104: Transmission protocols -  
Network access for IEC 60870-5-101  
using standard transport profiles  
(IEC 60870-5-104:2006)**

Matériels et systèmes de téléconduite  
Partie 5-104: Protocoles de transmission -  
Accès aux réseaux utilisant  
des profils de transport normalisés  
pour la CEI 60870-5-101  
(CEI 60870-5-104:2006)

Fernwirkeneinrichtungen und -systeme  
Teil 5-104: Übertragungsprotokolle -  
Zugriff für IEC 60870-5-101 auf Netze  
mit genormten Transportprofilen  
(IEC 60870-5-104:2006)

This European Standard was approved by CENELEC on 2006-09-01. 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.

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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

The text of document 57/812/FDIS, future edition 2 of IEC 60870-5-104, prepared by IEC TC 57, Power systems management and associated information exchange, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60870-5-104 on 2006-09-01.

This European Standard supersedes EN 60870-5-104:2001.

The main changes with respect to EN 60870-5-104:2001 are as follows: improvement of the sequences and interoperability of the protocol and addition of new functions for the handling of redundant connections.

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) | 2007-06-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn   | (dow) | 2009-09-01 |

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 60870-5-104:2006 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

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

| <u>Publication</u>              | <u>Year</u>     | <u>Title</u>   | <u>EN/HD</u>   | <u>Year</u> |
|---------------------------------|-----------------|--|----------------|-------------|
| IEC 60870-5-3                   | 1992            | Telecontrol equipment and systems<br>Part 5: Transmission protocols - Section 3:<br>General structure of application data  | EN 60870-5-3   | 1992        |
| IEC 60870-5-4                   | 1993            | Telecontrol equipment and systems<br>Part 5: Transmission protocols - Section 4:<br>Definition and coding of application<br>information elements   | EN 60870-5-4   | 1993        |
| IEC 60870-5-5                   | 1995            | Telecontrol equipment and systems<br>Part 5: Transmission protocols - Section 5:<br>Basic application functions  | EN 60870-5-5   | 1995        |
| IEC 60870-5-101                 | 2003            | Telecontrol equipment and systems<br>Part 5-101: Transmission protocols -<br>Companion standard for basic telecontrol<br>tasks   | EN 60870-5-101 | 2003        |
| IEC 60870-5-102                 | 1996            | Telecontrol equipment and systems<br>Part 5: Transmission protocols - Section 102:<br>Companion standard for the transmission of<br>integrated totals in electric power systems  | EN 60870-5-102 | 1996        |
| ITU-T<br>Recommendation<br>X.25 | 1996            | Interface between Data Terminal Equipment -<br>(DTE) and Data Circuit-terminating<br>Equipment (DCE) for terminals operating in<br>the packet mode and connected to public<br>data networks by dedicated circuit   | -              | -           |
| IEEE 802.3                      | 1998            | Information technology - Telecommunications -<br>and information exchange between systems -<br>Local and metropolitan area networks -<br>Specific requirements<br>Part 3: Carrier sense multiple access with<br>collision detection (CSMA/CD) access<br>method and physical layer specifications | -              | -           |
| RFC 791                         | 1981            | Internet Protocol - DARPA Internet Program -<br>Protocol Specification   | -              | -           |
| RFC 793                         | 1981            | Transmission Control Protocol - DARPA<br>Internet Program Protocol Specification   | -              | -           |
| RFC 894                         | - <sup>1)</sup> | Standard for the Transmission of IP<br>datagrams over Ethernet Networks  | -              | -           |

<sup>1)</sup> Undated reference.

| <u>Publication</u> | <u>Year</u>     | <u>Title</u>                         | <u>EN/HD</u> | <u>Year</u> |
|--------------------|-----------------|--------------------------------------|--------------|-------------|
| RFC 1661           | - <sup>1)</sup> | Point-to-Point Protocol (PPP)        | -            | -           |
| RFC 1662           | - <sup>1)</sup> | PPP in HDLC Framing                  | -            | -           |
| RFC 1700           | 1994            | Assigned Numbers                     | -            | -           |
| RFC 2200           | 1997            | Internet Official Protocol Standards | -            | -           |

# INTERNATIONAL STANDARD

**IEC**  
**60870-5-104**

Second edition  
2006-06

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## Telecontrol equipment and systems –

### Part 5-104: Transmission protocols – Network access for IEC 60870-5-101 using standard transport profiles

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*



Reference number  
IEC 60870-5-104:2006(E)

## Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

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# INTERNATIONAL STANDARD

**IEC**  
**60870-5-104**

Second edition  
2006-06

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## **Telecontrol equipment and systems –**

### **Part 5-104: Transmission protocols – Network access for IEC 60870-5-101 using standard transport profiles**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## TELECONTROL EQUIPMENT AND SYSTEMS –

**Part 5-104: Transmission protocols –  
Network access for IEC 60870-5-101 using  
standard transport profiles**

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of 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, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). 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. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60870-5-104 Ed.2 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

This second edition cancels and replaces the first edition published in 2000 and constitutes a technical revision. The main changes of this second edition with respect to the previous edition are as follows: improvement of the sequences and interoperability of the protocol and addition of new functions for the handling of redundant connections.

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

|             |                  |
|-------------|------------------|
| FDIS        | Report on voting |
| 57/812/FDIS | 57/819/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.

This publication has been drafted in accordance with the ISO/IEC directives, Part 2.

IEC 60870-5 consists of the following parts, under the general title *Telecontrol equipment and systems – Part 5: Transmission protocols*

- Part 5: Transmission protocols – Section One: Transmission frame formats
- Part 5: Transmission protocols – Section 2: Link transmission procedures
- Part 5: Transmission protocols – Section 3: General structure of application data
- Part 5: Transmission protocols – Section 4: Definition and coding of application information elements
- Part 5: Transmission protocols – Section 5: Basic application functions
- Part 5-6: Guidelines for conformance testing for the IEC 60870-5 companion standards
- Part 5-101: Transmission protocols – Companion standard for basic telecontrol tasks
- Part 5: Transmission protocols – Section 102: Companion standard for the transmission of integrated totals in electric power systems
- Part 5-103: Transmission protocols – Companion standard for the informative interface of protection equipment
- Part 5-104: Transmission protocols – Network access for IEC 60870-5-101 using standard transport profiles
- Part 5-601: Conformance test cases for the IEC 60870-5-101 companion standard

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

## INTRODUCTION

IEC 60870-5-101 provides a communication profile for sending basic telecontrol messages between a central telecontrol station and telecontrol outstations, which uses permanent directly connected data circuits between the central station and individual outstations.

In some applications, it may be required to send the same types of application messages between telecontrol stations using a data network containing relay stations which store and forward the messages and provide only a virtual circuit between the telecontrol stations. This type of network delays messages by varying amounts of time depending on the network traffic load.

In general, the variable message delay times mean that it is not possible to use the link layer as defined in IEC 60870-5-101 between telecontrol stations. However, in some cases it is possible to connect telecontrol stations having all three layers of the companion standard IEC 60870-5-101 to suitable data networks using Packet Assembler Disassembler (PAD) type stations to provide access for balanced communication.

In all other cases this companion standard, which does not use the link functions of IEC 60870-5-101, may be used to provide balanced access via a suitable transport profile.

## TELECONTROL EQUIPMENT AND SYSTEMS –

### **Part 5-104: Transmission protocols – Network access for IEC 60870-5-101 using standard transport profiles**

#### **1 Scope and object**

This part of IEC 60870 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 IEC 60870-5 series. The specifications of this part present a combination of the application layer of IEC 60870-5-101 and the transport functions provided by a TCP/IP (Transmission Control Protocol/Internet Protocol). Within TCP/IP, various network types can be utilized, including X.25, FR (Frame Relay), ATM (Asynchronous Transfer Mode) and ISDN (Integrated Service Data Network). Using the same definitions, alternative ASDUs (Application Service Data Unit) as specified in other IEC 60870-5 companion standards (for example, IEC 60870-5-102) may be combined with TCP/IP, but this is not described further in this part.

NOTE Security mechanisms are outside the scope of this standard.

#### **2 Normative references**

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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 60870-5-101:2003, *Telecontrol equipment and systems – Part 5-101: Transmission protocols – Companion standard for basic telecontrol tasks*

IEC 60870-5-102:1996, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 102: Companion standard for the transmission of integrated totals in electric power systems*

ITU-T Recommendation X.25:1996, *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*

IEEE 802.3:1998, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*



RFC 791, *Internet Protocol, Request for Comments 791 (MILSTD 1777) (September, 1981)*

RFC 793, *Transmission Control Protocol, Request for Comments 793 (MILSTD 1778) (September, 1981)*

RFC 894, *Internet Protocol on Ethernet Networks*

RFC 1661, *Point-to-Point Protocol (PPP)*

RFC 1662, *PPP in HDLC Framing*

RFC 1700, *Assigned Numbers, Request for Comments 1700 (STD 2) (October, 1994)*

RFC 2200, *Internet Official Protocol Standards, Request for Comments 2200 (June, 1997)*

### **3 General architecture**

This standard defines the use of an open TCP/IP-interface to a network, containing for example a LAN for telecontrol equipment, which transports IEC 60870-5-101 ASDUs. Routers which include the different WAN-types (for example, X.25, Frame Relay, ISDN, etc.) may be connected via a common TCP/IP-LAN-interface (see figure 1). Figure 1 shows a redundant configuration in the central station in addition to a non-redundant system.

Motivations:

The use of separate routers offers the following advantages.

- There is no need for network-specific software in end systems.
- There is no need for routing functionality in end systems.
- There is no need for network management in end systems.
- It facilitates obtaining end systems from manufacturers that specialize in telecontrol equipment.
- It facilitates obtaining individual separate routers, to suit a variety of networks from manufacturers specializing in this non-telecontrol specific field.
- It is possible to change the network type by replacing only the router type, without affecting the end systems.
- It is particularly suitable for converting existing end systems that conform to IEC 60870-5-101.
- It is suitable for present and future implementations.