
Telecontrol equipment and systems – Part 5-104: Transmission protocols – Network access for IEC 60870-5-101 using standard transport profiles (IEC 60870-5-104:2000)

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EUROPEAN STANDARD

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EUROPÄISCHE NORM

May 2001

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English version

**Telecontrol equipment and systems
Part 5-104: Transmission protocols -
Network access for IEC 60870-5-101
using standard transport profiles
(IEC 60870-5-104:2000)**

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 60870-5-104:2000)

Fernwirkrichtungen und -systeme
Teil 5-104: Übertragungsprotokolle -
Zugriff für IEC 60870-5-101 auf Netze
mit genormten Transportprofilen
(IEC 60870-5-104:2000)

STANDARD PREVIEW
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This European Standard was approved by CENELEC on 2001-03-01. 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

The text of document 57/487/FDIS, future edition 1 of IEC 60870-5-104, 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 60870-5-104 on 2001-03-01.

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) 2001-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2004-03-01

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 60870-5-104:2001 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.

<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 Part 5: Transmission protocols -- Section 3: General structure of application data	EN 60870-5-3	1992
IEC 60870-5-4	1993	Part 5: Transmission protocols -- Section 4: Definition and coding of application information elements	EN 60870-5-4	1993
IEC 60870-5-5	1995	Part 5: Transmission protocols -- Section 5: Basic application functions	EN 60870-5-5	1995
IEC 60870-5-101	1995	Part 5-101: Transmission protocols - Companion standard for basic telecontrol tasks	EN 60870-5-101	1996
IEC 60870-5-102	1996	Part 5: Transmission protocols -- Section 102: Companion standard for the transmission of integrated totals in electric power systems	EN 60870-5-102	1996
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	1981	Internet Protocol, Request for Comments 791 (MILSTD 1777)	-	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
RFC 793	1981	Transmission Control Protocol, Request for Comments 793 (MILSTD 1778)	-	-
RFC 894		Internet Protocol on Ethernet Networks	-	-
RFC 1661		Point-to-Point Protocol (PPP)	-	-
RFC 1662		PPP in HDLC Framing	-	-
RFC 1700	1994	Assigned Numbers request for comments 1700 (STD 2)	-	-
RFC 2200	1997	Internet Official Protocol, Standard Request for Comments 2200	-	-

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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**

Telecontrol equipment and systems –

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

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

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CONTENTS

	Page
FOREWORD	7
INTRODUCTION	9
Clause	
1 Scope and object	11
2 Normative references	11
3 General architecture	13
4 Protocol structure	17
5 Definition of Application Protocol Control Information (APCI)	21
5.1 Protection against loss and duplication of messages	25
5.2 Test procedures	29
5.3 Transmission Control using Start/Stop	33
5.4 Portnumber	35
5.5 Maximum number of outstanding I format APDUs (<i>k</i>)	37
6 Selection of ASDUs defined in IEC 60870-5-101 and additional ASDUs	39
7 Mapping of selected application data units and functions to the TCP services	45
7.1 Station initialization (6.1.5 to 6.1.7 of IEC 60870-5-5)	45
7.2 Data acquisition by polling (6.2 of IEC 60870-5-5)	55
7.3 Cyclic data transmission (6.3 of IEC 60870-5-5)	55
7.4 Acquisition of events (6.4 of IEC 60870-5-5)	55
7.5 General interrogation (6.6 of IEC 60870-5-5)	55
7.6 Clock synchronization (6.7 of IEC 60870-5-5)	57
7.7 Command transmission (6.8 of IEC 60870-5-5)	59
7.8 Transmission of integrated totals (6.9 of IEC 60870-5-5)	61
7.9 Parameter loading (6.10 of IEC 60870-5-5)	61
7.10 Test procedure (6.11 of IEC 60870-5-5)	63
7.11 File transfer (6.12 of IEC 60870-5-5) Control and monitor direction	63
8 ASDUs for process information in control direction with time tag	67
8.1 TYPE IDENT 58: C_SC_TA_1 Single command with time tag CP56Time2a	67
8.2 TYPE IDENT 59: C_DC_TA_1 Double command with time tag CP56Time2a	69
8.3 TYPE IDENT 60: C_RC_TA_1 Regulating step command with time tag CP56Time2a	71
8.4 TYPE IDENT 61: C_SE_TA_1 Set-point command with time tag CP56Time2a, normalized value	73
8.5 TYPE IDENT 62: C_SE_TB_1 Set-point command with time tag CP56Time2a, scaled value	75
8.6 TYPE IDENT 63: C_SE_TC_1 Set-point command with time tag CP56Time2a, short floating point number	77
8.7 TYPE IDENT 64: C_BO_TA_1 Bitstring of 32 bit with time tag CP56Time2a	79
8.8 TYPE IDENT 107: C_TS_TA_1 Test command with time tag CP56Time2a	81

Clause	Page
9 Interoperability	83
9.1 System or device.....	83
9.2 Network configuration	83
9.3 Physical layer.....	85
9.4 Link layer	85
9.5 Application layer.....	87
9.6 Basic application functions	99
Figure 1 – General architecture (example)	15
Figure 2 – Selected standard provisions of the defined telecontrol companion standard.....	17
Figure 3 – Selected standard provisions of the TCP/IP protocol suite RFC 2200 (example)....	19
Figure 4 – APDU of the defined telecontrol companion standard	21
Figure 5 – APCI of the defined telecontrol companion standard.....	21
Figure 6 – Control field of type Information transfer format (I format).....	23
Figure 7 – Control field of type numbered supervisory functions (S format).....	23
Figure 8 – Control field of type unnumbered control functions (U format).....	25
Figure 9 – Undisturbed sequences of numbered I format APDUs.....	27
Figure 10 – Undisturbed sequences of numbered I format APDUs acknowledged by an S format APDU	27
Figure 11 – Disturbed sequence of numbered I format APDUs	29
Figure 12 – Time-out in case of a not acknowledged last I format APDU	29
Figure 13 – Undisturbed test procedure	31
Figure 14 – Unconfirmed test procedure	31
Figure 15 – Start data transfer procedure.....	33
Figure 16 – Stop data transfer procedure	35
Figure 17 – TCP connection establishment and close.....	47
Figure 18 – Initialization of the controlling station	49
Figure 19 – Local initialization of the controlled station	51
Figure 20 – Remote initialization of the controlled station	53
Figure 21 – ASDU: C_SC_TA_1 Single command with time tag CP56Time2a.....	67
Figure 22 – ASDU: C_DC_TA_1 Double command with time tag CP56Time2a	69
Figure 23 – ASDU: C_RC_TA_1 Regulating step command with time tag CP56Time2a	71
Figure 24 – ASDU: C_SE_TA_1 Set-point command with time tag CP56Time2a, normalized value	73
Figure 25 – ASDU: C_SE_TB_1 Set-point command with time tag CP56Time2a, scaled value	75
Figure 26 – ASDU: C_SE_TC_1 Set-point command with time tag CP56Time2a, short floating point number	77
Figure 27 – ASDU: C_BO_TA_1 Bitstring of 32 bit with time tag CP56Time2a	79
Figure 28 – ASDU: C_TS_TA_1 Test command with time tag CP56Time2a.....	81
Table 1 – Process information in monitor direction	39
Table 2 – Process information in control direction	41
Table 3 – System information in monitor direction	43
Table 4 – System information in control direction	43
Table 5 – Parameter in control direction.....	43
Table 6 – File transfer.....	43

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 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 specifications, 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 60870-5-104 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
57/487/FDIS	57/499/RVD

<https://standards.iteh.ai/catalog/standards/sist/1268e5eb-b76f-42de-8bac->

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 3.

The committee has decided that the contents of this publication will remain unchanged until 2005. 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.

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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 normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60870. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 60870 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

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 60870-5-101:1995, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 101: Companion standard for basic telecontrol tasks*
Amendment 1 (2000)

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)*

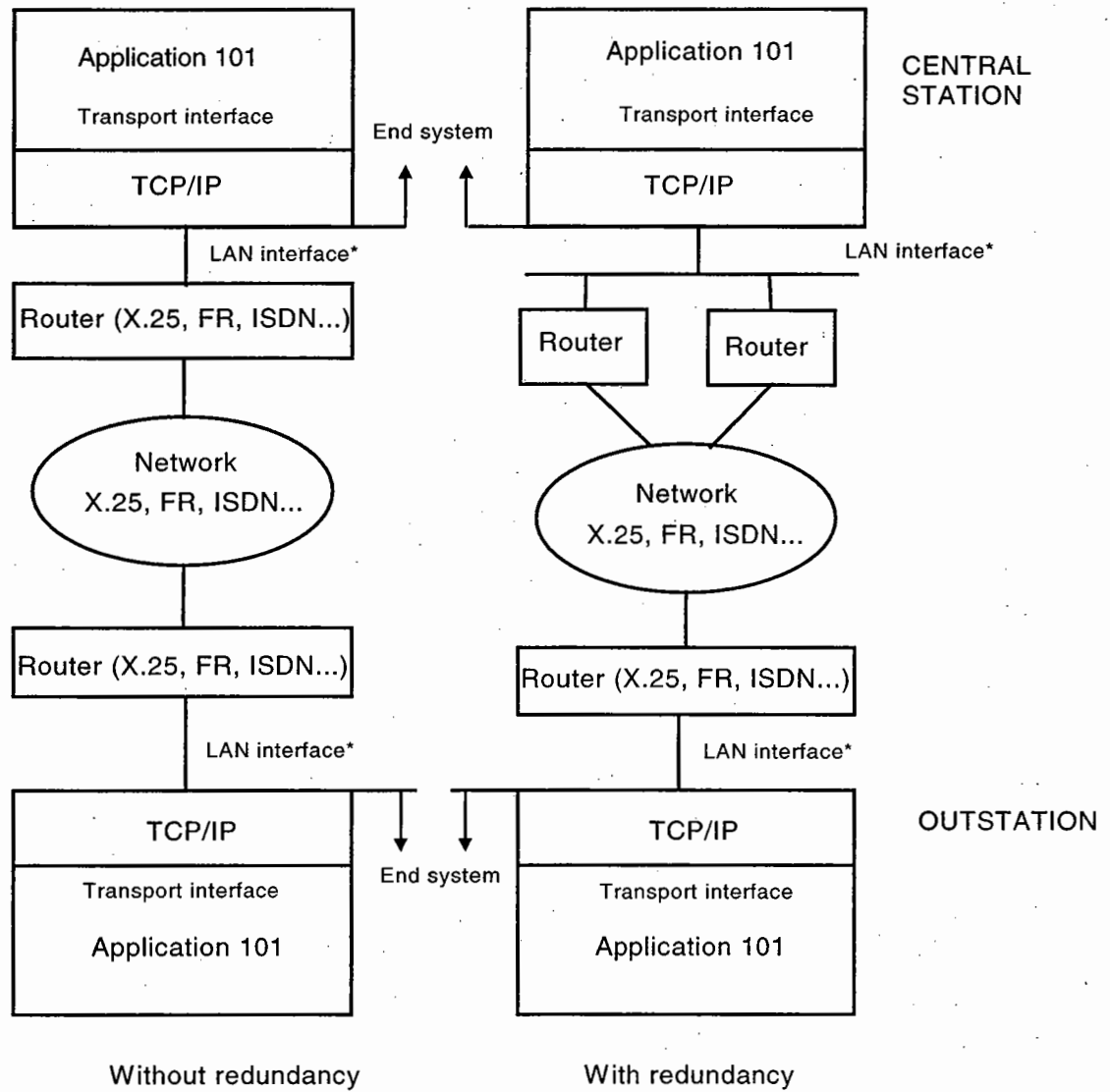
3 General architecture

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.



* The LAN interface may be redundant.

Figure 1 - General architecture (example)
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4 Protocol structure

Figure 2 shows the protocol structure of the end system.

Selection of application functions of IEC 60870-5-5 according to IEC 60870-5-101	Initialization	User process
Selection of ASDUs from IEC 60870-5-101 and IEC 60870-5-104		Application (layer 7)
APCI (Application Protocol Control Information) Transport Interface (user to TCP interface)		
Selection of TCP/IP protocol suite (RFC 2200)		Transport (layer 4)
		Network (layer 3)
		Link (layer 2)
		Physical (layer 1)
NOTE Layers 5 and 6 are not used.		

IEC 2786/2000

Figure 2 – Selected standard provisions of the defined telecontrol companion standard

Figure 3 shows the recommended selection of the TCP/IP Protocol suite (RFC 2200) used in this standard. At the time of publication, the RFCs indicated were valid, but may have been replaced in the meantime by equivalent, relevant RFCs. The relevant RFCs are available at the Internet address <http://www.ietf.org>.

The Ethernet 802.3 stack shown may be used by a telecontrol station end system or DTE (Data Terminal Equipment) to drive a separate router as shown in the example in figure 1. If a redundant configuration is not required, a point-to-point interface (for example, X.21) to the separate router may be used instead of a LAN interface, thus retaining more of the original hardware when converting end systems originally conforming to IEC 60870-5-101.

Other compatible selections from RFC 2200 are also permitted.

This standard uses the TCP/IP transport profile as defined in other referenced standards, without alteration.