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CONSOLIDATED VERSION

Telecontrol equipment and systems -
Part 5-601: Transmission protocols - Conformance test cases for the IEC 60870-5-101 companion standard

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Telecontrol equipment and systems - Part 5-601: Transmission protocols - Conformance test cases for the IEC 60870-5-101 companion standard

FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 60870-5-601 edition 2.1 contains the second edition (2015-10) [documents 57/1528/DTS and 57/1590/RVC] and its amendment 1 (2026-09) [documents 57/2938/DTS and 57/2978/RVDTS].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

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 specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- The subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

This technical specification is to be used in conjunction with IEC 60870-5-101:2003/AMD1:2015. IEC 60870-5-101:2003/AMD1:2015 resolves ambiguities and inconsistencies discovered by users of the standard and was worked out in parallel with IEC 60870-5-601:2006.

IEC 60870-5-601, which is a technical specification, 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 2006. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Resolving ambiguities and inconsistencies between IEC 60870-5-101:2003 and IEC TS 60870-5-601:2006;
b) Enhancements and optimisation of test cases which are needed to prove conformance with IEC 60870-5-101:2003;
c) Additional negative test cases made to avoid circulation of messages not conformant with IEC 60870-5-101:2003.

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

Enquiry draft	Report on voting
57/1528/DTS	57/1590/RVC

Full information on the voting for the approval of this technical specification 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.

A list of all parts of the IEC 60870 series, under the general title *Telecontrol equipment and systems*, can be found on the IEC website.

The committee has decided that the contents of this document and its amendment will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

1 Scope

This part of IEC 60870 describes test cases for conformance testing of telecontrol equipment, Substation Automation Systems (SAS) and telecontrol systems, including front-end functions of SCADA.

The use of this part of IEC 60870 facilitates interoperability by providing a standard method of testing protocol implementations, but it does not guarantee interoperability of devices. It is expected that using this part of IEC 60870 during testing will minimize the risk of non-interoperability.

The goal of this part of IEC 60870 is to enable unambiguous and standardised evaluation of IEC 60870-5 companion standard protocol implementations. The guidelines and conditions for the testing environment are described in IEC 60870-5-6. The detailed test cases per companion standard, containing among others mandatory and optional mandatory test cases per Basic Application Function, ASDU and transmission procedures, will become available as a technical specification (TS). Other functionality may need additional test cases but this is beyond the scope of this part of IEC 60870. For proper testing, it is recommended to define these additional test cases.

This part of IEC 60870 deals mainly with communication conformance testing; therefore other requirements, such as safety or EMC are not covered. These requirements are covered by other standards (if applicable) and the proof of compliance for these topics is done in accordance with these standards.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies[1].

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

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

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 60870-5-5:1999, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 5: Basic application functions*

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[1] The base standard always takes precedence. In case of ambiguity between this part of IEC 60870 and the base standards (IEC 60870-5-1 to IEC 60870-5-5, IEC 60870-5-101), this part of IEC 60870 needs to be clarified or amended.

When testing negative behaviour is not described in the base standard, the behaviour described in this part of IEC 60870 shall prevail and shall be observed.

The conformance statement produced after testing shall indicate any lack of conformance to either the test plan or the base standard.

IEC 60870-5-6, *Telecontrol equipment and systems – Part 5-6: Guidelines for conformance testing for the IEC 60870-5 companion standards*

IEC 60870-5-101:2003, *Telecontrol equipment and systems – Part 5-101: Transmission protocols – Companion standard for basic telecontrol tasks*
IEC 60870-5-101:2003/AMD1:2015

IEEE 754, *Standard for Binary Floating-Point Arithmetic*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60870-5-6 apply.

4 Abbreviated terms

For the purposes of this document, the abbreviations given in IEC 60870-5-6 apply.

5 Conformance testing for IEC 60870-5-101

5.1 Overview and legend

Procedural and functional testing should always start with the Station Initialization function and proceeds with the next Basic Application Functions. The procedure in each test case should be followed, which means that the DUT is able to function as described in the specific test case.

The test procedures in Tables 1 to 14 should be tested with no errors detected during testing of all the Basic Application Functions in Tables 15 to 32. These tests are preferably automatically performed by the used test platform.

In addition to the performance criteria listed in the test procedures, Subclause 5.3 lists the protocol specifications that should be verified automatically by the testing software or verified manually by review of the test history log after execution of the test procedures. The verification should result in no errors detected during the complete test procedure.

This test plan has a direct reference to the PICS and possibly a PIXIT. Without a reference to a PICS or PIXIT, this test plan is obsolete.

Test case numbering syntax is Subclause number + Table number + test case number.

Test cases are mandatory depending on the description in the column ‘Required’. The following situations are possible:

M = Mandatory test case regardless if enabled in the PICS/PIXIT, not only in one situation but during execution of all the tests as in the PICS and/or PIXIT

PICS, x.x = Mandatory test case if the functionality is enabled in the PICS (by marking the applicable check box), with a reference to the Subclause number of the PICS (x.x); For example: PICS 8.x always refers to IEC 60870-5-101:2003, Clause 8

PIXIT = Mandatory test case if the functionality is enabled/described in the PIXIT. Verification of these test cases by the user/owner of the PIXIT is required before the test is started

For each test case, the test results need to be marked in the appropriate column of the test result chart in 5.5 and 5.6. Each test case can either pass the test (Passed), fail the test (Failed), be not applicable when the configuration value is not supported by the device (N.A.),