



TECHNICAL SPECIFICATION

**Power systems management and associated information exchange – Data and communications security –
Part 5: Security for IEC 60870-5 and derivatives**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD.....	6
1 Scope and object.....	8
2 Normative references	9
3 Terms and definitions	10
4 Abbreviated terms	11
5 Problem description (informative)	11
5.1 Overview of clause	11
5.2 Specific threats addressed	11
5.3 Design issues.....	11
5.3.1 Overview of subclause.....	11
5.3.2 Asymmetric communications.....	11
5.3.3 Message-oriented.....	12
5.3.4 Poor sequence numbers or no sequence numbers.....	12
5.3.5 Limited processing power.....	12
5.3.6 Limited bandwidth.....	12
5.3.7 No access to authentication server	12
5.3.8 Limited frame length.....	13
5.3.9 Limited checksum.....	13
5.3.10 Radio systems.....	13
5.3.11 Dial-up systems.....	13
5.3.12 Variety of protocols affected	13
5.3.13 Differing data link layers	14
5.3.14 Long upgrade intervals	14
5.3.15 Remote sites	14
5.3.16 Multiple users	14
5.3.17 Unreliable media	14
5.4 General principles	14
5.4.1 Overview of subclause.....	14
5.4.2 Authentication only	14
5.4.3 Application layer only	15
5.4.4 Generic definition mapped onto different protocols	15
5.4.5 Bi-directional	15
5.4.6 Challenge-response.....	15
5.4.7 Pre-shared keys as default option.....	15
5.4.8 Backwards tolerance	15
5.4.9 Upgradeable.....	16
5.4.10 Perfect forward secrecy.....	16
5.4.11 Multiple users and auditing.....	16
6 Theory of operation (informative).....	16
6.1 Overview of clause	16
6.2 Narrative description	16
6.2.1 Basic concepts	16
6.2.2 Initiating the challenge.....	17
6.2.3 Replying to the challenge	17
6.2.4 Authenticating	18
6.2.5 Authentication failure.....	18

6.2.6	Aggressive mode	18
6.2.7	Changing keys	18
6.2.8	Security statistics	22
6.3	Example message sequences	22
6.3.1	Overview of subclause	22
6.3.2	Challenge of a Critical ASDU	23
6.3.3	Aggressive Mode	24
6.3.4	Initializing and changing Session Keys	24
6.4	State machine overview	28
7	Formal specification	32
7.1	Overview of clause	32
7.2	Message definitions	32
7.2.1	Distinction between messages and ASDUs	32
7.2.2	Challenge message	33
7.2.3	Reply message	35
7.2.4	Aggressive Mode Request message	36
7.2.5	MAC := OS8i[1..8i]; i:=specified by MALKey Status Request message	38
7.2.6	Key Status message	38
7.2.7	Session Key Change message	41
7.2.8	Error message	43
7.2.9	User Status Change message	45
7.2.10	Update Key Change Request message	49
7.2.11	Update Key Change Reply message	51
7.2.12	Update Key Change message	52
7.2.13	Update Key Change Signature message	53
7.2.14	Update Key Change Confirmation message	54
7.3	Formal procedures	55
7.3.1	Overview of subclause	55
7.3.2	Security statistics	56
7.3.3	Challenger procedures	58
7.3.4	Responder procedures	74
7.3.5	Controlling station procedures	75
7.3.6	Controlled station procedures	88
8	Interoperability requirements	90
8.1	Overview of clause	90
8.2	Minimum requirements	90
8.2.1	Overview of subclause	90
8.2.2	MAC algorithms	90
8.2.3	Key wrap / transport algorithms	91
8.2.4	Fixed values	91
8.2.5	Configurable values	91
8.3	Options	96
8.3.1	Overview of subclause	96
8.3.2	MAC algorithms	96
8.3.3	Encryption algorithms	98
8.3.4	Key wrap / transport algorithms	98
8.3.5	Configurable values	98
9	Special Applications	99

9.1	Overview of clause	99
9.2	Use with TCP/IP	99
9.3	Use with redundant channels.....	99
9.4	Use with external link encryptors	99
10	Requirements for referencing this specification.....	99
10.1	Overview of clause	99
10.2	Selected options.....	99
10.3	Operations considered critical	100
10.4	Addressing information.....	100
10.5	Message format mapping	100
10.6	Reference to procedures	100
11	Protocol implementation conformance statement.....	101
11.1	Overview of clause	101
11.2	Required algorithms	101
11.3	MAC algorithms.....	101
11.4	Key wrap algorithms.....	101
11.5	Maximum Error messages sent.....	101
11.6	Use of Error messages	101
11.7	Update Key Change Methods	102
11.8	User Status Change	102
Annex A	(informative) Compliance with ISO/IEC 11770.....	103
Bibliography	109
Figure 1	– Overview of interaction between Authority and stations.....	22
Figure 2	– Example of successful Challenge of Critical ASDU.....	23
Figure 3	– Example of failed Challenge of Critical ASDU	23
Figure 4	– Example of a successful Aggressive Mode Request	24
Figure 5	– Example of a failed Aggressive Mode Request.....	24
Figure 6	– Example of Session Key initialization and periodic update.....	25
Figure 7	– Example of communications failure followed by Session Key change	26
Figure 8	– Example of successful User Status and Update Key Change	27
Figure 9	– User changes controlling stations.....	28
Figure 10	– Major state transitions for controlling station authentication.....	29
Figure 11	– Major state transitions for controlled station authentication	30
Figure 12	– Major state transitions for controlling station Update Key change	31
Figure 13	– Major state transitions for controlled station Update Key change	32
Figure 14	– Example Use of Challenge Sequence Numbers.....	60
Table 1	– Scope of application to standards.....	8
Table 2	– Summary of symmetric keys used	18
Table 3	– Summary of asymmetric keys used (optional).....	19
Table 4	– Challenge message.....	33
Table 5	– Reply message	35
Table 6	– Data Included in the MAC Value calculation	36
Table 7	– Aggressive Mode Request message.....	36

Table 8 – Data Included in the MAC Value calculation in Aggressive Mode.....	37
Table 9 – Key Status Request Message.....	38
Table 10 – Use of Default Session Keys	38
Table 11 – Key Status Message.....	39
Table 12 – Data Included in the MAC Value Calculation for Key Status.....	41
Table 13 – Key Change message.....	41
Table 14 – Data Included in the key wrap (in order)	42
Table 15 – Example of key order.....	42
Table 16 – Example of Wrapped Key Data.....	43
Table 17 – Error message.....	43
Table 18 – Creation of Certification Data	46
Table 19 – User Status Change message	46
Table 20 – Update Key Change Request message.....	50
Table 21 – Update Key Change Reply message.....	51
Table 22 – Update Key Change message	52
Table 23 – Encrypted Update Key Data	53
Table 24 – Update Key Change Signature message	53
Table 25 – Data included in the Digital Signature.....	54
Table 26 – Update Key Change Confirmation message.....	54
Table 27 – Data included in the MAC calculation	55
Table 28 – States used in the state machine descriptions	55
Table 29 –Security statistics	57
Table 30 – Challenger state machine	63
Table 31 – User roles	77
Table 32 – Controlling Station State Machine – Changing Session Keys.....	80
Table 33 – Controlling Station State Machine – Changing Update Keys.....	84
Table 34 – Special Statistic Event Thresholds.....	92
Table 35 – Algorithms and Messages used for each Update Key Change Method.....	94
Table 36 – Size of Challenge Data.....	94
Table 37 – Configuration of Cryptographic Information.....	95
Table 38 – Legend for configuration of cryptographic information.....	96
Table 39 – Construction of AES-GMAC initialization vector.....	96
Table 40 – Source of initialization vector components in each message.....	97
Table A.1 – Cryptographic Notation	105
Table A.2 – Compliance with ISO/IEC 11770	107

INTERNATIONAL ELECTROTECHNICAL COMMISSION

POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE – DATA AND COMMUNICATIONS SECURITY –

Part 5: Security for IEC 60870-5 and derivatives

FOREWORD

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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.

IEC/TS 62351-5, 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 2009. It constitutes a technical revision. The primary changes in the second edition are:

- adds the capability to change Update Keys remotely;
- adds security statistics to aid in detecting attacks;
- adds measures to avoid being forced to change session keys too often;
- discards unexpected messages more often as possible attacks;
- adds to the list of permitted security algorithms;
- adds new rules for calculating challenge sequence numbers.

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

Enquiry draft	Report on voting
57/1204/DTS	57/1282/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.

Capitalization has been used in the text of this specification to formally identify the most important components of the described security mechanism. These components include: 1) data items e.g. Update Keys, Session Keys; 2) message names, e.g. Challenge, Reply, Aggressive Mode Request; 3) event names e.g. Reply Timeout, Rx Invalid Reply; 4) state names, e.g. Security Idle, Wait for Reply; and 5) statistics e.g. Authentication Failures, Unexpected Messages.

A list of all the parts in the IEC 62351 series, published under the general title *Power systems management and associated information exchange – Data and communications security*, can be found on the IEC website.

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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE – DATA AND COMMUNICATIONS SECURITY –

Part 5: Security for IEC 60870-5 and derivatives

1 Scope and object

This part of IEC 62351 specifies messages, procedures and algorithms for securing the operation of all protocols based on or derived from IEC 60870-5: Telecontrol equipment and systems – Transmission protocols. This Technical Specification applies to at least those protocols listed in Table 1.

Table 1 – Scope of application to standards

Number	Name
IEC 60870-5-101	Companion standard for basic telecontrol tasks
IEC 60870-5-102	Companion standard for the transmission of integrated totals in electric power systems
IEC 60870-5-103	Companion standard for the informative interface of protection equipment
IEC 60870-5-104	Network access for IEC 60870-5-101 using standard transport profiles
DNP3	Distributed Network Protocol (based on IEC 60870-1 through IEC 60870-5 and controlled by the DNP Users Group)

The initial audience for this Technical Specification is intended to be the members of the working groups developing the protocols listed in Table 1. For the measures described in this specification to take effect, they must be accepted and referenced by the specifications for the protocols themselves. This document is written to enable that process.

The subsequent audience for this specification is intended to be the developers of products that implement these protocols.

Portions of this specification may also be of use to managers and executives in order to understand the purpose and requirements of the work.

This part of IEC/TS 62351 focuses only on application layer authentication and security issues arising from such authentication. Other security concerns – in particular, protection from eavesdropping or man-in-the-middle attacks through the use of encryption – are considered to be outside the scope. Encryption may be added through the use of this specification with other specifications.

This document is organized working from the general to the specific, as follows:

- Clauses 2 through 4 provide background terms, definitions, and references.
- Clause 5 describes the problems this specification is intended to address.
- Clause 6 describes the mechanism generically without reference to a specific protocol.
- Clauses 7 and 8 describe the mechanism more precisely and are the primary normative part of this specification.
- Clause 9 describes a few particular implementation issues that are special cases.
- Clause 10 describes the requirements for other standards referencing this specification.

- Clause 11 describes the Protocol Implementation Conformance Statement (PICS) for this mechanism.

Unless specifically labelled as informative or optional, all clauses of this specification are normative.

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.

IEC 60870-5 (all parts), *Telecontrol equipment and systems – Transmission protocols*

IEC/TS 62351-1, *Power systems management and associated information exchange – Data and communications security – Part 1: Communication network and system security – Introduction to security issues*

IEC/TS 62351-2, *Power systems management and associated information exchange – Data and communications security – Part 2: Glossary of terms*

IEC/TS 62351-3, *Power systems management and associated information exchange – Data and communications security – Part 3: Communication network and system security – Profiles including TCP/IP*

IEC/TS 62351-8, *Power systems management and associated information exchange – Data and communications security – Part 8: Role-based access control*

ISO/IEC 9798-4, *Information technology – Security techniques – Entity authentication – Part 4: Mechanisms using a cryptographic check function*

ISO/IEC 11770-2:2008, *Information technology – Security techniques – Key management – Part 2: Mechanisms using symmetric techniques*

ISO/IEC 11770-3:2008, *Information technology – Security techniques – Key management – Part 3: Mechanisms using asymmetric techniques*

FIPS 180-2, *Secure Hash Standard* (includes SHA-1, SHA-224, SHA-256, SHA-384 and SHA-512). USA NIST

FIPS 186-2, *Digital Signature Standard (DSS)*, USA NIST, February 2000 including Change Notice #1, October 2001. Used for the random number generation algorithms in the Appendix

FIPS 186-3, *Digital Signature Standard (DSS)*, USA NIST, June 2009. Used for digital signature algorithms when asymmetric Update Key change is implemented

RFC 2104, *HMAC: Keyed-Hashing for Message Authentication*

RFC 3394, *Advanced Encryption Standard (AES) Key Wrap Algorithm*

RFC 3447, *Public-Key Cryptography Standards (PKCS) #1: RSA Cryptography Specifications Version 2.1*

RFC 3629, *UTF-8, a transformation format of ISO 10646*

RFC 5280, *Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile*

NIST SP 800-38D, *Recommendation for Block Cipher Modes of Operation: Galois/Counter Mode (GCM) and GMAC*