

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Security for industrial automation and control systems –
Part 4-2: Technical security requirements for IACS components**

**Sécurité des systèmes d'automatisation et de commande industrielles –
Partie 4-2: Exigences de sécurité technique des composants IACS**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2019 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Security for industrial automation and control systems –
Part 4-2: Technical security requirements for IACS components**

**Sécurité des systèmes d'automatisation et de commande industrielles –
Partie 4-2: Exigences de sécurité technique des composants IACS**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 25.040.40; 35.030

ISBN 978-2-8322-6597-0

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	12
INTRODUCTION.....	14
1 Scope.....	17
2 Normative references	17
3 Terms, definitions, abbreviated terms, acronyms, and conventions.....	18
3.1 Terms and definitions.....	18
3.2 Abbreviated terms and acronyms	24
3.3 Conventions.....	26
4 Common component security constraints.....	27
4.1 Overview.....	27
4.2 CCSC 1: Support of essential functions	27
4.3 CCSC 2: Compensating countermeasures	27
4.4 CCSC 3: Least privilege.....	27
4.5 CCSC 4: Software development process.....	27
5 FR 1 – Identification and authentication control	27
5.1 Purpose and SL-C(IAC) descriptions.....	27
5.2 Rationale	28
5.3 CR 1.1 – Human user identification and authentication	28
5.3.1 Requirement.....	28
5.3.2 Rationale and supplemental guidance.....	28
5.3.3 Requirement enhancements	28
5.3.4 Security levels	29
5.4 CR 1.2 – Software process and device identification and authentication	29
5.4.1 Requirement.....	29
5.4.2 Rationale and supplemental guidance.....	29
5.4.3 Requirement enhancements	29
5.4.4 Security levels	30
5.5 CR 1.3 – Account management.....	30
5.5.1 Requirement.....	30
5.5.2 Rationale and supplemental guidance.....	30
5.5.3 Requirement enhancements	30
5.5.4 Security levels	30
5.6 CR 1.4 – Identifier management.....	30
5.6.1 Requirement.....	30
5.6.2 Rationale and supplemental guidance.....	30
5.6.3 Requirement enhancements	31
5.6.4 Security levels	31
5.7 CR 1.5 – Authenticator management.....	31
5.7.1 Requirement.....	31
5.7.2 Rationale and supplemental guidance.....	31
5.7.3 Requirement enhancements	32
5.7.4 Security levels	32
5.8 CR 1.6 – Wireless access management	32

5.9	CR 1.7 – Strength of password-based authentication	32
5.9.1	Requirement	32
5.9.2	Rationale and supplemental guidance	32
5.9.3	Requirement enhancements	32
5.9.4	Security levels	33
5.10	CR 1.8 – Public key infrastructure certificates	33
5.10.1	Requirement	33
5.10.2	Rationale and supplemental guidance	33
5.10.3	Requirement enhancements	33
5.10.4	Security levels	33
5.11	CR 1.9 – Strength of public key-based authentication	34
5.11.1	Requirement	34
5.11.2	Rationale and supplemental guidance	34
5.11.3	Requirement enhancements	35
5.11.4	Security levels	35
5.12	CR 1.10 – Authenticator feedback	35
5.12.1	Requirement	35
5.12.2	Rationale and supplemental guidance	35
5.12.3	Requirement enhancements	35
5.12.4	Security levels	35
5.13	CR 1.11 – Unsuccessful login attempts	35
5.13.1	Requirement	35
5.13.2	Rationale and supplemental guidance	36
5.13.3	Requirement enhancements	36
5.13.4	Security levels	36
5.14	CR 1.12 – System use notification	36
5.14.1	Requirement	36
5.14.2	Rationale and supplemental guidance	36
5.14.3	Requirement enhancements	36
5.14.4	Security levels	37
5.15	CR 1.13 – Access via untrusted networks	37
5.16	CR 1.14 – Strength of symmetric key-based authentication	37
5.16.1	Requirement	37
5.16.2	Rationale and supplemental guidance	37
5.16.3	Requirement enhancements	37
5.16.4	Security levels	38
6	FR 2 – Use control	38
6.1	Purpose and SL-C(UC) descriptions	38
6.2	Rationale	38
6.3	CR 2.1 – Authorization enforcement	38
6.3.1	Requirement	38
6.3.2	Rationale and supplemental guidance	38
6.3.3	Requirement enhancements	39
6.3.4	Security levels	39
6.4	CR 2.2 – Wireless use control	40
6.4.1	Requirement	40
6.4.2	Rationale and supplemental guidance	40
6.4.3	Requirement enhancements	40
6.4.4	Security levels	40

6.5	CR 2.3 – Use control for portable and mobile devices	40
6.6	CR 2.4 – Mobile code.....	40
6.7	CR 2.5 – Session lock.....	40
6.7.1	Requirement.....	40
6.7.2	Rationale and supplemental guidance.....	41
6.7.3	Requirement enhancements	41
6.7.4	Security levels	41
6.8	CR 2.6 – Remote session termination	41
6.8.1	Requirement.....	41
6.8.2	Rationale and supplemental guidance.....	41
6.8.3	Requirement enhancements	41
6.8.4	Security levels	41
6.9	CR 2.7 – Concurrent session control.....	41
6.9.1	Requirement.....	41
6.9.2	Rationale and supplemental guidance.....	42
6.9.3	Requirement enhancements	42
6.9.4	Security levels	42
6.10	CR 2.8 – Auditable events	42
6.10.1	Requirement.....	42
6.10.2	Rationale and supplemental guidance.....	42
6.10.3	Requirement enhancements	42
6.10.4	Security levels	43
6.11	CR 2.9 – Audit storage capacity	43
6.11.1	Requirement.....	43
6.11.2	Rationale and supplemental guidance.....	43
6.11.3	Requirement enhancements	43
6.11.4	Security levels	43
6.12	CR 2.10 – Response to audit processing failures	43
6.12.1	Requirement.....	43
6.12.2	Rationale and supplemental guidance.....	44
6.12.3	Requirement enhancements	44
6.12.4	Security levels	44
6.13	CR 2.11 – Timestamps.....	44
6.13.1	Requirement.....	44
6.13.2	Rationale and supplemental guidance.....	44
6.13.3	Requirement enhancements	44
6.13.4	Security levels	44
6.14	CR 2.12 – Non-repudiation.....	45
6.14.1	Requirement.....	45
6.14.2	Rationale and supplemental guidance.....	45
6.14.3	Requirement enhancements	45
6.14.4	Security levels	45
6.15	CR 2.13 – Use of physical diagnostic and test interfaces	45
7	FR 3 – System integrity	45
7.1	Purpose and SL-C(SI) descriptions	45
7.2	Rationale	46

7.3	CR 3.1 – Communication integrity.....	46
7.3.1	Requirement.....	46
7.3.2	Rationale and supplemental guidance.....	46
7.3.3	Requirement enhancements	47
7.3.4	Security levels	47
7.4	CR 3.2 – Protection from malicious code.....	47
7.5	CR 3.3 – Security functionality verification	47
7.5.1	Requirement.....	47
7.5.2	Rationale and supplemental guidance.....	47
7.5.3	Requirement enhancements	47
7.5.4	Security levels	48
7.6	CR 3.4 – Software and information integrity	48
7.6.1	Requirement.....	48
7.6.2	Rationale and supplemental guidance.....	48
7.6.3	Requirement enhancements	48
7.6.4	Security levels	48
7.7	CR 3.5 – Input validation.....	48
7.7.1	Requirement.....	48
7.7.2	Rationale and supplemental guidance.....	49
7.7.3	Requirement enhancements	49
7.7.4	Security levels	49
7.8	CR 3.6 – Deterministic output	49
7.8.1	Requirement.....	49
7.8.2	Rationale and supplemental guidance.....	49
7.8.3	Requirement enhancements	49
7.8.4	Security levels	50
7.9	CR 3.7 – Error handling	50
7.9.1	Requirement.....	50
7.9.2	Rationale and supplemental guidance.....	50
7.9.3	Requirement enhancements	50
7.9.4	Security levels	50
7.10	CR 3.8 – Session integrity.....	50
7.10.1	Requirement.....	50
7.10.2	Rationale and supplemental guidance.....	51
7.10.3	Requirement enhancements	51
7.10.4	Security levels	51
7.11	CR 3.9 – Protection of audit information.....	51
7.11.1	Requirement.....	51
7.11.2	Rationale and supplemental guidance.....	51
7.11.3	Requirement enhancements	51
7.11.4	Security levels	51
7.12	CR 3.10 – Support for updates.....	52
7.13	CR 3.11 – Physical tamper resistance and detection.....	52
7.14	CR 3.12 – Provisioning product supplier roots of trust.....	52
7.15	CR 3.13 – Provisioning asset owner roots of trust.....	52
7.16	CR 3.14 – Integrity of the boot process	52
8	FR 4 – Data confidentiality.....	52
8.1	Purpose and SL-C(DC) descriptions.....	52
8.2	Rationale	52

8.3	CR 4.1 – Information confidentiality	52
8.3.1	Requirement.....	52
8.3.2	Rationale and supplemental guidance.....	53
8.3.3	Requirement enhancements	53
8.3.4	Security levels	53
8.4	CR 4.2 – Information persistence	53
8.4.1	Requirement.....	53
8.4.2	Rationale and supplemental guidance.....	53
8.4.3	Requirement enhancements	53
8.4.4	Security levels	54
8.5	CR 4.3 – Use of cryptography	54
8.5.1	Requirement.....	54
8.5.2	Rationale and supplemental guidance.....	54
8.5.3	Requirement enhancements	54
8.5.4	Security levels	54
9	FR 5 – Restricted data flow	55
9.1	Purpose and SL-C(RDF) descriptions	55
9.2	Rationale	55
9.3	CR 5.1 – Network segmentation.....	55
9.3.1	Requirement.....	55
9.3.2	Rationale and supplemental guidance.....	55
9.3.3	Requirement enhancements	56
9.3.4	Security levels	56
9.4	CR 5.2 – Zone boundary protection.....	56
9.5	CR 5.3 – General-purpose person-to-person communication restrictions	56
9.6	CR 5.4 – Application partitioning.....	56
10	FR 6 – Timely response to events.....	56
10.1	Purpose and SL-C(TRE) descriptions.....	56
10.2	Rationale	57
10.3	CR 6.1 – Audit log accessibility.....	57
10.3.1	Requirement.....	57
10.3.2	Rationale and supplemental guidance.....	57
10.3.3	Requirement enhancements	57
10.3.4	Security levels	57
10.4	CR 6.2 – Continuous monitoring	57
10.4.1	Requirement.....	57
10.4.2	Rationale and supplemental guidance.....	57
10.4.3	Requirement enhancements	58
10.4.4	Security levels	58
11	FR 7 – Resource availability	58
11.1	Purpose and SL-C(RA) descriptions.....	58
11.2	Rationale	58
11.3	CR 7.1 – Denial of service protection	59
11.3.1	Requirement.....	59
11.3.2	Rationale and supplemental guidance.....	59
11.3.3	Requirement enhancements	59
11.3.4	Security levels	59

11.4	CR 7.2 – Resource management	59
11.4.1	Requirement.....	59
11.4.2	Rationale and supplemental guidance.....	59
11.4.3	Requirement enhancements	59
11.4.4	Security levels	59
11.5	CR 7.3 – Control system backup	60
11.5.1	Requirement.....	60
11.5.2	Rationale and supplemental guidance.....	60
11.5.3	Requirement enhancements	60
11.5.4	Security levels	60
11.6	CR 7.4 – Control system recovery and reconstitution	60
11.6.1	Requirement.....	60
11.6.2	Rationale and supplemental guidance.....	60
11.6.3	Requirement enhancements	60
11.6.4	Security levels	61
11.7	CR 7.5 – Emergency power	61
11.8	CR 7.6 – Network and security configuration settings.....	61
11.8.1	Requirement.....	61
11.8.2	Rationale and supplemental guidance.....	61
11.8.3	Requirement enhancements	61
11.8.4	Security levels	61
11.9	CR 7.7 – Least functionality	61
11.9.1	Requirement.....	61
11.9.2	Rationale and supplemental guidance.....	61
11.9.3	Requirement enhancements	62
11.9.4	Security levels	62
11.10	CR 7.8 – Control system component inventory.....	62
11.10.1	Requirement.....	62
11.10.2	Rationale and supplemental guidance.....	62
11.10.3	Requirement enhancements	62
11.10.4	Security levels	62
12	Software application requirements	62
12.1	Purpose	62
12.2	SAR 2.4 – Mobile code	62
12.2.1	Requirement.....	62
12.2.2	Rationale and supplemental guidance.....	63
12.2.3	Requirement enhancements	63
12.2.4	Security levels	63
12.3	SAR 3.2 – Protection from malicious code	63
12.3.1	Requirement.....	63
12.3.2	Rationale and supplemental guidance.....	63
12.3.3	Requirement enhancements	63
12.3.4	Security levels	63
13	Embedded device requirements	64
13.1	Purpose	64
13.2	EDR 2.4 – Mobile code	64
13.2.1	Requirement.....	64
13.2.2	Rationale and supplemental guidance.....	64
13.2.3	Requirement enhancements	64

13.2.4	Security levels	64
13.3	EDR 2.13 – Use of physical diagnostic and test interfaces	64
13.3.1	Requirement	64
13.3.2	Rationale and supplemental guidance	65
13.3.3	Requirement enhancements	65
13.3.4	Security levels	65
13.4	EDR 3.2 – Protection from malicious code	65
13.4.1	Requirement	65
13.4.2	Rationale and supplemental guidance	65
13.4.3	Requirement enhancements	66
13.4.4	Security levels	66
13.5	EDR 3.10 – Support for updates	66
13.5.1	Requirement	66
13.5.2	Rationale and supplemental guidance	66
13.5.3	Requirement enhancements	66
13.5.4	Security levels	66
13.6	EDR 3.11 – Physical tamper resistance and detection	66
13.6.1	Requirement	66
13.6.2	Rationale and supplemental guidance	66
13.6.3	Requirement enhancements	67
13.6.4	Security levels	67
13.7	EDR 3.12 – Provisioning product supplier roots of trust	67
13.7.1	Requirement	67
13.7.2	Rationale and supplemental guidance	67
13.7.3	Requirement enhancements	67
13.7.4	Security levels	68
13.8	EDR 3.13 – Provisioning asset owner roots of trust	68
13.8.1	Requirement	68
13.8.2	Rationale and supplemental guidance	68
13.8.3	Requirement enhancements	68
13.8.4	Security levels	68
13.9	EDR 3.14 – Integrity of the boot process	69
13.9.1	Requirement	69
13.9.2	Rationale and supplemental guidance	69
13.9.3	Requirement enhancements	69
13.9.4	Security levels	69
14	Host device requirements	69
14.1	Purpose	69
14.2	HDR 2.4 – Mobile code	69
14.2.1	Requirement	69
14.2.2	Rationale and supplemental guidance	70
14.2.3	Requirement enhancements	70
14.2.4	Security levels	70
14.3	HDR 2.13 – Use of physical diagnostic and test interfaces	70
14.3.1	Requirement	70
14.3.2	Rationale and supplemental guidance	70
14.3.3	Requirement enhancements	71
14.3.4	Security levels	71
14.4	HDR 3.2 – Protection from malicious code	71

14.4.1	Requirement.....	71
14.4.2	Rationale and supplemental guidance.....	71
14.4.3	Requirement enhancements	71
14.4.4	Security levels	71
14.5	HDR 3.10 – Support for updates	71
14.5.1	Requirement.....	71
14.5.2	Rationale and supplemental guidance.....	71
14.5.3	Requirement enhancements	72
14.5.4	Security levels	72
14.6	HDR 3.11 – Physical tamper resistance and detection	72
14.6.1	Requirement.....	72
14.6.2	Rationale and supplemental guidance.....	72
14.6.3	Requirement enhancements	72
14.6.4	Security levels	72
14.7	HDR 3.12 – Provisioning product supplier roots of trust	73
14.7.1	Requirement.....	73
14.7.2	Rationale and supplemental guidance.....	73
14.7.3	Requirement enhancements	73
14.7.4	Security levels	73
14.8	HDR 3.13 – Provisioning asset owner roots of trust.....	73
14.8.1	Requirement.....	73
14.8.2	Rationale and supplemental guidance.....	73
14.8.3	Requirement enhancements	74
14.8.4	Security levels	74
14.9	HDR 3.14 – Integrity of the boot process.....	74
14.9.1	Requirement.....	74
14.9.2	Rationale and supplemental guidance.....	74
14.9.3	Requirement enhancements	74
14.9.4	Security levels	75
15	Network device requirements.....	75
15.1	Purpose	75
15.2	NDR 1.6 – Wireless access management.....	75
15.2.1	Requirement.....	75
15.2.2	Rationale and supplemental guidance.....	75
15.2.3	Requirement enhancements	75
15.2.4	Security levels	75
15.3	NDR 1.13 – Access via untrusted networks	75
15.3.1	Requirement.....	75
15.3.2	Rationale and supplemental guidance.....	76
15.3.3	Requirement enhancements	76
15.3.4	Security levels	76
15.4	NDR 2.4 – Mobile code	76
15.4.1	Requirement.....	76
15.4.2	Rationale and supplemental guidance.....	76
15.4.3	Requirement enhancements	77
15.4.4	Security levels	77
15.5	NDR 2.13 – Use of physical diagnostic and test interfaces.....	77
15.5.1	Requirement.....	77
15.5.2	Rationale and supplemental guidance.....	77

15.5.3	Requirement enhancements	77
15.5.4	Security levels	78
15.6	NDR 3.2 – Protection from malicious code	78
15.6.1	Requirement	78
15.6.2	Rationale and supplemental guidance	78
15.6.3	Requirement enhancements	78
15.6.4	Security levels	78
15.7	NDR 3.10 – Support for updates	78
15.7.1	Requirement	78
15.7.2	Rationale and supplemental guidance	78
15.7.3	Requirement enhancements	78
15.7.4	Security levels	79
15.8	NDR 3.11 – Physical tamper resistance and detection	79
15.8.1	Requirement	79
15.8.2	Rationale and supplemental guidance	79
15.8.3	Requirement enhancements	79
15.8.4	Security levels	79
15.9	NDR 3.12 – Provisioning product supplier roots of trust	79
15.9.1	Requirement	79
15.9.2	Rationale and supplemental guidance	80
15.9.3	Requirement enhancements	80
15.9.4	Security levels	80
15.10	NDR 3.13 – Provisioning asset owner roots of trust	80
15.10.1	Requirement	80
15.10.2	Rationale and supplemental guidance	80
15.10.3	Requirement enhancements	81
15.10.4	Security levels	81
15.11	NDR 3.14 – Integrity of the boot process	81
15.11.1	Requirement	81
15.11.2	Rationale and supplemental guidance	81
15.11.3	Requirement enhancements	81
15.11.4	Security levels	82
15.12	NDR 5.2 – Zone boundary protection	82
15.12.1	Requirement	82
15.12.2	Rationale and supplemental guidance	82
15.12.3	Requirement enhancements	82
15.12.4	Security levels	82
15.13	NDR 5.3 – General purpose, person-to-person communication restrictions	83
15.13.1	Requirement	83
15.13.2	Rationale and supplemental guidance	83
15.13.3	Requirement enhancements	83
15.13.4	Security levels	83
Annex A	(informative) Device categories	84
A.1	General	84
A.2	Device category: embedded device	84
A.2.1	Programmable logic controller (PLC)	84
A.2.2	Intelligent electronic device (IED)	84

A.3	Device category: network device	85
A.3.1	Switch	85
A.3.2	Virtual private network (VPN) terminator	85
A.4	Device category: host device/application	85
A.4.1	Operator workstation	85
A.4.2	Data historian	86
Annex B (informative)	Mapping of CRs and REs to FR SLs 1-4	87
B.1	Overview	87
B.2	SL mapping table	87
Bibliography		93
Figure 1	– Parts of the IEC 62443 series	16
Table B.1	– Mapping of CRs and REs to FR SL levels 1-4	88

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SECURITY FOR INDUSTRIAL AUTOMATION AND CONTROL SYSTEMS –**Part 4-2: Technical security requirements for IACS components****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.
- 2) The formal decisions or agreements of 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 IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62443-4-2 has been prepared by IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
65/735/FDIS	65/740/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62443 series, published under the general title *Security for industrial automation and control systems*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

0.1 Overview

Industrial automation and control system (IACS) organizations increasingly use commercial-off-the-shelf (COTS) networked devices that are inexpensive, efficient and highly automated. Control systems are also increasingly interconnected with non-IACS networks for valid business reasons. These devices, open networking technologies and increased connectivity provide an increased opportunity for cyber-attack against control system hardware and software. That weakness may lead to health, safety and environmental (HSE), financial and/or reputational consequences in deployed control systems.

Organizations choosing to deploy business information technology (IT) cyber security solutions to address IACS security may not fully comprehend the results of their decision. While many business IT applications and security solutions can be applied to IACS, they should be applied in an appropriate way to eliminate inadvertent consequences. For this reason, the approach used to define system requirements is based on a combination of functional requirements and risk assessment, often including an awareness of operational issues as well.

IACS security countermeasures should not have the potential to cause loss of essential services and functions, including emergency procedures (IT security countermeasures, as often deployed, do have this potential). IACS security goals focus on control system availability, plant protection, plant operations (even in a degraded mode) and time-critical system response. IT security goals often do not place the same emphasis on these factors; they may be more concerned with protecting information rather than physical assets. These different goals should be clearly stated as security objectives regardless of the degree of plant integration achieved. A key step in the risk assessment, as required by IEC 62443-2-1¹ [1]², should be the identification of which services and functions are truly essential for operations (for example, in some facilities engineering support may be determined to be a non-essential service or function). In some cases, it may be acceptable for a security action to cause temporary loss of a non-essential service or function, unlike an essential service or function that should not be adversely affected.

This document provides the cyber security technical requirements for the components that make up an IACS, specifically the embedded devices, network components, host components and software applications. Annex A describes categories of devices commonly used in IACSs. This document derives its requirements from the IACS system security requirements described in IEC 62443-3-3. The intent of this document is to specify security capabilities that enable a component to mitigate threats for a given security level (SL) without the assistance of compensating countermeasures. Annex B provides a table that summarizes the SLs of each of the requirements and requirement enhancements defined in this document.

The primary goal of the IEC 62443 series is to provide a flexible framework that facilitates addressing current and future vulnerabilities in IACS and applying necessary mitigations in a systematic, defensible manner. It is important to understand that the intention of the IEC 62443 series is to build extensions to enterprise security that adapt the requirements for business IT systems and combines them with the unique requirements for strong integrity and availability needed by IACS.

¹ Many documents in the IEC 62443 series are currently under review or in development.

² Numbers in square brackets refer to the bibliography.

0.2 Purpose and intended audience

The IACS community audience for this document is intended to be asset owners, system integrators, product suppliers, and, where appropriate, compliance authorities. Compliance authorities include government agencies and regulators with the legal authority to perform audits to verify compliance with governing laws and regulations.

System integrators will use this document to assist them in procuring control system components that make up an IACS solution. The assistance will be in the form of helping system integrators specify the appropriate security capability level of the individual components they require. The primary standards for system integrators are IEC 62443-2-1 [1], IEC 62443-2-4 [3], IEC 62443-3-2 [5]³ and IEC 62443-3-3 that provide organizational and operational requirements for a security management system and guide them through the process of defining security zones for a system and the target security capability levels (SL-T) for those zones. Once the SL-T for each zone has been defined, components that provide the necessary security capabilities can be used to achieve the SL-T for each zone.

Product suppliers will use this document to understand the requirements placed on control system components for specific security capability levels (SL-C) of those components. A component may not provide a required capability itself but may be designed to integrate with a higher-level entity and thus benefit from that entity's capability – for example an embedded device may not be maintaining a user directory itself, but may integrate with a system wide authentication and authorization service and thus still meet the requirements to provide individual user authentication, authorization and management capabilities. This document will guide product suppliers as to which requirements can be allocated and which requirements should be native in the components. As defined in Practice 8 of IEC 62443-4-1, the product supplier will provide documentation on how to properly integrate the component into a system to meet a specific SL-T.

The component requirements (CRs) in this document are derived from the system requirements (SRs) in IEC 62443-3-3. The requirements in IEC 62443-3-3 are referred to as SRs, which are derived from the overall foundational requirements (FRs) defined in IEC 62443-1-1. CRs may also include a set of requirement enhancements (REs). The combination of CRs and REs is what will determine the target security level that a component is capable of.

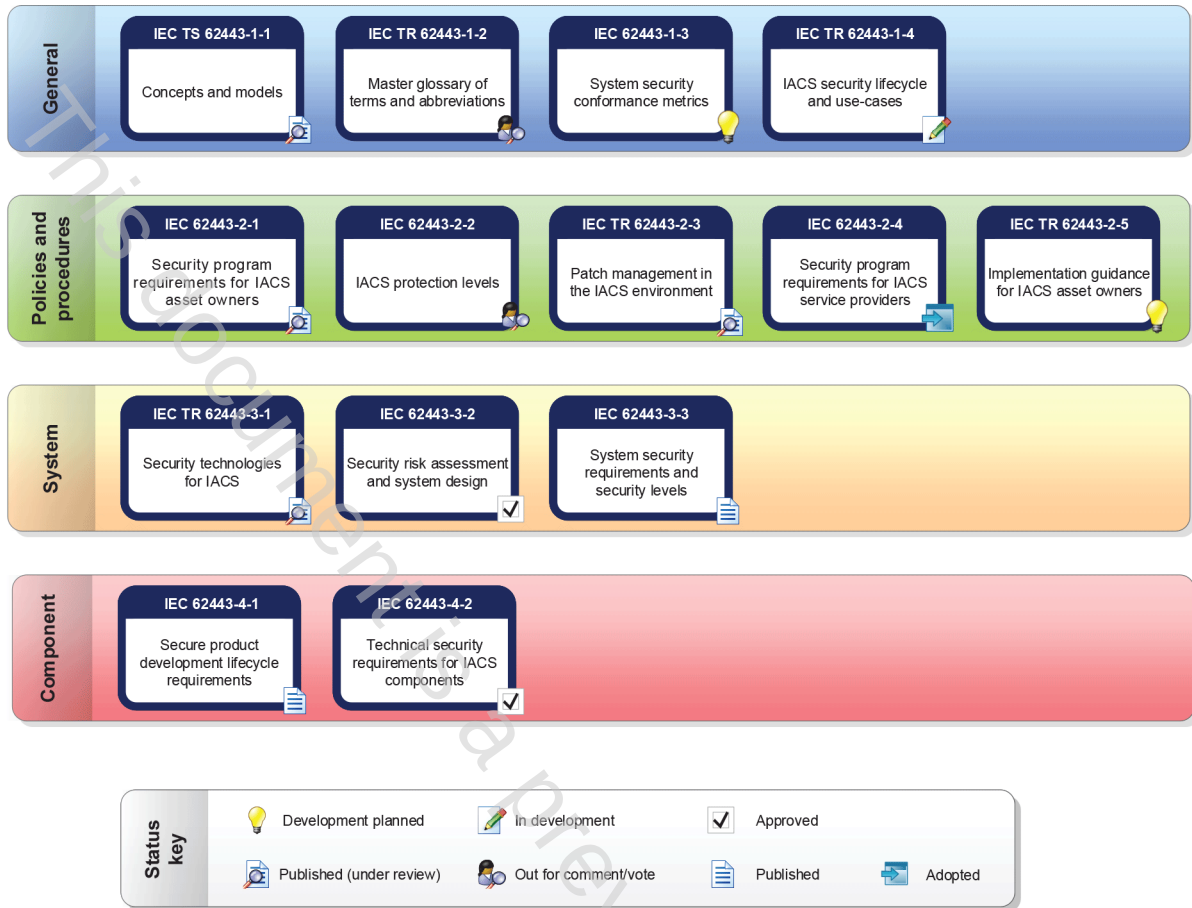
This document provides component requirements for four types of components: software application, embedded device, host device and network device. Thus, the CRs for each type of component will be designated as follows:

- Software application requirements (SAR);
- Embedded device requirements (EDR);
- Host device requirements (HDR); and
- Network device requirements (NDR).

The majority of the requirements in this document are the same for the four types of components and are thus designated simply as a CR. When there are unique component-specific requirements then the generic requirement will state that the requirements are component-specific and are located in the component-specific requirements clauses of this document.

Figure 1 shows a graphical depiction of the IEC 62443 series when this document was written.

³ Under preparation. Stage at the time of publication: IEC PRVC 62443-3-2:2018.



IEC

Figure 1 – Parts of the IEC 62443 series

SECURITY FOR INDUSTRIAL AUTOMATION AND CONTROL SYSTEMS –

Part 4-2: Technical security requirements for IACS components

1 Scope

This part of IEC 62443 provides detailed technical control system component requirements (CRs) associated with the seven foundational requirements (FRs) described in IEC TS 62443-1-1 including defining the requirements for control system capability security levels and their components, SL-C(component).

As defined in IEC TS 62443-1-1 there are a total of seven foundational requirements (FRs):

- a) identification and authentication control (IAC),
- b) use control (UC),
- c) system integrity (SI),
- d) data confidentiality (DC),
- e) restricted data flow (RDF),
- f) timely response to events (TRE), and
- g) resource availability (RA).

These seven FRs are the foundation for defining control system security capability levels. Defining security capability levels for the control system component is the goal and objective of this document as opposed to SL-T or achieved SLs (SL-A), which are out of scope.

NOTE 1 Refer to IEC 62443-2-1 [1] for an equivalent set of non-technical, program-related, capability requirements necessary for fully achieving a SL-T(control system).

NOTE 2 The trademarks and trade names mentioned in this document are given for the convenience of users of this document. This information does not constitute an endorsement by IEC of the products named.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 TS 62443-1-1, *Industrial communication networks – Network and system security – Part 1-1: Terminology, concepts and models*

IEC 62443-3-3:2013, *Industrial communication networks – Network and system security – Part 3-3: System security requirements and security levels*

IEC 62443-4-1, *Security for industrial automation and control systems – Part 4-1: Secure product development lifecycle requirements*