

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Management of alarm systems for the process industries

Gestion de systèmes d'alarme dans les industries de transformation





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2022 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 Secretariat
3, rue de Varembé
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 It also gives information on projects, replaced and withdrawn publications.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.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



IEC 62682

Edition 2.0 2022-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Management of alarm systems for the process industries

Gestion de systèmes d'alarme dans les industries de transformation

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 13.320; 25.040.40

ISBN 978-2-8322-5885-9

**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 9
- INTRODUCTION 11
- 1 Scope 12
 - 1.1 General applicability 12
 - 1.2 Exclusions and inclusions 13
 - 1.2.1 Operators 13
 - 1.2.2 Process sensors and final control elements 13
 - 1.2.3 Annunciators 13
 - 1.2.4 Human machine interface 13
 - 1.2.5 Safety instrumented systems 14
 - 1.2.6 Fire and gas detection and protective systems 14
 - 1.2.7 Security systems 14
 - 1.2.8 Packaged systems 14
 - 1.2.9 Event data 14
 - 1.2.10 Alarm identification methods 14
 - 1.2.11 Management of change 14
 - 1.2.12 Purchase specification 14
- 2 Normative references 14
- 3 Terms, definitions and abbreviated terms 15
 - 3.1 Terms and definitions 15
 - 3.2 Abbreviated terms 24
- 4 Conformance to this document 25
 - 4.1 Conformance guidance 25
 - 4.2 Existing systems 25
 - 4.3 Use of required functionalities 25
 - 4.4 Responsibility 25
 - 4.5 Local Jurisdictions 25
- 5 Alarm system models 25
 - 5.1 Alarm systems 25
 - 5.2 Alarm management life cycle 25
 - 5.2.1 Alarm management life cycle model 25
 - 5.2.2 Alarm management life cycle stages 26
 - 5.2.3 Alarm management life cycle entry points 29
 - 5.2.4 Simultaneous and encompassing stages 29
 - 5.2.5 Alarm management life cycle loops 29
 - 5.2.6 Alarm management life cycle stage inputs and outputs 30
 - 5.3 Alarm states 31
 - 5.3.1 Alarm state transition diagram 31
 - 5.3.2 Alarm states 32
 - 5.3.3 Alarm state transition paths 34
 - 5.4 Alarm response timeline 35
 - 5.4.1 General 35
 - 5.4.2 Normal (A) 36
 - 5.4.3 Unacknowledged (B) 36
 - 5.4.4 Acknowledged (C) and response 36
 - 5.4.5 Return-to-normal (D) 37

5.4.6	Allowable response time	37
5.4.7	Alarm setpoint	37
5.4.8	Consequence threshold	37
5.4.9	Alarm deadband	37
5.5	Feedback model of operator-process interaction	37
5.5.1	General	37
5.5.2	Detect.....	38
5.5.3	Diagnose	38
5.5.4	Respond	38
5.5.5	Performance shaping factors	38
6	Alarm philosophy	39
6.1	Purpose	39
6.2	Alarm philosophy contents	39
6.2.1	General	39
6.2.2	Purpose of alarm system	40
6.2.3	Definitions	40
6.2.4	References	40
6.2.5	Roles and responsibilities for alarm management	40
6.2.6	Alarm design principles.....	40
6.2.7	Alarm setpoint determination	41
6.2.8	Prioritization method.....	41
6.2.9	Alarm class definition.....	41
6.2.10	Highly managed alarms	41
6.2.11	Rationalization.....	41
6.2.12	Alarm documentation	42
6.2.13	Alarm design guidance	42
6.2.14	Specific alarm design considerations	42
6.2.15	HMI design principles	42
6.2.16	Approved enhanced and advanced alarming techniques	43
6.2.17	Implementation guidance	43
6.2.18	Alarm response procedures	43
6.2.19	Training	43
6.2.20	Alarm shelving.....	43
6.2.21	Alarm system maintenance	43
6.2.22	Testing of alarms	43
6.2.23	Alarm system performance monitoring	44
6.2.24	Alarm history preservation	44
6.2.25	Management of change	44
6.2.26	Alarm management audit	44
6.2.27	Related site procedures	44
6.3	Alarm philosophy development and maintenance	45
7	Alarm system requirements specification	45
7.1	Purpose	45
7.2	Recommendations	45
7.3	Development.....	46
7.4	Systems evaluation.....	46
7.5	Packaged systems	46
7.6	Customization	46
7.7	Alarm system requirements verification	46

8	Identification.....	46
8.1	Purpose	46
8.2	Alarm identification methods	47
8.3	Identification training.....	47
8.4	Identification documentation	47
9	Rationalization.....	47
9.1	Purpose	47
9.2	Rationalization documentation	48
9.2.1	Rationalization documentation requirements.....	48
9.2.2	Rationalization documentation recommendations.....	48
9.2.3	Plant states	48
9.3	Alarm justification	48
9.3.1	Alarm justification process	48
9.3.2	Justification approach.....	49
9.3.3	Individual alarm justification.....	49
9.3.4	Impact on alarm system performance	49
9.4	Alarm setpoint determination.....	49
9.5	Prioritization	50
9.6	Classification	50
9.7	Review.....	50
9.8	Removal of rejected alarms.....	50
9.9	Documentation.....	50
10	Detailed design: basic alarm design	50
10.1	Purpose	50
10.2	Basic alarm design capabilities	51
10.3	Usage of alarm states	51
10.3.1	Alarm state triggering	51
10.3.2	Alarm states and other logic functions	51
10.3.3	Alarm suppression and other logic functions	51
10.4	Alarm types.....	51
10.5	Alarm attributes	52
10.5.1	General	52
10.5.2	Alarm description.....	52
10.5.3	Alarm setpoints.....	52
10.5.4	Alarm priority.....	52
10.5.5	Alarm deadbands.....	52
10.5.6	Alarm on-delay and off-delay	53
10.6	Programmatic changes to alarm attributes	53
10.7	Review of basic alarm design.....	53
11	Detailed design: human-machine interface design for alarm systems.....	54
11.1	Purpose	54
11.2	HMI functions.....	54
11.2.1	General	54
11.2.2	HMI information requirements.....	54
11.2.3	HMI functional requirements	54
11.2.4	HMI functional recommendations	54
11.2.5	HMI display requirements	54
11.2.6	Alarm records requirements.....	55

11.2.7	Alarm records recommendations.....	55
11.3	Alarm states indications	55
11.3.1	General	55
11.3.2	Required alarm state indications.....	55
11.3.3	Recommended alarm state indications.....	55
11.3.4	Audible alarm state indications	57
11.4	Alarm priority indications.....	57
11.4.1	General	57
11.4.2	Alarm priority indication requirements.....	57
11.4.3	Colour alarm priority indications requirements	57
11.4.4	Recommended alarm priority indications.....	57
11.5	Alarm message indications	58
11.5.1	General	58
11.5.2	Recommended alarm message indications	58
11.6	Alarm displays	58
11.6.1	General	58
11.6.2	Alarm summary display.....	59
11.6.3	Alarm summary status	60
11.6.4	Alarm log displays	60
11.6.5	Process displays.....	61
11.6.6	Tag detail displays.....	61
11.6.7	Other graphic elements	61
11.7	Alarm shelving	61
11.7.1	General	61
11.7.2	Alarm shelving functional requirements.....	61
11.7.3	Alarm shelving functional recommendations	62
11.7.4	Shelved alarm displays.....	62
11.8	Out-of-service alarms.....	62
11.8.1	General	62
11.8.2	Out-of-service alarm functional requirements.....	63
11.8.3	Out-of-service alarm displays	63
11.9	Alarms suppressed by design	63
11.9.1	General	63
11.9.2	Designed suppression functional requirements	64
11.9.3	Designed suppression functional recommendations.....	64
11.9.4	Suppressed-by-design displays	64
11.10	Alarm annunciator integration	65
11.10.1	General	65
11.10.2	Alarm annunciator integration recommendations.....	65
11.10.3	Alarm annunciator display integration recommendations.....	65
11.11	Safety related alarm HMI	65
11.11.1	General	65
11.11.2	Independent safety related alarm HMI	65
12	Detailed design: enhanced and advanced alarming	65
12.1	Purpose	65
12.2	Basis of enhanced and advanced alarming	66
12.2.1	General	66
12.2.2	Effort, manpower requirements and complexity.....	66
12.3	Information linking	66

12.4	Logic-based alarming	66
12.4.1	General	66
12.4.2	Alarm attribute modification	66
12.4.3	Externally enabled systems	66
12.4.4	Logical alarm suppression and attribute modification	66
12.4.5	State-based alarming.....	66
12.5	Model-based alarming.....	67
12.6	Additional alarming considerations.....	67
12.6.1	General	67
12.6.2	Remote alarm systems	67
12.6.3	Supplementary alarm systems	67
12.6.4	Batch process considerations	67
12.7	Training, testing, and auditing systems	68
12.8	Alarm attribute enforcement.....	68
13	Implementation	68
13.1	Purpose	68
13.2	Implementation planning	68
13.3	Implementation training.....	69
13.3.1	General	69
13.3.2	Implementation training requirements for new or modified alarms	69
13.3.3	Training documentation requirements for new or modified highly managed alarms	69
13.3.4	Training documentation recommendations for new or modified alarms.....	69
13.3.5	Implementation training requirements for new or modified alarm systems	69
13.3.6	Implementation training recommendations for new or modified alarm systems	69
13.4	Implementation testing and verification	69
13.4.1	General	69
13.4.2	Implementation testing requirements for highly managed alarms	70
13.4.3	Implementation testing recommendations for new or modified alarms	70
13.4.4	Implementation testing requirements for new or modified alarm systems	70
13.5	Implementation documentation	70
13.5.1	General	70
13.5.2	Documentation requirements	70
13.5.3	Implementation documentation recommendations.....	71
14	Operation	71
14.1	Purpose	71
14.2	Alarm response procedures	71
14.2.1	Alarm response procedures requirements.....	71
14.2.2	Alarm response procedure recommendations	71
14.3	Alarm shelving	72
14.3.1	Alarm shelving requirements.....	72
14.3.2	Alarm shelving for highly managed alarms.....	72
14.3.3	Alarm shelving recommendations	72
14.3.4	Alarm shelving record requirements.....	72
14.3.5	Shift change procedures and alarm review	72
14.4	Refresher training for operators	72
14.4.1	Refresher training requirements for operators.....	72

14.4.2	Refresher training documentation requirements for highly managed alarms	72
14.4.3	Refresher training content for highly managed alarms	73
14.4.4	Refresher training recommendations for alarms	73
15	Maintenance	73
15.1	Purpose	73
15.2	Periodic alarm testing	73
15.2.1	General	73
15.2.2	Periodic alarm testing requirements	73
15.2.3	Periodic alarm testing for highly managed alarms	73
15.2.4	Periodic alarm test procedure requirements	74
15.2.5	Periodic alarm test procedure recommendations	74
15.2.6	Periodic alarm testing recommendations	74
15.3	Out-of-service alarms	74
15.3.1	General	74
15.3.2	Out-of-service process requirements	74
15.3.3	Out-of-service highly managed alarms	74
15.3.4	Out-of-service process recommendations	75
15.3.5	Requirements for returning alarms to service	75
15.4	Equipment repair	75
15.5	Equipment replacement	75
15.6	Refresher training for maintenance	75
15.6.1	General requirements	75
15.6.2	Refresher training requirements for highly managed alarms	75
15.6.3	Refresher training recommendations for alarms	75
16	Monitoring and assessment	75
16.1	Purpose	75
16.2	Performance monitoring requirements	76
16.3	Monitoring and assessment	76
16.3.1	General	76
16.3.2	Alarm system performance metrics	76
16.3.3	Average alarm rate per operator console	76
16.3.4	Peak alarm rate per operator console	77
16.3.5	Alarm floods	77
16.3.6	Frequently occurring alarms	77
16.3.7	Chattering and fleeting alarms	77
16.3.8	Stale alarms	78
16.3.9	Annunciated alarm priority distribution	78
16.3.10	Rationalization and alarm priority distribution	78
16.4	Unauthorized alarm suppression	78
16.5	Alarm attribute monitoring	79
16.6	Reporting of alarm system analyses	79
16.7	Alarm performance metric summary	79
17	Management of change	79
17.1	Purpose	79
17.2	Changes subject to management of change	80
17.3	Change documentation requirements	80
17.4	Alarm removal recommendations	80
17.5	Alarm documentation review recommendations	80

18 Audit..... 80

18.1 Purpose 80

18.2 Benchmark..... 80

18.3 Audit requirements..... 81

18.4 Audit interviews 81

18.5 Audit process recommendations 81

18.6 Action plans 81

Bibliography..... 82

Figure 1 – Alarm system dataflow 13

Figure 2 – Alarm management life cycle 26

Figure 3 – Alarm state transition diagram..... 32

Figure 4 – Alarm response timeline..... 36

Figure 5 – Feedback model of operator-process interaction 38

Table 1 – Alarm management life cycle stage inputs and outputs..... 31

Table 2 – Summary of alarm states..... 34

Table 3 – Required and recommended alarm philosophy contents 39

Table 4 – Recommended alarm state indications 57

Table 5 – Average alarm rates 77

Table 6 – Example annunciated alarm priority distribution..... 78

Table 7 – Recommended alarm performance metrics summary..... 79

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MANAGEMENT OF ALARM SYSTEMS
FOR THE PROCESS INDUSTRIES****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.

IEC 62682 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This second edition cancels and replaces the first edition published in 2014. This edition constitutes a technical revision.

This edition includes minor technical changes with respect to the previous edition, based on changes to ANSI/ISA-18.2:2016. These include the inclusion of packaged systems in the scope (Clause 1), definitions (Clause 3) and alarm system requirements specification (Clause 7). There are changes to improve clarity in wording throughout the document.

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

Draft	Report on voting
65A/1046/FDIS	65A/1064/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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.

INTRODUCTION

This International Standard addresses the development, design, installation, and management of alarm systems in the process industries. Alarm management includes multiple work processes throughout the alarm management life cycle. This document defines the terminology and models to develop an alarm system, and it defines the work processes recommended to effectively maintain the alarm throughout the life cycle. Ineffective alarm systems have often been cited as contributing factors in the investigation reports following major process incidents. This document is intended to provide a methodology that will result in the improved safety, quality, and operation in the process industries.

The first edition of this document was adapted from ANSI/ISA-18.2-2009, *Management of Alarm Systems for the Process Industries*, an International Society of Automation (ISA) standard, and with due consideration of other guidance documents that have been developed throughout industry. This second edition has incorporated some changes made in ANSI/ISA-18.2-2016.

This document is not the first effort to define terminology and practices for effective alarm systems. In 1999 the Engineering Equipment and Materials Users' Association (EEMUA) issued Publication 191, *Alarm Systems: A Guide to Design, Management and Procurement*, with the 2nd edition published in 2007 and the 3rd edition published in 2013. In 2003 the User Association of Process Control Technology in Chemical and Pharmaceutical Industries (NAMUR) issued worksheet NA 102, *Alarm Management*, which was updated in 2008. During the development and maintenance of this document, every effort was made to keep terminology and practices consistent with the previous work of these respected organizations and committees.

This document provides requirements for alarm management and alarm systems. It is intended for those individuals and organizations that

- a) manufacture or implement embedded alarm systems,
- b) manufacture or install third-party alarm system software,
- c) design or install alarm systems,
- d) operate and maintain alarm systems, and
- e) audit or assess alarm system performance.

This document is organized in parts. The first part (Clause 1 to Clause 3) are normative without any mandatory requirements. Clause 4 contains mandatory requirements. Clause 5 is normative without any mandatory requirements. The main body of the standard (Clause 6 to Clause 18), describes mandatory requirements and non-mandatory recommendations.

Within this document, mandatory requirements are stated with "shall", non-mandatory recommendations are stated with "should", and permissible requirements are stated with "may". The phrase "is required" indicates the requirement has been stated previously in the document.