

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**OPC unified architecture –
Part 9: Alarms and conditions**

**Architecture unifiée OPC –
Partie 9: Alarmes et conditions**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2012 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 la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
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 corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you 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It also gives information on projects, replaced and withdrawn publications.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 on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

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: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) 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 CEI

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

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI 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.

Just Published CEI - webstore.iec.ch/justpublished

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

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

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

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**OPC unified architecture –
Part 9: Alarms and conditions**

**Architecture unifiée OPC –
Partie 9: Alarmes et conditions**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

XD

ICS 25.040.40; 25.100.01

ISBN 978-2-83220-286-9

**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.....	7
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references	10
3 Terms, definitions, abbreviations and data types	10
3.1 Terms and definitions	10
3.2 Abbreviations	12
3.3 Used data types	12
4 Concepts.....	12
4.1 General.....	12
4.2 Conditions.....	13
4.3 Acknowledgeable Conditions.....	14
4.4 Previous States of Conditions.....	16
4.5 Condition State Synchronization.....	16
4.6 Severity, Quality and Comment	17
4.7 Dialogs.....	17
4.8 Alarms.....	17
4.9 Multiple Active States.....	18
4.10 Condition Instances in the Address Space.....	19
4.11 Alarm and Condition Auditing.....	20
5 Model.....	20
5.1 General.....	20
5.2 Two-State State Machines.....	21
5.3 Condition Variables.....	23
5.4 Substate Reference Types.....	23
5.4.1 General.....	23
5.4.2 HasTrueSubState ReferenceType.....	23
5.4.3 HasFalseSubState ReferenceType	24
5.5 Condition Model.....	24
5.5.1 General.....	24
5.5.2 ConditionType	25
5.5.3 Condition and Branch Instances	28
5.5.4 Disable Method	28
5.5.5 Enable Method	29
5.5.6 AddComment Method	29
5.5.7 ConditionRefresh Method	30
5.6 Dialog Model	32
5.6.1 General	32
5.6.2 DialogConditionType	32
5.6.3 Respond Method	34
5.7 Acknowledgeable Condition Model	34
5.7.1 General	34
5.7.2 AcknowledgeableConditionType	34
5.7.3 Acknowledge Method.....	36
5.7.4 Confirm Method	37

5.8	Alarm Model	38
5.8.1	General	38
5.8.2	AlarmConditionType	38
5.8.3	ShelvedStateMachineType	40
5.8.4	Unshelve Method	43
5.8.5	TimedShelve Method	44
5.8.6	OneShotShelve Method	44
5.8.7	LimitAlarmType	45
5.8.8	ExclusiveLimit Types	46
5.8.9	NonExclusiveLimitAlarmType	49
5.8.10	Level Alarm	51
5.8.11	Deviation Alarm	52
5.8.12	Rate of Change	53
5.8.13	Discrete Alarms	54
5.9	ConditionClasses	56
5.9.1	Overview	56
5.9.2	Base ConditionClassType	56
5.9.3	ProcessConditionClassType	56
5.9.4	MaintenanceConditionClassType	57
5.9.5	SystemConditionClassType	57
5.10	Audit Events	57
5.10.1	Overview	57
5.10.2	AuditConditionEventType	58
5.10.3	AuditConditionEnableEventType	58
5.10.4	AuditConditionCommentEventType	59
5.10.5	AuditConditionRespondEventType	59
5.10.6	AuditConditionAcknowledgeEventType	59
5.10.7	AuditConditionConfirmEventType	59
5.10.8	AuditConditionShelvingEventType	59
5.11	Condition Refresh Related Events	60
5.11.1	Overview	60
5.11.2	RefreshStartEventType	60
5.11.3	RefreshEndEventType	60
5.11.4	RefreshRequiredEventType	61
5.12	HasCondition Reference Type	61
5.13	Alarm and Condition Status Codes	62
6	AddressSpace Organisation	62
6.1	General	62
6.2	Event Notifier and Source Hierarchy	62
6.3	Adding Conditions to the Hierarchy	63
6.4	Conditions in InstanceDeclarations	64
6.5	Conditions in a VariableType	65
Annex A	(informative) Recommended Localized Names	66
Annex B	(informative) Examples	69
Annex C	(informative) Mapping to EEMUA	74
Annex D	(informative) Mapping from OPC A&E to OPC UA A&C	75
Bibliography		89

Figure 1 – Base Condition State Model	14
Figure 2 – AcknowledgeableConditions State Model	14
Figure 3 – Acknowledge State Model	15
Figure 4 – Confirmed Acknowledge State Model	16
Figure 5 – Alarm State Machine Model.....	18
Figure 6 – Multiple Active States Example	19
Figure 7 – ConditionType Hierarchy	21
Figure 8 – Condition Model	25
Figure 9 – DialogConditionType Overview.....	32
Figure 10 – AcknowledgeableConditionType Overview	35
Figure 11 – AlarmConditionType Hierarchy Model.....	38
Figure 12 – Alarm Model	39
Figure 13 – Shelve state transitions	41
Figure 14 – Shelved State Machine Model	41
Figure 15 – LimitAlarmType	45
Figure 16 – ExclusiveLimitStateMachine	47
Figure 17 – ExclusiveLimitAlarmType	49
Figure 18 – NonExclusiveLimitAlarmType	50
Figure 19 – DiscreteAlarmType Hierarchy.....	54
Figure 20 – ConditionClass Type Hierarchy	56
Figure 21 – AuditEvent Hierarchy.....	58
Figure 22 – Refresh Related Event Hierarchy	60
Figure 23 – Typical Event Hierarchy	63
Figure 24 – Use of HasCondition in an Event Hierarchy	64
Figure 25 – Use of HasCondition in an InstanceDeclaration	65
Figure 26 – Use of HasCondition in a VariableType	65
Figure B.1 – Single State Example.....	69
Figure B.2 – Previous State Example.....	70
Figure B.3 – HasCondition used with Condition instances	72
Figure B.4 – HasCondition reference to a Condition Type	73
Figure B.5 – HasCondition used with an instance declaration	73
Figure D.1 – The Type Model of a Wrapped COM AE Server	77
Figure D.2 – Mapping UA Event Types to COM A&E Event Types.....	81
Figure D.3 – Example Mapping of UA Event Types to COM A&E Categories.....	82
Figure D.4 – Example Mapping of UA Event Types to A&E Categories with Attributes	85
Table 1 – Parameter Types defined in IEC 62541-3	12
Table 2 – Parameter Types defined in IEC 62541-4	12
Table 3 – TwoStateVariableType Definition.....	22
Table 4 – ConditionVariableType Definition.....	23
Table 5 – HasTrueSubState ReferenceType	24
Table 6 – HasFalseSubState ReferenceType	24
Table 7 – ConditionType Definition	26

Table 8 – SimpleAttributeOperand to select ConditionId.....	28
Table 9 – Disable Method AddressSpace Definition	29
Table 10 – Enable Method AddressSpace Definition	29
Table 11 – AddComment Method AddressSpace Definition	30
Table 12 – ConditionRefresh Method AddressSpace Definition	32
Table 13 – DialogConditionType Definition.....	33
Table 14 – Respond Method AddressSpace Definition	34
Table 15 – AcknowledgeableConditionType Definition	35
Table 16 – Acknowledge Method AddressSpace Definition	37
Table 17 – Confirm Method Parameters	37
Table 18 – Confirm Method AddressSpace Definition.....	38
Table 19 – AlarmConditionType Definition	39
Table 20 – ShelvedStateMachine Definition	42
Table 21 – ShelvedStateMachine Transitions.....	43
Table 22 – Unshelve Method AddressSpace Definition	44
Table 23 – TimedShelve Method AddressSpace Definition.....	44
Table 24 – OneShotShelve Method AddressSpace Definition.....	45
Table 25 – LimitAlarmType Definition	46
Table 26 – ExclusiveLimitStateMachineType Definition.....	47
Table 27 – ExclusiveLimitStateMachineType Transitions	48
Table 28 – ExclusiveLimitAlarmType Definition.....	49
Table 29 – NonExclusiveLimitAlarmType Definition.....	51
Table 30 – NonExclusiveLevelAlarmType Definition.....	52
Table 31 – ExclusiveLevelAlarmType Definition	52
Table 32 – NonExclusiveDeviationAlarmType Definition.....	53
Table 33 – ExclusiveDeviationAlarmType Definition	53
Table 34 – NonExclusiveRateOfChangeAlarmType Definition	54
Table 35 – ExclusiveRateOfChangeAlarmType Definition	54
Table 36 – DiscreteAlarmType Definition	55
Table 37 – OffNormalAlarmType Definition	55
Table 38 – TripAlarmType Definition	55
Table 39 – BaseConditionClassType Definition	56
Table 40 – ProcessConditionClassType Definition	57
Table 41 – MaintenanceConditionClassType Definition	57
Table 42 – SystemConditionClassType Definition	57
Table 43 – AuditConditionEventType Definition.....	58
Table 44 – AuditConditionEnableEventType Definition.....	58
Table 45 – AuditConditionCommentEventType Definition.....	59
Table 46 – AuditConditionRespondEventType Definition.....	59
Table 47 – AuditConditionAcknowledgeEventType Definition	59
Table 48 – AuditConditionConfirmEventType Definition	59
Table 49 – AuditConditionShelvingEventType Definition	59
Table 50 – RefreshStartEventType Definition.....	60

Table 51 – RefreshEndEventType Definition	60
Table 52 – RefreshRequiredEventType Definition	61
Table 53 – HasCondition ReferenceType	61
Table 54 – Alarm and Condition Result Codes	62
Table A.1 – Recommended state names for LocaleId “en”	66
Table A.2 – Recommended display names for LocaleId “en”	66
Table A.3 – Recommended state names for LocaleId “de”	67
Table A.4 – Recommended display names for LocaleId “de”	67
Table A.5 – Recommended state names for LocaleId “fr”	67
Table A.6 – Recommended display names for LocaleId “fr”	68
Table A.7 – Recommended Dialog Response Options.....	68
Table B.1 – Example of a Condition that only keeps the latest state.....	69
Table B.2 – Example of a <i>Condition</i> that maintains previous states via branches	71
Table C.1 – EEMUA Terms	74
Table D.1 – Mapping from ONEVENTSTRUCT fields to UA BaseEventType Variables.....	78
Table D.2 – Mapping from ONEVENTSTRUCT fields to UA AuditEventType Variables.....	78
Table D.3 – Mapping from ONEVENTSTRUCT fields to UA AlarmType Variables	79
Table D.4 – Event Category Attribute Mapping Table.....	83