

© Copyright SEK. Reproduction in any form without permission is prohibited.

OPC Unified Architecture – Del 9: Larm och villkor

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

Som svensk standard gäller europastandarden EN 62541-9:2012. Den svenska standarden innehåller den officiella engelska språkversionen av EN 62541-9:2012.

Nationellt förord

Europastandarden EN 62541-9:2012

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 62541-9, First edition, 2012 - OPC unified architecture - Part 9: Alarms and conditions**

utarbetad inom International Electrotechnical Commission, IEC.

ICS 25.040.40; 25.100.01

Denna standard är fastställd av SEK Svensk Elstandard, som också kan lämna upplysningar om **sakinnehållet** i standarden.
Postadress: SEK, Box 1284, 164 29 KISTA
Telefon: 08 - 444 14 00. Telefax: 08 - 444 14 30
E-post: sek@elstandard.se. Internet: www.elstandard.se

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a säkerhet, prestanda, dokumentation, utförande och skötsel av elprodukter, elanläggningar och metoder. Genom att utforma sådana standarder blir säkerhetskraven tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

English version

**OPC unified architecture -
Part 9: Alarms and conditions
(IEC 62541-9:2012)**

Architecture unifiée OPC -
Partie 9: Alarmes et conditions
(CEI 62541-9:2012)

OPC Unified Architecture -
Teil 9: Alarme und Zustände
(IEC 62541-9:2012)

This European Standard was approved by CENELEC on 2012-08-31. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 65E/243/FDIS, future edition 1 of IEC 62541-9, prepared by SC 65E "Devices and integration in enterprise systems" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62541-9:2012.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-05-31
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-08-31

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 62541-9:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated :

IEC 62541-7 NOTE Harmonised as EN 62541-7.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC/TR 62541-1	-	OPC unified architecture - Part 1: Overview and concepts	CLC/TR 62541-1	-
IEC 62541-3	-	OPC unified architecture - Part 3: Address space model	EN 62541-3	-
IEC 62541-4	-	OPC unified architecture - Part 4: Services	EN 62541-4	-
IEC 62541-5	-	OPC unified architecture - Part 5: Information model	EN 62541-5	-
IEC 62541-6	-	OPC unified architecture - Part 6: Mappings	EN 62541-6	-
IEC 62541-8	-	OPC unified architecture - Part 8: Data access	EN 62541-8	-
EEMUA 191	2007	Alarm systems - A guide to design, management and procurement	-	-

CONTENTS

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

INTRODUCTION

This International Standard is a specification intended for developers of OPC UA applications. The specification is a result of an analysis and design process to develop a standard interface to facilitate the development of applications by multiple vendors that inter-operate seamlessly together.

OPC UNIFIED ARCHITECTURE –

Part 9: Alarms and conditions

1 Scope

This part of the IEC 62541 series specifies the representation of *Alarms* and conditions in the OPC unified architecture. Included is the *Information Model* representation of *Alarms* and conditions in the OPC UA address space.

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/TR 62541-1, *OPC Unified Architecture – Part 1: Overview and Concepts*

IEC 62541-3, *OPC unified architecture – Part 3: Address Space Model*

IEC 62541-4, *OPC unified architecture – Part 4: Services*

IEC 62541-5, *OPC unified architecture – Part 5: Information Model*

IEC 62541-6, *OPC unified architecture – Part 6: Mappings*

IEC 62541-8, *OPC unified architecture – Part 8: Data Access*

EEMUA 191:2007, *Alarm Systems – A guide to design, management and procurement*, available at <<http://www.eemua.co.uk/>>