



IEC 62541-8

Edition 4.0 2026-01

# INTERNATIONAL STANDARD

REDLINE VERSION

**OPC unified architecture -  
Part 8: Data access**

## CONTENTS

FOREWORD .....	5
1 Scope .....	8
2 Normative references .....	8
3 Terms, definitions and abbreviated terms .....	8
3.1 Terms and definitions.....	8
3.2 Abbreviated terms.....	9
4 Concepts .....	10
5 Model .....	10
5.1 General.....	10
5.2 SemanticsChanged .....	11
5.3 Variable Types.....	12
5.3.1 DataItemType .....	12
5.3.2 AnalogItem VariableTypes .....	13
5.3.3 DiscreteItemType .....	16
5.3.4 ArrayItemType .....	19
5.4 Address Space model .....	26
5.5 Attributes of DataItems .....	27
5.6 DataTypes .....	28
5.6.1 Overview .....	28
5.6.2 Range.....	28
5.6.3 EUInformation .....	28
5.6.4 ComplexNumberType .....	32
5.6.5 DoubleComplexNumberType .....	33
5.6.6 AxisInformation.....	33
5.6.7 AxisScaleEnumeration.....	34
5.6.8 XVType .....	35
6 Quantities and Units model.....	35
6.1 General.....	35
6.2 Quantities entry point.....	36
6.3 Syntax References.....	36
6.3.1 General .....	36
6.3.2 Using Dictionary References.....	37
6.3.3 Syntax Reference Identifier .....	38
6.4 ObjectTypes .....	39
6.4.1 QuantityType ObjectType definition .....	39
6.4.2 UnitType and subtypes .....	41
6.4.3 SyntaxReferenceEntryType ObjectType definition .....	45
6.5 References .....	46
6.5.1 HasEngineeringUnitDetails .....	46
6.5.2 HasQuantity.....	47
6.6 DataTypes .....	47
6.6.1 AnnotationDataType DataType definition .....	47
6.6.2 LinearConversionDataType DataType definition .....	48
6.6.3 ConversionLimitEnum .....	49
6.6.4 QuantityDimension .....	50
7 Data Access specific usage of Services.....	52

7.1	General.....	52
7.2	PercentDeadband .....	52
7.3	Data Access status codes .....	53
7.3.1	Overview .....	53
7.3.2	Operation level result codes .....	53
7.3.3	LimitBits .....	54
Annex A	( <del>informative</del> normative) OPC COM DA to UA mapping .....	55
A.1	<del>Overview</del> Introduction .....	55
A.2	Security Considerations .....	55
A.3	COM UA wrapper for OPC DA Server .....	55
A.3.1	Information Model mapping.....	55
A.3.2	Data and error mapping .....	60
A.3.3	Read data.....	63
A.3.4	Write Data .....	64
A.3.5	Subscriptions.....	65
A.4	COM UA proxy for DA Client .....	65
A.4.1	Guidelines .....	65
A.4.2	Information Model and Address Space mapping .....	66
A.4.3	Data and error mapping .....	70
A.4.4	Read data.....	73
A.4.5	Write data.....	74
A.4.6	Subscriptions.....	75
Annex B	(normative) UCUM Symbols.....	76
B.1	Introduction – License.....	76
B.2	Representation .....	76
B.3	Tables of terminal symbols .....	77
B.3.1	General .....	77
B.3.2	Prefixes .....	77
B.3.3	Base units .....	78
B.3.4	Derived unit atoms.....	79
B.3.5	Customary unit atoms .....	82
B.3.6	Other legacy units .....	86
Annex C	(informative) Outline of syntax references.....	91
C.1	UCUM syntax reference .....	91
C.2	QUDT syntax reference.....	91
C.3	UNECE syntax reference .....	92
C.4	IEC CDD Syntax Reference .....	93
C.5	LATEX_SIUNITX Syntax Reference .....	94
Bibliography	.....	95
Figure 1	– OPC <i>DataItems</i> are linked to automation data .....	10
Figure 2	– <i>DataItem VariableType</i> hierarchy .....	11
Figure 3	– Graphical view of a <i>YArrayItem</i> .....	21
Figure 4	– Representation of <i>DataItems</i> in the <i>AddressSpace</i> .....	27
Figure 5	– Enhanced <i>EUIInformation</i> example .....	29
Figure 6	– Quantity model overview .....	36
Figure 7	– References to external works .....	38

Figure 8 – QuantityType .....	39
Figure 9 – Units model.....	41
Figure 10 – MathML example linear conversion .....	45
Figure 11 – MathML example inverse linear conversion .....	45
Figure A.1 – Sample OPC UA Information Model for OPC DA .....	56
Figure A.2 – OPC COM DA to OPC UA data and error mapping.....	61
Figure A.3 – Status Code mapping .....	62
Figure A.4 – Sample OPC DA mapping of OPC UA Information Model and Address Space .....	67
Figure A.5 – OPC UA to OPC DA data & error mapping .....	71
Figure A.6 – OPC UA Status Code to OPC DA quality mapping .....	72
Table 1 – DataItemType definition .....	12
Table 2 – BaseAnalogType definition .....	13
Table 3 – AnalogItemType definition .....	15
Table 4 – AnalogUnitType definition.....	15
Table 5 – AnalogUnitRangeType definition .....	16
Table 6 – DiscreteItemType definition .....	16
Table 7 – TwoStateDiscreteType definition .....	17
Table 8 – MultiStateDiscreteType definition .....	17
Table 9 – MultiStateValueDiscreteType definition .....	18
Table 10 – ArrayItemType definition.....	19
Table 11 – YArrayItemType definition .....	20
Table 12 – YArrayItem item description .....	22
Table 13 – XYArrayItemType definition .....	23
Table 14 – ImageItemType definition .....	24
Table 15 – CubelItemType definition.....	25
Table 16 – NDimensionArrayItemType definition.....	26
Table 17 – Range DataType structure.....	28
Table 18 – Range definition .....	28
Table 19 – EUInformation DataType structure.....	29
Table 20 – EUInformation definition .....	30
Table 21 – Examples from the UNECE Recommendation <del>N° 20</del> .....	31
Table 22 – ComplexNumberType DataType structure .....	32
Table 23 – ComplexNumberType definition .....	33
Table 24 – DoubleComplexNumberType DataType structure.....	33
Table 25 – DoubleComplexNumberType definition .....	33
Table 26 – AxisInformation DataType structure.....	34
Table 27 – AxisInformation definition .....	34
Table 28 – AxisScaleEnumeration values .....	34
Table 29 – AxisScaleEnumeration definition .....	35
Table 30 – XVType DataType structure.....	35
Table 31 – XVType definition .....	35

Table 32 – Quantities definition .....	36
Table 33 – List of Syntax References.....	37
Table 34 – Definition of NodeId for instances of the SyntaxReferenceEntryType.....	37
Table 35 – List of Syntax Reference Identifiers .....	38
Table 36 – QuantityType definition.....	40
Table 37 – QuantityType Additional Subcomponents.....	41
Table 38 – UnitType definition .....	42
Table 39 – Non-exhaustive list of well-known systems of units.....	42
Table 40 – ServerUnitType definition .....	43
Table 41 – ServerUnitType Additional Subcomponents .....	43
Table 42 – AlternativeUnitType definition.....	44
Table 43 – SyntaxReferenceEntryType Definition .....	46
Table 44 – HasEngineeringUnitDetails definition.....	46
Table 45 – HasQuantity definition .....	47
Table 46 – AnnotationDataType Structure.....	47
Table 47 – AnnotationDataType examples .....	48
Table 48 – AnnotationDataType definition.....	48
Table 49 – LinearConversionDataType Structure .....	49
Table 50 – LinearConversionDataType Definition.....	49
Table 51 – ConversionLimitEnum Items .....	49
Table 52 – ConversionLimitEnum Definition .....	50
Table 53 – QuantityDimension DataType structure.....	50
Table 54 – QuantityDimension definition .....	51
Table 55 – QuantityDimension examples .....	51
Table 56 – Operation level result codes for BAD data quality .....	53
Table 57 – Operation level result codes for UNCERTAIN data quality .....	54
Table 58 – Operation level result codes for GOOD data quality.....	54
Table A.1 – OPC COM DA to OPC UA Properties mapping.....	59
Table A.2 – DataTypes and mapping .....	62
Table A.3 – Quality mapping.....	63
Table A.4 – OPC DA Read error mapping .....	64
Table A.5 – OPC DA Write error code mapping.....	65
Table A.6 – DataTypes and Mapping .....	72
Table A.7 – Quality mapping.....	73
Table A.8 – OPC UA Read error mapping .....	74
Table A.9 – OPC UA Write error code mapping.....	74

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

### **OPC unified architecture - Part 8: Data access**

#### **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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62541-8:2020. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 62541-8 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) addition of a "Quantity Model" which can be referenced from EngineeringUnit Properties. The model defines quantities and assigned units. In addition it provides alternative units and the conversion to them.
- b) addition of rules for ValuePrecision Property:
  - can also be used for other subtypes like Duration and Decimal.
  - rules have been added when ValuePrecision has negative values.

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

Draft	Report on voting
65E/1055/CDV	65E/1108/RVC

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](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

Throughout this document and the other parts of the IEC 62541 series, certain document conventions are used:

*Italics* are used to denote a defined term or definition that appears in the "Terms and definitions" clause in one of the parts of the IEC 62541 series.

*Italics* are also used to denote the name of a service input or output parameter or the name of a structure or element of a structure that are usually defined in tables.

The *italicized terms and names* are, with a few exceptions, written in camel-case (the practice of writing compound words or phrases in which the elements are joined without spaces, with each element's initial letter capitalized within the compound). For example, the defined term is *AddressSpace* instead of Address Space. This makes it easier to understand that there is a single definition for *AddressSpace*, not separate definitions for Address and Space.

A list of all parts in the IEC 62541 series, published under the general title *OPC Unified Architecture*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn, or
- revised.

## 1 Scope

This part of IEC 62541 is part of the overall OPC Unified Architecture (OPC UA) standard series and defines the information model associated with Data Access (DA). It particularly includes additional *VariableTypes* and complementary descriptions of the *NodeClasses* and *Attributes* needed for Data Access, additional *Properties*, and other information and behaviour.

The complete address space model, including all *NodeClasses* and *Attributes* is specified in IEC 62541-3. The services to detect and access data are specified in IEC 62541-4.

Annex A specifies how the information received from OPC COM Data Access (DA) Servers is mapped to the Data Access model.

## 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 ~~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 62541-19, *OPC Unified Architecture - Part 19: Dictionary References*

UN/CEFACT: UNECE Recommendation N°20, *Codes for Units of Measure Used in International Trade*

[https://www.unece.org/cefact/codesfortrade/codes\\_index.html](https://www.unece.org/cefact/codesfortrade/codes_index.html)

## Bibliography

IEC CDD, *IEC Common Data Dictionary*, available at <https://cdd.iec.ch/>

LATEX\_SIUNITX: *A comprehensive (si) units package*, available at  
<https://ctan.org/pkg/siunitx>  
<https://www.texdev.net/>

QUDT, *Quantities, Units, Dimensions and Data Types Ontologies*, available at  
<https://QUDT.org>  
<https://github.com/qudt/qudt-public-repo>

UCUM, *Unified Code for Units of Measure*, available at <https://ucum.org>

UNECE, Recommendation N° 20, *Codes for Units of Measure Used in International Trade*,  
available at <https://www.unece.org/cefact/>