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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

OPC unified architecture – Part 8: Data Access

Architecture unifiée OPC – Partie 8: Accès aux données

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Part 8: Data Access

FOREWORD

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The text of this standard is based on the following documents:

FDIS	Report on voting
65E/194/FDIS	65E/216/RVD

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

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

A list of all parts of 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 publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication 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- withdrawn,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

This International Standard is the specification 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 will inter-operate seamlessly together.

OPC UNIFIED ARCHITECTURE –

Part 8: Data Access

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 complemental 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.

2 Normative references

The following referenced documents are indispensable for the application 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, *OPCUnified architecture – Part 5: Information Model*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document the terms and definitions given in IEC 62541-1, IEC 62541-3 and IEC 62541-4 as well as the following apply.

3.1.1
DataItem
link to arbitrary, live automation data, that is, data that represents currently valid information

NOTE Examples of such data are

- device data (such as temperature sensors),
- calculated data,
- status information (open/closed, moving),
- dynamically-changing system data (such as stock quotes),
- diagnostic data.

3.1.2
AnalogItem
DataItems that represent continuously-variable physical quantities

NOTE Typical examples are the values provided by temperature sensors or pressure sensors. OPC UA defines a specific *VariableType* to identify an *AnalogItem*. *Properties* describe the possible ranges of *AnalogItems*.

3.1.3
DiscreteItem
*DataItem*s that represent data that may take on only a certain number of possible values

NOTE Specific *VariableTypes* are used to identify *DiscreteItems* with two states or with multiple states. *Properties* specify the string values for these states.

3.1.4
EngineeringUnits
units of measurement for *AnalogItem*s that represent continuously-variable physical quantities (e.g., length, mass, time, temperature)

NOTE This standard defines *Properties* to inform about the unit used for the *DataItem* value and about the highest and lowest value likely to be obtained in normal operation.

3.2 Abbreviations

DA Data Access

EU Engineering Unit

UA Unified Architecture

4 Concepts

Data Access deals with the representation and use of automation data in OPC UA Servers.

Automation data can be located inside the OPC UA Server or on I/O cards directly connected to the OPC UA Server. It can also be located in sub-servers or on other devices such as controllers and input/output modules connected by serial links via field buses or other communication links. OPC UA Data Access Servers provide one or more OPC UA Data Access Clients with transparent access to their automation data.

The links to automation data instances are called *DataItems*. Which categories of automation data are provided is completely vendor-specific. Figure 1 illustrates how the *AddressSpace* of an OPC UA server might consist of a broad range of different *DataItem*s.

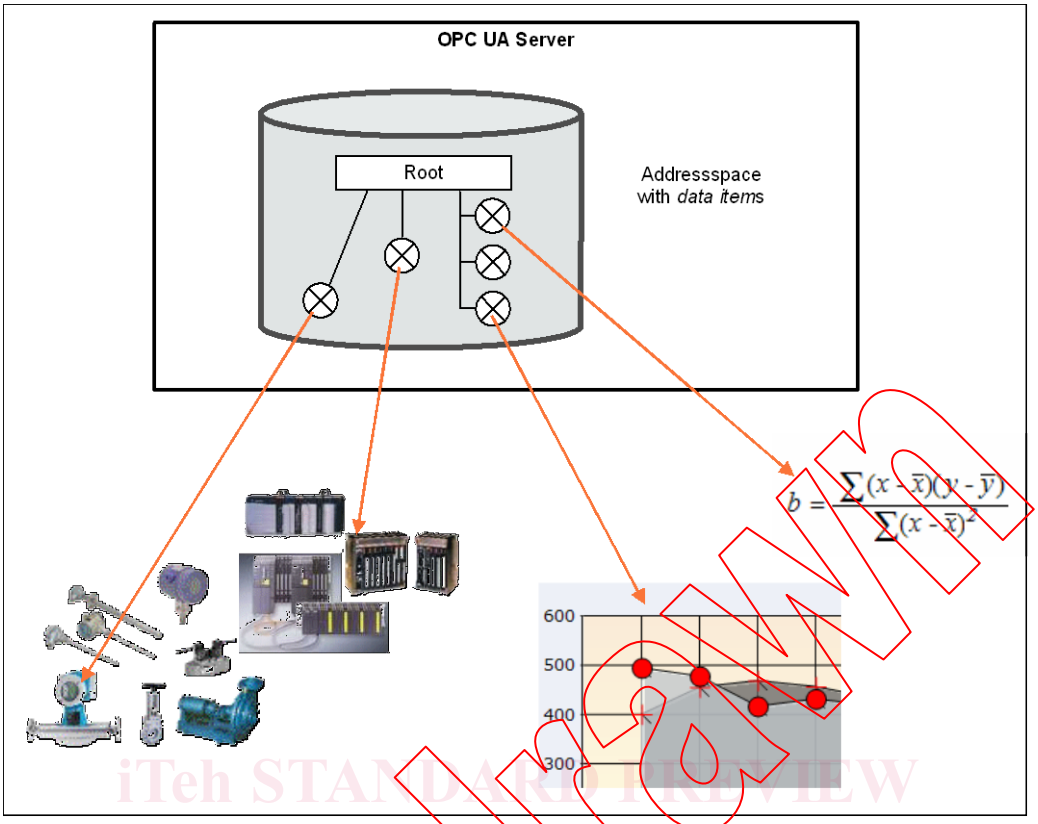

Figure 1 – OPC *DataItems* are linked to automation data

Clients may read or write *DataItems*, or monitor them for value changes. The services needed for these operations are specified in Part 4. Changes are defined as a change in status (quality) or a change in value that exceeds a client-defined range called a *Deadband*. To detect the value change, the difference between the current value and the last reported value is compared to the *Deadband*.

5 Model

5.1 General

The DataAccess model extends the variable model by defining *VariableTypes*. The *DataItemType* is the base type. *AnalogItemType* and *DiscreteItemType* (and its *TwoState* and *MultiState* subtypes) are specializations. See Figure 2. Each of these *VariableTypes* can be further extended to form domain or server specific *DataItems*.

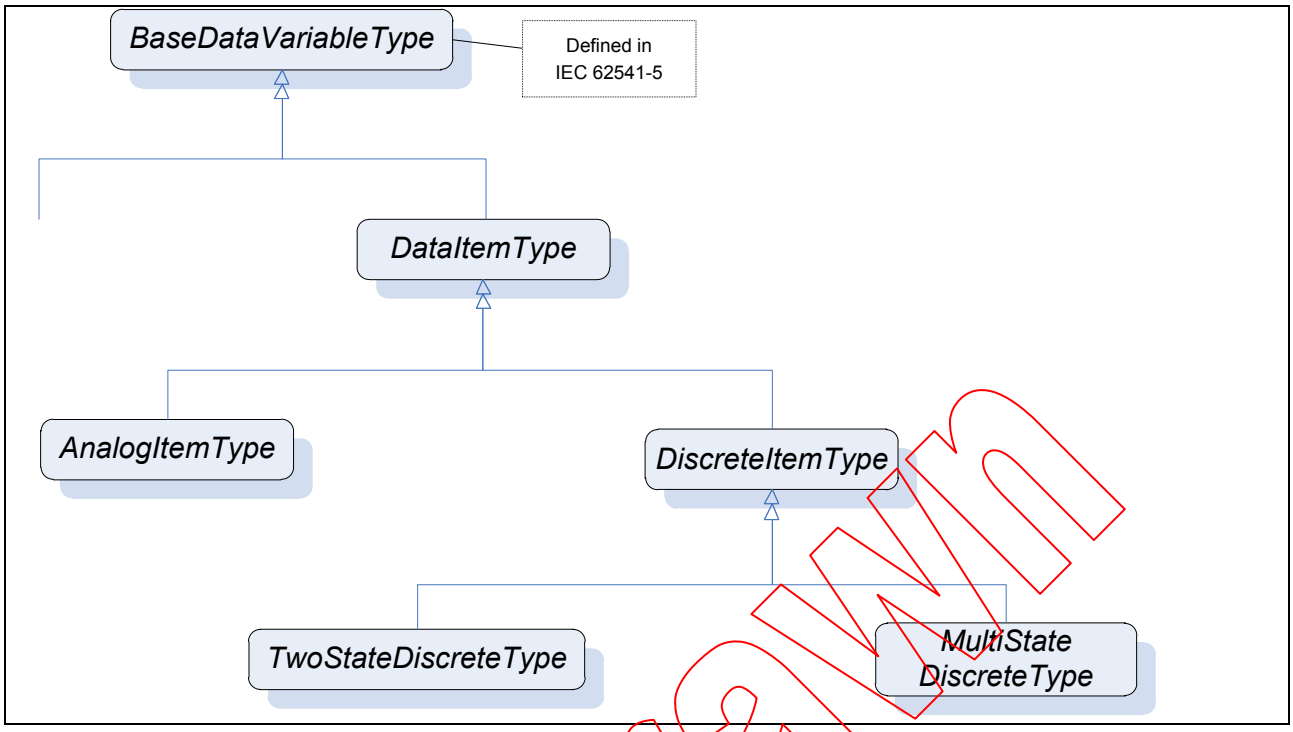

Figure 2 – *DataItem VariableType* Hierarchy

5.2 Variable Types

5.2.1 DataItemType

This *VariableType* defines the general characteristics of a *DataItem*. All other *DataItem* Types derive from it. The *DataItemType* derives from the *BaseDataVariableType* and therefore shares the variable model as described in Part 3 and Part 5. It is formally defined in Table 1.

Table 1 – DataItemType Definition

Attribute	**Value**				
BrowseName	DataItemType				
IsAbstract	False				
ValueRank	−2 (−2 = 'Any')				
DataType	BaseDataType				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the *BaseDataVariableType* defined in Part 5; i.e the *Properties* of that type are inherited.					
HasSubtype	VariableType	AnalogItemType	Defined in 5.2.2		
HasSubtype	VariableType	DiscreteItemType	Defined in 5.2.3		
HasProperty	Variable	Definition	String	PropertyType	Optional
HasProperty	Variable	ValuePrecision	Double	PropertyType	Optional

Definition is a vendor-specific, human readable string that specifies how the value of this *DataItem* is calculated. *Definition* is non-localized and will often contain an equation that can be parsed by certain clients.

Example: *Definition* ::= "(TempA – 25) + TempB"

ValuePrecision specifies the maximum precision that the server can maintain for the item based on restrictions in the target environment.

ValuePrecision can be used for the following *DataTypes*:

- For Float and Double values it specifies the number of digits after the decimal place.
- For DateTime values it indicates the minimum time difference in nanoseconds. For example, a ValuePrecision of 20 000 000 defines a precision of 20 ms.

The *ValuePrecision Property* is an approximation that is intended to provide guidance to a client. A server is expected to silently round any value that it supports with more precision. This implies that a *Client* may encounter cases where the value read back from a *Server* differs from the value that it wrote to the *Server*. This difference shall be no more than the difference suggested by this *Property*.

5.2.2 AnalogItemType

This VariableType defines the general characteristics of an *AnalogItem*. All other *AnalogItem* Types derive from it. The *AnalogItemType* derives from the *DataItemType*. It is formally defined in Table 2.

Table 2 – *AnalogItemType* Definition

Attribute	Value				
BrowseName	AnalogItemType				
IsAbstract	False				
ValueRank	−2 (−2 = 'Any')				
DataType	Number				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the *DataItemType* defined in 5.2; i.e the *Properties* of that type are inherited.					
HasProperty	Variable	InstrumentRange	Range	PropertyType	Optional
HasProperty	Variable	EURange	Range	PropertyType	Mandatory
HasProperty	Variable	EngineeringUnits	EUInformation	PropertyType	Optional

InstrumentRange defines the value range that can be returned by the instrument.

```
Example:        InstrumentRange ::= {-9999.9, 9999.9}
```

The *Range Data Type* is specified in 5.5.2.

EURange defines the value range likely to be obtained in normal operation. It is intended for such use as automatically scaling a bar graph display.

Sensor or instrument failure or deactivation can result in a returned item value which is actually outside this range. Client software must be prepared to deal with this. Similarly a client may attempt to write a value that is outside this range back to the server. The exact behaviour (accept, reject, clamp, etc.) in this case is server-dependent. However, in general servers shall be prepared to handle this.

```
Example:        EURange ::= {-200.0,1400.0}
```

See also 6.2 for a special monitoring filter (*PercentDeadband*) which is based on the engineering unit range.

EngineeringUnits specifies the units for the *DataItem*'s value (e.g., DEGC, hertz, seconds).

The *EUInformation* type is specified in 5.5.3.

If the item contains an array, the *Properties* shall apply to all elements in the array.

5.2.3 DiscreteItemType

5.2.3.1 General

This VariableType is an abstract type. That is, no instances of this type can exist. However, it might be used in a filter when browsing or querying. The *DiscreteItemType* derives from the *DataItemType* and therefore shares all of its characteristics. It is formally defined in Table 3.

Table 3 – DiscreteItemType Definition

Attribute	**Value**				
BrowseName	DiscreteItemType				
IsAbstract	True				
ValueRank	−2 (−2 = 'Any')				
DataType	BaseDataType				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the *DataItemType* defined in 5.2; i.e the *Properties* of that type are inherited.					
HasSubtype	VariableType	TwoStateDiscreteType	Defined in 5.2.3.2		
HasSubtype	VariableType	MultiStateDiscreteType	Defined in 5.2.3.3		

5.2.3.2 TwoStateDiscreteType

This *VariableType* defines the general characteristics of a *DiscreteItem* that can have two states. The *TwoStateDiscreteType* derives from the *DiscreteItemType*. It is formally defined in Table 4.

Table 4 – TwoStateDiscreteType Definition

Attribute	**Value**				
BrowseName	TwoStateDiscreteType				
IsAbstract	False				
ValueRank	−2 (−2 = 'Any')				
DataType	Boolean				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the *DiscreteItemType* defined in 5.2.3; i.e the *Properties* of that type are inherited.					
HasProperty	Variable	TrueState	LocalizedText	PropertyType	Mandatory
HasProperty	Variable	FalseState	LocalizedText	PropertyType	Mandatory

TrueState contains a string to be associated with this *DataItem* when it is TRUE. This is typically used for a contact when it is in the closed (non-zero) state.

for example "RUN", "CLOSE", "ENABLE", "SAFE", etc.

FalseState contains a string to be associated with this *DataItem* when it is FALSE. This is typically used for a contact when it is in the open (zero) state.

for example "STOP", "OPEN", "DISABLE", "UNSAFE", etc.

If the item contains an array, the *Properties* will apply to all elements in the array.