IEC 62714-1

Edition 1.0 2014-06

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Engineering data exchange format for use in industrial automation systems engineering – Automation markup language – Part 1: Architecture and general requirements

Format d'échange de données techniques pour une utilisation dans l'ingénierie des systèmes d'automatisation industrielle – Automation markup language – Partie 1: Architecture et exigences générales

IEC 62714-1:2014-06(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

PRICE CODE
CODE PRIX XC

ICS 25.040.40; 35.06; 35.240.50

ISBN 978-2-8322-1554-8

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ENGINEERING DATA EXCHANGE FORMAT FOR USE IN INDUSTRIAL AUTOMATION SYSTEMS ENGINEERING – AUTOMATION MARKUP LANGUAGE –

Part 1: Architecture and general requirements

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

FDIS	Report on voting
65E/385/FDIS	65E/396/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.

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A list of all parts in the IEC 62714 series, published under the general title *Engineering data exchange format for use in industrial automation systems engineering – Automation Markup Language*, can be found on the IEC website.

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INTRODUCTION

IEC 62714 is a solution for data exchange focusing on the domain of automation engineering.

The data exchange format defined in the IEC 62714 series (Automation Markup Language, AML) is an XML schema based data format and has been developed in order to support the data exchange in a heterogeneous engineering tools landscape.

The goal of AML is to interconnect engineering tools in their different disciplines, e.g. mechanical plant engineering, electrical design, process engineering, process control engineering, HMI development, PLC programming, robot programming, etc.

AML stores engineering information following the object oriented paradigm and allows modelling of physical and logical plant components as data objects encapsulating different aspects. An object may consist of other sub-objects, and may itself be part of a larger composition or aggregation. Typical objects in plant automation comprise information on topology, geometry, kinematics and logic, whereas logic comprises sequencing, behaviour and control. Therefore, an important focus in the data exchange in engineering is the exchange of object oriented data structures, geometry, kinematics and logic.

AML combines existing industry data formats that are designed for the storage and exchange of different aspects of engineering information. These data formats are used on an "as-is" basis within their own specifications and are not branched for AML needs.

The core of AML is the top-level data format CAEX that connects the different data formats. Therefore, AML has an inherent distributed document architecture.

Figure 1 illustrates the basic AML architecture and the distribution of topology, geometry, kinematics and logic information.

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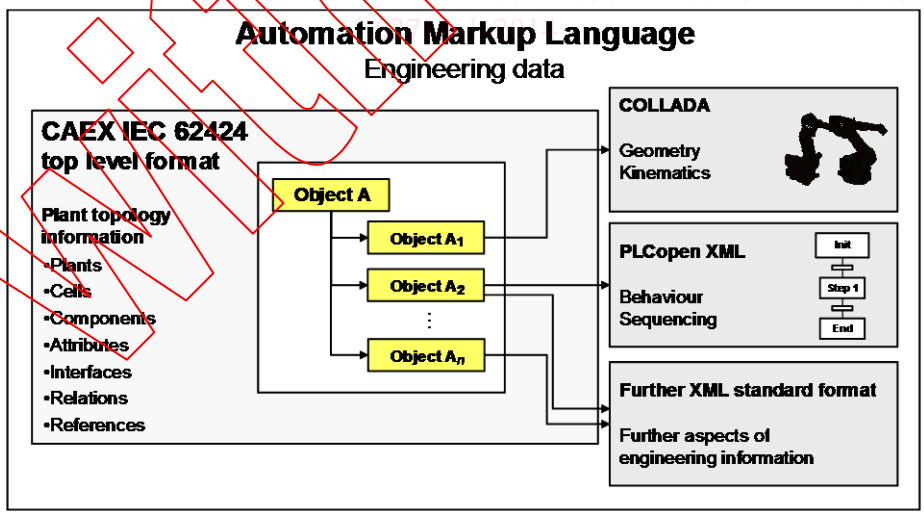

Figure 1 – Overview of the engineering data exchange format AML

Due to the different aspects of AML, the IEC 62714 series consists of different parts focussing on different aspects:

- IEC 62714-1: Architecture and general requirements

  This part specifies the general AML architecture, the modelling of engineering data, classes, instances, relations, references, hierarchies, basic AML libraries and extended AML concepts. It is the basis of all future parts, and it provides mechanisms to reference other sub formats.

- IEC 62714-2: Role class libraries

  This part is intended to specify additional AML libraries.

- IEC 62714-3: Geometry and kinematics

  This part is intended to specify the modelling of geometry and kinematics information.

- IEC 62714-4: Logic

  This part is intended to specify the modelling of logics, sequencing, behaviour and control related information.

Further parts may be added in the future in order to interconnect further data standards to AML.

As long as no further parts describe the integration of further standards, it is important to focus on a limited set of sub data formats. Otherwise it would open up the usage of any data format and data exchange would not work.

Annex A gives an informative introduction, use cases and examples regarding AML.

Annex B gives an informative XML representation of the libraries defined in this part of IEC 62714.

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ENGINEERING DATA EXCHANGE FORMAT FOR USE IN INDUSTRIAL AUTOMATION SYSTEMS ENGINEERING – AUTOMATION MARKUP LANGUAGE –

Part 1: Architecture and general requirements

1 Scope

This part of IEC 62714 specifies general requirements and the architecture of AML for the modelling of engineering information which is exchanged between engineering tools for industrial automation and control systems. Its provisions apply to the export/import applications of related tools.

This part of IEC 62714 does not define details of the data exchange procedure or implementation requirements for the import/export tools.

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 62424:2008, *Representation of process control engineering – Requests in P&I diagrams and data exchange between P&ID tools and PCE-CAE tools*

IEC 62714 (all parts), *Engineering data exchange format for use in industrial automation systems engineering – Automation Markup Language*

ISO/IEC 9834-8, *Information technology – Open Systems Interconnection – Procedures for the operation of OSI Registration Authorities: Generation and registration of Universally Unique Identifiers (UUIDs) and their use as ASN.1 Object Identifier components*

ISO/PAS 17506, *Industrial automation systems and integration — COLLADA digital asset schema specification for 3D visualization of industrial data*

COLLADA 1.4.1:March 2008, COLLADA – Digital Asset Schema Release 1.4.1
(available at <http://www.khronos.org/files/collada_spec_1_4.pdf>)

Extensible Markup Language (XML) 1.0 1.0:2004, W3C Recommendation
(available at <http://www.w3.org/TR/2004/REC-xml-20040204/>)

PLCopen XML 2.0:December 3rd 2008 and PLCopen XML 2.0.1:May 8th 2009, XML formats for *IEC 61131*-3
(available at <*http://www.plcopen.org*>/)

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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3.1.1
AML
XML based data exchange format for plant engineering data following IEC 62714

3.1.2
automation object
physical or logical entity in the automated system

Note 1 to entry: An example of an automation object is an automation component, a valve or a signal.

3.1.3
AML object
data representation of an automation object with a relation to an AML role class

Note 1 to entry: The AML objects are the core elements of AML. They represent instances and may contain administration items, attributes, interfaces, relations and references.

3.1.4
AML class
predefined AML object type

Note 1 to entry: AML classes are stored within AML libraries.

Note 2 to entry: AML classes define reusable sample solutions, characterized by attributes, interfaces and aggregated objects.

Note 3 to entry: AML classes can be used for multiple instantiations.

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3.1.5
AML attribute
property which belongs to an AML object

Note 1 to entry: AML attributes are described as an XML element corresponding to IEC 62424:2008, A.2.4.

3.1.6
AML document
certain CAEX document following IEC 62714 including all referenced sub documents

Note 1 to entry: AML documents may be stored as files, but also e.g. as string or data streams.

3.1.7
AML file
certain CAEX file following IEC 62714-1 with the extension .aml excluding all referenced sub files

3.1.8
AML interface
single connection point that belongs to an AML object and can be linked with another interface

Note 1 to entry: Interfaces allow the description of relations between objects by the definition of CAEX InternalLinks. Examples are a signal interface, a device interface or a power interface.

3.1.9
AML library
library containing AML classes

3.1.10
AML Port
AML object that represents a container for a group of interfaces characterized by additional properties

Note 1 to entry: Ports belong to a parent AML object and describe complex interfaces of this object. Ports can be connected to each other on a higher abstraction level.

3.1.11
AML Group
AML object providing a certain view on AML objects

3.1.12
AML Facet
AML object providing a certain view on AML attributes or interfaces of one AML object

3.1.13
CAEX
neutral XML based data format

Note 1 to entry: CAEX is a neutral data format according to IEC 62424:2008, Clause 7, Annex A and Annex C

3.1.14
copy-instance-relation
relation between the instance and the corresponding class where the instance is created by copying the class data structures

Note 1 to entry: The instance receives a copy of all features and properties of the source AML class. Modifications of the class do not lead to modifications of the instance. Within the instance, class properties are individualized. Further copies are possible due to the knowledge of the source AML class.

3.1.15
universal unique identifier
UUID
unique identifier for AML objects

Note 1 to entry: This note applies to the French language only.

3.1.16
global unique identifier
GUID
implementation of a UUID

Note 1 to entry: Real GUID example: "{AC76BA86-7AD7-1033-7B44-A70000000000}".

Note 2 to entry: In IEC 62714, GUIDs are also presented in a short form such as "GUID1", "GUID2" etc. This serves the readability and acts as a real GUID.

Note 3 to entry: This note applies to the French language only.

3.1.17
inheritance relation
relation between two AML classes

Note 1 to entry: The derived class inherits all attributes and features of the parent class.

3.1.18
instance
data representation of an individual physical or logical item

Note 1 to entry: Instances can be extended, e.g. by aggregated objects or attributes.

3.1.19
PropertySet
AML standard role class containing a set of semantically predefined attributes

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