

INTERNATIONAL STANDARD

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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**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ENGINEERING DATA EXCHANGE FORMAT FOR USE IN
INDUSTRIAL AUTOMATION SYSTEMS ENGINEERING –
AUTOMATION MARKUP LANGUAGE –****Part 1: Architecture and general requirements**

FOREWORD

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International Standard IEC 62714-1 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2014. This edition constitutes a technical revision.

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

- a) use of CAEX 3.0 according to IEC 62424:2016 which provides technical improvements as attribute libraries, nested interfaces, new fields for indicating the source of an object, a refinement of the mirror concept and native support of multiple roles, native meta information about the CAEX file source tool, identification of instances via unique IDs instead of paths, etc.,

- b) improved modelling of references to documents outside of the scope of the present standard,
- c) modelling of references between CAEX attributes and items in external documents, e.g. within an Excel sheet,
- d) revised role libraries,
- e) modified Port concept,
- f) modelling of multilingual expressions,
- g) modelling of structured attribute lists or array,
- h) a new AML container format,
- i) a new standard AML attribute library.

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

FDIS	Report on voting
65E/582/FDIS	65E/586/RVD

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

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

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.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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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 for plant engineering data. AML 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. The application of IEC 62714 is industry independent. It is applicable in all industries that require data exchange in their engineering tool chain, e.g. in discrete industry or process industry.

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 can 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. CAEX is utilized to interconnect 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.

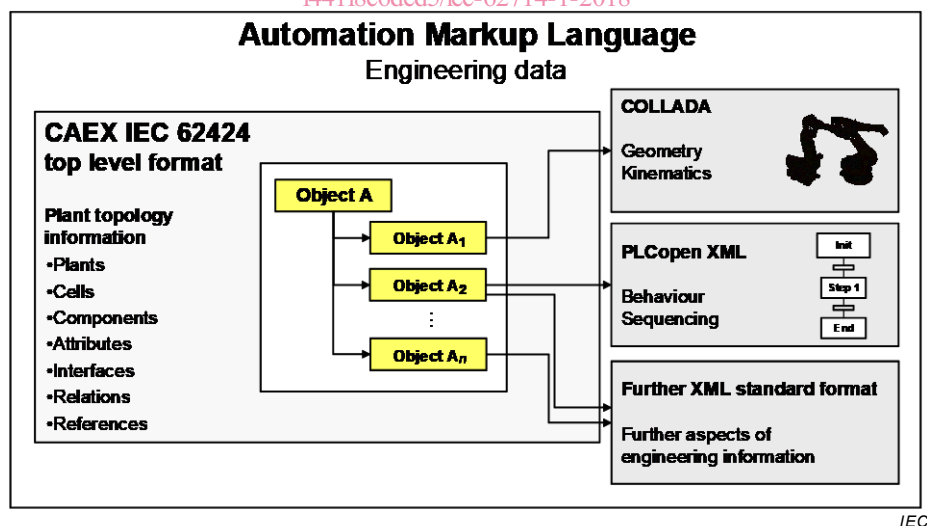


Figure 1 – Overview of the engineering data exchange format AML

Due to the different aspects of AML, the IEC 62714 series consists of different parts focusing 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 subformats.

- IEC 62714-2: Role class libraries
This part specifies additional AML libraries.
- IEC 62714-3: Geometry and kinematics
This part specifies the modelling of geometry and kinematics information.
- IEC 62714-4¹: Logic
This part specifies the modelling of logics, sequencing, behaviour and control related information.

Further parts will 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.

Clause 1 defines the scope for IEC 62714.

Clause 2 provides normative references.

Clause 3 provides terms, definitions and abbreviations.

Clause 4 defines the conformity to IEC 62714.

Clause 5 describes general architecture specifications for IEC 62714.

Clause 6 defines the basic AML libraries.

Clause 7 describes how to model user-defined data.

Clause 8 describes extended AML concepts.

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.

¹ Under consideration.

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 automation markup language (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 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 62424:2016, *Representation of process control engineering – Requests in P&I diagrams and data exchange between P&ID tools and PCE-CAE tools*
<http://www.iec.ch/standards/catalogue/iec/62424-1a08-420a-8a5c-f441f8c6ded5/iec-62714-1-2018>

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

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

ISO/IEC 29500-2, *Information technology – Document description and processing languages – Office Open XML File Formats – Part 2: Open Packaging Conventions*

IETF RFC 2046, *Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types* [viewed 2017-11-13]. Available at <<http://www.ietf.org>>

IETF RFC 4122, *A Universally Unique Identifier (UUID) URN Namespace* [viewed 2017-11-13]. Available at <<http://www.ietf.org>>

IETF RFC 5646, *Tags for Identifying Languages* [viewed 2017-11-13]. Available at <<http://www.ietf.org>>

COLLADA 1.4.1:March 2008, *COLLADA – Digital Asset Schema Release 1.4.1* [viewed 2017-11-13]. Available at <http://www.khronos.org/files/collada_spec_1_4.pdf>

PLCopen XML 2.0:December 3rd 2008 and PLCopen XML 2.0.1:May 8th 2009, *XML formats for IEC 61131-3* [viewed 2017-11-13]. 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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

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 one or more CAEX RoleRequirements that relate 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, either an AML system unit class, AML interface class, AML role class or AML attribute type

Note 1 to entry: AML classes are stored within AML libraries, AML classes are of type SystemUnitClass, InterfaceClass, RoleClass or AttributeType.

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.

Note 4 to entry: AML classes can be user-defined or standard AML classes.

3.1.5

AML attribute

CAEX attribute which belongs to an AML object and is related to an attribute defined in an AML class or AML AttributeType

Note 1 to entry: AML attributes are described as an XML element corresponding to IEC 62424:2016, A.2.4.

3.1.6

AML document

certain AML CAEX document following IEC 62714 (all parts) 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.

Note 2 to entry: AML documents contain AML objects and/or user-defined objects.

Note 3 to entry: An AML document may consist of multiple files, with one AML CAEX document as root.

3.1.7

AML file

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

3.1.8

AML interface

single connection point with a relation to an AML interface class

Note 1 to entry: Interfaces allow the description of relations between objects by the definition of CAEX Internal-Links. 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 interface with a direct or indirect relation to the standard AML interface class Port, allowing to specify nested interfaces

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 with a direct or indirect relation to the standard AML role class Group, providing a certain view on AML objects

3.1.12

AML Facet

AML object with a direct or indirect relation to the standard AML role class Facet, 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 62424:2016, 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 automatically 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

3.1.16

global unique identifier

GUID

implementation of a UUID

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