IEC 62714-5

Edition 1.0 2022-03

INTERNATIONAL STANDARD

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Engineering data exchange format for use in industrial automation systems engineering – Automation markup language – Part 5: Communication

Format d'échange de données techniques pour une utilisation dans l'ingénierie des systèmes d'automatisation industrielle – Automation markup language – Partie 5: Communication

IEC 62714-5:2022-03(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ICS 25.040; 25.040.01

ISBN 978-2-8322-1085-7

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

Draft	Report on voting
65E/844/FDIS	65E/886/RVD

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. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts of the IEC 62714 series, 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 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- withdrawn,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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ENGINEERING DATA EXCHANGE FORMAT FOR USE IN INDUSTRIAL AUTOMATION SYSTEMS ENGINEERING – AUTOMATION MARKUP LANGUAGE –

Part 5: Communication

1 Scope

Engineering processes of technical systems and their embedded automation systems are executed with increasing efficiency and quality. Especially since the project duration tends to increase as the complexity of the engineered system increases. To solve this problem, the engineering process is more often being executed by exploiting software based engineering tools exchanging engineering information and artefacts along the engineering process related tool chain.

Communication systems establish an important part of modern technical systems and, especially, of automation systems embedded within them. Following the increasing decentralisation of automation systems and the application of fieldbus and Ethernet technology connecting automation devices and further interacting entities need to fulfil special requirements on communication quality, safety and security. Thus, within the engineering process of modern technical systems, engineering information and artefacts relating to communication systems also need to be exchanged along the engineering process tool chain.

In each phase of the engineering process of technical systems, communication system related information can be created which can be consumed in later engineering phases. A typical application case is the creation of configuration information for communication components of automation devices including communication addresses and communication package structuring within controller programming devices during the control programming phase and its use in a device configuration tool. Another typical application case is the transmission of communication device configurations to virtual commissioning tools, to documentation tools, or to diagnosis tools.

At present, the consistent and lossless transfer of communication system engineering information along the complete engineering chain of technical systems is unsolved. While user organisations and companies have provided data exchange formats for parts of the relevant information like FDCML, EDDL, and GSD, the above named application cases cannot be covered by a data exchange format. Notably the networking related information describing communication relations and their properties and qualities cannot be modelled by a data exchange format.

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 61131-3, *Programmable controllers − Part 3: Programming languages*

IEC 61131-10:2019, *Programmable controllers – Part 10: PLC open XML exchange format*

IEC 62424:2016, *Representation of process control engineering − Requests in P&I diagrams and data exchange between P&ID tools and PCE-CAE tools*

IEC 62714-1, *Engineering data exchange format for use in industrial systems engineering – Automation Markup Language – Part 1: Architecture and general requirements*

IEC 62714-4, *Engineering data exchange format for use in industrial systems engineering – Automation markup language − Part 4: Logic*

IEC 81346 (all parts), *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations*

3 Terms, definitions, abbreviated terms and acronyms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62714-1 and the following 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
AutomationML/AML
XML based data exchange format for plant engineering data

3.1.2
Automation object
entity in an automated system

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

3.2 Abbreviated terms and acronyms

For the purposes of this document, the following abbreviations apply.

AML	Automation Markup Language
CAEX	Computer Aided Engineering Exchange as defined in IEC 62424:2016
ECAD	Computer aided engineering for electrical engineering
EDDL	Electronic Device Description Language
FDCML	Field Device Configuration Markup Language
GUID	Global Unique Identifier
GSD	General Station Description
HMI	Human Machine Interface
ID	Identifier
MCAD	Computer aided engineering for mechanical engineering
OPC	Open Platform Communications
PDU	Protocol Data Unit
SCADA	Supervisory Control And Data Acquisition
UML	Unified Modelling Language
UUID	Universal Unique Identifier
XML	Extensible Markup Language

4 Use cases and network structures

4.1 General

The modelling of communication systems based on AutomationML targets the modelling of a large amount of information created, exchanged, and applied within the engineering process of manufacturing systems. Nevertheless, not all possible communication system related information will be modelled. Within the following subclause, the use cases for the application of the communication system modelling as well as the relevant information sets within them are named.

4.2 Use cases

4.2.1 Engineering activities

Network topology and communication system related information is relevant to various engineering activities along the engineering chain of production systems. Within the engineering process of production systems, the communication system can be designed in the detailed engineering phase exploiting various tools. Thereby, communication system related information is created which subsequently can be applied within the detailed design of devices and the device commissioning. Figure 1 represents an example set of engineering activities relevant within the general engineering process of production systems and the communication system engineering embedded within.

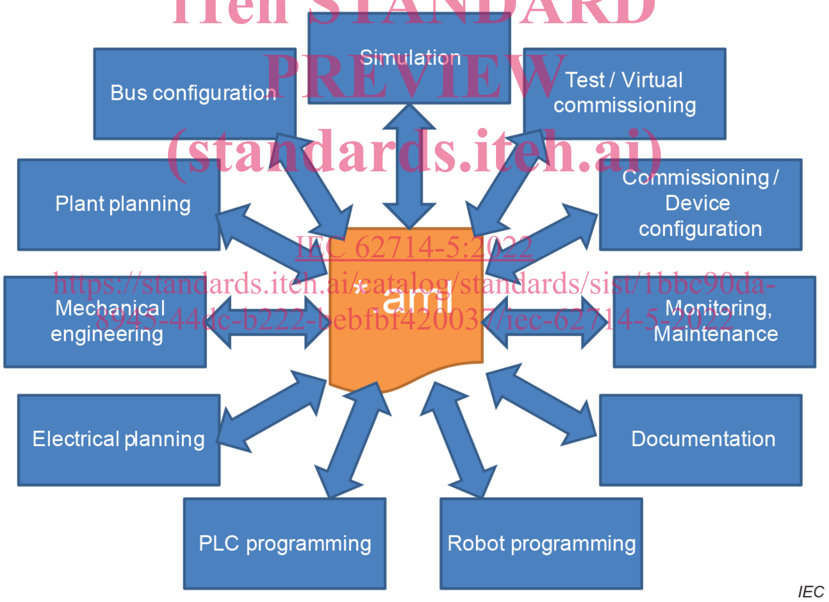

Figure 1 – General engineering activities communication system engineering is embedded within

Within the named engineering activities, engineering tools like (but not limited to) the following will have a relevant impact:

- plant planning tools,
- mechanical engineering tools (MCAD),
- electrical engineering tools (ECAD),
- controller programming tools,
- robot programming tools,
- HMI programming tools,
- OPC system configuration tools,

- device configuration tools,
- bus configuration tools,
- simulation tools,
- SCADA systems,
- virtual commissioning tools,
- documentation tools,
- communication system security tools,
- communication system management tools,
- communication system diagnosis tools.

These tools will create and/or consume communication system related engineering information depending on the use case of the engineering chain.

Nevertheless, (among others) there are two main application cases within this engineering chain, where communication system related information can be exchanged between engineering tools. These two use cases are the main target of the modelling of communication systems based on AutomationML.

4.2.2 Lossless transfer of communication device instance information

Within the general engineering process, this use case covers the transition of communication relevant information for configuration of communication components of sensors and actuators from controller programming tool and similar tools to sensor and actuator configuration/programming tools. It contains the transition of information relevant for correct communication (like addresses and channels) as well as for correct structuring of communication data packages transmitted within communication (like transmitted data points of sensors). An overview is shown in Figure 2.

Within the related engineering activities, engineers with the engineering roles of controller programmer, HMI programmer, electrical design engineer, commissioner communication, commissioner controller, and robot programmer can be involved. They will execute the following sequence of engineering and data exchange activities which should be seen as an example sequence.

Step 1. Design of system instrumentation, definition of used/interconnected devices

Step 2. Export of device information from system instrumentation tool

Step 3. Import of device information to controller programming and device configuration tools

Step 4. Integration of device descriptions (like GSD) in controller programming tool

Step 5. Design of controller programs and configurations within controller programming tool

Step 6. Export of communication device relevant information from controller programming tool

Step 7. Import of communication device relevant information to device configuration tool

Step 8. Use of information for parameterisation of communication component of device (addresses, etc.) and for structuring of communication packages (send data points)

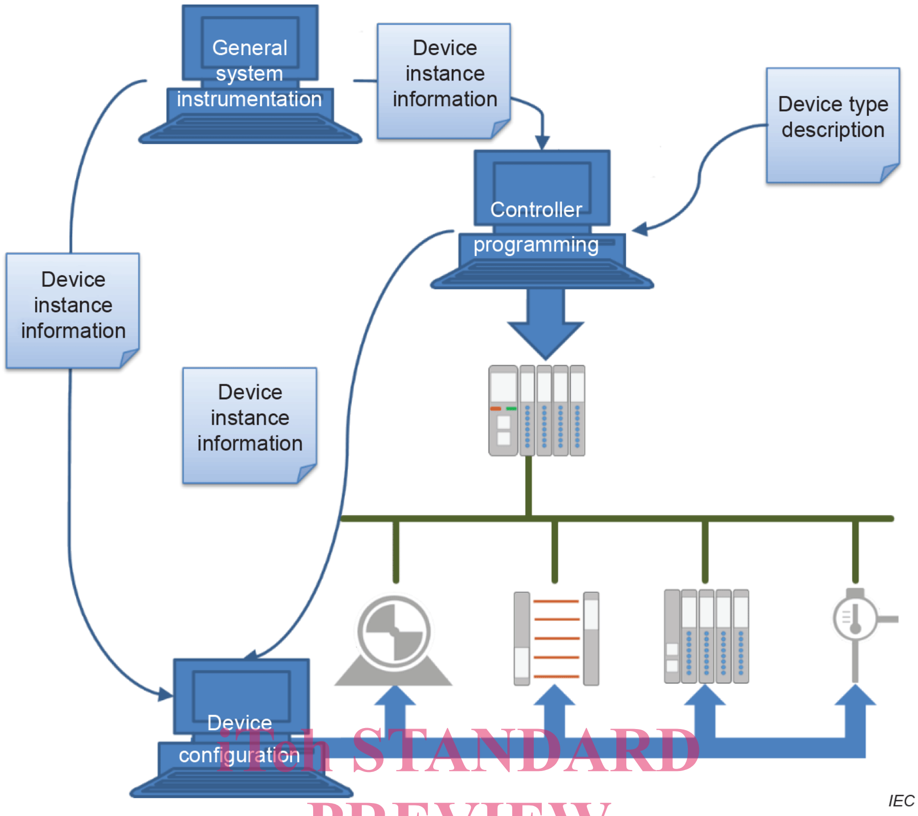

Figure 2 – Information flow of the use case

There are different alternatives possible but not usually applied. The following two sequences are imaginable which will be in the focus of the use case.

Sequence 1:

Step 1. Design of communication system configurations within third party tool

Step 2. Integration of device descriptions

Step 3. Export of communication device relevant information

Step 4. Import of communication device relevant information to device configuration/programming tool

Step 5. Use of information for parameterization of communication component of device (addresses, etc.) and for structuring of communication packages (send data points)

Sequence 2:

Step 1. Third party tool, e.g. the device configuration tool provides information like signals, data volume, describing the instance information

Step 2. Device vendor provides device descriptions, describing the type information

Step 3. Bus configuration tool consumes these snippets and device descriptions

Step 4. Bus configurator generates bus configuration

Step 5. Import of the bus configuration into the controller programming tool

Step 6. Use of information from peripheral devices inside the controller program

Both sequences are commonly depicted in Figure 3.

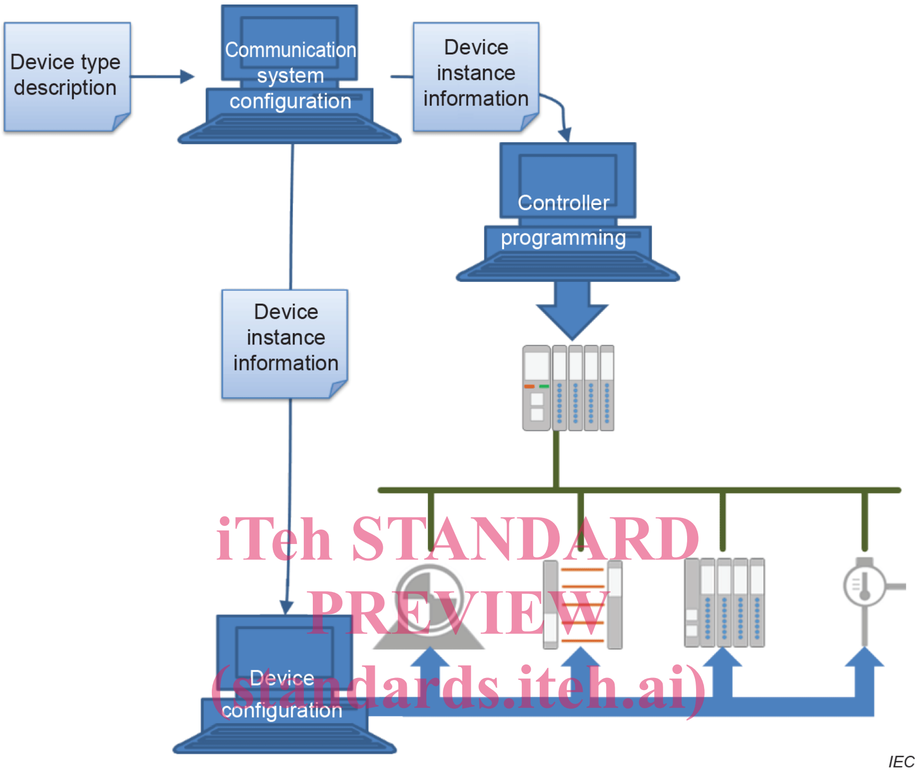

Figure 3 – Alternative information flow of the use case

Possible tools exporting communication system information can be e.g. controller programming tools. They cover controller programming projects with data points (variables), device configurations, and indirect communication network descriptions. In addition, communication system engineering tools can be data sources as well as instrumentation tools like ECAD tools.

Data sinks of the data exchange can be tools for sensor communication configuration, HMI programming, robot programming, OPC system configuration, or actor communication configuration. They mostly cover programming projects with data points (variables), device configurations, and indirect communication network descriptions. Relevant tools can be FDT tools, HMI programming tools, and robot programming tools.

Based on this use case, the modelling of communication systems based on AutomationML should cover information about IO lists, association of variables (IOs) to communication data packages and device parameters for parameterization of communication devices such as addresses (e.g. IP address), media access (e.g. MAC address), subnet masks, gateway addresses, and communication objects used, such as profile information.

In addition, the modelling should fulfil the following non-functional requirements. Device parameter list shall be extendable by users to cover upcoming technologies. Appropriate RoleClassLibs and/or SystemUnitClassLibs enabling the identification of object semantics shall be defined.