SLOVENSKI STANDARD
oSIST prEN IEC 62714-5:2021

01-julij-2021

Oblika izmenjave tehničnih podatkov za uporabo v industrijskem inženiringu avtomatizacije sistemov - Označevalni jezik za avtomatizacijo - 5. del: Komunikacija

Engineering data exchange format for use in industrial automation systems engineering - Automation Markup Language - Part 5: Communication

Ta slovenski standard je istoveten z: prEN IEC 62714-5:2021

ICS:

25.040.40	Merjenje in krmiljenje industrijskih postopkov	Industrial process measurement and control
35.060	Jeziki, ki se uporabljajo v informacijski tehniki in tehnologiji	Languages used in information technology
35.240.50	Uporabniške rešitve IT v industriji	IT applications in industry

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IEC SC 65E : DEVICES AND INTEGRATION IN ENTERPRISE SYSTEMS	
SECRETARIAT: United States of America	SECRETARY: Mr Donald (Bob) Lattimer
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TITLE:

Engineering data exchange format for use in industrial automation systems engineering - Automation Markup Language - Part 5: Communication

PROPOSED STABILITY DATE: 2024

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

Part 5: Communication

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

FDIS	Report on voting
XX/XX/FDIS	XX/XX/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.

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- reconfirmed,
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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 have to be 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 have 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 have 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, 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 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 60050, *International Electrotechnical Vocabulary*

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

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*

IEC 62714-1, *Engineering data exchange format for use in industrial systems engineering – AutomationML, Architecture and general requirements*

IEC 62714-2, *Engineering data exchange format for use in industrial systems engineering – AutomationML, Role Libraries*

IEC 62714-4, *Engineering data exchange format for use in industrial systems engineering – AutomationML, Logic*

ISO 80000-1, *Quantities and units – Part 1: General*

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

IEC 61158, *Industrial communication networks – Fieldbus specifications*

IEC 61784, *Industrial communication networks – Profiles*

IEC 61346, *Industrial systems, Installations and Equipment and Industrial Products — Structuring Principles and Reference Designations*

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

3 Terms, definitions, abbreviated terms and acronyms

3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 62714-1 as well as the following apply.

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 purpose of this document the abbreviations apply.

AML	Automation Markup Language
CAEX	Computer Aided Engineering Exchange
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
ID	Identifier
MCAD	Computer aided engineering for mechanical engineering
PDU	Protocol Data Unit
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 clause 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

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 should 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.

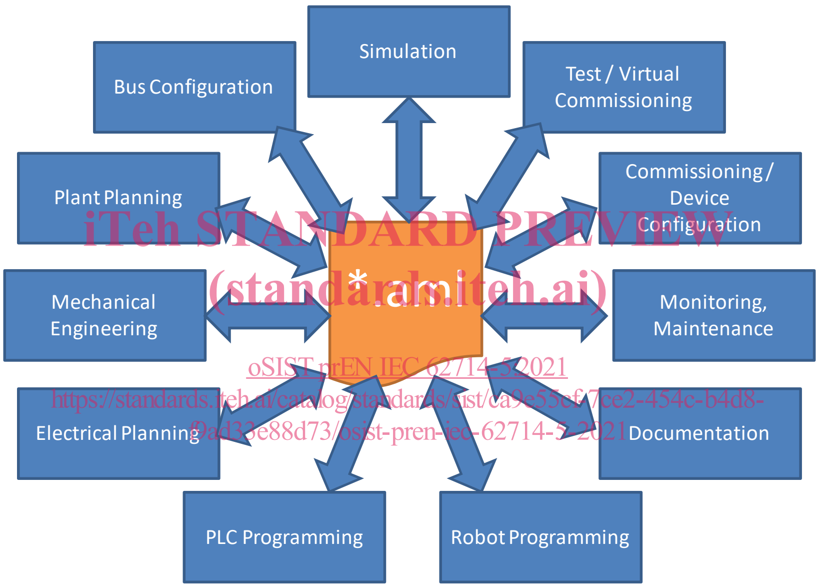

Figure 1 – General Engineering activities communication system engineering is embedded within

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 should be exchanged between engineering tools. These two use cases are the main target of the modelling of communication systems based on AutomationML.

4.2.1 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).

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 has to 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)

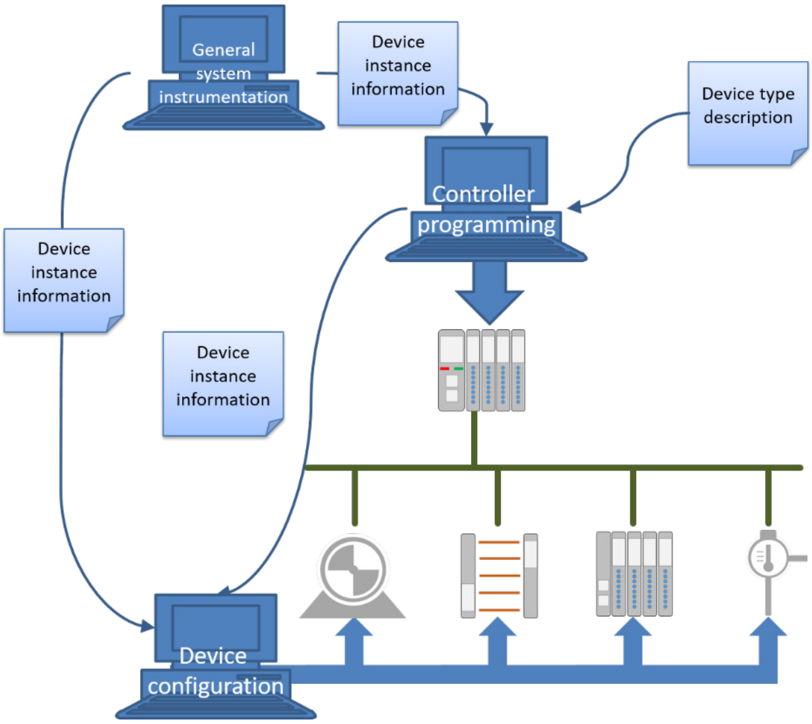

Figure 2 – Information flow of the use case

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

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)

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.

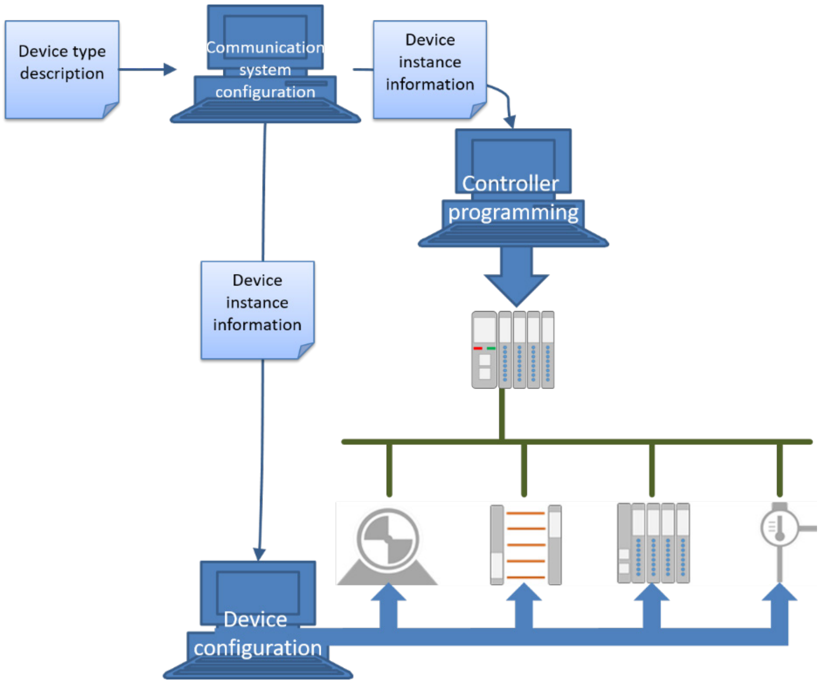

Figure 3 – Alternative information flow of the use case

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 has to cover information about I/O lists, association of variables (I/Os) 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 has to be extendable by users to cover upcoming technologies. Appropriate RoleClassLibs and/or SystemUnitClassLibs enabling the identification of object semantics have to be defined.

4.2.2 Lossless transfer of communication system information

Beyond the configuration of communication devices, communication system information is exploited in different engineering, monitoring, maintenance, etc. tools. Therefore, this use case covers the transmission of communication network configuration and structure information including infrastructure device configuration, end device configuration with respect to communication system parameters, network structure and wiring, quality of service, etc. This information shall be provided to device configuration tools, documentation and maintenance tools, and network management tools. They shall enable the combination of physical wiring with logical communication connections for error detection.

Within this use case engineers with the engineering roles controller programmer, HMI programmer, electrical design engineer, commissioner communication, commissioner controller, robot programmer, and operator are involved. They will execute the following engineering process which has to be seen as an example sequence.