

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Communication networks and systems for power utility automation –
Part 4: System and project management

(standards.iteh.ai)

Réseaux et systèmes de communication pour l'automatisation des systèmes
électriques – <https://standards.iteh.ai/catalog/standards/sist/a2a37d5b-1855-4dfb-8c1a-3834a1e1e381>
Partie 4: Gestion du système et gestion de projet



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2011 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

www.iec.ch/online_news/justpub

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch

Tel.: +41 22 919 02 11

Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: csc@iec.ch

Tél.: +41 22 919 02 11

Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Communication networks and systems for power utility automation –
Part 4: System and project management**

**Réseaux et systèmes de communication pour l'automatisation des systèmes
électriques –**
Partie 4: Gestion du système et gestion de projet

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	7
4 Abbreviations.....	10
5 Engineering requirements	11
5.1 Overview	11
5.2 Categories and types of parameters.....	12
5.2.1 Classification	12
5.2.2 Parameter categories.....	13
5.2.3 Parameter types	14
5.3 Engineering tools.....	15
5.3.1 Engineering process	15
5.3.2 System specification tool.....	17
5.3.3 System configuration tool.....	17
5.3.4 IED configuration tool.....	18
5.3.5 Documentation tool.....	19
5.4 Flexibility and expandability	19
5.5 Scalability.....	20
5.6 Automatic project documentation.....	20
5.6.1 General	20
5.6.2 Hardware documentation.....	22
5.6.3 Parameter documentation.....	22
5.6.4 Requirements of the documentation tool	23
5.7 Standard documentation	23
5.8 System integrator's support	24
6 System life cycle.....	24
6.1 Requirements of product versions.....	24
6.2 Announcement of product discontinuation	26
6.3 Support after discontinuation	26
7 Quality assurance.....	27
7.1 Division of responsibility	27
7.1.1 General	27
7.1.2 Responsibility of the manufacturer and system integrator	27
7.1.3 Responsibility of the customer.....	29
7.2 Test equipment.....	29
7.2.1 General	29
7.2.2 Normal process test equipment.....	29
7.2.3 Transient and fault test equipment	29
7.2.4 Communication test equipment	30
7.3 Classification of quality tests.....	30
7.3.1 Basic test requirements	30
7.3.2 System test.....	30
7.3.3 Type test	31
7.3.4 Routine test.....	32
7.3.5 Conformance test	32

7.3.6	Factory Acceptance Test (FAT).....	32
7.3.7	Site Acceptance Test (SAT).....	32
Annex A (informative)	Announcement of discontinuation (example).....	34
Annex B (informative)	Delivery obligations after discontinuation (example).....	35
Bibliography	36
Figure 1	– Structure of the UAS and its environment.....	11
Figure 2	– Structure of UAS and IED parameters.....	13
Figure 3	– Engineering tasks and their relationship.....	16
Figure 4	– IED configuration process.....	18
Figure 5	– Project related documentation of UAS.....	21
Figure 6	– Two meanings of the system life cycle.....	25
Figure 7	– Stages of quality assurance – Responsibility of manufacturer and system integrator.....	27
Figure 8	– Contents of system test.....	30
Figure 9	– Contents of type test.....	31
Figure 10	– Contents of routine test.....	32
Figure 11	– Testing stages for site acceptance test.....	33
Figure A.1	– Announcement conditions.....	34
Figure B.1	– Periods for delivery obligations.....	35

ITEH STANDARD PREVIEW
 (standards.iteh.ai)

[IEC 61850-4:2011](https://standards.iteh.ai/catalog/standards/sist/a2a37d5b-1855-4dfb-8c1a-e8beac181824/iec-61850-4-2011)

<https://standards.iteh.ai/catalog/standards/sist/a2a37d5b-1855-4dfb-8c1a-e8beac181824/iec-61850-4-2011>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**COMMUNICATION NETWORKS AND SYSTEMS
FOR POWER UTILITY AUTOMATION –**

Part 4: System and project management

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
<https://standards.iteh.ai/catalog/standards/sist/a2a37d5b-1855-4dfb-8c1a-11d1a270827c-2f1ec1850e2e>
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61850-4 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

This second edition cancels and replaces the first edition published in 2002. It constitutes a technical revision to align the document more closely with the other parts of the IEC 61850 series, in addition to enlarging the scope from substation automation systems to all utility automation systems.

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

FDIS	Report on voting
57/1103/FDIS	57/1122/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 61850 series, under the general title: *Communication networks and systems for power utility automation*, 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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 61850-4:2011](#)

<https://standards.iteh.ai/catalog/standards/sist/a2a37d5b-1855-4dfb-8c1a-e8beac181824/iec-61850-4-2011>

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 4: System and project management

1 Scope

This part of IEC 61850 applies to projects associated with process near automation systems of power utilities (UAS, utility automation system), like e.g. substation automation systems (SAS). It defines the system and project management for UAS systems with communication between intelligent electronic devices (IEDs) in the substation respective plant and the related system requirements.

The specifications of this part pertain to the system and project management with respect to:

- the engineering process and its supporting tools;
- the life cycle of the overall system and its IEDs;
- the quality assurance beginning with the development stage and ending with discontinuation and decommissioning of the UAS and its IEDs.

The requirements of the system and project management process and of special supporting tools for engineering and testing are described

2 Normative references

[IEC 61850-4:2011](https://standards.iteh.ai/catalog/standards/sist/a2a37d5b-1855-4dfb-8c1a-8b9ed818746e/iec-61850-4-2011)

[https://standards.iteh.ai/catalog/standards/sist/a2a37d5b-1855-4dfb-8c1a-](https://standards.iteh.ai/catalog/standards/sist/a2a37d5b-1855-4dfb-8c1a-8b9ed818746e/iec-61850-4-2011)

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 60848, *GRAFCET specification language for sequential function charts*

IEC 61082 (all parts), *Preparation of documents used in electrotechnology*

IEC 61175, *Industrial systems, installations and equipment and industrial products – Designation of signals*

IEC 61850-6, *Communication networks and systems for power utility automation – Part 6: Configuration description language for communication in electrical substations related to IEDs*

IEC 61850-7 (all parts), *Communication networks and systems for power utility automation – Part 7: Basic communication structure*

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

IEC 81346-1, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 1: Basic rules*

IEC 81346-2, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 2: Classification of objects and codes for classes*

3 Terms and definitions

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

3.1

supporting tools

those tools that support the user in the engineering, the operation and the management of the UAS and its IEDs

NOTE These tools are usually a part of the UAS.

3.1.1

engineering tools

tools that support the creation and documentation of the conditions for adapting an automation system to the specific plant (substation) and customer requirements

NOTE Engineering tools are divided into project management, configuration and documentation tools.

3.1.2

system specification tools

tools used to create a system requirement specification including the relation of system functions to the plant/substation to be managed; especially a tool creating a specification in a formally defined, standardized format for evaluation by other tools

3.1.3

system configuration tools

tools handling the communication between the IEDs in the system, configuration of issues common for several IEDs, and the logical association of the IED's functions to the process to be controlled and supervised

[IEC 61850-4:2011](https://standards.iteh.ai/catalog/standards/sist/a2a37d5b-1855-4dfb-8c1a-e8beac181824/iec-61850-4-2011)

NOTE See also "system parameters". <https://standards.iteh.ai/catalog/standards/sist/a2a37d5b-1855-4dfb-8c1a-e8beac181824/iec-61850-4-2011>

3.1.4

IED configuration tools

tools handling the specific configuration and download of configuration data to a specific IED of a specific type

3.2

expandability

criteria for the efficient extension of an automation system (hardware and functional) by use of the engineering tools

3.3

flexibility

criteria for the fast and efficient implementation of functional changes including hardware

3.4

scalability

criteria for a cost effective system while recognizing various functionalities, various IEDs, substation sizes and substation voltage ranges

3.5

parameters

variables which define the behaviour of functions of the automation system and its IEDs within a given range of values

3.5.1**system parameters**

data which define the interaction of IEDs in the system

NOTE System parameters are especially important in the:

- configuration of the system;
- communication between IEDs;
- marshalling of data between IEDs;
- processing and visualization of data from other IEDs (for example, at the station level).

3.5.2**IED parameters**

parameters defining the behaviour of an IED and its relation to the process

3.6**IED-parameter set**

all parameter values and configuration data needed for the definition of the behaviour of the IED and its adaptation to the substation conditions

NOTE Where the IED has to operate autonomously, the parameter-set can be generated without system parameters using an IED-specific parameterization tool. Where the IED is a part of the system, the parameter set may include the IED related or complete set of system parameters, which should be coordinated by a general parameterization tool at the system level.

3.7**UAS-parameter set**

all parameter values and configuration data needed for the definition of the behaviour of the overall UAS and its adaptation to the substation conditions

NOTE The parameter set includes the IED-parameter sets of all participating IEDs.

<https://standards.iteh.ai/catalog/standards/sist/a2a37d5b-1855-4dfb-8c1a-e8beac181824/iec-61850-4-2011>

3.8**remote terminal unit****RTU**

used as an outstation in a supervisory control and data acquisition (SCADA) system

NOTE An RTU may act as an interface between the communication network to the SCADA system and the substation equipment. The function of an RTU may reside in one IED or may be distributed.

3.9**UAS product family**

different IEDs of one manufacturer with various functionalities and with the ability to perform within utility automation systems

NOTE The IEDs of a product family are unified in relation to the design, the operational handling, the mounting and wiring conditions, and they use common or coordinated supporting tools.

3.10**UAS installation**

the concrete instance of a substation automation system consisting of multiple interoperable and connected IEDs of one or more manufacturers

3.11**configuration list**

overview of all instances of IEDs and other installed products of a system, their hardware and software versions including the software versions of relevant supporting tools

NOTE The configuration list also contains the configured communication connections and addresses.

3.12 configuration compatibility list

overview of all compatible hardware and software versions of components and IEDs, including the software versions of relevant supporting tools operating together in an UAS-product family

NOTE The configuration compatibility list also contains the supported transmission protocols and protocol versions for communication with other IEDs.

3.13 manufacturer

the producer of IEDs and/or supporting tools

NOTE A manufacturer may be able to deliver an UAS solely by use of his own IEDs and supporting tools (UAS product family).

3.14 system integrator

a turnkey deliverer of UAS installations

NOTE The responsibility of system integration includes the engineering, the delivery and mounting of all participating IEDs, the factory and site acceptance tests and the trial operation. The quality assurance, the maintenance and spare delivery obligations and the warranty are agreed in the contract between the system integrator and the customer. A system integrator may use IEDs from several different manufacturers.

3.15 system life cycle

the term has two specific meanings:

- a) for the manufacturer, the time period between the start of the production of a newly developed UAS product family and the discontinuation of support for the relevant IEDs;
- b) for the customer, the time period between the commissioning of the system installation and the decommissioning of the last IED of the system installation

3.16 test equipment

all tools and instruments which simulate and verify the input/outputs of the operating environment of the automation system such as switchgear, transformers, network control centres or connected telecommunication units on one side, and the communication channels between the IEDs of the UAS on the other side

3.17 conformance test

verification of data flow on communication channels in accordance with the standard conditions concerning access organization, formats and bit sequences, time synchronization, timing, signal form and level, reaction to errors

NOTE The conformance test can be carried out and certified for the standard or specially described parts of the standard. The conformance test should be carried out by an ISO 9001 certified organization or system integrator.

3.18 system test

validation of correct behaviour of the IEDs and of the overall automation system under various application conditions

NOTE The system test marks the final stage of the development of IEDs as part of a UAS product family.

3.19 type test

verification of correct behaviour of the IEDs of the automation system by use of the system tested software under the environmental test conditions corresponding with the technical data

NOTE This test marks the final stage of the hardware development and is the precondition for the start of the production. This test is carried out with IEDs that have been manufactured through the normal production cycle, and not with prototype HW.

**3.20
factory acceptance test
FAT**

customer agreed functional tests of the specifically manufactured system or its parts, using the parameter set for the planned application

NOTE This test is typically performed in the factory of the system integrator by the use of process simulating test equipment.

**3.21
site acceptance test
SAT**

verification of each data and control point and the correct functionality inside the automation system and between the automation system and its operating environment at the whole installed plant by use of the final parameter set

NOTE The SAT is a precondition for the automation system being put into operation.

**3.22
system requirements specification**

the specification of all requirements including functions, technical quality, and interfaces to the surrounding world

NOTE The requirement specification is typically supplied by the customer.

**3.23
system design specification**

a description of a system design showing how a system requirement specification is fulfilled with selected products, and how the required functions are implemented on them

NOTE The system design specification is typically provided by the system integrator.

4 Abbreviations

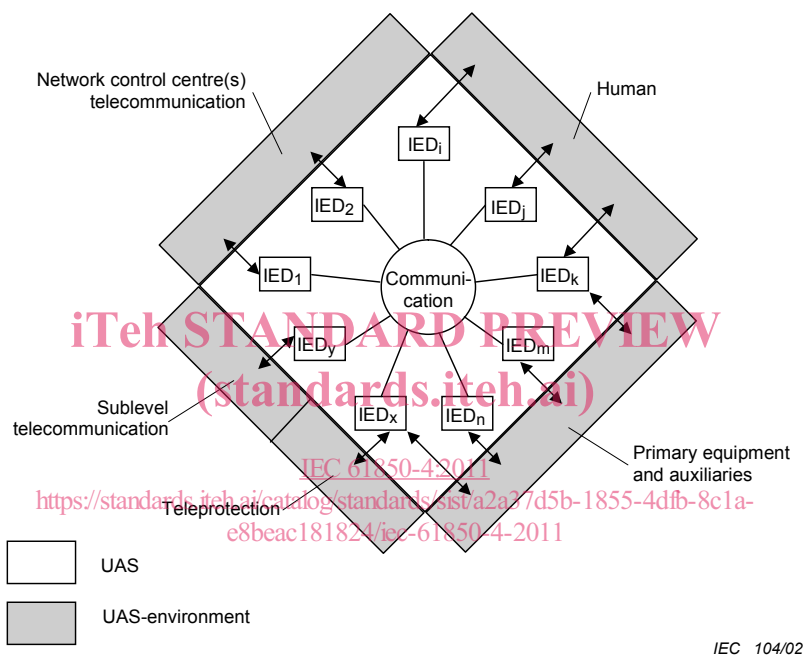
ASDU	application service data unit
CD ROM	compact disc read only memory
CAD	computer aided design
CT	current transformer
FAT	factory acceptance test
HMI	human machine Interface
IED	intelligent electronic device
PE	process environment
RTU	remote terminal unit
SAS	substation automation system
SAT	site acceptance test
SCADA	supervisory control and data acquisition
TE	telecommunication environment
UAS	utility automation system
VT	voltage transformer

5 Engineering requirements

5.1 Overview

The engineering of a utility automation system is based on a system requirement specification, which defines the scope, functions, boundaries and additional restrictions and requirements for the system, and includes:

- the definition of the necessary hardware configuration of the UAS: i.e. the definition of the IEDs and their interfaces with one another and to the environment as shown in Figure 1;
- the adaptation of functionality and signal quantities to the specific operational requirements by use of parameters;
- the documentation of all specific definitions (i.e. parameter set, terminal connections, etc.).



IEC 104/02

Figure 1 – Structure of the UAS and its environment

As shown in Figure 1, the UAS consists of different IEDs which communicate with each other via communication channels and which execute tasks concerning interactions with the environment of the automation system, such as:

- telecommunication environment (TE);
 - network control centre(s);
 - subordinate systems;
 - teleprotection;
- the human as a local operator;
- process environment (PE) like switchgear, transformer, auxiliaries.

Typical IEDs may be:

- for the telecommunication environment:
 - gateways;
 - converters;
 - RTUs (telecommunication side);

- protection relays (teleprotection side);
- for the human machine interface (HMI):
 - gateways;
 - personal computers;
 - workstations;
 - other IEDs with integrated HMIs;
- for the process environment (PE):
 - bay control units;
 - protection relays;
 - RTUs (process side);
 - meters;
 - autonomous controllers (i.e. voltage controllers);
 - transducers;
 - digital switchgear interface;
 - digital power transformer interface;
 - digital VTs and CTs.

5.2 Categories and types of parameters

5.2.1 Classification

Parameters are data, which control and support the operation of:

- hardware configuration (composition of IEDs);
- software of IEDs;
- process environment (primary equipment and auxiliaries);
- HMI with different supporting tools; and
- telecommunication environment

in an automation system and its IEDs in such a way that the operations of the plant and customer specific requirements are fulfilled.

The total set of parameters and configuration data of an UAS is termed the UAS-parameter set. It consists of the used parts of the parameter sets of all participating IEDs.

With respect to handling methods and input procedure, parameter set contents is divided into two categories:

- configuration parameters;
- operating parameters.

With respect to origin and function, the parameters are divided into types:

- system parameters;
- process parameters;
- functional parameters.

In Figure 2, the overview of the parameter structure is given.

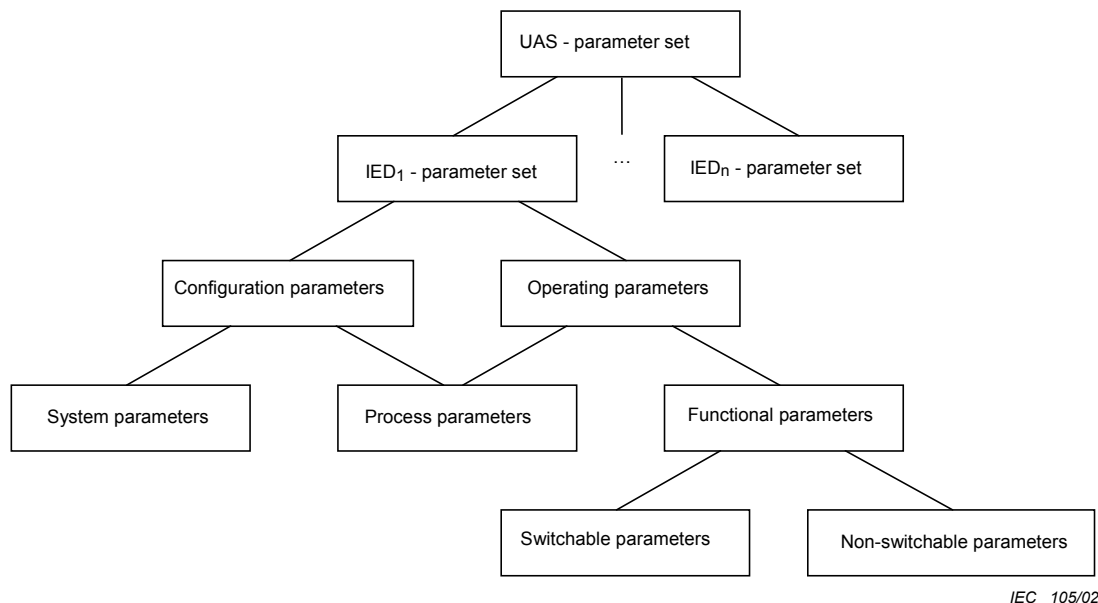


Figure 2 – Structure of UAS and IED parameters

The categories and types of parameters in Figure 2 are described below.

5.2.2 Parameter categories

5.2.2.1 Configuration parameters

The configuration parameters define the global behaviour of the whole UAS and its IEDs. As a rule, they are only assigned a value during the initial parameterization, but they should be updated when extending or functionally changing the UAS.

The generation and modification of the configuration parameters should be carried out off-line, i.e. separately from the operation of the automation system. During the input of configuration parameters, a temporary restriction of the system operation is allowed.

Observe that the term parameter in a more narrow sense means some variables, whose setting defines the wanted behaviour. System and IED configuration needs however often more than just setting of values. If we want to differentiate these different kinds of configuration, we talk about “configuration data” meaning more complex parameterizations, while “configuration parameters” means an adjustment by value setting alone.

The configuration parameters of an IED usually include system and process parameters. Observe that UAS configuration parameters are typically defined at system level. They contain or specify IED related system parameters.

5.2.2.2 Operating parameters

The operating parameters define the behaviour of partial functions of the system. They shall be changeable on-line during the normal operation of the system. The modification is allowed without restricting the system operation and within a framework of ranges of parameter values. Protection functions, as far as combined in IEDs with other functions, shall not be influenced during the parameterization of these functions.

The range and the basic settings of these parameters are determined at the initial parameterization or at a modification stage, separate from the operation of the system. The operating parameters can be put on-line into the system via:

- telecommunication interface;