

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



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

**Représentation de l'ingénierie de commande de processus – Demandes sous forme de diagrammes P&I et échange de données entre outils P&ID et outils PCE-CAE**



**THIS PUBLICATION IS COPYRIGHT PROTECTED**  
**Copyright © 2016 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 l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://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.

#### IEC Catalogue - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

#### IEC publications search - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

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 It also gives information on projects, replaced and withdrawn publications.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

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

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [csc@iec.ch](mailto:csc@iec.ch).

#### A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) 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 IEC

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

#### Catalogue IEC - [webstore.iec.ch/catalogue](http://webstore.iec.ch/catalogue)

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

#### Recherche de publications IEC - [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [csc@iec.ch](mailto:csc@iec.ch).

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Representation of process control engineering – Requests in P&I diagrams and data exchange between P&ID tools and PCF-CAE tools**

**Représentation de l'ingénierie de commande de processus – Demandes sous forme de diagrammes P&I et échange de données entre outils P&ID et outils PCE-CAE**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

ICS 25.040.40; 35.240.50

ISBN 978-2-8322-3477-8

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD.....	8
INTRODUCTION.....	10
1 Scope.....	12
2 Normative references.....	12
3 Terms and definitions .....	12
4 Abbreviations .....	17
5 Conformity.....	18
6 Representation of PCE requests in a P&ID.....	19
6.1 PCE request and PCE loop .....	19
6.2 Objectives and principles.....	20
6.3 Requirements for the reference designation and representation of PCE requests.....	20
6.3.1 General .....	20
6.3.2 Types of lines .....	21
6.3.3 Displaying the location of the operator interface.....	21
6.3.4 PCE categories and processing functions .....	22
6.3.5 PCE request reference designation system.....	25
6.3.6 PU-vendor and typical identification.....	26
6.3.7 Device information .....	26
6.3.8 Alarming, switching and indicating.....	27
6.3.9 Safety-relevant, GMP and quality-relevant PCE requests .....	27
6.3.10 PCE control functions.....	28
7 Neutral data exchange of PCE relevant P&ID information .....	29
7.1 Objectives.....	29
7.2 Meaning of P&ID elements .....	29
7.3 PCE relevant information on P&ID tools.....	30
7.4 Formal description of PCE relevant information of P&ID tools.....	31
7.4.1 General object model of a plant hierarchy.....	31
7.4.2 General object model of a PCE request.....	31
7.5 Modeling PCE relevant information using the CAEX system description language .....	32
7.5.1 Overview .....	32
7.5.2 Basic CAEX mappings .....	33
7.5.3 Standard CAEX library of PCE request related attributes .....	34
7.5.4 Mapping of indirect links between PCE requests of different plant sections.....	35
7.5.5 CAEX description of direct links between PCE requests of different plant sections.....	38
7.5.6 PCE loops.....	40
8 Additional PCE attributes .....	40
Annex A (normative) CAEX – Data model for machine information exchange .....	42
A.1 CAEX and its diagram conventions .....	42
A.2 General CAEX concepts.....	43
A.2.1 General CAEX terms.....	43
A.2.2 General CAEX concept description.....	46
A.2.3 Data definition of SystemUnitClass.....	50

A.2.4	Definition of attributes .....	52
A.2.5	Data definition of an AttributeType.....	54
A.2.6	Data definition of InterfaceClass.....	56
A.2.7	Data definition of RoleClass .....	59
A.2.8	Modelling of relations .....	60
A.2.9	Usage of paths.....	68
A.2.10	CAEX role concept.....	69
A.2.11	Use of the CAEX MappingObject .....	74
A.2.12	References to external CAEX files.....	76
A.3	CAEX schema definition .....	78
A.3.1	General .....	78
A.3.2	Element CAEXFile .....	79
A.3.3	CAEXFile/SuperiorStandardVersion.....	81
A.3.4	CAEXFile/ SourceDocumentInformation.....	81
A.3.5	CAEXFile/ExternalReference.....	82
A.3.6	CAEXFile/InstanceHierarchy .....	83
A.3.7	CAEXFile/InstanceHierarchy/InternalElement .....	84
A.3.8	CAEXFile/InterfaceClassLib .....	85
A.3.9	CAEXFile/InterfaceClass .....	86
A.3.10	CAEXFile/RoleClassLib.....	87
A.3.11	CAEXFile/RoleClass .....	88
A.3.12	CAEXFile/SystemUnitClassLib .....	89
A.3.13	CAEXFile/SystemUnitClass .....	90
A.3.14	CAEXFile/AttributeTypeLib .....	91
A.3.15	Group Header .....	93
A.3.16	CAEX complex type AttributeFamilyType .....	98
A.3.17	CAEX complex type AttributeFamilyType/AttributeType.....	99
A.3.18	CAEX complex type AttributeType .....	100
A.3.19	CAEX complex type CAEXBasicObject .....	108
A.3.20	CAEX complex type CAEXObject .....	109
A.3.21	CAEX complex type InterfaceClassType .....	110
A.3.22	CAEX complex type InterfaceFamilyType.....	113
A.3.23	CAEX complex type InternalElementType .....	115
A.3.24	CAEX complex type RoleClassType .....	123
A.3.25	CAEX complex type RoleFamilyType .....	125
A.3.26	CAEX complex type SourceDocumentInformationType.....	128
A.3.27	CAEX complex type SystemUnitClassType .....	129
A.3.28	CAEX complex type SystemUnitFamilyType.....	136
A.3.29	CAEX simpleType ChangeMode .....	138
Annex B (informative)	Examples of PCE requests.....	139
Annex C (normative)	Full XML schema of the CAEX model.....	149
Annex D (informative)	CAEX modelling examples .....	155
D.1	CAEX Attribute Type Library definition for additional attributes .....	155
D.2	Example of CAEX InterfaceLib definition .....	156
D.3	Example of a CAEX RoleLib definition .....	157
D.4	Example CAEX definition of PCE relevant P&ID information .....	158
Annex E (informative)	List of major changes and extensions of the second edition .....	163
Bibliography	.....	166

Figure 1 – Information flow between P&ID and PCE tool.....	11
Figure 2 – Organization of PCE requests.....	20
Figure 3 – General representation of a PCE-Request in a P&ID.....	21
Figure 4 – Multi-sensing element.....	21
Figure 5 – Local interface.....	22
Figure 6 – Manually operated switch in local control panel.....	22
Figure 7 – Pressure indication in central control room by a central control system.....	22
Figure 8 – Example of PCE request reference designation.....	26
Figure 9 – Example of flow measurement with indication in the CCR delivered by vendor A specified by typical identification A20.....	26
Figure 10 – Example of pH-measurement with indication in the CCR.....	26
Figure 11 – Example of flow measurement with indication in the CCR and high and low alarm.....	27
Figure 12 – Flow measurement with indication in the CCR and high alarm and a high-high switching function.....	27
Figure 13 – Flow measurement with indication in the CCR and a high-high switch limit, a high alarm, a low alarm and a low-low switch limit for a safety function.....	27
Figure 14 – GMP relevant, safety relevant and quality relevant flow measurement with indication in the CCR.....	28
Figure 15 – Control function.....	28
Figure 16 – Safety relevant control function.....	29
Figure 17 – P&ID elements and associations (PCE relevant items are shown in dark lines).....	30
Figure 18 – Process data model (PCE relevant items are shown in dark lines).....	31
Figure 19 – PCE request data model.....	32
Figure 20 – CAEX data model of major PCE request related attributes.....	35
Figure 21 – XML code of the attribute type library.....	35
Figure 22 – Example of two plant sections and a signal connection via external interfaces.....	36
Figure 23 – Simplified CAEX model of indirect links between PCE requests across different plant hierarchy items.....	37
Figure 24 – Simplified CAEX model of indirect links between PCE requests across different plant hierarchy items.....	38
Figure 25 – Example of two plant sections and a direct connection.....	39
Figure 26 – Simplified CAEX model of direct links between PCE requests across different sections of a plant.....	39
Figure 27 – XML code of the simplified CAEX model.....	40
Figure A.1 – XML text of the CAEX source document information.....	49
Figure A.2 – CAEX architecture of a SystemUnitClass.....	51
Figure A.3 – Example of a SystemUnitClassLib.....	51
Figure A.4 – XML code of the example of a SystemUnitClassLib.....	52
Figure A.5 – Examples of attributes.....	53
Figure A.6 – XML code of the example.....	54
Figure A.7 – Example of an AttributeTypeLib and its application in an instance hierarchy.....	55

Figure A.8 – XML code of the AttributeTypeLib example .....	55
Figure A.9 – Example of an InterfaceClassLib .....	56
Figure A.10 – XML code of the example of an InterfaceClassLib .....	57
Figure A.11 – Second example of an InterfaceClassLib and the usage of nested interfaces .....	57
Figure A.12 – XML code of the second example .....	58
Figure A.13 – Usage of Links .....	59
Figure A.14 – XML code for the usage of links.....	59
Figure A.15 – Example of a RoleClassLib.....	60
Figure A.16 – Relations in CAEX.....	61
Figure A.17 – XML description of the relations example.....	62
Figure A.18 – XML text of the InstanceHierarchy of the relations example.....	62
Figure A.19 – XML text of the SystemUnitClassLib of the relations example.....	62
Figure A.20 – Example of a parent-child-relation between CAEX InternalElements.....	63
Figure A.21 – Example for a hierarchical plant structure .....	63
Figure A.22 – Example of a parent-child relation between classes .....	64
Figure A.23 – Multiple crossed structures .....	67
Figure A.24 – Example for mirror attributes and restructured minor objects.....	67
Figure A.25 – CAEX role concept .....	70
Figure A.26 – CAEX data definition for use case 1.....	70
Figure A.27 – CAEX data definition for use case 2.....	71
Figure A.28 – CAEX data definition for use case 3.....	71
Figure A.29 – XML code for use case 3.....	72
Figure A.30 – Multiple role support.....	73
Figure A.31 – XML code of the multiple role support example .....	74
Figure A.32 – CAEX data definition of a MappingObject.....	75
Figure A.33 – XML code for the data definition of a MappingObject.....	76
Figure A.34 – Distribution of data in several CAEX files .....	77
Figure A.35 – Referencing of external CAEX files .....	77
Figure A.36 – XML code for referencing of external CAEX files .....	77
Figure A.37 – Example of how to use alias names .....	78
Figure A.38 – XML code for the alias example.....	78
Figure B.1 – Local level indication, 1 process connection.....	139
Figure B.2 – Local level indication, 2 process connections.....	139
Figure B.3 – Local flow indication.....	139
Figure B.4 – Local pressure indication.....	139
Figure B.5 – Local temperature indication.....	139
Figure B.6 – Local control panel, pressure indication, high alarm .....	140
Figure B.7 – Local temperature indication, CCR temperature high alarm .....	140
Figure B.8 – Local pressure indication, CCR pressure high alarm and switch .....	140
Figure B.9 – CCR flow indication, device information: Orifice Plate .....	140
Figure B.10 – CCR pressure indication, low, low low and high alarm.....	140
Figure B.11 – CCR temperature indication and registration .....	141

Figure B.12 – CCR level indication and registration, 1 process connection .....	141
Figure B.13 – CCR level indication, 2 process connections .....	141
Figure B.14 – Two flow indications and flow ratio control in CCR .....	141
Figure B.15 – CCR flow indication and high alarm, flow control, control valve with extra interlock and open/close indication .....	142
Figure B.16 – Local pressure indication, CCR pressure indication, high alarm and high high safety relevant switch; representation of transmitters with integrated local display (if not otherwise defined in a specification of the field device) .....	142
Figure B.17 – Local pressure indication, CCR pressure indication, alarms and switches .....	142
Figure B.18 – CCR pressure indication, high and low alarm, safety relevant switch action on on/off valve .....	143
Figure B.19 – Switched valve with on/off indication and switching action, safety relevant switched valve .....	143
Figure B.20 – Pressure restriction .....	143
Figure B.21 – Flow restriction .....	143
Figure B.22 – PT compensated flow control, safety-relevant pressure switch (two out of three (2oo3) shutdown), switched control valve with on/off indication and switching action at open position .....	144
Figure B.23 – CCR temperature control, additional manual switch actions from CCR with indication and local control panel .....	144
Figure B.24 – Motor typical, local on/off control, CCR off control, current, fault with alarm and running indication .....	145
Figure B.25 – Multivariable controller .....	145
Figure B.26 – On/off valve with position indication .....	146
Figure B.27 – On/off valve with safety relevant switch and position indication .....	146
Figure B.28 – Level control with continuous controller .....	146
Figure B.29 – Level control with on/off switch .....	146
Figure B.30 – Cascade control for temperature as control input, flow control as follow-up controller .....	147
Figure B.31 – Safety directed flow control to a subsequent valve, manual control for reset function and manual control for manual/automatic switch of the valve, valve with open/close indication and safety-relevant switch to subsequent valve .....	147
Figure B.32 – Flow control in CCR .....	147
Figure B.33 – Temperature control with high alarm and high switch .....	148
Figure B.34 – Manual control from CCR .....	148
Figure B.35 – Flow measurement with display and alarms in CCR, high high switch on process control function and switch on/off valve .....	148
Figure B.36 – Local P-/F-/T-/S- control without auxiliary power (stand-alone) .....	148
Figure C.1 – Full XML text of the CAEX Schema file “CAEX_ClassModel_V.3.0.xsd” .....	154
Figure D.1 – Attribute type library with additional PCE request related attributes .....	155
Figure D.2 – XML code of the Attribute type library .....	156
Figure D.3 – Example of CAEX interface library .....	156
Figure D.4 – XML code of the example CAEX interface library .....	156
Figure D.5 – Example CAEX role library illustrating the modeling of a PCE request role referencing PCE request related attributes .....	157
Figure D.6 – XML code for the example CAEX role library .....	158
Figure D.7 – Example P&ID data to be mapped with CAEX .....	159

Figure D.8 – CAEX model of the example described in Figure D.7 .....	160
Figure D.9 – XML code of the example described in Figure D.7 .....	162
Table 1 – Abbreviations .....	17
Table 2 – PCE categories .....	23
Table 3 – PCE processing function.....	24
Table 4 – Sequence combinations.....	25
Table 5 – PCE processing functions for final controlling equipments .....	25
Table 6 – P&ID attributes relevant in PCE environment.....	41
Table 7 – Data handling attributes.....	41
Table A.1 – XML notation conventions.....	42
Table A.2 – CAEX data types and elements.....	43

Currently in preview, click buy full version

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**REPRESENTATION OF PROCESS CONTROL ENGINEERING –  
REQUESTS IN P&I DIAGRAMS AND DATA EXCHANGE  
BETWEEN P&ID TOOLS AND PCE-CAE TOOLS**

## 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.
- 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 62424 has been prepared by IEC technical committee 65: Industrial-process measurement, control and automation.

This second edition cancels and replaces the first edition published in 2008. This edition constitutes a technical revision.

This second edition is a compatible extension of the first edition. The main changes and extensions are detailed in Annex E and are summarized below:

- a) updated definitions and new definitions;
- b) identification replaced with reference designation;
- c) updated PCE categories and process functions;
- d) CAEX version 3.0, introduction of:
  - native multiple role support;

- nested interfaces;
  - life cycle meta information;
  - a separate Attribute library;
  - updated examples;
- e) updated electronic data model of the PCE request:
- new normative attribute library for basic PCE request attributes;
  - new informative extended attribute library for further PCE request attributes;
  - new informative electronic data model for the PCE request.

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

CDV	Report on voting
65/544/CDV	65/560B/RVC

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.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## INTRODUCTION

Efficient process engineering requires highly sophisticated tools for the different needs of the involved work processes and departments. These engineering tools are normally specialized in Process Design (PD), in Process Control Engineering (PCE), etc. Therefore, a working interoperability is essential to optimize the engineering process in total. Thus, the definition of a harmonized interface and data management is a core task to ensure a smooth workflow during the whole project and to guarantee data consistency in the different tools.

This standard defines procedures and specifications for the exchange of PCE relevant data provided by the Piping and Instrumentation Diagram (P&ID) tool. The basic requirements for a change management procedure are described. A generally accepted technology for machine information exchange, the Extensible Markup Language (XML) is used. Hereby, a common basis is given for information integration.

However, a definition for uniform semantics is still necessary. CAEX (Computer Aided Engineering eXchange) as it is defined in this document is an appropriate data format for this purpose. This concept of data exchange is open for different applications.

The main task of a data exchange is transporting/synchronizing information from the P&ID database to the PCE databases and vice versa. The owner's reference designation system and a unique description of the processing requirement is the key for a unique identification. For detailed information about representation of PCE loops in P&IDs see Clause 6.

The data exchange system may be a stand-alone, vendor independent application or a module in an engineering environment. The data between a P&ID tool and a PCE tool and vice versa is exchanged via CAEX.

After the data exchange, there are three places where information about the plant is stored. Both the proprietary databases of the considered tools include private and common information. Both are stored at different places and in different divisions that are working on them. Hereby, the intermediate database CAEX only stores common information. In a wider approach, the intermediate database should store both common and private information. This becomes important if a third application is connected to the neutral database. If the intermediate database is used as a temporary data stream only (without storing the information in a file), the information will be lost after processing the data conciliation.

Figure 1 illustrates the information flow for the P&ID and the PCE database reconciliation. The data exchange is done via a neutral intermediate CAEX database, not directly from database to database. The intermediate CAEX database should be a file (for file based data exchange) or a stream (for network based data exchange). The term "CAEX database" within this standard has to be understood in this way, it does not denominate a database product as for example SQL.

Annex C of this standard contains the full XML schema of the CAEX Model. It is attached to this publication in XSD format.

NOTE Buyers of this publication can copy it for their own purposes only in the required amount.

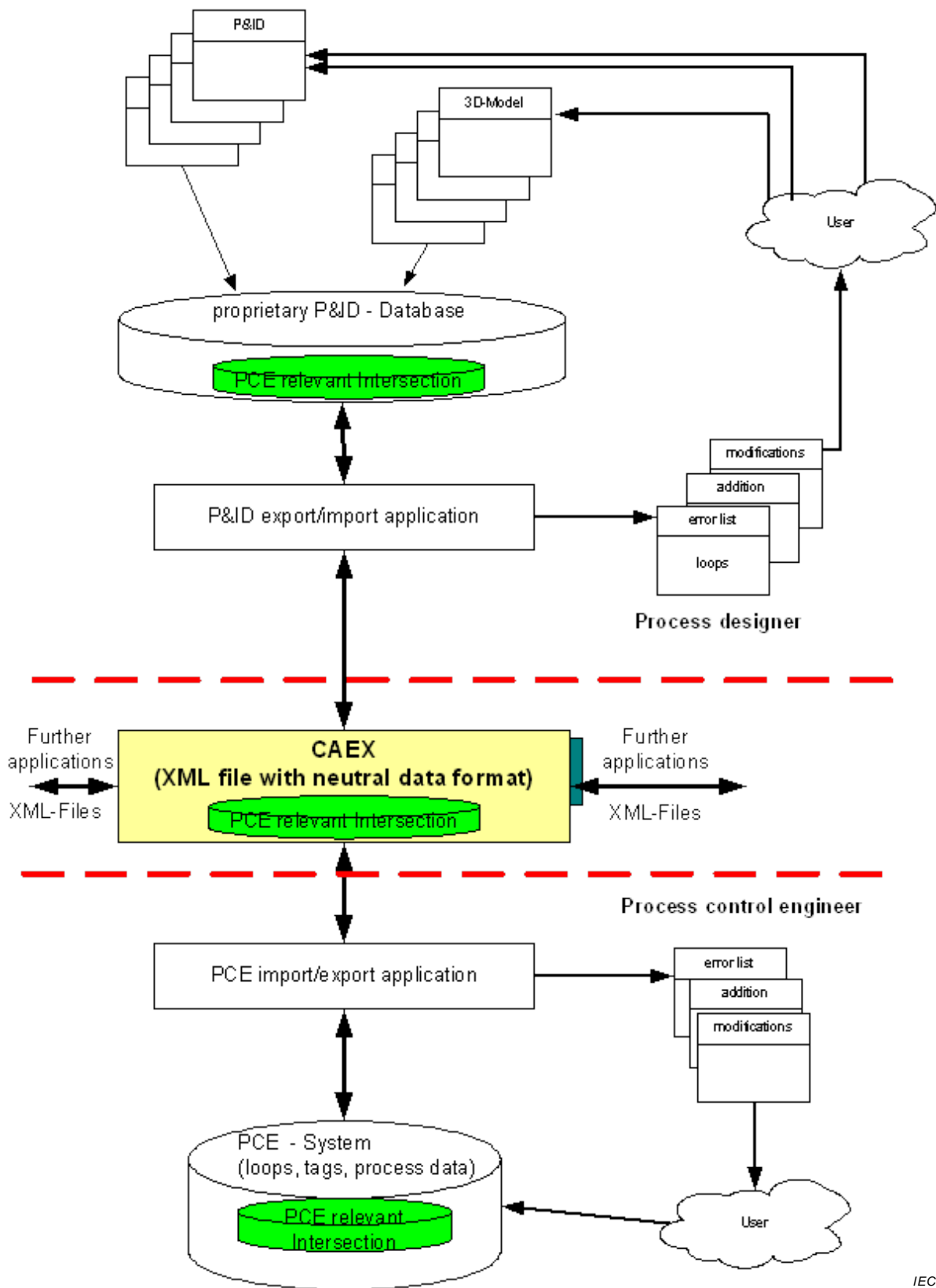


Figure 1 – Information flow between P&ID and PCE tool

# REPRESENTATION OF PROCESS CONTROL ENGINEERING – REQUESTS IN P&ID DIAGRAMS AND DATA EXCHANGE BETWEEN P&ID TOOLS AND PCE-CAE TOOLS

## 1 Scope

This International Standard specifies how process control engineering requests are represented in a P&ID for automatic transferring data between P&ID and PCE tool and to avoid misinterpretation of graphical P&ID symbols for PCE.

It also defines the exchange of process control engineering request relevant data between a process control engineering tool and a P&ID tool by means of a data transfer language (called CAEX). These provisions apply to the export/import applications of such tools.

The representation of the PCE functionality in P&IDs will be defined by a minimum number of rules to clearly indicate their category and processing function, independent from the technique of realization (see Clause 6). The definition of graphical symbols for process equipment (e.g. vessels, valves, columns, etc.), their implementation and rules for the reference designation system are not in the scope of this standard. These rules are independent from this standard.

Clause 7 specifies the data flow between the different tools and the data model CAEX.

## 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 61511-1, *Functional safety – Safety instrumented systems for the process industry sector – Part 1: Framework, definitions, system, hardware and application programming requirements*

IEC 81346-1:2009, *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations – Part 1: Basic rules*

ISO 13849-1, *Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*

*Extensible Markup Language (XML) 1.0 (Third Edition)*, W3C Recommendation 04 February 2004, available at <http://www.w3.org/TR/2004/REC-xml-20040204/>

## 3 Terms and definitions

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

### 3.1 actuator

functional unit that generates the manipulated variable, required to drive the final controlling element, from the output variable of the controlling element