IEC 62832-3

Edition 1.0 2020-10

INTERNATIONAL STANDARD

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Industrial-process measurement, control and automation – Digital Factory framework –
Part 3: Application of Digital Factory for life cycle management of production systems

Mesure, commande et automation dans les processus industriels – Cadre de l'usine numérique (Digital Factory) –
Partie 3: Application de l'usine numérique pour la gestion du cycle de vie de systèmes de production

IEC 62832-3:2020-10(en-fr)

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Part 3: Application of Digital Factory for life cycle management of production systems

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

FDIS	Report on voting
65/831/FDIS	65/842/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 of the IEC 62832 series, published under the general title, *Industrial-process measurement, control and automation – Digital Factory framework*, 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- withdrawn,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 62832 provides a framework used for establishing and maintaining the digital representations of production systems, including the representation of the elements of the production systems and of the relationships between these elements. The framework is intended also to support the exchange of information about these elements.

The framework aims at reducing the interoperability barriers for exchange of information for the various activities related to production systems. The main advantages of this method are that all information related to a production system is described in a standardized manner, and it can be used and modified through its entire life cycle. The method defined in IEC 62832 is kept as generic as possible in order to enable its use in several industrial sectors.

Manufacturers and suppliers provide information about available PS asset types by using electronic catalogues, which are based on commonly agreed data definitions (for instance IEC CDD, eCl@ss[1] and eOTD[2]). Such data definitions can be provided by standard organizations (like IEC CDD), by consortia (like eCl@ss e.V.) or by companies (like eOTD dictionaries).

The DF Framework provides a standardized approach, by defining the concepts of Libraries (i.e. SupplierLibraries and DFlibraries) and by defining basic rules for such Libraries.

The intention of this document is to provide a common base for implementation of the DF framework using different technologies (for example different engineering data formats). Proposals for such implementations are provided in Annex A.

IEC 62832-1 describes the general principles of the DF reference model together with its most important model elements. IEC 62832-2 specifies detailed requirements for model elements of the DF reference model. This part of IEC 62832 specifies the rules for using the DF framework.

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INDUSTRIAL-PROCESS MEASUREMENT, CONTROL AND AUTOMATION – DIGITAL FACTORY FRAMEWORK –

Part 3: Application of Digital Factory for life cycle management of production systems

1 Scope

This part of IEC 62832 specifies rules of the Digital Factory framework for managing information of a production system throughout its life cycle. It also defines how information will be added, deleted or changed in the DigitalFactory by the various activities during the life cycle of the production system.

These rules include:

– rules to represent a production system with a DigitalFactory;
– rules to represent a PS asset or a role with a DFasset;
– rules to represent a relationship between PS assets with a DFassetLink;
– rules to represent a relationship between roles with a DFassetLink;
– rules to represent the hierarchy of PS assets in a production system;
– rules to check the compatibility between associated PS assets.

NOTE 1 "PS" and "DF" are used in IEC 62832 (all parts) as qualifiers, they are part of the concept names. See IEC 62832-1:2020, Clause 3.

NOTE 2 Common rules are the base for the exchange of data between and within enterprises, between engineering tools, and between departments.

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 62832-1:2020, *Industrial-process measurement, control and automation – Digital Factory framework – Part 1: General principles*

IEC 62832-2:2020, *Industrial-process measurement, control and automation – Digital Factory framework – Part 2: Model elements*

ISO/IEC 6523 (all parts), *Information technology – Structure for the identification of organizations and organization parts*

3 Terms, definitions and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions as well as the abbreviated terms given in IEC 62832-1, IEC 62832-2 and the following apply.

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

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

3.2 Conventions

While IEC 62832-1 is using general names for describing the concepts, IEC 62832-2 and IEC 62832-3 define more formal requirements. In order to clearly identify the names of the model elements, IEC 62832-2 and IEC 62832-3 use 'PascalCase' for names.

A help for matching the names is provided in IEC 62832-2:2020, Table B.1.

4 General rules

4.1 Information about PS asset types

The description of a PS asset type is provided in a Library by means of a DFassetClass, which is derived from a DFassetClassDefinition in a ConceptDictionary. This relationship is documented by the "DFassetClassDefinition" reference in the header of the DFassetClass. The product characteristics are described by DataElements and CDELs, which commonly also are based on definitions from the same ConceptDictionary as the DFassetClassDefinition. If the used dictionary does not support description of all relevant product characteristics, additional DataElements and CDELs may be provided based on definitions from a different ConceptDictionary (e.g. from a different consortium or from the vendor) (see for example Figure 1).

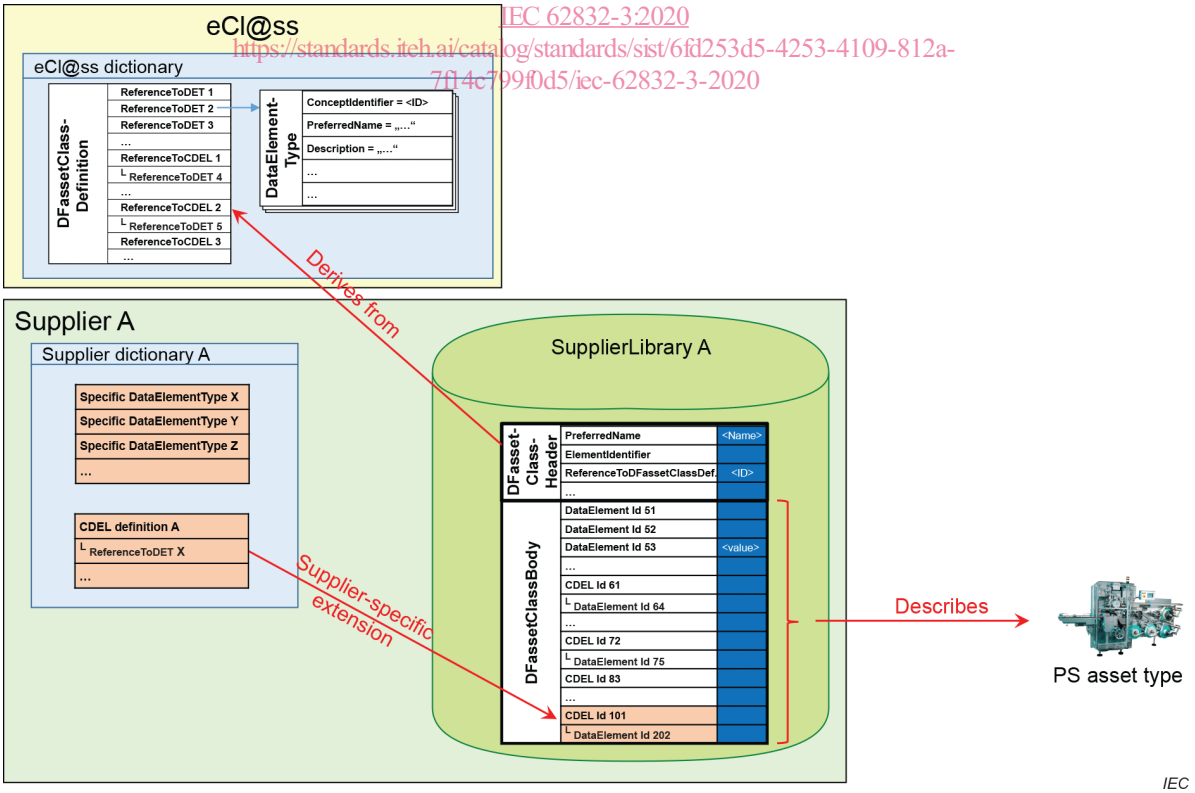

Figure 1 – Example for PS asset type description based on multiple dictionaries

4.2 Representation of a production system

A DigitalFactory shall be used to represent a production system (see Figure 2). The production system represented by a DigitalFactory may be a planned production system or an existing production system.

The granularity of the digital representation of the production system may vary depending on the intended purpose.

EXAMPLE For initial planning purposes, the DigitalFactory can contain DFassets representing the main components of the production systems, while for operation purposes the DFassets can describe sub-structures down to single devices or depending on criticality minor mechanical components (such as bolts and screws).

During the life cycle of the production system, the information in the DigitalFactory should change according to the changing production system.

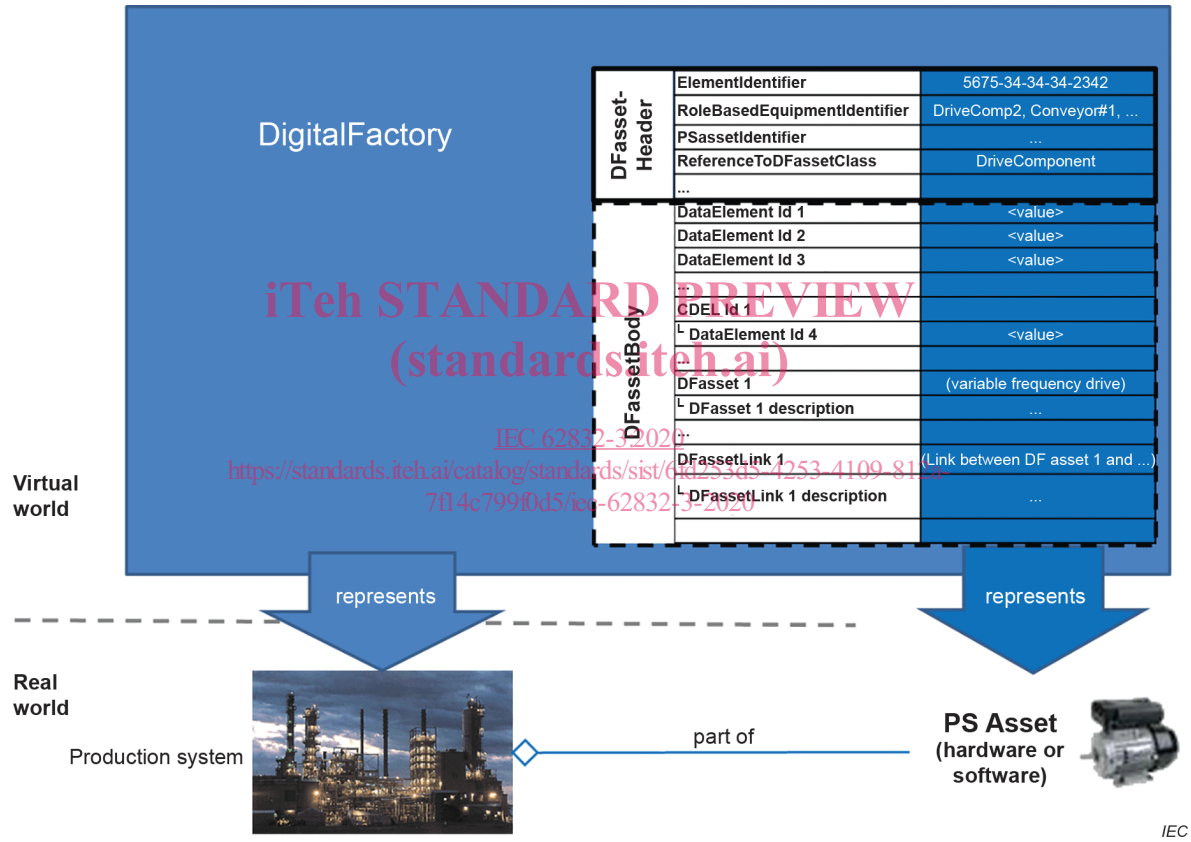

Figure 2 – Representation of a production system

4.3 Rules for CDELs and DataElements

4.3.1 General

A DFasset shall be used to represent a specific PS asset, a specific role or a specific PS asset with an assigned role. The particular aspects or features of a PS asset or role should be described with CDELs. Each CDEL collects all DataElements describing a specific feature (for example an interface, a part, an aspect) of the PS asset.

A DataElement shall contain the actual information describing a characteristic of a PS asset or of a role. DataElements shall be created based on DETs and CDELs shall be created based on CDELdefinitions.

A CDEL may contain at the same time DataElements with defined DataValues and DataElements with undefined DataValues. The method to leave DataValues of DataElements undefined shall be specified for each Library as well as for each DigitalFactory.

EXAMPLE Examples for methods to assign an undefined DataValue are: to keep the value empty; to define an invalid value; or to eliminate the value space from the DataElement.

4.3.2 Constant and variable DataElements

Depending on the intended use of a specific DataElement, it can be necessary to provide additional information together with the DataValue of the DataElement. In order to specify such requirements, a DataElementType shall be categorized by using DET category. The possible values of DET categories are "variable" and "constant". If a DET does not have a defined DET category, the value of DET category shall be considered as "constant".

DET that have a DET category of "constant" are called in this document "constant DET" and DET that have a DET category of "variable" are called "variable DET". DataElements that are derived from "variable DET" are called "variable DataElements", all other DataElements are called "constant DataElements".

If DataElements are ‘variable’, thenTimeStamp and ValueQuality shall be provided for the DataValue.

EXAMPLE Figure 3 shows an example for a constant DataElement ("max. temperature") and a variable DataElement ("measured temperature"). The "max. temperature" is defined for a PS asset type "temperature sensor". The DataValue does not change for the life time of the actual temperature sensor (PS asset). On the other hand, the actually measured temperature can change. This is why the DataElement is classified as variable DataElement.

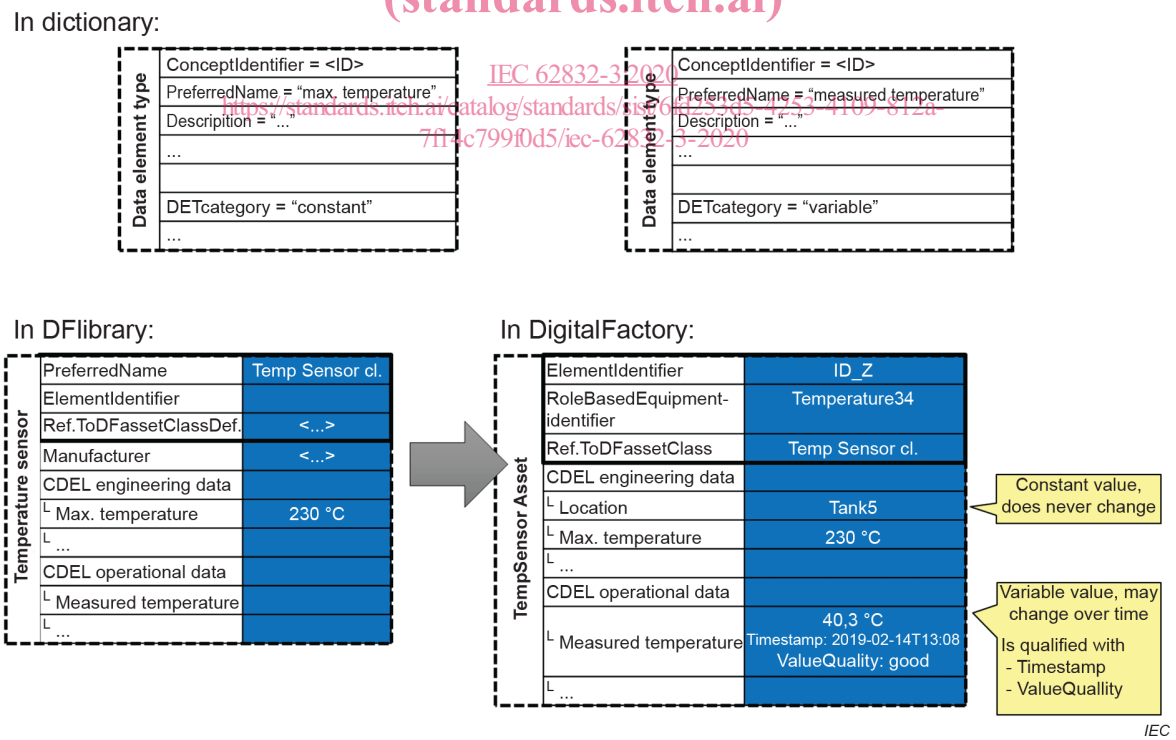

Figure 3 – Example for use of constant and variable DataElements

4.4 Filtering of information for different technical disciplines

4.4.1 General

A view is a set of information extracted from a search space. Different views of the information about the PS assets or roles reduce the complexity that is presented to the user. These views support operational activities to access, manage, and update the information. A given operational activity typically does not use all of the PS asset information.

It is possible to filter the information for a particular technical discipline or for a particular application aspect.

A technical discipline is defined as an area of technical expertise applied to a specific set of activities. A particular view may be provided for multiple technical disciplines, because activities which belong to different technical disciplines need to exchange the same common information.

For a particular activity, the view should be provided based on two aspects. The first aspect is what kinds of elements of information are shown in the view, and the second aspect is how those elements are associated in the view.

The first aspect is provided by filtering, and the second aspect is provided by supporting multiple views with different hierarchies. The DF framework provides support for the first aspect (filtering) but does not support the second aspect (organization of filtering results into views).

A particular application might be related to a tool processing information from a Library or from a DigitalFactory for a specific purpose.

If views are used to select only the relevant information, subsequent processing of this information can be executed more efficiently. This may be implemented by using a combination of multiple ViewElements.

4.4.2 Using ViewElements

ViewElements may be used to filter information from Libraries or in DigitalFactories (depending on the defined search space). This allows filtering information specific for a TechnicalDiscipline.

ViewElements may be used to select

– DFassetClasses,
– DFassetClassAssociations,
– DFassets,
– DFassetLinks,
– CDELs, and
– DataElements.

4.4.3 Providing ViewElements

ViewElements may be provided by data suppliers in SupplierLibraries or by the enterprise in DFlibraries.

The enterprise may provide ViewElements in a DFlibrary by

- importing them from SupplierLibraries, or
- creating them as filters for similar queries (e.g. for specific purposes or for a specific technical discipline).

When a ViewElement is provided, technical disciplines shall be used to specify the purpose of filtering.

4.4.4 Filtering information from a Library

In order to find a specific DFassetClass in a Library, a ViewElement shall be used. The Library can be filtered to find a DFassetClass derived from a specific DFassetClassDefinition, which has certain DataElements with specific values.

A ViewElement shall be used to define which information from the DFassetClasses is filtered from the Library. This helps comparing DFassetClasses.

EXAMPLE Selection of replacement for a failed asset.

To select assets replacing an existing asset, the replacement needs to fulfil all necessary requirements, even if the same PS asset type is no longer available on the market. Therefore, the new part needs to be selected by its technical parameters. The ViewElement is used to define the technical parameters for selection.

4.4.5 Filtering information from a DigitalFactory

A ViewElement shall be used to find a specific DFasset, DFassetLink or DFassetAssignment in a DigitalFactory.

A DFasset can be found, if it is derived from a specific DFassetClass and has certain DataElements with specific DataValues.

A DFassetLink can be found if it is derived from a specific DFassetClassAssociation.

5 Rules for dictionaries

5.1 General

ConceptDictionaries may have different structural organization and contents. A ConceptDictionaryEntry may define a DET, a CDELdefinition, or a DFassetClassDefinition.

The rules for defining DETs of a ConceptDictionary shall be specified by a data specification. Such a data specification defines for example the data types to be used in definition of the DETs.

Concept dictionaries should provide information regarding physical assets and information regarding roles.

EXAMPLE The IEC CDD is a repository of different dictionaries with different rules. The dictionary for IEC 61987 (all parts) provides DFassetClassDefinitions for role-based equipment information (as part of the OLOP). Other dictionaries in the IEC CDD do not provide such DFassetClassDefinitions.

Concept dictionaries may be owned and managed by a standardization body, a consortium, a data supplier or an enterprise.

5.2 Rules for consortia dictionaries and standardized dictionaries

Standardization bodies and classification consortia providing concept dictionaries shall be registered as a registration authority by registration authority identifiers defined by ISO/IEC 6523.

5.3 Rules for supplier dictionaries

If content of a SupplierLibrary cannot be interpreted based on standardized dictionaries or consortium dictionaries only, then a supplier dictionary that supports interpretation of the content of the SupplierLibrary shall be provided.

Every concept that is used in the SupplierLibrary and is not defined by existing concept dictionaries shall be defined by a ConceptDictionaryEntry in a corresponding supplier dictionary.

Data suppliers providing concept dictionaries shall be registered as a registration authority by registration authority identifiers defined by ISO/IEC 6523.

5.4 Rules for DFdictionary

A DFdictionary shall contain all ConceptDictionaryEntries necessary to interpret contents of the associated DFlibraries.

DFdictionaries shall be created by integrating copies of ConceptDictionaryEntries or by referencing to ConceptDictionaryEntries from standardized dictionaries, from consortium dictionaries or from supplier dictionaries.

When integrating a LibraryEntry (for example a DFassetClass) of a SupplierLibrary into a DFlibrary, it should be made sure that every concept used in the LibraryEntry is defined in the DFdictionary.

ConceptDictionaryEntries from multiple concept dictionaries specific to different domains or owned by different organizations may be integrated into or referenced from a DF dictionary, as long as the ConceptDictionaryEntries conform to the definitions of ConceptDictionaryEntries in IEC 62832-2. If a ConceptDictionaryEntry from a different ConceptDictionary is integrated into a DFdictionary, the ConceptIdentifier is not changed.

The enterprise providing concept dictionaries may or may not be registered as a registration authority by a registration authority identifier defined by ISO/IEC 6523.

5.5 Rules for DFassetClassDefinition

DFassetClassDefinitions including physical asset information and DFassetClassDefinitions for role-based equipment information should be provided in a concept dictionary.

A DFassetClassDefinition may define rules and/or structures for describing the physical asset information of a PS asset type, role-based equipment information, or both.

6 Rules for Libraries

6.1 Rules for SupplierLibraries

SupplierLibraries shall be used to provide information from the data supplier to the enterprise, including information about PS asset types that are used for production systems.

LibraryEntries in a SupplierLibrary shall be based on ConceptDictionaryEntries defined in concept dictionaries.

Information about a PS asset type shall be provided as a DFassetClass, based on a DFassetClassDefinition defined by a ConceptDictionary. The general rules defined in 6.3 apply to all DFassetClasses in SupplierLibraries.

EXAMPLE Examples for information about a PS asset type are information about the characteristics and structure of a PS asset type.

In order to provide information from the data supplier to the enterprise, ViewElements, DFassetClassAssociations, GenericAssociations and DataElementRelationships may be provided in SupplierLibraries.