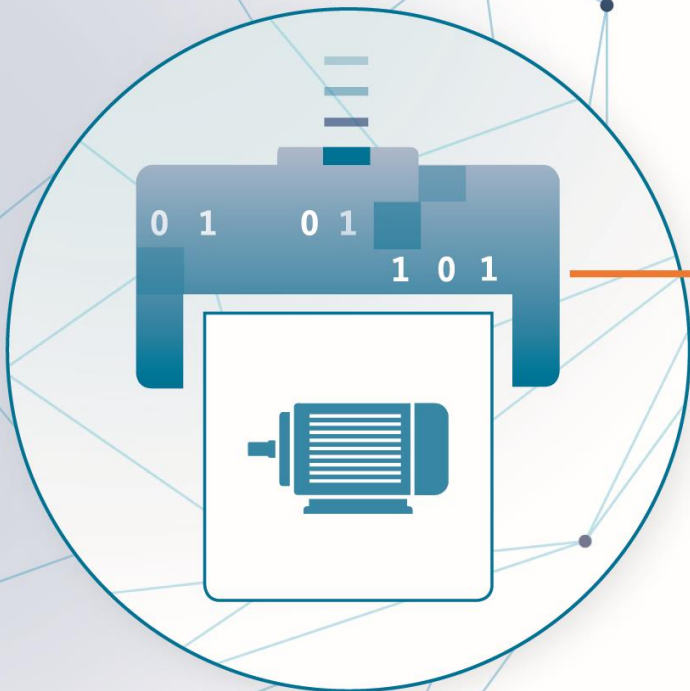


SPECIFICATION

# Submodel Templates of the Asset Administration Shell



**Submodel IDENTIFICATION**

- Serial Number

**Submodel TECHNICAL DATA**

- Max. Rotation Speed = 5000 [1/min]
- Max. Torque = 200 [Nm]
- Cooling Type = BAB657

**Submodel OPERATIONAL DATA**

- Rotation Speed = 4370 [1/min]
- Torque = 117.4 [Nm]

**Submodel DOCUMENTATION**

- Title = Operating Manual
- Digital File PDF → /aasx/OperatingManual.PDF
- Document Class ID = 03-02
- Document Class Name = Operating Manual

# Imprint

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Plattform Industrie 4.0; Anna Salari, designed by freepik (Title)

# 1 General

## 1.1 About this document

This document is a part of a specification series. Each part specifies the contents of a Submodel template for the Asset Administration Shell (AAS). The AAS is described in [1], [2], [3] and [6]. First exemplary Submodel contents were described in [4], while the actual format of this document was derived by the "Administration Shell in Practice" [5]. The format aims to be very concise, giving only minimal necessary information for applying a Submodel template, while leaving deeper descriptions and specification of concepts, structures and mapping to the respective documents [1] to [6]. Common terms and abbreviations can be found in [8].

The target audience of the specification are developers and editors of technical documentation and manufacturer information, which are describing assets in smart manufacturing by means of the Asset Administration Shell (AAS) and therefore need to create a Submodel instance with a hierarchy of SubmodelElements. This document especially details on the question, which SubmodelElements with which semantic identification shall be used for this purpose.

## 1.2 Scope of the Submodel

This Submodel template aims at interoperable provision of technical data describing the asset of the respective Asset Administration Shell. Central element is the provision of properties [7], ideally interoperable by the means of dictionaries such as ECLASS and IEC CDD (Common data dictionary).

The intended use-case is, that a manufacturer of industrial equipment describes assets (type or instance), which are provided to the market, by the means of technical data (properties), which are interoperable and unambiguously understood by the other market participants, such as system integrators or operators of industrial equipment. For providing individual industrial equipments to the market, also a supplier is covered by the use-case (for this purpose seen as functioning as manufacturer).

This Submodel template specifies a basic set of SubmodelElements in order to bring about the necessary information according to this use-case.

## 1.3 Relevant providers of Properties for the Submodel template

According [3], interoperable properties might be defined by standards, consortium specifications or manufacturer specifications. For the former two cases, so called dictionaries, repositories or classification systems exist in the market. In the further document, these entities are summarized by "property dictionaries" (see Terms and Definitions of [6]). Such property dictionaries include:

- **ECLASS**, see: <https://www.eclasscontent.com/>
- **IEC CDD**, see: <https://cdd.iec.ch/cdd/iec61987/iec61987.nsf> and <https://cdd.iec.ch/cdd/iec62683/cdddev.nsf>

## 2 Submodel for description by Technical Data of Industrial Equipment

### 2.1 Approach

A Submodel according to this Submodel template specification consists of four areas, represented by four SubmodelElementCollections:

- The **General Information** section contains information which gives minimal information about the provider of the industrial equipment and the equipment itself. The aim of the provided information is to allow recognizing, if the provided technical data fits to the particular asset. A minimal set of information is given to allow a value chain partner to order or re-order the industrial equipment from the manufacturer or a supplier. For further identification or managing ordering processes, suitable Submodels for Identification, Nameplate and business contact points shall be consulted.
- The **Product classification** sections treats the described asset (industrial equipment) as commercial product, which is brought into the market by the manufacturer. For the asset, a product classification is given. Multiple product classifications can be stated.  
The hereby provided information targets the product classification only; the provided information does not automatically imply, that certain sets of properties need to be given, that a completeness or coherency of these sets of properties exists, or that these are to be arranged in a specific structure.
- The **Technical Properties** section contains individual SubmodelElements detailing on technical data. Technical data may be comprised of information expressed via properties or by providing additional files containing information about the asset or any other kind of provision of information about technical data of the asset.  
For the structuring of these SubmodelElements, main and subsections can be defined. However, these sections serve mainly the purpose to structure the information for human readability. Ideally, the information provided by the SubmodelElements shall stand for itself and shall be unambiguously identified by the semanticIds of the SubmodelElements.  
In any case, the SubmodelElements can be structured according domains, aspects, groups or blocks described by the used property dictionary, such as eC@ss or IEC CDD. This structure is therefore domain specific and shall be defined by domain specific specifications, but will serve as sections for the technical properties, as well.
- The section for **Further Information** holds additional information, such as textual statements by the manufacturer and date of validity.

If possible, the Submodel utilizes the AAS provisions for multiple-language support. Specifically, the AAS LangStringSet data structure is used for accessing the description of SubmodelElements, the short und preferred names of ConceptDescriptions and the values of MultiLanguageProperties. By such provisions, the same technical data entities can be provided for multiple language domains required by multiple target markets of the industrial equipments and therefore fosters cross-relationships between these language domains for engineering and analytics.

Figure 1 shows, how such information might be rendered in a user application.

The screenshot displays the AASX Package Explorer interface for a submodel named "TechnicalData". The left pane shows a tree view of the submodel structure, including elements like "GeneralInformation", "ProductClassifications", "TechnicalProperties", and "FurtherInformation". The right pane shows the "Technical Data" viewer, which displays the asset ID "EEA-EX-200-S/47-Q3" and various technical properties such as "ManufacturerName", "ManufacturerLogo", "ManufacturerPartNumber", "ManufacturerOrderCode", "ProductImage01", "ProductImage02", "ClassificationSystem", "SystemVersion", "ProductClass", "Max.Current", "Freq.Range", "Nr.Phases", and "Current\_rating". The viewer also includes a table for "Dimensions" and "Electrical" properties, and a "Details" section.

Property	Semantics	Value
<b>Dimensions</b>		
Width	[[IRD]]0173-1#02-BAA019#004	200 mm
Height	[[IRD]]0173-1#02-BAA020#007	345 mm
Depth	[[IRD]]0173-1#02-BAG154#004	150 mm
<b>Electrical</b>		
Max.Current	(not available)	4 A
Freq.Range	(not available)	50..60 Hz
<b>Details</b>		
Nr.Phases	(not available)	3 Phases
Current_rating	(not available)	AC Current

The interface also shows a "Submodel" section on the left with a "Submodel element" and a "Submodel element" button. The bottom status bar indicates "AASX saved successfully" and "All rights reserved. 17-04-2020".

Figure 1 Screen shot of the AASX Package Explorer with Submodel "TechnicalData" of an example asset<sup>1</sup>, featuring multiple technical properties and visualization of the Submodel information via a specific plug-in "Technical Data Viewer"

<sup>1</sup> The classification of this example asset does not exist by intention

## 2.2 Attributes of the Submodel instance

For the Submodel instance, these important attributes need to be set:

<b>idShort:</b>	TechnicalData Note: The above idShort shall always be as stated.		
<b>Class:</b>	Submodel		
<b>semanticId:</b>	[IRI]http://admin-shell.io/ZVEI/TechnicalData/Submodel/1/1 Note: Version 1.0 was an informal version for the open source development		
<b>Parent:</b>	Asset Administration Shell with asset, which is an industrial equipment		
<b>Explanation:</b>	Submodel containing technical data of the asset and associated product classifications.		
<b>[SME type]</b>	<b>semanticId = [idType]value</b>	<b>[valueType]</b>	<b>card.</b>
<b>idShort</b>	<b>Description@en</b>	<b>example</b>	
[SMC] GeneralInformation	[IRI]https://admin-shell.io/ZVEI/TechnicalData/GeneralInformation/1/1 General information, for example ordering and manufacturer information.	n/a	1
[SMC] ProductClassifications	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ProductClassifications/1/1 Product classifications by association of product classes with common classification systems.	n/a	0..1
[SMC] TechnicalProperties	[IRI]https://admin-shell.io/ZVEI/TechnicalData/TechnicalProperties/1/1 Technical and product properties. Individual characteristics that describe the product and its technical properties.	n/a	1
[SMC] FurtherInformation	[IRI]https://admin-shell.io/ZVEI/TechnicalData/FurtherInformation/1/1 Further information on the product, the validity of the information provided and this data record.	n/a	0..1

## 2.3 SubmodelElements of General Information

The SubmodelElementCollection (SMC) described as follows contains the general information according to the approach in 2.1. The table convention is explained in Annex A.2.

<b>idShort:</b>	GeneralInformation Note: The above idShort shall always be as stated.		
<b>Class:</b>	SubmodelElementCollection (SMC)		
<b>semanticId:</b>	[IRI]https://admin-shell.io/ZVEI/TechnicalData/GeneralInformation/1/1		
<b>Parent:</b>	Submodel with idShort = TechnicalData.		
<b>Explanation:</b>	General information, for example ordering and manufacturer information.		
<b>[SME type]</b>	<b>semanticId = [idType]value</b>	<b>[valueType]</b>	<b>card.</b>
<b>idShort</b>	<b>Description@en</b>	<b>example</b>	
[Property] ManufacturerName	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ManufacturerName/1/1  Legally valid designation of the natural or judicial body which is directly responsible for the design, production, packaging and labeling of a product in respect to its being brought into the market.	[string]  Example Company	1
[File] ManufacturerLogo	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ManufacturerLogo/1/1  Imagefile for logo of manufacturer provided in common format (.png, .jpg).	MimeType = image/png  Value = /aasx/TechnicalData/logo.png	0..1
[MLP] ManufacturerProductDesignation	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ManufacturerProductDesignation/1/1  Product designation as given by the manufacturer. Short description of the product, product group or function (short text) in common language.  Note: Whenever possible, a multi-language definition is preferred.	[string]  Electrical energy accelerator  Electrical energy accelerator@en  Elektrischer Energie Beschleuniger@de	1
[Property] ManufacturerPartNumber	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ManufacturerPartNumber/1/1  Unique product identifier of the manufacturer for the product type respective the type designation of the industrial equipment.  Note: The Manufacturer part number is represented as a string, although often a numerical id.	[string]  A123-456	1

[Property] ManufacturerOrder Code	[IRI]https://admin- shell.io/ZVEI/TechnicalData/ManufacturerOrderCode/1/1  Unique product identifier of the manufacturer sufficient to order the exact same product.	[string]  EEA-EX-200-S/47- Q3	1
[File] ProductImage	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ProductImage/1/1  Image file for associated product provided in common format (.png, .jpg).	MimeType = image/jpg  Value = /aasx/TechnicalData / ProdFromTop.jpg	0..*

## 2.4 SubmodelElements of Product Classifications

The SubmodelElementCollection (SMC) described as follows contains an arbitrary number of product classification items according to the approach in clause 2.1. As these items are SMCs by themselves, these are described in a second table. The table convention is explained in Annex A.2.

<b>idShort:</b>	ProductClassifications  Note: The above idShort shall always be as stated.		
<b>Class:</b>	SubmodelElementCollection (SMC)		
<b>semanticId:</b>	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ProductClassifications/1/1		
<b>Parent:</b>	Submodel with idShort = TechnicalData.		
<b>Explanation:</b>	Product classifications by association with product classes in common classification systems.		
<b>[SME type]</b>	<b>semanticId = [idType]value</b>	<b>[valueType]</b>	<b>card.</b>
<b>idShort</b>	<b>Description@en</b>	<b>example</b>	
[SMC] ProductClassificatio nItem{00}	[IRI]https://admin- shell.io/ZVEI/TechnicalData/ProductClassificationItem/1/1  Single product classification item by association with product class in a particular classification system or property dictionary.		0..*



The classification items themselves are defined by the following table. The table convention is explained in Annex A.2.

<b>idShort:</b>	ProductClassificationItem{00}		
<b>Class:</b>	SubmodelElementCollection (SMC)		
<b>semanticId:</b>	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ProductClassificationItem/1/1		
<b>Parent:</b>	SubmodelElementCollection with idShort = ProductClassifications.		
<b>Explanation:</b>	Single product classification by association with product class in a particular classification system or property dictionary.		
<b>[SME type]</b>	<b>semanticId = [idType]value</b>	<b>[valueType]</b>	<b>card.</b>
<b>idShort</b>	<b>Description@en</b>	<b>example</b>	
[Property] ProductClassificationSystem	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ProductClassificationSystem/1/1  Common name of the classification system.  Note: Examples for common names for classification systems are "ECLASS" or "IEC CDD".	[string]  ECLASS  or:  IEC CDD	1
[Property] ClassificationSystemVersion	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ClassificationSystemVersion/1/1  Common version identifier of the used classification system, in order to distinguish different version of the property dictionary.  Note: Casing is to be ignored.	[string]  9.0 (BASIC)	0..1
[Property] ProductClassId	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ProductClassId/1/1  Class of the associated product or industrial equipment in the classification system. According to the notation of the system.  Note: Ideally, the Property/valueId is used to reference the IRI/IRDI of the product class.	[string]  27-01-88-77  or:  0112/2///61987# ABA827#003	1

## 2.5 SubmodelElements of Technical Properties

The SubmodelElementCollection (SMC) described as follows contains the actual technical properties according to the approach in 2.1. The property instances are given by individual SubmodelElements (see [6][7]). There is no structural distinction between properties of different classification systems, as they can easily be identified by checking the heading part of the IRI or IRDI identifier of the semanticId.

Note: The property dictionary is not separated per property, but can be identified by inspection the property identification.

Properties, which are part of manufacturer specifications and consortium specification (see [3]) are supported as well, as the set of suitable semanticIds is not restricted. Even SubmodelElements without distinctive semanticId are supported by providing a reserved ConceptDescription named "SemanticIdNotAvailable".

For structuring the information elements for human readability, main sections and sub sections are supported by a distinguished ConceptDescriptions. These sections can be introduced by the provider of the information (manufacturer)

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to group elements into easy perceivable parts (see screenshot in clause 2.1). These sections do not imply consequences for the machine understanding of the information. If, however, aspects, groups or blocks are required by the particular property dictionary, such as eC@ss or IEC CDD, these elements can be introduced by SubmodelElementCollection with semanticId to that block or other respective entity, as well.

The table convention is explained in Annex A.2.

<b>idShort:</b>	TechnicalProperties Note: The above idShort shall always be as stated.		
<b>Class:</b>	SubmodelElementCollection (SMC)		
<b>semanticId:</b>	[IRI]https://admin-shell.io/ZVEI/TechnicalData/TechnicalProperties/1/1		
<b>Parent:</b>	Submodel with idShort = TechnicalData.		
<b>Explanation:</b>	Individual characteristics that describe the product (industrial equipment) and its technical properties.		
<b>[SME type]</b>	<b>semanticId = [idType]value</b>	<b>[valueType]</b>	<b>card.</b>
<b>idShort</b>	<b>Description @en</b>	<b>example</b>	
[SME] {arbitrary}	semanticId = {arbitray} but defined in a classification system Arbitrary SubmodelElement with semanticId possibly referring to a ConceptDescription can be used within the Technical Properties.	Width@en= 32 [mm]	0..*
[SME] {arbitrary}	[IRI]https://admin-shell.io/SemanticIdNotAvailable/1/1 Represents a SubmodelElement that is not described using a common classification system, a consortium specification, an open community standard, a published manufacturer specification or such.  Note: The idShort of the SubmodelElement can be named accordingly. Constraints concerning the usable characters for idShort shall be respected.  Note: Only perceivable by human understanding.  Note: The special case of SME being a SMC is accepted, will be rendered as MainSection/ SubSection accordingly.	[string] Length	0..*
[SMC] MainSection{00}	[IRI]https://admin-shell.io/ZVEI/TechnicalData/MainSection/1/1 Main subdivision possibility for properties.  Note: Each Main Section SMC may contain arbitray sets of SubmodelElements, SemanticIdNotAvailable, SubSection.	Electrical	0..*
[SMC] SubSection{00}	[IRI]https://admin-shell.io/ZVEI/TechnicalData/SubSection/1/1 Subordinate subdivision possibility for properties.  Note: Each Sub Section SMC may contain arbitray sets of SubmodelElements, SemanticIdNotAvailable, SubSection.	Details	0..*

	Note: In the hierarchy of SubmodelElements, a MainSection shall be super-ordinate to the SubSection.		
--	--	--	--

## 2.6 Display names for sections and properties with no semanticId available

For displaying property names in a user interface, the following precedence of display names shall be maintained:

Priority	Concept in AAS metamodel	Description
1 (highest)	SubmodelElement/description	<p>If available, an adequate language will be chosen from the LangStringSet of description. Thus, the user explanation of the property by the SubmodelElement will overrule the definition of the ConceptDescription by the semanticId.</p> <p>Note: In a future version of the AAS metamodel, a distinctive "DisplayName" will be available and will substitute the use of description.</p> <p>Note: If a user or application requests a preferred language, then this language shall be used; default is English (en).</p>
2	ConceptDescription/preferredName	<p>If available, an adequate language will be chosen from preferred name.</p> <p>Note: The user interface is recommended to be capable of handling presentation of at least 50 characters.</p> <p>Note: If a user or application requests a preferred language, then this language shall be used; default is English (en).</p>
3	ConceptDescription/shortName	<p>As above, but shorter definition.</p> <p>Note: If a user or application requests a preferred language, then this language shall be used; default is English (en).</p>
4 (lowest)	SubmodelElement/idShort	<p>If only available, the idShort shall be presented.</p> <p>Note: This is usually not language adequate and the least user orientation presentation.</p>

Note: Consequently, for editors of instances of this Submodel Template, the following procedure is recommended to be applied:

- (i) Whenever possible, include a ConceptDescription within the AAS with speaking elaboration of preferredName, shortName and definition.
- (ii) If no ConceptDescription could be provided (no semanticId, that is, no formal conceptualization of the property could be given to the user), a speaking explanation shall be provided by SubmodelElement/description.
- (iii) in any case, a short but speaking, unique idShort for the SubmodelElement shall be chosen, respecting the allowed characters (regex definition: [a-zA-Z0-9\_-]+)

## 2.7 SubmodelElements of Further Information

The SubmodelElementCollection (SMC) described as follows contains some further information according to the approach in 2.1. The table convention is explained in Annex A.2.

<b>idShort:</b>	FurtherInformation Note: The above idShort shall always be as stated.		
<b>Class:</b>	SubmodelElementCollection (SMC)		
<b>semanticId:</b>	[IRI]https://admin-shell.io/ZVEI/TechnicalData/FurtherInformation/1/1		
<b>Parent:</b>	Submodel with idShort = TechnicalData.		
<b>Explanation:</b>	Further information on the product, the validity of the information provided and this data record.		
<b>[SME type]</b>	<b>semanticId = [idType]value</b>	<b>[valueType]</b>	<b>card.</b>
<b>idShort</b>	<b>Description@en</b>	<b>example</b>	
[MLP] TextStatement{00}	[IRI]https://admin-shell.io/ZVEI/TechnicalData/TextStatement/1/1 Statement by the manufacturer in text form, e.g. scope of validity of the statements, scopes of application, conditions of operation. Note: Whenever possible, a multi-language definition is preferred.	[string] Restricted use Restricted use@en Eingeschränkter Geltungsbereich@de	0..*
[Property] ValidDate	[IRI]https://admin-shell.io/ZVEI/TechnicalData/ValidDate/1/1 Denotes a date on which the data specified in the Submodel was valid from for the associated asset. Note: Often this date will be the date of the last update of the corresponding data, that are the source for the technical properties section in the master data system.	date	1

# Annex A. Explanations on used table formats

## 1. General

The used tables in this document try to outline information as concise as possible. They do not convey all information on Submodels and SubmodelElements. For this purpose, the definitive definitions are given by the following annex in form of an XML mapping of the Submodel template and its elements.

## 2. Tables on Submodels and SubmodelElements

For clarity and brevity, a set of rules is used for the tables for describing Submodels and SubmodelElements.

- The tables follow in principle the same conventions as in [5].
- The table heads abbreviate 'cardinality' with 'card'.
- The tables often place two informations in different rows of the same table cell. In this case, the first information is marked out by sharp brackets [] from the second information. A special case are the semanticIds, which are marked out by the format: (type)(local)[idType]value.
- The types of SubmodelElements are abbreviated:

SME type	SubmodelElement type
Property	Property
MLP	MultiLanguageProperty
Range	Range
File	File
Blob	Blob
Ref	ReferenceElement
Rel	RelationshipElement
SMC	SubmodelElementCollection
SME, SubmodelElement	SubmodelElement

- If an idShort ends with '{00}', this indicates a suffix of the respective length (here: 2) of decimal digits, in order to make the idShort unique. A different idShort might be chosen, as long as it is unique in the parents context.
- The Keys of semanticId in the main section feature only idType and value, such as: [IRI]https://admin-shell.io/vdi/2770/1/0/DocumentId/Id. The attributes "type" and "local" (typically "ConceptDescription" and "(local)" or "GlobalReference" and (no-local)) need to be set accordingly; see [6].
- If a table does not contain a column with "parent" heading, all represented attributes share the same parent. This parent is denoted in the head of the table.
- Multi-language strings are represented by the text value, followed by '@'-character and the ISO639 language code: example@EN.
- The [valueType] is only given for Properties.

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