

IDTA 02012-1-0

Information Model for P&I Diagrams based on DEXPI Standard

September 2023

SPECIFICATION

Submodel Template of the
Asset Administration Shell



Submodel Template

IDTA approved

- 100% AAS compliant
- Consistent & interoperable
- Released by the AAS experts

Imprint

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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].

The target group of the specification are developers and engineers designing processes and plants and creating 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 the question, which SubmodelElements with which semantic identification shall be used for this purpose.

1.2 Scope of the Submodel

The engineering of a process plant is a complex multi-disciplinary and multi-organizational process involving exchange of a vast number of (semi-)standardized artifacts like diagrams, drawings, tables, certificates, and other documents.

One core artifact which is created and extended during the engineering process is the Piping & Instrumentation Diagram (P&ID) providing among others a good balance of abstraction between the physical layout of the plant (i.e., used equipment and piping connections) and its representation within the automation domain (i.e., signal types, tag names, logical connections between sensor and actuators). Due to this fact P&IDs are long-living artifacts which are frequently used during the whole plant's lifecycle beyond the engineering phase [7].

Even though most engineering artifacts are created digitally, they are not necessarily exchanged in a machine-readable format. The lack of a machine-readable representation of engineering artifacts (including P&IDs) hinders the digital transformation and can be a showstopper for digital use-cases due to high costs of creation of a machine-readable P&ID representation.

Efforts to create a standardized machine-readable exchange format for P&ID are made by the DEXPI working group of DECHEMA including operators from multiple verticals (e.g., Oil and Gas, and Chemistry), engineering companies, software tool vendors and research institutes. DEXPI [8] is an UML-Model implemented using an XML-based P&ID exchange format including multiple aspects of plant design like piping topology and its graphical representation, instrumentation structure, tag names. DEXPI is an open industrial standard aiming for a broad usage across industrial domains.

Due to the paramount role of P&ID during the whole plant's lifecycle, the importance of DEXPI has been identified by the Industry 4.0 community. Inclusion of DEXPI models into a standardized lifecycle information container – the Industry 4.0 Asset Administration Shell (AAS) – would facilitate links between different disciplines, organizations and industry domains. Mapping of DEXPI models to the AAS by defining an AAS Submodel template is governed by Industrial Digital Twin Association (IDTA) where a respective working group was founded in 2022. The group consists of representatives of the DEXPI working group, oil and gas industry, engineering and procurement companies, automation equipment suppliers, and research institutes.

1.3 Relevant standards for the Submodel template

DEXPI specification version 1.3 [8]

ISO 10209

IEC 62264

ISA 106

1.4 Use cases, requirements and design decisions

1.4.1 UC1: DEXPI Handover

The first use case for the Submodel is the handover of the P&ID Information Models, encoded as DEXPI. One especial gap in the existing DEXPI specification is the lack of possibility to bundle multiple DEXPI files into one package. This is explicitly made possible by the present Submodel template definition.

In case of combining multiple DEXPI models within one AAS Submodel, we assume that the DEXPI models share the same plant (segment) they are describing.

1.4.2 UC2: Local-Global Identifier Translation

DEXPI as a P&ID specification contains valuable information, particularly the plant structure, which are relevant through the whole lifecycle of the plant especially during the operational phase. In addition, tag names for used equipment and details for its use in automation applications. In use case 2 the plant structure usually developed in basic engineering is used to systematically generate a (not yet existent) Role-AASs (cf. ¹ for more information) used to further specify the apparatus/machines, piping and automation equipment in detail engineering to procure and construct the plant.

Like other artifacts, DEXPI files are using local, i.e., file-unique, identifiers which DEXPI inherits from its current serialization format ProteusXML. These local element identifiers tend to change over time and there is also no warranty that there is no duplication of local IDs between different DEXPI models in one AAS Submodel (note that persistent IDs are planned in the upcoming DEXPI release 1.4 and will be incorporated in a future version of this Submodel template). To prevent the possible overlaps between local identifiers, a set of stable references is needed which are guaranteed not to change over time and also to be unique in a larger context (ideally, globally). These stable references pave a way to a set of use-cases which is described in NAMUR position papers on AAS usage in process industries^{1 2}.

1.4.3 Design Decisions

- No altering of the DEXPI standard. Identified points (e.g., missing stable identifiers, or missing possibility to package multiple DEXPI models) were communicated to the DEXPI working group.
- Use of ISO 10209 to identify plant hierarchy levels, in case of redundant hierarchy definitions, e.g., ISO 10209 Plant Section and ISA-style Unit, within the DEXPI file, the latter should be ignored, and ISO 10209 be preferred. In case no ISO 10209 attribute is available, ISA-style attributes should be renamed and their values reused as indicated in the figure below.

¹ https://www.namur.net/fileadmin/media_www/Dokumente/AK_POSITION_1.4_Verwaltungsschale-in-der-Prozessindustrie_Arten_EN_2023-05-03.pdf

² https://www.namur.net/fileadmin/media_www/Dokumente/AK_POSITION_1.4_Verwaltungsschale_Use-Cases_EN_2023-05-03.pdf

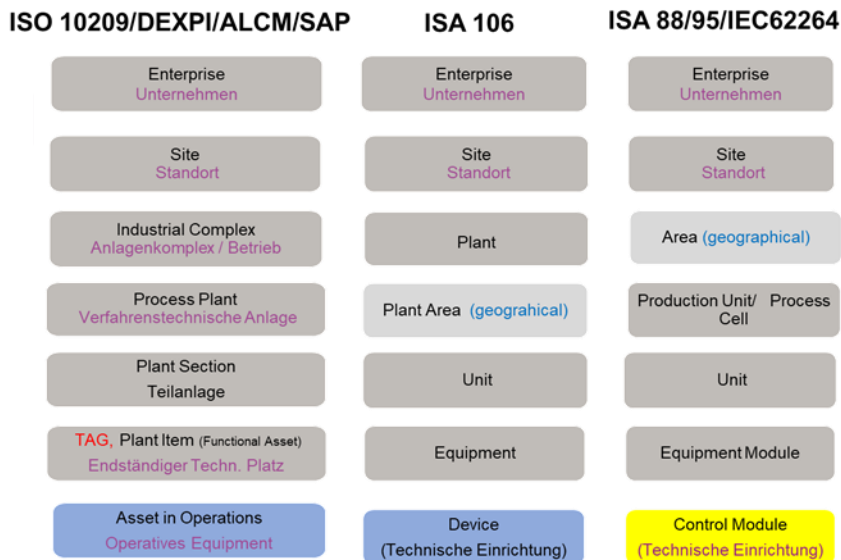


Figure 1: Alignment of hierarchical structure elements according to different standards

- Re-modeling of the DEXPI standard should happen as “sparse” as possible to avoid double-modeling and allow best-possible reuse of existing tools. In case double-modeling is required, common patterns from existing IDTA Submodel definitions should be used, i.e.,
 - FragmentReference mechanisms as already used and described in the MTP Submodel template definition³.
 - Usage of existing Submodels, e.g., the “Hierarchical Structure enabling Bills of materials” Submodel template ID 02011⁴ to represent/reference a hierarchy of plant segments which are described by the DEXPI file.
- Reuse semantic IDs for elements included in the DEXPI standard, for example, meta data properties. This applies for semantic IDs where IRIs starting with “http://sandbox.dexpi.org/rdl/” or IRDIs are reused where applicable.
- Slight extensions plant metadata attribute selection of the DEXPI specification to keep logical information combined, e.g., EnterpriseReference property along with EnterpriseName property.

³ <https://github.com/admin-shell-io/submodel-templates/tree/main/published/MTP/1/0>

⁴ To be found under <https://industrialdigitaltwin.org/en/content-hub/submodels> after publishing

2 DEXPI Submodel

2.1 Approach

The approach for building the Submodel is as follows: First, we partition the meta-data properties of the DEXPI model into:

- Plant Metadata – attributes describing the actual plant (segment), and
- Model Metadata – attributes related to the particular DEXPI model, e.g., the drawing title.

The plant metadata is linked directly to the root of the Submodel and is hence shared between different DEXPI models representing P&IDs which are supplied using the Submodel.

Each supplied model is represented via a dedicated SMC. The SMC contains a container for model metadata, the actual model file, i.e., DEXPI model in the XML serialization, an optional model representation, e.g., an SVG file, and an optional mapping directory containing mappings between local and global identifiers.

Note that the Submodel can contain multiple DEXPI models sharing the same plant metadata which closes the gap of supplying a “bundle” of coherent DEXPI models in one information package (compare UC 1).

The aim of the mapping directory is to create a reference between a locally identifiable element within the DEXPI model, e.g., a tagged element to an AssetId which can in a further step be resolved to one or many AASs supplying additional information on the DEXPI element, e.g., its requirements. This approach closes the gap of potentially non-unique and non-stable local Ids within the DEXPI file (originating from ProteusXML) specification (compare UC 2). The stable references are realized by common fragment reference techniques within the AAS information model.

Additionally, ReferenceElements can be included within the plant metadata to contain reference elements pointing to Entity objects contained in other Submodels, e.g., in a BOM Submodel. These references can be used to resolve used plant hierarchy elements to respective Entities within Industry 4.0 domain.

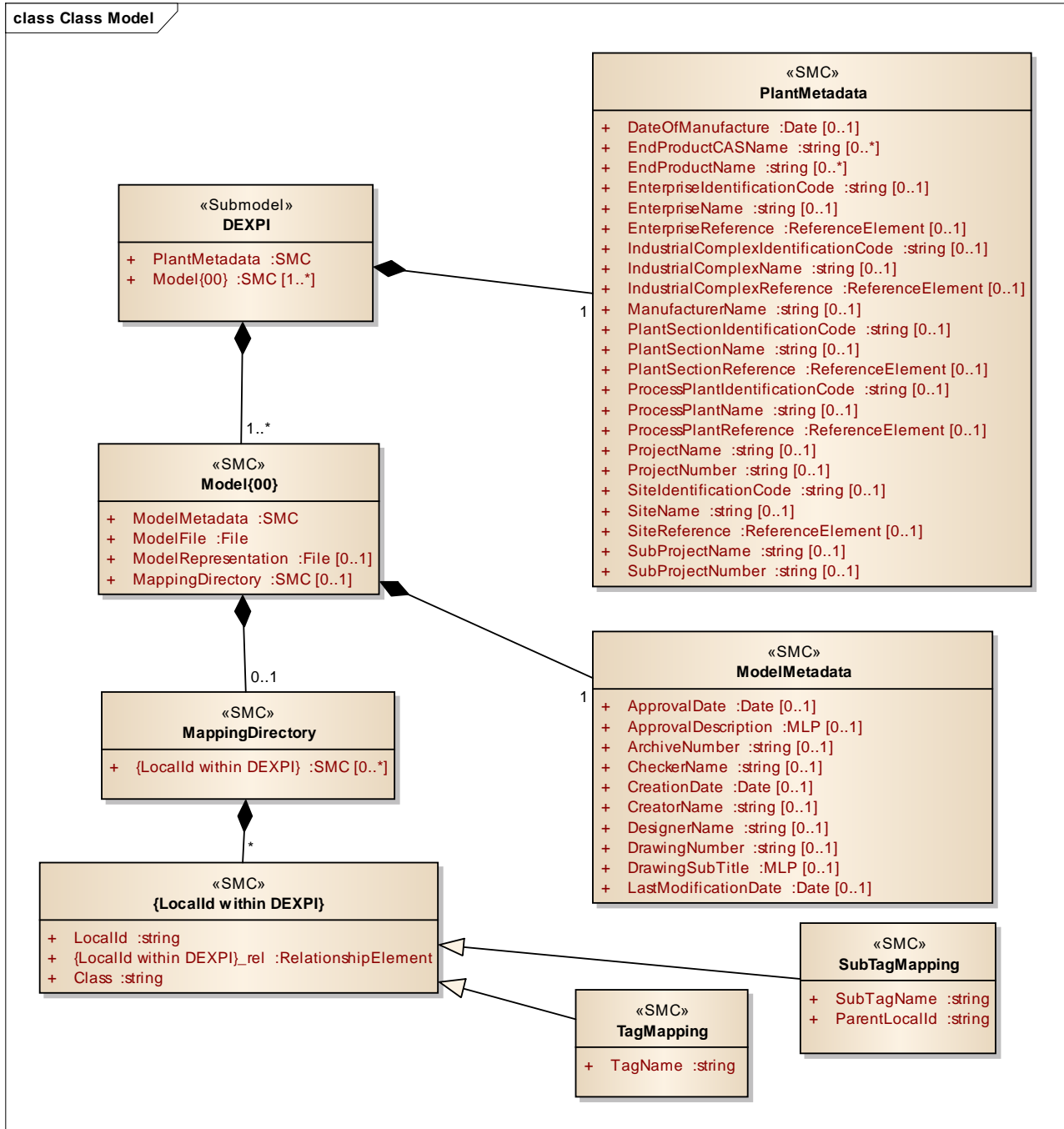


Figure 2: UML class diagram of the Submodel

2.2 Submodel

Note that “card.” denotes cardinality which should be interpreted as the “multiplicity” concept known from UML.

Table 1: Submodel DEXPI

idShort:	DEXPI		
	Note: the above idShort can differ from proposed “DEXPI” idShort, in order to enable multiple Submodels for an asset, e.g., inherited DEXPI files from higher-level Submodel templates or assets.		
Class:	Submodel (SM)		
semanticId:	[IRI] Fehler! Linkreferenz ungültig. https://admin-shell.io/idta/DEXPI/1/0/Submodel		
Parent:	Asset Administration Shell with asset which is a plant segment the DEXPI file belongs to.		
Explanation:	Submodel containing one or multiple DEXPI models for the asset.		
[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description @en	example	
[SMC] PlantMetadata	[IRI] https://admin-shell.io/idta/DEXPI/1/0/PlantMetadata Container for the metadata of the plant segment which is described by the supplied DEXPI file	n/a	1
[SMC] Model{00}	[IRI] https://admin-shell.io/idta/DEXPI/1/0/Model Container for the actual DEXPI file, its metadata and its mapping directory. Note that {00} a running counter suffix, e.g., “Model01” for the first element i.e. first DEXPI model and so on (“Model01”, “Model02”, “Model03”, ...) in the case of multiple models included in the Submodel.	n/a	1..*

2.3 Properties of the SMC PlantMetadata

Table 2: Properties of the SMC PlantMetadata

idShort:	PlantMetadata Note: the above idShort shall always be as stated.		
Class:	SubmodelElementCollection (SMC)		
semanticId:	[IRI] https://admin-shell.io/idta/DEXPI/1/0/PlantMetadata		
Parent:	Submodel with semanticId = https://admin-shell.io/idta/DEXPI/1/0/Submodel		
Explanation:	Metadata attributes of the plant or plant segment. It includes a subset of generic DEXPI Package Metadata (section 5 of the DEXPI specification) plus some additional optional elements. Note: we keep all attributes optional due they optional definition in the DEXPI specification.		
[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description@en	example	
[Property] EnterpriseIdentificationCode	[IRI] http://sandbox.dexpi.org/rdl/EnterpriseIdentificationCodeAssignmentClass Enterprise Identification Code	[string] oil-gas-inc	0..1
[Property] EnterpriseName	[IRI] http://sandbox.dexpi.org/rdl/EnterpriseNameAssignmentClass Enterprise Name	[string] Oil & Gas, Inc.	0..1
[ReferenceElement] EnterpriseReference	[IRI] https://admin-shell.io/idta/DEXPI/1/0/EnterpriseReference Optional reference to an Entity element representing the enterprise in another Submodel, e.g., BOM Note: this is an attribute which is not included in DEXPI metadata and is added to the Submodel	(Entity)(non-local)[IRI] http://example.com/id/9992020020616052921	0..1
[Property] SiteIdentificationCode	[IRI] http://sandbox.dexpi.org/rdl/SiteIdentificationCodeAssignmentClass Site Identification Code	[string] DC	0..1
[Property] SiteName	[IRI] http://sandbox.dexpi.org/rdl/SiteNameAssignmentClass Site Name	[string] Dexpi City	0..1
[ReferenceElement] SiteReference	[IRI] https://admin-shell.io/idta/DEXPI/1/0/SiteReference Optional reference to an Entity element representing the site in another Submodel, e.g., BOM Note: this is an attribute which is not included in DEXPI metadata and is added to the Submodel	(Entity)(non-local)[IRI] http://example.com/id/9992020020616052922	0..1

[Property] IndustrialComplexIdentificationCode	[IRI] http://sandbox.dexpi.org/rdl/IndustrialComplexIdentificationCodeAssignmentClass Industrial Complex Identification Code	[string] I-Chain	0..1
[Property] IndustrialComplexName	[IRI] http://sandbox.dexpi.org/rdl/IndustrialComplexNameAssignmentClass Industrial Complex Name	[string] Isophorone Chain	0..1
[ReferenceElement] IndustrialComplexReference	[IRI] https://admin-shell.io/idta/DEXPI/1/0/IndustrialComplexReference Optional reference to an Entity element representing the industrial complex in another Submodel, e.g., BOM Note: this is an attribute which is not included in DEXPI metadata and is added to the Submodel	(Entity)(non-local)[IRI] http://example.com/id/9992020020616052923	0..1
[Property] ProcessPlantIdentificationCode	[IRI] http://sandbox.dexpi.org/rdl/ProcessPlantIdentificationCodeAssignmentClass Process Plant Identification Code	[string] ABC	0..1
[Property] ProcessPlantName	[IRI] http://sandbox.dexpi.org/rdl/ProcessPlantNameAssignmentClass Process Plant Name	[string] ABC Plant	0..1
[ReferenceElement] ProcessPlantReference	[IRI] https://admin-shell.io/idta/DEXPI/1/0/ProcessPlantReference Optional reference to an Entity element representing the process plant in another Submodel, e.g., BOM Note: this is an attribute which is not included in DEXPI metadata and is added to the Submodel	(Entity)(non-local)[IRI] http://example.com/id/9992020020616052924	0..1
[Property] PlantSectionIdentificationCode	[IRI] http://sandbox.dexpi.org/rdl/PlantSectionIdentificationCodeAssignmentClass Plant Section Identification Code	[string] 10	0..1
[Property] PlantSectionName	[IRI] http://sandbox.dexpi.org/rdl/PlantSectionNameAssignmentClass Plant Section Name	[string] PlantSectionName	0..1
[ReferenceElement] PlantSectionReference	[IRI] https://admin-shell.io/idta/DEXPI/1/0/PlantSectionReference Optional reference to an Entity element representing the plant in section another Submodel, e.g., BOM Note: this is an attribute which is not included in DEXPI metadata and is added to the Submodel	(Entity)(non-local)[IRI] http://example.com/id/9992020020616052925	0..1

[Property] ProjectNumber	[IRI] http://sandbox.dexpi.org/rdl/ProjectNumberAssignmentClass Project Number	[string] P3.1415	0..1
[Property] ProjectName	[IRI] http://sandbox.dexpi.org/rdl/ProjectNameAssignmentClass Project Name	[string] a project	0..1
[Property] SubProjectNumber	[IRI] http://sandbox.dexpi.org/rdl/SubProjectNumberAssignmentClass Sub Project Number	[string] P3.1415-SP2	0..1
[Property] SubProjectName	[IRI] http://sandbox.dexpi.org/rdl/SubProjectNameAssignmentClass Sub Project Name	[string] a sub-project	0..1
[Property] ManufacturerName	[IRDI] 0173-1#02-AAO677#002 Legal 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. We assume that this plant segment vendor is producing or, at least, modifying the P&ID (e.g., as-built documentation). Note: this is an attribute which is not included in DEXPI metadata and is added to the Submodel	[string] Plant Segment Vendor or EPC company name	0..1
[Property] DateOfManufacture	[IRDI] 0173-1#02-AAR972#002 Date from which the production and / or development process is completed or from which a service is provided completely. Note: see also [IRDI] 0112/2///61987#ABB757#007 date of manufacture in CDD Note: format by lexical representation: YYYY-MM-DD Note: this is an attribute which is not included in DEXPI metadata and is added to the Submodel	[Date] 2021-01-01	0..1
[Property] EndProductName	[IRI] https://admin-shell.io/idta/DEXPI/1/0/EndProductName End Product Name of the main product the plant segment is producing. Note: this is an attribute which is not included in DEXPI metadata and is added to the Submodel	[string] water	0..*
[Property] EndProductCASName	[IRI] https://admin-shell.io/idta/DEXPI/1/0/EndProductCASName End Product CAS Name of the main product Note: this is an attribute which is not included in DEXPI metadata and is added to the Submodel	[string] 7732-18-5	0..*

2.4 Properties of the SMC Model{00}

Table 3: Properties of the SMC Model

idShort:	Model{00}		
Class:	SubmodelElementCollection (SMC)		
semanticId:	[IRI] https://admin-shell.io/idta/DEXPI/1/0/Model		
Parent:	Submodel with semanticId = https://admin-shell.io/idta/DEXPI/1/0/Submodel		
Explanation:	Container for a single DEXPI model.		
[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description@en	example	
[SMC] ModelMetadata	[IRI] https://admin-shell.io/idta/DEXPI/1/0/ModelMetadata Metadata of the model	n/a	0..1
[File] ModelFile	[IRI] https://admin-shell.io/idta/DEXPI/1/0/ModelFile Actual DEXPI model, e.g., in ProteusXML serialization	[file] mimeType=application/xml C01V04-VER.EX01.xml	1
[Property] ModelRepresentation	[IRI] https://admin-shell.io/idta/DEXPI/1/0/ModelRepresentation Rendered DEXPI model, e.g., as an SVG file	[file] mimeType=application/svg C01V04-VER.EX01.svg	0..1
[SMC] MappingDirectory	[IRI] https://admin-shell.io/idta/DEXPI/1/0/MappingDirectory Directory with model-specific mappings	n/a	0..1

2.5 Properties of the SMC ModelMetadata

Table 4: Properties of the SMC ModelMetadata

idShort:	ModelMetadata Note: the above idShort shall always be as stated.		
Class:	SubmodelElementCollection (SMC)		
semanticId:	[IRI] https://admin-shell.io/idta/DEXPI/1/0/Model		
Parent:	Submodel with idShort = Model{00}		
Explanation:	Metadata container for a single DEXPI model. This is a subset of generic DEXPI Package Metadata (section 5 of the specification).		
[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description @en	example	
[Property] ApprovalDate	[IRI] http://sandbox.dexpi.org/rdl/ApprovalDateRepresentationAssignmentClass Date of Approval Note: DEXPI intentionally does not guarantee that the included string can be converted into a date, use string as fallback if this is the case	[Date] or [string] 2021-01-01	0..1
[MLP] ApprovalDescription	[IRI] https://sandbox.dexpi.org/rdl/ApprovalDescriptionAssignmentClass Approval Decision Description	en, approved	0..1
[Property] ApproverName	[IRI] http://sandbox.dexpi.org/rdl/ApproverNameAssignmentClass Approver Name	[string] A. P. Prover	0..1
[Property] ArchiveNumber	[IRI] http://sandbox.dexpi.org/rdl/ArchiveNumberAssignmentClass Archive Number	[string] XY923-463	0..1
[Property] CheckerName	[IRI] http://sandbox.dexpi.org/rdl/CheckerNameAssignmentClass Checker Name	[string] C. Hecker	0..1
[Property] CreationDate	[IRI] http://sandbox.dexpi.org/rdl/CreationDateRepresentationAssignmentClass Date of Creation Note: DEXPI intentionally does not guarantee that the included string can be converted into a date, use string as fallback if this is the case	[Date] or [string] 2021-01-01	0..1

[Property] CreatorName	[IRI] http://sandbox.dexpi.org/rdl/CreatorNameAssignmentClass Creator Name	[string] A. Creator	0..1
[Property] DesignerName	[IRI] http://sandbox.dexpi.org/rdl/DesignerNameAssignmentClass Designer Name	[string] D. E. Signer	0..1
[Property] DrawingNumber	[IRI] http://sandbox.dexpi.org/rdl/DrawingNumberAssignmentClass Number of the drawing	[string] 123/A93	0..1
[MLP] DrawingSubTitle	[IRI] http://sandbox.dexpi.org/rdl/DrawingSubTitleAssignmentClass Drawing subtitle	en, DEXPI Example PID	0..1
[Property] LastModificationDate	[IRI] http://sandbox.dexpi.org/rdl/LastModificationDateRepresentationAssignmentClass Last Modification Date Note: DEXPI intentionally does not guarantee that the included string can be converted into a date, use string as fallback if this is the case	[Date] or [string] 2026-04-02	0..1

2.6 Properties of the SMC MappingDirectory

Table 5: Properties of the SMC MappingDirectory

idShort:	MappingDirectory Note: the above idShort shall always be as stated.		
Class:	SubmodelElementCollection (SMC)		
semanticId:	[IRI] https://admin-shell.io/idta/DEXPI/1/0/MappingDirectory		
Parent:	SMC with idShort = Model{00}		
Explanation:	Container for local-global mappings within the DEXPI model		
[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description@en	example	
[SMC] {LocalId within DEXPI} e.g., PlateHeatExchanger_1	[IRI] https://admin-shell.io/idta/DEXPI/1/0/Metadata/TagMapping or [IRI] https://admin-shell.io/idta/DEXPI/1/0/Metadata/SubTagMapping Container for mapping information Note: idShort should be the LocalId (i.e., "ID" field of the element within ProteusXML) within DEXPI that is adapted to the naming conventions of idShort (e.g., by replacing "-" with "_")	n/a	0..*

2.7 Properties of the SMC {LocalId within DEXPI}

Two kinds of SMC are possible within the parent SMC – one describes the Tag, another describes the Subtag.

TagMapping SMC element is used to capture two concepts within DEXPI:

- Tagged elements, e.g., “Equipment” elements, having a “TagNameAssignmentClass” DEXPI attribute, an example is “PlateHeatExchanger” used in the example table below. In this case the TagName property corresponds to the value of tag name assignment.
- “ProcessInstrumentationFunction” elements within the DEXPI model describing process instrumentation, in this case the TagName property corresponds to the DEXPI attribute values of “ProcessInstrumentationFunctionNumberAssignmentClass” DEXPI attributes of the respective element, e.g., 4712.01 for an element with local ID “ProcessInstrumentationFunction-1” within the example DEXPI file.

Table 6: Properties of the SMC LocalID within DEXPI

idShort:	{LocalId within DEXPI}		
Class:	SubmodelElementCollection (SMC)		
semanticId:	[IRI] https://admin-shell.io/idta/DEXPI/1/0/TagMapping		
Parent:	SMC with idShort = MappingDirectory		
Explanation:	Collection describing tag information		
[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description @en	example	
[Property] TagName	[IRI] https://admin-shell.io/idta/DEXPI/1/0/TagName Tag Name, for exact formulation rules see the description above.	[String] H1007	1
[Property] Class	[IRI] https://admin-shell.io/idta/DEXPI/1/0/Class Class of the Equipment according to DEXPI	[String] PlateHeatExchanger	1
[Property] LocalId	[IRI] https://admin-shell.io/idta/DEXPI/1/0/LocalId Local ID of the element within the DEXPI representation, e.g., ID field of XML element within ProteusXML Note: the value comes from DEXPI and may not be compatible to idShort naming restrictions	[String] PlateHeatExchanger-1	1
[RelationshipElement] {LocalId within DEXPI}_rel e.g., PlateHeatExchanger_1_rel	[IRI] https://admin-shell.io/idta/DEXPI/1/0/MappingRelationship Relationship to map the local element to a globally identifiable asset Note: the following FragmentReference naming schema is proposed: ProteusXML@ID=PlateHeatExchanger-1 where Id is the LocalId	[RelationshipElement] First: (Submodel) (no-local) [id of Submodel] (SEC) (local) Model01 (SubmodelElement) (local) ModelFile (FragmentReference) (local) ProteusXML@ID=PlateHeatExchanger-1 Second: (Asset) (no-local) [id of asset]	1

The second kind of SMC within the mapping directory describes the subtag capturing objects having a "SubTagNameAssignmentClass" DEXPI attribute.

Table 7: Properties of the SMC LocalId within DEXPI

idShort:	{LocalId within DEXPI}		
Class:	SubmodelElementCollection (SMC)		
semanticId:	[IRI] https://admin-shell.io/idta/DEXPI/1/0/Metadata/SubTagMapping		
Parent:	SMC with idShort = MappingDirectory		
Explanation:	Collection describing subtag information		
[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description@en	example	
[Property] SubTagName	[IRI] https://admin-shell.io/idta/DEXPI/1/0/SubTagName Sub tag name	[String] N04	1
[Property] ParentLocalId	[IRI] https://admin-shell.io/idta/DEXPI/1/0/ParentLocalId Local identifier of the parent element within the DEXPI representation, e.g., ID field of XML element within ProteusXML Note: the value comes from DEXPI and may not be compatible to idShort naming restrictions	[String] PlateHeatExchanger-1	1
[Property] Class	[IRI] https://admin-shell.io/idta/DEXPI/1/0/Class Class of the equipment according to DEXPI	[String] Nozzle	1
[Property] LocalId	[IRI] https://admin-shell.io/idta/DEXPI/1/0/LocalId Local identifier of the element within the DEXPI representation, e.g., ID field of XML element within ProteusXML Note: the value comes from DEXPI and may not be compatible to idShort naming restrictions	[String] Nozzle-4	1
[RelationshipElement] {LocalId within DEXPI}_rel e.g., Nozzle_4_rel	[IRI] https://admin-shell.io/idta/DEXPI/1/0/MappingRelationship Relationship to map the local element to a globally identifiable asset Note: the value comes from DEXPI and may not be compatible to idShort naming restrictions Note: the following FragmentReference naming schema is proposed: ProteusXML@ID=Nozzle-4 where Id is the LocalId	[RelationshipElement] First: (Submodel) (no-local) [id of Submodel] (SEC) (local) Model01 (SubmodelElement) (local) ModelFile (FragmentReference) (local) ProteusXML@ID=Nozzle-4 Second: (Asset) (no-local) [id of asset]	1

List of Abbreviations

Table 8: List of Abbreviations

AAS	Asset Administration Shell
ALCM	Asset Life Cycle Management
BOM	Bill of Material
CAS	Chemical Abstracts Service
DECHEMA	Dechema Gesellschaft für Chemische Technik und Biotechnologie
DEXPI	Data Exchange in the Process Industry
ID	Identifier
IDTA	Industrial Digital Twin Association
IEC	International Electrotechnical Commission
IRI	Internationalized Resource Identifier
IRDI	International Registration Data Identifier
ISA	International Society of Automation
ISO	International Organization for Standardization
MLP	Multi-Language Property
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regeltechnik in der Chemischen Industrie
P&ID	Piping & Instrumentation Diagram
SM	Submodel
SMC	Submodel Element Collection
SVG	Scalable Vector Graphics
UC	Use Case
XML	Extensible Markup Language

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