IDTA 02019-1-0 Plant Asset Management Specification Sheet

November 2024

Submodel Template of the Asset Administration Shell

Submodel Template
IDTA approved

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

Imprint

Publisher
Industrial Digital Twin Association
Lyoner Strasse 18
60528 Frankfurt am Main
Germany
https://www.industrialdigitaltwin.org/

Version history

Date	Version/Revision	Comment
15.11.2024	1.0	Release of the official Submodel template published by IDTA.

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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 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

The AAS Submodel "Plant Asset Management Specification Sheet" is a crucial tool for the procurement and documentation of Plant Asset Management (PAM) functions in industrial settings. Its scope includes establishing a clear contractual basis and documenting PAM functions. These functions can range from special control system functions to add-on parts on production equipment or enabled functions within the equipment.

The Submodel ensures a well-defined contractual basis during procurement, minimizing misunderstandings and improving efficiency. It standardizes requirements, specifications, and expectations related to PAM functions, allowing all stakeholders, such as producers, control system manufacturers, and equipment manufacturers, to have a shared understanding.

Furthermore, the Submodel serves as documentation for PAM functions, capturing vital information. It includes detailed descriptions of function blocks, sensors, and monitoring devices, ensuring a comprehensive record of PAM functionalities. This documentation facilitates troubleshooting, maintenance, and modifications.

In addition, the Submodel supports the engineering process, which often involves multiple stakeholders and departments. It acts as a central reference, aligning efforts and fostering collaboration between departments such as procurement, operation, maintenance, sales, and engineering. The Submodel promotes transparency and manages dependencies in engineering PAM functions.

The Submodel also aids decision-making throughout the PAM functions' lifecycle. It provides information for informed decisions regarding maintenance, upgrades, and component replacement. It also assists in evaluating compatibility and integration of new PAM functions into existing systems. This is crucial for managing complex industrial environments with interconnected systems.

The management of online and historical data for a specific PAM function is not within the scope of this Submodel. This is because such data may contain highly detailed and specific information that is beyond the level of specification covered here. Additionally, the management of this data may be better suited for a separate AAS Submodel focused on general condition monitoring, which is not addressed in this particular Submodel. The primary focus of this Submodel is to establish a contractual basis, document PAM functions, and support the engineering process, rather than delving into the intricacies of online and historical data management.

1.3 Relevant standards for the Submodel template

The current version of the Submodel template is considered to meet the minimum requirement for nameplate information, hence it solely concentrates on the requirements specified by EU directive 2006/42/EC. Requirements specified by further regulations and directives will be taken into account in subsequent versions.

The EU directive 2006/42/EC aims to standardize the market entry requirements for machines in the European economic area and further related countries. In regard to nameplate the EU directive establishes the minimum requirements on information a nameplate should provide which state as follows:

- the business name and full address of the manufacturer and, where applicable, his authorised representative,
- designation of the machinery,
- the CE Marking,
- designation of series or type,
- serial number, if any,
- the year of construction, that is the year in which the manufacturing process is completed.

Further relevant requirements are:

- VDI/VDE 2651 sheet 2: „Plant asset management (PAM) in process industry - Specifications and methods" [7]

1.4 Use cases, requirements and design decisions

1.4.1 Asset procurement process for partial production systems

The Asset Procurement Process is a critical procedure that ensures the efficient and effective acquisition of partial production systems. This use case describes the interactions between the operator of the asset and the vendor, focusing on the definition of requirements, specification of existing signals, provision of asset type alternatives, and the finalization of the PAM Specification Sheet that forms part of the contract. The process highlights the complexity of managing multiple assets, offers, and offer versions, emphasizing the importance of the formal PAM Specification Sheet as an Asset Administration Shell (AAS) Submodel for facilitating comparison and management through computer programs.

Actors:

- *Operator of Asset*: The entity responsible for defining the requirements and specifying existing signals for the partial production system.
- *Vendor of Asset*: The entity that provides alternatives for the asset type, possibly with additional requirements for sensor signals, and delivers the asset upon order.
- *Engineering Contractor*: The entity responsible for engineering or parts of engineering delegated by operator.

Preconditions:

- The operator has identified the need for a partial production system within a production plant.
- The vendor has the capability to supply various types of assets that meet the operator's requirements.

Basic Workflow:

- *Requirement Definition*: The operator of the asset defines the requirements for the partial production system and specifies any existing signals that need to be accommodated.
- *Provision of Alternatives*: The vendor provides several alternatives for the asset type, each possibly requiring additional sensor signals beyond what was initially specified by the operator.
- *Iteration of the PAM Specification Sheet*: Through a collaborative effort, the operator and the vendor iterate on the PAM Specification Sheet Submodel. This iterative process ensures that all technical specifications and requirements are accurately captured and agreed upon.

- *Order and Delivery*: Once the PAM Specification Sheet is finalized, the operator orders the delivery of the asset. The vendor then delivers the asset, making the PAM Specification Sheet a binding part of the contract.
- *Integration into Contract*: The finalized PAM Specification Sheet, now an integral part of the contract, ensures that both parties have a clear understanding of the technical specifications and requirements of the asset.

Alternative Workflows:

- *Revision of Requirements*: If, during the iteration of the PAM Specification Sheet, new requirements emerge or existing specifications need adjustments, the document is revised accordingly. This may involve revisiting earlier steps to ensure all requirements are met.
- *Multiple Offers and Versions*: In scenarios where there are many assets, with three offers per asset and many offer versions per asset, the process of comparing and selecting the best offer becomes complex. The use of the PAM Specification Sheet as an AAS Submodel allows for the efficient management and comparison of these specification sheets through computer programs.
- *Delegation of engineering tasks to engineering contractor:* If the engineering or parts of the engineering is done by a engineering contractor we have an additional actor. We focus on engineering contractor doing full service for the operator.

Finally, the asset is delivered to the operator's production plant, and its specifications are in accordance with the PAM Specification Sheet included in the contract. The operator and vendor have a formalized document (PAM Specification Sheet) that clearly outlines the technical specifications and requirements of the asset, facilitating easier management and comparison of assets and offers.

1.4.2 Asset Replacement Process

The Asset Replacement Process is designed to streamline the acquisition of a new asset to replace an existing one, utilizing the Asset Administration Shell (AAS) Submodel, specifically the "PAM Specification Sheet." This use case outlines how the PAM Specification Sheet facilitates the replacement of assets by providing a comprehensive documentation of specifications, including available input signals and required output signals. The process ensures that a replacement asset can be ordered easily, even years after the original purchase, and accommodates scenarios where the original vendor or asset is no longer available.

Actors:

- *Operator of Asset*: The entity that operates the asset and initiates the replacement process.
- *Vendor of Asset*: The provider of the replacement asset, which may or may not be the original vendor of the asset being replaced.
- *Service Contractor*: The entity responsible for service and maintenance tasks delegated by operator.

Basic Workflow:

- *Identification of Replacement Need*: The asset operator or service contractor identifies the need to replace an existing asset due to obsolescence, failure, or inefficiency.
- *Retrieval of PAM Specification Sheet*: The operator or service contractor retrieves the PAM Specification Sheet for the existing asset, which details the specifications, including available input signals and required output signals.
- *Vendor Selection*: The operator or service contractor selects a vendor for the replacement asset. This may involve contacting the original vendor or finding a new vendor if the original is no longer available or does not produce the asset anymore.
- *Order Placement*: Using the specifications from the PAM Specification Sheet, the operator or service contractor places an order for the replacement asset. The detailed specifications ensure that the new asset will meet the same operational requirements as the original.
- *Delivery and Installation*: The vendor delivers the replacement asset, and it is installed and integrated into the operator's system.

Alternative Workflows:

- *Re-design Requirement*: If the replacement asset requires a re-design due to changes in technology or operational requirements, the Asset Procurement Process is initiated using the existing PAM Specification Sheet as the starting point. This ensures that the new design is based on the documented specifications and requirements of the former asset.
- *Multiple Vendors*: In scenarios where multiple vendors are capable of providing the replacement, the operator may solicit bids or proposals based on the PAM Specification Sheet to ensure competitive pricing and compatibility.

Finally, the replacement asset is installed and fully operational, meeting or exceeding the performance and specification requirements of the original asset. The PAM Specification Sheet for the new asset is updated if necessary and saved for future reference.

1.4.3 Inspection Planning during Operation Phase

This use case outlines the process for planning inspections and maintenance for an asset during its operation phase. It describes how the vendor provides an asset type relevant inspection and maintenance plan at the time of sale, which is part of the PAM Specification Sheet. The maintenance manager of the plant operator then evaluates and adapts this plan based on the asset's functional location and operational conditions. The process allows for flexibility in scheduling, acknowledging that actual usage, such as a lower load on the asset, may warrant a more generous inspection and maintenance schedule.

Actors:

- *Vendor of Asset*: The entity that sells the asset and provides the initial inspection and maintenance plan.
- *Maintenance Manager (Plant Operator)*: The individual responsible for evaluating the vendor's plan and adjusting it based on the asset's operational context.

Preconditions:

- The asset has been sold and installed in its operational location within the plant.
- The vendor has provided an inspection and maintenance plan as part of the PAM Specification Sheet.

Basic Workflow:

- *Handover of Inspection and Maintenance Plan*: At the time of selling the asset, the vendor provides the plant operator with an inspection and maintenance plan specific to the asset type, included in the PAM Specification Sheet.
- *Evaluation of Vendor's Plan*: The maintenance manager evaluates the provided inspection and maintenance plan, considering the asset's functional location and the specific operational context within the plant.
- *Adaptation of the Plan*: Based on the evaluation, the maintenance manager adapts the vendor's plan to better suit the operational realities of the asset. This includes adjusting frequencies of inspections and maintenance activities.
- *Agreement on Adjusted Plan*: If necessary, the maintenance manager communicates with the vendor to agree on a more generous inspection and maintenance schedule, particularly if the asset's operational load is lower than anticipated.
- *Finalization of Inspection and Maintenance Plan*: The adjusted plan is finalized as the actual inspection and maintenance plan to be followed for the asset.
- *Documentation of Inspection Results*: During operation phase, the results of inspections are documented. If necessary, then related maintenance actions are performed, and results of the maintenance actions are documented too.

Alternative Workflows:

- *Re-evaluation Due to Operational Changes*: If there are significant changes in the asset's operational conditions or functional location, the maintenance manager may need to re-evaluate and further adjust the inspection and maintenance plan.
- *Vendor Consultation for Major Adjustments*: For significant deviations from the initial plan, especially if they involve extending maintenance intervals, the maintenance manager consults with the vendor to ensure that the adjustments are safe and will not affect the asset's performance or warranty.

Finally, an inspection and maintenance plan that is tailored to the actual operational conditions of the asset is established and ready to be implemented. The plant operator has a clear schedule for inspection and maintenance activities, ensuring the asset's reliability and longevity.

2 Information Set of the Submodel

The PAMSpecificationSheet Submodel is an integral component of an Asset Administration Shell, designed to encapsulate detailed specifications and metadata for asset management. This Submodel is structured into several main sections, each serving a distinct purpose in providing comprehensive information about an asset:

- DocumentHeader: This section includes essential identification and classification data about the asset and its type, ensuring clear and precise documentation from the outset.
- GeneralInformation: This section provides an extensive overview of the asset, including its locations, descriptions, safety measures, criticality categories, and references to further information. It establishes a foundational understanding of the asset's general attributes and operational context.
- CompleteSystem: Encompassing the asset's complete system details, this section links various subsystems and their status conditions, offering a holistic view of the asset's operational environment.
- StatusCondition: Detailed within this section are the various status conditions of the asset, including monitoring requirements and relevant methods, aligned with industry standards such as NE107 and NE129.
- SubSystem: This section breaks down the asset into its constituent subsystems, detailing their respective locations, references, and associated status conditions, facilitating targeted management and analysis.
- ApplicableMethod: This comprehensive section outlines the Plant Asset Management methods applicable to the asset, including headers, static parameters, generated signals, and required input signals. It ensures that all methodological aspects are thoroughly documented for effective implementation and monitoring.
- DocumentFooter: Finalizing the document, this section contains confirmation details, including dates, authorship, checks, releases, and versioning, providing a formal closure to the specification sheet.

The PAMSpecificationSheet Submodel serves as a detailed and structured repository of information, enabling asset management and facilitating interoperability within an industrial context.
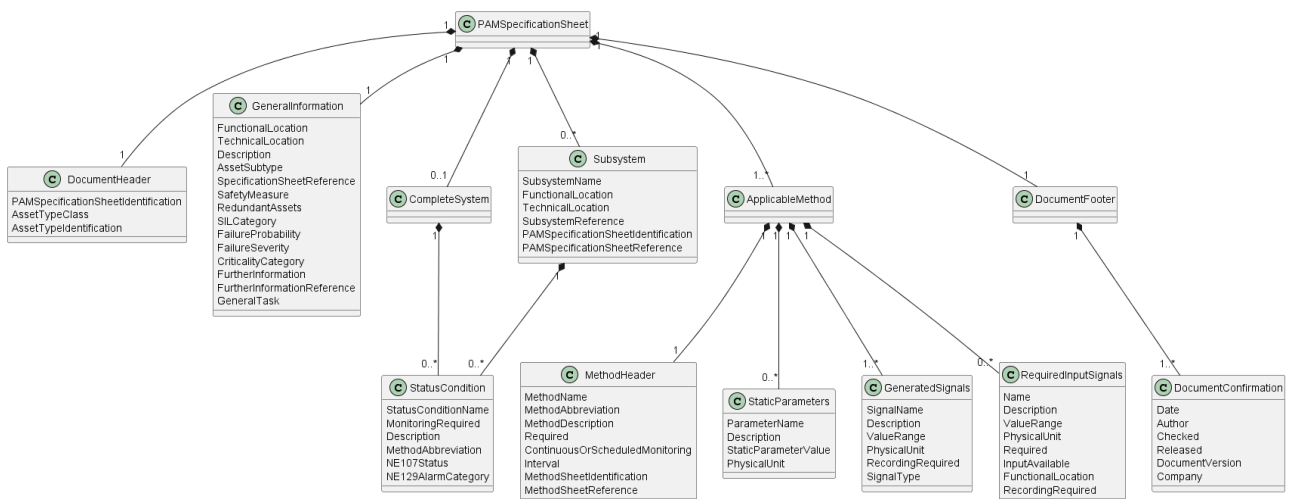
Figure 1:Overview of PAM Specification Sheet Submodel

The figure above provides an overview of the Submodel as a UML class diagram, while the following sections contain detailed descriptions of the attributes of the sub-model elements.

3 Submodel and Collections

3.1 Properties of the Submodel "PAM Specification Sheet"

Table 1: Properties of the Submodel "PAM Specification Sheet"

idShort:	PAMSpecificationSheet
Class:	Submodel
semanticId:	[IRDI] 0173-1#01-AGC973#003
Parent:	Asset Adminsitration Shell with asset
Explanation:	PAM Specification Sheet according to VDI/VDE GMA RL 2651-2 and specification of Plant Asset Management functions

[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	**Description@en**	**example**	
[SMC] DocumentHeader	[IRDI] 0173-1#01-AGC974#002 Identifier for the asset type and associated PAM specification sheet.	[-] 3 elements	1
[SMC] GeneralInformation	[IRDI] 0173-1#01-AGC975#002 Provides details about the specific asset.	[-] 14 elements	1
[SMC] CompleteSystem	[IRDI] 0173-1#01-AGC979#001 Interconnected fields, incorporating status/fault profiles that apply to the entire asset rather than specific parts.	[-] 1 elements	0..1
[SMC] SubSystem	[IRDI] 0173-1#01-AGC981#001 Properties of the subsystem.	[-] 7 elements	0..*
[SMC] ApplicableMethod	[IRDI] 0173-1#01-AGC983#002 Characteristics of the method used for state or fault detection.	[-] 4 elements	1..*
[SMC] DocumentFooter	[IRDI] 173-1#02-AAW627#001 Release information related to the complete PAM specification sheet.	[-] 1 elements	1

3.2 Properties of the SMC "DocumentHeader"

Table 2: Properties of the SMC "DocumentHeader"

idShort:	DocumentHeader			
Class:	SubmodelElementCollection			
semanticId:	[IRDI] 0173-1#01-AGC974#002			
Parent:	Submodel "PAMSpecificationSheet"			
Explanation:	Identifier for the asset type and associated PAM specification sheet.			
[SME type]	**semanticId = [idType]value**		**[valueType]**	**card.**
idShort	**Description@en**		**example**	
[Prop] PAMSpecificationSheetIdentification	[IRDI] 0173-1#02-AAV929#001 Unique identifier for the PAM specification sheet.		[String] PAM Specifications Sheet - Loop - 2014-04-28 - Version 1.00	1
[Prop] AssetTypeClass	[IRDI] 0173-1#02-AAV939#001 Defines the general category of the asset described in the PAM specification sheet.		[String] Dosage control loop	1
[Prop] AssetTypeIdentification	[IRDI] 0173-1#02-AAV940#001 Unique identifier for a general asset type's PAM specification sheet.		[String] Dosage Control Loop - 2014-04-28 - Version 1.00	1

3.3 Properties of the SMC "GeneralInformation"

Table 3: Properties of the SMC "GeneralInformation"

idShort:	GeneralInformation			
Class:	SubmodelElementCollection			
semanticId:	[IRDI] 0173-1#01-AGC975#002			
Parent:	Submodel "PAMSpecificationSheet"			
Explanation:	Provides details about the specific asset.			
[SME type]	**semanticId = [idType]value**		**[valueType]**	**card.**
idShort	**Description@en**		**example**	
[Prop] FunctionalLocation	[IRDI] 0173-1#02-AAV946#001 Specifies the asset's logical position within a piping and instrumentation diagram.		[String] LEVNAMUR-V220-CA23-Y2233	0..1
[Prop] TechnicalLocation	[IRDI] 0173-1#02-AAV947#001 Specifies the actual location of the asset within the plant.		[String] V220	0..1

[Prop] Description	[IRDI] 0173-1#02-AAV948#001 Offers a concise explanation of the asset's primary function.	[String] SISO Control Loop for the dosing valve	0..1
[Prop] AssetSubtype	[IRDI] 0173-1#02-AAV949#001 Defines the specific subtype of the asset.	[String] SISO Control Loop	0..1
[Prop] SpecificationShe etReference	[IRDI] 0173-1#02-AAV952#001 Reference to the technical specification sheet accompanying the asset.	[AnyUri] -	0..1
[Prop] SafetyMeasure	[IRDI] 0173-1#02-AAV950#001 Denotes whether the asset is part of a safety equipment.	[Boolean] False	0..1
[Prop] RedundantAsset s	[IRDI] 0173-1#02-AAV951#001 References zero (if empty), one or more backup assets for redundancy purposes.	[Boolean] False	0..1
[Prop] SILCategory	[IRDI] 0173-1#02-AAV930#002 Denotes the safety integrity level (SIL), categorized into four levels (optional).	[Int] 2	1
[Prop] FailureProbabilit y	[IRDI] 0173-1#02-AAV942#001 Indicates the probability of a failure occurring, classified into four levels.	[Enumeration] Value List: low, medium, high, critical	0..1
[Prop] FailureSeverity	[IRDI] 0173-1#02-AAV943#001 Indicates the potential impact or seriousness of a failure, classified into four levels.	[Enumeration] Value List: no impact, potential, measurable, significant	0..1
[Prop] CriticalityCatego ry	[IRDI] 0173-1#02-AAV941#001 A computed value based on Failure Probability and Failure Severity, usually calculated automatically, classified into four levels.	[Enumeration] Value List: low, medium, high, critical	0..1
[Prop] FurtherInformati on	[IRDI] 0173-1#02-AAW617#001 Additional relevant details about the asset, such as maintenance schedules.	[String] Text	0..*
[Prop] FurtherInformati onReference	[IRI] https://admin-shell.io/idta/prop/furtherinformationreference/1/0 A field for including references to supplementary information.	[AnyUri] -	0..*
[Prop] GeneralTask	[IRDI] 0173-1#02-AAV956#001 Detailed description of the task and installation or placement conditions of the specific asset.	[String] control loop is used to control the ratio between two input product.	0..1

3.4 Properties of the SMC "CompleteSystem"

Table 4: Properties of the SMC "CompleteSystem"

idShort:	CompleteSystem		
Class:	SubmodelElementCollection		
semanticId:	[IRDI] 0173-1#01-AGC979#001		
Parent:	Submodel "PAMSpecificationSheet"		
Explanation:	Interconnected fields, incorporating status/fault profiles that apply to the entire asset rather than specific parts.		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] StatusCondition	[IRDI] 0173-1#01-AGC980#001 Characteristics of the asset's operational and failure states.	[-] 6 elements	0..*

3.5 Properties of the SMC "StatusCondition"

Table 5: Properties of the SMC "StatusCondition"

idShort:	StatusCondition		
Class:	SubmodelElementCollection		
semanticId:	[IRDI] 0173-1#01-AGC980#001		
Parent:	SMC "CompleteSystem"		
Explanation:	Name of the asset's state, highlighting deviations from normal operations or reduced lifespan.		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Prop] StatusConditionName	[IRDI] 0173-1#02-AAV958#001 Name of the asset's state, highlighting deviations from normal operations or reduced lifespan.	[String] Friction in valve	1
[Prop] MonitoringRequired	[IRDI] 0173-1#02-AAV959#001 Specifies whether the user is requiring monitoring.	[Boolean] True	1
[Prop] Description	[IRDI] 0173-1#02-AAV960#001 Offers further information about the asset's status/fault profile or status monitoring.	[String] Text	1
[Prop] MethodAbbreviation	[IRDI] 0173-1#02-AAV961#001 Captures the abbreviated name of the PAM method employed for monitoring purposes.	[String] friction_dect	0..1

| [Prop]
NE107Status | [IRDI] 0173-1#02-AAV962#001
Status according to NAMUR recommendation NE 107. | [String]
failure | 0..1 |
| [Prop]
NE129AlarmCat
egory | [IRDI] 0173-1#02-AAV963#001
Alarm/signaling category according to NAMUR
recommendation NE 129. | [String]
Asset-Alarm | 0..1 |

3.6 Properties of the SMC "SubSystem"

Table 6: Properties of the SMC "SubSystem"

idShort:	SubSystem		
Class:	SubmodelElementCollection		
semanticId:	[IRDI] 0173-1#01-AGC981#001		
Parent:	Submodel "PAMSpecificationSheet"		
Explanation:	Properties of the subsystem.		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Prop] SubSystemNam e	[IRDI]0173-1#02-AAV965#001 Specifies the name of the subsystem.	[String] Control valve	1
[Prop] FunctionalLocati on	[IRDI] 0173-1#02-AAV946#001 Indicates the subsystem's logical position within a piping and instrumentation diagram.	[String] LEVTDA-V220-AB13-WT013	0..1
[Prop] TechnicalLocatio n	[IRDI] 0173-1#02-AAV947#001 Specifies the actual location of the subsystem in the plant.	[String] V220	0..1
[SMC] StatusCondition	[IRDI] 0173-1#01-AGC980#001 Characteristics of the subsystems's operational and failure states.	[-] 6 elements	0..*
[Prop] SubSystemRefe rence	[IRDI] 0173-1#02-AAW622#001 Additional references associated to the subsystem.	[String] FilePath	0..1
[Prop] PAMSpecificatio nSheetIdentificat ion	[IRDI] 0173-1#02-AAV929#001 The distinct identifier for the PAM specification sheet for the subsystem.	[String] FilePath	0..1
[Prop] PAMSpecificatio nSheetReferenc e	[IRDI] 0173-1#02-AAV967#001 Links to relevant PAM specification documentation for the subsystem.	[String] FilePath or URL	0..1

3.7 Properties of the SMC "StatusCondition"

Table 7: Properties of the SMC "StatusCondition"

idShort:	StatusCondition
Class:	SubmodelElementCollection
semanticId:	[IRDI] 0173-1#01-AGC980#001
Parent:	SMC "SubSystem"
Explanation:	Characteristics of the subsystems's operational and failure states.

[SME type] idShort	semanticId = [idType]value Description@en	[valueType] example	card.
[Prop] StatusCondition Name	[IRDI] 0173-1#02-AAV958#001 Name of the subsystem's state, highlighting deviations from normal operations or reduced lifespan.	[String] Low temperature	1
[Prop] MonitoringRequired	[IRDI] 0173-1#02-AAV959#001 Specifies whether the user is requiring monitoring.	[Boolean] True	1
[Prop] Description	[IRDI] 0173-1#02-AAV960#001 Offers further information about the subsystem's status/fault profile or status monitoring.	[String] Outlet temperature drops below threshold	1
[Prop] MethodAbbreviation	[IRDI] 0173-1#02-AAV961#001 Captures the abbreviated name of the PAM method employed for monitoring purposes.	[String] OutletTemperatureMonitoring	0..1
[Prop] NE107Status	[IRDI] 0173-1#02-AAV962#001 Status according to NAMUR recommendation NE 107.	[String] failure	0..1
[Prop] NE129AlarmCategory	[IRDI] 0173-1#02-AAV963#001 Alarm/signaling category according to NAMUR recommendation NE 129.	[String] Asset-Alarm	0..1

3.8 Properties of the SMC "ApplicationMethod"

Table 8: Properties of the SMC "ApplicationMethod"

idShort:	ApplicableMethod		
Class:	SubmodelElementCollection		
semanticId:	[IRDI] 0173-1#01-AGC983#002		
Parent:	Submodel "PAMSpecificationSheet"		
Explanation:	Characteristics of the method used for state or fault detection.		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] MethodHeader	[IRI] https://admin-shell.io/idta/smc/methodheader/1/0 Header of the employed PAM method.	[-] 8 elements	1
[SMC] StaticParameters	[IRDI] 0173-1#01-AGC984#001 List of static parameters such as trigger limits.	[-] 4 elements	0..*
[SMC] GeneratedSignals	[IRDI] 0173-1#01-AGC985#001 List of generated signals.	[-] 6 elements	1..*
[SMC] RequiredInputSignals	[IRDI] 0173-1#01-AGC986#001 List of necessary input signals of the method.	[-] 8 elements	0..*

3.9 Properties of the SMC "MethodHeader"

Table 9: Properties of the SMC "MethodHeader"

idShort:	MethodHeader		
Class:	SubmodelElementCollection		
semanticId:	[IRI] https://admin-shell.io/idta/smc/methodheader/1/0		
Parent:	SMC "ApplicableMethod"		
Explanation:	Header of the employed PAM method.		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Prop] MethodName	[IRDI] 0173-1#02-AAV969#001 Name of this method used for state or fault detection.	[String] EfficiencyDetermination	1
[Prop] MethodAbbreviation	[IRDI] 0173-1#02-AAV970#001 The concise identifier of the utilized method.	[String] EffDet	0..1

[Prop] MethodDescripti on	[IRDI] 0173-1#02-AAV971#001 Summarizes how this method operates, its installation, and application.	[String] By measuring the volume flow and the media temperature in the primary and secondary circuit per unit of time, the heat output and the heat transfer resistance and heat output loss and thus the efficiency of the heat exchanger can be determined.	0..1
[Prop] Required	[IRDI] 0173-1#02-AAV973#001 Specifies if this method is required.	[Boolean] True	1
[Prop] ContinuousOrSc heduledMonitori ng	[IRDI] 0173-1#02-AAV974#001 Selection between continuous measurement or scheduled inspection.	[String] Scheduled	1
[Prop] Interval	[IRDI] 0173-1#02-AAV975#002 For continuous monitoring, the cycle time, otherwise a scheduling rule.	[DateTime] 3600s	1..*
[Prop] MethodSheetIde ntification	[IRDI] 0173-1#02-AAV972#001 The distinct identifier for this method used for monitoring this subsystem.	[String] PAMMethodeDescription4711	0..1
[Prop] MethodSheetRef erence	[IRDI] 0173-1#02-AAV976#001 Links to the documentation of this method.	[AnyUri] Link	0..1

3.10 Properties of the SMC "StaticParameter"

Table 10: Properties of the SMC "StaticParameter"

idShort:	StaticParameter		
Class:	SubmodelElementCollection		
semanticId:	[IRDI] 0173-1#01-AGC984#001		
Parent:	SMC "ApplicableMethod"		
Explanation:	List of static parameters such as trigger limits.		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Prop] ParameterName	[IRDI] 0173-1#02-AAV978#001 Name of method parameter.	[String] Warning limit for efficiency	1
[Prop] Description	[IRDI] 0173-1#02-AAV979#001 Provides a concise explanation of the parameter's purpose.	[String] Falling below the limit triggers an alarm	0..1

[Prop] StaticParameter Value	[IRDI] 0173-1#02-AAV980#001 A static parameter value of a method used for monitoring of this subsystem.	[Long] 75.0	1
[Prop] PhysicalUnit	[IRDI] 0173-1#02-AAV981#001 Specifies the physical unit of the static parameter.	[String] %	1

3.11 Properties of the SMC "GeneratedSignal"

Table 11: Properties of the SMC "GeneratedSignal"

idShort:	GeneratedSignal		
Class:	SubmodelElementCollection		
semanticId:	[IRDI] 0173-1#01-AGC985#001		
Parent:	SMC "ApplicableMethod"		
Explanation:	List of generated signals.		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Prop] SignalName	[IRDI] 0173-1#02-AAV983#001 Name of the generated signal.	[String] Efficiency Bad	1
[Prop] Description	[IRDI] 0173-1#02-AAV984#001 Provides a concise explanation of the generated signal.	[String] Binary alarm signal	0..1
[Prop] ValueRange	[IRDI] 0173-1#02-AAV985#001 Specifies the possible range of values for the generated signal (optional).	[Long] [0;100]	0..1
[Prop] PhysicalUnit	[IRDI] 0173-1#02-AAV981#001 Physical unit of the generated signal.	[String] m	0..1
[Prop] RecordingRequired	[IRDI] 0173-1#02-AAV986#001 Determines whether the signal is transmitted to the PAM system for long-term archiving.	[Boolean] True	1
[Prop] SignalType	[IRDI] 0173-1#02-AAV987#001 Indicates whether the generated signal from the method is a floating point, integer or binary value.	[String] floating point	1

3.12 Properties of the SMC "RequiredInputSignals"

Table 12: Properties of the SMC "RequiredInputSignals

idShort:	RequiredInputSignals
Class:	SubmodelElementCollection
semanticId:	[IRDI] 0173-1#01-AGC986#001
Parent:	SMC "ApplicableMethod"

Explanation:	List of necessary input signals of the method.		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Prop] Name	[IRDI] 0173-1#02-AAV989#001 Name of the required input signal.	[String] Flow1	1
[Prop] Description	[IRDI] 0173-1#02-AAV990#001 Provides a concise explanation of the input signal.	[String] Primary flow	0..1
[Prop] ValueRange	[IRDI] 0173-1#02-AAV991#001 Specifies the value range of the input signal (optional).	[String] [0;100]	0..1
[Prop] PhysicalUnit	[IRDI] 0173-1#02-AAV981#001 Physical unit of the input signal (optional).	[String] m	0..1
[Prop] Required	[IRDI] 0173-1#02-AAV992#001 Specifies whether the input signal is required for the method.	[Boolean] True	1
[Prop] InputAvailable	[IRDI] 0173-1#02-AAV993#001 Clarification whether this input signal for the method is already available.	[Boolean] True	1
[Prop] FunctionalLocation	[IRDI] 0173-1#02-AAV946#001 Indicates the asset's logical position within a piping and instrumentation diagram.	[String] LEVTDA-V220-AB13-FV01	0..1
[Prop] RecordingRequired	[IRDI] 0173-1#02-AAV994#001 Determines whether the values of the input signal are transmitted to the PAM system for long-term archiving.	[Boolean] True	1

3.13 Properties of the SMC "DocumentFooter"

Table 13: Properties of the SMC "DocumentFooter"

idShort:	DocumentFooter		
Class:	SubmodelElementCollection		
semanticId:	[IRDI] 173-1#02-AAW627#001		
Parent:	Submodel "PAMSpecificationSheet"		
Explanation:	Properties related to the complete PAM specification sheet.		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] DocumentConfirmation	[IRDI] 0173-1#01-AGC988#001 Information regarding the confirmation to the current status of the PAM specification sheet.	[-] 6 elements	1..*

3.14 Properties of the SMC "DocumentConfirmation"

Table 14: Properties of the SMC "DocumentConfirmation"

idShort:	DocumentConfirmation		
Class:	SubmodelElementCollection		
semanticId:	[IRDI] 0173-1#01-AGC988#001		
Parent:	Submodel "PAMSpecificationSheet"		
Explanation:	properties of the user		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Prop] Date	[IRDI] 0173-1#02-AAR969#002 Date of revision of the PAM specification sheet.	[Date] 2024-05-17	1
[Prop] Author	[IRDI] 0173-1#02-AAV997#001 The individual responsible for the document's revision.	[String] H. Müller	1
[Prop] Checked	[IRDI] 0173-1#02-AAV999#001 The person who has checked the document.	[String] T. Mayer	0..1
[Prop] Released	[IRDI] 0173-1#02-AAV998#001 The individual who has authorized the document for release.	[String] O. Boss	0..1
[Prop] DocumentVersion	[IRDI] 0173-1#02-AAW000#001 Identifier for the document's version.	[String] V0.8	0..1
[Prop] Company	[IRDI] 0173-1#02-AAW001#001 The name of the company associated with the confirmation of the document.	[String] IDTA	0..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 a separate file in form of an AASX file 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 [] form 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

- 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 choosen, as long as it is unique in the parent's 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 ISO 639 language code: example@EN.
- The [valueType] is only given for Properties.

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