Digitale Interoperabilität in kollaborativen
Wertschöpfungsnetzwerken der Industrie 4.0

SPECIFICATION

Submodel Digital Nameplate for Laser Engraving Machine

V1.0

Day Month Year

Submodel Template of the

Asset Adminstration Shell

Version history

Date	Version	Comment
2022-12-16	0.0	First draft. Used for development only. No official version published.
2023-03-06	1.0	Revised draft. Ready for review.

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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 [1-3] 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 [1-6].

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

This Submodel template aims at interoperable provision of information describing asset nameplate for a laser engraving machine (LEM). Central element is the provision of properties [7], which are mandatory for the nameplate of a LEM, ideally interoperable by the means of dictionaries such as ECLASS and IEC CDD (Common Data Dictionary).

The nameplate information has been modelled generally by the existing IDTA Submodel "Digital Nameplate for Industrial Equipment" [8], regardless of application domains. For specific types of products, the asset-specific nameplate information is intended to be capsuled in the SubmodelElementCollections (SMC) "GuidelineSpecificProperties" within the SMC "AssetSpecificProperties". The asset-specific properties have to be defined by the manufacturer. Interoperability cannot be ensured if different manufacturers have different descriptions of the properties for the same product type. The purpose of this document is to standardize the minimum required asset-specific properties of LEM, which should be provided by manufacturers and included in the digital nameplate.

The properties are defined based on the existing EU directives, standards and common practices at enterprises so that a far-reaching acceptance can be achieved. The defined properties are included in the SMC "AssetSpecificProperties" of the IDTA existing IDTA Submodel "Digital Nameplate for Industrial Equipment" V2.0. Therefore, this template is an extension of the existing template for LEM.

1.3 Relevant standards and sources of concepts for the Submodel template

This submodel template is considered to meet the minimum requirement for LEM-specific nameplate information. An LEM as a laser device should meet the legislative requirements specified by Directive 2006/25/EC on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation). Certain artificial sources of optical radiation should be classified accordingly and thus give an indication of the accessible hazard from optical radiation. The classification is laid down by the harmonized standard EN IEC 60825-1:2014 Safety of laser products - Part 1: Equipment

classification and requirements. Therefore, Directive 2006/25/EC and the standard EN IEC 60825-1:2014 are the most relevant standards for this submodel template, which, in addition to the general nameplate information required by Machinery Directive 2006/42/EC, indicates the minimum required asset-specific properties of LEM:

- maximum optical output power of laser
- laser class

Furthermore, in practical applications, manufacturers of electrical industrial equipment typically provide information regarding basic electrical data on the nameplate:

- power consumption
- operating voltage and its type
- operating current
- operating frequency

Some manufacturers of laser engraving machines may include the fusing current and control voltage in the nameplate, although these electrical data are not required by industrial equipment directives or standards. Instead, they are provided as per the manufacturer's practice. As such, this information is modeled as optional properties, rather than mandatory ones. An exemplary nameplate of an LEM is shown in

Typ	HAWK 20W
Gerätenummer	2017-7974-20
Baujahr	05I2017
Betriebsspannung	230 VAC
Betriebsstrom	8 A
Frequenz	50 Hz
Leistungsaufnahme	1.8 kW
Vorschaltsicherung	16 A
Steuerspannung	24 VDC
max. Laserleistung	20W
Laserklasse	1

Figure 1: Exemplary nameplate of an LEM

To ensure the interoperability, the identified properties are aimed to be described by

- 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

For the properties, which have not been described by the both dictionaries, manufacturer specifications are used. The definitions of these properties have been submitted to ECLASS to initialize the standardization process.

2 Information set for Submodel Template

This submodel template is mainly based on the IDTA submodel template "Digital Nameplate for industrial equipment". It extends the SMC "AssetSpecificProperties" to include the minimum required LEM-specific nameplate information. While defining Submodels the following three aspects must be considered as suggested in [5]:

Use and economic relevance

The IDTA submodel template "Digital Nameplate for industrial equipment" has paved the way to establish the standardized and machine-readable digital nameplate for industrial machines that are subject to EU Machine Directive 164 2006/42/EC. However, certain machines require more asset-specific information on the nameplate, which are not included in the existing IDTA submodel. For instance, the standard ISO 8121:2007 specifies the nameplate content for knitting machines. In additional to the general content required by Machine Directive 164 2006/42/EC, the asset-specific properties such as nominal width according to ISO 11675 or ISO 8640-1 as applicable in millimeters and pitch in accordance with ISO 8188 should be included in the nameplate for flat knitting machines [9]. However, such a standard that explicitly defines the nameplate information for a certain type of machines usually does not exist. The nameplate information is defined by manufacturers based on relevant standards and common practices in their domain. The present submodel template "Digital Nameplate for Laser Engraving Machine" helps standardize the LEM-specific nameplate properties. As a result, the nameplate information of LEMs is completely extended and standardized, which ensures the interoperability of digital nameplates from different manufacturers of LEMs.

Possible functions and interactions

The submodel template "Digital Nameplate for Laser Engraving Machine" provides the complete nameplate information of a LEM. Manufacturers use this submodel to fulfill the legal commitment for LEMs. Customers can use this submodel to acquire identifying, classifying, safety information about an LEM.

Property specification

See Section 3 Submodel and Collections.

3 Submodel and Collections

Table 1 describes this submodel "Digital Nameplate for Laser Engraving Machine". Its structure and properties correspond to the IDTA submodel template "Digital Nameplate for industrial equipment". More details can be find in its specification document [8]. The distinguished properties are incorporated in the SMC "AssetSpecificProperties".

Table 1: SM "Digital Nameplate for Laser Engraving Machine"

idShort	NameplateLaserEngravingMachine
Class	Submodel
semanticId	[IRI] https://admin-shell.io/InterOpera/NameplateLaserEngravingMachine/1/0/ NameplateLaserEngravingMachine
Parent	Asset Administration Shell of a laser engraving machine
Explanation	nameplate extended for laser engraving machines

3.1 Properties of the SMC "AssetSpecificProperties"

Figure 2 shows the UML-diagram defining the SMC "AssetSpecificProperties". Table 2 describes the details of the SMC structure.
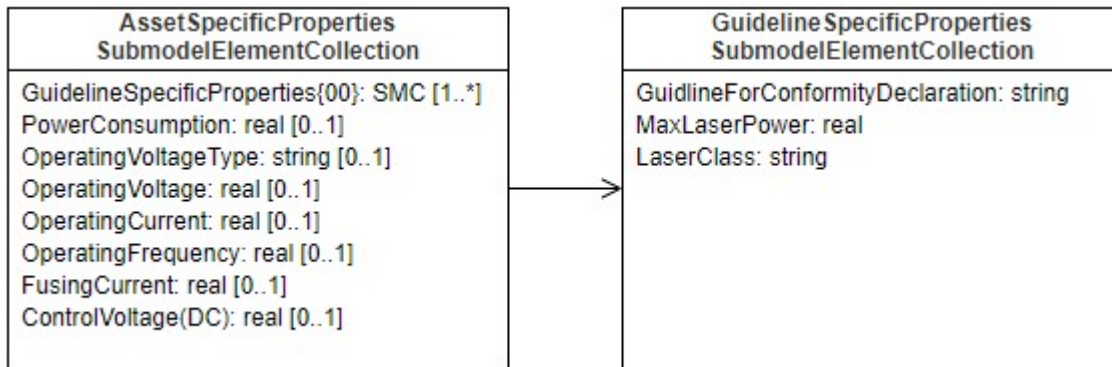

Figure 2: UML-Diagram of the SMC "AssetSpecificProperties"

Table 2: Properties of the SMC "AssetSpecificProperties"

idShort	AssetSpecificProperties		
Class	SubmodelElementCollection		
semanticId	[IRDI] 0173-1#01-AGZ672#001		
Parent	Submodel "NameplateLaserEngravingMachine"		
Explanation	Group of properties that are listed on the nameplate of a laser engraving machine and are grouped based on guidelines		
[SME type]	semanticId = [idType]value	[valueType]	card.

idShort	Description@en	Example / Value	
[SubmodelElementCollection] GuidelineSpecificProperties	[IRDI] 0173-1#01-AHD205#001 Asset specific nameplate information required by guideline, stipulation or legislation.	n/a	[1..*]
[Property] PowerConsumption	[IRDI] 0173-1#02-AAC969#007 power requirement of the device or component during defined operating conditions	[float] 1.8 kw	[0..1]
[Property] OperatingVoltageType	[IRDI] 0173-1#02-BAC064#008 Type of voltage required for operation of the device	[string] AC	[0..1]
[Property] OperatingVoltage	[IRDI] 0173-1#02-BAB415#008 voltage which, together with the rated operating current, determines the use of the device and to which the various tests and the use categories refer.	[float] 230 V	[0..1]
[Property] OperatingCurrent	[IRDI] 0173-1#02-BAC051#004 Manufacturer's value of the current, which is or must be present during operation of the system or of system parts	[float] 8 A	[0..1]
[Property] OperatingFrequency	[IRDI] 0173-1#02-AAB505#006 The voltage frequency and/or electromagnetic pulse for which the device is designed	[float] 50 Hz	[0..1]
[Property] FusingCurrent	[IRDI] 0173-1#02-ABD379#001 Current rating of the fuse. The characteristic of the fuse is to be found in Characteristic of backup fuse	[float] 16 A	[0..1]
[Property] ControlVoltage(DC)	[IRDI] 0173-1#02-AAI938#004 describes the control voltage DC of the object in volts	[float] 24 V	[0..1]

3.2 Properties of the SMC "GuidelineSpecificProperties"

Table 3 describes the details of the SMC "GuidelineSpecificProperties".

Table 3: Properties of the SMC "GuidelineSpecificProperties "

idShort	GuidelineSpecificProperties		
Class	SubmodelElementCollection		
semanticId	[IRDI] 0173-1#01-AHD205#001		
Parent	SMC "AssetSpecificProperties"		
Explanation	Asset specific nameplate information required by guideline, stipulation or legislation.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**Example / Value**	
[Property] GuidelineForConformityDeclaration	[IRDI]0173-1#02-AAO856#002 guideline, stipulation or legislation used for determining conformity	[String] IEC 60825-1:2014 Safety of laser products - Part 1: Equipment classification and requirements	[1]
[Property] MaxLaserPower	[IRI]https://admin-shell.io/id/InterOpera/NameplateLaserEngravingMachine/MaxLaserPower maximum optical output power of laser	[float] 20 W	[1]
[Property] LaserClass	[IRDI]0173-1#02-AAH938#005 information on the obtainable radiation with respective limits for the photochemical danger that is set into certain classes	[string] 1	[1]

Annex A: Explanations on used table formats

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.

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

SME type Submodel	Element 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@de.
- The [valueType] is only given for Properties.

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