SPECIFICATION

Submodel Technical Data for Laser Engraving Machine

V1.0

Day Month Year

Submodel Template of the

Asset Adminstration Shell

Version history

Date	Version	Comment
2022-01-25	0.0	First draft. Used for development only. No official version published.
2023-03-06	1.0	Revised draft. Ready for review.

Content

List of Figures

List of Tables

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 technical data for a laser engraving machine (LEM). Central element is the provision of properties [7], which are applicable to describe the technical specifications of a LEM, ideally interoperable by the means of dictionaries such as ECLASS and IEC CDD (Common Data Dictionary).

A standardized information model of technical data of industrial equipment has been provided by the existing IDTA Submodel "Generic Frame for Technical Data for Industrial Equipment in Manufacturing" [8]. This submodel template specifies the basic data structure by using a set of SubmodelElements and defines the necessary general properties to describe the manufacturer information. For specific types of products, the asset-specific technical data is intended to be capsuled in the SubmodelElementCollections (SMC) "GuidelineSpecificProperties" within the SMC "TechnicalProperties". The asset-specific technical properties have to be defined by the manufacturer. Interoperability cannot be ensured if different manufacturers have different descriptions of technical properties for the same product type. The purpose of this submodel template is to standardize the possible-applicable technical properties of LEM.

The properties are defined based on the existing standards and common practices at enterprises so that a far-reaching acceptance can be achieved. The defined properties are included in the SMC "TechnicalProperties" of the IDTA existing IDTA Submodel "Generic Frame for Technical Data for Industrial Equipment in Manufacturing" V1.2. Therefore, this template is an extension of the existing template for LEM.

1.3 Relevant standards and sources of concepts for the Submodel template

In the property dictionary ECLASS, a category of "Marking lasers" (with the classification number 19140127) has already been defined. The properties defined under this category are included in this submodel template. In addition, several applicable standards are considered based on common practices of LEMs' manufacturers. The applicable standards are listed in Table 1. Moreover, manufacturer specifications have been considered. The technical

properties given by different manufacturers were compared and evaluated. A part of them have been defined in the property dictionary ECLASS and IEC CDD. Other non-standardized properties are defined by the representatives of LEM manufacturers within the working group. The definitions of these properties have been submitted to ECLASS to initialize the standardization process.

Table 1: List of examplary standards defining interoperable properties

DIN EN IEC 60825-1:2014 Safety of laser products - Part 1: Equipment classification and requirements
IEC TR 60825-5:2019 Safety of laser products – Part 5: Manufacturer's checklist for IEC 60825-1
DIN EN ISO 11252:2014-02 Lasers and laser-related equipment – Laser device – Minimum requirements for documentation
DIN EN ISO 11553-1:2020 Sicherheit von Maschinen – Laserbearbeitungsmaschinen – Teil 1: Anforderungen an die Lasersicherheit
DIN EN ISO 11553-3:2013 Sicherheit von Maschinen – Laserbearbeitungsmaschinen – Teil 3: Lärmminderungs- und Geräuschmessverfahren für Laserbearbeitungsmaschinen und handgeführte Laserbearbeitungsgeräte sowie zugehörige Hilfseinrichtungen

2 Information set for Submodel Template

This submodel template is mainly based on the IDTA submodel template "Generic Frame for Technical Data for Industrial Equipment in Manufacturing" [8]. It extends the SMC "TechnicalProperties" to include the LEM-specific technical properties. While defining Submodels the following three aspects must be considered as suggested in [5]:

Use and economic relevance

The IDTA submodel template "Generic Frame for Technical Data for Industrial Equipment in Manufacturing" has defined a standardized information model of technical properties. It contains four aspects of information by defining the following four SMCs: General Information, Product classification, Technical Properties, Further Information. More details can be found in the specification document [8]. Among them, the SMC "TechnicalProperties" is kept empty in the IDTA submodel template, since the technical properties should be defined according to the corresponding industrial equipment. The technical properties are usually defined by manufacturers based on relevant standards and common practices in their domains. However, interoperability cannot be ensured if different manufacturers have different descriptions of technical properties for the same product type. The present submodel template "Techincal Data for Laser Engraving Machine" helps standardize the LEM-specific technical properties. The defined properties are the vendor-neural properties, which ensures the interoperability of technical data of LEMs provided by different manufacturers.

Possible functions and interactions

The submodel template "Technical Data for Laser Engraving Machine" provides the vendor-neural technical properties of a LEM. The LEM manufacturers can use this template to fill in the property values according to their own products and add more private product-specific properties. Customers can use this submodel to acquire the information about the manufacturer, product classification, detailed technical data, and product descriptions of an LEM.

Property specification

See Section 3 Submodel and Collections.

3 Submodel and Collections

Table 2 describes this submodel "Technical Data for Laser Engraving Machine". Its structure and properties are the same as the IDTA submodel template "Generic Frame for Technical Data for Industrial Equipment in Manufacturing". The distinguished properties are defined in the SMC "TechnicalProperties".

Table 2: SM "Technical Data for Laser Engraving Machine"

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

3.1 Properties of the SMC "AssetSpecificProperties"

Figure 1 shows the UML-diagram defining the SMC "TechnicalProperties". Table 3 describes the details of the SMC structure. Three aspects of properties are defined for laser engraving machines and represented by three SMCs:

- The SMC "General Machinery" contains the technical properties that are relevant to any types of machines and have not been included in the SMC "General Information" within the existing IDTA submodel template "Generic Frame for Technical Data for Industrial Equipment in Manufacturing". The majority of the general technical properties refer to the category "Marking lasers" predefined in ECLASS. Others stem from the relevant standards and manufacturer practices. Apart from the general technical properties, a SMC "ManufacturerSpecificProp" is defined and left empty to hold the customized technical properties.
- The SMC "laser" contains the laser-specific properties that may be relevant and adoptable to any laser devices. They are defined according the category "Marking lasers" predefined in ECLASS, the relevant technical standards and manufacturer practices.
- The SMC "LaserEngravingMachines" contains the production-machine-specific technical properties which may be merely applicable to laser engraving machines. Nevertheless, these properties are the vendor-neural ones, regardless of product variants. The majority thereof are defined based on manufacturer practices.
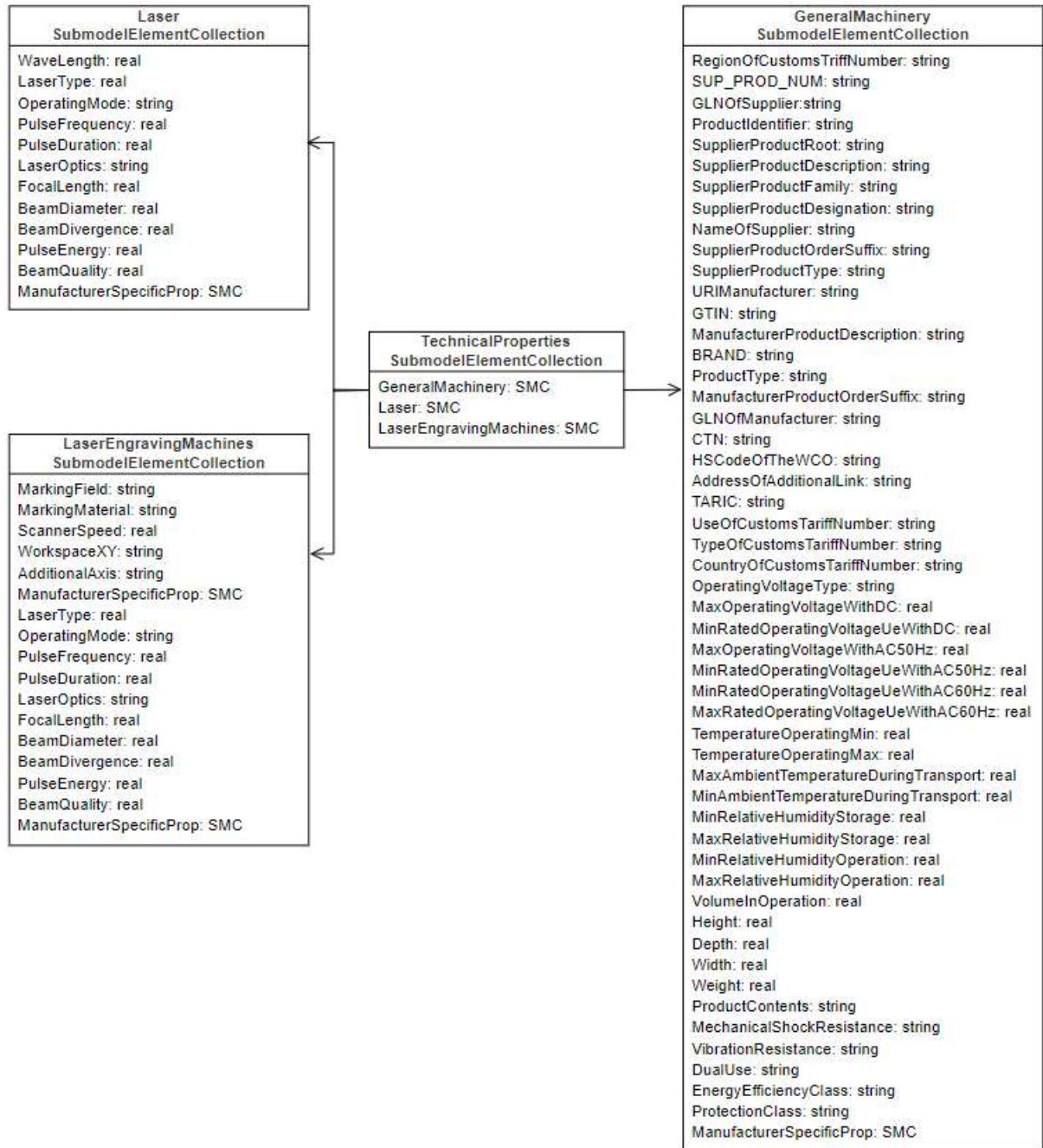
Figure 1: UML-Diagram of the SMC "TechnicalProperties"

Laser
SubmodelElementCollection

- WaveLength: real
- LaserType: real
- OperatingMode: string
- PulseFrequency: real
- PulseDuration: real
- LaserOptics: string
- FocalLength: real
- BeamDiameter: real
- BeamDivergence: real
- PulseEnergy: real
- BeamQuality: real
- ManufacturerSpecificProp: SMC

LaserEngravingMachines
SubmodelElementCollection

- MarkingField: string
- MarkingMaterial: string
- ScannerSpeed: real
- WorkspaceXY: string
- AdditionalAxis: string
- ManufacturerSpecificProp: SMC
- LaserType: real
- OperatingMode: string
- PulseFrequency: real
- PulseDuration: real
- LaserOptics: string
- FocalLength: real
- BeamDiameter: real
- BeamDivergence: real
- PulseEnergy: real
- BeamQuality: real
- ManufacturerSpecificProp: SMC

TechnicalProperties
SubmodelElementCollection

- GeneralMachinery: SMC
- Laser: SMC
- LaserEngravingMachines: SMC

GeneralMachinery
SubmodelElementCollection

- RegionOfCustomsTriffNumber: string
- SUP_PROD_NUM: string
- GLNOfSupplier:string
- ProductIdentifier: string
- SupplierProductRoot: string
- SupplierProductDescription: string
- SupplierProductFamily: string
- SupplierProductDesignation: string
- NameOfSupplier: string
- SupplierProductOrderSuffix: string
- SupplierProductType: string
- URIManufacturer: string
- GTIN: string
- ManufacturerProductDescription: string
- BRAND: string
- ProductType: string
- ManufacturerProductOrderSuffix: string
- GLNOfManufacturer: string
- CTN: string
- HSCodeOfTheWCO: string
- AddressOfAdditionalLink: string
- TARIC: string
- UseOfCustomsTariffNumber: string
- TypeOfCustomsTariffNumber: string
- CountryOfCustomsTariffNumber: string
- OperatingVoltageType: string
- MaxOperatingVoltageWithDC: real
- MinRatedOperatingVoltageUeWithDC: real
- MaxOperatingVoltageWithAC50Hz: real
- MinRatedOperatingVoltageUeWithAC50Hz: real
- MinRatedOperatingVoltageUeWithAC60Hz: real
- MaxRatedOperatingVoltageUeWithAC60Hz: real
- TemperatureOperatingMin: real
- TemperatureOperatingMax: real
- MaxAmbientTemperatureDuringTransport: real
- MinAmbientTemperatureDuringTransport: real
- MinRelativeHumidityStorage: real
- MaxRelativeHumidityStorage: real
- MinRelativeHumidityOperation: real
- MaxRelativeHumidityOperation: real
- VolumeInOperation: real
- Height: real
- Depth: real
- Width: real
- Weight: real
- ProductContents: string
- MechanicalShockResistance: string
- VibrationResistance: string
- DualUse: string
- EnergyEfficiencyClass: string
- ProtectionClass: string
- ManufacturerSpecificProp: SMC

Table 3: Properties of the SMC "TechnicalProperties"

idShort	TechnicalProperties
Class	SubmodelElementCollection
semanticId	[IRI]https://admin-shell.io/ZVEI/TechnicalData/TechnicalProperties/1/1
Parent	Submodel "Generic Frame for Technical Data for Industrial Equipment in Manufacturing"
Explanation	Technical and product properties. Individual characteristics that describe the product and its technical properties

[SME type]	semanticId = [idType]value	[dataType]	card.
idShort	Description@en	Example	
[SubmodelElement Collection] GeneralMachinery	[IRI] https://admin-shell.io/sandbox/SG2/TechnicalData/Main Section/1/1 Technical properties of general machinery	n/a	[1]
[SubmodelElement Collection] Laser	[IRI] https://admin-shell.io/sandbox/SG2/TechnicalData/Main Section/1/1 Technical properties of laser	n/a	[1]
[SubmodelElement Collection] LaserEngravingMa chines	[IRI] https://admin-shell.io/sandbox/SG2/TechnicalData/Main Section/1/1 Technical properties of laser engraving machines	n/a	[1]

3.2 Properties of the SMC "GeneralMachinery"

Table 4 describes the details of the SMC "GeneralMachinery".

Table 4: Properties of the SMC "GeneralMachinery"

idShort	GeneralMachinery		
Class	SubmodelElementCollection		
semanticId	[IRI] https://admin-shell.io/sandbox/SG2/TechnicalData/MainSection/1/1		
Parent	SMC "TechnicalProperties"		
Explanation	Technical Data for General Machinery		
[SME type]	semanticity = [idType]value	[dataType]	card.
idShort	Description@en	Example	
[Property] RegionOfCustom sTariffNumber	[IRDI] 0173-1#02-AAO264#002 Region, zone or union for which the declared tariff number is applicable in terms of content and structure	[String]	[0..1]
[Property] SUP_PROD_NU M	[IRDI] 0173-1#02-AAO736#004 unique product order identifier of the supplier	[String]	[0..1]
[Property] GLNOfSupplier	[IRDI] 0173-1#02-AAO736#004 internationally unique identification number for the supplier of the device or the product and for the physical location	[String]	[0..1]

[Property] ProductIdentifier	[IRDI] 0173-1#02-ABA671#001 unique identifier of the product	[String]	[0..1]
[Property] SupplierProductRoot	[IRDI] 0173-1#02-AAU729#001 Top level of a 3 level supplier specific product hierarchy	[String]	[0..1]
[Property] SupplierProductDescription	[IRDI] 0173-1#02-AAU730#001 Description of the product, it's technical features and implementation if needed (long text)	[String]	[0..1]
[Property] SupplierProductFamily	[IRDI] 0173-1#02-AAU728#001 2nd level of a 3 level supplier specific product hierarchy	[String]	[0..1]
[Property] SupplierProductDesignation	[IRDI] 0173-1#02-AAM551#002 Short description of the product (short text)	[String]	[0..1]
[Property] NameOfSupplier	[IRDI] 0173-1#02-AAO735#003 name of supplier which provides the customer with a product or a service	[String]	[0..1]
[Property] SupplierProductOrderSuffix	[IRDI] 0173-1#02-AAW337#001 By the supplier awarded string for the identification of additional attributes, not by a structured supplier item number may be expressed	[String]	[0..1]
[Property] SupplierProductType	[IRDI] 0173-1#02-AAW336#001 Characteristic to differentiate between different products of a product family or special variants	[String]	[0..1]
[Property] URIManufacturer	[IRDI] 0173-1#02-ABA669#001 fully qualified domain name of the manufacturer of a product using a universal resource identifier (URI)	[String]	[0..1]
[Property] GTIN	[IRDI] 0173-1#02-AAO663#003 internationally unique and unambiguous article number for products and services (Global Trade Item Number)	[String]	[0..1]
[Property] ManufacturerProductDescription	[IRDI] 0173-1#02-AAU734#001 Description of the product, it's technical features and implementation if needed (long text)	[String]	[0..1]
[Property] BRAND	[IRDI] 0173-1#02-AAU734#001	[String]	[0..1]

	Part of the naming for the support and the recognition of the brand position of products and services consisting of words, numbers, letters or other characters. Registered brands and trademarks are indicated with the appropriate protective signs (® or TM)		
[Property] ProductType	[IRDI] 0173-1#02-AAO057#002 Characteristic to differentiate between different products of a product family or special variants	[String]	[0..1]
[Property] ManufacturerProductOrderSuffix	[IRDI] 0173-1#02-AAU733#001 By the manufacturer awarded string for the identification of additional attributes, not by a structured manufacturer item number may be expressed	[String]	[0..1]
[Property] GLNOfManufacturer	[IRDI] 0173-1#02-AAY812#001 internationally unique identification number for the manufacturer of the device or the product and for the physical location	[String]	[0..1]
[Property] CTN	[IRDI] 0173-1#02-AAZ800#001 Nomenclature of goods in accordance with a regulation relating to customs tariff and statistical purposes for application to a specific country and / or region. The structure of the customs tariff number is defined by the type otherwise indicated	[String]	[0..1]
[Property] HSCodeOfTheWCO	[IRDI] 0173-1#02-AAZ851#001 Internationally applied 4 to 6-digit coding of classes of goods as defined by the Harmonized System (HS) of the World Customs Organization (WCO)	[String]	[0..1]
[Property] AddressOfAdditionalLink	[IRDI] 0173-1#02-AAQ326#002 address of additional link	[String]	[0..1]
[Property] TARIC	[IRDI] 0173-1#02-AAD931#006 customs tariff number (TARIC)	[String]	[0..1]
[Property] UseOfCustomsTariffNumber	[IRDI] 0173-1#02-AAZ850#001 Use of customs tariff number	[String]	[0..1]

[Property] TypeOfCustomsTariffNumber	[IRDI] 0173-1#02-AAZ849#001 Type of customs tariff number	[String]	[0..1]
[Property] CountryOfCustomsTariffNumber	[IRDI] 0173-1#02-AAO263#004 Country for which the declared tariff number is applicable in terms of content and structure	[String]	[0..1]
[Property] OperatingVoltageType	[IRDI] 0173-1#02-BAC064#008 Type of voltage required for operation of the device	[String]	[1]
[Property] MaxOperatingVoltageWithDC	[IRDI] 0173-1#02-AAB840#008 The maximum value of DC voltage (DC), that can be applied to operating unit under consideration of the conditions of use and which relates to the different product-specific tests (i.e. insulation, switching capacity)	[real]	[0..1]
[Property] MinRatedOperatingVoltageUeWithDC	[IRDI] 0173-1#02-AAB954#008 The minimum value of DC voltage, stipulated by the manufacturer that can be applied to an operating unit under consideration of the conditions of use	[real]	[0..1]
[Property] MaxOperatingVoltageWithAC50Hz	[IRDI] 0173-1#02-AAB838#008 The maximum value of alternating voltage (AC) with 50 Hz, that can be applied to operating unit under consideration of the conditions of use and which relates to the different product-specific tests (i.e. insulation, switching capacity)	[real]	[0..1]
[Property] MinRatedOperatingVoltageUeWithAC50Hz	[IRDI] 0173-1#02-AAB952#008 The minimum value of alternating voltage with 50 Hz, stipulated by the manufacturer that can be applied to an operating unit under consideration of the conditions of use	[real]	[0..1]
[Property] MinRatedOperatingVoltageUeWithAC60Hz	[IRDI] 0173-1#02-AAB953#008 The minimum value of alternating voltage with 60 Hz, stipulated by the manufacturer that can be applied to an operating unit under consideration of the conditions of use	[real]	[0..1]
[Property] MaxRatedOperatingVoltageUeWithAC60Hz	[IRDI] 0173-1#02-AAB819#008 The maximum value of alternating voltage with 60 Hz, stipulated by the manufacturer that can be applied to an operating unit under consideration of the conditions of use	[real]	[0..1]

[Property] TemperatureOperatingMin	[IRDI] 0173-1#02-AAV869#002 Minimum operating temperature within a system for the design of an component / selection of an applicable component type	[real]	[1]
[Property] TemperatureOperatingMax	[IRDI] 0173-1#02-AAV666#002 Maximum operating temperature within a system for the design of an component / selection of an applicable component type	[real]	[1]
[Property] MaxAmbientTemperatureDuringTransport	[IRDI] 0173-1#02-AAW844#002 Under defined conditions, the temperature of the atmosphere / duration which surrounds the operating medium, in the course of which something takes place: Transport of objects (and / or persons) / maximum limit of a physical quantity whose value can not be exceeded or allowed	[real]	[1]
[Property] MinAmbientTemperatureDuringTransport	[IRDI] 0173-1#02-AAW845#002 Under defined conditions, the temperature of the atmosphere / duration which surrounds the operating medium, in the course of which something takes place: Transport of objects (and / or persons) / minimum limit of a physical quantity, the value of which can no longer be or must not be exceeded	[real]	[1]
[Property] MinRelativeHumidityStorage	[IRDI] 0173-1#02-AAW201#002 Lower limit of ambient humidity in which a product can be stored without permanent changes in its characteristics	[real]	[1]
[Property] MaxRelativeHumidityStorage	[IRDI] 0173-1#02-AAW210#002 Highest permitted limit around humidity at which a product without permanent changes in its characteristics may be stored	[real]	[1]
[Property] MinRelativeHumidityOperation	[IRDI] 0173-1#02-AAA942#007 lowest relative humidity which is required for the intended use of device	[real]	[1]
[Property] MaxRelativeHumidityOperation	[IRDI] 0173-1#02-AAA915#007 highest relative humidity which is permitted for the intended use of device	[real]	[1]
[Property] VolumeInOperation	[IRDI] 0173-1#02-AAZ228#001 measure of the intensity of the perception of audible sound waves during the operation	[real]	[1]
[Property] Height	[IRDI] 0173-1#02-BAA020#009	[real]	[1]

	for objects with orientation in preferred position during use the dimension perpendicular to diameter/length/width/depth		
[Property] Depth	[IRDI] 0173-1#02-BAB577#008 for objects with fixed orientation or in preferred utilization position, the rear , generally away from the observer expansion is described as depth	[real]	[1]
[Property] Width	[IRDI] 0173-1#02-BAF016#006 for objects with orientation in preferred position during use the dimension perpendicular to height/ length/depth	[real]	[1]
[Property] Weight	[IRDI] 0173-1#02-AAQ808#004 mass of a device or component in operating state	[real]	[1]
[Property] ProductContents	[IRDI] 0173-1#02-AAE263#003 designation of gastrointestinal tube accessories which are included	[real]	[1]
[Property] MechanicalShock Resistance	[IRDI] 0173-1#02-AAT320#002 degree of sudden mechanical loading a device can or must be designed to withstand without permanent impairment of operating characteristics	[String]	[1]
[Property] VibrationResistance	[IRDI] 0173-1#02-AAO888#003 mechanical resistance capacity of devices against sinusoidal oscillations with prescribed test intensity	[String]	[1]
[Property] DualUse	[IRDI] 0173-1#02-AAE319#004 dual use mark indicates if the product can be used both for civilian and military applications	[String]	[1]
[Property] EnergyEfficiency Class	[IRDI] 0173-1#02-AAR804#008 Energy label classification (2010/30/EU framework directive amendments)	[String]	[0..1]
[Property] ProtectionClass	[IRDI] 0173-1#02-AAJ501#002 indicates the protection class acc. IP of a laser level gage	[String]	[1]
[SMC] ManufacturerSpecificProp	[IRI] https://admin-shell.io/sandbox/SG2/TechnicalData/SubSection/1/1 Subordinate subdivision possibility for product-specific properties that are defined by manufacturers	n/a	[0..1]

3.3 Properties of the SMC "Laser"

Table 5 describes the details of the SMC "Laser".

Table 5: Properties of the SMC "Laser "

idShort	Laser		
Class	SubmodelElementCollection		
semanticId	[IRI] https://admin-shell.io/sandbox/SG2/TechnicalData/MainSection/1/1		
Parent	SMC "TechnicalProperties"		
Explanation	Technical Data for Laser		
[SME type]	**semanticity = [idType]value**	**[dataType]**	**card.**
idShort	**Description@en**	**Example**	
[Property] WaveLength	[IRDI] 0173-1#02-AAZ225#001 Specifies the wavelength of the laser in nanometers	[real]	[1]
[Property] LaserType	[IRDI] 0173-1#02-AAZ227#001 Which laser type is used	[string]	[1]
[Property] OperatingMode	[IRI] https://admin-shell.io/id/InterOpera/TechnicalDataLaserEngravingMachine/OperatingMode Type of laser output, its value could be pulsed or continuous wave (cw)	[string]	[1]
[Range] PulseFrequency	[IRDI] 0173-1#02-AAW183#002 Specification of the pulse frequency per time unit	[real] 20-80 kHz	[1]
[Property] PulseDuration	[IRDI] 0173-1#02-AAI639#004 duration of a single transmitted pulse	[real]	[1]
[Property] LaserOptics	[IRDI] 0173-1#02-ABF536#001 type of optical focus: teach autofocus, adjustable focus (manual), fixed focus, adjustable focus (electric) or dynamic focus control	[string]	[1]
[Property] FocalLength	[IRDI] 0173-1#02-BAF034#004 With a lense, the distance in which parallel rays (e.g. from the sun) which pass through it are bundled together in a single point behind it	[real]	[1]

[Property] BeamDiameter	[IRI] https://admin-shell.io/id/InterOpera/TechnicalDataLaserEngravingMachine/BeamDiameter physical size of the beam perpendicular to the direction of beam propagation	[real]	[1]
[Property] BeamDivergence	[IRI] https://admin-shell.io/id/InterOpera/TechnicalDataLaserEngravingMachine/BeamDivergence Expansion of a laser beam over a certain distance	[real]	[1]
[Property] PulseEnergy	[IRI] https://admin-shell.io/id/InterOpera/TechnicalDataLaserEngravingMachine/PulseEnergy maximum energy of a laser pulse	[real]	[1]
[Property] BeamQuality	[IRI] https://admin-shell.io/id/InterOpera/TechnicalDataLaserEngravingMachine/BeamQuality Indicator of the deviation between the actual beam profile of a laser and the ideal beam profile	[string]	[1]
[SMC] ManufacturerSpecificProp	[IRI] https://admin-shell.io/sandbox/SG2/TechnicalData/SubSection/1/1 Subordinate subdivision possibility for product-specific properties that are defined by manufacturers	n/a	[0..1]

3.4 Properties of the SMC "LaserEngravingMachines"

Table 6 describes the details of the SMC "LaserEngravingMachines".

Table 6: Properties of the SMC "LaserEngravingMachines"

idShort	LaserEngravingMachines		
Class	SubmodelElementCollection		
semanticId	[IRI] https://admin-shell.io/sandbox/SG2/TechnicalData/MainSection/1/1		
Parent	SMC "TechnicalProperties"		
Explanation	Collections containing production-machine-specific technical properties which may be merely applicable to laser engraving machines		
[SME type]	**semanticity = [idType]value**	**[dataType]**	**card.**
idShort	**Description@en**	**Example**	

[Property] MarkingField	[IRDI] 0173-1#02-AAZ222#001 Specification of the dimensions of the area that can be labeled	[string]	[1]
[Property] MarkingMaterial	[IRI] https://admin-shell.io/id/InterOpera/TechnicalDataLaserEngravingMachine/MarkingMaterial suitable marking materials	[string]	[0..1]
[Property] ScannerSpeed	[IRI] https://admin-shell.io/id/InterOpera/TechnicalDataLaserEngravingMachine/ScannerSpeed maximum marking speed of the beam deflection and positioning unit (scanner)	[real]	[1]
[Property] ScanningField	[IRI] https://admin-shell.io/id/InterOpera/TechnicalDataLaserEngravingMachine/ScanningField maximum range for deflection of the laser beam by the scanner unit	[string]	[1]
[Property] WorkspaceXY	[IRI] https://admin-shell.io/id/InterOpera/TechnicalDataLaserEngravingMachine/WorkspaceXY maximum size of the working plane based on the traverse paths of the X/Y positioning axes	[string]	[1]
[Property] AdditionalAxis	[IRI] https://admin-shell.io/id/InterOpera/TechnicalDataLaserEngravingMachine/AdditionalAxis rotation axis	[string]	[0..1]
[SMC] ManufacturerSpecificProp	[IRI] https://admin-shell.io/sandbox/SG2/TechnicalData/SubSection/1/1 Subordinate subdivision possibility for product-specific properties that are defined by manufacturers	n/a	[0..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.

Bibliography

[1] "Recommendations for implementing the strategic initiative INDUSTRIE 4.0", acatech, April 2013. [Online]. Available: https://www.acatech.de/Publikation/recommendations-for-implementing-the-strategic-initiative-industrie-4-0-final-report-of-the-industrie-4-0-working-group/

[2] "Implementation Strategy Industrie 4.0: Report on the results of the Industrie 4.0 Platform"; BITKOM e.V. / VDMA e.V., /ZVEI e.V., April 2015. [Online]. Available: https://www.bitkom.org/noindex/Publikationen/2016/Sonstiges/Implementation-Strategy-Industrie-40/2016-01-Implementation-Strategy-Industrie40.pdf

[3] "The Structure of the Administration Shell: TRILATERAL PERSPECTIVES from France, 404 Italy and Germany", March 2018, [Online]. Available: https://www.plattform-405 i40.de/I40/Redaktion/EN/Downloads/Publikation/hm-2018-trilaterale-coop.html

[4] "Beispiele zur Verwaltungsschale der Industrie 4.0-Komponente – Basisteil (German)"; ZVEI e.V., Whitepaper, November 2016. [Online]. Available: https://www.zvei.org/presse-medien/publikationen/beispiele-zur-verwaltungsschale-der-industrie-40-komponente-basisteil/

[5] "Verwaltungsschale in der Praxis. Wie definiere ich Teilmodelle, beispielhafte Teilmodelle und Interaktion zwischen Verwaltungsschalen (in German)", Version 1.0, April 2019, Plattform Industrie 4.0 in Kooperation mit VDE GMA Fachausschuss 7.20, Federal Ministry for Economic Affairs and Energy (BMWi), Available: https://www.plattform-i40.de/PI40/Redaktion/DE/Downloads/Publikation/2019-verwaltungsschale-in-der-praxis.html

[6] "Details of the Asset Administration Shell; Part 1 - The exchange of information between partners in the value chain of Industrie 4.0 (Version 3.0RC01)", November 2020, [Online]. Available: https://www.plattform-i40.de/PI40/Redaktion/EN/Downloads/Publikation/Details-of-the-Asset-Administration-Shell-Part1.html

[7] "Semantic interoperability: challenges in the digital transformation age"; IEC, International Electronical Commission; 2019. [Online]. Available:https://basecamp.iec.ch/download/iec-white-paper-semantic-nteroperability-challenges-in-the-digital-transformation-age-en/

[8] IDTA, IDTA 02003-1-2 Generic Frame for Technical Data for Industrial Equipment in Manufacturing, Specification of Submodel Template of the Asset Administration Shell

[9] International Standard ISO 8121:2007, Textile machinery — Knitting machines — Nameplate information