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SPECIFICATION

Submodel Technical Data for Temperature Control Unit

Version 1.0

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Submodel Template of the
Asset Administration Shell

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Plattform Industrie 4.0
Bertolt-Brecht-Platz 3
10117 Berlin
Germany

Authors

Dr. Saeid Aminabadi	WITTMANN BATTENFELD GmbH
Marc Brinkmeier	WAGO GmbH & Co. KG
Florian Brinkmeyer	WAGO GmbH & Co. KG
Matthias Busl	KraussMaffei Technologies GmbH
Linus Fallert	KraussMaffei Technologies GmbH
Jan Heinzelmann	ARBURG GmbH & Co. KG
Rupert Hirn	KraussMaffei Technologies GmbH
Prof. Dr. Christian Hopmann	Institut für Kunststoffverarbeitung an der RWTH Aachen
Jörg Humm	ARBURG GmbH & Co. KG
Dr. Philipp Liedl	Steinbeis-Beratungszentrum Technologische Transformation
Jürgen Opdenhoff	Opdenhoff Technologie GmbH
Wolfgang Roth	WITTMANN BATTENFELD GmbH
Patrick Sapel	Institut für Kunststoffverarbeitung an der RWTH Aachen
Dr. Micha Scharf	Phoenix Contact GmbH & Co. KG
Dr. Thomas Schilling	Sumitomo (SHI) Demag Plastics Machinery GmbH
Gunther Schmid	ARBURG GmbH & Co. KG
Marc Schmitt	VDMA e.V.
Julian Steiger	Opdenhoff Technologie GmbH
Dr. Mikula Thiem	VDMA e.V.
Dr. Thomas Walther	ARBURG GmbH & Co. KG

Die Teilmodell-Spezifikation enthält ECLASS. Es gelten die ECLASS Nutzungsbedingungen (<https://eclass.eu/eclass-standard/nutzungsbedingungen>).

Version history

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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 the interoperable provision of information describing a temperature control unit (TCU) regarding to the asset of the respective Asset Administration Shell. The central element is the provision of properties [7], ideally interoperable by means of dictionaries such as ECLASS and IEC CDD (Common Data Dictionary). The purpose of this Submodel is to enhance the already published IDTA specification "Generic Frame for Technical Data for Industrial Equipment in Manufacturing" (02003-1-2) with specific properties of a TCU. The focus of this document is the standardized description of relevant properties that represent the technical master data of a TCU. Master data in this context characterize the TCU's capabilities, usually expressed in minimum, maximum, or boolean values, e.g., the maximal cooling capacity or minimal possible pressure. Typically, this master data is unalterable or fixed for a certain period.

This Submodel targets order management, production planning and control, and can be used for predictive maintenance. In order management, comparing the technical requirements of a plastic part to be produced from a customer with the technical capabilities of the manufacturer's machinery is possible, e.g., for subcontracting. In a production planning scenario, performing a capability check to find suitable TCU that is required for the production process is conceivable [8]. Moreover, for production control, this Submodel enables resilience by allowing an accelerated locating of alternative TCU, e.g., in the case of a technical failure. Lastly, the Submodel can be used for predictive maintenance by providing nominal values of single properties relevant for calculations, e.g., of the remaining useful life. This concept can serve as a basis for standardizing the respective Submodel. The conception is based on existing norms, studies of common practices at enterprises, directives, and standards to achieve far-reaching acceptance.

Besides the standardized Submodel, this template also introduces standardized SubmodelElementCollections (SMC) in order to improve interoperability while modeling aspects of IMM within other Submodels, e.g., the injection molding machine or periphery.

1.3 Relevant standards and sources of concepts for the Submodel template

According to [3], interoperable properties might be defined by standards, consortium specifications or manufacturer specifications. Useful standards providing sources of concepts are:

Table 1: List of exemplary standards defining interoperable properties

Number	Title
DIN 24450	Maschinen zum Verarbeiten von Kunststoffen und Kautschuk; Begriffe
EUROMAP 82.1 (VDMA 40082-1)	OPC UA interfaces for plastics and rubber machinery – Peripheral devices – Temperature control devices

So called property dictionaries are used identify information elements (see Terms and Definitions of [6]). Such property dictionaries include:

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

In this document, properties are aimed to be described by ECLASS.

2 Information set for Submodel Contact Information

While defining Submodels, the following three aspects must be considered as suggested in [5]:

Use and economic relevance

The Submodel “Technical Data for Temperature Control Unit” is designed to determine the general characteristics and features of a temperature control unit’s (TCU) type in a standardized manner. For all TCU, using the Submodel “Technical Data for Temperature Control Unit” should be mandatory since the defined properties are vendor-independent and thus valid for all TCU instances. This ensures an unambiguous characterization of TCU and serves as a foundation for vendor-independent asset communication, as all TCU shares the same properties and corresponding metadata, e.g., identifiers.

Possible functions and interactions

The Submodel “Technical Data for Temperature Control Unit” provides multiple benefits for different functions, which are economically relevant. First, the Submodel acts as a blueprint, so vendors of TCU can define their instances using a predefined template without developing their own. Second, predefined AAS of TCU ensure a high standard of master data quality, as a manual definition of the TCU instances by plastic parts manufacturers is obsolete. This prevents rework, e.g., occurring by misspellings, etc. Third, the vendor-independent manner of this Submodel supports unambiguous interpretation of all TCU. Especially in injection molding factories, plastic parts manufacturers have often equipped their shopfloor with TCU from different vendors, so a standard definition of TCU. This avoids translations between different, vendor-specific definitions of single properties. Fourth, accelerated production planning or control is possible. Due to an automatic matching for a capable machine-mold-TCU combination for manufacturing a plastics part, the manual matching process made by humans can be omitted or reduced significantly.

The interaction of this Submodel with other Submodels takes place whenever other Submodels require the technical master data of the TCU. Due to the fact that manufacturing a plastic part normally consists of an injection molding machine, an injection mold, and diverse periphery, interacting with the Submodels of the injection molding machine, mold and other periphery is obvious. In detail, matching between the IMM, the injection mold, and the TCU can be performed, e.g., regarding the required temperature. Another interaction of the Submodel “Technical Data for Temperature Control Unit” is at Submodel “Predictive Maintenance”, since the technical data can serve as a basis for values that the Submodel “Predictive Maintenance” requires for calculating metrics.

Property specification

See section 3 Submodel and Collections.

3 Submodel and Collections

3.1 Properties of the Submodel “TechnicalData”

The figure below shows the UML-diagram defining the relevant properties, which need to be set. Table 2 describes the details of the Submodel structure combined with examples.

Figure 1: UML-Diagram for Submodel "TechnicalData"

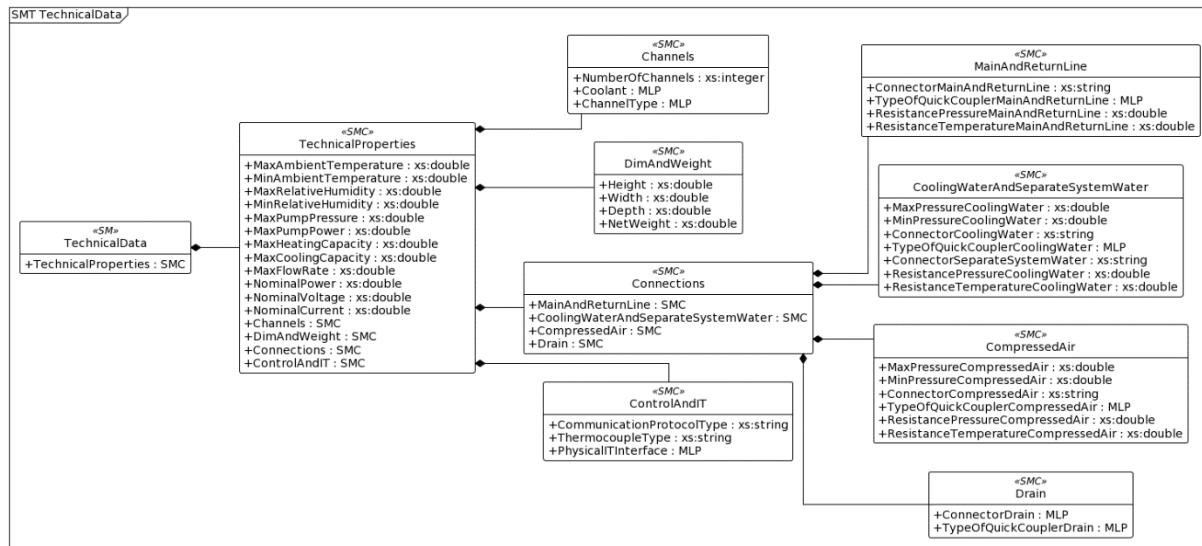


Table 2: Properties of Submodel “TechnicalData”

idShort	TechnicalData		
Class	Submodel		
semanticId	[IRI] https://admin-shell.io/ZVEI/TechnicalData/Submodel/1/2		
Parent	TechnicalData		
Explanation	Submodel containing technical data of the asset and associated product classifications		
[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description@en	example	
[SMC] Technical Properties	[IRI] https://admin-shell.io/ZVEI/TechnicalData/TechnicalProperties/1/1 - - Individual characteristics that describe the product and its technical properties. [-]	n/a	1

3.2 Properties of the SMC "TechnicalProperties"

Table 3: Properties of SMC "TechnicalProperties"

idShort	TechnicalProperties		
Class	SubmodelElementCollection		
semanticId	[IRI] https://admin-shell.io/ZVEI/TechnicalData/TechnicalProperties/1/1		
isCaseOf	-		
Allow Duplicates	True		
Parent	[IRI] https://admin-shell.io/ZVEI/TechnicalData/Submodel/1/2		
Explanation	Individual characteristics that describe the product and its technical properties		
[SME type]	semanticity = [idType] value	[valueType]	card.
idShort	preferredName@en preferredName@de Description@en [sourceOfDefinition]	example [unit]	
[Prop] MaxAmbient Temperature	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/maxAmbientTemperature Maximum ambient temperature Maximale Umgebungstemperatur Highest ambient temperature to which the device is exposed and at which it must operate as specified, or the maximum allowable temperature of the surroundings, irrespective of the medium temperature, at which the device still operates to its intended purpose, i.e. within the accuracy limits specified by the manufacturer or the highest ambient temperature allowed by legal or other directives [-]	[Double] 40.00 [°C]	1
[Prop] MinAmbient Temperature	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/minAmbientTemperature Minimum ambient temperature Minimale Umgebungstemperatur Least temperature, which must be present in the immediate exterior environment of the operation resource. This is the least environmental temperature which must be maintained for the operating resource to be operated without permanent changes in its characteristics [-]	[Double] 5.00 [°C]	1

[Prop] MaxRelative Humidity	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/maxRelativeHumidity Maximum relative humidity Maximale Luftfeuchtigkeit Maximum value for ratio of the actual compression of water vapor in the atmosphere and the saturation vapor pressure during operation [-]	[Double] 85.00 [%]	1
[Prop] MinRelative Humidity	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/minRelativeHumidity Minimum relative humidity Minimale Luftfeuchtigkeit Minimum value for ratio of the actual compression of water vapor in the atmosphere and the saturation vapor pressure during operation [-]	[Double] 35.00 [%]	1
[Prop] MaxPump Pressure	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/maxPumpPressure Maximum pump pressure Maximaler Pumpendruck Maximum pressure that the pump can build up [-]	[Double] 5.00 [bar]	1
[Prop] MaxPump Power	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/maxPumpPower Maximum pump power Maximale Pumpenleistung Maximum power that the pump can provide [-]	[Double] 1.20 [kW]	1
[Prop] MaxHeating Capacity	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/maxHeatingCapacity Maximum heating capacity Maximale Heizleistung Usable heat that is emitted from a heat source within a certain time. In EUROMAP 82.1, this datapoint corresponds to PowerValue [-]	[Double] 8.00 [kW]	1
[Prop] MaxCooling Capacity	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/maxCoolingCapacity Maximum cooling capacity Maximale Kühlleistung Heat flow taken by the heat sink from the temperature system [-]	[Double] 66.00 [kW]	1

[Prop] MaxFlowRate	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/maxFlowRate Maximum flow rate Maximale Durchflussrate Maximum flow rate, defines the maximum achievable flow rate of the TCD. In EUROMAP 82.1, this datapoint corresponds to NominalFlowRate [-]	[Double] 40.00 [l/min]	1
[Prop] Nominal Power	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/nominalPower Nominal power Nennleistung Describes the nominal power [-]	[Double] 9.10 [kW]	1
[Prop] Nominal Voltage	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/nominalVoltage Nominal voltage Nennspannung Nominal voltage is the specified value which shows the voltage in normal operation given by the manufacturer or supplier [-]	[Double] 400.00 [V]	1
[Prop] Nominal Current	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/nominalCurrent Nominal current Nennstrom Suitable (normally rounded) value of a current for describing, designating or identifying a component, a device, an operating medium, an installation or equipment [-]	[Double] 14.00 [A]	1
[SMC] Channels	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/channels Channels Kanäle Channels are holes through which the coolant flows [-]	n/a	1..n
[SMC] DimAnd Weight	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/dimAndWeight Dimensions and Weight Abmaße und Gewicht Contains the dimensions and weight of the asset [-]	n/a	1

[SMC] Connections	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/connections Connections Verbindungen Interfaces to the connections, e.g. the forward and return flow [-]	n/a	1..n
[SMC] ControlAndIT	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/controlAndIT Control and IT interfaces IT-Schnittstelle Features of the machine control and the IT interfaces [-]	n/a	1

3.3 Properties of the SMC "Channels"

Table 4: Properties of SMC "Channels"

idShort	Channels		
Class	SubmodelElementCollection		
semanticId	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/channels		
isCaseOf	-		
Allow Duplicates	True		
Parent	[IRI] https://admin-shell.io/ZVEI/TechnicalData/Submodel/1/2		
Explanation	Channels are holes through which the coolant flows		
[SME type]	semanticity = [idType] value	[valueType]	card.
idShort	preferredName@en preferredName@de Description@en [sourceOfDefinition]	example [unit]	
[Prop] NumberOf Channels	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/numberOfChannels Number of channels Anzahl der Kanäle Number of channels that an asset has integrated [-]	[Integer] 6 [1]	1

[MLP] Coolant	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/coolant Type of coolant Art des Kühlmittels Type of medium the asset operates with [-]	[LangString] Water@en,Wasser@de [-]	1
[MLP] ChannelType	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/channelType Channel type Kanaltyp Defines if the channel type is for hot or cold runners [-] Value List: Cold runner [IRI] https://iop.rwth-aachen.de/IM/cd/1/1/coldRunner Hot runner [IRI] https://iop.rwth-aachen.de/IM/cd/1/1/hotRunner	[LangString] Hot runner@en,Heißkanal @de [-]	1

3.4 Properties of the SMC "DimAndWeight"

Table 5: Properties of SMC "DimAndWeight"

idShort	DimAndWeight		
Class	SubmodelElementCollection		
semanticId	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/dimAndWeight		
isCaseOf	-		
Allow Duplicates	True		
Parent	[IRI] https://admin-shell.io/ZVEI/TechnicalData/Submodel/1/2		
Explanation	Contains the dimensions and weight of the asset		
[SME type]	semanticity = [idType] value	[valueType]	card.
idShort	preferredName@en preferredName@de Description@en [sourceOfDefinition]	example [unit]	
[Prop] Height	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/height Height Höhe For objects with orientation in preferred position during use the dimension perpendicular to diameter/height/width/depth [-]	[Double] 85.00 [cm]	1
[Prop] Width	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/width Width Breite For objects with orientation in preferred position during use the dimension perpendicular to height/length/depth [-]	[Double] 98.20 [cm]	11
[Prop] Depth	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/depth Depth Tiefe For objects with fixed orientation or in preferred utilization position, the rear , generally away from the observer expansion is described as depth [-]	[Double] 30.00 [cm]	1

[Prop] NetWeight	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/netWeight Net weight Nettogewicht Net weight of a component or an element [-]	[Double] 147.00 [kg]	1
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3.5 Properties of the SMC "Connections"

Table 6: Properties of SMC "Connections"

idShort	Connections		
Class	SubmodelElementCollection		
semanticId	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/connections		
isCaseOf	-		
Allow Duplicates	True		
Parent	[IRI] https://admin-shell.io/ZVEI/TechnicalData/Submodel/1/2		
Explanation	Interfaces to the connections, e.g. the forward and return flow		
[SME type]	semanticity = [idType] value	[valueType]	card.
idShort	preferredName@en preferredName@de Description@en [sourceOfDefinition]	example [unit]	
[SMC] MainAnd ReturnLine	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/mainAndReturnLine Main and return line Vor- und Rücklauf Comprises relevant properties for connecting the main and return line [-]	n/a	1
[SMC] CoolingWaterAnd SeparateSystem Water	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/coolingWaterAndSeparateSystemWater Cooling water and separate system water Kühlwasser und separates Systemwasser Comprises relevant properties for connecting the cooling water and separate system water [-]	n/a	1

[SMC] CompressedAir	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/compressedAir Compressed air Druckluft Comprises relevant properties for connecting the compressed air [-]	n/a	1
[SMC] Drain	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/drain Drain Ablauf Via the drain, the used cooling medium is separated so that it is no longer in the circuit [-]	n/a	1

3.6 Properties of the SMC "MainAndReturnLine"

Table 7: Properties of SMC "MainAndReturnLine"

idShort	MainAndReturnLine		
Class	SubmodelElementCollection		
semanticId	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/mainAndReturnLine		
isCaseOf	-		
Allow Duplicates	True		
Parent	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/connections		
Explanation	Comprises relevant properties for connecting the main and return line		
[SME type]	semanticity = [idType] value	[valueType]	card.
idShort	preferredName@en preferredName@de Description@en [sourceOfDefinition]	example [unit]	
[Prop] ConnectorMain AndReturnLine	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/connectorMainAndReturnLine Connector main and return line Anschluss Vor- und Rücklauf The connector of the temperature control unit for the main and return line [-]	[String] G 1 1/4 [-]	1

[MLP] TypeOf QuickCoupler MainAndReturn Line	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/typeOfQuickCoupler Type of quick coupler Typ der Schnellkupplung Quick coupler realize a fast connection (e.g. hose to hose or hose to device) so that liquid or gaseous media can be transported [-] Value List: Self closing [IRI] https://iop.rwth-aachen.de/IM/cd/1/1/selfClosing Open [IRI] https://iop.rwth-aachen.de/IM/cd/1/1/open Thread [IRI] https://iop.rwth-aachen.de/IM/cd/1/1/thread Other [IRI] https://iop.rwth-aachen.de/IM/cd/1/1/otherQuickCoupler	[LangString] Self closing@en, Selbstverschließend @de [-]	1
[Prop] Resistance PressureMain AndReturnLine	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/resistancePressure Resistance pressure Druckbeständigkeit Indicates to how many pressure the object is resistant. Pressure resistance is the resistance or durability of a material or product designated to high pressure [-]	[Double] 20.00 [bar]	1
[Prop] Resistance Temperature MainAndReturn Line	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/resistanceTemperature Resistance temperature Temperaturbeständigkeit Indicates to how many degrees the object is temperature resistant. Temperature resistance is the resistance or durability of a material or product designated to high temperatures [-]	[Double] 120.00 [°C]	1

3.7 Properties of the SMC "CoolingWaterAndSeparateSystemWater"

Table 8: Properties of SMC "CoolingWaterAndSeparateSystemWater"

idShort	CoolingWaterAndSeparateSystemWater		
Class	SubmodelElementCollection		
semanticId	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/coolingWaterAndSeparateSystemWater		
isCaseOf	-		
Allow Duplicates	True		
Parent	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/connections		
Explanation	Comprises relevant properties for connecting the cooling water and separate system water		
[SME type]	semanticity = [idType] value	[valueType]	card.
idShort	preferredName@en preferredName@de Description@en [sourceOfDefinition]	example [unit]	
[Prop] MaxPressure CoolingWater	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/maxPressure Maximum possible pressure Maximal möglicher Druck Maximal working range of the pressure value [-]	[Double] 5.00 [bar]	1
[Prop] MinPressure CoolingWater	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/minPressure Minimum possible pressure Minimal möglicher Druck Minimal working range of the pressure value [-]	[Double] 2.00 [bar]	1
[MLP] TypeOfQuick CouplerCooling Water	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/typeOfQuickCoupler Type of quick coupler Typ der Schnellkupplung Quick coupler realize a fast connection (e.g. hose to hose or hose to device) so that liquid or gaseous media can be transported [-]	[LangString] Self closing@en, Selbstver-schließend @de [-]	1
[Prop] Connector CoolingWater	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/connectorCoolingWater	[String] G 3/4 [-]	1

	<p>Connector cooling water Anschluss Kühlwasser The connector of the temperature control unit for cooling water [-]</p>		
[Prop] Connector Separate SystemWater	<p>[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/connectorSeparateSystemWater Connector separate system water Anschluss separates Systemwasser The connector of the temperature control unit for separate system water [-]</p>	[String] G 1/2 [-]	1
[Prop] Resistance Pressure CoolingWater	<p>[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/resistancePressure Resistance pressure Druckbeständigkeit Indicates to how many pressure the object is resistant. Pressure resistance is the resistance or durability of a material or product designated to high pressure [-]</p>	[Double] 10.0 [bar]	1
[Prop] Resistance Temperature CoolingWater	<p>[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/resistanceTemperature Resistance temperature Temperaturbeständigkeit Indicates to how many degrees the object is temperature resistant. Temperature resistance is the resistance or durability of a material or product designated to high temperatures [-]</p>	[Double] 100.0 [°C]	1

3.8 Properties of the SMC “CompressedAir”

Table 9: Properties of SMC “CompressedAir”

idShort	CompressedAir		
Class	SubmodelElementCollection		
semanticId	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/compressedAir		
isCaseOf	-		
Allow Duplicates	True		
Parent	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/connections		
Explanation	Comprises relevant properties for connecting the compressed air		
[SME type]	semanticity = [idType] value	[valueType]	card.
idShort	preferredName@en preferredName@de Description@en [sourceOfDefinition]	example [unit]	
[Prop] MaxPressure CompressedAir	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/maxPressure Maximum possible pressure Maximal möglicher Druck Maximal working range of the pressure value [-]	[Double] 8.00 [bar]	1
[Prop] MinPressure Compressed Air	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/minPressure Minimum possible pressure Minimal möglicher Druck Minimal working range of the pressure value [-]	[Double] 2.00 [bar]	1
[Prop] Connector Compressed Air	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/connectorCompressedAir Connector compressed air Anschluss Druckluft The connector of the temperature control unit for compressed air [-]	[String] G 1/2 [-]	1

[MLP] TypeOfQuick Coupler Compressed Air	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/typeOfQuickCoupler Type of quick coupler Typ der Schnellkupplung Quick coupler realize a fast connection (e.g. hose to hose or hose to device) so that liquid or gaseous media can be transported [-]	[LangString] Self closing@en, Selbstver-schließend @de [-]	1
[Prop] Resistance Pressure Compressed Air	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/resistancePressure Resistance pressure Druckbeständigkeit Indicates to how many pressure the object is resistant. Pressure resistance is the resistance or durability of a material or product designated to high pressure [-]	[Double] 10.00 [bar]	1
[Prop] Resistance Temperature Compressed Air	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/resistanceTemperature Resistance temperature Temperaturbeständigkeit Indicates to how many degrees the object is temperature resistant. Temperature resistance is the resistance or durability of a material or product designated to high temperatures [-]	[Double] 100.00 [°C]	1

3.9 Properties of the SMC "Drain"

Table 10: Properties of SMC "Drain"

idShort	Drain		
Class	SubmodelElementCollection		
semanticId	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/drain		
isCaseOf	-		
Allow Duplicates	True		
Parent	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/connections		
Explanation	Via the drain, the used cooling medium is separated so that it is no longer in the circuit		
[SME type]	semanticity = [idType] value	[valueType]	card.
idShort	preferredName@en preferredName@de Description@en [sourceOfDefinition]	example [unit]	
[Prop] Connector Drain	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/connectorDrain Connector drain Anschluss Entleerung The connector of the temperature control unit that is responsible for the mold draining [-]	[String] G 1/2 [-]	1
[MLP] TypeOfQuick CouplerDrain	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/typeOfQuickCoupler Type of quick coupler Typ der Schnellkupplung Quick coupler realize a fast connection (e.g. hose to hose or hose to device) so that liquid or gaseous media can be transported [-]	[LangString] Self closing@en, Selbstverschließend @de [-]	1

3.10 Properties of the SMC "ControlAndIT"

Figure 1 shows the UML-diagram defining the relevant properties which need to be set. The following table describes the details of the SMC structure combined with examples.

Table 11: Properties of SMC "ControlAndIT"

idShort	ControlAndIT		
Class	SubmodelElementCollection		
semanticId	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/controlAndIT		
isCaseOf	-		
Allow Duplicates	True		
Parent	[IRI] https://admin-shell.io/ZVEI/TechnicalData/TechnicalProperties/1/1		
Explanation	Features of the machine control and the IT interfaces		
[SME type]	semanticity = [idType] value	[valueType]	card.
idShort	preferredName@en preferredName@de Description@en [sourceOfDefinition]	example [unit]	
[Prop] Communication ProtocolType	[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/communicationProtocolType Communication protocol Kommunikationsprotokoll This variable is used to specify the used communication protocol that is used between the sensor and the control system of the TCD [EUROMAP 82.1] Value List: Local https://iop.rwth-aachen.de/IM/cd/1/1/local Profibus https://iop.rwth-aachen.de/IM/cd/1/1/profibus OPC UA https://iop.rwth-aachen.de/IM/cd/1/1/opcua I2C https://iop.rwth-aachen.de/IM/cd/1/1/i2c CAN https://iop.rwth-aachen.de/IM/cd/1/1/can Other Protocol https://iop.rwth-aachen.de/IM/cd/1/1/otherProtocol	[String] OPC UA [-]	0..n

<p>[Prop] Thermocouple Type</p>	<p>[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/thermocoupleType Thermocouple type Thermoelement This variable is used to specify the type of connected external temperature sensor [EUROMAP 82.1] Value List: Type E sensor: NiCr-CuNi [IRDI] 0173-1#07-AAX047#001 Type J, L sensor: Fe-CuNi [IRDI] 0173-1#07-AAX048#001 Type K sensor: NiCr-Ni [IRDI] 0173-1#07-AAX049#001 Type N sensor: NiCrSi-NiSi [IRDI] 0173-1#07-AAX051#001 Type T sensor: Cu-CuNi [IRDI] 0173-1#07-AAX054#001 PT100-Sensor [IRDI] 0173-1#07-AAL570#004 Other Thermocouple Type [IRI] https://iop.rwth-aachen.de/IM/cd/1/1/otherThermocoupleType</p>	<p>[String] PT100- Sensor [-]</p>	<p>1..n</p>
<p>[MLP] Physical ITInterface</p>	<p>[IRI] https://iop.rwth-aachen.de/IM/cd/1/1/physicalITInterface Physical IT interface Physische IT-Schnittstelle Physical IT interface (e.g., plugs) that is present for realizing the data transfer [-]</p>	<p>[LangString] Plugs@en, Stecker@de [-]</p>	<p>1..n</p>

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 chosen, 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: <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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