SPECIFICATION

Submodel Digital Quality Documents.

Version 1.0

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Submodel Template of the

Asset Administration Shell

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

Version history

2023-07-07	1.0 Version	Init document
2023-07-21	1.1 Version	Development of the DQD UML class diagrams
2023-08-21	1.2 version	Population of the DCC terms in tables as AAS elements
2023-09-04	1.3 version	Designation of semanticids to DCC terms in accordance to DCC namespace.

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Foreword

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

This Submodel template aims at providing a digital quality document model that can be transferred across an asset lifecycle. The information contained in the submodel is inspired by the already developed XML model for Digital Calibration Certificate [8]. The XML model has proven to have met the requirement of IEC 17025 and has the ability to be cryptographically signed thus the reason for using it.

Figure 1 shows the overall concept behind the mapping of the DCC XML model to the DQD AAS submodel.

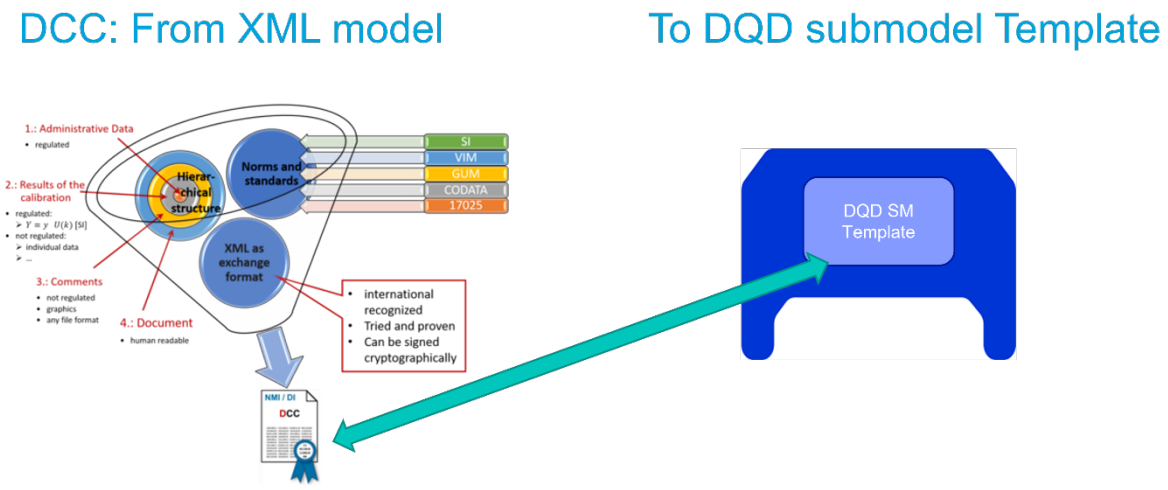


Figure 1: Overall Mapping or integration concept of DCC XML model to DQD AAS submodel template.

Information described in DQD submodel regarding the asset of the respective Asset Administration Shell is semantically Identified by means primarily of the DCC namespace. If it not directly applicable (n/a), alternative dictionaries such as ECLASS and IEC CDD (Common Data Dictionary) can be considered for a potential semantic assignment.

1.3 Relevant Standard for the submodel template

- ISO 17025
- ISO 9001ISO 9001

1.4 Use cases.

Table 1: List of examplary use cases for “dcc:digitalCalibrationCertificate” submodel.

Use Case	Explanation
Device Onboarding	
Transfer of device Calibration information between machine manufacturers and machine users.	With dcc:digitalCalibrationCertificate submodel, device calibration information can be transmitted electronically across different organizations (laboratories and companies) through a standardized API provided for AAS.
automated preventive maintenance applications	Calibrated information of a device could serve as a base data for preventive maintenance application.

1.5 Design decisions.

- The design of the submodel template is done by making a one to one mapping of the DCC XML version 3.2.1 [8] elements to the elements of the related AAS submodel.
- Also, due to backward compatibility, the native DCC XML model or DCC PDF file can be attached to the DQD submodel to create different usage options for the consumer of the submodel.
- Elements grouped for oneOf are in blue while values grouped as for enumeration are written in red. Both colors are use in UML class diagrams and Table.
- If an external DCC document is referenced (e.g., DCC XML file is provided), the specified mandatory elements in the DQD Submodel are not obligatory (should be seen as optional).
- For clarification, terms used in DQD submodel is extracted from DCC XML model and used the “dcc” and “si” namespaces. So “dcc” and “si” will be seen mostly in the submodel UML class diagrams and tables.

2 Submodel Digital Quality Documents

An important aspect of the calibration of sensors, measurement systems and calibration artifacts is the need to regularly check their functionality and accuracy. Sensors can change over time due to aging, environmental influences and other factors, which can lead to a reduction in measurement accuracy. Therefore, it is important to calibrate and check sensors according to the specific requirements (quality management, ISO 9001 ff.) of the application.

As a standard, the Asset Administration Shell and the Digital Quality Documents Submodel can help to store the certified calibration results and their metrological core information as well as the calibration certificates in digital form. This enables uniform and faster traceability or retraceability of the calibrations, which increases the transparency of the processes and improves the quality of the application.

3 Elements of Submodel DQD with idShort "dcc:digitalCalibrationCertificate"

3.1 Properties of the Submodel QDQ

Figure 2 shows the UML class diagram defining the relevant properties which need to be set. Table 2 describes the details of the Submodel structure combined with examples.

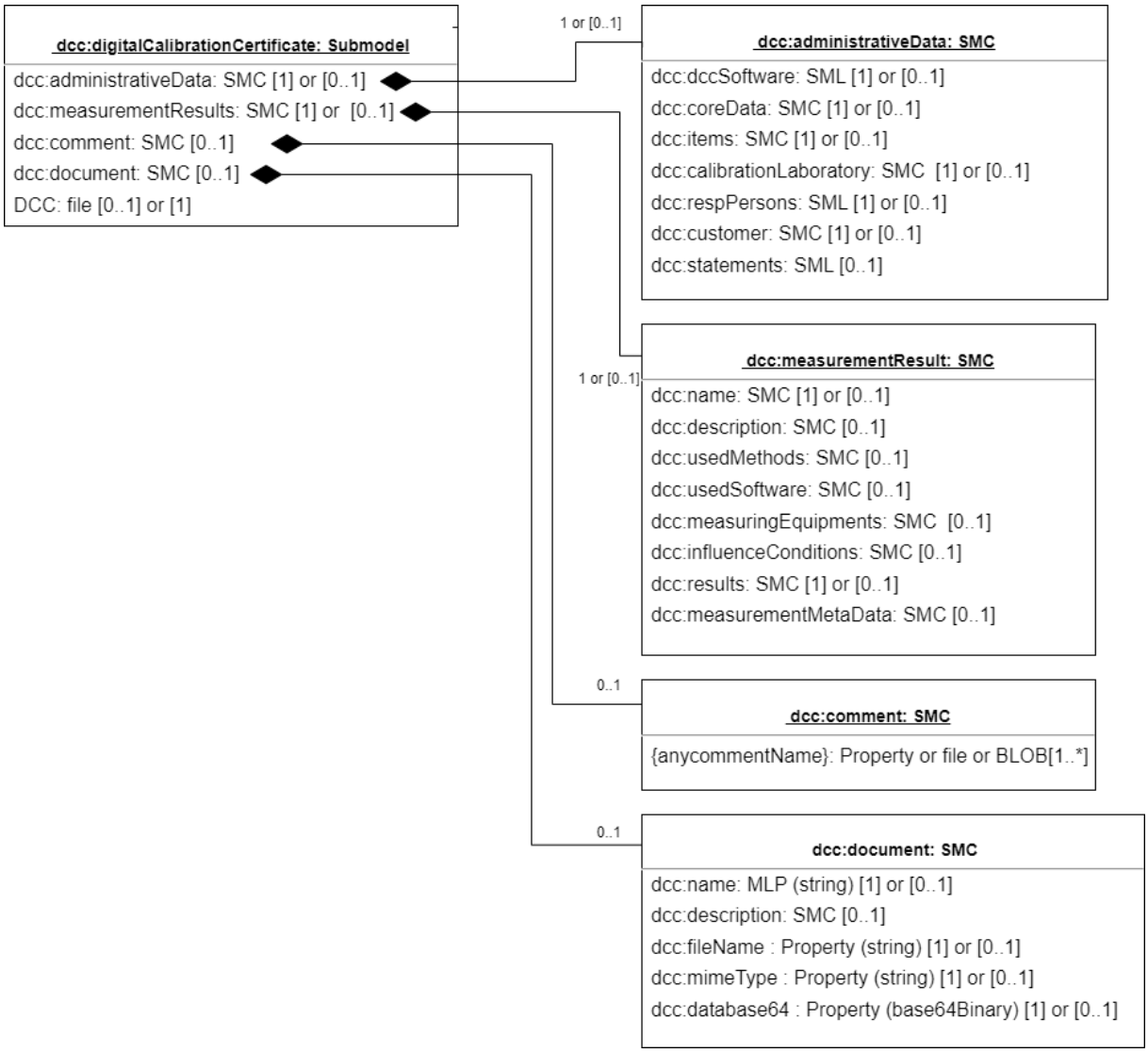


Figure 2: UML-diagram for Submodel QDQ with idShort dcc:digitalCalibrationCertificate.

Table 2: Properties of Submodel DQD

idShort	dcc:digitalCalibrationCertificate.
Class	Submodel
semanticId	https://dccwiki.ptb.de/en/root
Parent	None

Explanation	The Submodel DQD is the collection for various calibrated information about a device		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] dcc:administrativeData	[IRI]https://dccwiki.ptb.de/en/dccadministrativeData. dcc:administrativeData contains all essential administrative information, which describes various details of the calibrated device.	n/a see Table 3	[1][1] or [0..1]
[SMC] dcc:measurementResults	[IRI]https://dccwiki.ptb.de/en/dccmeasurementResult. dcc:measurementResult contains all results of the measurements, evaluations and information about the calibration.	n/a see Table 40	[1] or [0..1]
[SMC] dcc:comment	[IRI]https://dccwiki.ptb.de/en/dcccomment. The element dcc:comment contains an unlimited count of optional files and comment.	n/a see	[0..1]
[SMC] dcc:document	[IRI]https://dccwiki.ptb.de/en/dccdocument. This element can be used to store human-readable document of the calibration result. The elements in dcc:documents are the same as Table 7	n/a see Table 7	[0..1]
[file] DCC	[IRI] https://dccwiki.ptb.de/en/root This element acts as a container for the DCC XML or PDF file. Note: If an external DCC file reference is used, all mandatory elements should be seen as optional.	n/a	[1] or [0..1]

[1] The cardinality of the dcc:administrativeData reflects the last highlighted design decision in subsection1.5. The same conditions should apply to all elements that are mandatory in the UML class diagrams and Table.

3.2 Properties of the SMC “dcc:administrativeData”

Figure 2 shows the UML-diagram defining the relevant properties which need to be set for “dcc:administrativeData”. The following table describes the details of the SMC structure combined with examples.

Table 3: Properties of SMC "dcc:administrativeData"

idShort	dcc:administrativeData.		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccadministrativeData.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:digitalCalibrationCertificate.		
Explanation	This submodel element collection contains all essential administrative information, which describes various details of the calibrated device.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SML] dcc:dccSoftware	[IRI] https://dccwiki.ptb.de/en/dccdccSoftware. Contains list of software information used to create the DCC.	n/a see Table 4	[1] or [0..1]
[SMC] dcc:coreData	[IRI] https://dccwiki.ptb.de/en/dcccoredata. Contains essential calibration information	n/a see Table 9	[1] or [0..1]
[SMC] dcc:items	[IRI] https://dccwiki.ptb.de/en/dccitems. Contains unique identification, description and if applicable, condition of the calibrated item.	n/a see Table 14	[1] or [0..1]
[SMC] dcc:calibrationLaboratory	[IRI] https://dccwiki.ptb.de/en/dcccalibrationLaboratory. Contains information that identifies the calibration laboratory.	n/a see Table 23	[1] or [0..1]
[SML] dcc:respPersons	[IRI] https://dccwiki.ptb.de/en/dccrespPerson. Identification of the person(s) responsible for the release of the report.	n/a see Table 24	[1] or [0..1]
[SMC] dcc:customer	[IRI] https://dccwiki.ptb.de/en/dcccontactType.	n/a see Table 16	[1] or [0..1]

	definition of contact information of the customer ordering the calibration.		
[SML] dcc:statements	[IRI] https://dccwiki.ptb.de/en/dccstatement. Contains list of statement records regarding to the calibration.	n/a see Table 26	[0..1]

3.2.1 Properties of the SML "dcc:dccSoftware"

Figure 3 shows the UML-diagram defining the relevant properties which need to be set for "dcc:dccSoftware". The following table describes the details of the SMC structure combined with examples.

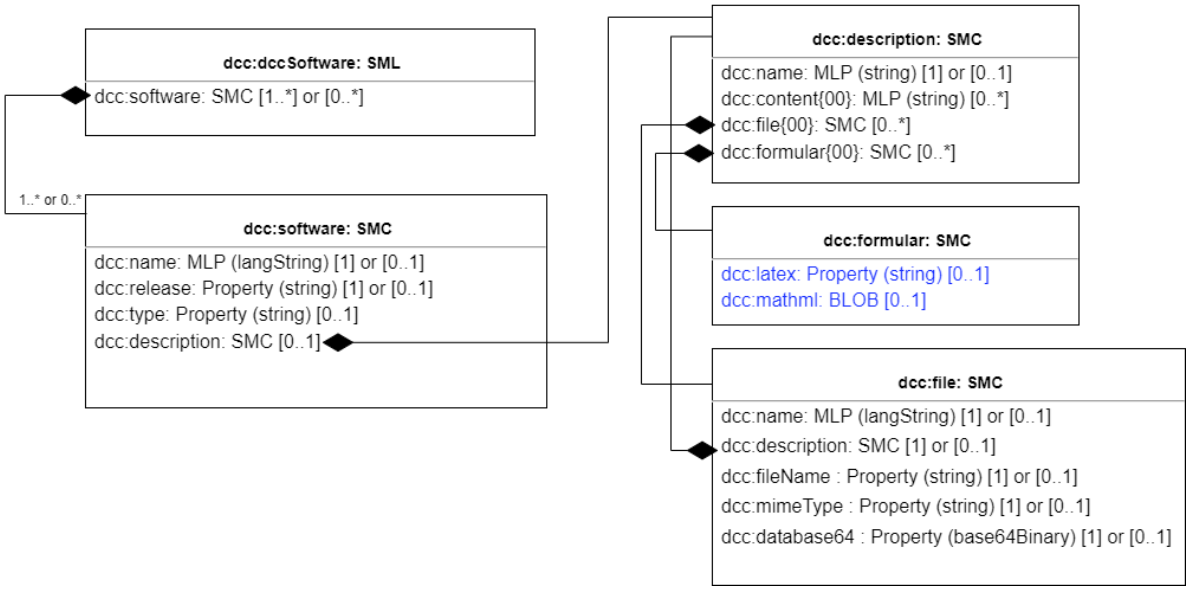


Figure 3: UML-diagram of SML dcc:dccSoftware.

Table 4: Properties of SML "dcc:dccSoftware"

idShort	dcc:dccSoftware.		
Class	SubmodelElementList		
semanticId	https://dccwiki.ptb.de/en/dccdccSoftware.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:administrativeData.		
Explanation	This submodel element collection Contains list of software information used to create the DCC.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	

[SMC] dcc:Software	[IRI] https://dccwiki.ptb.de/en/dccsoftwareListType. The software SMC represents an entry of exactly one software used to create the DCC XML file.	n/a see Table 5	[1..*] or [0..*]

Table 5: Properties of SMC “dcc:software”

idShort	dcc:software.		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccsoftwareListType.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:dccSoftware.		
Explanation	This submodel element collection Contains list of software information used to create the DCC.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType It is used to indicate the name of the parent object (e.g name of software).	[langString] lang: en value: notepad	[1] or [0..1]
[Property] dcc:release	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Defines the software release version	[string] 8.1	[1] or [0..1]
[Property] dcc:type	[IRI] n/a To specify the type of software. The value can be one of application, bios, driver, editor, firmware, library, os, other	[string] application	[0..1]
[SMC] dcc:description	[IRI] https://dccwiki.ptb.de/en/dccrichContentType. Contains descriptive information about the content of the parent element.	n/a see Table 6	[0..1]

Table 6: Properties of SMC “dcc:description”

idShort	dcc:description.		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccrichContentType.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:software.		
Explanation	Contains descriptive information about the content of the parent element.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType It is used to indicate the name of the parent object (e.g name of software).	[langString] lang: en value: notepad	[1] or [0..1]
[MLP] dcc:content{00}	[IRI] https://dccwiki.ptb.de/en/dcctextType The element is used to enter any text.	n/a	[0..*]
[SMC] dcc:file{00}	[IRI]https://dccwiki.ptb.de/en/dccbyteDataType The file SMC is describes any electronic data in DCC.	n/a see Table 7	[0..*]
[SMC] dcc:formula{00}	[IRI]https://dccwiki.ptb.de/en/dccformulaType. Contains definition of mathematical formula.	n/a see Table 8	[0..*]

Table 7: Properties of SMC “dcc:file”

idShort	dcc:file.
Class	SubmodelElementCollection
semanticId	https://dccwiki.ptb.de/en/dccbyteDataType.
isCaseOf	
AllowDuplicates	True
Parent	dcc:description
Explanation	The file SMC is describes any electronic data in DCC.

[SME type]	semanticity = [idType]value	[valueType]	card.
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. It is used to indicate the name of the parent object (e.g name of software).	[langString] lang: en value: notepad	[1] or [0..1]
[SMC][2] dcc:description	[IRI] https://dccwiki.ptb.de/en/dccrichContentType. Constains descriptive information about the content of the parent element. Elements in dcc:description is the same as Table 6	n/a Table 6	[1] or [0..1]
[Property] dcc:filename	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Describes name of the attached file	[string] exampleName	[1] or [0..1]
[Property] dcc:mimeType	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Defines the mimeType of the attached file.	[string] application/pdf	[1] or [0..1]
[Property] dcc:dataBase64	[IRI]https://dccwiki.ptb.de/en/dccformulaType. Contains information of the encoded data of the file.	[base64Binary]	[1] or [0..1]

Table 8: Properties of the SMC “dcc:formula”

idShort	dcc:formula		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccformulaType		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:description		
Explanation	Contains definition of mathematical formula.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**

[2] The dcc:description SMC is used in many elements of the DCC. So as not to repeat the same table multiple times, Table 6 will be referenced for information of the SMC. Also the table of other elements used multiple times in DCC will referenced just like dcc:description.

idShort	Description@en	example	
[Property] dcc:latex	[IRI] n/a The elements is used to store latex formatted string.	[string]	[0..1]
[BLOB] dcc:mathml	[IRI] https://dccwiki.ptb.de/en/dccxmlType Used to insert formulas and equations into the measurement result of the DCC	[BLOB] n/a	[0..1]

From the design of DCC XML, when defining a formula, either dcc:latex or dcc:mathml can be used and not both.

3.2.2 Properties of the SMC "dcc:coreData"

Figure 4 shows the UML class diagram defining the relevant properties which need to be set for "dcc:coreData". The following table describes the details of the SMC structure combined with examples.

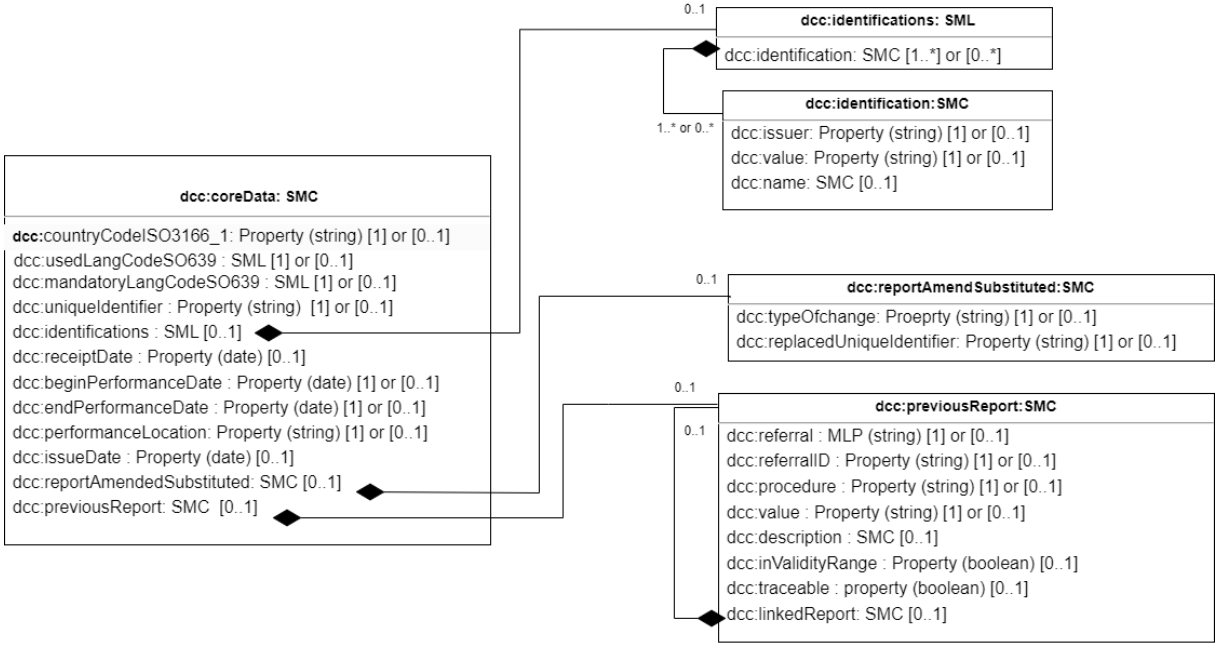


Figure 4: UML class diagram of SMC "dcc:coreData"

Table 9: Properties of SMC "coreData"

idShort	dcc:coreData
Class	SubmodelElementCollection
semanticId	https://dccwiki.ptb.de/en/dcccoredata
isCaseOf	

AllowDuplicates	True		
Parent	dcc:administrativeData		
Explanation	Contains essential calibration information.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] dcc:countryCode ISO3166_1	[IRI] https://dccwiki.ptb.de/en/dccstringISO3166Type. Defines the country where the calibration was performed? The information is given in the country code specified in ISO 3166 (two capital letters)	[string] DE	[1] or [0..1]
[SML] dcc:usedLangCodeISO639_1	[IRI] https://dccwiki.ptb.de/en/dccstringISO639Type. Indicates the official language(s) in which the DCC was created. The specification is made in the code for the official languages defined in ISO 639 (two lower case letters).	n/a de en es …	[1] or [0..1]
[Property] dcc:mandatoryLangCodeSO639	[IRI] https://dccwiki.ptb.de/en/dccstringISO639Type. Determines the official language(s) valid in case of doubt. The specification shall be made in the code for official languages (two lower case letters) specified in ISO 639.	[string] de	[1] or [0..1]
[Property] dcc:uniqueIdentifier	[IRI] https://dccwiki.ptb.de/en/dccnotEmptyStringType A worldwide unique identifier for the DCC (calibration certificate number) shall be specified here.	[string]	[1] or [0..1]
[SML] dcc:identifications	[IRI] https://dccwiki.ptb.de/en/dccidentificationType.	[string] GP_DCC_temperature _1.2	[0..1]

	Contains list of dcc:identification object(s) which describes the calibration exactly.		
[Property] dcc:receiptDate	[IRI] n/a Date of receipt of the calibration device. The date shall be given if it has a temporal influence on the calibration result.	[date] 2023-08-13	[0..1]
[Property] dcc:beginPerformanceDate	[IRI] n/a Date at the start of the performance of the laboratory activity.	[date] 2023-08-13	[1] or [0..1]
[Property] dcc:endPerformanceDate	[IRI] n/a Date at the end of the performance of the laboratory activity.	[date] 2023-08-13	[1] or [0..1]
[Property] dcc:performanceLocation	[IRI]https://dccwiki.ptb.de/en/dccperformanceLocationType. This element specifies the location of the calibration. The choices are "laboratory", "customer", "laboratoryBranch", "customerBranch" and "other". Where Laboratory and Customer refer to the respective postal address.	[string] laboratory	[1] or [0..1]
[Property] dcc:issueDate	[IRI] n/a Defines the date of issue of the DCC.	[date] 2023-08-13	[0..1]
[SMC] dcc:reportAmendedSubstituted	[IRI]https://dccwiki.ptb.de/en/dccreportAmendedSubstitutedType. With this element it is possible to specify whether the DCC is amending or substituting a previous DCC.	n/a see Table 12	[0..1]
[SMC] dcc:previousReport	[IRI] https://dccwiki.ptb.de/en/dcchashType. The element dcc:previousReport gives the possibility to refer to the previous calibration certificate which was replaced by this DCC. A chain of calibration certificates can be specified.	n/a see Table 13	[0..1]

Table 10: Properties of SML “dcc:identifications”

idShort	dcc:identifications.		
Class	SubmodelElementList		
semanticId	https://dccwiki.ptb.de/en/dccidentificationType		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:coreData.		
Explanation	Contains list of objects that provide exact description of the calibration.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] dcc:identification	[IRI] https://dccwiki.ptb.de/en/dccidentificationType. It is an object that provides exact description of the calibration.	n/a see Table 11	[1..*] or [0..*]

Table 11: Properties of SMC “dcc:identification”

idShort	dcc:identification		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccidentificationType		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:identifications		
Explanation	It is an object that provides exact description of the calibration.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] dcc:issuer	[IRI] n/a Indicates name of the issuer. It can be one of manufacturer, calibrationLaboratory, customer, owner, other.	[string] manufacturer	[1] or [0..1]
[Property] dcc:value	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType	[string] string-calibrationLa	[1] or [0..1]

	Provides a placeholder for the identifier.	boratory-coreData	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType Provides other information about the identifier.	[langString] lang: en value: Order no.	[0..1]

Table 12: Properties of SMC “dcc:reportAmendedSubstituted”

idShort	dcc:reportAmendedSubstituted		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccreportAmendedSubstitutedType.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:coreData		
Explanation	This SMC is used to define if a DCC is amending or substituting a previous DCC.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] dcc:typeOfChange	[IRI] n/a Contains information of whether the DCC is amended or substituted. Possible values are: amended or substituted.	[string] amended	[1] or [0..1]
[Property] dcc: replaceUniqueIdentifier	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Defines the unique identifier of the DCC to be amended/ substituted.	[string] GP_DCC_temperature_1.1	[1] or [0..1]

Table 13: Properties of SMC “dcc:previousReport”

idShort	dcc: previousReport
Class	SubmodelElementCollection
semanticId	https://dccwiki.ptb.de/en/dcchashType
isCaseOf	

AllowDuplicates	True		
Parent	dcc:coreData		
Explanation	The dcc:previousReport SMC provides the possibility to refer to the previous calibration certificate which was replaced by this DCC		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:referral	[IRI] https://dccwiki.ptb.de/en/dcctextType This field contains the details and description of the additional certificate, ideally already a digital certificate such as the DCC	[string]	[1] or [0..1]
[Property] dcc:referralID	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType This field contains an identifier (e.g. the calibration certificate number of the previous calibration certificate)	[string]	[1] or [0..1]
[Property] dcc:procedure	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType The further certificate is uniquely identified with a hash value algorithm. If it is an analogue certificate, the word "*analogue*" is entered in this mandatory element.	[string]	[1] or [0..1]
[Property] dcc:value	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType The hash value is stored in this element. It was obtained by applying the hash value algorithm mentioned in the element dcc:procedure to the calibration certificate. If it is an analogue certificate, the word "*analogue*" is entered in this mandatory element.	[string]	[1] or [0..1]
[SMC] dcc:description	[IRI]https://dccwiki.ptb.de/en/dccrichContentType Same as Table 6		[0..1]
[Property] dcc:inValidityRange	[IRI] n/a Indicates that the result is in valid range	[boolean]	[0..1]

[Property] dcc:traceable	[IRI] n/a Indicates that the result is traceable	[boolean]	[0..1]
[SMC] dcc:linkedReport	[IRI] https://dccwiki.ptb.de/en/dcchashType Same as Table 13		[0..1]

3.2.3 Properties of the SMC "dcc:items"

Figure 5 shows the UML-diagram defining the relevant properties which need to be set for "dcc:items". The following table describes the details of the SMC structure combined with examples.

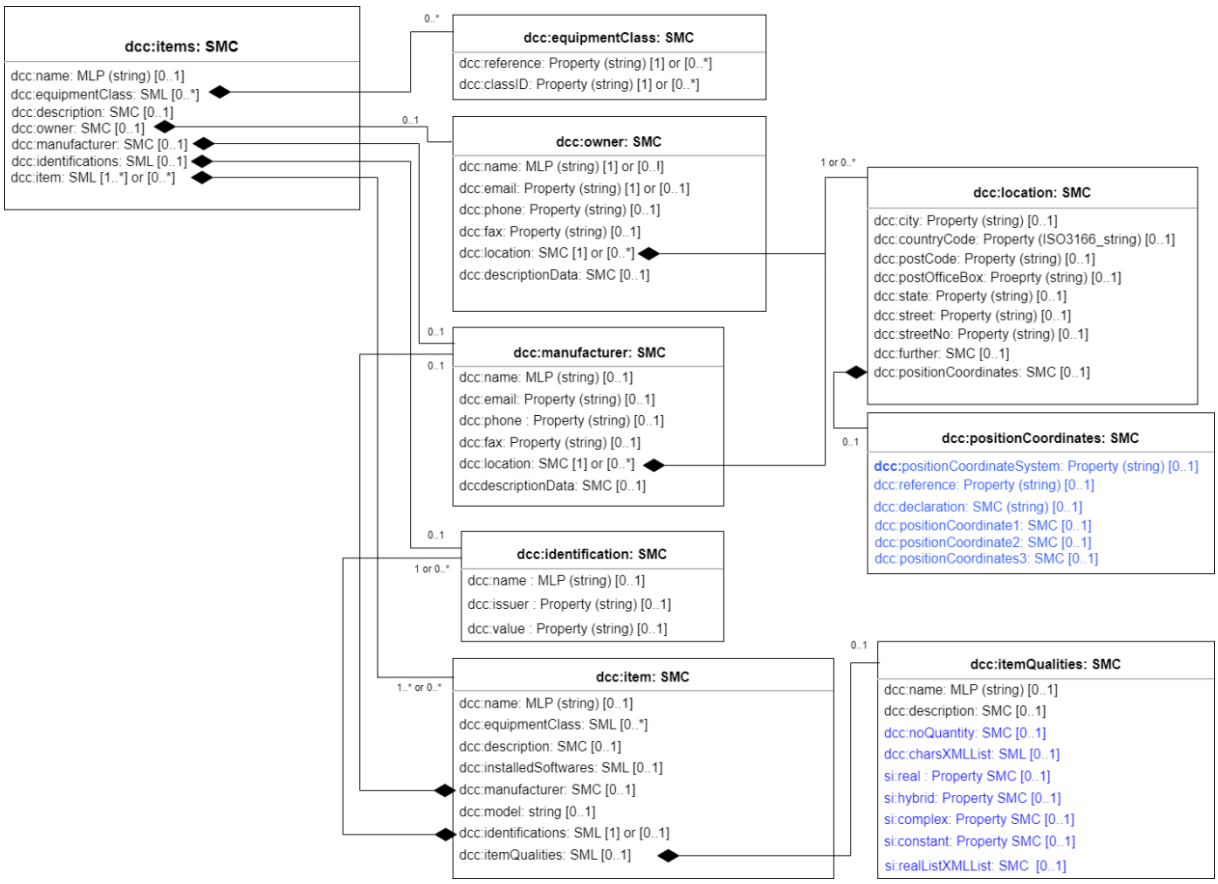


Figure 5: UML- diagram of SMC "dcc:items"

Table 14: Properties of SMC "dcc:items"

idShort	dcc:items
Class	SubmodelElementCollection
semanticId	https://dccwiki.ptb.de/en/dccitems
isCaseOf	

AllowDuplicates	True		
Parent	dcc:administrativeData		
Explanation	The SMC dcc:items contains all necessary information to identify and describe a system of calibration items or a single calibration item		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. This element shall specify the name of the system of calibration items.	[string]	[0..1]
[SML] dcc:equipmentClass	[IRI]https://dccwiki.ptb.de/en/dccequipmentClassType. The equipmentClass element contains all the necessary information to uniquely identify a system of calibration items or a single calibration item using a classification scheme.	n/a see Table 15	[0..*]
[SMC] dcc:description	[IRI]https://dccwiki.ptb.de/en/dccrichContentType Same as Table 6	n/a see Table 6	[0..1]
[SMC] dcc:owner	[IRI] https://dccwiki.ptb.de/en/dcccontactType. The element dcc:owner contains all necessary information to uniquely identify the owner of the calibration item(s).	n/a see Table 16	[0..1]
[SMC] dcc:manufacturer	[IRI]https://dccwiki.ptb.de/en/dcccontactNotStrictType. The element dcc:manufacturer contains all necessary information to uniquely identify the manufacturer of the calibration item(s).	n/a see Table 19	[0..1]
[SML] dcc:identifications	[IRI] https://dccwiki.ptb.de/en/dccidentificationType. Same as Table 11	n/a see Table 10	[0..1]
[SML] dcc:item	[IRI] https://dccwiki.ptb.de/en/dccitem.	n/a see Table 20	[1] or [0..1]

	The element dcc:item contains all necessary information of each individual calibration item.		

Table 15: Properties of SMC “dcc:equipmentClassType”

idShort	dcc:equipmentClass		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccequipmentClassType.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:items		
Explanation	The dcc:equipmentClass SMC contains all the necessary information to uniquely identify a system of calibration items or a single calibration item using a classification scheme.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] dcc:reference	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType defines the standard(s) according to which the classification of the calibration items is carried out.	[string]	[1] or [0..1]
[Property] dcc:classID	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType defines the classification of the calibration goods.	[string]	[0..1]

Table 16: Properties of SML “dcc:owner”

idShort	dcc:owner
Class	SubmodelElementCollection
semanticId	https://dccwiki.ptb.de/en/dcccontactType.
isCaseOf	
AllowDuplicates	True
Parent	dcc:items
Explanation	The dcc:owner SMC contains all necessary information to uniquely identify the owner of the calibration item(s).

[SME type]	semanticity = [idType]value	[valueType]	card.
idShort	**Description@en**	**example**	
[Property] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType Indication of the name of the legal or natural person.	[string]	[1] or [0..1]
[Property] dcc:email	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Indication of the e-mail address of the legal entity or natural person.	[string]	[1] or [0..1]
[Property] dcc:phone	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Statement of the telephone number of the legal or natural person.	[string]	[0..1]
[Property] dcc:fax	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Statement of the fax number of the legal or natural person.	[string]	[0..1]
[SMC] dcc:location	[IRI] https://dccwiki.ptb.de/en/dcclocationType. Information on the address of the legal entity or natural person.		[1] or [0..1]
[SMC] dcc:descriptionData	[IRI] https://dccwiki.ptb.de/en/dccbyteDataType Additional information of the legal or natural person. Elements in dcc:descriptionData is the same as Table 7	n/a see Table 7	[0..1]

Table 17: Properties of SML “dcc:location”

idShort	dcc:location
Class	SubmodelElementCollection
semanticId	https://dccwiki.ptb.de/en/dcclocationType.
isCaseOf	
AllowDuplicates	True

Parent	dcc:owner		
Explanation	Contains information on the address of the legal entity or natural person.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] dcc:city	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Indicates name of city	[string] Frankfurt	[0..1]
[Property] dcc:countryCode	[IRI]https://dccwiki.ptb.de/en/dccstringISO3166Type Indicates the country code, consisting of two capital letters.	[string] +49	[0..1]
[Property] dcc:postCode	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Indicates the location's post code	[string] 60528	[0..1]
[Property] dcc:postOfficeBox	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Indicates the location’s postbox	[string] 60528	[0..1]
[Property] dcc:state	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Indicate the location’s state	[string] Hesse	[0..1]
[Property] dcc:street	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Indicates the street name.	[string] Example street	[0..1]
[Property] dcc:streetNo	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Indicates the location’s street number.	[string] 25	[0..1]
[SMC] dcc:further	[IRI]https://dccwiki.ptb.de/en/dccrichContentType	n/a see Table 6	[0..1]

	Provide additional information useful for an accurate postal address. Information in this SMC is the same as Table 6		
[SMC] dcc:positionCoordinates	[IRI]https://dccwiki.ptb.de/en/dccpositionCoordinatesType. Provision of additional information for the exact determination of the position when carrying out the calibration procedures (e.g. in the case of wind turbines) if it is not possible to provide a postal address.	n/a see Table 18	[0..1]

Table 18: Properties of SMC “dcc:positionCoordinates”.

idShort	dcc:positionCoordinates		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccpositionCoordinatesType.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:location		
Explanation	This SMC provides additional information for the exact determination of the position when carrying out the calibration procedures.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] dcc:positionCoordinateSystem	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType	[string]	[0..1]
[Property] dcc:reference	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType	[string]	[0..1]
[Property] dcc:declaration	[IRI]https://dccwiki.ptb.de/en/dccrichContentType Same as Table 6	[string]	[0..1]
[Property] dcc:positionCoordinate1	[IRI] n/a	n/a Table 44	[0..1]
[Property]	[IRI] n/a	n/a	[0..1]

dcc:positionCoordinate2		Table 44	
[Property] dcc:positionCoordinate3	[IRI] n/a	n/a Table 44	[0..1]

Table 19: Properties of SMC “dcc:manufacturer”

idShort	dcc:manufacturer		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dcccontactType.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:items		
Explanation	The element dcc:manufacturer contains all necessary information to uniquely identify the manufacturer of the calibration item(s).		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType Indication of the name of the legal or natural person.	[string]	[1] or [0..1]
[Property] dcc:email	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Indication of the e-mail address of the legal entity or natural person.	[string]	[0..1]
[Property] dcc:phone	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Statement of the telephone number of the legal or natural person.	[string]	[0..1]
[Property] dcc:fax	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Statement of the fax number of the legal or natural person.	[string]	[0..1]

[SMC] dcc:location	[IRI] https://dccwiki.ptb.de/en/dcclocationType. Information on the address of the legal entity or natural person. The elements in dcc:location is the same as Table 17	n/a see Table 17	[0..1]
[SMC] dcc:descriptionData	[IRI] https://dccwiki.ptb.de/en/dccbyteDataType Additional information of the legal or natural person. Elements in dcc:descriptionData is the same as Table 7	n/a see Table 7	[0..1]

Table 20: Properties of “dcc:item”

idShort	dcc:item		
Class	SubmodelElementList		
semanticId	https://dccwiki.ptb.de/en/dccitems		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:item		
Explanation	The SMC dcc:item contains all necessary information to identify and describe a system of calibration items or a single calibration item. Elements define below are collection of the dcc:item SMC.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. This element shall specify the name of the system of calibration items.	[string]	[0..1]
[SMC] dcc:equipmentClass	[IRI]https://dccwiki.ptb.de/en/dccequipmentClassType. Same as Table 15	n/a see Table 15	[0..*]
[SMC] dcc:description	[IRI]https://dccwiki.ptb.de/en/dccrichContentType Same as Table 6	n/a see Table 6	[0..1]
[SML]	[IRI]https://dccwiki.ptb.de/en/dccsoftwareListType	n/a	[0..1]

dcc:installedSoftwares	Same as Table 4	see Table 4	
[SMC] dcc:manufacturer	[IRI]https://dccwiki.ptb.de/en/dcccontactNotStrictType. Same as Table 19	n/a see Table 19	[0..1]
[Property] model	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Other information which has not made a statement about the model or variant of the calibration object used in the previously listed elements.	[string]	[0..1]
[SML] dcc:identifications	[IRI]https://dccwiki.ptb.de/en/dccidentificationType. Same as Table 11	n/a see Table 10	[0..1]
[SML] dcc:itemQuantities	[IRI]https://dccwiki.ptb.de/en/dccitemQuantities. The element dcc:itemQuantity was introduced to specify machine-readable physical properties. It is used exclusively to specify unchangeable values which originate, for example, from the manufacturer's data sheet. This field is not used to reproduce the entire data sheet.	n/a see Table 21	[0..1]

Table 21: Properties of SMC “itemQuatities”

idShort	dcc:itemQualities		
Class	SubmodelElementList		
semanticId	https://dccwiki.ptb.de/en/dccitemQuantities.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:item		
Explanation	It contains a list of itemQuality SMC. It is used exclusively to specify unchangeable values which originate, for example, from the manufacturer's data sheet. This field is not used to reproduce the entire data sheet.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**

idShort	Description@en	example	
[SMC] dcc:itemQuatity	[IRI] https://dccwiki.ptb.de/en/dccprimitiveQuantityType. This item contains measurable value(s).	n/a see Table 22	[1..*] or [0..*]

Table 22: Properties of SMC “itemQuatity”.

idShort	dcc:itemQuatity		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccprimitiveQuantityType.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:itemQuantites		
Explanation	This SMC is used to define measurable value(s).		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. This element can be used to store text specifying the language used.	[string]	[0..1]
[SMC] dcc:description	[IRI]https://dccwiki.ptb.de/en/dccrichContentType Same as Table 6	n/a see Table 6	[0..1]
[SMC] dcc:noQuantity	[IRI]https://dccwiki.ptb.de/en/dccrichContentType Same as Table 6	n/a see Table 6	[0..1]
[SMC] dcc:charsXMLList	[IRI] n/a	n/a	[0..1]
[SMC] si:real	[IRI] n/a Elements defined in Table 44	n/a see Table 44	[0..1]
[SMC]	[IRI] n/a	n/a	[0..1]

si:hybrid	Elements defined in Table 47	see Table 47	
{SMC} si:complex	[IRI] n/a Elements defined in Table 48	n/a see Table 48	[0..1]
[SMC] si:constant	[IRI] n/a Elements defined in Table 49	n/a see Table 49	[0..1]
[SMC] si:realListXMLList	[IRI] n/a Elements defined in Table 50	n/a see Table 50	[0..1]

3.2.4 Properties of SMC "dcc:calibrationLaboratory"

Figure 6 shows the UML-diagram defining the relevant properties which need to be set for "dcc:calibrationLaboratory". The following table describes the details of the SMC structure combined with examples.

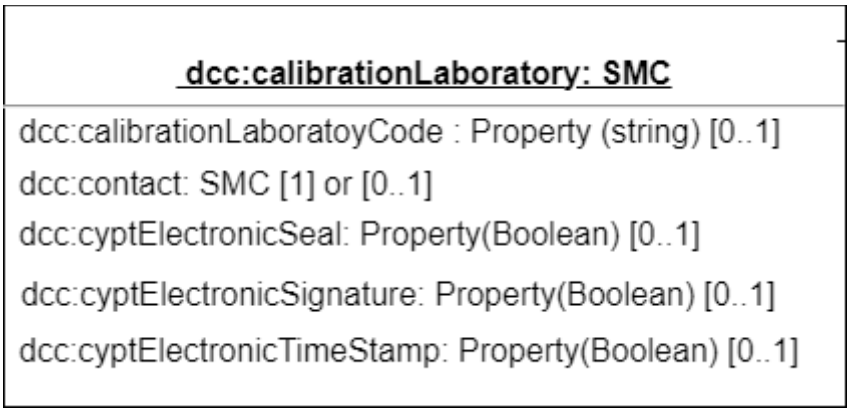


Figure 6: UML-diagram of SMC "dcc:calibrationLaboratory"

Table 23: Properties of SMC "calibrationLaboratory"

idShort	dcc:calibrationLaboratory
Class	SubmodelElementCollection
semanticId	https://dccwiki.ptb.de/en/dcccalibrationLaboratory.
isCaseOf	
AllowDuplicates	True
Parent	dcc:adminstrativeData

Explanation	The element type *dcc:calibrationLaboratory* contains essential information on the calibration laboratory.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] dcc:calibrationLaboratoryCode	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType This element can either be empty or have an assigned identifier entered. Depending on if it is PTB or DAkkS that is issuing the DCC	[string]	[0..1]
[SMC] dcc:contact	[IRI] https://dccwiki.ptb.de/en/dcccontactType Elements defined in Table 16	n/a see Table 16	[1] or [0..1]
[Property] dcc:cryptElectronicSeal	[IRI] n/a Indicates if the calibration laboratory has a cryptographic electronical seal.	[boolean]	[0..1]
[Property] dcc:cryptElectronicSignature	[IRI] n/a Indicates if the calibration laboratory has a cryptographic electronical signature.	[boolean]	[0..1]
[Property] dcc:cryptElectronicTimeStamp	[IRI] n/a Indicates if the calibration laboratory has a cryptographic electronical timestamp.	[boolean]	[0..1]

3.2.5 Properties of SML “dcc:respPersons”

Figure 7 shows the UML-diagram defining the relevant properties which need to be set for “dcc:respPersons”. The following table describes the details of the SMC structure combined with examples.

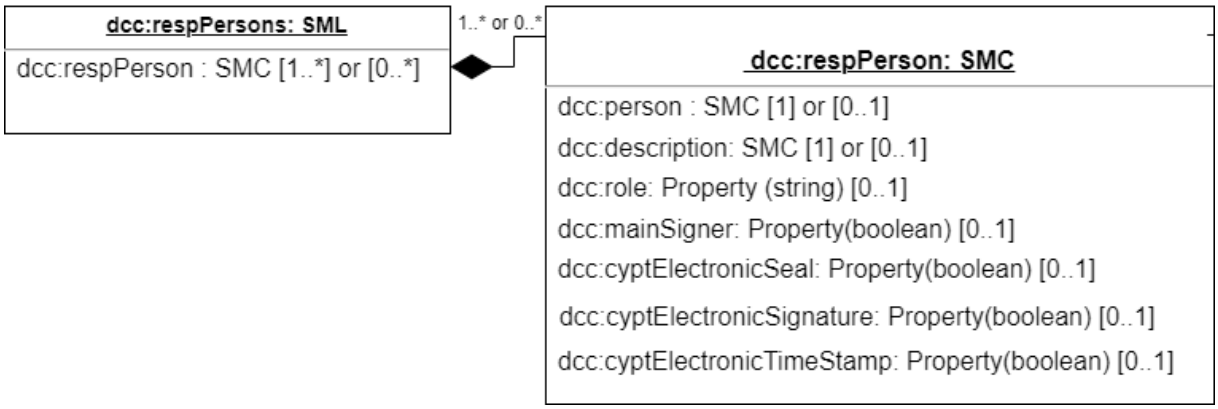


Figure 7: UML-diagram of SML “dcc:respPersons”

Table 24: Properties of SML “dcc:respPersons”

idShort	dcc:respPersons		
Class	SubmodelElementList		
semanticId	https://dccwiki.ptb.de/en/dccrespPerson.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:adminstrativeData		
Explanation	The SML dcc:respPersons is used to identify llist of persons responsible for releasing the report.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] dcc:respPerson	[IRI] https://dccwiki.ptb.de/en/dccrespPerson. This SMC is used to identitfy a single person out of a list of people responsible for releasing the report.		[1..*] or [0..*]

Table 25: Properties of SMC “dcc:respPerson”

idShort	dcc:respPerson
Class	SubmodelElementCollection
semanticId	https://dccwiki.ptb.de/en/dccrespPerson.
isCaseOf	

AllowDuplicates	True		
Parent	dcc:respPersons		
Explanation	This SMC is used to identify a single person out of a list of people responsible for releasing the report.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] dcc:person	[IRI]https://dccwiki.ptb.de/en/dcccontactNotStrictType Name of the person and their contact details. Elements same as Table 19.	n/a see Table 19	[1] or [0..1]
[SMC] dcc:description	[IRI]https://dccwiki.ptb.de/en/dccrichContentType. Same as Table 6	n/a see Table 6	[0..1]
[Property] dcc:role	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Role of the responsible person.	[string]	[0..1]
[Property] dcc:mainSigner	[IRI]n/a A person shall take overall responsibility for the DCC. Therefore, the value for the child element mainSigner shall have the value "TRUE" for exactly one element of respPerson.	[boolean]	[0..1]
[Property] dcc:cryptElectronicSeal	[IRI] n/a Is the person responsible for applying the cryptographic electronic seal? In this case, the element cryptElectronicSeal shall have the value "TRUE".	[boolean]	[0..1]
[Property] dcc:cryptElectronicSignature	[IRI] n/a Is the person responsible for affixing the cryptographic electronic signature? In this case, the element *cryptElectronicSignature* shall have the value "TRUE".	[boolean]	[0..1]
[Property]	[IRI]n/a	[boolean]	[0..1]

dcc:cryptElectronicTimeStamp	Is the person responsible for applying the cryptographic electronic time stamp? In this case, the ELement *cryptElectronicTimeStamp* shall have the value "TRUE".		

3.2.6 Properties of SMC “dcc:customer”

The properties of the SMC “dcc:customer” have the same elements as SMC “dcc:owner” in Table 16.

3.2.7 Properties of SML “dcc:statements”

Figure 8 shows the UML-diagram defining the relevant properties which need to be set for “dcc:statements”. The following table describes the details of the SMC structure combined with examples.

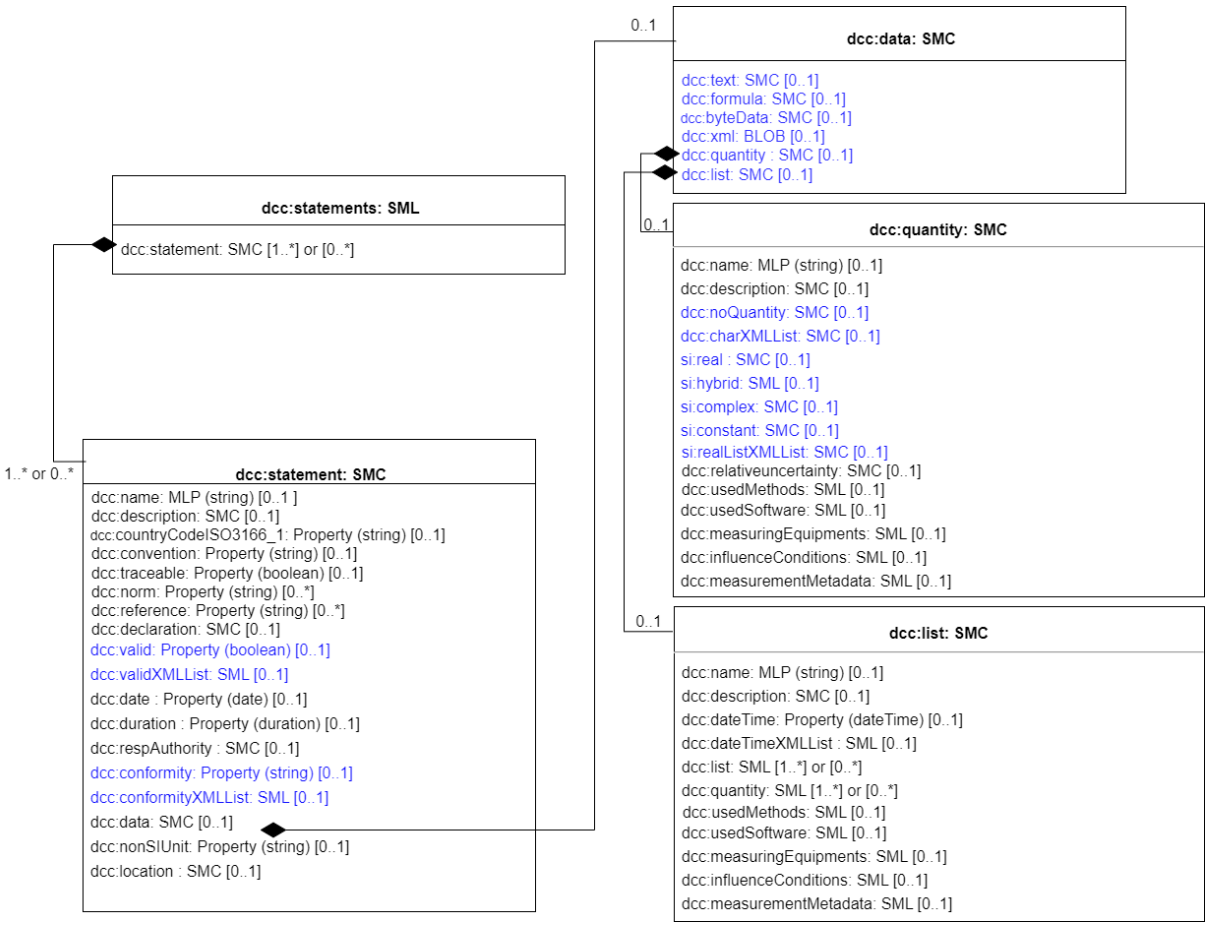


Figure 8: UML-diagram of SML “dcc:statements”

Table 26: Properties of SML “dcc:statements”

idShort	dcc:statements		
Class	SubmodelElementList		
semanticId	https://dccwiki.ptb.de/en/dccstatement.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:adminstrativeData		
Explanation	The SML dcc:statements contains list of statements recorded for the entire calibration process.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] dcc:statement	[IRI] https://dccwiki.ptb.de/en/dccstatement. Contains information recorded during calibration process		[1..*] or [0..*]

Table 27: Properties of SMC “dcc:statement”

idShort	dcc:statement		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccstatement.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:statements		
Explanation	Contains statement information recorded for the entire calibration process.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType.	[string]	[0..1]

[SMC] dcc:description	[IRI] https://dccwiki.ptb.de/en/dccrichContentType.		[0..1]
[Property] dcc:countryCodeISO3166_1	[IRI] https://dccwiki.ptb.de/en/dccstringISO3166Type. The abbreviation of the official language is entered in this element. Here the country code is given. The StringISO3166 element is configured to hold exactly two uppercase letters.	[string] DE	[0..1]
[Property] dcc:convention	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType The String data type represents strings in XML.	[string]	[0..1]
[Property] dcc:traceable	[IRI]n/a Indicates whether the measurement result is traceable.	[boolean]	[0..1]
[Property] dcc:norm	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Reference is made here to the standards and guidelines that were taken into account in the measurement.	[string]	[0..1]
[Property] dcc:reference	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType The String data type represents strings in XML.	[string]	[0..1]
[SMC] dcc:declaration	[IRI]https://dccwiki.ptb.de/en/dccrichContentType. Text as well as images and formulas can be stored in this element. The elements in dcc:declaration is the same as Table 6	n/a see Table 6	[0..1]
[Property] dcc:valid	[IRI] n/a Indicates that the result is in valid range.	[boolean]	[0..1]
[SMC] dcc:validXMLList	[IRI] n/a this SMC is used to define valid XML list boolean values. Elements of the SMC are defined in Table 50.		[0..1]

[Property] dcc:date	[IRI] n/a Indicates a valid date	[date] 2023-08-13	[0..1]
[Property] dcc:period	[IRI] n/a defines the period of exchange of the DCC.	[duration]	[0..1]
[SMC] dcc:respAuthority	[IRI]https://dccwiki.ptb.de/en/dccrichContentType. Text as well as images and formulas can be stored in this element. The elements in dcc:respAuthority is the same as Table 6.		[0..1]
[Property] dcc:conformity	[IRI]https://dccwiki.ptb.de/en/dccstringConformityStatementStatusType. Used to enter compliance statements. Valid value can be one of “pass”, “fail”, “conditionalPass”, “conditionalFail”, “noPass” or “noFail	[string]	[0..1]
[SML] dcc:conformityXMLList	[IRI] https://dccwiki.ptb.de/en/dccstringConformityStatementStatusType. Used to enter compliance statements in a XMLList defined in Table 50. The allowed value for the si:valueXMLList are “pass”, “fail”, “conditionalPass”, “conditionalFail”, “noPass” or “noFail”.	n/a see Table 50	[0..1]
caöibrat	[IRI] https://dccwiki.ptb.de/en/dccdataType. With the help of the element type dcc:data SMC, different data formats are made known.	n/a see Table 28	[0..1]
[Property] dcc:nonSIDefinition	[IRI] n/a Definition of a non-SI unit used by the DCC can be derived from BIPM definition in the near future. The IEC CDD can also be used for this definition.	[string]	[0..1]
[Property] dcc:nonSIUnit	[IRI] n/a non-SI unit used by the DCC can be derived from BIPM definition in the near future. The IEC CDD can also be used for this definition	[string]	[0..1]

[SMC] dcc:location	[IRI] https://dccwiki.ptb.de/en/dcclocationType An additional location can be described here. The elements in the dcc:location SMC is the same as Table 17	n/a see Table 17	[0..1]

Table 28: Properties of SMC “dcc:data”

idShort	dcc:data		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccdataType..		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:statements		
Explanation	The SMC “dcc:data” helps provide definition for different data formats during calibration.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] dcc:text	[IRI]https://dccwiki.ptb.de/en/dccrichContentType text can be stored in this element. Elements of this SMC is the same as Table 6.	n/a see Table 6	[0..1]
[SMC] dcc:formula	[IRI] https://dccwiki.ptb.de/en/dccformulaType Formulas can be stored in this element. Elements of this SMC is the same as Table 8	n/a see Table 8	[0..1]
[SMC] dcc:byteData	[IRI] https://dccwiki.ptb.de/en/dccbyteDataType The element type dcc:byteDataType is used to enter any information that is available as electronic data.	n/a see Table 7	[0..1]
[BLOB] dcc:xml	[IRI] https://dccwiki.ptb.de/en/dccxmlType. The BLOB dcc:xml allows formulas and equations to be inserted into the measurement result area of the DCC	n/a	[0..1]

[SMC] dcc:quantity	[IRI] https://dccwiki.ptb.de/en/dccquantityType. A single measurand that may contain a D-SI element or text. Each value describing a physical quantity is placed in a *dcc:quantity*.	n/a see Table 29	[0..1]
[SMC] dcc:list	[IRI] https://dccwiki.ptb.de/en/dcclistType The "list" element allows the definition of a collection of measurement results to which structures with integrity are subject, e.g. vector quantities.	n/a see Table 39	[0..1]

3.2.7.1 Properties of SMC "dcc:quantity"

Figure 9 shows the UML-diagram defining the relevant properties which need to be set for "dcc:quantity". The following table describes the details of the SMC structure combined with examples.

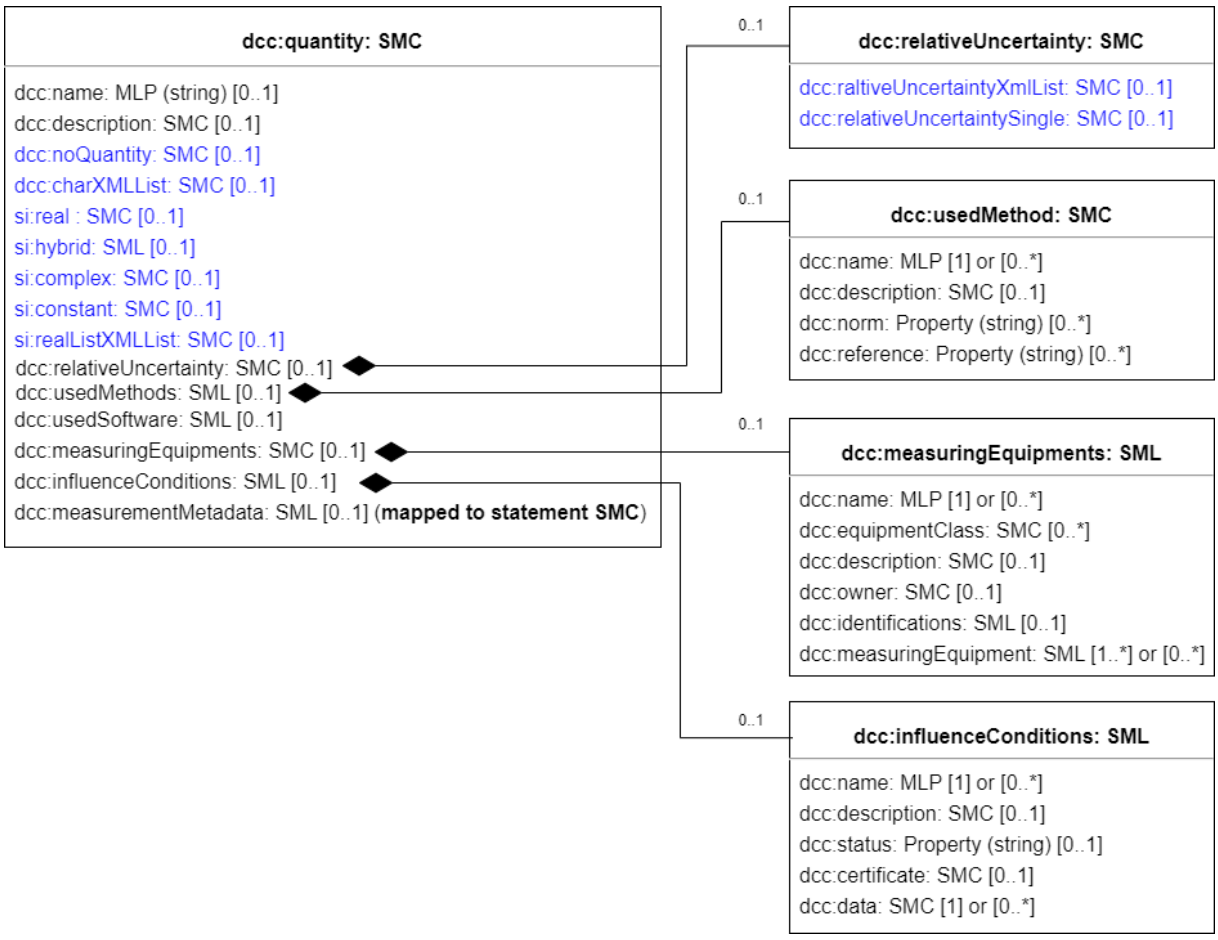


Figure 9: UML-diagram of SMC "dcc:quantity"

Table 29: Prioperties of SMC "dcc:quantity"

idShort	dcc:quantity
Class	SubmodelElementCollection

semanticId	https://dccwiki.ptb.de/en/dccquantityType.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:data		
Explanation	A single measurand that may contain a D-SI element or text. Each value describing a physical quantity is placed in a *dcc:quantity*.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. This element can be used to store text specifying the language used.	[string]	[0..1]
[SMC] dcc:description	[IRI]https://dccwiki.ptb.de/en/dccrichContentType Description of the Quantity. The element type dcc:richContentType is used to enter any information. With it, it is possible to accommodate text as well as images and formulas in one element.	n/a see Table 6	[0..1]
[SMC] dcc:noQuantity	[IRI]https://dccwiki.ptb.de/en/dccrichContentType Elements defined in Table 6	n/a see Table 6	[0..1]
[SMC] dcc:charsXMLList	[IRI] n/a		[0..1]
[SMC] si:real	[IRI] n/a Elements defined in Table 44	n/a see Table 44	[0..1]
[SMC] si:hybrid	[IRI] n/a Elements defined in Table 47	n/a see Table 47	[0..1]
{SMC] si:complex	[IRI] n/a	n/a seeTable 48	[0..1]

	Elements defined in Table 48		
[SMC] si:constant	[IRI] n/a Elements defined in Table 49	n/a see Table 49	[0..1]
[SMC] si:realListXMLList	[IRI] n/a Elements defined in Table 50	n/a see Table 50	[0..1]
[SMC] dcc:relativeuncertainty	[IRI]https://dccwiki.ptb.de/en/dccrelativeUncertainty. Relative Uncertainty of the D-SI according to GUM is implemented here.	n/a see Table 30	[0..1]
[SML] dcc:usedMethods	[IRI]https://dccwiki.ptb.de/en/dccxxxListType#dccusedmethodlisttype. The element dcc:usedMethodListType contains the list of methods used during calibration. It is possible that a method has already been named in a parent element, which is also valid for this dcc:quantity.	n/a see Table 31	[0..1]
[SML] dcc:usedSoftware	[IRI] https://dccwiki.ptb.de/en/dccxxxListType#dccsoftwarelisttype. Essential information to identify the software used to create and edit the DCC is stored here. It is possible that a software has already been named in a parent element, which is also valid for this dcc:quantity. The elements in the dcc:usedSoftware is the same as Table 4	n/a see Table 4	[0..1]
[SML] dcc: measuringEquipments	[IRI] https://dccwiki.ptb.de/en/dccxmlType. Describes list of measuring equipment used in the calibration of the DCC.	n/a see Table 33	[0..1]
[SML] dcc: influenceConditions	[IRI]https://dccwiki.ptb.de/en/dccxxxListType#dccmeasuringequipmentlisttype. Describes list of conditions which have influence on the calibration result. In this type, it is also possible to store the measurement values that are no longer current if a repair or	n/a see Table 37	[0..1]

	adjustment was carried out on the calibration item.		
[SML] dcc:measurementMetaData	[IRI] https://dccwiki.ptb.de/en/dccxxxListType#dccmeasurementmetadatalisttype. Elements of dc:measurementMetaData is the same as Table 27	n/a see Table 27	[0..1]

Table 30: Properties of SMC “dcc:relativeUncertainty”

idShort	dcc:relativeUncertainty		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccrelativeUncertainty.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:quantity		
Explanation	Defines Relative Uncertainty of the D-SI according to GUM		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] dcc:relativeuncertaintyXmlList	[IRI] n/a Elements defined in Table 50	n/a see Table 50	[0..1]
[SMC] dcc:relativeUncertaintySingle	[IRI] n/a Elements defined in Table 44	n/a see Table 44	[0..1]

Table 31: Properties of SML “dcc:usedMethods”

idShort	dcc:usedMethods
Class	SubmodelElementList
semanticId	https://dccwiki.ptb.de/en/dccxxxListType#dccusedmethodlisttype.
isCaseOf	
AllowDuplicates	True
Parent	dcc:quantity

Explanation	The element dcc:usedMethods contains a list of methods used during calibration.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] dcc:usedMethod	[IRI] https://dccwiki.ptb.de/en/dccusedMethodType. Definition of method used during calibration		[1..*] or [0..*]

Table 32: Properties of SMC “dcc:usedMethod”

idShort	dcc:usedMethod		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccusedMethodType		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:usedMethods		
Explanation	Definition of method used during calibration		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. This element shall specify the name of the calibration method.	[string]	[1] or [0..1]
[SMC] dcc:description	[IRI]https://dccwiki.ptb.de/en/dccrichContentType Other information not given in the elements *dcc:name* is given here, thus describing the element. The element of dcc:description is the same as that of Table 6	n/a see Table 6	[0..1]
[Property] dcc:norm	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType The name of the underlying norm	[string]	[0..1]
[Property] dcc:reference	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType	[string]	[0..1]

	The reference to interested method used.		

Table 33: Properties of SML “dcc:measuringEquipments”

idShort	dcc:measuringEquipments		
Class	SubmodelElementList		
semanticId	https://dccwiki.ptb.de/en/dccxxxListType#dccmeasuringequipmentlisttype.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:quantity		
Explanation	In dcc:measuringEquipments, information about the list of equipment used during calibration is documented		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType This element shall specify the name of the system of calibration items.	[string]	[0..1]
[SMC] dcc:equipmentClass	[IRI]https://dccwiki.ptb.de/en/dccequipmentClassType The equipmentClass element contains all the necessary information to uniquely identify a system of calibration items or a single calibration item using a classification scheme.	n/a see Table 15	[0..*]
[SMC] dcc:description	[IRI]https://dccwiki.ptb.de/en/dccrichContentType Same as Table 6	n/a see Table 6	[0..1]
[SMC] dcc:owner	[IRI] https://dccwiki.ptb.de/en/dcccontactType. The element dcc:owner contains all necessary information to uniquely identify the owner of the calibration item(s). the elements in dcc:owner are the same as Table 16	n/a see Table 16	[0..1]

[SML] dcc:identifications	[IRI]https://dccwiki.ptb.de/en/dccidentificationType Same as Table 11	n/a see Table 10	[0..1]
[SML] dcc:measuringEquipment	[IRI]https://dccwiki.ptb.de/en/dccmeasuringEquipmentType. In dcc:measuringEquipment, information about the equipment used during calibration is documented.	n/a see Table 34	[1..*] or [0..*]

Table 34: Properties of SMC “dcc:measuringEquipment”.

idShort	dcc:measuringEquipment		
Class	SubmodelElementList		
semanticId	https://dccwiki.ptb.de/en/dccmeasuringEquipmentType.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:measuringEquipments		
Explanation	In dcc:measuringEquipment, information about the equipment used during calibration is documented. Elements defined below are collection of the dcc:measurementEquipment SMC.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. This element shall specify the name of the system of calibration items.	[string]	[1] or [0..1]
[SMC] dcc:equipmentClass	[IRI]https://dccwiki.ptb.de/en/dccequipmentClassType. Same as Table 15	n/a see Table 15	[0..*]
[SMC] dcc:description	[IRI]https://dccwiki.ptb.de/en/dccrichContentType Same as Table 6	n/a see Table 6	[0..1]
[SML]	[IRI] https://dccwiki.ptb.de/en/dcccontactType.	n/a	[0..1]

dcc:certificate	In this element the certificate for the equipment can be specified. Elements in dcc:certificate is the same as Table 13	see Table 13	
[SMC] dcc:manufacturer	[IRI]https://dccwiki.ptb.de/en/dcccontactNotStrictType. Same as Table 19	n/a see Table 19	[0..1]
[Property] model	[IRI]https://dccwiki.ptb.de/en/dccnotEmptyStringType Other information which has not made a statement about the model or variant of the calibration object used in the previously listed elements.	[string]	[0..1]
[SML] dcc:identifications	[IRI]https://dccwiki.ptb.de/en/dccidentificationType. Same as Table 11	n/a see Table 10	[0..1]
[SML] dcc:measuringEquipmentQuantities	[IRI]https://dccwiki.ptb.de/en/dccmeasuringEquipmentQuantities. The element dcc:measuringEquipmentQuantities contains a list of measurable value(s) which belongs to the measurement equipment.	n/a see Table 35	[0..1]

Table 35: Properties of SML “dcc:measuringEquipmentQuantities”

idShort	dcc:measuringEquipmentQuantities		
Class	SubmodelElementList		
semanticId	https://dccwiki.ptb.de/en/dccmeasuringEquipmentQuantities.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:measuringEquipment		
Explanation	The element dcc:measuringEquipmentQuantities contains a list of measurable value(s) which belongs to the measurement equipment.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	

[SMC] dcc:measuringEquipmentQuantity	[IRI] https://dccwiki.ptb.de/en/dccprimitiveQuantityType. The element dcc:measuringEquipmentQuantity contains measurable value(s) which belongs to the measurement equipment.	n/a see Table 36	[1..*] or [0..*]

Table 36: Properties of SMC “dcc:measuringEquipmentQuantity”

idShort	dcc:measuringEquipmentQuantity		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccprimitiveQuantityType.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:measuringEquipmentQuantities		
Explanation	The element dcc:measuringEquipmentQuantity contains measurable value(s) which belongs to the measurement equipment.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. This element shall specify the name of the calibration method.	[string]	[0..1]
[SMC] dcc:description	[IRI]https://dccwiki.ptb.de/en/dccrichContentType. Other information not given in the elements *dcc:name* is given here, thus describing the element. The element of dcc:description is the same as that of Table 6	n/a see Table 6	[0..1]
[SMC] dcc:noQuantity	[IRI]https://dccwiki.ptb.de/en/dccrichContentType. Same as Table 6	n/a see Table 6	[0..1]
[SMC] dcc:charsXMLList	[IRI] n/a		[0..1]

[SMC] si:real	[IRI] n/a Elements defined in Table 44	n/a see Table 44	[0..1]
[SMC] si:hybrid	[IRI] n/a Elements defined in Table 47	n/a see Table 47	[0..1]
{SMC] si:complex	[IRI] n/a Elements defined in Table 48	n/a seeTable 48	[0..1]
[SMC] si:constant	[IRI] n/a Elements defined in Table 49	n/a see Table 49	[0..1]
[SMC] si:realListXMLList	[IRI] n/a Elements defined in Table 50	n/a see Table 50	[0..1]

Table 37: Properties of SML “dcc:influenceConditions”

idShort	dcc:influenceConditions		
Class	SubmodelElementList		
semanticId	https://dccwiki.ptb.de/en/dccxxxListType#dccinfluenceconditionlisttype.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:quantity		
Explanation	Describes list of conditions which have influence on the calibration result. In this type, it is also possible to store the measurement values that are no longer current if a repair or adjustment was carried out on the calibration item.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] dcc:influenceCondition	[IRI] https://dccwiki.ptb.de/en/dccinfluenceConditionType.	n/a see Table 38	[1..*] or [0..*]

	Defines conditions which have influence on the calibration result.		

Table 38: Properties of SMC “dcc:influenceCondition”

idShort	dcc:influenceCondition		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccinfluenceConditionType..		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:influenceConditions		
Explanation	Defines conditions which have influence on the calibration result.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. This element shall specify the name of the calibration method.	[string]	[0..1]
[SMC] dcc:description	[IRI] https://dccwiki.ptb.de/en/dccrichContentType. Other information not given in the elements *dcc:name* is given here, thus describing the element. The element of dcc:description is the same as that of Table 6	n/a see Table 6	[0..1]
[Property] dcc:status	[IRI] n/a indicates a change due to a repair or adjustment of the unit, making the information in dcc:data history data. The status can be beforeAdjustment, afterAdjustment, beforeRepair, afterRepair.	[string] beforeAdjustment	[0..1]
[SMC] dcc:certificate	[IRI] https://dccwiki.ptb.de/en/dcchashType Reference to another certificate as the source of the values. The elements of the dcc:certificate are the same as in Table 13	n/a see Table 13	[0..1]
[SMC] dcc:data	[IRI] https://dccwiki.ptb.de/en/dccdataType.	n/a see Table 28	[1]

	without dcc:status: The element dcc:data contains the data of the influence conditions. with dcc:status: The element contains the history data before a change was made to the device. The elements of dcc:data are the same as in Table 28.		or [0..1]

3.2.7.2 Properties of SMC "dcc:list"

shows the UML-diagram defining the relevant properties which need to be set for "dcc:list". The following table describes the details of the SMC structure combined with examples.

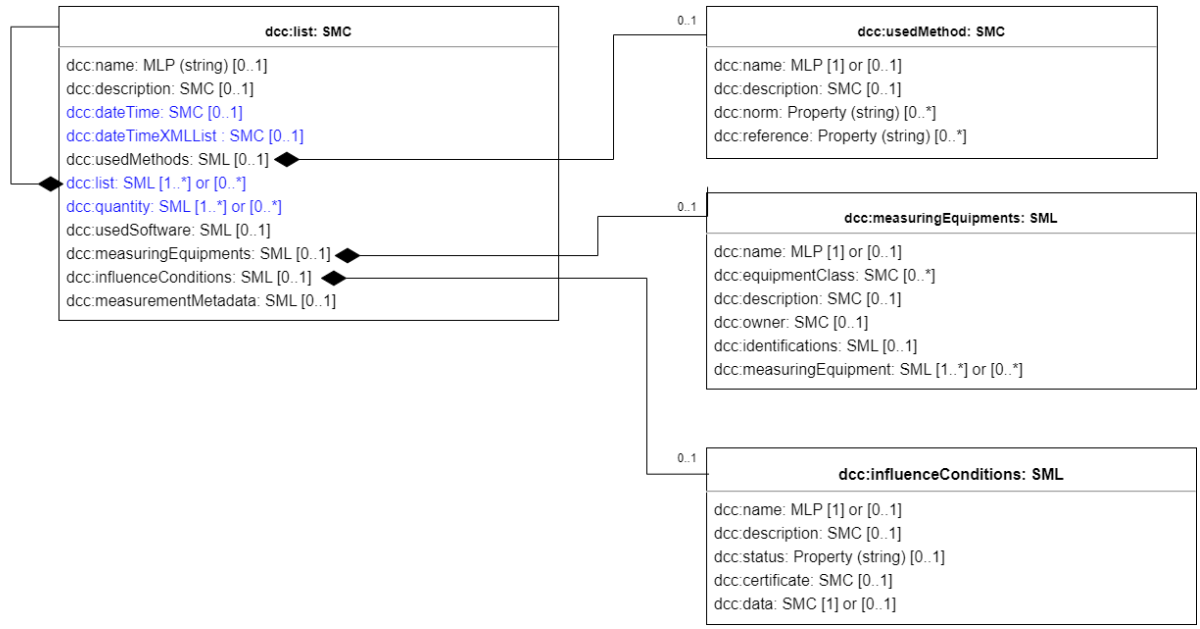


Figure 10 : UML-diagram of SMC "dcc:list"

Table 39: Properties of SMC "dcc:list"

idShort	dcc:list
Class	SubmodelElementCollection

semanticId	https://dccwiki.ptb.de/en/dcclistType.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:data		
Explanation	The "dcc:list" element allows the definition of a collection of measurement results to which structures with integrity are subject, e.g. vector quantities.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. This element can be used to store text specifying the language used.	[string]	[0..1]
[SMC] dcc:description	[IRI] https://dccwiki.ptb.de/en/dccrichContentType. Description of the Quantity. The element type dcc:richContentType is used to enter any information. With it, it is possible to accommodate text as well as images and formulas in one element.	n/a see Table 6	[0..1]
[Property] dcc:dateTime	[IRI] n/a This element can be used to specify a common measurement time for the child elements of this list.	[dateTime]	[0..1]
[SML] dcc:dateTimeXMLList	[IRI] n/a Contains list of dateTime properties. Element in dcc:datTimeXMLList is a list of dcc:dateTime property defined above.	[dateTime]	[0..1]
[SML] dcc:usedMethods	[IRI]https://dccwiki.ptb.de/en/dccxxxListType#dccusedmethodlisttype. The element dcc:usedMethodListType contains the list of methods used during calibration. It is possible that a method has already been named in a parent element, which is also valid for this dcc:quantity.	n/a see Table 31	[0..1]

[SML] dcc:list	[IRI] https://dccwiki.ptb.de/en/dcclistType. The "list" element allows the definition of a collection of measurement results to which structures with integrity are subject, e.g. vector quantities.	n/a see Table 39	[1..*] or [0..*]
[SML] dcc:quantity	[IRI] https://dccwiki.ptb.de/en/dccquantityType. A single measurand that may contain a D-SI element or text. Each value describing a physical quantity is placed in a *dcc:quantity*.	n/a see Table 29	[1..*] or [0..*]
[SML] dcc:usedSoftware	[IRI]https://dccwiki.ptb.de/en/dccxxxListType#dccsoftwarelisttype. Essential information to identify the software used to create and edit the DCC is stored here. It is possible that a software has already been named in a parent element, which is also valid for this dcc:quantity. The elements in the dcc:usedSoftware is the same as Table 4	n/a see Table 4	[0..1]
[SML] dcc: measuringEquipments	[IRI] https://dccwiki.ptb.de/en/dccxmlType. Describes list of measuring equipment used in the calibration of the DCC.	n/a see Table 33	[0..1]
[SML] dcc: influenceConditions	[IRI]https://dccwiki.ptb.de/en/dccxxxListType#dccmeasuringequipmentlisttype. Describes list of conditions which have influence on the calibration result. In this type, it is also possible to store the measurement values that are no longer current if a repair or adjustment was carried out on the calibration item.	n/a see Table 37	[0..1]
[SML] dcc:measurementMetaData	[IRI]https://dccwiki.ptb.de/en/dccxxxListType#dccmeasurementmetadatalisttype. The elements of dc:measurementMetaData are the same as Table 27.	n/a see Table 27	[0..1]

3.3 Properties of the SMC “dcc:measurementResults”

Figure 11 shows the UML-diagram defining the relevant properties which need to be set for “dcc:statements”. The following table describes the details of the SMC structure combined with examples.

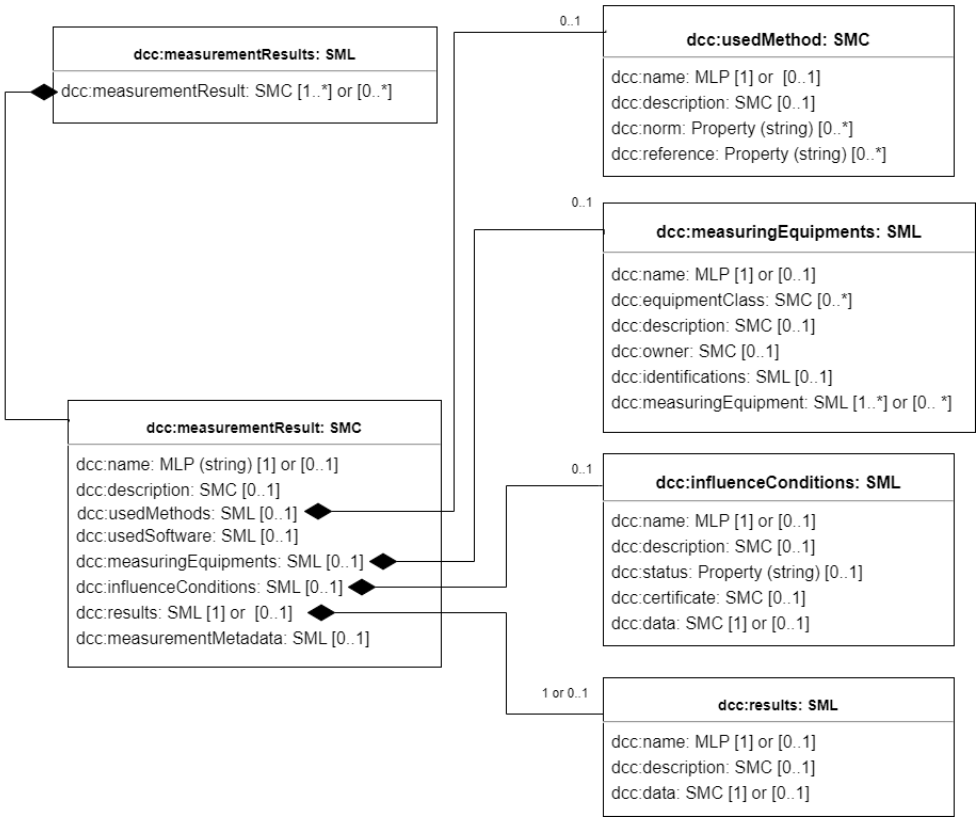


Figure 11: UML-diagram of SML “dcc:measurementResults”

Table 40: Properties of SML “dcc:measurementResults”

idShort	dcc:measurementResults		
Class	SubmodelElementList		
semanticId	https://dccwiki.ptb.de/en/dccmeasurementResult.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:digitalCalibrationCertificate		
Explanation	The element *dcc:measurementResults* contains list of all results of the measurements, evaluations and information about the calibration. The entries in this area are such that a value is always linked to a unit. SI units should always be used.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] dcc:measurementResult	[IRI] https://dccwiki.ptb.de/en/dccmeasurementResult.	n/a see Table 41	[1..*] or [0..*]

	Contains results of the measurements, evaluations and information about the calibration.		

Table 41: Properties of SMC “dcc:measurementResult”

idShort	dcc:measurementResult		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccmeasurementResult.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:measurementResults		
Explanation	Contains results of the measurements, evaluations and information about the calibration.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. This element can be used to store text specifying the language used.	[string]	[1] or [0..1]
[SMC] dcc:description	[IRI]https://dccwiki.ptb.de/en/dccrichContentType. Description of the Quantity. The element type dcc:richContentType is used to enter any information. With it, it is possible to accommodate text as well as images and formulas in one element.	n/a see Table 6	[0..1]
[SML] dcc:usedMethods	[IRI]https://dccwiki.ptb.de/en/dccxxxListType#dccusedmethodlisttype. The element dcc:usedMethodListType contains the list of methods used during calibration. It is possible that a method has already been named in a parent element, which is also valid for this dcc:quantity. The elements in dcc:usedMethods are the same as in Table 31	n/a see Table 31	[0..1]

[SML] dcc:usedSoftware	[IRI] https://dccwiki.ptb.de/en/dccxxxListType#dccsoftwarelisttype. Essential information to identify the software used to create and edit the DCC is stored here. It is possible that a software has already been named in a parent element, which is also valid for this dcc:quantity. The elements in the dcc:usedSoftware are the same as in Table 4	n/a see Table 4	[0..1]
[SML] dcc: measuringEquipments	[IRI] https://dccwiki.ptb.de/en/dccxmlType. Describes list of measuring equipment used in the calibration of the DCC. The elements in the dcc:measuringEquipments are the same as in Table 33.	n/a see Table 33	[0..1]
[SML] dcc: influenceConditions	[IRI]https://dccwiki.ptb.de/en/dccxxxListType#dccmeasuringequipmentlisttype. Describes list of conditions which have influence on the calibration result. In this type, it is also possible to store the measurement values that are no longer current if a repair or adjustment was carried out on the calibration item. The elements in the dcc:influenceConditions are the same as in Table 37	n/a see Table 37	[0..1]
[SML] dcc:results	[IRI]https://dccwiki.ptb.de/en/dccxxxListType#dccresultlisttype. Contains list of calibration results	n/a see Table 42	[1] or [0..1]
[SML] dcc:measurement MetaData	[IRI] https://dccwiki.ptb.de/en/dccxxxListType#dccmeasurementmetadatalisttype. The elements of dc:measurementMetaData are the same as in Table 28	n/a see Table 28	[0..1]

Table 42: Properties of SML “dcc:results”

idShort	dcc:results
Class	SubmodelElementList
semanticId	https://dccwiki.ptb.de/en/dccxxxListType#dccresultlisttype.

isCaseOf			
AllowDuplicates	True		
Parent	dcc:measurementResult		
Explanation	Contains list of calibration results.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] dcc:result	[IRI] https://dccwiki.ptb.de/en/dccxxxListType#dccresultlisttype. holds information about calibration result	n/a see Table 43	[1..*] or [0..*]

Table 43: Properties of SML “dcc:result”

idShort	dcc:result		
Class	SubmodelElementCollection		
semanticId	https://dccwiki.ptb.de/en/dccxxxListType#dccresultlisttype.		
isCaseOf			
AllowDuplicates	True		
Parent	dcc:results		
Explanation	holds information about calibration result		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[MLP] dcc:name	[IRI] https://dccwiki.ptb.de/en/dcctextType. This element shall specify the name of the calibration method.	[string]	[1] or [0..1]
[SMC] dcc:description	[IRI] https://dccwiki.ptb.de/en/dccrichContentType. Other information not given in the elements *dcc:name* is given here, thus describing the element. The element of dcc:description is the same as that of Table 6	n/a see Table 6	[0..1]

[SMC] dcc:data	[IRI] https://dccwiki.ptb.de/en/dccdataType. The SMC “dcc:data” helps provide definition for different data formats during calibration. The elements of dcc:data are the same as Table 28.	n/a see Table 28	[1] or [0..1]

Annex A: Explanations on table formats used

General
The tables used in this document outline information as concisely 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 pieces of information 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.

Annex B: Explanation and properties of SI elements

- **si:real**: The si:real element is a submodel element collection that collects data about a measured value and its other information like unit, label etc. table below should information that can be contained in si:real.

Table 44: Properties of SMC “si:real”

idShort	si:real		
Class	SubmodelElementCollection		
semanticId			
isCaseOf			
AllowDuplicates	True		
Parent			
Explanation	si:real element is a submodel element collection that collects data about a measured value and it other information like unit, label.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] si:label	[IRI] Indicates the name of the measure value	[string]	[0..1]
[Property] si:value	[IRI] Indicates the value of the measured element	[realMeasure]	[1] or [0..1]
[Property] si:unit	[IRI] Indicates the unit of the measured element	[string]	[1] or [0..1]
[Property] si:dateTime	[IRI] Local time with an information about he offset to UTC time	[dateTime]	[0..1]
[SMC] si:expandedUnc	[IRI] It is used to collect uncertainty information. Used when considering real values with uncertainty Elements of expandedUnc are defined in Table 45		[0..1]
[SMC]	[IRI]		[0..1]

si:coverageInterval	It is used to collect probabilistic information. Used when considering coverage interval. Elements of coverageInterval are defined in Table 46		

Table 45: Properties of SMC “expandedUnc”

idShort	si:expandedUnc		
Class	SubmodelElementCollection		
semanticId			
isCaseOf			
AllowDuplicates	True		
Parent	si:real		
Explanation	It is used to collect uncertainty information		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] si:uncertainty	[IRI] Value of the expanded measurement uncertainty (half length of coverage interval)	[unsignedInt]	[1] or [0..1]
[Property] si:coverageFactor	[IRI] Positive number greater or equal to “1”	[unsignedInt]	[1] or [0..1]
[Property] si:coverageProbability	[IRI] Defines positive decimal number with zero and one. This element takes no scientific exponent as value.	[unsignedInt]	[1] or [0..1]
[Property] si:distribution	[IRI] Textual definition of the distribution of the measured quantity value.	[string]	[0..1]

Table 46: Properties of SMC “coverageInterval”

idShort	si:coverageInterval
Class	SubmodelElementCollection
semanticId	
isCaseOf	
AllowDuplicates	True

Parent	si:real		
Explanation	It is used to collect uncertainty information		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] si:uncertainty	[IRI] Value of the expanded measurement uncertainty (half length of coverage interval)	[unsignedInt]	[1] or [0..1]
[Range] si:interval	[IRI] Defines upper and lower bound of probabilistic symmetric	[unsignedInt]	[1] or [0..1]
[Property] si:coverageProbability	[IRI] Defines positive decimal number with zero and one. This element takes no scientific exponent as value.	[unsignedInt]	[1] or [0..1]
[Property] si:distribution	[IRI] Textual definition of the distribution of the measured quantity value.	[string]	[0..1]

- **si:hybrid**: si:hybrid is a submodel element list that's contains list of si:real elements. One of the si:real elements must have it value provided with SI-base unit.

Table 47: Properties of SML "si:hybrid"

idShort	si:hybrid		
Class	SubmodelElementCollection		
semanticId			
isCaseOf			
AllowDuplicates	True		
Parent			
Explanation	contains list of si:real elements		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SMC] si:real	[IRI]		[1..*] or [0..*]

	si:real element is a submodel element collection that collects data about a measured value and other information like unit, label.		

- **si:complex**: The si:complex element is a submodel element collection that defines complex measured value. It provides place holder for both real and imaginary values of the measure value.

Table 48: Properties of SMC “si:complex”

idShort	si:complex		
Class	SubmodelElementCollection		
semanticId			
isCaseOf			
AllowDuplicates	True		
Parent			
Explanation	The si:complex element is a submodel element collection that defines complex measured value. It provides place holder for both real and imaginary values of the measure value.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] si:label	[IRI] Indicates the name of the measure value	[string]	[0..1]
[Property] si:valueReal	[IRI] Indicates the real value of the complex measured element. Used when considering cartesian coordinate form.	[realMeasure]	[1] or [0..1]
[Property] si:valueImag	[IRI] Indicates the imaginary value of the complex measured element. Used when considering cartesian coordinate form	[realMeasure]	[1] or [0..1]
[Property] si:valueMagnitude	[IRI] Indicates the magnitude value of the complex measured element. Used when considering polar coordinate form.	[realMeasure]	[1] or [0..1]

[Property] si:valuePhase	[IRI] Indicates the phase value of the complex measured element. Used when considering polar coordinate form	[realMeasure]	[1] or [0..1]
[Property] si:unitPhase	[IRI] Defines constrained SI-unit of the phase angle. The unit must represent an angular unit.	[string] \radian	[1] or [0..1]
[Property] si:unit	[IRI] Indicates the unit of the measured element	[string]	[1] or [0..1]
[Property] si:dateTime	[IRI] Local time with an information about the offset to UTC time	[dateTime]	[0..1]

- **si:constant**: the si:constant submodel element collection is used to define constant value.

Table 49: Properties of SMC “si:constant”

idShort	si:constant		
Class	SubmodelElementCollection		
semanticId			
isCaseOf			
AllowDuplicates	True		
Parent			
Explanation	the si:constant SMC is used to define constant value.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] si:label	[IRI] Indicates the name of the measure value	[string]	[0..1]
[Property] si:value	[IRI] Indicates the value of the measured element	[realMeasure]	[1] or [0..1]
[Property] si:unit	[IRI] Indicates the unit of the measured element	[string]	[1] or [0..1]
[Property]	[IRI]	[dateTime]	[0..1]

si:dateTime	Local time with an information about the offset to UTC time		
[SMC] si:uncertainty	[IRI] It is used to collect uncertainty information. Used when considering an uncertainty.	[unsignedInt]	[1] or [0..1]
[Property] si:distribution	[IRI] Textual definition of the distribution of the measured quantity value. Used when considering an uncertainty.	[string]	[0..1]

- **si:realListXMLList**: The si:XMLListXMLList SMC is used to define measure values that should be provided as list.

Table 50: Properties of SMC "si:realListXMLList"

idShort	si:realListXMLList		
Class	SubmodelElementCollection		
semanticId			
isCaseOf			
AllowDuplicates	True		
Parent			
Explanation	The si:XMLListXMLList SMC is used to define measure values in an array or list format		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[Property] si:labelXMLList	[IRI] Indicates the name of the measure value	[string]	[0..1]
[SML] si:valueXMLLIst[3]	[IRI] Contains list of numeric measure values.	[realMeasure]	[1] or [0..1]
[Property] si:unitXMLList	[IRI] Indicates the unit of the measured element	[string]	[1] or [0..1]

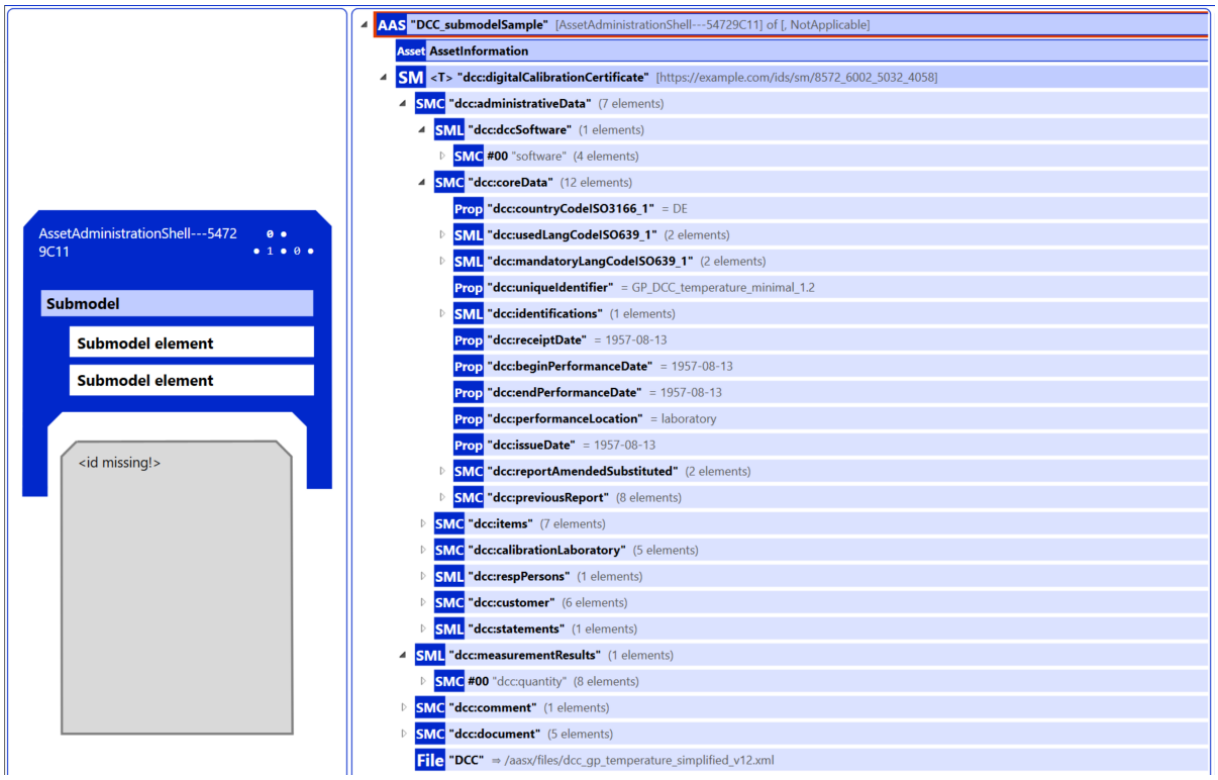
[3] Table 50 is based on XML type real numericals so the value of si:valueXMLList will be real. For type Boolean(dcc:booleanXMLListType), chars(dcc:charsXMLListType) and dateTime(dcc:dateTimeXMLListType), the value of si:valueXMLList will be boolean, string and dateTime.

[Property] si:dateTimeXMLList	[IRI] Local time with an information about the offset to UTC time	[dateTime]	[0..1]
[SMC] si:expandedUncXMLList	[IRI] It is used to collect uncertainty information in a XMLList form. Used when considering an uncertainty. Elements of si:expandedUncXMLList can be found in Table 51		[0..1]

Table 51: Properties of SMC “si:expandedUncXMLList”

idShort	si:expandedUncXMLList		
Class	SubmodelElementCollection		
semanticId			
isCaseOf			
AllowDuplicates	True		
Parent			
Explanation	It is used to collect uncertainty information in a XMLList form. Used when considering an uncertainty.		
[SME type]	**semanticity = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	
[SML] si:uncertaintyXMLList	[IRI] It is used to collect list uncertainty information. Used when considering an uncertainty.		[1] or [0..1]
[SML] si:coverageFactorXMLLIst	[IRI] Positive number greater or equal to “1”	[unsignedInt]	[1] or [0..1]
[Property] si:coverageProbabilityXMLList	[IRI] Defines positive decimal number with zero and one. This element takes no scientific exponent as value.	[unsignedInt]	[1] or [0..1]
[Property] si:distributionXMLList	[IRI] Textual definition of the distribution of the measured quantity value.	[string]	[0..1]

Annex C: Submodel dcc:digitalCalibrationCertificate in AASX Package Explorer.



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