

S-100 – Part XX

Discovery Metadata for Information Exchange Catalogues

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Contents

4a-1	Scope	5
4a-2	Conformance	5
4a-2.1	Conformance of this Profile with other Standards	5
4a-2.2	Backward compatibility	Error! Bookmark not defined.
4a-3	Conformance to this Profile	Error! Bookmark not defined.
4a-4	Normative references	5
4a-4.1	Profile definition	5
4a-4.2	Informative references	6
4a-5	Requirements	Error! Bookmark not defined.
4a-5.1	Business purpose and Intended use	Error! Bookmark not defined.
4a-5.2	Metadata for describing geographic data and other resources	Error! Bookmark not defined.
4a-5.3	Obligations/conditions	Error! Bookmark not defined.
4a-5.4	Minimum metadata requirements	Error! Bookmark not defined.
4a-5.5	S-100 compliancy categories	Error! Bookmark not defined.
4a-5.6	Recommended metadata for geographic datasets	Error! Bookmark not defined.
4a-5.7	Variations and preferences	Error! Bookmark not defined.
4a-5.7.1	Metadata element metadataIdentifier	Error! Bookmark not defined.
4a-5.7.2	Metadata element parentMetadata	Error! Bookmark not defined.
4a-5.7.3	Geographic extent of the dataset	Error! Bookmark not defined.
4a-5.7.4	Data and Date Time information	Error! Bookmark not defined.
4a-5.7.5	Metadata extension information	Error! Bookmark not defined.
4a-5.8	Metadata for services	Error! Bookmark not defined.
Appendix 4a-A	Metadata Schema Class Information	Error! Bookmark not defined.
Appendix 4a-B	Data Dictionary	Error! Bookmark not defined.
Appendix 4a-C	Metadata Implementation	Error! Bookmark not defined.
Appendix 4a-D	Discovery Metadata for Information Exchange Catalogues	Error! Bookmark not defined.
Appendix 4a-E	Metadata Extensions	Error! Bookmark not defined.

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4a-1 Scope

The S-100 Discovery Metadata for Information Exchange Catalogues profile described in this part provides a specification for describing and creating exchange catalogues that enables users to identify, discover and manage content of the S-100 exchange sets. More importantly it leverages XML to allow machine to machine discovery and exchange of information about about geographic datasets commonly produced by hydrographic organizations. Its purpose is the creation of metadata records that provide information about the identification, spatial and temporal extent, quality, application schema, spatial reference system, and distribution of digital geographic data. It is applicable to the cataloguing of datasets, clearinghouse activities, and the full description of geographic and non-geographic resources.

For information exchange, there are several categories of metadata required: metadata about the overall exchange catalogue, metadata about each of the datasets contained in the catalogue, and metadata about the support files that make up the package. If the exchange catalogue contains any Feature, Portrayal or Interoperability Catalogues there is a provision to carry additional metadata about those.

This document is intended for developers and implementers of metadata applications, and provides a basic understanding of the principles and the overall requirements for standardisation of geographic information. It should be used in conjunction with the standards listed under clause 4a-4 – Normative references.

4a-2 Conformance

4a-2.1 Conformance of this Profile with other Standards

The S-100 Discovery Metadata for Information Exchange Catalogues profile adopts data types defined in other ISO standards, mainly in ISO 19115 Geographic information - Metadata and ISO 19136 Geographic Information - Geography Markup Language, along with their underlying obligations and conditions. The XML schema references related to these external data types are embedded in the XML schemas for this profile, thus ensuring the conformance of this profile with other standards during authoring and validation of XML catalogue instances.

4a-2.2 Conformance to this Profile

The conformance to this profile can be confirmed by validating XML catalogue instances against the S-100 Metadata Profile schemas which are available from the IHO S-100 repository.

4a-3 Normative references

The following referenced documents are required for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including amendments) applies.

4a-3.1 Profile definition

The following documents were the references used to define the S-100 Metadata Profile:

ISO 19115-1:2014, *Geographic information – Metadata – Part 1 - Fundamentals*

ISO 19115-1/Amdt01:2018, *Geographic information – Metadata – Part 1 - Fundamentals* (Amendment 1)

ISO 19115-2:2009, *Geographic information - Metadata - Part 2: Extensions for imagery and gridded data*

ISO 19119:2016, *Geographic information – Services*

ISO/TS 19115-3:2016, *Geographic information - Metadata - XML schema implementation for fundamental concepts*

4a-3.2 Informative references

ISO 19115:2003, *Geographic information – Metadata*

ISO 19115:2003/Cor.1:2006, *Geographic information - Metadata* (Technical Corrigendum 1)

ISO/TS 19139:2007, *Geographic information - Metadata - XML schema implementation*

4a-4 Overview

4a-4.1 S-100 Exchange Set Structure

The S-100 Exchange Set is a data container that provides all the elements needed for a reliable and secure exchange of S-100 conformant data. It is intended to be a self-contained entity consisting of data files and metadata records packaged together using applicable data integrity and optional security provisions. The overall concept of the S-100 Exchange Set is a realization of the ISO 19115-3 classes, which fundamentally underpin the interchange of geospatial data and relevant metadata, as depicted in figure 4a-D-1. This figure depicts, from left to right, the ISO data exchange structural classes, the relevant ISO classes for metadata for exchange, S-100 structure classes representing the S-100 exchange set components, and the relevant S-100 exchange set metadata classes.

Note that the S-100 structure classes represent components of the exchange set (files/folders/archives), not XML fragments in an exchange file. Accordingly, they do not have attributes nor do they have corresponding documentation tables in this Part.

Note also that the S-100 exchange set metadata classes are analogues of the corresponding ISO classes but (strictly speaking) not specialisations or realisations of them.

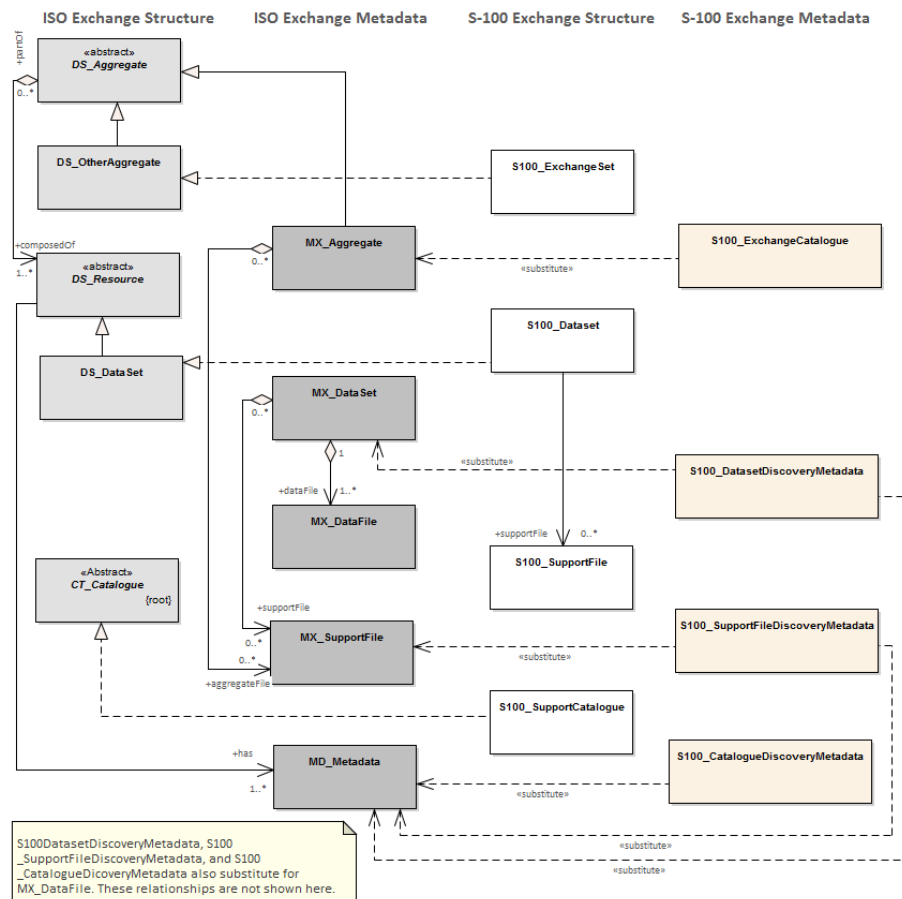


Figure 4a-D-1 Realization of the Exchange Set Classes

The above diagram illustrates the conceptual correspondence between data exchange provisions in ISO-19115 and S-100 standards. At an implementation level, the S-100 Exchange Set may include a combination of S-100 datasets, support files, and catalogue files along with the metadata information for all such resources in the form of the S-100 Exchange Set Catalogue. Conceptually this leads to the more detailed model of the S-100 exchange set, as shown in figure 4a-D-2.

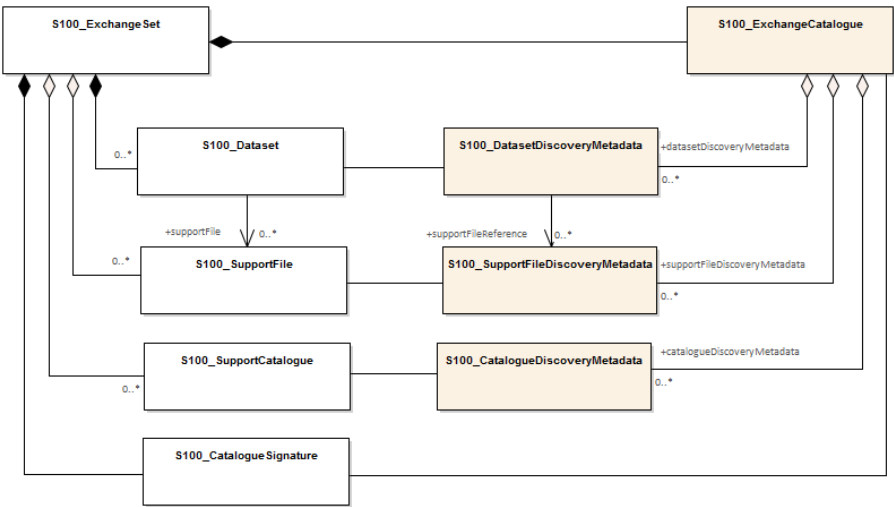


Figure 4a-D-2 – S-100 Exchange Set

The conceptual model depicted in Figure 4a-D-2 is very flexible and can be implemented in a variety of ways as virtually all components, except for the S-100_ExchangeCatalogue, are optional. This level of flexibility is essential to properly support the mainstream use case of exchanging geospatial data, as well as the use cases for releasing dataset cancellation notices or new catalogue releases without any data files present.

This approach ensures that an exchange set catalogue is always included in any S-100 conformant exchange set, providing the essential discovery metadata about any included resources and their intended use.

Preparation of an exchange set consists of packaging its components using a predefined file folder structure shown in figure 4a-D-3.

Commented [rmm1]: UML has been updated, should now be compatible with the new material below in 4a-2.5 about exchange set structure.

4a-4.2 S-100 Exchange Set Folder Structure.

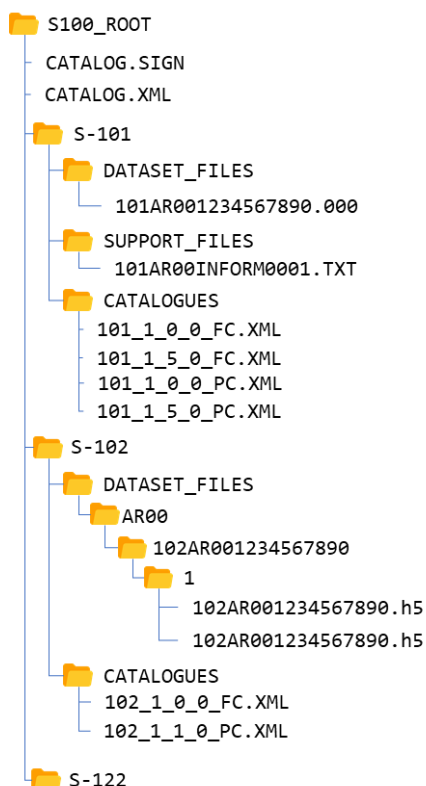


Figure 4a-D-3 – An S-100 Exchange Set Folder Structure

1. An S-100 exchange set must contain an exchange set catalogue, CATALOG.XML, its digital signature CATALOG.SIGN and may contain any number of S-100 conformant dataset files, support files and catalogue files.
2. All S-100 content must be placed inside a top root folder named S100_ROOT. This is the only top level root folder in an exchange set containing only S-100 products.
3. The S100_ROOT folder must contain a subfolder for each specific S-100 product specification data type included in the exchange set, e.g. S-101, S-104, S-102 (names defined in the IHO product specification register). These subfolders hold S-100 content specific to an individual product specification, all other exchange set files must be located in the S100_ROOT folder.
4. Each product subfolder must contain subfolders for the component dataset files (DATASET_FILES), support files (SUPPORT_FILES) and catalogues (CATALOGUES) as required.
5. Individual data files, such as base dataset, update files or detailed ISO 19115 metadata may be optionally placed in their own subfolders or grouped together.
6. Support files, on the other hand, may be grouped together in one folder to prevent duplication across multiple dataset folders. Similarly, when needed, an exchange set may carry additional catalogues and/or their different versions which should also be grouped together in one folder.
7. The required exchange set catalogue XML document instance must be named CATALOG.XML and placed in the S100_ROOT folder, together with its digital signature

(CATALOG.SIGN) file. All other digital signatures are included within their corresponding resource metadata records in the CATALOG.XML.

An S-100 exchange set can be optionally defined alongside S-57 datasets with their own ENC_ROOT and INFO root folders as required by the S-57 ENC product specification and (optionally) S-63. In this case there are three top level folders: ENC_ROOT and INFO for S-57, and S100_ROOT with two separate catalogues covering their respective content (CATALOG.031 and CATALOG.XML). Figure 4a-D-4 shows one of these use cases with S-57 and multiple S-100 products included..

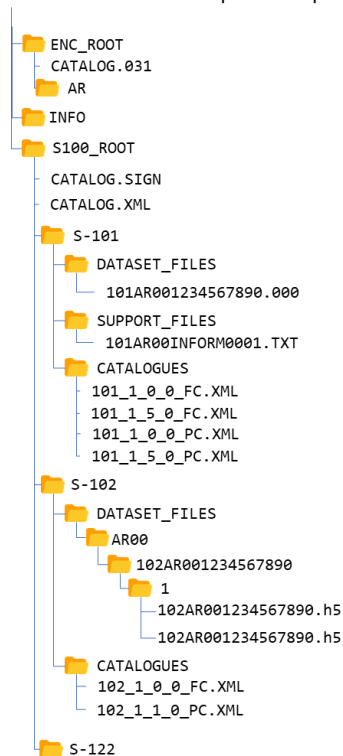


Figure 4a-D-4 – Combined S-100 and S-57 Exchange Sets Folder Structure

In addition to the folder structure, it is important to align the exchange set creation workflow with the data integrity and security provisions outlined in S-100 Part 15. These provisions cover digital signing, compression, and encryption of exchange set resources. All resources within an S-100 Exchange Set must be digitally signed and their signatures included in the exchange set catalogue. Data compression and encryption are optional operations.

Exchange set creation, therefore, consists of:

1. The creation of a suitable exchange set folder structure
2. The arrangement of all resources in their designated folders.
3. Creation of digital signatures for all resources
4. Optional compression and encryption of any resources which require it.
5. Construction of an Exchange Set Catalogue which records the structure created.

S-100 Part 15 defines the requirements and process for creation and verification of digital signature values and production of compressed/encrypted datasets.

4a-4.3 Storage and Management of External Resources

S-100 datasets may refer to a number of externally referenced, supporting resources for content. This content may be textual or graphical and encoded in any of a number of formats (defined by the XXXX enumeration in the exchange catalogue Schema). Datasets hold a reference to the external resource as an attribute value. This value may be updated as any other attribute and updates the reference to the external resource.

The S-100 exchange catalogue provides:

- 1. A normative definition of the location of each supporting resource. Where these are physical files this is a physical location within the SUPPORT/FILES/<S-100 Product> subdirectory in the exchange catalogue file structure.
- 2. For every reference to an external resource within a dataset, a unique map (by reference) in that dataset's metadata to the definition of the resource.

All content relating to such external resources should be validated and must be consistent with the dataset content to form a valid S-100 exchange set. Datasets refer to external resources using S-100 attributes with a URI primitive type. Such references can be in any supported S-100 URI form and must be uniquely resolvable by the implementing system without requiring any supplementary information within the exchange catalogue metadata entries.

Examples of such URI definitions are:

URI type	Example URI
File reference	file::101GB00400797.000
MRN (S-100 Digital Signature Value)	urn:mrn:iho:s100:dsig:dsa:302C021421EF1102A1BA0416FC6A8F916114FBB991F94A2E02146C4D87E83D4AEEBC15AC23B2A6F2A7301A681A7C
MRN (File Hash)	urn:mrn:iho:s100:hash:sha256:a948904f2f0f479b8f8197694b30184b0d2ed1c1cd2a1ec0fb85d299a192a447

Full specification of file URIs and MRNs supported by S-100 are contained in S-100 Part 1 and Part 15 15-8.10

As long as the mapping from the dataset metadata to the metadata of the external resource is unique it is valid, so multiple datasets are able to “share” common external resources within an exchange catalogue without ambiguity.

As all resources are digitally signed to preserve data integrity and authenticity the digital signature provides an ideal unique map to the supporting resource. When using digital signatures in a file based exchange catalogue the file name of the resource is therefore not used and thus can conform to any naming convention.

Use of the file name in a file URI allows an exchange set producer to maintain a single, up-to-date version of any supporting file resource without necessitating dataset updates when the content of the resource changes. There is, however, an attendant responsibility on the producer of maintaining unique file names across all resources to ensure identifiers are unique.

4a-4.4 S-100 Exchange Set Catalogue

The S100 Exchange Set Catalogue is an XML document instance, which provides the metadata information needed to discover and use the resources contained in the S-100 Exchange Set. It must be named CATALOG.XML. This mandatory, central component of S-100 exchange sets consists of several components which capture suitable metadata records for each resource type. These components cover metadata for the exchange set catalogue, dataset discovery, support file discovery, any references to ISO 19115 dataset metadata, and additional catalogues as depicted in figure Figure 4a-D-4.

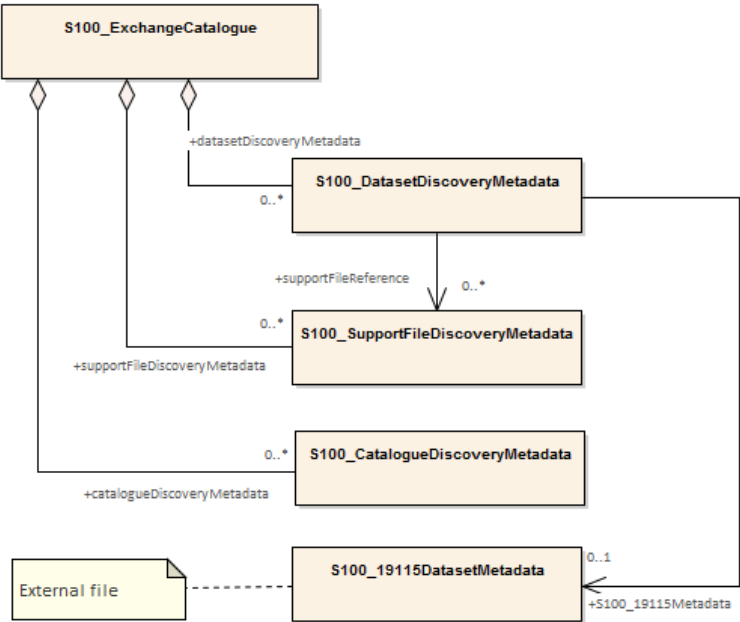


Figure 4a-D-5 – S-100 Exchange Set Catalogue

The discovery metadata subsections have attributes which enable important information about the datasets and accompanying support files to be examined without the need to process the data, for example encryption/compression flags. Similarly, other catalogues can be included in the S-100 Exchange Set, in support of the datasets, such as feature, portrayal, coordinate reference systems, codelists etc. Additionally, the S100 Exchange Set Catalogue provides mechanisms for managing the life cycle of datasets and support files. For example, the S-100 Support File Purpose enumeration within support file metadata provides revision control for support files.

More detailed information about the various elements of the catalogue is shown in Figure 4a-D-5 and in the textual description in the tables at clause 3.

Commented [rmm2]: Figure numbering has changed with the addition of new figures in the new Storage and Management Clause.
Also, this figure shows only metadata, the caption should be changed to reflect that („Exchange Catalogue and its Component Metadata“?)

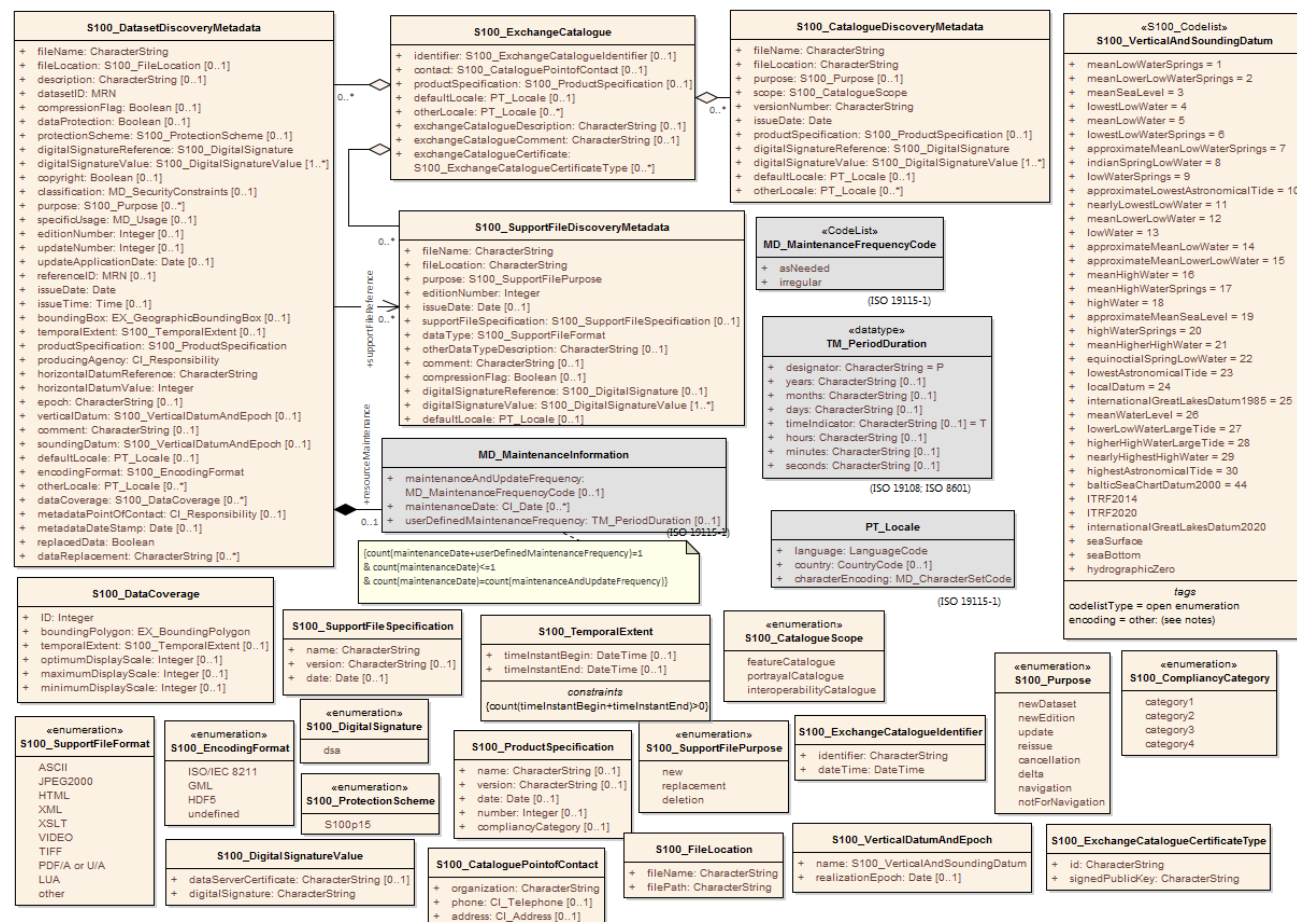
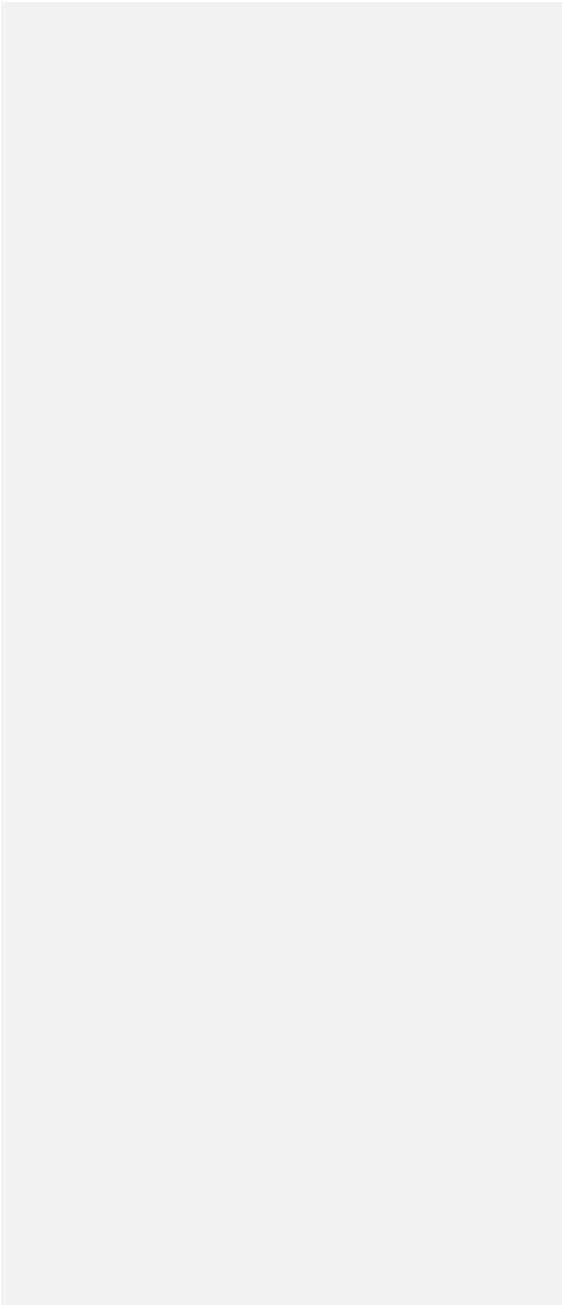


Figure 4a-D-6 – S-100 Exchange Set Catalogue - class details

Commented [D3]: Needs update for S100_VericalCRS

Commented [rmm4]: Diagram has been updated. The new diagram will probably need more updates after everyone is done. There is some ambiguity and redundancy in the Oct. 18 draft.

Also, the new diagram has grown large enough that it should be split. Perhaps into one diagram with the main classes & selected types, and a second containing most of the types? Splitting the diagram to be addressed after its classes and types stabilize.



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4a-4.5 Elements of the exchange set

S100_ExchangeCatalogue

Each exchange set has a single S100_ExchangeCatalogue which contains meta information for the data and support files in the exchange set.

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_ExchangeCatalogue	An exchange catalogue contains the discovery metadata about the exchange datasets and support files	-	-	-
Attribute	identifier	Uniquely identifies this exchange catalogue	0..1	S100_CatalogueIdentifier	
Attribute	contact	Details about the issuer of this exchange catalogue	0..1	S100_CataloguePointOfContact	
Attribute	productSpecification	Details about the product specifications used for the datasets contained in the exchange catalogue	0..*	S100_ProductSpecification	
Attribute	defaultLocale	Default language and character set used for all metadata records in this exchange catalogue	0..1	PT_Locale	Default is English and UTF-8.
Attribute	otherLocale	Other languages and character sets used for the localized metadata records in this exchange catalogue	0..*	PT_Locale	Required if any localized entries are present in the exchange catalogue.
Attribute	exchangeCatalogueDescription	Description of what the exchange catalogue contains	0..1	CharacterString	
Attribute	exchangeCatalogueComment	Any additional Information	0..1	CharacterString	
Attribute	exchangeCatalogueCertificate	Signed public key certificates referred to by digital signatures in the exchange set	0..*	S100_ExchangeCatalogueCertificateType	Content defined in S-100 Part 15. All certificates used, except the SA root certificate (installed separately by the implementing system) shall be included.
Role	datasetDiscoveryMetadata	Exchange catalogues may include or reference discovery metadata for the datasets in the exchange set	0..*	Aggregation S100_DatasetDiscoveryMetadata	

Commented [rmm5]: The whole set of tables should be surveyed to determine which CharacterString type attributes can and cannot use multilingual text (e.g., description and comment can, file names probably cannot).

Commented [JP6R5]: Will be reviewed based on the outcome of the multilingual paper submitted by Canada

Role Name	Name	Description	Mult	Type	Remarks
Role	catalogueDiscoveryMetadata--	Metadata for catalogue	0..*	Aggregation S100_CatalogueDiscoveryMet adata	Metadata for the feature, portrayal, and interoperability catalogues, if any
Role	supportFileDiscoveryMetadata	Exchange catalogues may include or reference discovery metadata for the support files in the exchange set	0..*	Aggregation S100_SupportFileDiscoveryMe tadata	

S100_ExchangeCatalogueIdentifier

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_ExchangeCatalogueIdentifier	An identifier for an exchange catalogue .	-	-	The concatenation of identifier, editionNumber and dateTime form the unique name
Attribute	identifier	Uniquely identifies this exchange catalogue	1	CharacterString	<S100XC:identifier>US_101_20200101_120101_01</S100XC:identifier>
Attribute	dateTime	Creation date and time of the exchange catalogue, including time zone	1	DateTime	Format: yyyyymmddThhmmssZ

Commented [JP7]: Suggestion to replace whole class with a URN/URI. But will clean up the rest of the metadata and then come back to this in a separate editing session.

S100_CataloguePointofContact

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_CataloguePointOfContact	Contact details of the issuer of this exchange catalogue	-	-	-
Attribute	organization	The organization distributing this exchange catalogue	1	CharacterString	This could be an individual producer, value added reseller, etc.
Attribute	phone	The phone number of the organization	0..1	CI_Telephone	
Attribute	address	The address of the organization	0..1	CI_Address	

Commented [rmm8]: Check nature and structure of this type
Looks like a class, going by the contents, but row 1 says Enumeration and the table headers are different.
Data -> Remarks?

S100_ExchangeCatalogueCertificateType

Commented [JP9R8]: Leave in as a reference point as it may move to Part 15

Role Name	Name	Description	Code	Remarks	Data
Enumeration	S100_ExchangeCatalogueCertificateType	Certificate for digital signature	-	-	
Attribute	id	The data server id	-		e.g. "UKHO", "PRIMAR"
Attribute	signedPublicKey	The data server's public key	1	CharacterString	

S100_DatasetDiscoveryMetadata

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_DatasetDiscoveryMetadata	Metadata about the individual datasets in the exchange catalogue	-	-	-
Attribute	fileName	Dataset file name	1	CharacterString	
Attribute	fileLocation	Full location from the exchange set root directory	0..1	S100_FileLocation	Without fileLocation the exchange set is unpacked into directory <ROOT>/S100_ROOT/DATASET_FILE S/<fileName>
Attribute	description	Short description giving the area or location covered by the dataset	0..1	CharacterString	For example, a harbour or port name, between two named locations etc.
Attribute	datasetID	Dataset ID expressed as a Marine Resource Name	1	mrn	urn:mrn...
Attribute	compressionFlag	Is the data compressed	1	Boolean	
Attribute	dataProtection	Indicates if the data is encrypted	1	Boolean	0 indicates an unencrypted dataset 1 indicates an encrypted dataset
Attribute	protectionScheme	Specification or method used for data protection	0..1	S100_ProtectionScheme	
Attribute	digitalSignatureReference	Digital Signature of the file	1	S100_DigitalSignature	Specifies the algorithm used to compute digitalSignatureValue

Commented [rmm10]: No „mrn“ type defined yet in S-100 Part 1. Assuming it will be added (as „MRN“ (sic), by analogy to URI/URL/URN), otherwise this will have to be changed to URN and the Remark cell to say it's an MRN.

Role Name	Name	Description	Mult	Type	Remarks
Attribute	digitalSignatureValue	Value derived from the digital signature	1..*	S100_DigitalSignatureValue	The value resulting from application of digitalSignatureReference Implemented as the digital signature format specified in Part 15
Attribute	copyright	Indicates if the dataset is copyrighted	0..1	Boolean	
Attribute	classification	Indicates the security classification of the dataset	0..1	Class MD_SecurityConstraints>MD_ClassificationCode (codelist)	1. unclassified 2. restricted 3. confidential 4. secret 5. top secret 6. sensitive but unclassified 7. for official use only 8. protected 9. limited distribution
Attribute	purpose	The purpose for which the dataset has been issued	0..*	S100_Purpose (codelist)	
Attribute	specificUsage	The use for which the dataset is intended	0..1	MD_USAGE>specificUsage (character string)	For example, in the case of ENC's this would be a Navigational Purpose classification. This is strictly for discovery catalogue purposes
Attribute	editionNumber	The edition number of the dataset	0..1	Integer	When a data set is initially created, the edition number 1 is assigned to it. The edition number is increased by 1 at each new edition. Edition number remains the same for a re-issue.
Attribute	updateNumber	Update number assigned to the dataset and increased by one for each subsequent update	0..1	Integer	Update number 0 is assigned to a new dataset
Attribute	updateApplicationDate	This date is only used for the base cell files (that is new data set, re-issue and new edition), not update cell files. All updates dated on or before this date must have been applied by the producer	0..1	Date	

Role Name	Name	Description	Mult	Type	Remarks
Attribute	referenceID	Reference back to the datasetID	0..1	Urn	Update metadata refers to the datasetID of the dataset metadata. This is used if and only if the dataset is an update. The URN must be an MRN
Attribute	issueDate	Date on which the data was made available by the data producer	1	Date	
Attribute	issueTime	Time of day at which the data was made available by the data producer	0..1	Time	The S-100 datatype Time
Attribute	boundingBox	The extent of the dataset limits	0..1	EX_GeographicBoundingBox	-
Attribute	temporalExtent	Specification of the temporal extent of the dataset.	0..1	S100_TemporalExtent	The temporal extent is encoded as the date/time of the earliest and latest data records (in coverage datasets) or date/time ranges (in vector datasets). If there is more than one feature in a dataset, the earliest and latest time values of records in all features are used, which means the earliest and latest values may be from different features. If date/time information for a feature is not encoded in the dataset, it is treated for the purposes of this attribute as extending indefinitely in the appropriate direction on the time axis, limited by the issue date/time or the cancellation or supersession of the dataset. This attribute is encoded if and only if at least one of the start and end of the temporal extent is known.
Attribute	productSpecification	The product specification used to create this dataset	1	S100_ProductSpecification	
Attribute	producingAgency	Agency responsible for producing the data	1	CI_Responsibility>CI_Organisation	See Tables 4a-2
Attribute	horizontalDatumReference	Reference to the register from which the horizontal datum value is taken	1	characterString	For example, EPSG
Attribute	horizontalDatumValue	Horizontal Datum of the entire dataset	1	Integer	For example, 4326

Commented [rmm11]: See comment for datasetID

Role Name	Name	Description	Mult	Type	Remarks
Attribute	epoch	Code denoting the epoch of the geodetic datum used by the CRS	0..1	CharacterString	For example, G1762 for the 2013-10-16 realization of the geodetic datum for WGS84
Attribute	verticalCRS	Vertical CRS of the entire dataset	0..1	S100_VerticalCRS	
Attribute	soundingCRS	Sounding CRS of the entire dataset	0..1	S100_VerticalCRS	
Attribute	encodingFormat	The encoding format of the dataset	1	S100_EncodingFormat	
Attribute	dataCoverage	Provides information about data coverages within the dataset	0..*	S100_DataCoverage	
Attribute	comment	Any additional information	0..1	CharacterString	
Attribute	defaultLocale	Default language and character set used in the dataset	0..1	PT_Locale	In absence of defaultLocale the language is English, UTF-8
Attribute	otherLocale	Other languages and character sets used in the dataset	0..*	PT_Locale	
Attribute	metadataPointOfContact	Point of contact for metadata	0..1	CI_Responsibility>CI_Individual or CI_Responsibility>CI_Organisation	Only if metadataPointOfContact is different to producingAgency
Attribute	metadataDateStamp	Date stamp for metadata	0..1	Date	May or may not be the issue date
Attribute	replacedData	If a data file is cancelled is it replaced by another data file	0..1	Boolean	
Attribute	dataReplacement	Cell name	0..*	CharacterString	A dataset may be replaced by 1 or more datasets

Role Name	Name	Description	Mult	Type	Remarks
Attribute	navigationPurpose	Classification of intended navigation purpose (for catalogue indexing purposes).	0..3	Enumerate	1. Port For port and near shore operations. 2. Transit For coast and planning purposes. 3. Overview For ocean crossing and planning purposes. * See note
Role	supportFileReference	Reference to discovery metadata for the support files referenced in the dataset	0..*	<Reference>S100_SupportFileDiscoveryMetadata	See clause 4a-4.3.
Role	S100_19115Metadata	Reference to ISO-format metadata file	0..1	FileName (ISO 19115-3)	Reference to external ISO-format file (ISO gcx:FileName).
Role	resourceMaintenance	Information about the frequency of resource updates, and the scope of those updates	0..1	MD_MaintenanceInformation	S-100 restricts the multiplicity to 0..1 and adds specific restrictions on the ISO 19115 structure and content. See clause MD_MaintenanceInformation later in this Part. Format: PnYnMnDTnHnMnS (XML built-in type for ISO 8601 <i>duration</i>). See Notes.

NOTE:

navigationPurpose: If product specification is intended for creation of navigational products this attribute should be mandatory.

S100_DataCoverage

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_DataCoverage	A spatial extent where data is provided; and the display scale information for the provided data	-	-	This field is used by user systems as part of the data loading and unloading algorithms and it is strongly encouraged that product specifications mandate the use of one or more of the displayScale

Commented [rmm12]: Name, description, type updated, as I recall this will become a reference to a support file metadata block.

Commented [rmm13]: Not in the Ed. 4.0 table, but the 4.0 schemas implement it as S100_19115Metadata: <ISO 19115-x>FileName because it is in Figure 4a-D-2. This row is needed for the now-optional reference to an ISO metadata file is retained (it was mandatory in Fig. 4a-D-2 in Ed. 4.0.0).

Commented [rmm14]: resourceMaintenance and related additions still to be agreed in this form; the precursor „datasetDeliveryInterval: CharacterString<TM_PeriodDuration> was discussed by the metadata working group on Sep. 30.

					provided as part of S100_DataCoverage
Attribute	ID	Uniquely identifies the coverage	1	Integer	-
Attribute	boundingPolygon	A polygon which defines the actual data limit	1..1	EX_BoundingPolygon	
Attribute	temporalExtent	Specification of the temporal extent of the coverage.	0..1	S100_TemporalExtent	The remarks for <i>temporalExtent</i> in the dataset discovery block (S100_DatasetDiscoveryMetadata) block apply, except that their scope is the individual coverage and not the dataset as a whole.
Attribute	optimumDisplayScale	The scale with which the data is optimally displayed	0..1	Integer	Example: A scale of 1:25000 is encoded as 25000
Attribute	maximumDisplayScale	The maximum scale with which the data is displayed	0..1	Integer	
Attribute	minimumDisplayScale	The minimum scale with which the data is displayed	0..1	Integer	
Attribute	approximateGridResolution	The resolution of gridded or georeferenced data (in metres).	0..*	Real	<p>A single value may be provided when all axes have a common resolution.</p> <p>For multiple value provision, use axis order as specified in dataset.</p> <p>May be approximate for ungeorectified data.</p> <p>E.g., for 5 metre resolution, the value 5 must be encoded.</p> <p>* See note</p>

NOTE:

approximateGridResolution: If the grid cell size varies over the extent of the grid, an approximated value based on model parameters or production metadata should be used.

S100_DigitalSignature

Role Name	Name	Description	Code	Remarks
Enumeration	S100_DigitalSignature	Algorithm used to compute the digital signature	-	-
Value	dsa	Digital Signature Algorithm	-	FIPS 186-4 (2013)

S100_DigitalSignatureValue

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_DigitalSignatureValue	Signed Public Key plus the digital signature	-	-	Data type for encoding digital signature values
Attribute	dataServerCertificate	Data Server Certificate as defined in S-100 Part 15	0..1	CharacterString	A certificate will be encoded in PEM format as a character string as defined in S-100 Part 15. Optional. digitalSignature can use a reference to refer to certificates defined in S100_ExchangeCatalogue to avoid repetition.
Attribute	digitalSignature	Digital signature as defined in S-100 Part 15	1	CharacterString	As defined in S-100 Part 15.

S100_FileLocation

Commented [JP15]: Needs a harmonization effort across the metadata profile

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_FileLocation	Full location relative to the exchange set root directory		-	-
Attribute	fileName	Name of the dataset file	1	CharacterString	
Attribute	filePath	Path Relative to the root directory	1	CharacterString	Path relative to the root directory of the exchange set. The location of the file after the exchange set is unpacked into directory <ROOT> will be <ROOT>/<fileLocation>/<fileName>. If fileLocation is undefined the file is located in the appropriate directory as per the folder structure defined in 4a-4.2

S100_Purpose

Role Name	Name	Description	Code	Remarks
Enumeration	S100_Purpose	The Purpose of the Dataset	-	
Value	newDataset	Brand New dataset	-	-
Value	newEdition	New edition of the dataset	-	-
Value	update	Dataset update		-
Value	reissue	Dataset that has been re-issued	-	
Value	cancellation	Dataset that has been cancelled		
Value	delta	Dataset difference		
Value	navigation	Dataset Intended for navigation		
Value	notForNavigation	Dataset not intended for navigation		

S100_TemporalExtent

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_TemporalExtent	Temporal extent	--		At least one of the timeInstantBegin and timeInstantEnd attributes must be populated; if both are known, both must be populated. The absence of either begin or end indicates indefinite validity in the corresponding direction, limited by the issue date/time or the cancellation or supersession of the dataset.
Attribute	timeInstantBegin	The instant at which the temporal extent begins.	0..1	DateTime	
Attribute	timeInstantEnd	The instant at which the temporal extent ends.	0..1	DateTime	

NOTES:

- (1) In case of overlap in temporal extent between predecessor and successor datasets, the successor dataset prevails. For example, water level or weather forecast datasets may have a temporal extent of N days or hours, but be replaced by new forecast at N - X.
- (2) Precedence and succession can be determined from information in dataset discovery metadata (e.g., attributes for dataReplacement, edition and update numbers, issue data and time).

EXAMPLE 1: An S-104 (Water Level Information for Surface Navigation) predictions dataset has the following data for *temporalExtent* encoded in the dataset discovery block in the exchange catalogue:

```
<temporalExtent>
  <timeInstantBegin>2021-07-03T06:00:00Z</timeInstantBegin>
  <timeInstantEnd>2021-07-10T18:00:00Z</timeInstantEnd>
</temporalExtent>
```

indicating that the temporal extent of the predictions in the dataset is the period beginning at exactly 6 a.m. on 3 July 2021 (UTC) and ending at exactly 6 p.m. on 10 July 2021 (UTC).

EXAMPLE 2: The successor dataset to Example 1 has the following data for *temporalExtent*:

```
<temporalExtent>
  <timeInstantBegin>2021-07-03T12:00:00Z</timeInstantBegin>
  <timeInstantEnd>2021-07-10T24:00:00Z</timeInstantEnd>
</temporalExtent>
```

indicating that the temporal extent of the predictions in the dataset is the period beginning at exactly noon on 3 July 2021 (UTC) and ending at exactly midnight at the end of 10 July 2021 (UTC). Since this temporal extent overlaps the temporal extent of Example 1 from noon UTC on 3 July 2021, it supersedes the dataset in Example 1 at and after noon UTC on 3 July 2021.

S100_VerticalCRS

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_VerticalCRS	Identification of a vertical datum and its coordinate system.	--	--	
Attribute	name	Identifier for the datum	1	S100_VerticalAndSoundingDatum	

Attribute	realizationEpoch	The time after which this datum definition is valid.	0..1	Date	
Attribute	axis	The axis of the coordinate system	1	CS_CoordinateSystemAxis	rangeMeaning must be "exact" if present. axisDirection must be either "up" or "down".

NOTES:

S100_VerticalCRS is derived from, but not a specialisation of, the ISO 19111:2007 type SC_VerticalCRS. The differences are:

- Most ISO attributes are not realized.
- The *name* and *realizationEpoch* attributes of CD_VerticalDatum are provided as attributes of this class.
- The *name* attribute (datatype RS_Identifier in the ISO model), is assigned the datatype S100_VerticalAndSoundingDatum.
- The *realizationEpoch* attribute carries the same significance and datatype as in ISO 19111:2007, except that it must always be coded as the date after which it is valid.

This time may be precise (e.g. 1997.0 for IRTF97) or merely a year (e.g. 1986 for NAD83(86)). In the latter case, the epoch usually refers to the year in which a major recalculation of the geodetic control network underlying the datum, was executed or initiated. An old datum may remain valid after a new datum is defined. Alternatively, a datum may be replaced by a later datum, in which case the realization epoch for the new datum defines the upper limit for the validity of the replaced datum. [ISO 19111:2007]

S100_VerticalAndSoundingDatum

Role Name	Name	Description	Code	Remarks
S100_Codelist	S100_VerticalAndSoundingDatum	Allowable vertical and sounding datums	-	Open enumeration.
Value	meanLowWaterSprings		1	(MLWS)
Value	meanLowerLowWaterSprings		2	-
Value	meanSeaLevel		3	(MSL)
Value	lowestLowWater		4	-
Value	meanLowWater		5	(MLW)
Value	lowestLowWaterSprings		6	-
Value	approximateMeanLowWaterSprings		7	-

Role Name	Name	Description	Code	Remarks
Value	indianSpringLowWater		8	-
Value	lowWaterSprings		9	-
Value	approximateLowestAstronomicalTide		10	-
Value	nearlyLowestLowWater		11	-
Value	meanLowerLowWater		12	(MLLW)
Value	lowWater		13	(LW)
Value	approximateMeanLowWater		14	-
Value	approximateMeanLowerLowWater		15	-
Value	meanHighWater		16	(MHW)
Value	meanHighWaterSprings		17	(MHWS)
Value	highWater		18	(HW)
Value	approximateMeanSeaLevel		19	-
Value	highWaterSprings		20	-
Value	meanHigherHighWater		21	(MHHW)
Value	equinoctialSpringLowWater		22	-
Value	lowestAstronomicalTide		23	(LAT)
Value	localDatum		24	-
Value	internationalGreatLakesDatum1985		25	-
Value	meanWaterLevel		26	-
Value	lowerLowWaterLargeTide		27	-
Value	higherHighWaterLargeTide		28	-
Value	nearlyHighestHighWater		29	-
Value	highestAstronomicalTide		30	(HAT)
Value	balticSeaChartDatum2000	Baltic Sea Chart Datum 2000	44	

Role Name	Name	Description	Code	Remarks
Value	ITRF2014	International Terrestrial Reference Frame 2014	TBD	
Value	ITRF2020	International Terrestrial Reference Frame 2020	TBD	
Value	internationalGreatLakesDatum2020	International Great Lakes Datum 2020	TBD	
Value	seaSurface	Sea surface	TBD	Local sea bottom
Value	seaBottom	Sea bottom	TBD	Local sea bottom reference
Value	hydrographicZero	Hydrographic Zero	TBD	A vertical reference near the lowest astronomical tide (LAT, following IHO recommendation), below which the sea level falls only very exceptionally. The origin of the deviation between LAT and hydrographic zero may be due to a strong anticyclonic atmospheric condition, adding weight to the water column that may exceptionally cause the lowest sea level to fall below the astronomical low water level. The deviation between hydrographic zero and LAT must be less than 0.50 m.

NOTE: The numeric codes are the codes specified in the IHO GI Registry for the equivalent listed values of the IHO Hydro domain attribute *Vertical datum*, since the registry does not at present (20 June 2018) contain entries for exchange set metadata and dataset metadata attributes.

Datums not included in the S-100 enumeration must be encoded using the “other: ...” form. If the datum in question is listed in the IHO GI registry (as one of the standard listed values for attribute “Vertical Datum” in the “IHO Hydro” domain), the “camel case code” in the registry must be used in the “other: ...” element. For datums from the EPSG registry but not listed in the IHO GI registry, the form should be “other: EPSG_NNNN”.

EXAMPLE 1: “Local Low Water Reference Level” is in the GI registry but not listed in the S-100 standard. It must be encoded with the camel case in the GI registry as: “other: localLowWaterReferenceLevel”.

EXAMPLE 2: “European Vertical Reference Frame 2019 mean tide” is in the EPSG registry list of vertical datums (EPSG 1287) but not in the IHO GI registry list. It must be encoded as: “other: EPSG_1287”.

If the datum is not listed in any the table above, the IHO GI registry, or the EPSG registry, producers should determine a suitable special code in consultation with the IHO working group(s) and the IHO GI registry authority.

The use of datums that are neither in the enumeration above, nor in the IHO GI registry, nor the EPSG registry is discouraged. Producers who need to use a datum not listed in the S-100 enumeration should propose its addition to the IHO GI registry and/or this enumeration by means of an S-100 maintenance proposal.

Note that application software is not required to process information encoded in “other: ...” form, meaning that ECDIS software, for example, is not required to recognise any datum encoded as “other: ...” and will therefore be unable to adjust ENC depth information with water level data from the corresponding S-104 dataset, and may warn or reject the S-104 dataset as being incompatible with S-101 ENCs.

S100_EncodingFormat

Role Name	Name	Description	Code	Remarks
Enumeration	S100_DataFormat	The encoding format	-	-
Value	ISO/IEC 8211	The ISO 8211 data format as defined in Part 10a	-	-
Value	GML	The GML data format as defined in Part 10b	-	-
Value	HDF5	The HDF5 data format as defined in Part 10c	-	-
Value	undefined	The encoding is defined in the Product Specification	-	Use product specification specific encoding means the data product and product specification is not intended for an IHO S-100 compliant system.

S100_ProductSpecification

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_ProductSpecification	The Product Specification contains the information needed to build the specified product	-	-	-
Attribute	name	The name of the product specification used to create the datasets	0..1	CharacterString	The name in the GI Registry should be used for this field
Attribute	version	The version number of the Product Specification	0..1	CharacterString	TR 2/2007 specifies versioning of product specifications.
Attribute	date	The version date of the product specification	0..1	Date	

Role Name	Name	Description	Mult	Type	Remarks
Attribute	number	The number used to lookup the product in the Product Specification Register of the IHO GI registry	1	Integer	For IHO Product Specifications these should be taken from the IHO Product Specification Register, in the IHO Geospatial Information Registry.
Attribute	complianceCategory	The level of compliance of the Product Specification to S-100	0..1	S100_ComplianceCategory	See clause Part 4a-5.5

S100_ComplianceCategory

Role Name	Name	Description	Code	Remarks
Enumeration	S100_ComplianceCategory		-	-
Value	category1	IHO S-100 object model compliant		
Value	category2	IHO S-100 compliant with non-standard encoding		
Value	category3	IHO S-100 compliant with standard encoding		
Value	category4	IHO S-100 and IMO harmonized display compliant		

S100_ProtectionScheme

Role Name	Name	Description	Code	Remarks
Enumeration	S100_ProtectionScheme	Data protection schemes	-	-
Value	S100p15	IHO S-100 Part 15	-	See Part 15

S100_SupportFile

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_SupportFile		-	-	-
Role	aggregateFile	Collection of support files	0..*	-	

Commented [rmm16]: S100_SupportFile is actually a structural class and is not part of the exchange catalogue. The other structural class in ed. 4.0 (S100_ExchangeSet) has been deleted from this draft, so S100_SupportFile should also be deleted.

Role Name	Name	Description	Mult	Type	Remarks
Role	supportFile	File which has information about a dataset	0..*	-	

S100_SupportFileDiscoveryMetadata

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_SupportFileDiscoveryMetadata	Metadata about the individual support files in the exchange catalogue	-	-	-
Attribute	fileName	Name of the support file	1	CharacterString	
Attribute	fileLocation	Full location from the exchange set root directory	1	S100_FileLocation	Path relative to the root directory of the exchange set. The location of the file after the exchange set is unpacked into a directory <ROOT> will be <ROOT>/S100_ROOT/<fileLocation>/<filename>. If fileLocation is undefined the file is located in <ROOT>/S100_ROOT/SUPPORT_FILES/fileName
Attribute	purpose	The purpose for which the support file has been issued	1	S100_SupportFilePurpose	For example new, re-issue, new edition, update etc.
Attribute	editionNumber	The edition number of the support file	1	Integer	When a data set is initially created, the edition number 1 is assigned to it. The edition number is increased by 1 at each new edition. Edition number remains the same for a re-issue
Attribute	issueDate	Date on which the data was made available by the data producer	0..1	Date	
Attribute	supportFileSpecification	The specification used to create this file	0..1	S100_SupportFileSpecification	
Attribute	dataType	The format of the support file	1	S100_SupportFileFormat	
Attribute	otherDataTypeDescription	Support file format other than those listed	0..1	CharacterString	
Attribute	comment	Optional comment	0..1	CharacterString	
Attribute	compressionFlag	Is the data compressed	0..1	Boolean	Yes or No

Role Name	Name	Description	Mult	Type	Remarks
Attribute	digitalSignatureReference	Digital Signature of the file	0..1	CharacterString	Reference to the appropriate digital signature algorithm
Attribute	digitalSignatureValue	Value derived from the digital signature	1..*	S100_DigitalSignatureValue	The value resulting from application of digitalSignatureReference Implemented as the digital signature format specified in Part 15
Attribute	defaultLocale	Default language and character set used in the support file	0..1	PT_Locale	In absence of defaultLocale the language is English in UTF-8. A support file is expected to use only one as locale. Additional support files can be created for other locales.

S100_SupportFileFormat

Role Name	Name	Description	Code	Remarks
Enumeration	S100_SupportFileFormat	The format used for the support file	-	-
Value	ASCII	UTF-8 text excluding control codes	-	Many files use UTF-8
Value	JPEG2000	JPEG2000 format	-	ISO 15444
Value	HTML	Hypertext Markup Language	-	
Value	XML	Extensible Markup Language	-	
Value	XSLT	Extensible Stylesheet Language Transformations	-	
Value	VIDEO	Representation of moving images in unspecified format	-	
Value	TIFF	Tagged Image File Format	-	
Value	PDF/AorUA	Portable Document Format	-	ISO 19005, ISO 32000 Product Specification developers should take careful consideration in using PDF as a support file format. It is recommended that PDF never be used in products that will be used on a navigation system as it may impair night vision

Role Name	Name	Description	Code	Remarks
				Must be PDF/A or UA
Value	LUA	Lua programming language	-	
Value	other	Other format	-	

S100_SupportFilePurpose

Role Name	Name	Description	Code	Remarks
Enumeration	S100_SupportFilePurpose	The reason for inclusion of the support file in this exchange set	-	-
Value	new	A file which is new	-	Signifies a new file
Value	replacement	A file which replaces an existing file	-	Signifies a replacement for a file of the same name
Value	deletion	Deletes an existing file	-	Signifies deletion of a file of that name

S100_SupportFileSpecification

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_SupportFileSpecification	The standard or specification to which a support file conforms	-	-	-
Attribute	name	The name of the specification used to create the support file	1	CharacterString	
Attribute	version	The version number of the specification	0..1	CharacterString	
Attribute	date	The version date of the specification	0..1	Date	

S100_CatalogueDiscoveryMetadata

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_CatalogueDiscoveryMetadata	Class for S-100 catalogue metadata	1	-	-
Attribute	fileName	The name for the catalogue	1	S100_FileLocation	

Commented [JP17]: From CCG: Multiple files and file locations indicate that there need to be some ordered pairing. How will this work with portrayal catalogue consisting of hundreds of files? It is probably best to have one S100_CatalogueMetadata instance per catalogue, and this has impact on packaging of catalogues. Some form of container file is probably needed. It may also have impact on other attribute multiplicities in this class.

Commented [JP18R17]: Support the concept, Changed multiplicity from 1..* to 1 to fix this

Role Name	Name	Description	Mult	Type	Remarks
Attribute	purpose	The purpose for which the dataset has been issued	0..1	S100_Purpose (codelist)	2. new edition 5. cancellation Default is value 2:new edition
Attribute	fileLocation	Full location from the exchange set root directory	1	CharacterString	Path relative to the root directory of the exchange set. The location of the file after the exchange set is located in a directory <ROOT> will be <ROOT>/<fileLocation>/<fileName> If fileLocation is undefined then the file will be located in <ROOT>/S100_ROOT/CATALOGUES/<fileName>
Attribute	scope	Subject domain of the catalogue	1	S100_CatalogueScope	
Attribute	versionNumber	The version number of the product specification	1	CharacterString	
Attribute	issueDate	The version date of the product specification	1	Date	
Attribute	productSpecification	The product specification used to create this file	0..1	S100_ProductSpecification	
Attribute	digitalSignatureReference	Digital Signature of the file	1	S100_DigitalSignature	Reference to the appropriate digital signature algorithm
Attribute	digitalSignatureValue	Value derived from the digital signature	1..*	S100_DigitalSignatureValue	The value resulting from application of digitalSignatureReference Implemented as the digital signature format specified in Part 15
Attribute	defaultLocale	Default language and character set used in the catalogue	0..1	PT_Locale	In absence of defaultLocale the language is English in UTF-8
Attribute	otherLocale	Other languages and character sets used in the catalogue	0..*	PT_Locale	

S100_CatalogueScope

Role Name	Name	Description	Code	Remarks
Enumeration	S100_CatalogueScope	The scope of the catalogue	-	-
Value	featureCatalogue	S-100 feature catalogue		
Value	portrayalCatalogue	S-100 portrayal catalogue		
Value	interoperabilityCatalogue	S-100 interoperability information		

S100_SV_ServiceIdentification

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_SV_ServiceIdentification	Identification of capabilities which a service provider makes available to a service user through a set of interfaces which define a behaviour	-	-	Specialization of SV_ServiceIdentification (ISO 19115-1) and thereby a specialization of MD_Identification (The ISO attributes coupledResource and couplingType are not used.)
(Inherited properties)	(Inherited from SV_ServiceIdentification.)				
Attribute	serviceType	A service type name	1	Class GenericName	GenericName is an abstract class for all names in a NameSpace. Each instance of a GenericName is either a LocalName or a ScopedName. A LocalName references a local object directly accessible from the NameSpace. A ScopedName is a composite of a LocalName for locating another NameSpace and a GenericName valid in the NameSpace. (ISO 19103). In short: A name that is defined in a namespace. For S-100 services, the recommended namespace is the IALA/IMO/IHO list of Maritime Services (TBD as of May 2018)
Attribute	serviceTypeVersion	The version of the service, supports searching based on the version of serviceType	0..*	CharacterString	

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Role Name	Name	Description	Mult	Type	Remarks
Attribute	accessProperties	Information about the availability of the service, including fees, planned available date and time, ordering instructions, turnaround	0..1	MD_StandardOrderProcess	ISO 19115-1 B.11.5
Attribute	operatedDataset	Provides a reference to the resource on which the service operates	0..*	CI_Citation	For any single resource referenced, only one of operatedDataset or operatesOn is allowed to be documented (not both for the same resource)
Attribute	profile	Profile to which the service adheres	0..*	CI_Citation	profile of the standard cited in serviceStandard The specification for the data product can be identified here
Attribute	serviceStandard	Standard to which the service adheres	0..*	CI_Citation	For example, citation for OGC WFS, WMS, etc.
Role	operatesOn		0..*	MD_DataIdentification	For any single resource referenced, only one of operatedDataset or operatesOn is allowed to be documented (not both for the same resource)
(Inherited properties)	(Inherited from MD_Identification.) (not shown)				

MD_MaintenanceInformation

Role Name	Name	Description	Mult	Type	Remarks
Class	MD_MaintenanceInformation	Information about the scope and frequency of updating.	--	--	S-100 restricts the ISO 19115-class to: <ul style="list-style-type: none"> prohibit maintenanceScope, maintenanceNote, and contact attributes; define restrictions on maintenanceAndUpdate Frequency, maintenanceDate, and userDefinedMaintenance Frequency attributes.

Attribute	maintenanceAndUpdateFrequency	frequency with which changes and additions are made to the resource after the initial resource is completed	0..1	MD_MaintenanceFrequencyCode (codelist)	Must be populated if userDefinedMaintenanceFrequency is not present, otherwise optional. See table MD_MaintenanceFrequencyCode in this Part for values allowed in S-100 metadata.
Attribute	maintenanceDate	date information associated with maintenance of resource	0..1	CI_Date	Exactly one of maintenanceDate and userDefinedMaintenanceFrequency must be populated. Allowed value for dateType: nextUpdate
Attribute	userDefinedMaintenanceFrequency	maintenance period other than those defined	0..1	TM_PeriodDuration	Exactly one of maintenanceDate and userDefinedMaintenanceFrequency must be populated. Only positive durations allowed.

See clause 4a-4.9 for more information about encoding maintenance information.

MD_MaintenanceFrequencyCode

S-100 uses a subset of the values allowed in ISO 19115-1.

Role Name	Name	Description	Code	Remarks
Enumeration	MD_MaintenanceFrequencyCode	frequency with which modifications and deletions are made to the data after it is first produced	-	S-100 is restricted to only the following values from the ISO 19115-1 codelist. The conditions for the use of a particular value are described in its Remarks.
Value	asNeeded	resource is updated as deemed necessary	-	Use only for datasets which normally use a regular interval for update or supersession, but will have the next update issued at an interval different from the usual. Allowed if and only if userDefinedMaintenanceFrequency is not populated.
Value	irregular	resource is updated in intervals that are uneven in duration	-	Use only for datasets which do not use a regular schedule for update or supersession. Allowed if and only if userDefinedMaintenanceFrequency is not populated.

CI_DateTypeCode

This codelist is documented in the ISO schemas documentation, available in the S-100 schemas distribution. It is used in several places in S-100 metadata.

PT_Locale

Role Name	Name	Description	Mult	Type	Remarks
Class	PT_Locale	Description of a locale	-	-	From ISO 19115-1
Attribute	language	Designation of the locale language	1	LanguageCode	ISO 639-2 3-letter language codes.
Attribute	country	Designation of the specific country of the locale language	0..1	CountryCode	ISO 3166-2 2-letter country codes
Attribute	characterEncoding	Designation of the character set to be used to encode the textual value of the locale	1	MD_CharacterSetCode	Use (the "Name" from the) IANA Character Set register: http://www.iana.org/assignments/character-sets . (ISO 19115-1 B.3.14) For example, UTF-8

4a-4.6 Overview of multilingual support in S-100 Exchange Set Catalogue

The S100 Exchange Set Catalogue provides the necessary multilingual support by directly reusing the localization framework present in ISO 19115-1:2014 metadata standard. This effectively adds two localization elements: defaultLocale and otherLocale to various classes within the model. These elements are intended to consistently identify the languages used in both the metadata records and within the geospatial resources, such as datasets, support files and other catalogues included in an exchange set. The defaultLocale element is intended to identify the default language and character set while the otherLocale element is intended to provide the same for any alternatively used localized character strings. Both elements are defined as PT_Locale type defined as illustrated in Figure 4a-D-6.

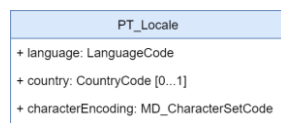


Figure 4a-D-6 – ISO 19115-1:2014 PT_Locale class.

The PT_Locale class as defined in ISO 19115-1:2014 has the following members:

- LanguageCode – required ISO 639-2, 3-letter code in lowercase i.e. “fra”
- CountryCode – optional ISO 3166-1 2-letter code in uppercase i.e. “CA” intended to be used when the national language differences can impact the interpretation or processing of localized content
- MD_CharacterSetCode – required MD_CharacterSetCode in lowercase i.e. “utf8”

The implementation of the PT_Locale type provides the necessary structure to consistently define and communicate the key language characteristics within metadata or other geospatial resources.

Additionally, the localization framework provides the support for using multiple languages in the metadata records by extending CharacterString simple type with PT_FreeText and LocalisedCharacterString subtypes as illustrated in Figure 4a-D-7.

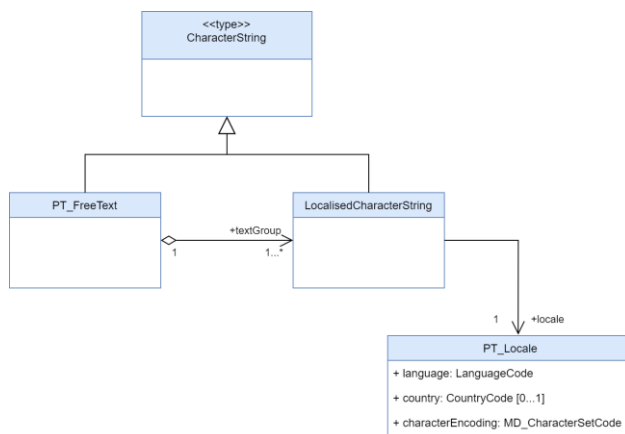


Figure 4a-D-7 – ISO 19115-1:2014 PT_FreeText and LocalisedCharacterString subtypes.

This allows any free text metadata record instances expressed in the default metadata language to also be expressed in other languages by aggregating the corresponding localized translations using

LocalisedCharacterString and adding a reference to the underlying otherLocale definition. The diagram below shows a pseudo-XML implementation example illustrating how such aggregations should be constructed.

```
<S100XC:metadata_record xsi:type="lan:PT_FreeText_PropertyType">
  <gco:CharacterString>text expressed using defaultLocale</gco:CharacterString>
  <lan:PT_FreeText>
    <lan:textGroup>
      <lan:LocalisedCharacterString locale="#referece_to_otherLocale">text expressed using otherLocale</lan:LocalisedCharacterString>
    </lan:textGroup>
  </lan:PT_FreeText>
</S100XC:metadata_record>
```

4a-4.7 Encoding of S-100 Exchange Set Catalogue elements in multiple languages

The S100 Exchange Set Catalogue model provides two elements: defaultLocale and otherLocale to define and indicate the languages used for all metadata records within an instance of an exchange catalogue. Only one defaultLocale is permitted within the core section of the S100 Exchange Set Catalogue (within S100_ExchangeCatalogue) and it is intended to communicate the default language used for all catalogue records. Since the expected default language is English and the default character set is UTF-8 the defaultLocale element is optional and can be omitted. In most situations, however, it is prudent to explicitly define defaultLocale to prevent any confusion and more readily support data sharing with other user communities that might not be fully aware of S-100 conventions. This can be achieved as illustrated below.

```
<S100XC:defaultLocale>
  <lan:PT_Locale>
    <lan:language>
      <lan:LanguageCode codeList="http://www.ihb.int/S100/ ... #S100_MD_LanguageCode" codeListValue="eng">English</lan:LanguageCode>
    </lan:language>
    <lan:characterEncoding>
      <lan:MD_CharacterSetCode codeList="http://www.ihb.int/S100/ ... #S100_MD_CharacterSetCode" codeListValue="utf8">UTF-8</lan:MD_CharacterSetCode>
    </lan:characterEncoding>
  </lan:PT_Locale>
</S100XC:defaultLocale>
```

Data producing agencies wishing to provide additional localized translations of any of the catalogue records can achieve so by first defining otherLocale and then referring to it when required. The first step can be achieved as illustrated below and, similarly to defaultLocale, this only needs to be defined once within the core section of the S100 Exchange Set Catalogue (within S100_ExchangeCatalogue) for each additional language used in a catalogue instance. This approach is intended to communicate any additional language used for localized catalogue records.

```
<S100XC:otherLocale>
  <lan:PT_Locale id="locale_fra_ca">
    <lan:language>
      <lan:LanguageCode codeList="http://www.ihb.int/S100/ ... #S100_MD_LanguageCode" codeListValue="fra">Français</lan:LanguageCode>
    </lan:language>
    <lan:country>
      <lan:CountryCode codeList="http://www.ihb.int/S100/ ... #S100_MD_CountryCode" codeListValue="CA">Canada</lan:CountryCode>
    </lan:country>
    <lan:characterEncoding>
      <lan:MD_CharacterSetCode codeList="http://www.ihb.int/S100/ ... #S100_MD_CharacterSetCode" codeListValue="utf8">UTF-8</lan:MD_CharacterSetCode>
    </lan:characterEncoding>
  </lan:PT_Locale>
</S100XC:otherLocale>
```

Of note is the id attribute of PT_Locale. When used in otherLocale definition, it needs to be a unique, ideally descriptive identification of a specific language which can be used as a reference by localized records. With the otherLocale element defined, any free text instances captured using the default language can also provide corresponding localized translations using PT_FreeText and LocalisedCharacterString subtypes as illustrated below.

```

<S100XC:specificUsage>
  <mri:MD_Usage>
    <mri:specificUsage xsi:type="lan:PT_FreeText_PropertyType">
      <gco:CharacterString>Coastal Navigation</gco:CharacterString>
      <lan:PT_FreeText>
        <lan:textGroup>
          <lan:LocalisedCharacterString locale="#locale_fra_ca">Navigation côtière</lan:LocalisedCharacterString>
        </lan:textGroup>
      </lan:PT_FreeText>
    </mri:specificUsage>
  </mri:MD_Usage>
</S100XC:specificUsage>

```

4a-4.8 Indicating languages used inside geospatial resources described in S-100 Exchange Set Catalogue

Data producing agencies using multiple languages in their products or other resources, who wish to explicitly indicate the languages used can use the same localization framework. In contrast to the metadata records, where language definitions are applicable to all records in an exchange catalogue instance, the default and other language definitions are individual resource specific. This is accomplished by defining default and/or other languages in the same way as before but placing them inside specific resource records. For example, a data producing agency wishing to communicate that a specific dataset includes features encoded using multiple languages can add the defaultLocale and otherLocale definitions inside the corresponding dataset discovery metadata record. At the resource level, both of these elements are optional and English UTF-8 encoding is considered to be the default therefore there is generally no need to capture this fact explicitly.

S-100 support file resources are a special case, as the textual information inside them is intended to be in a single language. As with all other resources, English UTF-8 encoding is the default therefore there is no need to capture this fact explicitly. It would be prudent, however, to define support file specific defaultLocale when the language used for the content is other than English. Both the S-100 Exchange Set Catalogue and S-100 Datasets can reference any number of support resources. The diagram below shows a pseudo-XML version with examples of MRN-based identifiers used as references between datasets and support resources. This illustrates the mechanism for using a predefined referencing system to interconnect the independently captured metadata records for datasets and support resources.

```

<?xml version="1.0" encoding="UTF-8"?>
<S100_ExchangeCatalogue>
  <datasetDiscoveryMetadata>
    <S100_DatasetDiscoveryMetadata>
      <fileLocation>DATASET_FILES/101GB00141199.000</fileLocation>
      <digitalSignatureValue>
        302C0214394435532378E3E5038E56D081054174D4B445C6402143D41CBAD478BB8A863CC3D8C270F27C532A39151
      </digitalSignatureValue>
      <supportFileDiscoveryMetadataReference>
        urn:mrn:iho:sha256:6003c71cca084c4c1e285722391bb0f0e47bbd672e316d9842c3b93a6f6e050
      </supportFileDiscoveryMetadataReference>
    </S100_DatasetDiscoveryMetadata>
  </datasetDiscoveryMetadata>
  <S100_DatasetDiscoveryMetadata>
    <fileLocation>DATASET_FILES/101GB00220401.000</fileLocation>
    <digitalSignatureValue>
      302C0214145339C46C30382CED4655F85001877A873D67502140D5168EBC665C02A3CBA20163CC60E82FA7A306
    </digitalSignatureValue>
    <supportFileDiscoveryMetadataReference>
      urn:mrn:iho:sha256:27f96dfe8d9f19608837e68bea0d1f3ee0c6f8defbcb02a5a9f6abd4d9459d67
    </supportFileDiscoveryMetadataReference>
  </S100_DatasetDiscoveryMetadata>
  OR:
  <supportFileDiscoveryMetadataReference>
    urn:mrn:iho:dsig:302C02147CFBFB02A731BA7CD6292C06942DF4D4413468A50214191C9373D038D87FB7EEE760275F7A422F77BD4C
  </supportFileDiscoveryMetadataReference>
  </S100_DatasetDiscoveryMetadata>
</datasetDiscoveryMetadata>
<supportFileDiscoveryMetadata>
  <fileLocation>SUPPORT_FILES/101GB000INFORM1.TXT</fileLocation>
  <digitalSignatureValue>
    302C021435C50AAC507E8D8395EEF4EDFA48420490376FD0021479F008300577654E0ABA6BC80721BA883EE3EE76
  </digitalSignatureValue>
</supportFileDiscoveryMetadata>
<supportFileDiscoveryMetadata>
  <fileLocation>SUPPORT_FILES/101GB000CABLES1.TXT</fileLocation>
  <digitalSignatureValue>
    302C02147CFBFB02A731BA7CD6292C06942DF4D4413468A50214191C9373D038D87FB7EEE760275F7A422F77BD4C
  </digitalSignatureValue>
</supportFileDiscoveryMetadata>
</S100_ExchangeCatalogue>

```

The above diagram also illustrates the optional `defaultLocale` fully omitted for any resources encoded using English UTF-8 thus simplifying the related metadata content. At the same time, data producers wishing to supply support resources in other languages can achieve this by capturing them independently and adding the corresponding metadata records, including defining their `defaultLocale`, as appropriate. The diagram below shows a pseudo-XML metadata example of a support resource supplied as two individual files one in English and the other in French.

```
<supportFileDiscoveryMetadata>
  <fileLocation>SUPPORT_FILES\101CACAB01_ENG.TXT</fileLocation>
  <digitalSignatureValue>642C559A55029FBC85CA86459DB769ABDE7C5E5CE631D32E789EA15B0805EE41</digitalSignatureValue>
</supportFileDiscoveryMetadata>

<supportFileDiscoveryMetadata>
  <fileLocation>SUPPORT_FILES\101CACAB01_FRA.TXT</fileLocation>
  <digitalSignatureValue>E3B0C44298FC1C149AFBF4C8996FB92427AE41E4649B934CA495991B7852B855</digitalSignatureValue>
  <S100XC:defaultLocale>
    <lan:PT_Locale id="locale_fra_ca">
      <lan:language>
        <lan:languageCode codeList="http://www.ihc.int/S100/ ... #S100_MD_LanguageCode" codeListValue="fra">Français</lan:languageCode>
      </lan:language>
      <lan:country>
        <lan:countryCode codeList="http://www.ihc.int/S100/ ... #S100_MD_CountryCode" codeListValue="CA">Canada</lan:countryCode>
      </lan:country>
      <lan:characterEncoding>
        <lan:MD_CharacterSetCode codeList="http://www.ihc.int/S100/ ... #S100_MD_CharacterSetCode" codeListValue="utf8">UTF-8</lan:MD_CharacterSetCode>
      </lan:characterEncoding>
    </lan:PT_Locale>
  </S100XC:defaultLocale>
</supportFileDiscoveryMetadata>
```

While the localization framework currently allows a high degree of flexibility, data producers are strongly encouraged to apply one consistent multilanguage support approach across their entire S-100 product portfolios to ensure a consistent user experience. The recommended approach is to provide all support resources in any other officially supported language in addition to English.

4a-4.9 Encoding of maintenance information

The interval described by *userDefinedMaintenanceFrequency* is with respect to the issue date and time of the dataset described by this dataset discovery metadata block. End-user's and distributor's systems should use this interval for planning any automated operations to obtain the successor dataset, but must allow for delays or variations in the actual availability of successor dataset(s).

The format for *userDefinedMaintenanceFrequency* is given by the XML built-in datatype *duration*, which can be validated by off-the-shelf XML parsers. See "XML Schema Part 2: Datatypes (2nd edition) - Clause 3.2.6 *duration*" (relevant extracts below):

The lexical representation for **duration** is the ISO 8601 extended format `PnYnMnDTnHnMnS`, where `nY` represents the number of years, `nM` the number of months, `nD` the number of days, `T` is the date/time separator, `nH` the number of hours, `nM` the number of minutes and `nS` the number of seconds. The number of seconds can include decimal digits to arbitrary precision.

The values of the Year, Month, Day, Hour and Minutes components are not restricted but allow an arbitrary unsigned integer, i.e., an integer that conforms to the pattern `[0-9]+`. Similarly, the value of the Seconds component allows an arbitrary unsigned decimal. Following ISO 8601, at least one digit must follow the decimal point if it appears.

Reduced precision and truncated representations of this format are allowed provided they conform to the following:

- If the number of years, months, days, hours, minutes, or seconds in any expression equals zero, the number and its corresponding designator *may* be omitted. However, at least one number and its designator *must* be present.
- The seconds part *may* have a decimal fraction.

- The designator 'T' must be absent if and only if all of the time items are absent. The designator 'P' must always be present.

4a-4.9.1 Encoding and interpretation rules in S-100 metadata

- (1) Restriction to non-negative durations: S-100 restricts the duration type by prohibiting zero or negative values of duration in userDefinedMaintenanceFrequency.
- (2) Number of digits: S-100 recommends (but does not require) using 2 digits for the months, days, hours, minutes, components, when they are present. If the seconds component is encoded, two digits are recommended for the number of whole seconds (for example, encode 0.5 seconds as PT00.5S; encode 100 seconds as PT01M40S).
- (3) Start and end instants: The start and end instants of the interval calculated by combining userDefinedMaintenanceFrequency with the issue date/time must be interpreted according to Part 3 Clause 3-8. The value must be encoded appropriately; this means that smaller date/time components must not be encoded unless the availability of the successor dataset is known to the corresponding level of precision. Smaller units should be used when the availability is known to the corresponding precision, such as "48 hours" instead of "2 days" when the successor dataset availability is planned to the hour.
- (4) Encoding of zero components: Zero components must be encoded if and only if they are significant for indicating the granularity of the start/end instants of the interval.
- (5) Variability: A variation of $\pm X$ should be allowed for, where X is the component of smallest granularity; if the value of the smallest component is 1, variability is unspecified.
- (6) Stability for successive datasets, and exceptions: The value of this attribute will normally be stable over a sequence of predecessor/successor datasets. The alternate encoding using maintenanceDate should be used for known exceptional circumstances affecting the release of a successor, such as an office closure at the end of the intervening period, reverting to normal encoding with userDefinedMaintenanceFrequency when the normal update schedule is restored.
- (7) Off-schedule updates: Communication of exceptional, unforeseeable off-schedule issues of data such as emergency hurricane forecasts should be provided for by other means than userDefinedMaintenanceFrequency or maintenanceDate attributes, since they are by definition unforeseeable.
- (8) Supersession: If both userDefinedMaintenanceFrequency and maintenanceDate are encoded in the same discovery metadata block, the maintenanceDate supersedes the userDefinedMaintenanceFrequency.

EXAMPLES

No.	maintenanceAnd UpdateFrequency	maintenanceDate	userDefined Maintenance Frequency	Remarks
1	--	--	P3DT10H30M	An interval of 3 days, 10 hours, and 30 minutes. Variability +/-1 minute.
2	--	--	PT6H	An interval of exactly 6 hours, with a variability of +/-1 hour.
3	--	--	P30M	an interval of 30 months.
4	--	--	PT30M	an interval of 30 minutes.
5	--	--	P6H P30S P30M10S	invalid (they contain time components but lack the 'T' designator)

6	--	--	PT30m	Invalid ('m' should be upper-case).
7	--	--	PT12:30 P3DT10H 30M	Invalid (the ':' or space separators are not allowed, only the separators specified by the XML Schema datatypes specification for duration are allowed)
8	--	--	P1M	One month, variability unknown. According to the "Start and end instants" rule, will be interpreted as the same day in the following month, or the nearest preceding day if there is no such date in the following month. If the issue date of the current dataset is 30 August, the successor dataset can be expected to be issued between midnight at the beginning of 30 September and midnight at the end of 30 September.
9	--	--	P1M00D	One month, with a variability of +/- 1 day. With a dataset issued on January 31 2021, the next dataset is expected on February 28, 2021; with a dataset issued on January 31, 2024 means the next dataset is expected February 29, 2024. A 1-day variation before after those dates should be anticipated.
10	--	--	P30D	30 days, variability +/- 1 day. With a dataset issued on January 31, 2021 it means the next dataset is expected on March 2, 2021; with a dataset issued on January 31, 2024 it means the next dataset is expected on March 1, 2024. A 1-day variation should be allowed for in both cases.

11	irregular	cit:CI_Date > cit:dateType=nextUpdate cit:date=2021-10-25	--	On 25 October 2021, at an unspecified time on that date.
12	irregular	cit:CI_Date > cit:dateType=nextUpdate cit:date=2021-10-25T14:00:00Z	--	On 25 October 2021, at 2 p.m. UTC.
13	asNeeded	cit:CI_Date > cit:dateType=nextUpdate cit:date=2021-10-25T14:00:00Z	--	To encode an exception to a dataset sequence normally on a regular schedule. Next dataset will be available on 25 October 2021, at 2 p.m. UTC.

XML encoding examples:

EXAMPLE 1: Dataset is updated at an interval of 6 hours:

```
<mri:resourceMaintenance>
  <mmi:MD_MaintenanceInformation>
    <mmi:userDefinedMaintenanceFrequency>
      <gco:TM_PeriodDuration>PT06H</gco:TM_PeriodDuration>
    </mmi:userDefinedMaintenanceFrequency>
  </mmi:MD_MaintenanceInformation>
</mri:resourceMaintenance>
```

EXAMPLE 2: Dataset is normally updated on a regular schedule, but the next update will be on 1 January 2022 at 5 a.m. local time in the time zone with UTC offset -5 hours (e.g., 5 a.m. US Eastern Standard Time). The codeList attributes must be populated with the URL of the appropriate codelist, which will be in the ISO or S-100 schema distribution package.

```
<mri:resourceMaintenance>
  <mmi:MD_MaintenanceInformation>
    <mmi:maintenanceAndUpdateFrequency>
      <mmi:MD_MaintenanceFrequencyCode codeList="http://...."
codeListValue="asNeeded">
        empty, or any text in any single language
      </mmi:MD_MaintenanceFrequencyCode>
    </mmi:maintenanceAndUpdateFrequency>
    <mmi:maintenanceDate>
      <cit:CI_Date>
        <cit:date>
          <gco:DateTime>2022-01-01T05:00:00-05:00</gco:DateTime>
        </cit:date>
        <cit:dateType>
          <cit:CI_DateTypeCode codeList="http://..."
codeListValue="nextUpdate">
            empty, or any text in any single language
          </cit:CI_DateTypeCode>
        </cit:dateType>
      </cit:CI_Date>
    </mmi:maintenanceDate>
  </mmi:MD_MaintenanceInformation>
</mri:resourceMaintenance>
```

EXAMPLE 3: Dataset has no consistent update schedule. The next update will be on 1 January 2022 at an unspecified time.

```
<mri:resourceMaintenance>
  <mmi:MD_MaintenanceInformation>
    <mmi:maintenanceAndUpdateFrequency>
      <mmi:MD_MaintenanceFrequencyCode          codeList="http://...."
codeListValue="irregular"/>
    </mmi:maintenanceAndUpdateFrequency>
    <mmi:maintenanceDate>
      <cit:CI_Date>
        <cit:date>
          <gco:Date>2022-01-01</gco:Date>
        </cit:date>
        <cit:dateType>
          <cit:CI_DateTypeCode          codeList="http://...."
codeListValue="nextUpdate"/>
        </cit:dateType>
      </cit:CI_Date>
    </mmi:maintenanceDate>
  </mmi:MD_MaintenanceInformation>
</mri:resourceMaintenance>
```