AIDC Standards Report

Automatic Identification & Data Capture

Title figure: EDCi CODE ART+DPP

Report on continued developments and standardization of the carriers Barcode, RFID and its data structures and applications for automatic identification, traceability and Internet of Things (IoT) communication
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Eurodata Council Institute e.V., 06618 Naumburg, Germany, +493445781160, info@e-d-c.info, www.e-d-c.info

AIDC Standards Report 2023

Authors: Erich Günter & Heinrich Oehlmann, EDCi.
Special thanks to the contributing experts and liaison partners:
Bertus Pretorius, Harald Oehlmann, Hiroyuki Imai, Wilfried Weigelt, ...

Content

AIDC Standards and Application

Report update on cross-industry and transnational standardization of barcode, RFID & associated data communication for automatic identification, tracking & tracing and the "Internet of Things" and it's application

This report provides information on the evolution of AIDC technologies from the point of view of standardization, but also toward practical applications with focus on internationality and global functionality.

AIDC applications in continuous development

AIDC stands for "Automatic Identification and Data Capture", a segment of Information Technologies (IT). Where other IT tech's target to computer to computer communication, AIDC stands for communication between items and computers. The technical media as data carriers are barcode and RFID technologies, completed by AIDC data structures. Was barcode just enforced by specific sectors for transfer of data via items a while ago, today barcode got a mandatory status for tracking & tracing items even required by specific governmental regulations. Examples are **UDI** (Unique Device Identification) for medical devices and In-vitro-Diagnostics, serialized codes for medicinal products (pharmaceuticals), unique IDs for Tobacco products, for Marine equipment, for Fish Boxes with catch data, etc. In such applications, barcodes on items carry references to databases where the related master data are stored. Examples are the Global UDI Database (GUDID) and the European equivalent EUDAMED for product data with public access to the product master data. Many countries follow this trend, like China, Japan and the other countries beeing members of the International Medical Device Forum (IMDRF). One more driver of AIDC for items is the development of the European Digital Product Passport (see chapter DPP).

The originally called "Automatic Identification Manufacturers" association (AIM) was formed 1973 by pioneering companies of a Product Section of the US Material Handling Association (MHI). Today not only manufacturers are members, but distributors, system integrators and user associations for AIDC as well.
At the pioneer time AIM initiated the standardisation of barcode and was the source for the technical standards a long time until establishing CEN TC 225 and ISO/IEC Subgroups for Barcode in the 80/90s (later for RFID as well). Today AIM is still a key address in this field, hosting an expert group for AIDC technologies and supplying resources for fulfilling tasks e.g. for ISO, like as ISO/IEC 15459-2 Registration Agency.
Read more: https://www.aimglobal.org/

The report will supply an update of the standards developed by ISO/IEC JTC 1/Sub Committee 31 and adjacent groups and associations. Also, it will include information about trends of combining barcode and RFID technologies for internet communication, like the use of QR Code in the public. The trend linking to Internet surely has impact to upgrade of numbering systems for performing to logistical processes in the supply chain as for Internet of Things functionality.

AIDC News

New chairman for ASC Data Identifiers Maintenance Committee (DIMC)

The Data Identifier Maintenance Committee (DIMC), as the name says, is responsible for maintaining the"ASC MH 10.8.2 Data Identifiers", part of "ISO/IEC 15418 GS1 Application Identifiers and ASC MH10 Data Identifiers and maintenance".
The new Chairman of the DIMC is **Craig A. MacDougall**, appointed in Sept. 2023. Craig has been delegated for the standardisation tasks by the United States Department of Defense. Craig brings with him a wealth of experience in the field of automatic identification. He takes over the role from his predecessor Bill Hoffman, who successfully led the DIMC for many years. New requests for new ASC Data Identifiers (DIs) will now reach the desk of Craig. His role is to manage any new DI request and to coordinate maintenance tasks. The DIMC consists of AIDC experts from different industries and from different geographical areas like from Asia, Europe, North America. Any ASC DI user group can apply for a new ASC DI if there is a demand and if existing DIs do not meet the requirements.
The DI request form is part of the document 'ANSI MH 10.8.2 Data Identifiers' and is available free of charge at: *https://my.mhi.org/s/store#/store/browse/detail/a153h000005lJuRAAU*

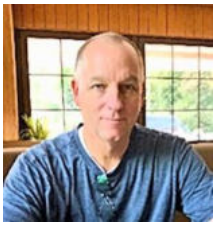


Figure 1
Craig A. MacDougall

Europe: Standardisation of the Digital Product Passport (DPP)

In line with the efforts of the European Parliament for "making sustainable products the norm" the European Commission instructed CEN/CENELEC to develop the European Norm (EN) for the Digital Product Passport. The project started Dec. 18, 2023 in Brussels establishing the committee "CEN/CLC/JTC 24 Digital Product Passport (DPP)". The title of the standard will be "**Digital Product Passport – Framework and System"**, the timeframe for development has been set for two years for availability by the end of 2025.

CEN-CLC/JTC 24 Business Plan of 2024-03-06 includes the explanations: *Quote "Stemming from political actions like the Ecodesign for Sustainable Products Regulation (ESPR) the Circular Economy action Plan (CEAP), and the Battery Regulation, the DPP initiative aims to enhance transparency, quality, and geostrategic resilience. The European Commission (EC) proposes the creation of a clear concept for DPPs by the definition of cross-sectoral product data models through a draft standardisation request to be delivered by December 2025 addressing:*

Unique identifiers, data carriers, links between physical and digital representations, access rights, interoperability, data processing, storage, authentication, and security." End of quote.

As a framework the standard will not cover the product data itself. The data for acessibility via the DPP system will be part of sectorial delegated acts or regulations such as for batteries, textiles, electrical/electronic products, construction, etc.

Considerations of modules of the DPP standard to be developed, specifically to the module "DPP Identifier", see page 12 under chapter Digital Product Passport – DPP considerations.

Asia: „International Identification Code Industry Alliance (ICA)" has started.

The International Identification Code Industry Alliance (abbreviated as "ICA") was registered in April 2023 and is headquartered in Singapore. It is a non-governmental, non-profit international organization voluntarily formed by international organizations and relevant national industry associations, backbone enterprises, standardization organizations, and professionals. The Alliance is an international professional organization in the field of Identification Code.

With the purpose of "Sharing, Green and Sustainability ", ICA aims to coordinate and formulate a unified international basis for digital identification, promote the interconnection and collaboration of mainstream international identification code systems, and build an international cooperation platform to carry digital technology cooperation and promote the development of digital economy. ICA will actively promote the development of digital industries at both national and international levels, and jointly build the foundation of digital economy and digital society.

AIDC will belong to the key areas of activities, for more details see http://www.e-d-c.info/images/edc/documents/Introduction_to_ICA.pdf

System Identifiers (SI) updated for unique identification of syntax

System Identifiers are to flag and to identify the syntax of encoded data specifically for bar code. The importance is increasing facing flooding of bar codes in and out from and to all areas without any standard syntax. Lot's of such codes are meaningful locally but are not unique in global environment as standard conforming codes would be (like ISO, ISO/IEC, IEC, etc.). Facing the importance of the issue DIN updated the standard "DIN 66403 System Identifiers" and published the update 04/2024 (first issue 2005).

Example danger of overlapping between codes (A1 and B) and how to solve the problem by System Identifier "." (A1) is shown at figure 2, using preceeding ASC MH 10.8.2 DI "V - Supplier Code Assigned by Customer".

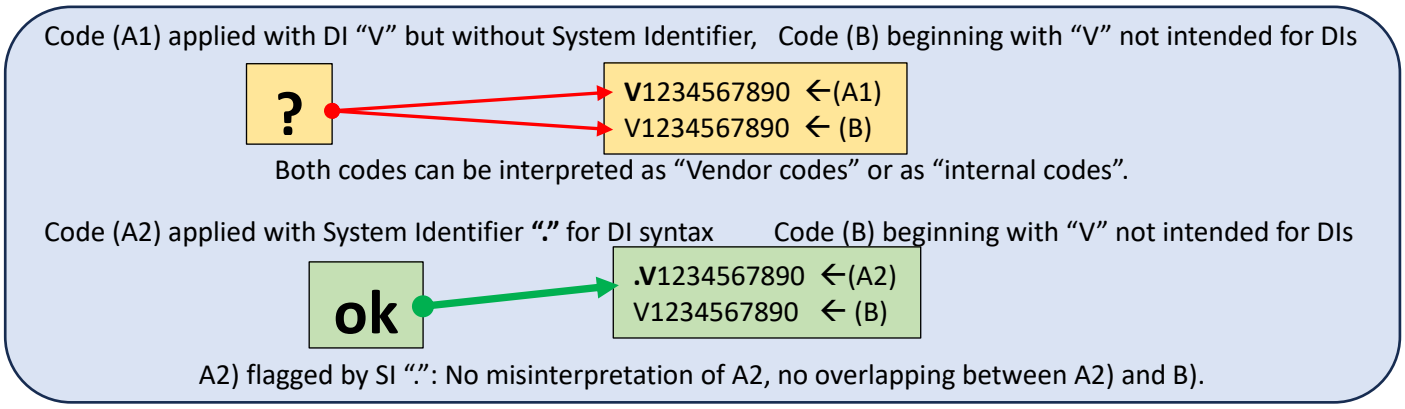


Figure 2) Data elements without and with System Identifier ".": Without SI may mean anything, with SI "." means flagged by DI.

Fig.2 illustrates how **System Identifiers** secure correct interpretation of syntax differentiating to “non standard codes”.

“HTTP” as System Identifier

With the latest update of DIN 66403 also flag “https” has been included as SI for the RFC 3986 URL syntax. This is to recognise developments of “URL first” codes like IEC 61406-01 and -02, AutoID URL and GS1 Digital Link. Table 1 below represents the updated list of System Identifiers, source DIN 66401:

Table 1 — List of currently defined system identifiers

System Identifier	System/Syntax	Reference	AIDC media
+	Health Industry Barcode (HIBC)	ISO/IEC 15418 – ANS HIBC 2	All symbologies
-	Pharma Zentral Nummer (PZN)	IFA – ABDATA	Code 39
&	American Ass. Of Blood Banks	ISO/IEC 15418	Code 128
=	International Society for Blood Transfusion (ISBT)	ISO/IEC 15418	Code 128, 2d-symbols (Data Matrix)
/	Graphic Communications Industry Barcode Council (GIBC)	ISO/IEC 15418	Code 128
!	Eurocode IBLS e.V.	EUROCODE 1997	Code 128 and 2D
.	ASC MH10 Data Identifiers (DI's)	AFNOR NF Z 63-400 DIN 16598 2022-04 IFA Coding System, UDI 2022-11	All symbologies
FNC1	GS1 Application Identifiers (AI's)	ISO/IEC 15418	Code 128, Databar, Datamatrix, PDF417, QR
[ )>$^{R}_{S}$	Syntax for High Capacity Media	ISO/IEC 15434	2D-symbols
https	URL syntax	RFC 3986	All symbologies

DIN, jointly with user groups like Automotive (see VIN label below) is suggesting DIMC to follow the initiative by updating the table of SIs within ANSI MH 10.8.2 Data Identifiers.

KB & WEB compatible codes solve problems

After EDIFICE published the KB & WEB compatible solution in 2018 DIN adapted the solution as pre-norm in 2019. Due to success and interest and support of application areas it was agreed for standard **“DIN 16598 Syntax keyboard and Web compatible encoding of data elements in machine readable symbols applied with ASC Data Identifiers”** published 2022/04. The base was the System Identifier “.” (see table 1) where simply the character “^” (Circumflex) has been defined as separator between concatenated data elements. This solution is fully keyboard and WEB compatible by avoiding non keyboard characters like “gs” (Group Separator), “rs” (R Separator), “eot” (End of Text” e.g. as used with the mutible format syntax ISO/IEC15434.

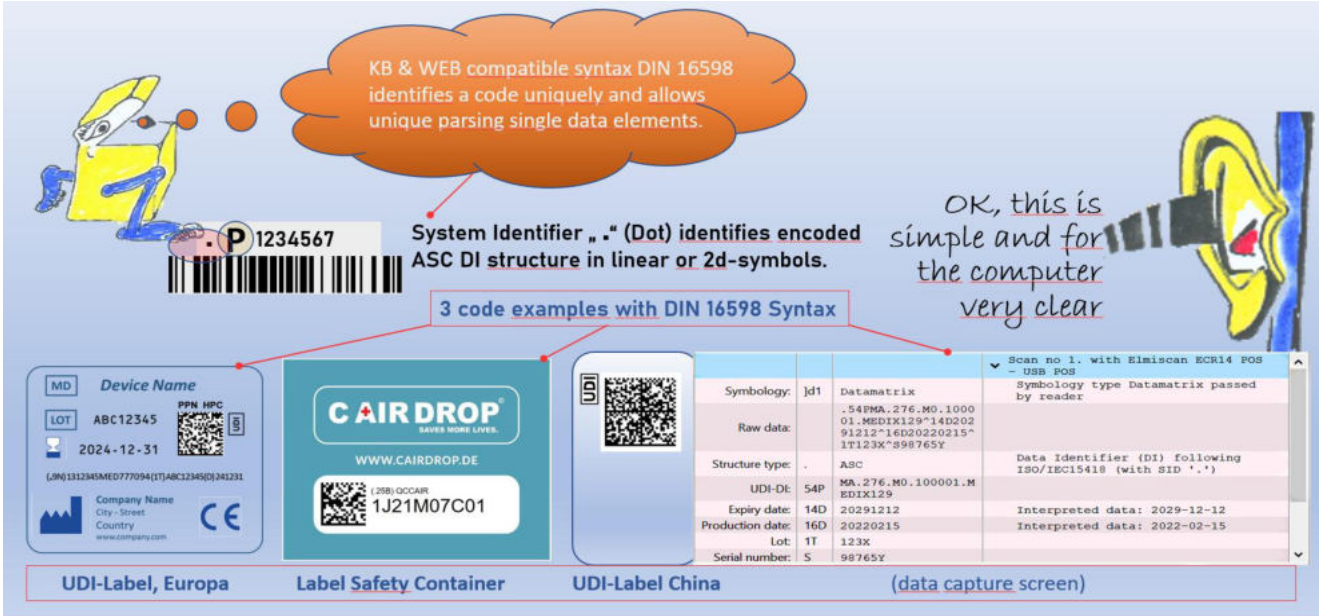


Figure 3) Keyboard and WEB compatible syntax, 3 examples (for one more example see VIN label).

ODETTE / ECG VIN Label Keyboard and WEB compatible

Odette is a European standardisation, services and networking platform for the entire automotive supply chain. One of the current publications is the "**VIN Label**" guideline, which was developed together with **ECG**, the Association of European Vehicle Logistics. Facing the increased use of keyboard and WEB interfaces the experts decided to avoid control characters for the VIN label code in favor of the Syntax keyboard and Web compatible encoding of data elements in machine readable symbols applied with ASC Data Identifiers, DIN°16598, see Fig.°3).

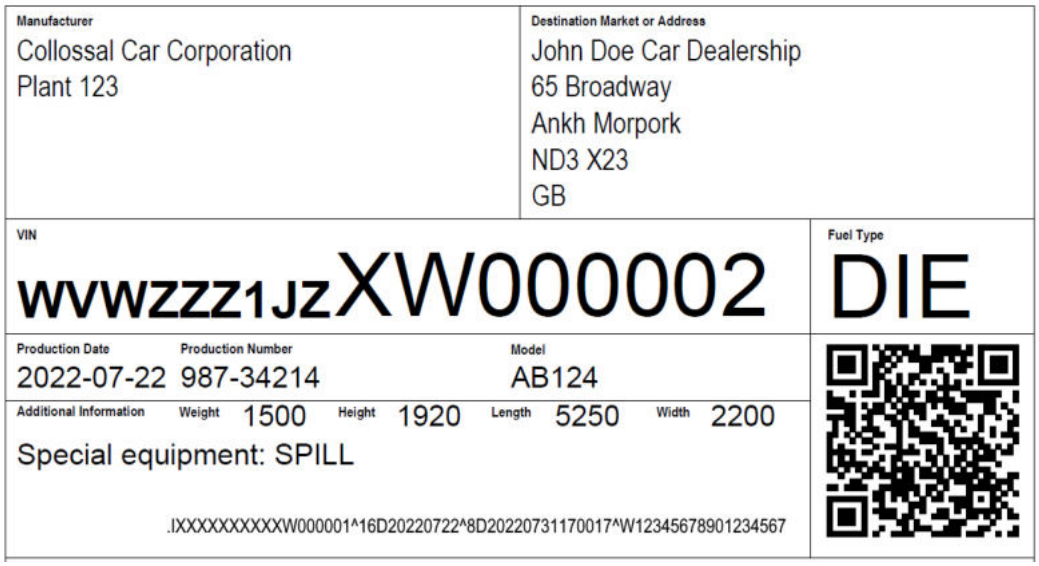


*Figure 4) *Vehicle ID Number (VIN) label, QR with keyboard & WEB compatible syntax*

Scanning the code from the VIN label using an ASC DI App, the data will be parsed uniquely ready to hand over to any system as single data elements:

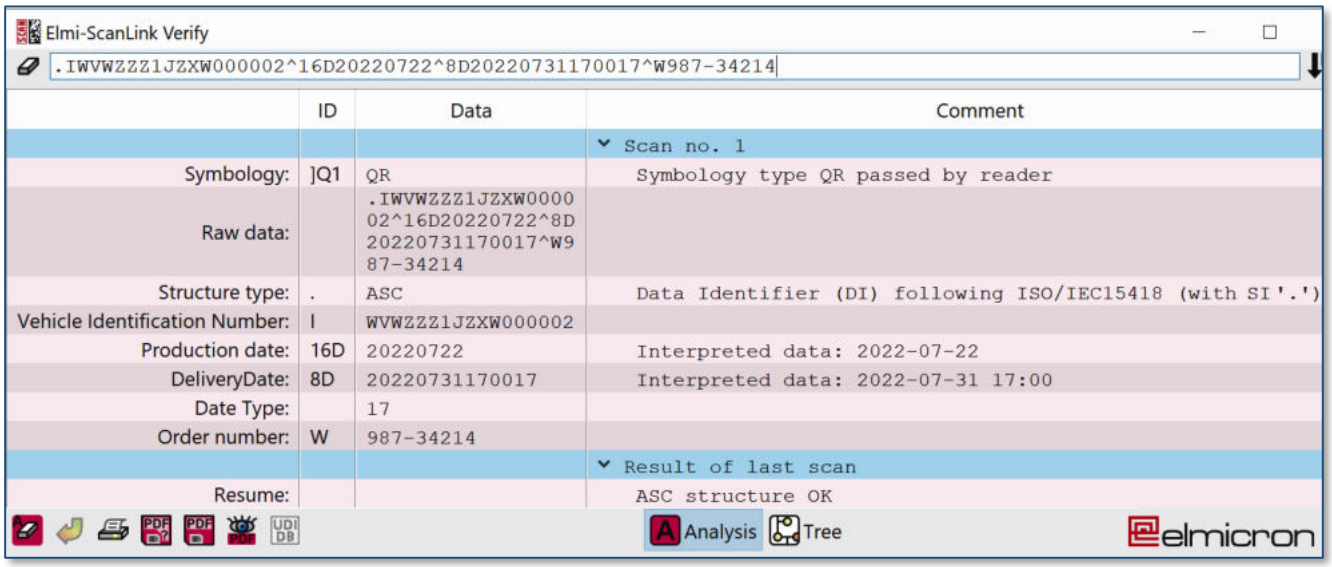


Figure 5) Scan screen shows raw data, syntax and data elements

**Source: A joint ODETTE/ECG Publication "VIN Labels in the Vehicle Distribution Process":*
https://www.ecgassociation.eu/wp-content/uploads/2022/12/FV26_VIN-Label-in-Vehicle-Distribution-Process_v1.0.pdf

ECG reported at the WEB page, quote: '*We are pleased to report that our recommendations have been very quickly taken up by Volvo Cars who have initiated a project to adapt VIN labels in their plants worldwide according to the new standard. <We at Volvo Cars happily lead by introducing one standard for all cars, wherever they are produced, whatever customer they are delivered to," said Erik Uyttendaele, Head of Outbound Logistics EMEA at Volvo Cars>.* End of qoute.

BARCODE QUALITY: TEST CHART KIT for ISO/IEC 24458 provided by JAISA

Universal performance testing of bar code readers can be achieved

Contribution of Hiroyuki Imai,

Japan Automatic Identification Systems Association

ISO/IEC 24458 “Information technology - Automatic identification and data capture techniques - bar code printer and bar code reader performance testing specification” was published on May 5, 2022, which is the first useful international standard that specifies how to evaluate performances of a bar code printer and a barcode reader. Please adopt the new international standard for evaluation of your products.
This standard also specifies test charts to be used for testing of a bar code reader.
JAISA(Japan Automatic Identification Systems Association) has prepared the test chart kit, see figure 6.

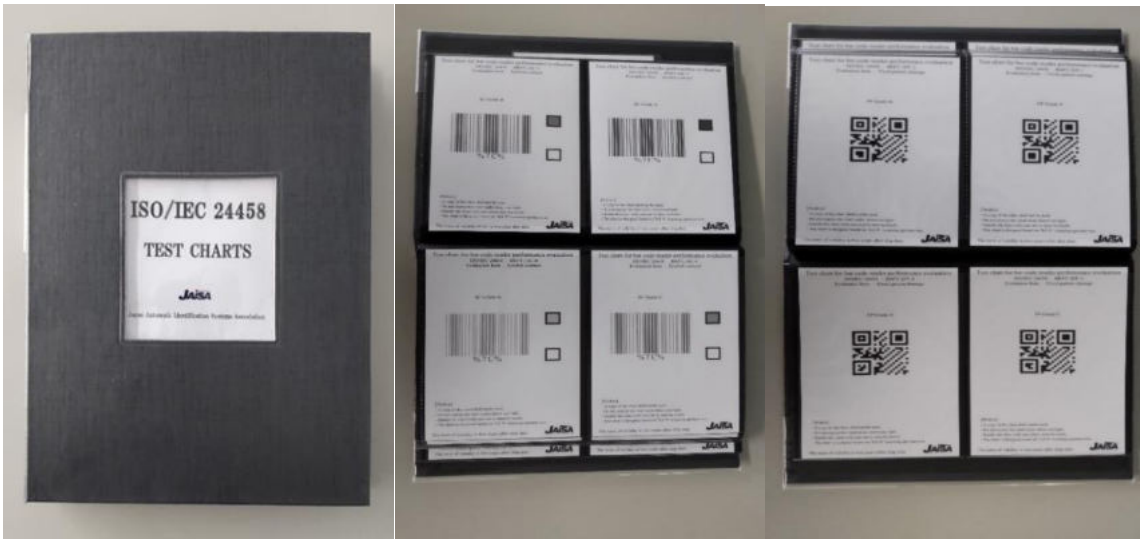


Figure 6) JAISA test chart kit includes 64 test charts for linear and 2d-bar codes

For more details, please visit https://www.jaisa.or.jp/en/?vr

Development URL as header for product identifiers (URL first)

To encode URLs in 2d-Barcode, e.g. in a QR Code, is not a new idea, new is using an URL for unique product identification.

The previous code structures, which always carry an application-related ID, have been joined by codes that are primarily intended for the Internet. We use the term **"UID-first"** to describe the principle of code structures that have been practiced for decades and begin with a system identifier or at least by a data identifier that specifies the meaning of a data element. Examples are a GS1 "GTIN" with leading symbol character "FNC1" as system identifier, a product code proceeded with an “AI” and also product codes applied with ASC-DIs and proceeding system identifier " . " (dot), both if not coded in the multi-format syntax ISO/IEC 15434.
A URL can be appended to this as a data elements if access to the Internet is intended.
Codes with a leading URL can also carry data elements that are supplied with identifiers/qualifiers for parsing and identifying specific data elements suitable for online or offline use.

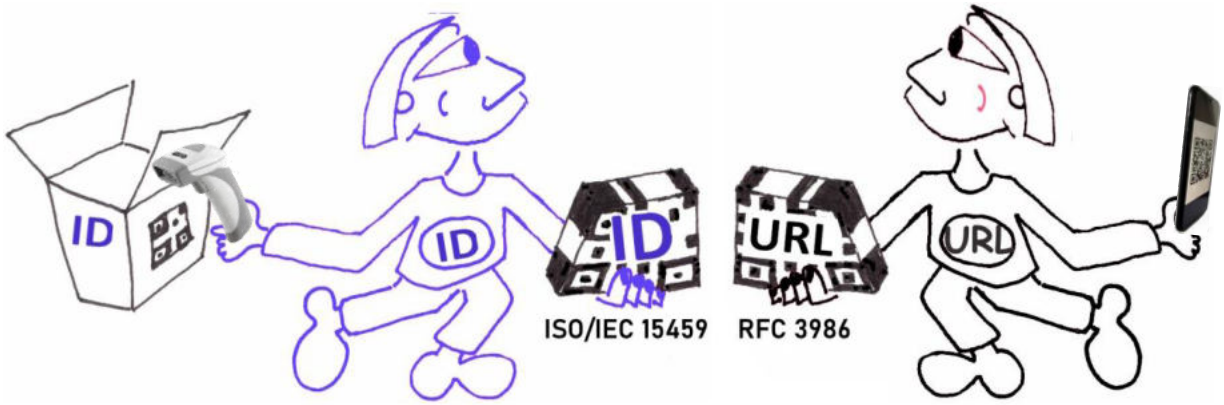


Figure 7) UID-first versus URL-first, one perfect for ERPs the other perfect for smartphones

The "UID-first" principle is generally practiced in production processes and in the supply chain supported by the existing ERP systems with connected scanners (wired, Bluetooth, WLAN), while "URL-first" is primarily appreciated for applications where smartphones are used. The degree to which smartphones are used as data capture devices on ERP systems today is rather unknown. The requirement for interoperability with existing systems and cost-consciousness aims for compatible application of both principles.

The following developments each offer specific features but all of them targed to product identification and access to product information:

GS1 Digital Link has been presented by GS1 to offer URLs applied with "AIs" for both access to a portal and for parsing the data by scanner.

AutoID URL 1.3 has been developed by EDCi for similar purposes but using ASC DIs for identification of embedded data elements.

> ***„URL first"***
> *A code, where "https" is proceeding the data constructed according to URL syntax RFC 3986. The code might include data elements flagged by identifiers.*
> ***"UID" first***
> *A code, where a System Identifier is proceeding the data elements (see table 1) flagged by identifiers (AIs, DIs, TEIs, etc.). This are today's most used standard*

The IEC consortium (IEC SC 65E) had the idea to use an internet domain name as responsible company ID for products and developed

IEC 61406-1 Identification Link. Experiences showed, that such an URL would allow viewing for product attributes with the backbone of the internet only. Since current codes according to ISO/IEC 15459 ("UID first") enable to identify each encoded data element by ERPs in the supply chain safely without any access to the WEB the consequence for the IEC SC was it to add the ability for parsing single data elements out of the code with or without internet as used in existing codes flagged by unique headers (UID first).

The outcome was a similar solution like the AutoID URL 1.3:

IEC 61406-2, Identification Link - Part 2: Types/Models, Batches, Items and Characteristics (status 2024-03: CDV).

In essence, already today we have optional solutions to supplement current "UID first" applications some of them in final development stage:

+ AutoID URL 1.3: ISO/IEC 15459 featured URL for parsing the encoded data elements by help of ASC DIs,
+ GS1 Digital Link 2023: GS1 AI featured URL for linking to resolvers or parsing by help of GS1 AIs,
+ IEC 61406-2 (in development) WEB domaine as company ID followed by data elements fpr parsing by help of ASC DIs,
+ ISO/IEC 18975 (in development) Encoding and resolving identifiers over HTTP (status 03-2024: DIS): Framework for "URL first identification schemes like the 3 above.

Will "URL first" replace "UID first" codes of today?

The figure below is illustrating methods for unique identification of products intended for use in open supply chains globally.

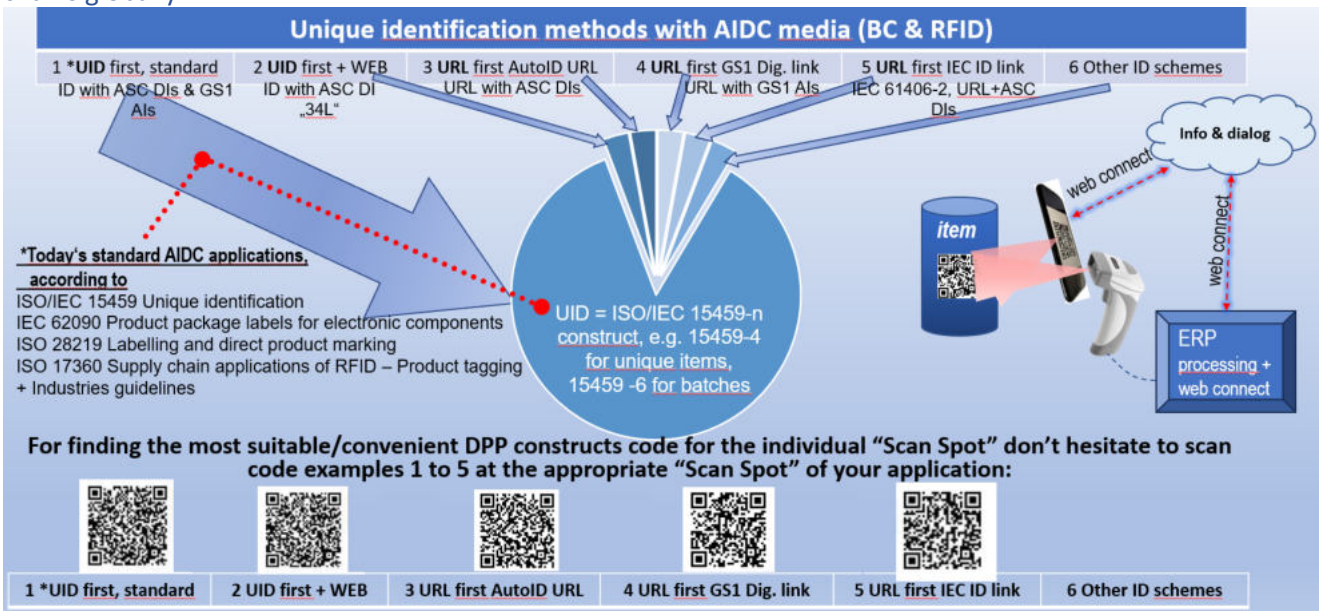


Figure 8) Methods to identify products today and tomorrow

Where method one is the most used method today but not including an URL the methods 2 to 5 include a link to the WEB or represent the link to the WEB.

Note:
For detailled code construct content of example 1 to 5 see https://www.e-d-c.info/en/projects/dpp-passport-en.html, docs: Investigation_of_DPP-ID-Codes_EDCi-whitePaper-r230823.pdf ***and*** *Digital-Passport-ID-methods_part-II_.230328.pdf*

Examples of AutoID methods 1 to 5 and 6 in relevance to DPP

Method 1, example of today's most used method "UID first" without URL

To method 1 belong product codes with GS1 AIs and/or ASC DIs featuring "UID first", this are the most used standard codes for supply chain management, shipment control and tracking and tracing today. Also the codes HIBC, ISBT, IFA Coding system, used for UDI belong to this category. For illustration the examples below show GS1 and ASC structure carrying a product code applied with the attribute "serial number".

Application since the 90th:
All industries, e.g.:
- Air & space.
- Automotive and suppliers
- Chemical
- Consumeables
- Electro, electronic
- Engineering
- Healthcare (UDI, PPN, …)

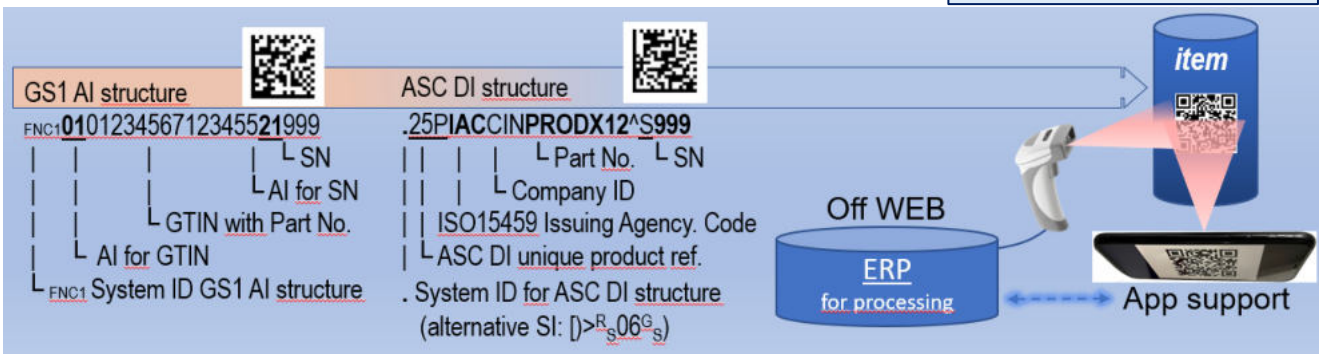


Figure 9) Two examples of "UID first" codes applied with ISO/IEC 15418 GS1 AIs and ASC MH10.8.2 DIs

If additional information is requested, e.g. via Internet, a WEB Portal might be prepared where the product relevant information can be accessed by the product identifier. One example where the UID first product identifier is the reference to the information stored in a WEB portal is the UDI code for medical devices. A typical example is the US GUDID accessible by URL https://accessgudid.nlm.nih.gov/. The product identifier opens access to the product specific information. Same principle is used for Medical Devices in Europe, where the data base is the EUDAMED, opening the portal the product data will be find by help of the product identifier encoded in GS1 AI-, ASC DI-, HIBC- or ISBT-syntax (UID first).

Method 2 "UID-first" for offline identification plus URL for WEB access

These examples are ERP-appropriate because they build on existing practices. There are increasingly corresponding APPs for offline data identification and WEB access for smartphones.

Example "UID-first" code with ISO/IEC 15418 ASC data identifiers.
Uniqueness is based on ISO/IEC 15459-4 in WEB-compatible structure DIN 16598, URL for WEB access is attached and the function is marked by ASC DI "34L".
Data elements: Company ID "QC**COID**", Product Ref.: BATTX99, SN: 1234567, Portal: www.portal-99
Syntax coded in QR: DIN 16598, converted for WEB transfer according to "34L rule": RFC syntax.

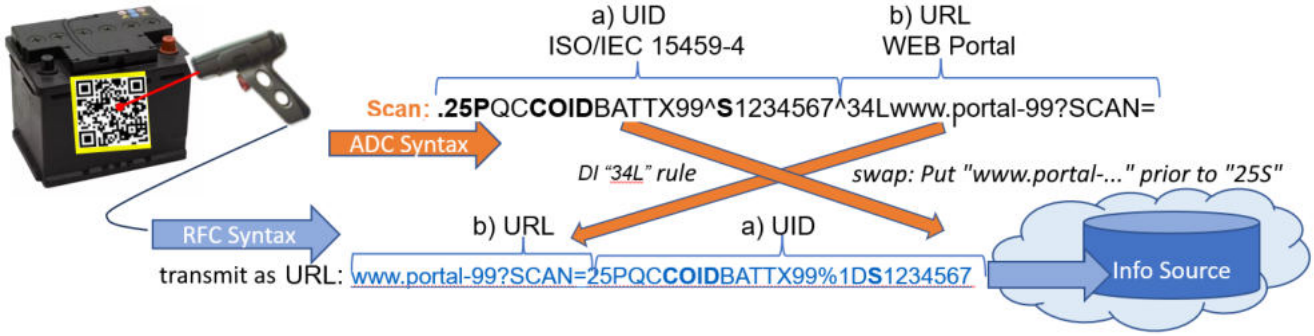


Figure 10 Example A "ID-first code" in ADC syntax, both for offline identification and for Internet access to the individual product data

Note: Other "ID-first" codes according to GS1-GTIN may carry an appended URL using GS1-AI "8200" or as an ASC product code with URL data identifier "33L". This is not illustrated here.

Method 3 to 5 "URL-first" for offline identification and WEB access

These examples of recent developments are smartphone-friendly when forwarded purely via the WEB, but require an APP for offline identification of the data elements. For ERP systems, "URL-first" codes mean interface adjustments, because URLs have not yet been established for globally unique codes according to ISO/IEC 15459. Investigations into the expenses are still pending today. Nevertheless, the "URL-first" solution does show interesting potential if the ERP system can process a code that begins with https://.....
Uniqueness is based on either registered "WEB domain" and/or registered ISO/IEC 15459-2 ID, both of which are centralized hierarchical solutions.
The following examples correspond to the latest developments in 2022/2023.

Method 3.0 "URL-first code" Example AutoID URL in RFC syntax with domain address

and provided with ISO/IEC 15418 identifiers for offline identification. It carries the WEB domain, but uniqueness of the product is based on registered ISO/IEC 15459 -2 ID.
Data elements for B.2.: WEB address: "https://srv.de/ART",

company ID: "QCELMI",
product ref.: "PRODX12",
expiry date: "20241231",
batch/lot: "PXPL",
SN: "YYYY2BB3"

Syntax coded in QR: RFC syntax, structure: AutoID URL 1.3
Uniqueness of data elements: By system identifier "." (dot) before each ASC data identifier.

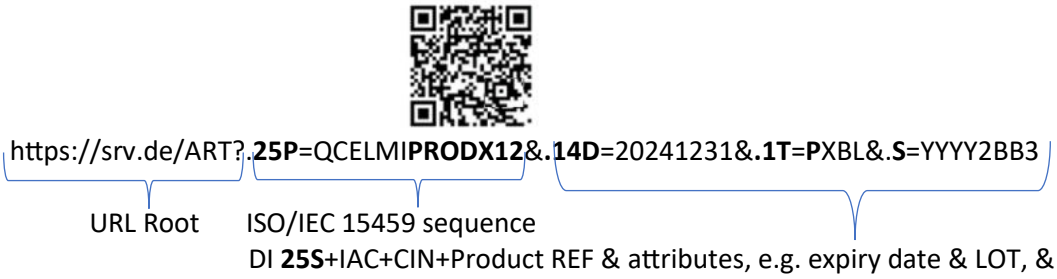


Figure 11 Example B.2.1 "URL first" according to AutoID URL 1.3 specification and RFC syntax, both for access to individual product data via the Internet and for offline identification.

Note: The AutoID structure developed by EDCi and EDIFICE is referenced in the ISO/IEC JTC 1/SC 31/WG 8 project "Encoding and resolving identifiers over HTTP". Details can be found in the specification "AutoID URL 1.3" published under https://www.e-d-c.info/en/documents-en.html

Method 3.1 "URL-first code", example like 3.0, but with data elements common in the **automotive industry** with ASC DI "37S", "DUNS number" from the manufacturer, here: UN123456789, product reference: 99755512300FFFAS and serial number: 123456. The example data for barcode or RFID is taken from the *sources of the automotive industry

(37S)UN123456789999755512300FFFAS+123456

Example headed by URL: HTTPS://WWW.DOMAIN-ABC.COM/SD09FQW4
building the AutoID URL: HTTPS://WWW.DOMAIN-ABC.COM/SD09FQW4?37S=UN123456789999755512300FFFAS%2B123456
and encode in AIDC media, e.g. QR Code:

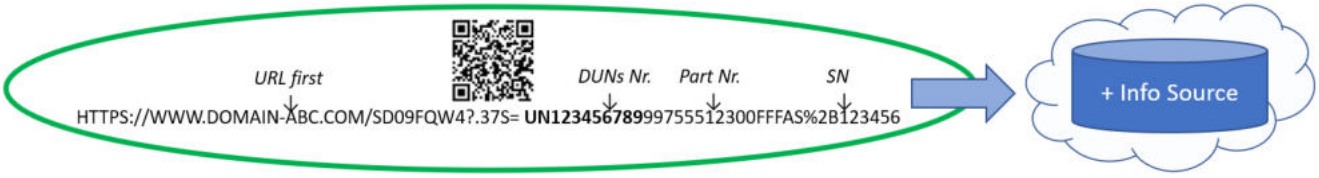


Figure 12 Example B.2.2 "URL first" according to the AutoID URL 1.3 specification with automotive-specific data elements for barcode and/or RFID and online and offline identification (Data character "+" coded as "%2B" in URL).

**Sources: LR05:2017, RFID Item Level Standard ODETTE, AIAG, JAMA, JAPIA, LR07:2021 ODETTE, VDA 5509_Version_1.1.2*

Method 4 "URL-first code", example GS1 Digital Link in RFC syntax, domain address and provided with ISO/IEC 15418 GS1 application identifiers for optional offline identification.
Data elements for B.1.: WEB address: https://example.com, company ID in GTIN "(**01**)08506000123252", product ref.: in GTIN, SN: (**21**)1234567,
in QR coded syntax: GS1 Digital Link, RFC syntax.

https://example.com/**01**/08506000123252/**21**/1234567

Figure 13 Example B.1. "URL first" in GS1 Digital Link and RFC syntax, intended for both access to individual product data via the Internet and for offline identification.

Method 5 "URL-first code" Example IEC 61406-2 Identification Link
like Method 3.0, but with the stipulation that the "domain owner" is also the person responsible for the prouct and data and an ISO/IEC 15459 ID may serve as an option.
The example in Figure 14 has the product reference 1A2B3C, SN 54321 and optional company ID as DUNS number. UN123456789, headed by the domain ID.

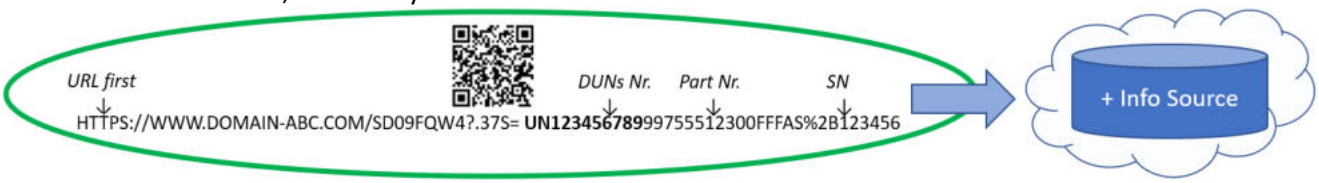


Figure 14 Example B.3. "URL first" according to IEC 61496-2.

Method 6 Other code structures, such as UUID

In addition to the centralized code structures, decentralized structures are also sought for the DPP. Among other things, the "UUID (Universal Unique Identifier)" was mentioned, which is used as a generation aid to identify information in computer systems, e.g. with a time stamp.
In <https://de.wikipedia.org/wiki/Universally_Unique_Identifier> you can read:
"A UUID consists of a 16-byte number written in hexadecimal and divided into five groups. For example, in its normal form a UUID looks like this:
"550e8400-e29b-11d4-a716-446655440000"
For a UUID in a code for WEB functionality, a URN with a domain name is prefixed, e.g.:
"https://example.com/550e8400-e29b-11d4-a716-446655440000"

Of course, the meaning of this URL only becomes apparent when the corresponding website at **https://example.com** is opened.

Such a URL, or any other URL, cannot therefore be used without the Internet to identify the meaning of this URL or the data elements it contains even without the Internet, for example at scanning points of ERP systems in the supply chain.

This also applies to a UUID, but if you want to specify the responsibility for the UUID, then this can be achieved using a standardized data identifier, which establishes responsibility for the data string (in the example the UUID), e.g. through ISO/IEC 15418-ANS MH10 .8.2 DI "5R". The defined sequence of this data identifier is:
<System identifier><DI><ISO/IEC 15459 Issuing Agency Code><Company ID><Value>. In this sequence, the above UUID becomes traceable through Issuing Agency Code (IAC) and Company ID (CIN) even without WEB and is distinguishable from any other UUID or UUID-like number. Below is the UUID example with DI "5R", IAC "QC" and Company ID "COID", which represents the responsibility for the character string. The example is initially designed for local identification without the Internet and can be converted into RFC syntax at any time with a URN.

The sequence is led by the system identifier <.>, the UUID by the separator <:>

<.><5R><QC><COID><:><**550e8400-e29b-11d4-a716-446655440000**>

.5RQCCOID:**550e8400-e29b-11d4-a716-446655440000**

Figure 15 UUID code with responsibility provided by DI "5R", IAC "QC" and Company ID "COID".

Although responsibility is determined with DI "5R", "IAC" and "CIN", it is not yet clear whether it is, for example, just a serial number or a product code or something else. This could be solved by identifying the UUID as a serial number, e.g. with DI "S": (S)**550e8400-e29b-11d4-a716-446655440000** and the affiliation to a specific product by a preceding product code, as in the example shown in method 3.0.

Outlook for the development of DPP

It will be exciting to observe which of the illustrated versions of the codes are preferred and by whom, the established methods or the new developments. In the same way, it will be interesting to see which specifications and rules will be created through standardization.

Digital Product Passport – DPP considerations

Figure 16 Graphic DPP Info emblem (EDCi)

Since the standardisation request for a DPP standard was directed from the European Commission to CEN JTC 24 DPP Framework and system and kick off took place 2023-12-18 in Bruxelles four working groups have been assigned for realisation of the work:

- WG 1: Strategic Advisory Group
- WG 2: Unique identifiers and data carrier
- WG 3: Security
- WG 4: Interoperability framework

Many ideas have been brought in already, e.g. how to use the internet for both identification and information. Six methods for designing unique codes for DPP have been illustrated under chapter above "Will "URL first" replace "UID first" codes of today?". The DPP WG2 working group will certainly look into these methods, but the outcome of the work will only become apparent in the final DPP standard, where many different players are involved.

The DPP code is the key to the DPP information

The DPP code shall be carried on the relevant products for their lifetime. The regulations determine which products have to get a DPP identifier, e.g. batteries, textiles, electronic items, etc. The DPP identifier as key shall enable access to product information for all market participants by scanning the DPP code; specific information is reserved for the authorities. DPP identifier + data carrier + IT structure will form the DPP system.

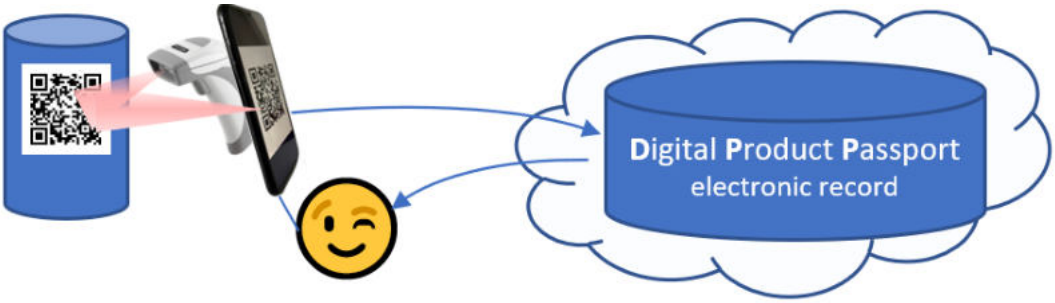


Figure 17 Encoded DPP identifier linking to the DPP electronic record

The purpose of the DPP code is to uniquely identify the individual product so that unambiguous identification and access to the DPP data via scanner is guaranteed.

The DPP code as a data carrier should be able to be designed according to standards in an technology-independent manner. The DPP code carries the DPP identifier with optional attributes. Despite the requirement for technology independence, there is a favorite for the data carriers, namely the QR code, which is already

mentioned as a DPP data carrier by the battery regulation. The DataMatrix code is also mentioned offering some advantages like automatic error correction and convinient character sets. Variations are the rectangular variants of QR and DataMatrix, or even the Aztek code, which does not require an edge zone.

Since smartphones are intended as recording devices for consumers, the radio-frequency technology RFID with NFC is also suitable. For both cases, an emblem is attached that visually indicates that it is a DPP code, for example the emblem “DPP” plus an optical code and/or plus an RFID emblem according to EN 16656. This is also the case if you choose RFID attached, but still add an optical data carrier to offer hybrid function, e.g. 2D barcode +RFID. The DPP code can then be recorded using both an optical code and radio frequency RFID, depending on the equipment of the reading devices in question.

Figure 18 DPP Emblem options to QR and to RFID Emblem EN 16656 (proposal EDCi)

The DPP identifier

The DPP identifier in the European DPP SYSTEM serves to uniquely identify an individual product; optional atributes are added to identify parameters, encoded in the DPP data carrier for identification at any point in the supply chain. The standard “ISO/IEC 15459 Unique Identification” plays an important role in the standardisation request, which regulates the responsibility for uniqueness of the product codes. However, the DPP identifier targets to product-specific information on the internet. Although comprehensive product information is possible in offline mode, in the event of a lack of network access, network interruptions, failures, etc. Same product information can be available in the code for offline scanning, e.g. company ID, product reference, date of manufacture, serial number or lot number and other product-specific attributes as parameters, that are also important for logistics.
Here, offline means identification without Internet access, suitable for recording and processing product ID and attributes using ERP systems. The Internet should be used for online functions with comprehensive access to information using a URL. The requirements results in typical elements of a DPP code:

→ Leading identifier that it is a unique code/identifier applied with system identifier for recognition of the coding system being used
→ Reference to the responsible party of the product (globally unique company ID, e.g ISO/IEC 15459-2.
→ Reference to the product (REF, article, part number)
→ Serial number or, if applicable, lot number
→ optional attributes such as manufacturing date, expiry date, color, ...
→ URL to access the DPP data
→ Security mechanisms

The relevant ISO/IEC standards to realize uniqueness are largely based on ISO/IEC 15459.
However, according to the EC, “decentrally” organized DPP identifiers should also be possible; the implementation needs to be illustrated in more detail, also with regard to the identification of contained data elements without internet consultation.

ISO and working groups for AIDC

ISO/IEC JTC 1/SC 31 Automatic identification and data capture techniques

The joined committee 1 of ISO and IEC was found in 1996 having got the responsibility for AIDC governed by the ISO secretariat in Geneva. The responsible ISO Technical Programme Manager [TPM] is
Dr Anna Caterina Rossi. Current chairman of the committee is Henri Barthel, committee manager is Eddy Merill. Members are delegated from national standardisation bodies of all continents in the world, they carry out the active work. SC 31 includes 4 working groups (WGs):

WG 1 Data carrier, Convenor Sprague Ackley
WG 2 Data and structures, Convenor Rainer Schrundner
WG 4 Radio communication (RFID), Convenor Josef Preishuber-Pflügl
WG 8 AIDC Application of AIDC standards, Convenor Jeanne Ducket

SC31 is coordinating the standardisation projects for all working groups. The committee members decide on accepting new projects as on final release of standards. Votings will be done on full planery level where the WGs are reporting to.

WG1 Data carrier

Convenor: Sprague Ackley (USA)
From “Code 39” to “Just another Barcode”, from printing to verifier quality.

WG1 Data Carrier is responsible for standardisation of optical symbols for automatic identification. It includes the work on new standards, like recently Data Matrix Rectangular Extension (DMRE), Micro QR Code R (Rectangular) Version and the colored code “JAB” but it includes also maintenance of existing standards with updates and optimisations. Quality specifications for printing, reading and verification belong to WG1 as well.

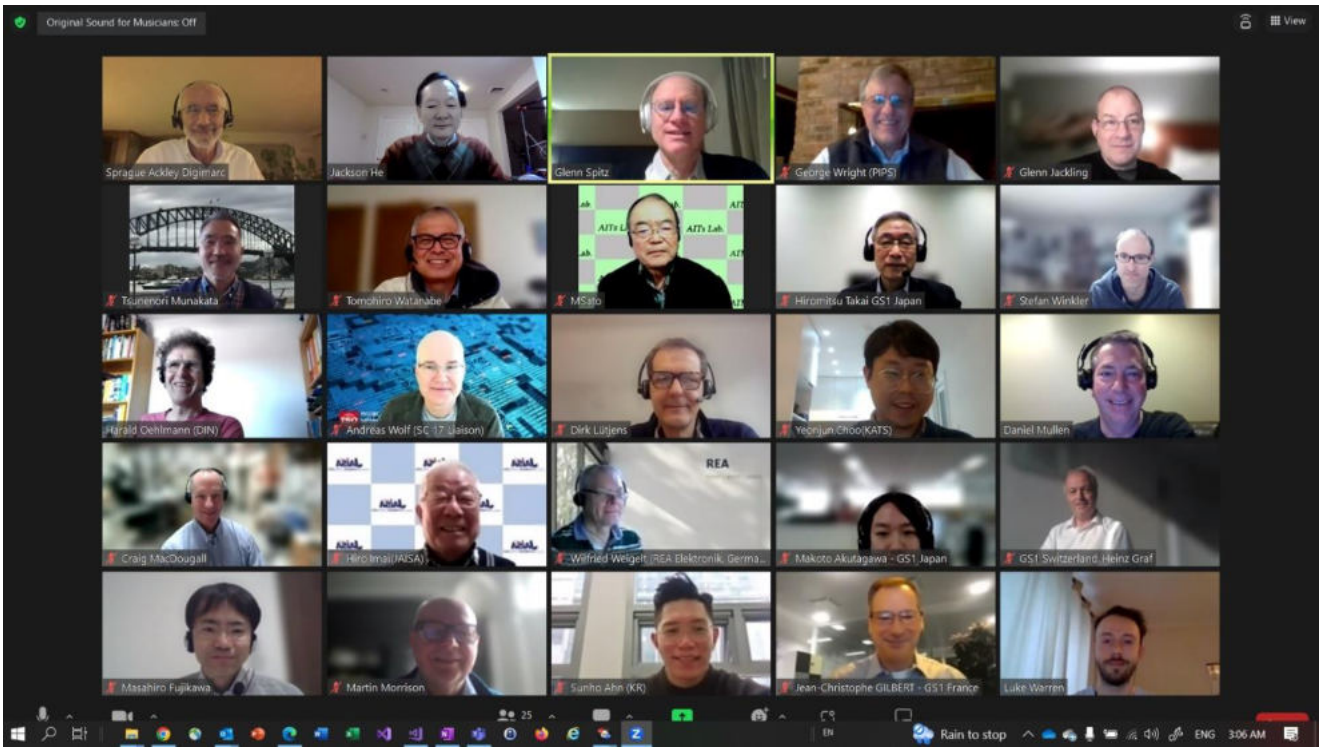
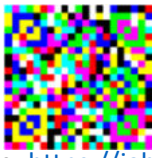
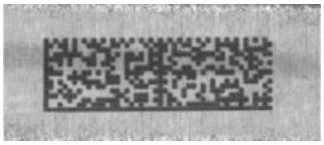


Figure 19 Screenshot group photo virtual WG 1 meeting 2023

The convenor Sprague Ackley has got the best experts for optical recognition for the very detailled work. Usually WG1 meets twice a year for three days each F2F or virtually.

Table 2 is illustrating some of the symbols subject of the WG1 work.

ISO/IEC 21471 DMRE Data Matrix Rectangular Extension, 18 rectangular formats have been add to the 6 original formats for more data on small surfaces by 24 rectangular sizes, e.g.  See: www.dmre.info Project editor: Harald Oehlmann	ISO/IEC 20830 Han XIN code a 2-dimensional matrix code developed by the Chinese Standards Institute and specialized for China character sets and URLs. See: https://committee.iso.org/standard/69321.html?browse=tc Project editor: Wang Yi

Table 2 continued	
QR Code extension: ISO/IEC 23941 Rectangular Micro QR (rMQR) is following the idea of DMRE and in “approval stage (50)” for estimated publication early in 2022. See www.iso.org/standard/77404.html Project editor: Tomohiro Watanabe	ISO/IEC DIS 23634.2 Just another Bar code (JAB) is a color code for high volume data capacity and variable shape.  See: https://jabcode.org/ Project editor: Waldemar Berchtold
Revision of ISO/IEC 16022 Data Matrix The standard is getting an update reflecting the development of “continuous grading” and other technical details.  Project editor: Harald Oehlmann	ISO/IEC 29158 Quality guideline for direct part marking (DPM). Features : “Continuous Quality Grading”, with numeric intermediate values of grades 0.0 to 3,9 and tilted camera position for pinned codes.  Project editors: Masahiro Fujikawa and Harald Oehlmann

Actually WG1 produced new editions of the symbology specifications of Data Matrix, QR Code, Aztec Code, EAN/UPC and Code 128 got an amendment elemininating older editing errors. It proves that maintenance is necessary for increasing the quality and to answer application requirements.

Selection of some new editions include:

ISO/IEC 16022 Data Matrix third edition
Key points are:
Extended Channel Interpretations and rectangular formats passed from optional to mandatory feature
— The historic Data Matrix variant **"ECC 000" to "ECC 140" was removed** from the document.
— **Continuous quality grading** according to ISO/IEC 15415 and ISO/IEC 29158 DPM was introduced to all quality measurements.
— Transition ratio grading was changed.
— New quality parameter “print growth” added.
— **Revised reference decoder.**
— **Clarification on interleaving blocks for 144x144 matrix size** for correct implementaions of this format.
Specifically the clarification was found as very appropriate due to non-conforming implementaion in printing and reading software occuring in the market. Such wrong implementation leads to error correction failure.

→ ***Manufacturers of software and devices are recommended to check the conformity of their developments.***

— **Continuous quality grading** according to ISO/IEC 15415 was introduced to all quality measurements of ISO/IEC 18004 QR Code, ISO/IEC 24778 Aztec Code and ISO/IEC 15420 EAN/UPC.

In addition to work assigned by the SC31 plenaries WG1 actively is corresponding with many groups using the WG1 symbologies, e.g. ISO/IEC JTC1 SC17 (see next chapter).

WG1 for languages in AIDC Media

To encode terms and words in specific languages is a rising demand in the world of global trade. Encoding shipment addresses or names are simple examples. The demand by the European Automotive Industry to encode licence plates into AIDC media initiated a project to unify the support of character sets outside of ASCII. All 2D Symbolgies feature an ISO-Latin-1 default character set (except JAB: UTF-8) and the capability to change to other encodings using an ECI code. An example is ECI 26 for UTF-8 to encode any Unicode character.

Figure 20 name with national character in barcode. Ssource: Harald Oe, Jackson He

This capability is wide spread and changed from optional to mandatory feature in many symbology specifications like ISO/IEC 16022 Data Matrix Edition 3 in the last years.
The ISO/IEC AWI 7430 standardisation project thought this capability to the end by making the decoder responsible for character set encoding.
Unfortunately, this project was aborted in the middle of development by the application of a time constraint of 18 months not recommended for new projects.
Nevertheless, WG1 decided to relaunch the project and eventually re-issue a new work item proposal in 2025 with a new project leader and hopes for more support by SC31.

WG 1 contribution for Machine Readable Travel Documents

"Uniqueness of the data carrier content, avoiding overlapping"
WG 1 cultivates cooperation with ISO/IEC JTC1 SC17 WG3/TF5 and the INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO). This consortium is currently working on the "ICAO Datastructure for Barcode" for MACHINE READABLE TRAVEL DOCUMENTS and consulted WG1 for symbology questions. Touching the content of document codes it turned up that the flag character of the intended code would easyly overlap with other codes applied with other internal structures or applied with ASC MH10 Data Identifiers. As a result, SC17/WG3 will apply for an ASC DI as unique flag for the ICAO Datastructure for Barcode in the course of finalising the specification.

Figure 21) Cover TR ICAO Datastructure for Barcode, source ICAO

WG2 Data and structure

Convenor: Rainer Schrundner (Germany) became Convenor of SC31 WG2 in 2021. WG2 is responsible for key standards of AIDC data structures and syntax such as ISO/IEC 15459 Unique Identification, which forms the basis for unique identifiers (see ANNEX Quick Guide) in Auto ID Data carriers. WG2 is also responsible for general security aspects, such as ISO/IEC 20248 DigSig (project editor: Bertus Pretorius). RFID issues are excluded and assigned to WG4 RFID.
Mr. Rainer Schrundner reported that the six parts of ISO/IEC 15459 entered into systematic review.
Project editor is: Harald Oehlmann.
The Parts of ISO/IEC 15459 Unique identification consist of
— Part 1: Individual transport units
— Part 2: Registration procedures
— Part 3: Common rules
—Part 4: Individual products and product packages
— Part 5: Individual returnable transport items (RTIs)
— Part 6: Groupings

The standard or parts of ISO/IEC 15459 are referenced by several national and international regulations becoming binding rules for unique IDs for companies and products such as for Medical Devices (UDI), TOBACCO Europe, Military (NATO) and everywhere where traceability is to be achieved under legal aspects and regulations.

ISO/IEC 15418 GS1 Application Identifiers and ASC MH10 Data Identifiers and maintenance is under the responsibility of WG 2 as well but maintenance of the identifiers is delegated for **GS1 Application Identifiers to GS1** and for **ASC MH 10 Data Identifiers** to ANSI MH 10.8.2 (see DIMC).
Both maintenance committees support continous updates by identifier assignements on request of user groups.
Another key standard is under review is
ISO/IEC 15434 Sntax for high-capacity ADC media, convenor: Craig A. MacDougall (USA).
This multible structure syntax allows to encode mor then one structure in one code, like UN EDIFACT structure and ASC DI structure in one codde or GS1 structure and ASC DI structure.
The latest update includes the JSON structure as format 14. Format indicators identify the formats being used:

Format indicator |	Format description
00	*Reserved for future use*
01	Transportation
02	Complete EDI message / transaction
02	Structured data using ANSI ASC X12 segments
04	Structured data using UN/EDIFACT segments
05	Data using GS1 application identifiers
06	Data using ASC MH10 data identifiers
07	Free form text
08	Structured data using CII syntax rules
09	Binary data
10-11	*Reserved for future use*
12	Structured data following text element identifier (TEI) rules
13	*Blocked for use to avoid conflict with ISO/IEC 15961-2*
14	Data using JSON syntax
15	ISO/IEC 20248 verifiable data construct (DigSig)
16-99	*Reserved for future use*

ISO/IEC 15434 multible format syntax for 2d & RFID

PROS and CONS of ISO/IEC 15434

ISO/IEC 15434 has pros and cons for the applications. Pros is the strong autodiscrimination and the multiple structuring options.
Cons is the character set with NON-printable characters like <rs>, <gs>, <eot>. Such characters don't pass keyboards and are not WEB compatible.

Note: *Solution for Keyboard and WEB compatibility for ASC DIs see DIN 16598.*

WG 2: ISO/IEC 20248 Digital Signature Meta Structure for bar code and RFID

Contribution by the editor Bertus Pretorius, Solutions Architect

The most modern Automatic Identification data standard, ISO/IEC 20248 Information Technology - Automatic Identification And Data Capture Techniques - Data Structures - **Digital Signature Meta Structure**, is fondly known by its developers and users as the DigSig Standard, specifies the syntax for the specification of a schema-based data structure using a X.509 Digital Certificate. The use of X.509 (both the certificate and the digital signature) provides for the verification of issuer, schema (data structure definition) and the data. ISO/IEC 20248 uses JSON as the specification and data delivery method, as such, fully interoperable with all modern Cloud and IoT systems. JSON (ISO/IEC 21778) has become the default message format for the Internet.

DigSig
ISO/IEC20248

The picture Fig. 21) depicts a 3rd License Plate windscreen label. It contains a DigSig data structure in the QR code and in the embedded RAIN tag providing for secure manual access using a mobile phone to the tag data (QR and NFC) and fully automated access to the data (RAIN).

Figure 22 Windscreen label applied with RFID and QR and embedded DigSig

EDCi certificate with ISO/IEC 20248 DigSig

Issuing Agency EDCi is applying DigSig secured QR code to any CERTIFICATE confirming validity of CIN registrations. Reading the code and transmission the URL to the WEB will provide access to the registry file of the individual CIN. The “pop up” will display address of the CIN holder and validity, active, passive or expires.

The Online Verifier for the CIN certificates is hosted by TRUEVOLVE. For more information see https://truevolve.com/suite-20248/

Figure 23 DigSig secured Code links to the verification page of the dedicated CIN Certificate.

For more information on DigSig application see AIDC Report 2020 and https://digsig.io/

WG4 Radio communication (RFID)

Convenor Josef Preishuber-Pflügl

The RFID Emblem ISO/IEC 29160 is the logo for RFID and it’s applications.

Figure 24 RFID Emblem ISO/IEC 29160

Originally developed by CEN as a warning sign ISO/IEC 29160 RFID emblem is used for the indication “Where you see the RFID emblem – RFID is in”. It can be considered as a warning “pay attention – you might be identified” or it can be an indication that the item can be scanned automatically.
RFID is still an emerging technology for supply chain management applications. WG 4 developed quite a number of RFID-related work items by help of about 12 editors. Today the work is moving to reviews and updates of existing standards. Still one of the basic standard is ISO/IEC 15963 for the Tag ID being important for the Tag identification and anti-collision in bulk reading processes. Updates include integration of sensor functionality in RFID tags. While barcode standards have long been established and mature, RFID standards still have some catching up to do, especially with regard to interoperability and for hybrid solutions with RFID and barcodes as reciprocal backups. Application standards such as the electronic type plate and RFID for railways, as well as industrial guidelines of user groups, such as the automotive industry, are based on the standards of WG 4. Security mechanisms for RFID using cryptographic methods are attracting increasing interest for protecting the data in the RFID data stream. ISO/IEC 29167, Part 1 forms the basis for the implementation of various security features with RFID. The standard defines the architecture for security services for the air interface of RFID according to ISO/IEC 18000 by so-called "crypto suites", which can be used by the tags according to the applications. Each "Crypto-Suite" is described in its own ISO/IEC 29167-x standard part, like part-19 is defining the "RAMON" crypto suite. The names of the "suites" refer to the algorithm being used. The security experts have to make the recommendations as to which mechanism provides the security required for the specific application.
ISO/IEC 20248 DigSig is another method to secure RFID applications. More and more countries use RFID for car license plate recognition where the DigSig is used for anti-counterfeiting. DigSig can be used for any RFID application where authentication is required (see chapter ISO/IEC 20248).

RFID standards for AIR Interfaces, Data Structures, Security, Quality measurement, etc. are the base for the RFID APPLICATION standard ISO/IEC 17360 of WG 8 but also WG8 standards are the base for guidelines and specifications of industries and associations like the RAIN Alliance, or AIAG, JAIAG and ODETTE for automotive industries.

That the **RFID industry is growing** reported Chris Diorio in a release of the RFID Chip manufacturer IMPINJ March 21, 2024:
(quote): *Impinj recently shipped its 100 billionth tag chip, an amazing milestone on our journey to connect every thing. Even more amazingly, we shipped more than half of those chips in the past four years, a testament to our market and our opportunities. Looking back, our industry's tag chip unit volumes grew at a remarkable 29% CAGR for the past 13 years. Looking forward, I can almost feel a trillion tag chips in our sights* (end of quote).
reported.
Standardistion might be one reason of the growth of the RFID and Chris Diorioi was contributing to it remarkably in addition to all other promoters of the standards. In other words: "No standard – no growth".

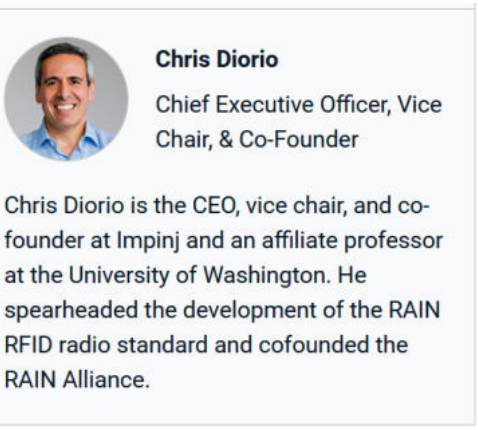


Figure 25 Chris Diorio

WG8 Application of AIDC standards

Convenor: Jeanne Dukket (USA)
Current projects are in development by WG8:

- ISO/IEC 8506 AIDC Application in Industrial Construction, Project Leader (PL): Wang Yi (China)
- ISO/IEC 18975 Encoding and resolving identifiers over HTTP, PL: Phil Archer (GS1)
- ISO/IEC 17360 Supply chain applications of RFID — Product tagging, product packaging, transport units, returnable transport units and returnable packaging items, PL: Bertus Pretorius

Project ISO/IEC 8506 AIDC Application in Industrial Construction

The quoted introduction is giving reasons, why China initiated the project:
The construction industry is one of the largest industries in the world, with a long history that spans almost the entire human history. Under the background of today's digital economy, the traditional construction industry is facing many challenges such as digital transformation, improving efficiency, improving productivity, green and low carbon, and reducing supply chain costs.
Accordingly the scope defines:
…. the identification data, information services, application guidance aspects, and applicable requirements of AIDC technology for different items and their hierarchy in Industrial Construction during their whole life-cycle. It:

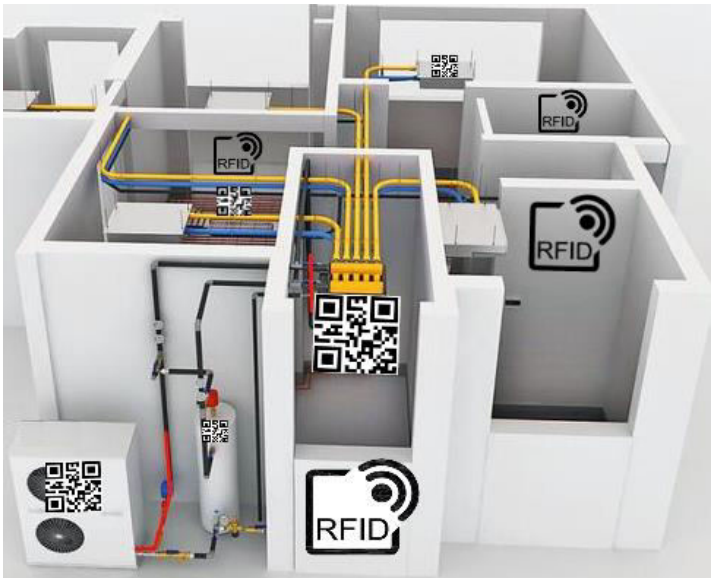


Figure 26 ISO/IEC 8506 for use of AIDC in industrial construction

—provides unique identification for items in Industrial construction.
—specifies the semantics and data syntax to be used.
—specifies the data carriers to be used on items of various categories, substitutes, and sizes.
—makes recommendations about the metadata of the items.
—specifies the application test method and parameters based on the large scale test and scientific sampling rules.
—defines the information services protocol to be used as interface between business applications and the AIDC system.
—makes guidance for designers, workers, engineers, managers, end users and maintainers about the AIDC application in their daily work.

The specification is in a good shape, thanks to the project leader Wang Ji and the contributing members of WG8.
The work was recognised by the European Workshop “CEN WS_Position markers for digital applications on construction sites, structural monitoring and *BIM-applications for possible synergy effects”. The workshop is aiming to a solution to mark positions in a construction by help of QR code and RFID and to store information related to it in a data base accessible via internet.

**Note: BIM stands for “Building Information Modeling”*

Project ISO/IEC 18975 Encoding and resolving identifiers over HTTP

ISO/IEC 18975 is a project on data structures but assigned by the committee management to WG 8 Application of AIDC standards insteadt to WG2.
Facing the rising interest in “Item to Internet Communication” and the developments of “URL first” code solutions, GS1 initiated ISO/IEC 18975 as a framework where the current developments should fit in (see chapter above ‘Will “URL first” replace “UID first” codes, method 3 to method 4).

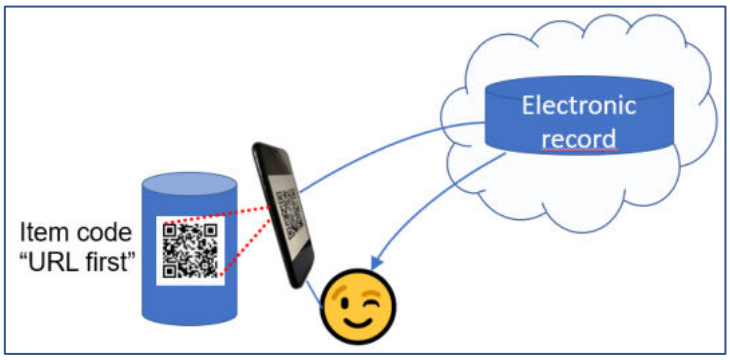


Figure 27 Item to Internet by ISO/IEC 18975 framework

The scope of the standard tells about the approaches as follows:
Quote *‘This document defines different approaches for using HTTP URIs to encode globally unique identifiers. It specifies a dual use data structure. It is both an HTTP URI and a composition of structured item identification properties and optionally descriptive attributes. These can be decomposed and interpreted on their own and/or be used as a pointer to additional information.*
Different methods are described to enable unique identification in the context of AIDC. These rely on either:

1. *identifiers, such as described in ISO/IEC 15459, in the path or query string independent of the internet domain name; or,*
2. *the internet domain name.*

The document further defines a basic common API for querying online services for information about identified items. ‘End of quote.

The framework is designed, so that GS1 Digital Link, AutoID URL/*Object-ID URL and IEC 61406-2 Identification Link, part 2 would fit in specifically.

**Note: Object-ID URL is a term developed by DIN NA 043-04-31 AIDC for upgrading AutoID URL 1.3 as DIN standard.*

Project ISO/IEC 17360 RFID for supply chain applications

Title: RFID — Product tagging, product packaging, transport units, returnable transport units (RTIs) and returnable packaging items (RPIs).

Originally the project was initiated by ISO TC 122 Packagung but 2021 the project was moved to SC31. The original 5-part standard will be bundled into one standard only covering the levels 0 to 4 (see figure below). Layer 5 is not part of the specification.

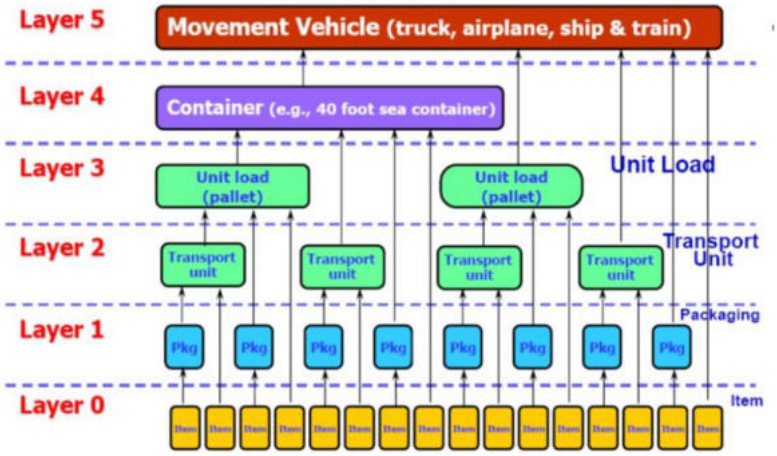


Figure 28 ISO/IEC 17360 layers 0 to 4

ISO/IEC 17360 layers are targeting to compatibility with corresponding barcode application standards dedicated to ISO TC 122 Packaging, WG 12 Supply chain applications of logistics technology.
The current status of the standard is “Draft International Standard-DIS”.

ISO TC122/WG 12 Supply chain applications of logistics technology

Convenor Dr. Shinchi Ishii (Japan)
The following Approved Work Items /AWI) are re-opened existing standards for potential updates in course of the 5 years maintenance cycle, like alignement with other corresponding standards:

- ISO/AWI 28219 Packaging — Labelling and direct product marking with linear bar code and two-dimensional Symbols. Project Leaders Dr. Harald Oehlmann/ Mr. Steven Keddie.
  This specification is corresponding to RFID project ISO/IEC 17360, layer 0
- ISO/AWI 22742 Packaging — Linear bar code and two-dimensional symbols for product packaging, P.L. Dr. Harald Oehlmann/ Mr. Steven Keddie
  This specification is corresponding to RFID project ISO/IEC 17360, layer 1.
- ISO 15394:2017 Packaging — Bar code and two-dimensional symbols for shipping, transport and receiving labels has been decided for re-opening as well and Dr. Harald Oehlmann has been nominated as P.L. This specification is corresponding to RFID project ISO/IEC 17360, layer 2

Other work items in process of WG 12:

- Proposed Work Item PWI 24168 Returnable Transport/Packaging Items — RFID data for logistics operations, P.L. Dr. Robert Williams, Proposers: Mr. Yasuhiro Morimoto, Mr. Naoki Shinkai.
  This PWI shall become a Technical Report (ISO TR) titled "Effective use of RF tags on returnable transport items (RTIs) to obtain information about goods on/in” RTIs" and the TR reports will be based on the findings obtained from the results of five demonstration experiments using 17360-compliant RTI management tags.
  Such practises to encode not only an RTI ID but also any single item packed in an RTI can be seen as 2d-barcode solution in industries (like, Automotive, Electronic, Healthcare, …). A term for such an application is “PaperEDI (PEDI)” using the hierarchical encoding structure with ASC DI “F”. The project leader will mention this as a meanigful option.

Figure 29 RFID to carry RTI content data. Source PWI 24168

Annexes Standing Information on Uniqueness and AIDC

ANNEX 1 „UNIQUENESS“

"Uniqueness is a prerequisite for unambiguous identification. This is why codes for global use in the supply chain must have uniquely marked data elements. Uniqueness can only be achieved through international agreements, through standardization.
A character string, e.g. 0123456XY, can be recognized within a system by "looking up" its meaning, but not in open systems, where it is just any number.

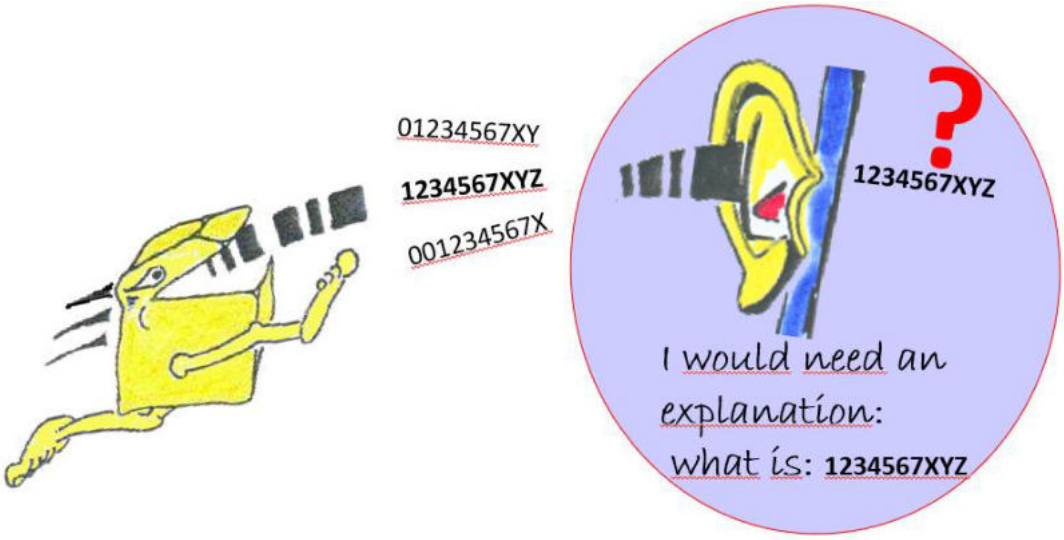


Figure 30 A number is a number, understanding the meaning needs a explanation

The understanding what kind of number is encoded in AIDC media can only be achieved through the relevant standards, such as "ISO/IEC 15459 Unique Identification" and specifically by help of Application Identifiers and/or Data Identifiers according to ISO/IEC 15418 .
Standardized identifiers enable unique identification of code content across systems, e.g. “I’m bringing a transport unit from LILY” (Fig. 31).

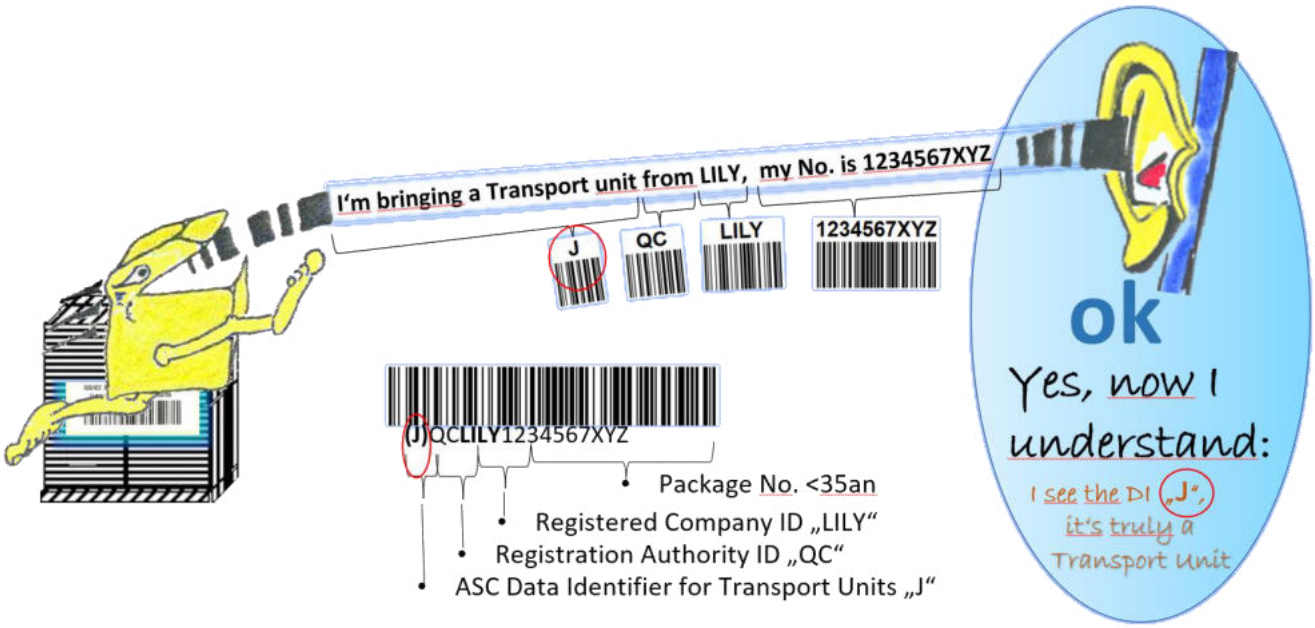


Figure 31 A number with explanation: I'm LILY and that's my product "1234567XYZ"

The above code guy is delivering transport unit 123456XYZ from the labeler QC LILY, identified by the standardised Data Identifier “J”. This is fully understandable throughout the supply chain.

In barcode typical ASC MH 10 Data Identifiers and GS1 Application Identifiers are used, the example above uses ASC MH 10 Identifier “J” for License Plates of transport units.
As an additional level of security for identifying the code structure and content correctly, System Identifiers determine which type of identifiers characterize the data elements, e.g. the "FNC1" a GS1 AI structure, the "Dot (.)" an ASC DI structured code, a "Plus (+)" a HIBC code, etc. (see chapter "System Identifier").

Annex 2 Quick Guide for globally unique labeling of items “Unique ID”

by help of the ISO/IEC 15459 - Hierarchical A, B, C, D structure

The rules for unique codes are as simple as effective:
ISO accredits a "Registration Authority" **(A),** which in turn registers Issuing Agencies **(B)**, which assign unique "Company Identification Codes-CIN" to companies **(C)** on request. Companies that have got a "CIN" are in a position to label everything that shall be identified uniquely and everywhere.

Hierarchy of global uniqueness for items according to ISO/IEC 15459 UNIQUE IDENTIFICATION

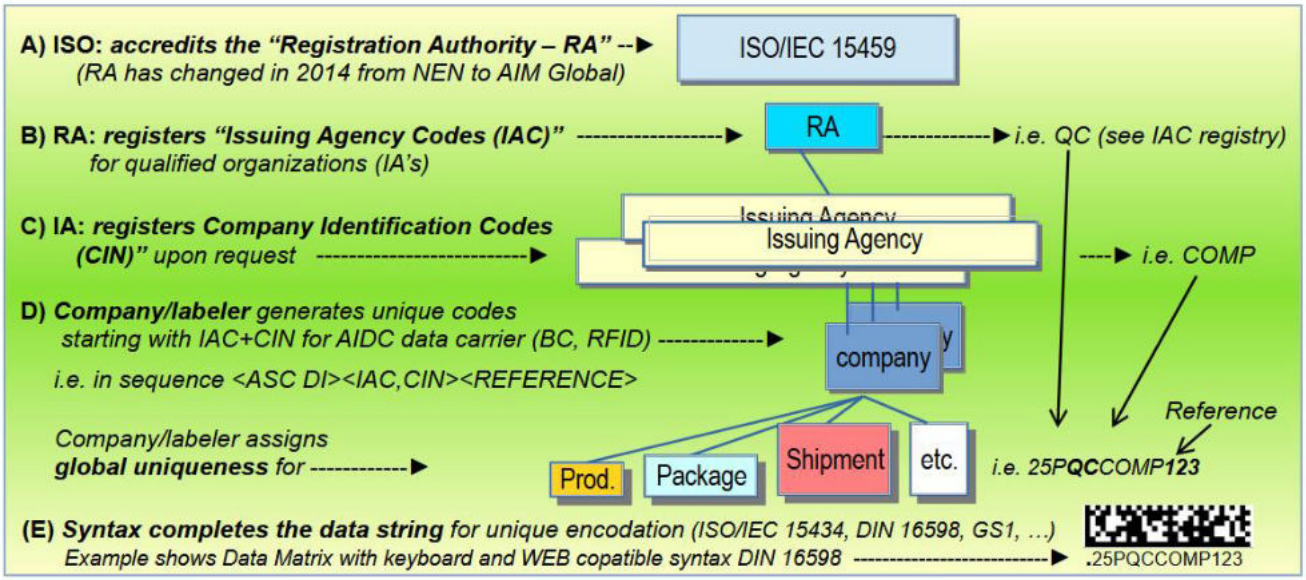


Figure 32 Hierarchically distributed responsibility for unique labelling snf identification

How do you generate a unique product code?

The prerequisite for generating an unique code is to get a CIN from an Issuing Agency. This Issuing Agency also determines the syntax for encoding. If the Issuing Agency supports the "ISO/IEC 15418-ASC MH 10 Data Identifier (DIs)", then the product reference can be alphanumeric. In case of GS1 syntax with Application Identifiers (AIs) then the key product reference of the product is numeric, called GTIN. The data length for ASC DI data elements can be from 1 to over 20 characters. For GS1 AIs, the product reference like the "Global Trade Item Number (GTIN)" is 14 digit long including company/location code and product article number. Other Issuing Agencies like EHIBCC include ASC DIs as well in the HIBC structure for up to 18-digit alphanumeric product codes.

Quick Guide with 6 steps for a unique product code conforming to ISO/IEC 15459-4

using the product reference REF: **M4215R73** and SN **1234567** as example data:

I) Determine the format of your product reference with fix or variable length, e.g. alphanumeric **M4215R73**

II) Decide on an Issuing Agency supporting your format for product codes

- ➔ a) if there are 5 digits, → both ISO/IEC 15418 ASC Data Identifiers and GS1 Application Identifiers and HIBC syntax can be used (also depending on the customers business area).
- ➔ b) if more than 5 digits or alpha characters like the example above → go to a registry that supports ASC DIs.

III) Apply for a CIN, e.g. "COMP" from "EDCi" (IAC "QC") with support of ASC DIs for alphanumeric product codes.

IV) Choose the appropriate ASC-DI “25P” for the sequence "unique product code" <DI><IAC><CIN><REF>
and form the data string:

- ➔ a) generate data string for REF **M4215R73:** <25P><QC><COMP><**M4215R73**>
- ➔ b) for individual serialization add DI "S" and serial number e.g. **1234567** for coding as:
  <S><**1234567**>, add more data elements such as LOT, date, etc. as required using appropriate ASC DIs

V) Select syntax DIN 16598 for Keyboard & WEB compatibility or ISO/IEC 15434 for high volume data

VI) Choose the appropriate medium, e.g. Code 128 for low volume or Data Matrix and/or RFID and encode the data string. The eExample is using Keyboard and WEB compatible encoding: **.**25PQCCOMP**M4215R73**^S1234567 for encoding in Data Matrix and RFID.

That’s it --► ...the unique string is generated visibly in 2d-code and invisible in RFID

.25PQCCOMP**M4215R73**^S1234567

Figure 33 *ISO/IEC 15459-4 conforming serialised product code in hybrid technology 2d-code and RFID*

Annex 3 Who supplies unique Company Identification Numbers (CIN)

Issuing Agencies serve for Uniqueness according to ISO/IEC 15459-3 Common Rules.

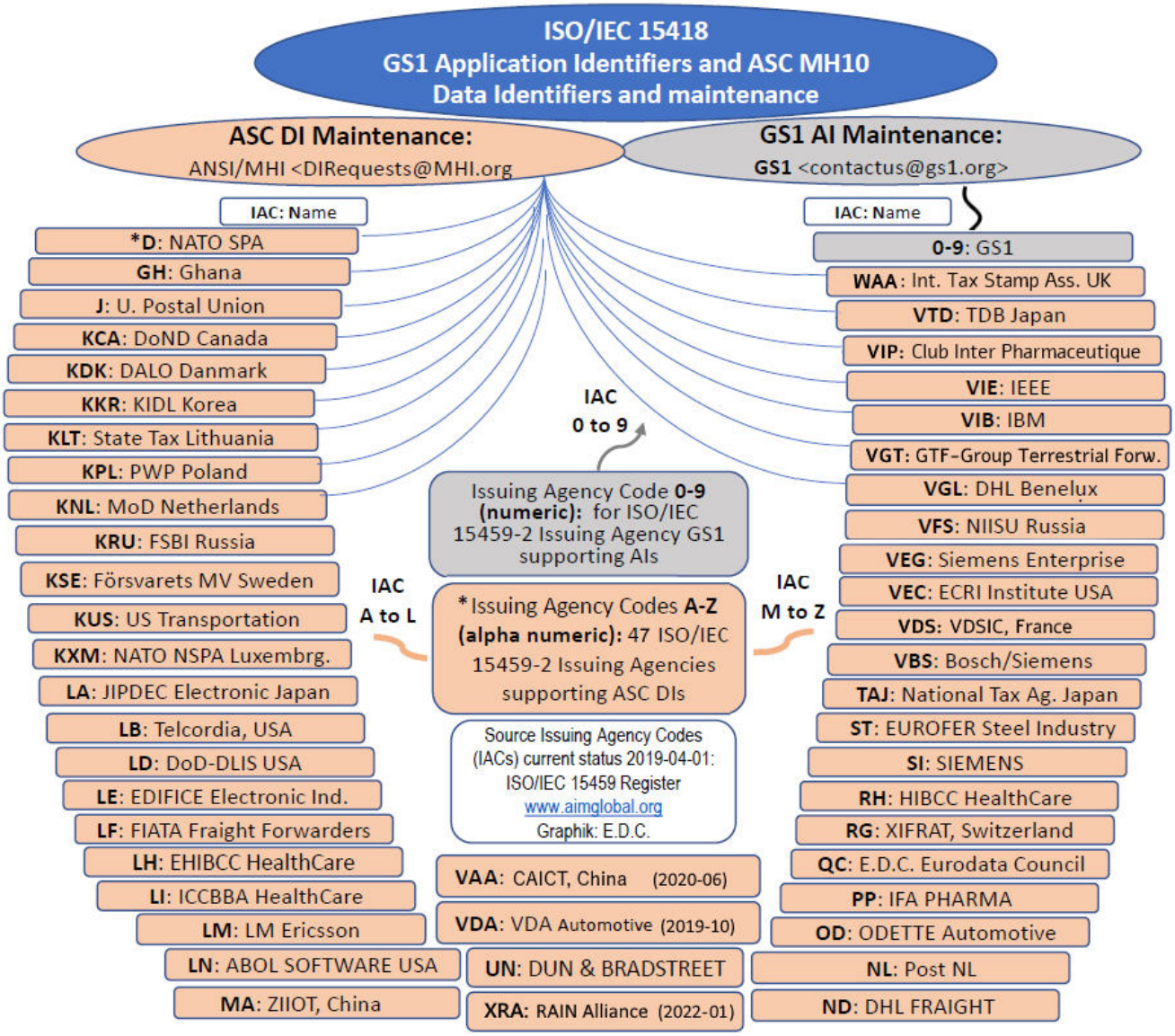


Figure 34 ISO/IEC 15459-2 accredited Issuing Agencies assign Company Identification Numbers (CIN) for unique identification codes conforming to ISO/IEC 15459-1, 3, 4, 5, 6

AIM Global is the appointed Registration Authority for maintenance of the ISO/IEC 15459-2 Registry. Access to the list is public accessible by https://www.aimglobal.org/uploads/1/2/4/5/124501539/register-iac-def_2022.pdf

Note: *Issuing Agency Codes (IACs) and assigned CINs do not become unique by themselves but in conjunction with the rules of ISO/IEC 15459-3. For example an IAC *D alone may mean different things under different context, like "D" for Deutschland" or a "3" as first number of a CIN from GS1 (GS1 prefix) may be part of a generic number. Same with all other IACs. ASC DI's and GS1 AIs supply the meaning for IAC & CIN sequences (see annexes 1 and 2).*

ANNEX 4 Selection of AIDC technology and application standards

Comprehensive document

ISO/IEC 19762 Harmonized Vocabulary, 5 languages (+ Japanese under work)

Documents of ISO/IEC JTC 1/SC 31/WG 1 Data Carrier

ISO/IEC 15417 Code 128
ISO/IEC 15438 PDF 417
ISO/IEC 16022 Data Matrix
ISO/IEC 18004 QR Code
ISO/IEC 15415 Bar code symbol print quality test specification-Two-dimensional symbols
ISO/IEC 15416 Bar code symbol print quality test specification-Linear symbols
ISO/IEC 16480 Reading and display of ORM by mobile devices
ISO/IEC 30116 OCR Quality Testing
ISO/IEC 21471 Extended Rectangular Data Matrix DMRE

Documents of ISO/IEC JTC 1/SC 31/WG 2 Data Structure“

ISO/IEC 15418 GS1 Application Identifiers and ASC Data Identifiers
ISO/IEC 15434 Syntax for High-Capacity ADC Media
ISO/IEC 15459 Unique Identification, Part 1 to 6
ISO/IEC 29162 Guidelines for using ADC Media (Bar code & RFID)
ISO/IEC 29161 Unique Identification for IoT
ISO/IEC 20248 Digital Signature meta structure

Documents of ISO/IEC JTC 1/SC 31/WG 4 RFID for Item Management

ISO/IEC 18000-1 REV 1 (including Battery Assistants, Sensor functions)
ISO/IEC 18000-2 AMD 1 (including Battery Assistants, Sensor functions)
ISO/IEC 18000-6, part 61 to 64, rev. 2 (incl. Battery Assistants, Sensor functions)
ISO/IEC 18000-7 REV 1 (including Battery Assistants, Sensor functions)
ISO/IEC 15963 Tag ID: applied with the list of IC manufacturer IDs
ISO/IEC 29160 RFID Emblem
ISO/IEC 24791-Part 1 to 6 Software System Infrastructure (SSI)
ISO/IEC 24753 RFID & Sensors with reference to IEEE 1451.7
ISO/IEC 15961, 15962: RFID Data protocol – Update
ISO/IEC 15961-4: Sensors commands (NP)
ISO/IEC 29172-19179 Mobile item identification and management
ISO/IEC 29143 Air Interface Specification for Mobile Interrogators

Documents of ISO/IEC JTC 1/SC 31WG 4/ RFID Security on Item Management

ISO/IEC 29167 Air Interface for file management and security services for RFID
ISO/IEC 29167 part 10-19 crypto suites with ISO/IEC 19823-X Conformance test methods
ISO/IEC 17360 Supply chain applications of RFID — Product tagging, product packaging, transport units, returnable transport units (RTIs) and returnable packaging items (RPIs)

Documents of Liaison ISO TC122/WG 10 for BC&RFID applications

ISO 22742 Linear bar code and two-dimensional symbols for product packaging
ISO 28219 Labeling and direct product marking with linear bar code and 2d- symbols
ISO 15394 Bar code and 2d- symbols for shipping, transport and receiving labels

IEC Standards

IEC 61406-1 Identifcation Link, part 1: General requirements
IEC 61406-2 Identifcation Link, part 2: Types/Models, Lots/Batches, Items and Characteristics

DIN Standards

DIN 66401 Unique Identification Mark – UIM
DIN 66403 System Identifiers
DIN 66277 Identification plate with RFID tag and/or 2D bar code
DIN 16598 Syntax keyboard and Web compatible encoding of data elements applied with ASC Data Identifiers
DIN Spec 16589 Product to Internet communication - Pointer to Process

Other relevant AIDC and Application standards

CEN 1573 Multi-Industry-Transport Label, www.din.de
IEC 62090 Product Package Labels for Electronic Components using Bar Code & 2-d symbologies
Global Transport Label V3, www.odette.org
Global Guideline for Returnable Transport Item Identification, www.aiag.org
GS1 Global Specifications, www.gs1.com
HIBC Health Industry Bar Code, www.hibc.de
PaperEDI-Standard, www.e-d-c.info
EDIFICE-Guideline WEB AND KEYBOARD COMPATIBLE ENCODING WITH ASC DATA IDENTIFIERS, www.edifice.org
AutoID-URL 1.3, www.e-d-c.info

Note: ISO, CEN and DIN standards are also available from all national institutes, e.g. via www.din.de

ANNEX 5 The UDI Book

On 26 September 2014, the law for barcodes on every medical device (UDI) came into force in the USA; on 5 April 2017, the corresponding EU regulation for Europe was published. Due to the penetration of these projects for the entire healthcare supply chain, DIN/BEUTH-Verlag published the reference book "UNIQUE DEVICE Identification" on 16 May 2017. The publication date matches the publication date of the Medical Devices Ordinance (MDR), in which "UDI" is integrated as a core element. The book provides instructions for UDI-compliant labelling for the manufacturer, but also informs users in hospitals how they can benefit from the legal requirements for UDI, because UDI is intended to increase patient safety and efficiency for all parties involved. With UDI, legislators are aiming for 100% barcodes for all medical devices. This will motivate users to implement AIDC in all areas where error-free recording is required. The book is written in German.

URL to the book: http://www.beuth.de/de/publikation/udi/228007232
URL to the MDR and IvDR: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017R0745

ANNEX 6) LIAISONS WITH INDUSTRY AND HEALTHCARE COOPERATING WITH THE REPORT:

- AIM DACH - AIM Germany, Austria, Switzerland, www.AIM-d.de
- CAICT - China Academy of Information and Communications Technology, www.caict.ac.cn
- DIN NA 043-01-31 - German Institute for Standardization, www.din.de
- EDIFICE, Global Network for B2B Integration in High Tech industries, Europe, USA, Asia, www.edifice.org
- EDCi - Eurodata Council Institute e.V., www.e-d-c.info
- IFA - Information Center for Pharmaceuticals, http://www.ifaffm.de/en/ifa-coding-system
- JTCH AIDC - Joined Technical Committee Healthcare, www.e-d-c.info www.vddi.de
- Shi Yu, Consulting, Beijing/Washington D.C.
- ZIIOT - Zhonguancun Industry & Information Research Institute of Two-Dimensional Code Technology

Logos of cooperating partners:

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Impressum
EDCi committee
Chair Heinrich Oehlmann
Eurodata Council Institute e.V.
06618 Naumburg, Germany
Status: Not for Profit Association
Register of Associations Stendal, Germany, Reg.-No. VR 6180
Phone: +4934456781160
Email: info@e-d-c.info, https://www.e-d-c.info