AIDC Standards Report

Automatic Identification & Data Capture
Update 2020

Fig. 1) ISO/IEC JTC 1/SC 31 virtual plenary meeting 2020 in action,
source: SC 31+ELMICRON.de

Australia	Austria	Belgium	China	Canada	Switzerland	Germany	Finland	France
Japan	Singapore	S. Africa	S.Korea	Sweden	NL	Russia	UK	USA
.. and contributing organizations, e.g.:								
AIM	**CEN TC225**	**NATO**	**EDC**	**ETSI**	**GS1**	**IATA**	**HIBC**	**ISO TC122**	**ISO SC17**	**ITU**	**UPU**

Fig. 1b) International Standardization: Flags and abbreviation of ISO/IEC JTC 1/SC 31 member countries

Continued report on the standardization of Barcode, RFID and its data structures and theire applications for automatic identification & data capture, traceability and the Internet of Things (IoT)

Content

Fig. 2) AIDC emblem, source E.D.C.

AIDC Standards Report 2020
Focus: ISO/IEC SC 31 VIRTUAL PLENARY MEETING and AIDC developments

FOREWORD

Since the report Dec. 11/12, 1997 on the ISO/IEC JTC 1/SC31 committee meeting „Item Management“ at BSI, London, the team of editors found it more than beneficial to continue collecting and distributing news about AIDC in view of standardization. Meanwhile it is a tradition to report on AIDC standardization and application of the standards. Originally the format of the previous reports since 1997 began with the focus on the the yearly plenary meetings of ISO/IEC JTC 1/SC 31 completed by the annexes with information on AIDC technology related issues and applications. Specifically the appendixes carried information of general interest being asked to become reproduced in succeeding reports in order to keep such infos present. This was the reason to decide for a change of the format of the report. Now the report will begin with a standing part on history and the structure of ISO/IEC JTC 1/SC 31 followed by news of the current year with focus on the latest plenary meeting. Elements of previous reports of special interest will stay in the report as annexes. The advantage for the reader shall be to keep specific information visible. This format will allow that the report grows as constantly updated source for information.
The team of editors would be happy to get input about the new format and its content.
On behalf of the editors team,

Heinrich Oehlmann

Breaking News

ISO/IEC JTC 1/SC 31 Automatic identification and data capture techniques plenary meeting
from Cape Town to WEB conference (see page 8)

IAC "VAA" for CAICT, China
The China Academy of Information and Communications Technology (**CAICT**) became Issuing Agency. The Registration Authority AIM registered the **IAC "VAA"** for CAICT according to ISO/IEC 15459-2 (for more information see contribution from Mr. Xiaoyu YOU, CAICT, page 21).

MHI celebrating 75th anniversary, responsible for maintenance of ISO/IEC 15418-**ASC MH 10 Data Identifiers**
Bill Hoffman has been confirmed in July 2020 as **chairman** for the **Data Identifier Maintenance Committee** (DIMC). DIMC is a sub-committee of the Material Handling Institute (MHI), celebrating 75th anniversary. MHI's DIMC is responsible for the maintenance of part ASC MH 10 Data Identifiers accredited under the rules of ISO and ANSI. Any ASC DI application request are processed by that committee (latest requests see page 24).

IFA CODING SYSTEM for UDI
The Issuing Agency IFA GmbH, maintaining the IFA Coding System, has been accredited as Issuing entity **for UDI** in Europe (Regulation 2017/745) jointly together with GS1, HIBC, ICCBBA,
see page 26)

ASC DI "54P" or UDI-DIs
A new **ASC Data Identifier** "54P" has been assigned August 2020 which is common for all of today's and future accredited options of "Unique Device Identification – Device Identifiers (UDI-DI)". Data elements applied with ASC DI "54P" will point straight to the governmentally controlled UDI data base(s). The ASC DI "54P" has been designed specifically for use with ISO/IEC 15434 containers applied to shipment labels or documents
(see page 25).

Web and keyboard compatible barcode structure succeeding
Guideline for Web and keyboard compatible encoding with ASC Data Identifiers (EDIFICE) is on the way to standard DIN 16598. The character "."(dot) becomes popular even for use with single ASC DI data elements to differentiate between standard and non standard. What the "dot" for ASC DI data elements is the "FNC1" for GS1. The "dot" does not replace ISO/IEC 15434 but will complement it (see page 28).

DMRE
ISO/IEC 21471 Data Matrix Rectangular Extension **(DMRE) published 2020-02-03**
This extension of Data Matrix suits very good for extremely rectangular marking spaces and with higher data volume, as required for tracking and tracing like for UDI (see page 35)

SC 31 calling for editors
Editors for key ADC standards are for call, like for ISO/IEC 15459-2 Unique identification, all parts, ISO/IEC 15418 – GS1 Application Identifiers and ASC MH 10 Data Identifiers, ISO/IEC 15434 Syntax for high-capacity ADC media, etc. (See page 16)

RFID
AIM became Registration Authority for RFID Tag IDs according to ISO/IEC 15963 Part 2: Unique identification for RF tags registration procedures (see page 17, WG4).

Fig. 3) ISO-Banner, source www.iso.org/home.html

AIDC - Automatic Identification and data capture more than a technology

a module of data processing and information systems

Some history:

Early in the 1970's, it was discovered that computing is fine, but errors always creep in when data from materials and processes is entered manually. These errors spoil the quality of information and database contents, even this may endanger human lives. Barcodes, however, can solve this problem.

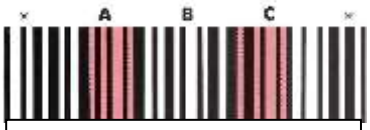

Fig. 4a) USD-3 Code 39 (3 of 9) now ISO/IEC 16388

As early in 1974, David C. Allais, founder of Interface Mechanism Inc (INTERMEC), developed the barcode Code 39 (3 out of 9) for alphanumeric data. However, it took some time before the barcode method established itself as a global basis for automatic data acquisition. One reason was certainly the lack of internationally available standards. It was only when hardware manufacturers joined forces in an association to promote this technology through standards that barcodes became widely established. The consortium was called "AIM, Automatic Identification Manufacturers", and still bears the abbreviation "AIM" in extended objectives. The US-based AIM initiative produced the "Uniform Symbol Descriptions (USD)" in 1981, e.g. "USD-1" for the barcode "Interleaved Two of Five" (I 2/5) and "USD-3" for Code 39. For example, the automotive industry uses Code 39 as "AIAG symbol specification B1", the US military sector as "MIL-STD-1189" for the "Uniform Product Code Council-UCC" in 1984, the "UPC barcode" as barcode for retail. Later the UPC Codes were enhanced by adding a 13th digit. This was initially used in Europe and therefore the enhanced code was called European Article Number in short EAN. Meanwhile the article number is called GTIN and the barcode symbology is the EAN and UPC code. National standardization institutes, such as the American Institute ANSI, adopted original AIM barcode specifications as national standards and supplemented the data identifiers ANSI/FACT-1 in 1991 to form a complete system consisting of data carrier and syntax. But the internationality was still missing at time.

In 1980 Craig K. Harmon wrote the book entitled "Reading between the lines", now 40 years later we read between the bars and dots black and white and colored but still we call it Bar Code →

1d linear Bar Code | 2d stacked Bar Code | 2d Dot Matrix Codes | 3d Color Code

Fig. 4b) Barcode development from linear to 2d and up to 3-dimensional

International standardization of AIDC began with CEN in Europe

The **European Standards Committee "CEN"** also launched an initiative in 1992 to bring the barcode method into an European form so that the standards could be referenced as binding standards under European law. For this purpose, the "CEN TC 225" Working Group for AutoID was founded. This group adopted selected standards to become European Standards (EN), such as AIM USS Code 39 in EN 800 and the ANSI FACT Data Identifiers Standard in EN 1571. The initiative was supported by associations and organizations interested in the internationalization, dissemination and adaptation of AIDC standards for common use. This includes **EDIFICE** for the electronics industry, the EAN-UCC network, now **GS1, ODETTE** for the automotive industry, **HIBCC/EHIBCC** for healthcare and many others. However, national and European standards are still not sufficient to serve the global market.

Global standards need to be published from the International Standards Organization (ISO) to become effective for world wide application.

To achieve this, the ISO/IEC JTC 1/SC 31 committee, SC 31 for short, was founded in 1996 with responsibility for AIDC under the umbrella of ISO/IEC JTC 1. SC 31 began to harmonize the ANSI and EN standards and to publish them as ISO/IEC standards. For example, USD 3 and EN 800 finally became ISO/IEC 16388 Code 39.

After **migrating the AIDC standards to the ISO level**, the CEN members recognized the advantages of the decision to have the AIDC standards globally available and reduced the EN projects to those with specific European relevance alone. For example, the European Union asked for an appropriate emblem in connection with the "Privacy Regulation" for RFID. CEN TC 225 was able to adopt the RFID emblem ISO/IEC 29160 developed at ISO level as EN ISO/IEC 29160 and publish it in the 3 CEN languages D/E/F in a simple manner. However, regularly, the opinion is shared that AIDC standards intended for the expert can remain at ISO level in only one language, namely English. Today ISO/IEC SC 31 offers all necessary standards for the global use of AIDC media barcode, OCR and RFID, including quality test specifications and data syntax for information content.
Following the **20th anniversary** plenary session in Sapporo in 2016 further developments were also apparent at the sessions 2017 in Stockholm, 2018 in Chicago and 2019 in Qingdao and at latest at the virtual meeting June 2020.

Fig. 5) ISO flag and background, source: ISO, Geneva

AIDC - the means for accuracy, efficiency and traceability

In 1992, 28 years ago, Pieter de Meijer and Lucas Schouten wrote the book entitled "No Barcode, No Business". Indeed, this has come true today. No shipment without a barcode, no food or non-food product, no electronic component and in future no medical device is conceivable without a barcode. Even the advertising departments discovered that QR code is good for business. Ministries recognized that AIDC is essential for product traceability, such as medical devices in the healthcare supply chain. In April 2017, for example, the **European Parliament** decided that all manufacturers of medical devices and in vitro diagnostics must affix a unique ISO-compliant barcode wherever the products are manufactured. The term "Unique Device Identifier (UDI)" was created for this purpose, under which barcode is a must and RFID an option. **The US parliament** decided this 3 years earlier and more and more countries will follow the recommendation of the International **Medical Device Regulatory Forum (IMDRF)** to implement UDI in the region. Due to UDI manufacturers actually find themselves in the "No Barcode, No Business" situation, in accordance with legal requirements. Same happens in other business areas like **TOBACCO** and **Medicinal Products**. The technology standards are provided by ISO/IEC JTC 1/SC 31 as modules for implementation, e.g. the "ISO/IEC 15459" module, which defines the hierarchical structure of uniqueness for unique codes.

IMDRF International Medical Device Regulators Forum

Even if laws do not directly demand the use of barcodes & RFID everywhere, companies easily run into problems if they do not introduce AIDC technologies. No use of use ISO-compliant AIDC drops competitiveness of a business. Applying the AIDC technologies is a benefit for them as well as the customer. As a matter of fact the consistent use of AIDC avoids internal and external errors, simplifies all logistics and accelerates processes. Of course, the implementation of AIDC in the process stages of supply, production, supply and application requires specific expertise because reading the AIDC standards is usually not really the core competence of management. However, "high level" application recommendations are also available, such as "DIN SPEC 16599 Automatic identification and data capture techniques - traceability". DIN 16599 contains **common practice solutions**, but also future aspects already today. For example, the code functionality of unique object identification, combined with a direct link to information on the Internet, i.e. the "Internet of Things (IoT)". While regular barcodes according to basic standards are becoming a prerequisite for survival in specific markets, innovative options increase competitiveness. Current examples are the mentioned link from the product ID to the IoT, as well as a Data Matrix on delivery notes, called "**PaperEDI**". The P'EDI solution enables the content of an entire pallet to be scanned in one hit, for example in incoming goods areas, "without unpacking or typing". Increasing "**security mechanism's**" are required in specific application areas of bar code and specifically of RFID, e.g. for pure identification plus additional verification or authentication. This is facilitated with the "ISO/IEC 20248 Digital Signature" option.
This report is under continuous update for providing an insight into this interesting technology and application area and the team of authors is happy to advise on such strategic approaches in more detail.

The Committee ISO/IEC JTC 1/SC 31

for Automatic Identification and Data Capture

is embedded in the ISO/IEC network for standards that connect the world

The standardization institutes form numerous Working Groups for the most diverse areas of interest.
ISO/IEC JTC 1/SC 31 was specifically formed by stakeholders to harmonize standards for automatic identification and data collection. SC 31 is integrated into the infrastructure of the Joint Technical Committee 1 (JTC1) of ISO and IEC with a focus on standards for information technologies. Figure 6) shows an excerpt from the structure of this standardization network.

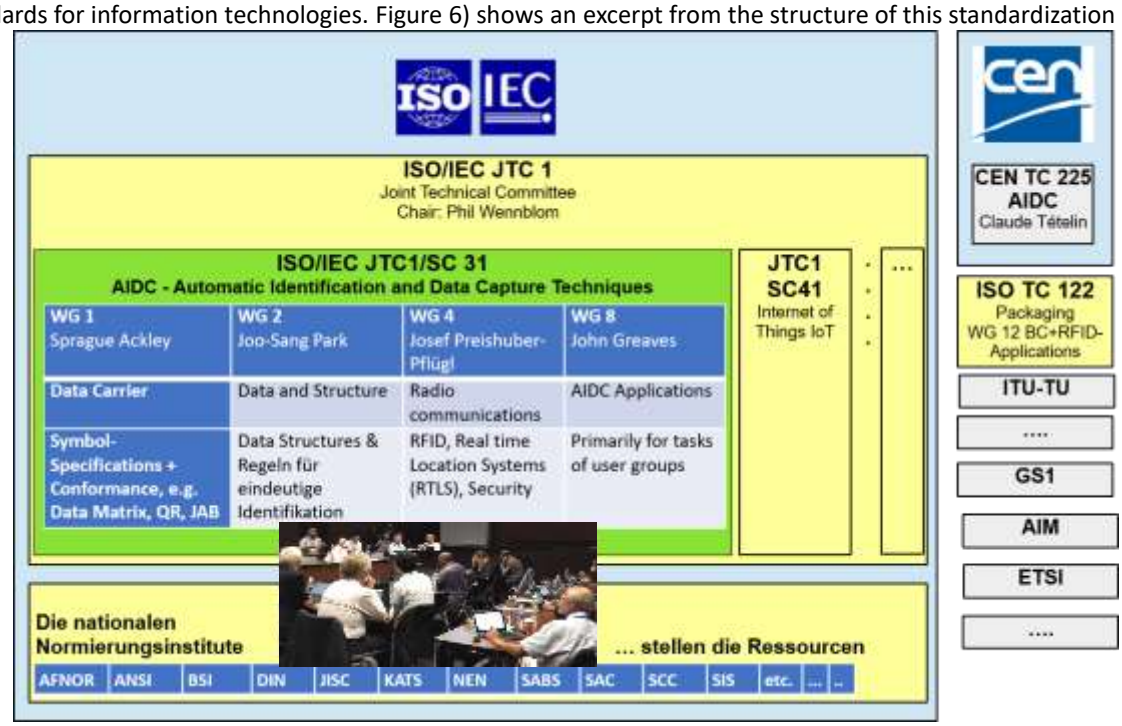

Fig. 6) Structure of ISO/IEC JTC1/SC 31, embedded in the network of ISO and IEC, and related organizations

The strength of the ISO/IEC JTC 1/Sub Committee 31 is the combined expertise and experience of the delegates of the National Standards Institutes which provide the resources. For example, 2017 the **German Institute for Standardization DIN celebrated its 100th anniversary** (in 1922 - the DIN paper format standard, like "A4" used for the report, today - high-tech standards).

ISO/IEC JTC1/SC 31 was given responsibility for AIDC by the controlling ISO/IEC Joint Technical Committee JTC1 with the objective of bringing standardization projects (New Work Items -NWI) in move under ISO rules and meeting the requests of the member countries and ensuring the continuous maintenance of the standards already published. Each project has to go through an agreement procedure of the members before the elaboration process starts. The proposal is accepted if two-thirds majority of the P-members of the SC vote in favour and if at least five P-members declare their commitment to participate actively in the project. Proposed standardisation projects are allocated to the relevant Working Group (WG).
The actual standardization process with the development of ISO/IEC standards consists of several defined process stages, which are made visible by an indicator: Proposal "10", preparation stage "20"(WD), committee processing stage "30"(CD), survey stage for the "Draft International Standard-DIS" provided "40"(DIS), positive vote on "Approval Stage" "50"(FDIS) and finally publication in stage "60"(Standard). The revision level is (90). Each individual level is in turn assigned an additional attribute for detail steps within the level using a decimal point. Each project is listed in the ISO catalogue; the indicators make the status of the standard transparent, see "International harmonized stage codes" https://www.iso.org/stage-codes.html#60.00
The results of the Working Groups with status 40/50 have to be voted on by a 2/3 majority of the "P-Members" entitled to vote before it is published. The SC 31 is involved in the ISO network with other committees. Through cooperation and exchange, duplications are to be avoided across the board. Figure 6) illustrates links to committees and organizations such as AIM, CEN TC 225, ETSI, GS1, ISO TC 122, SC 41, etc.
Each year, a different country invites members to the SC 31 session week. Where the meeting 2020 scheduled for Cape Town could not take place and being held virtually instead, the next years meetings are in planning for Canada 2021, South Korea 2022 and Europe 2023.

AIDC standards report update 2020

Authors: Heinrich Oehlmann, E-D-C, Erich Günter, IBM & chair EDIFICE ADC committee

Special thanks to the contributing AIDC technology and application experts:
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Harald Oehlmann, ELMICRON-DE, DIN. SC31; Erich Günter, IBM, DIN & EDIFICE; Hiroyuki Imai, JAISA-JP, SC31;
Wilfried Weigelt, REA Elektronik-DE, DIN, SC31; Josef Preishuber-Pflügl, CISC-AT; Paul Rupp, IFA Coding System;
Rainer Schrundner, IdentOne-DE, DIN, SC31

Report on the 26th ISO/IEC JTC 1/SC 31 Plenary Meeting „virtual“

After the Face2Face plenary meeting 2019 in Qingdao (China), the 26th plenary meeting was originally planned for Cape Town and to be hosted by the South African Bureao of Standards (SABS), but “Corona” changed it and the meeting took place in the web by means of the web service “zoom”.
Web conferences are not new for committee members, many of the working group meetings are using the web instead of F2F meetings already. But this was the first time with such a number of about 50 participants.

Fig. 7) SC 31 Group photo via Internet, source SC31 screen shot

Due to time differences some trouble had to be managed by delegates, specially of America and ASIA/Pacific. Nevertheless, everybody could drink the coffee in their home office or in a hotel with 24h services nearby. The virtual meeting was managed very well by the chair, Henri Barthel, and assisted by Eddy Merrill, the committee manager of SC31.
Henri has been confirmed for the next period as SC31 chair. Continuity is granted by his experience and leadership as well as by the experienced secretary Eddy Merril, and not to forget by the convenors of the working groups and editors for the standards. For the longstanding delegate of the Swedish Standardization Committee (SIS), Mikael Hjalmarson, it was the last meeting. Unfortunately he will leave this technology segment and SC 31 will lose one of the barcode and syntax experts for the working groups. Mikael was editor for the key standards ISO/IEC 15459 Unique Identification and ISO/IEC 15434 Syntax for high capacity ADC media (Meanwhile WG2 proposed Harald Oehlmann, DIN as successor.).
SC 31 expressed its sincere appreciation to Mr. Mikael Hjalmarson for his many contributions to SC 31 over the years and for his PE role for several important AIDC standards.

The agenda of the plenary meeting included reporting on the status of ongoing projects and information from liaison groups of adjacent business areas important for synchronization of the work and to generate synergy. Finally, the head of delegations of the SC31 member countries report on the developments in their domain.

What happens in the

ISO/IEC JTC 1/SC 31 Working Groups

ISO/IEC JTC 1/SC 31/Working Group 1 DATA CARRIER

Fig. 8) WG1 last F2F meeting Oct. 2019 in Tokyo, convenor Sprague Ackley in the middle (with tie)

WG1 DATA CARRIER, chaired by Sprague Ackley, USA, is a very technology driven and engaged group of experts. The group is responsible for standardization of AIDC Media which includes "Optical Character Recognition – OCR" and the linear and 2d-bar codes. With JAB code the first 3-dimensional symbology is on its way to standard.
The responsibility given to WG 1 is covering:

- Optical Character Recognition (OCR) quality testing" ISO/IEC 30116
- Han XIN code (ISO/IEC 20830)
- Rectangular Micro QR – rMQR (ISO/IEC 23941)
- Data Matrix rectangular extension – DMRE (ISO/IEC 21471)
- Just Another Barcode - JAB Code (NP23634)
- Quality guideline for direct part marking (DPM) (ISO/IEC 29158)
- Revisions and new prospects

WG 1 latest publication 2020-02-03:

DMRE: ISO/IEC 21471:2020 Extended rectangular data matrix (DMRE)

Editor: Harald Oehlmann [DIN, ELMICRON].
DMRE was driven by international projects like "Unique Device Identification (UDI) for medical devices and it's direct marking needs but also by other industries like Medicinal products, electronic devices, etc., anywhere where small or rounded devices would need a traceability code (more details see chapter Appendix "Symbologies", page 35).

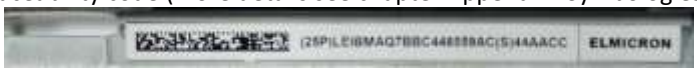


Fig. 9 DMRE at small surface carries tracking data, source: www.dmre.info

At WG1 in completion:

DPM: ISO/IEC 29158 Direct Part Mark (DPM) Quality Guideline

Editor Harald Oehlmann
The Direct Part Mark (DPM) Quality Guideline took a long time to move from an AIM standard into a non binding "Technical Report (TR) and now moving as a standard from DIS status to FDIS. Many industries from Automotive over Electronic to Health care are waiting to get a reliable reference to measure the quality of direct marked codes. ISO/IEC 29158 shall deliver it (for more details see chapter "Printing quality of 1D and 2D-bar codes").

At WG1 under work:

rMQR: ISO/IEC CD 23941.3 Rectangular Micro QR (rMQR)

Bar code symbology specification, editor: Tomohiro Watanabe, Japan
Following the idea to stretch Data Matrix to achieve smaller codes but higher data volume by extending the length of the code, DENSO, the developer of QR and MicroQR, took the initiative to develop rectangular formats for QR, specifically for MicroQR. This development bridges the gap for marking small items as an alternative solution to DMRE, but based on QR.

Fig. 10) rMQR, source: DENSO

JAB-CODE: ISO/IEC CD 23634.2

Polychrome bar code symbology

(JAB-Code), editor Waldemar Berchtold, (DIN, Fraunhofer Institut)
The eight-color symbology with LDPC (low-density parity-check) error correction coding is good for blobs and good for crumbs (see also chapter Appendix “Symbologies”, page 35).

Fig. 11) JAB Code with LDPC check good for blobs and crumbs, source: SC31/JTC1/SC 31/WG1

HAN XIN Code: ISO/IEC DIS 20830

Han Xin Code bar code symbology specification,
editor: Wang Yi, China
Han Xin code became AIM standard first and is now on the way to finalization stage to become the first ISO standard for barcode symbology originated by the Standardization Institute of China and applied with features to carry Latin characters as well as Chinese characters. (see more details under chapter AIDC report 2019, WG1.

WG 1 new projects:

Revision of ISO/IEC AWI* 16022 Data Matrix bar code symbology specification, editor: Harald Oehlmann, DE

Fig. 12) Data Matrix on white and invers

Any standard is subject to regular maintenance if not put in a “stabilized” status. ISO/IEC 16022 Data Matrix entered into the phase of the 5 years maintenance again after having received some “technical corrigendum” to be inserted in the standard. Also, the reference to DMRE will be inserted for completion of the information about the available sizes as Data Matrix options. The Data Matrix option with “Reed Salomon” error correction will be considered as the only choice.

**AWI: Approved Work Items (AWI)*

Printing quality of 1D and 2D-bar codes

WG 1 project ISO/IEC 29158 Direct Part Mark (DPM) Quality Guideline

Contribution by Wilfried Weigelt, REA Electronic, member of SC31/WG 1
Linear (1D) Bar codes were introduced decades ago in many industries to optimize and automate processes in logistics and manufacturing. When using it, there were always problems reading the codes, which meant that the processes did not work as optimal as planned. One reason for this was and is the print quality of the codes and it became time to think about how print quality control can be carried out. The result was the print quality standard ANSI X3.182 and ANSI UCC5. The further development of these original standards has led to the current version of ISO/IEC 15416: 2016.
In the case of 2D codes, which gained importance from around the year 2000, the question of print quality also arose. The 2D code test standard ISO/IEC 15415 was developed in parallel. Equipment for marking products by laser, ink or engraving enabled widespread use of 2D-codes for applications in all kind of areas. These directly marked codes are differing from printed codes on labels or similar materials in terms of performance and quality: → the print quality standards for 2D-codes did not work properly for directly marked codes.

Fig. 13) Data Matrix - DPM

This was the impetus for the development of a further print quality specification, the AIM DPM Guideline from 2006. For developing an international standard on ISO level, the AIM DPM guideline was taken as draft for the first issue of ISO/IEC TR 29158 for direct part marking quality control. As a Technical Report (TR) ISO/IEC TR 29158 was a good starting point, however, real applications had additional demands for detailed optical measurement aspects. The project has been opened again to revise ISO/IEC TR 29158 by working in latest findings. Meanwhile it became a heavily revised new document being upgraded from a technical report to an international standard.
The upgrade includes a more granular quality grading and meeting realistic aspects of lighting, „ISO/IEC 29158 Direct Part Mark (DPM) Quality Guideline“ is scheduled for publication in early 2021.

Different marking techniques need to be considered like “Dot Peening” and “Laser Edging”, partly performing with low contrast or even without contrast in terms of color. The specification will include the definition for camera and illumination angle. The essential parameter is the camera angle. Typical camera angles include 30°, 45° or 60° in relation to the marking plane. Figure 14) illustrates the setup of illumination of the test sample.

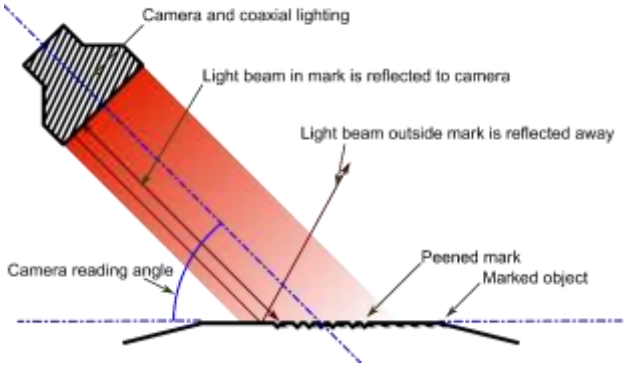


Fig. 14) Illumination of samples to be tested

ISO/IEC 15415 is defining 5 quality grades where A is best, and F stands for FAIL. Discussion concluded that for DPM the quality grading has to be more granular because for assessment of smoothly printed codes the 5 grades are pretty roughly divided. The solution found was to stay with alignment with the 5 grades but to divide the grades in tenth of a grade from 0,0 to 4,0. The grading in steps of 1/10 was called Continuous Grading. In reality, it is a granular grading in 41 steps rather than continuous.
Continuous grading of ISO/IEC CD 29158 Annex B applies for the parameters "Axial Nonuniformity", "Grid Nonuniformity", "Unused Error Correction", "MOD or MARGIN" and "Fix Pattern Damage".
The 41 DPM grades mapping to the 15415 grades A to F are shown in Annex B.1 “Grades and Mapping” as follows:

- Grade A: 3.5, 3.6, 3.7, 3.8, 3.9, 4.0
- Grade B: 2.5, 2.6, 2.7, 2.8, 2.9, 30., 3.1, 3.2, 3.3, 3.4
- Grade C: 1.5, 1.6, 1.7, 1.8, 1.9, 2.0, 2.1, 2.2, 2.3, 2.4
- Grade D: 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3, 1.4
- Grade F: 0.0, 0.1, 0.2, 0.3, 0.4

It is up to the application to define the appropriate DPM grade to be achieved as minimum quality grade.
Regulations like UDI see the quality measurement of the marking as part of the quality management for the product. This may explain the importance of the Barcode quality test specifications.

The DPM quality standard is essential as a basis for coordinating the qualitative properties in logistics and customer / supplier relationships. The accuracy of the measuring device is just as important, because measuring devices that provide different results are not particularly suitable for coordinating labeling qualities.

Barcode Verifiers

Along with the quality standards, special devices for print quality control were required. These are optical measuring devices, which in technical jargon are called barcode verifiers or simply verifiers. The different devices on the market often showed different measuring results. For this reason, the requirements for the accuracy of these devices were specified in the standards ISO/IEC 15426-1 and ISO/IEC 15426-2. However, both standards only relate to devices that have been developed for printed codes. These standards for measuring accuracy are not suitable for verifiers that work according to the DPM standard. For this reason, a draft for a measurement accuracy standard ISO/IEC 15426-3 for verifiers with DPM function was presented in the ISO standards committee ISO/IEC JTC1 SC31 WG1 in 2017. Since work was already being carried out on the revision of the DPM print quality standard ISO/IEC 29158 and significant changes had become apparent, work on the Verifier DPM measurement accuracy was postponed. Further work has recently started. Considerations were made as how test standards for DPM codes could look. Metal plates (reflective surfaces) were applied to the codes, which correspond to laser or ink marking. Engraved codes were discussed in order to be able to test the properties of the measurement of the dot peened codes as well as the new test arrangement with camera and lighting at an angle of e.g. 45 ° for both. On reflective materials, inhomogeneities in the illumination of the measuring arrangement immediately lead to falsified measurements. Therefore, the consideration in the WG1 is to create a perfectly reflective test pattern and then to check the uniformity of the illumination.
There are also codes that are created with individual separated dots. These are checked using a dot connection algorithm. In order to know whether the algorithm is working properly, test standards with dotted codes, for which the results are known, are required. The work on this test standard for a DPM verifier turns out to be complex, because the execution of the codes and the substrates are extremely diverse. The DPM measurement is becoming increasingly important for the application of the test equipment. A wide variety of direct markings are used in machine and vehicle manufacturing processes. In the medical device sector, labeling is required by EU regulation 2017/745. Much of it is also direct part marking. →

Fig. 15) UDI verification, pic.: REA

The manufacturer REA Elektronik GmbH has been producing the measuring devices (Verifiers) for print quality control for many years. The REA VeriCube started with ISO/IEC 15415 evaluation. It was then updated to use the adaptive ISO/IEC TR 29158 illumination as well as the ISO/IEC TR 29158 dot connecting algorithm. As a modification of the REA VeriCube, the „REA VeriCube Diffuse“ was presented later. The lighting is partial diffuse in order to simulate readings in which the lighting consists of a mixture of directional and diffuse components. For high-gloss surfaces that require very diffuse lighting for reading, the partial diffusivity is not sufficient. For this reason, the verifier „REA VeriCube DPM“ has a lighting that approximates DOME lighting very well. At the same time, the resolution was increased so that codes with matrix cell sizes from around 50 µm can be measured.

Fig. 16) Factory picture REA VeriCube DPM

ISO/IEC 24458 project Bar code printer and bar code reader performance testing

Contribution by Hiroyuki Imai, project editor, *JAISA

1 Background

There was no useful “Industrial Standard” which specifies performance testing methods on bar code printers and bar code readers in total, although bar code has been a key technology in AIDC for about a half century. Therefore, each manufacturer evaluates its products based on its own methods and regulations.

In Japan, a new Japanese Industrial Standard, **JIS X 0527**, was issued in March 2018 which specifies details of test and evaluation methods and moreover ranking of test results of key performance items in order to offer “Common rules” to barcode industries. The standard draft was created by **JAISA*** as a government project.

ISO/IEC 24458 project was initiated as a NWIP based on the **JIS X 0527** in September 2019 and its CD ballot was approved in July 2020.

2 Benefit of ISO/IEC 24458

- **a)** Ranking is specified on each key evaluation item, so that it is very helpful for users to select the best fit of products to their applications.
- **b)** Products that show evaluation result(s) which do not satisfy the ranking are to be excluded from the market.
- **c)** By trying to develop higher rank products, bar code markets and trading can be more activated.

3 Summary of specification of bar code printer quality evaluation

3.1 Specification of “Standard image” for printer quality evaluation

ISO/IEC 24458 specifies “Standard image” as shown in Figure 17) to be used to evaluate printer quality test items of a bar code printer.

The standard image is constructed as a pair of two images with each right and left image dimensions 50.8 mm x 76.2 mm (2 inches x 3 inches), which can correspond to printers with nominal print width of 2, 3, 4, 5, 6, 7, 8 and 10 inches.

The standard image shall be printed and used for evaluations of “Minimum print resolution”, “Maximum print speed”, “Electrical property” and “Mechanical characteristics”

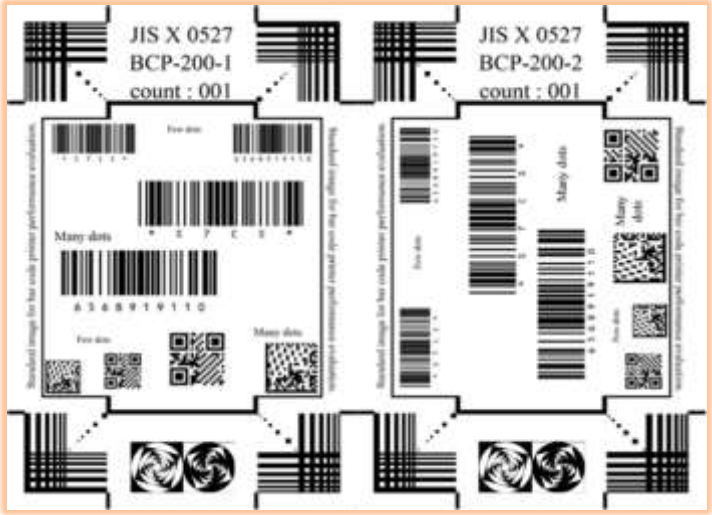


Figure 17) Standard image for print quality evaluation of bar code printer

Specification of consumables performance evaluation

In **ISO/IEC 24458**, “Reception paper”, “Label” and “Ink ribbon” which are supplied by users when needed are defined as “Consumables”. Although some characteristics of consumables may be evaluated individually, in **ISO/IEC 24458**, printed reception papers or labels are evaluated by mainly abrasion resistance tests.

After printed specimens whose overall print quality grade is more than 3.5 were scrubbed specified times with a piece of corrugated card-board, a piece of white cotton cloth with water, with ethanol, with synthetic detergent, measure overall print quality grade of the specimens and determine ranks according to the difference of grade before/after the test.

ISO/IEC 24458 also specifies tests related heat resistance. These tests can be applied to any kinds of combinations of reception papers and ink-ribbons. Examples of specimens during abrasion tests are shown in **Figure 18**.

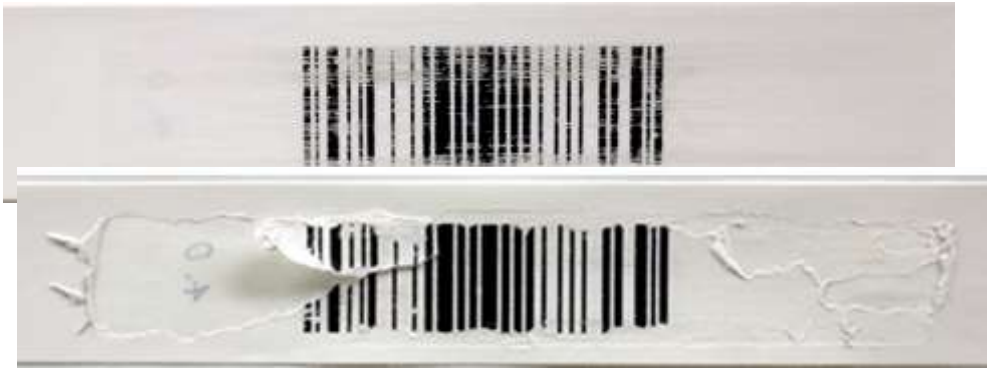


Figure 18) Examples of specimens during abrasion tests

4 Summary of specification of bar code reader quality evaluation

4.1 Specification of "Standard test charts" for reader quality evaluation

Bar code reader manufacturers and dealers shall use "Standard test charts" which is "Common rulers" to evaluate bar code reader performances. A set of standard test chart consists as shown in **Table 4.1.1**.

Table 4.1.11 List of test charts

Test chart	Chart number	Performance Evaluation Items
Test Chart for One-Dimensional Symbols	BRPT-1RES	Reading range, reading angle, reading speed and reading test of moving symbol
	BRPT-1SC-1, -2, -3, -4, -5, -6, -7, -8	Symbol contrast
	BRPT-1MOD-1, -2, -3, -4	Modulation
	BRPT-1DEF-1, -2, -3, -4	Defect
	BRPT-1DEC-1, -2, -3, -4	Decodability
Test Chart for Two-Dimensional Symbols	BRPT-2RES	Reading range, reading angle and reading speed
	BRPT-2SC-1, -2, -3, -4, -5, -6, -7, -8	Symbol contrast
	BRPT-2MOD-1, -2, -3, -4	Modulation
	BRPT-2FP-1, -2, -3, -4	Fixed pattern damage
	BRPT-2GNU-1, -2, -3, -4	Grid non-uniformity
	BRPT-2ANU-1, -2, -3, -4	Axial non-uniformity
	BRPT-2UEC-1, -2, -3, -4	Unused error correction (UEC)
Note Explanation on test charts is given in Annex E.		

Photo Fig. 19) shows a set of standard test charts created by ***JAISA** according to **JIS X 0527**. (A standard test chart set sample in an English version will be prepared by **JAISA** in mid. of year 2021.)

Fig. 19) Photo Example of "Standard test charts" for bar code reader performance evaluation test

ISO/IEC 24458 specifies test charts only with print quality grade A, B, C and D (Grade F is not specified since reading tests of F grade charts may lead reading ability competition of poor quality symbols between bar code reader manufacturers, which creates no read and/or mis-read troubles in the field.) and determine a bar code reader to be a defective product if it mis-read even one time during reading tests.
The test charts are designed based on 0.8X measurement aperture diameter.
Ranking of each test item result is determined by much of total reading time difference among four grade test chats.

*) **JAISA** : **J**apan **A**utomatic **I**dentification **S**ystems **A**ssociation
https://www.jaisa.or.jp/en/

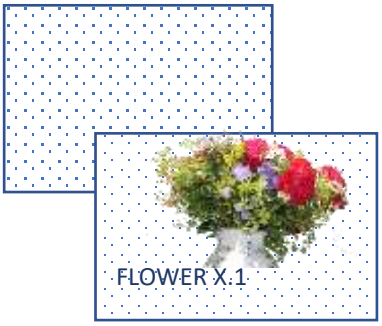
Potential new WG1 projects:

DIGIMARC - A new kind of 2D bar code

The Digimarc barcode is a new type of data carrier that is not visible to the human eye. The Digimarc barcode can be applied to the product packaging as a digital watermark. Digimarc Barcode is designed to contain the same information as a product code but as a machine-readable code repeating a 2D pattern of minimally contrasting dots within artwork elements. The code on product packaging and other printed materials is generally imperceptible to the human eye. These machine-readable codes enable phones, barcode scanners, cameras, xed-mount barcode readers and other devices to identify numbers encoded by Digimarc.

A Digimarc marked surface:

covered with label content and graphical elements underlined by the Digimarc watermark: →



Digimarc tells HOW DOES IT WORK:
(source https://ccllabel.com/news/digimarc/)
1 – We start with the same data found in the traditional barcode (e.g. UPC A or EAN 13), then imperceptibly repeat this data multiple times across the packaging.

2 – And hide it within the artwork – adjust the brightness & intensity of colors to introduce a readable signal.

Fig. 20) DIGIMARC on a blank page and printed

Focus of Digimarc is invisibility of the code by design by distributed dots all over the surface for readability at any position. Digimarc is not designed for higher data capacity but on short data elements like GTINs.
In fact, the ASC Data Identifier system would surely work as well applied with the unique flag like with EDIFICE solution "WEB AND KEYBOARD COMPATIBLE ENCODING WITH ASC DATA IDENTIFIERs" (see page 28). Digimarc might be asked to supply samples for such applications, e.g. using a unique serial number for plagiarism protection by the invisible code.

But DIGIMARC did not show the intention yet to pass the solution to ISO for public standardization, so for the moment it will remain as a closed system application. Nevertheless, some scanner manufacturers put the Digimarc code in the decoding software of specific scanner models already (Cognex, Honeywell, Datalogic, Zebra, …).

Extended Channel Interpretation (ECI) for 2D-symbols

WG1 study group on encodation Character Sets (Unicode & others)

Logistic codes, codes for international use for data collection, are defined as simple as possible with character sets understandable everywhere. This is usually the case with numbers and uppercase letters in the Latin character set. But as more barcode is used, the more ideas come up for extention of applications, e.g. to transmission of terms written in specific character sets like Slavic, Asian and many other languages. Think about coded names on wrist bands or ID cards. Two dimensional symbols like Data Matrix or QR offer for example a switch to "UNICODE" (ISO 10646) to encode ISO°8802 character sets. The default character set is ISO-Latin1. Within this character set, the character "Ö" can be encode e.g. in Data Matrix with the symbol code word "214".
The name "Ölmann" encoded in DataMatrix after
ASC DI "1H" (DI for Employee Identification Code) will look like the sample to the right →

In this case Data Matrix contains: <1><H><214><h><l><m><a><n><n>
So, Data Matrix enables encodation of "Ö" according to ISO LATIN-1
by help of the symbol character Byte <214> without ECI.
With activated symbology ID the scanner would transmit "<]d1>1HÖhlmann".
Note: The ISO/IEC 15424 symbolgy identifier "]d1" informs the application, that no ECI is used and thus, the default encodation ISO-Latin1 applies.
But there are names and terms written in characters of character sets not being supported by the 2d-symbols' default character encodation. For such cases "Extended Channel Interpretation (ECI)" has been developed.

If we would want to encode the character <ę> (ISO-Latin2) with the Slavic name "Jędrek", then e.g. Data Matrix or QR Code would not offer a code word for it, but ECI solves the problem. Staying with the Data Matrix sample, the 2d-symbol specification has been provided with a switch to "ECI" already, even so Data Matrix has got a specific symbol identifier for it, indicating "I'm carrying ECI encoded characters". The symbol ID is <]d4>.

Let's illustrate the functionality of ECI
by encoding the name "Jędrek" for an ID card code flagged with ASC DI "1H" →
the ECI value for the ISO-Latin 2 character table is <4> and the ISO-Latin2 Byte value is <234>. The ISO-Latin2 Byte value <234> applied with the ECI value would be shifted to the proper interpretation of the reader output.

At the sample above Data Matrix contains: <ECI:4><1><H><J><234><d><r><e><k>
Data Matrix enables encodation of <ę> according to ISO-LATIN2 by help of ECI value <4> of a the ECI table shifting the interpretation of the symbol character <234>. The scanner would transmit "]d4\0000041HJ<234>drek".
An application is informed by the symbology ID "]d4", that an ECI is used and that the ECI number will follow.
The application receives ECI 4 by the sequence "\000004" and thus interprets the received message as ISO-Latin2 encoded data. Thus, the understood message is: "1HJędrek"

The idea of "ECI" came along with the development of the stacked code "ISO/IEC 15438 PDF417" for optimizing support of languages. ECI become standard published in 2004 as "AIM Technical Specification on Extended Channel Interpretations (ECI). The ECI standard specifies the protocol for extending the interpretative capabilities of basic 7-bit, 8-bit, multi-byte and 16-bit codes when the data is encoded in data carriers. The 3 parts contain Part I defining the protocol, Part II defining the registration process for additional ECIs and Part III is the registry of current ECIs.
The WG1 study group on ECI will evaluate the status and features of the given AIM standard and will check the opportunities to open a project to produce a state-of-the art ISO/IEC ECI standard.

AIDC data structures under Working Group WG 2

Chairman of SC31 WG2 is Joo-Sang Park from Korea, the successor of Toshihiro Yoshioka from Japan who managed WG2 for many years. WG2 is responsible for key standards of AIDC such as ISO/IEC 15459 Unique Identification, which forms the basis for unique identifiers (see Quick Guide, page 23), **ISO/IEC 15434** Syntax for High Capacity ADC Media and **ISO/IEC 29161** Unique Identification for IoT. While security features for RFID are specifically assigned to WG4, WG2 is responsible for general security aspects, such as ISO/IEC 20248 DigSig. Mr. Joo-Sang Park reported that the six parts of **ISO/IEC 15459** would enter systematic review at the end of 2019 / beginning of 2020:

ISO/IEC 15459 Unique identification
— 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 it 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 under legal aspects is to be achieved.

ISO/IEC 15418 GS1 Application Identifiers and ASC Data Identifiers

Maintenance of the IDENTIFIERS is not the responsibility of WG2, it has been delegated to the responsible maintenance committees at ANSI and GS1. Concerning maintenance of the part ASC Data Identifiers it was concluded that this is in good hands of the appointed ASC Data Identifier maintenance committee at
MHI - Material Handling Industry, MH10.8.2 committee
Charlotte, NC 28217-3992 USA, phone: +1 704/522-8644 with the **Data Identifier and Maintenance Group (DIMC)** under chairman of Bill Hoffmann, http://www.mhi.org/standards/di (more information and achievements see page 24).
Maintenance of the part GS1 Application Identifiers is delegated to the GS1 Global Standards Management Process (GSMP) https://www.gs1.org/standards/wr

Most of that standards are under the 5 years maintenance cycle and will be opened for revision shortly. Since the editor for key standards like ISO/IEC 15459 etc., Mikael Hjalmarson, left his national body SES in June **SC 31 is calling for editors** as successors right now. There are candidates from USA, China and Germany being prepared to continue Mikael's work.

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

Contribution by the editor Bertus Pretorius, Solutions Architect | LicenSys, Australia

Fig. 21) DigSig secured DataMatrix

The most modern Automatic Identification data standard, ISO/IEC 20248 Information Technology - Automatic Identification And Data Capture Techniques - Data Structures - Digital Signature Meta Structure, has been opened for review by ISO. ISO/IEC 20248, which 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.
The review was requested by developers and users to:

1. Change the string default to UTF-8 to ensure its proper use in all languages.
2. Add more examples, specifically interface and *crypto methods.
3. Perform editing to remove ambiguities from the specification.

**Note, ISO/IEC 20248 does not specify crypto methods, but rather use the X.509, crypto methods specification whereby any method may be used.*

The revised document is planned for submission Dec. 2021. Please direct questions and feedback to the Euro Data Council who will liaise with the review team.

The picture Fig. 22) depicts a 3rd Licence Plate windscreen label. It contains a DigSig data structure in the QR code and in the embedded RAINFC 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).

Fig. 22) Windscreen label applied with RFID and QR and embedded DigSig

(For more information to ISO/IEC 20248 DigSig, see chapter „Application ISO/IEC 20248 Digital Signature", Page 31)

ISO/IEC JTC 1/SC 31/WG 4 Radio communications

Contribution by the convenor of WG4 Josef Preishuber-Pfluegl, CISC

Fig. 23) ISO/IEC 29160 RFID emblem

WG 4 of ISO/IEC JTC 1/SC 31 has got the responsibility for the RFID technology standards. These standards are the base for the application standards developed by user groups in industry and healthcare and specifically by WG 8 Application of AIDC standards. WG4 is cooperating closely with other standardization bodies e.g. with European Telecommunications Standards Institute (ETSI), European Standardisation Committee (CEN) and others. The RFID emblem (Fig. 23) has been adopted from the equivalent CEN standard. The ambitious agenda of WG 4 includes quite a number of RFID-related work items and reviews of existing standards undertaken by about 12 editors. Latest RFID standards publications and RFID standards under development/revision are listed below. The basic standard ISO/IEC 15963 for the Tag ID is still in focus (see announcement below) being important for the Tag identification and anti-collision in bulk reading processes.

ISO/IEC 15963 RFID Tag ID: AIM becomes Registration Authority.

The Tag ID is the unique serial number of a RFID chip. The structure is comparable with ISO/IEC 15459-2 where AIM is the Registration Authority (RA) too. Manufacturers get their unique company ID from AIM and add their own serial number for burning the tag ID sequence into the RFID chip. The Tag ID is resistant as a functional element also used for application support as well as for anti-counterfeiting, too.

Latest RFID standards publications:

ISO/IEC 15961-3:2019	Information technology — Data protocol for radio frequency identification (RFID) for item management — Part 3: RFID data constructs	2019-02-05	Standard is used for memory access and organisation
ISO/IEC 19823-21:2019	— Conformance test methods for security service crypto suites — Part 21: Crypto suite SIMON	2019-05-21	Standard for conformance testing of crypto suite SIMON
ISO/IEC 19823-22:2019	— Conformance test methods for security service crypto suites — Part 22: Crypto suite SPECK	2019-05-21	Standard for conformance testing of crypto suite SPECK
ISO/IEC 29167-19:2019	— Automatic identification and data capture techniques — Part 19: Crypto suite RAMON security services for air interface communications	2019-06-26	Revised crypto suite RAMON with minor changes
ISO/IEC 24770-5:2019	—Real-time locating system (RTLS) device performance test methods — Part 5: Test methods for chirp spread spectrum (CSS) air interface	2019-08-06	Standard for Conformance test for CSS based RTLS
ISO/IEC 15961-2:2019	— Data protocol for radio frequency identification (RFID) for item management — Part 2: Registration of RFID data constructs	2019-08-08	Standard is used for memory access and organisation
ISO/IEC 22243:2019	— Radio frequency identification for item management — Methods for localization of RFID tags	2019-09-30	2019-09-30
ISO/IEC 19823-10:2020	— Conformance test methods for security service crypto suites — Part 10: Crypto suite AES-128	2020-01-29	Revised crypto suite AES-128 with minor changes
ISO/IEC 15963-1:2020	— Radio frequency identification for item management — Part 1: Unique identification for RF tags numbering systems	2020-03-18	Standard that covers identification for RFID tags. Registration Authority is AIM, Inc.
ISO/IEC 15963-2:2020	— Radio frequency identification for item management — Part 2: Unique identification for RF tags registration procedures	2020-03-19	Standard that covers identification for RFID tags. Registration Authority is AIM, Inc. (https://www.aimglobal.org)
ISO/IEC 18046-2:2020	— Radio frequency identification device performance test methods — Part 2: Test methods for interrogator performance	2020-03-19	Standard for conformance test for readers. First time also addressing UHF RFID including ISO/IEC 18000-63, GS1 Gen 2 and RAIN Air Interface

RFID standards under development/revision

ISO/IEC NP 29167-16	Information technology — Automatic identification and data capture techniques — Part 16: Crypto suite ECDSA-ECDH security services for air interface communications	Minor revision for crypto suite ECDSA-ECDH
ISO/IEC NP 29167-11	— Part 11: Crypto suite PRESENT-80 security services for air interface communications	Revision for PRESENT-80 crypto suite
ISO/IEC NP 18047-3	— Radio frequency identification device conformance test methods — Part 3: Test methods for air interface communications at 13,56 MHz	Transfer of TR into International Standard (IS)
ISO/IEC PWI 23200-2	— Radio frequency identification for item management — Part 2: Interference rejection performance test method between a Interrogator as defined in ISO/IEC 18000-63 and a heterogeneous wireless system	Wide interference analysis to support regulatory work
ISO/IEC WD 19823-11	— Conformance test methods for security service crypto suites — Part 11: Part 11: Crypto suite PRESENT-80	Standard for conformance for PRESENT-80
ISO/IEC WD 18047-63	— Radio frequency identification device conformance test methods — Part 63: Part 63: Test methods for air interface communications at 860 MHz to 960 MHz	Revision of standard for tag conformance tests to better align ISO and GS1
ISO/IEC CD 24791-3	— Radio frequency identification (RFID) for item management — Software system infrastructure — Part 3: Device management	Editorial upate
ISO/IEC DIS 15961-1	— Data protocol for radio frequency identification (RFID) for item management — Part 1: Application interface	Standard is used for memory access and organisation
ISO/IEC DIS 18000-63	— Radio frequency identification for item management — Part 63: Parameters for air interface communications at 860 MHz to 960 MHz Type C	The main changes of ISO/IEC DIS 18000-63 compared to the previous edition are as follows: — Incorporation of the Technical Corrigendum — Incorporation of a new sensor class for snapshot sensors
ISO/IEC DIS 15962	— Radio frequency identification (RFID) for item management — Data protocol: data encoding rules and logical memory functions	40.60
ISO/IEC DIS 23200	— Interference rejection performance test method between tags as defined in ISO/IEC 18000-63 and a heterogeneous wireless system	Wide interference analysis to support regulatory work
ISO/IEC FDIS 18046-3	— Radio frequency identification device performance test methods — Part 3: Test methods for tag performance	Standard for conformance test for tags. Addressing all frequency band of ISO/IEC 18000 parts, including ISO/IEC 18000-63, GS1 Gen 2 and RAIN Air Interface
ISO/IEC FDIS 29160	— Radio frequency identification for item management — RFID Emblem	Update of registration athority for RFID emblem. Registration Authority is AIM, Inc. (https://www.aimglobal.org
ISO/IEC 19823-16	— Conformance test methods for security service crypto suites — Part 16: Crypto suite ECDSA-ECDH security services for air interface communications	Revised crypto suite ECDSA-ECDH with minor changes

Where the RFID standards define how the data are transmitted to RFID tags and re-read again, the syntax for the data itself at data element level are referenced with the specific AIDC standard, such as ISO/IEC 15459 Unique Identification, ISO/IEC 15418 GS1 Application Identifiers and ASC Data Identifiers and ISO/IEC 15434 syntax for high capacity media. Such standards for the data level enable compatibility for carrying data either by RFID or by optical AIDC media like linear or two-dimensional barcode.

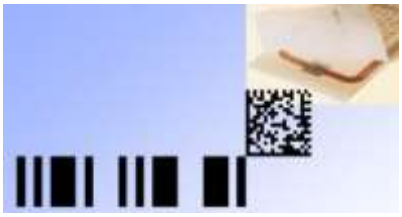


Fig. 23b) Compatibility of optical media and RFID by data syntax

ISO/IEC JTC 1/SC 31/WG 8 Application of AIDC standards

Convenor: John Greaves

AIDC application standards supply guidance how to combine technology standards and standards for the data structures and include quality assessment suitable for global applications of AIDC. Just a technology standard like for a bar code symbol or for a RFID Chip would not be sufficient to build a running AIDC application. Accordingly, WG8 projects are built from modules of the other technology WGs like WG1, WG2 and WG4 and completing it with standard modules from other ISO and/or IEC committees.

WG 8 RFID APPLICATION standards under revision

Where the RFID technologies are under the responsibility of WG4 the applications are subject of WG 8 Application of AIDC standards. As WG8 projects are referencing to standards of other ISO committees, so do committees of specific regions or industry areas. Some are mentioned under chapter “AIDC applications and implementation of standards”.

Currently four RFID application standards are under revision taken over from ISO TC 122 Packaging:

ISO/IEC WD 17367 Supply chain applications of RFID — Product tagging, editor: Bill Hoffman
ISO/IEC WD 17366 Supply chain applications of RFID — Product packaging
ISO/IEC WD 17365 Supply chain applications of RFID — Transport units
ISO/IEC WD 17364 Supply chain applications of RFID — Returnable transport items (RTIs) and returnable packaging items (RPIs).
Fig. 24) is showing how the four RFID applications standards aligns with equivalent barcode standards for the different logistical levels.

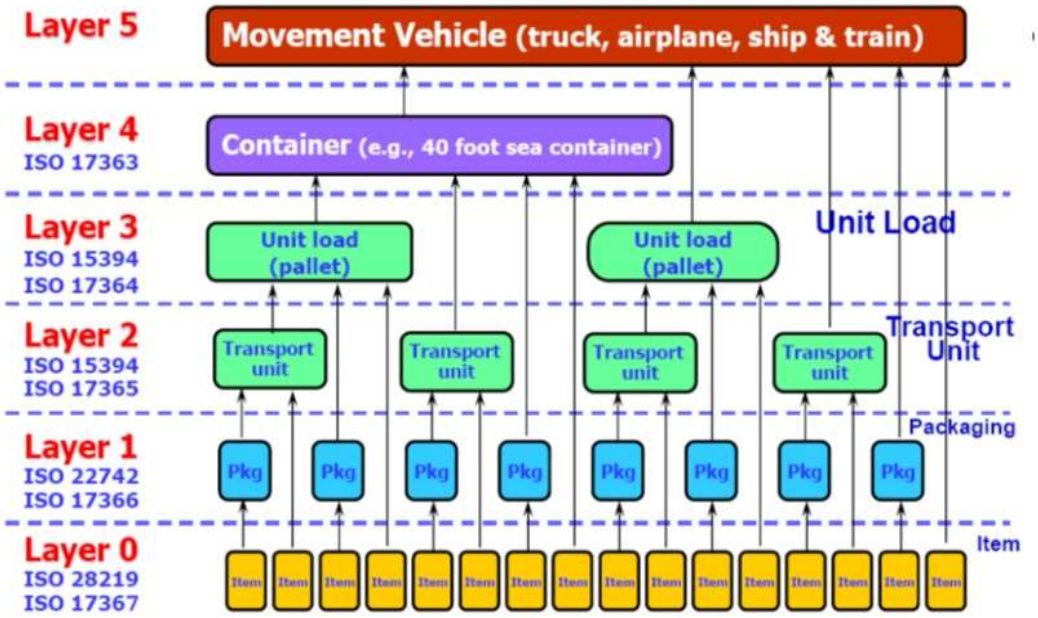


Fig. 24) ISO standards AIDC for the logistical levels of supply chains (C.Harmon)

First of the series of standards is **ISO/IEC WD 17367 RFID - Product tagging**. Under initiative of Japan the option of 8-Bit coding with UTF-8 Unicode has been added specifically to support applications with interfaces to automated systems using PLCs as controllers. Chapter A.7.2 deals with the decode process using ASCII 6-bit or UTF-8.

The standard “ISO 17363: 2017 RFID for Freight Containers” is no longer pursued by WG8 due to no activities of SC31 on this level.
RFID application standards go along with the bar code application standards on the four logistical levels (see Fig. 24) of AIDC report, part 2019 update) but remain under the responsibility of ISO TC 122 (secretariat Japan).

Future development of the RFID application standards over the 4 layers

The Covenor of WG8 John Greaves and project editor Bill Hoffmann are recommending that the 1736x series documents (minus 17363) be combined into one document - once all of the 1736x series has been balloted, and published individually. This will be a potential New Work Item proposal for avoiding to buy 4 different standards instead of one for getting the full information about RFID applications over all 4 layers from product tagging to returnable transport items.

WG 8 Application of AIDC standards

Other running projects of WG8 are still under work as reported in update 2019:

- ISO/IEC 18574 Internet of Things (IoT) in the supply chain - Containerized cargo
- ISO/IEC 18575 Internet of Things (IoT) in the supply chain - Products & product packages
- ISO/IEC 18576 Internet of Things (IoT) in the supply chain - Returnable transport items (RTIs)
- ISO/IEC 18577 Internet of Things (IoT) in the supply chain - Transport units
- ISO/IEC 22603 Standard for electronic labelling of electronics

WG8 project "ISO/IEC 22603 Standard for Electronic Labeling".
The approach, initiated by DELL Computer, includes just an encoded URL with a QR code as data carrier, called QRL (Quick Resource Locator). WG 8 did not consider yet to combine “Item ID” with “URL to Information” as the ASC DI “34L” does.
The very simple basic approach for the project is to describe the link from the product label to a web page where the certification information is accessible as an alternative to classic label markings.
The scope is covering the presentation of the certification information on an electronic display, the reference via a QR code and the provision of this information on the Web. Because of the very different characteristics, it was decided to create a series of standards rather than a single standard.

Fig. 25) QRL Quick Resource Locator on label

ISO/IEC 19762 Harmonized vocabulary

Vocabulary Rapporteur Tomohiro Watanabe, DENSO WAVE, JAISA

AIDC standards use specific terms collected and summarized up in the “vocabulary”. The standardization teams of different nations share the work for maintaining the harmonized version with AIDC terms in six languages.
The rapporteur is responsible for the maintenance of ISO/IEC 19762 Harmonized vocabulary and stands above the WGs. The WG conveners are obliged to pass new terms of their projects to the rapporteur for inclusion. The challenge is that the terms get translated into English, French, Korean, Russian, German language. In addition to that the rapporteur managed the translation into Japanese. For people interested in languages the vocabulary is an interesting work full of special terms used in the AIDC area internationally, e.g.:
“Bar code”: バーコード (jp), Символ штрихового кода (ru), code à barres (fr), Strichcode (de), 바코드 (kr)

The Harmonized vocabulary was evolving into a valuable dictionary for AIDC terms.

AIDC applications and implementation of standards

Issuing Agency Code *VAA for CAICT, China

Contribution by Mr. Xiaoyu YOU, CAICT

China Academy of Information and Communications Technology (CAICT) is a scientific research institute directly under the Ministry of Industry and Information Technology (MIIT) of China and plays a role as an innovation leader in China's ICT industry, especially in 5G applications, Industrial Internet, IoT and Blockchain technology. They provide services including new technology research, standardization, testing and certification, industrial innovation, decision-making support, consultancy, industry incubation, and application demonstration.

Identifier is one of the primary business for CAICT and we are playing the leading role in multiple identifier-related aspects in China including new technology research, standardization, infrastructure operations, etc. CAICT has established a nation-wide Industrial Internet Identifier system. Up to July 2020, CAIT has more than 2600 partnership enterprises and over 4.8 billion unique identifiers distributed and the number is growing very fast. The system has effectively promoted the development of the applications of AIDC technologies in China. In the field of identifier-related standardization in China, CAICT is doing top design of the standard architecture and leads the standard development in China. We also contribute to international standard organizations such as IETF, W3C, ISO, IEC, ITU, etc. CAICT is also acting as an enabler in the identifier industry and organizes the Identifier Working Group in the Alliance of Industrial Internet (AII), which is the most influential consortium in China (Initiated by CAICT), to promote the technology research, standardization, application innovations, etc.

**Note: Fig. 26) is showing IAC "VAA" aligning with the family of Issuing Agencies.*

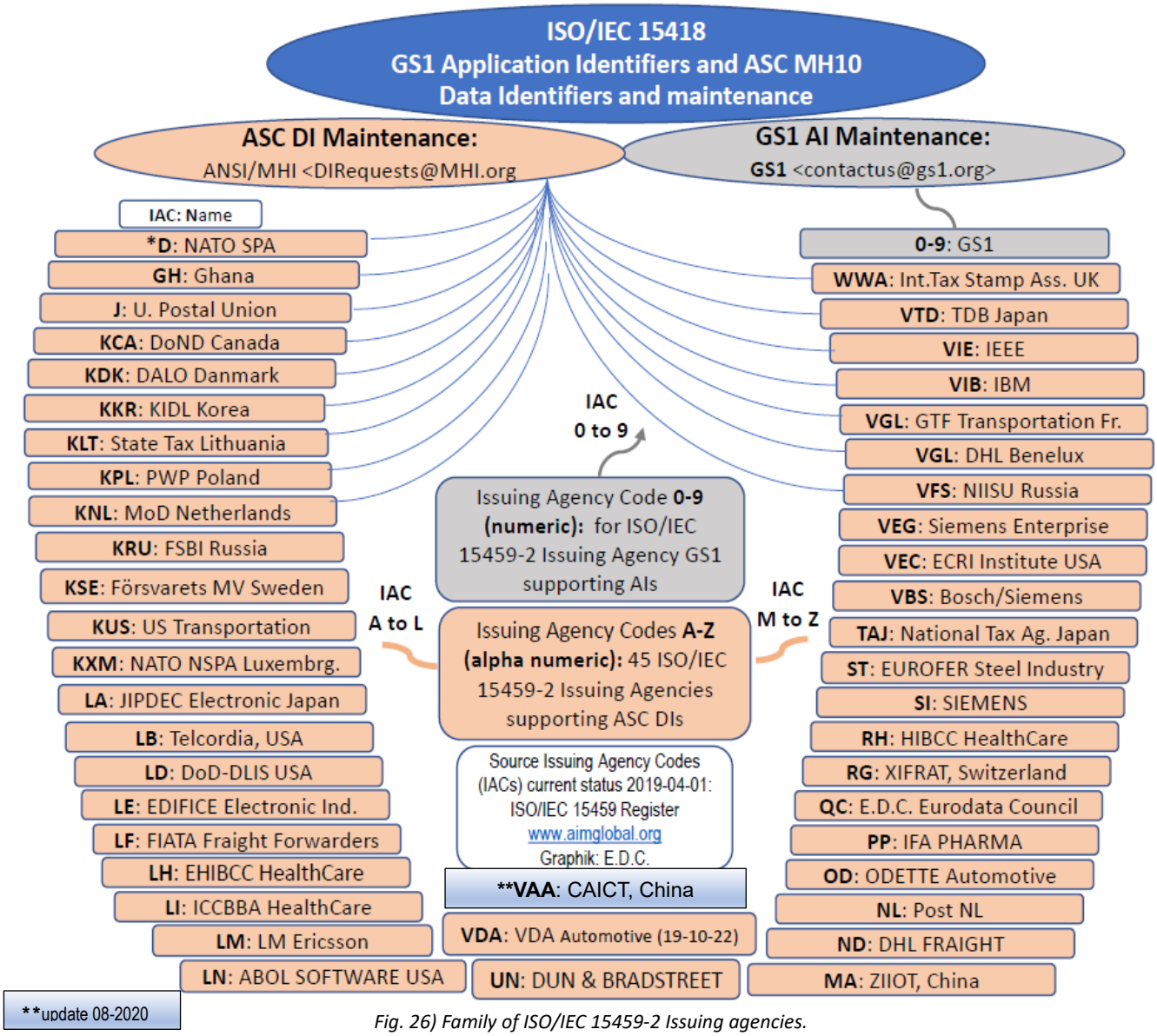


Fig. 26) Family of ISO/IEC 15459-2 Issuing agencies.
*IAC-Register see URL:

Note: One of the Issuing Agencies (GS1) is supporting GS1 AI's, 46 Issuing Agencies rely on ASC Data Identifiers.

Issuing Agencies for Company IDs determine the data format of the codes

Issuing Agencies (IA's) for company IDs (Company Identification Codes - CIN) have a key role in creating distinctive codes. According to ISO/IEC 15459-2, they ensure that no company ID can occur twice. This is something that a manufacturer alone could not achieve without the hierarchy of awarding bodies (see also Annex 2). Even the awarding bodies are accredited and registered. The registration body (RA) designated by ISO for this purpose has currently listed 47 Issuing Agencies entitled for issuing company IDs. The list is public, because it is the purpose of the system that every company/institution in the world can be given a unique CIN if it wants to send unmistakable codes into the world.

The ISO/IEC 15459-2 accredited Issuing Agencies (see Fig. 26) do not only register the company IDs according to their scheme, but also determine the data structure for the code for which the company ID is to be used. This can have an effect on the structure, for example, of the product and transport codes of the manufacturer concerned as a labeler. As a consequence, the choice for the awarding authority is also a choice for the code structure, which also offers various services in terms of code capacity. However, only a few basic structures are available for this purpose, which are referenced in "ISO/IEC 15418 GS1 Application Identifiers (AIs) and ASC MH 10 Data Identifiers (DIs)". Again, only the GS1 allocation authority requires the GS1 structure, the other 46 allocation authorities aim at the ASC-DI structure and differ technically only by company IDs of different length and character string.
Table 1) shows a selection of typical Issuing Agencies for industries and health care and it's associated structures for company IDs, as well as for product and transport codes, for example.

Table 1) Issuing Agencies, their Issuing Agency Codes (IAC), supported structures and data capacity

Selection of ISO/IEC 15459 "Issuing Agencies" for Company IDs (CIN) ▼	**IAC** ▼	**Length of the CIN** ▼	**Typical registered CIN, i.e.** ▼	**Supported data structure & and related capacity, here for product- and transport-codes** (n= numerical, an = alphanumerical)		
Selection of 8 of 47 issuing agencies ▼				**Data structure** ▼	**Product code 2-20an ▼ (max. 50)**	**Transport code 2-20an ▼ (max. 35)**
Eurodata Council	QC	4an	CPRO	ASC	YES	YES
DUN - Dun & Bradstreet	UN	9n	123456789	ASC	YES	YES
GS1 and EPC Global	0-9	3-7	1212345	GS1 (EPC)	3-5n	9n
EDIFICE, European Electronic Industries Association	LE	3an	IBM	ASC	YES	YES
IFA GmbH	PP	5an	12345	ASC	13an	13an
ODETTE European Automotive Industry Assoc.	OD	4an	A2B3	ASC	YES	YES
TELECORDIA Telecom. Equipment	LB	4an	CSCO	ASC	YES	YES
UPU Universal Postal Union,	J	6an	D00001	ASC	YES	YES
EUROFER (Steel Industry)	ST	4n	1234	ASC	YES	YES
etc.						
Selection might be completed on request. Complete list of the ISO/IEC 15459-2 Registry, see: www.aimglobal.org https://www.aimglobal.org/uploads/1/2/4/5/124501539/register-iac-def_2019.pdf						

Table 1) illustrates the link between the choice of the Issuing Agency for the Company ID CIN and the bounding to the application of the CIN with the use of ASC-DI syntax or GS1-AI syntax typically for product and transport codes. These are technical selection criteria for the decision for one or the other Issuing Agency. The complete list of Issuing Agencies is publicly available via the above URL of AIM Global.

Additional accreditation levels for Issuing Agencies in specific areas
Specific entities, also legal regulations, which require unique codes structured according to ISO, can select specific Issuing Agencies from the ISO/IEC 15459 Registry according to their requirements. This is the case, for example, with the regulation for medical devices and in vitro diagnostics (for the USA: UDI 2014, for Europe: MDR 2017, other areas are following). Specifically, the Issuing Agencies GS1, HIBC and ICCBBA and the IFA with its IFA CODING SYSTEM for Europe are accredited for supporting this area by the legislators and are subject to their regulations. However, other ISO/IEC 15459 Issuing Agencies being interested in supporting such specific areas, here health care, can apply for accreditation.

Quick Guide for the creation of global uniqueness for items

ISO/IEC 15459 - Hierarchical A, B, C, D structure

ISO/IEC 15459 describes the overall agreed hierarchy for the production of unmistakable codes. Figure 27 shows the responsibility distributed from A to D. WG 2 adopted the original concept of the hierarchy from CEN EN 1572 and extended it from its original validity only for transport units to codes for the various levels of logistical application. The rule is as simple as it is effective: ISO accredits a "Registration Authority" (A), which in turn registers the actual awarding bodies (B), which assign unmistakable "Company Identification Codes" to companies and institutions (C) on request. Companies that have received a "CIN" are in a position to code everything that is to be unmistakably marked. This includes not only products, packaging, containers, transport units, but also everything else, such as locations, papers, facilities, people, or their ID cards or wristbands. The identifier tells the computer who the code comes from, what it is, the code of the issuing office "IAC" plus the company ID "CIN".

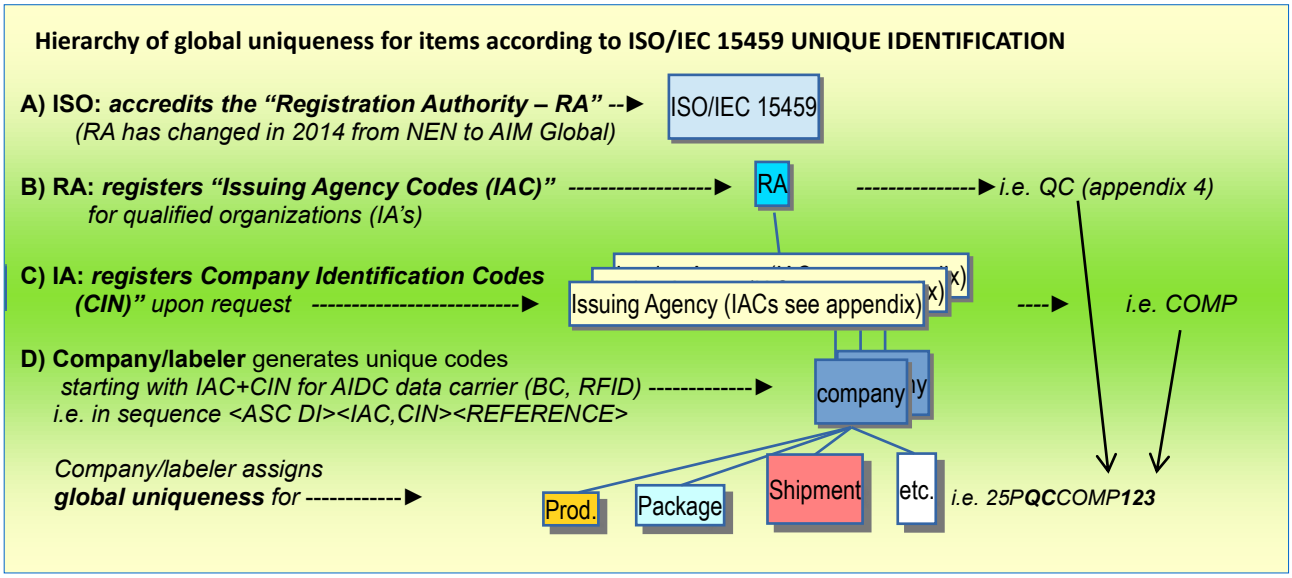


Fig. 27) Hierarchically distributed responsibility for unmistakable unique labelling

How do you generate a unique product code?

The prerequisite for generating an unmistakable code is the receipt of a CIN from an issuing agency. This issuing agency also determines the syntax of the relevant code. If the issuing agency supports the "ISO/IEC 15418-ASC MH 10 Data Identifier (DIs)", then the product reference can be alphanumeric, if it supports, and this is currently only GS1, the "ISO/IEC 15418 Application Identifier (AIs)", then it is numeric. The data length for ASC DI data elements can be from 1 to over 20 characters. For GS1 AIs, the product reference as "Global Trade Item Number (GTIN)" is 14 digit long including company/location code and product article number. The Issuing Agency EHIBCC supports ASC DIs as well as its own HIBC structure with up to 18-digit alphanumeric product codes. The "Quick Guide" below has 5 steps.

Quick Guide: 5 steps to uniqueness

to the unique product code, e.g. for the product reference REF: **M4215R73**:

I) Determine the format of the product reference, e.g. for **M4215R73**, to find the appropriate possible product code.
ISO/IEC 15418 format for the code:

II) Deciding on an issuing agency or its format specifications 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 customer group).

b) if more than 5 digits or alpha characters → go to a registry that supports ASC DIs.

III) Apply for a CIN, here for direct coding of **M4215R73** e.g. "COMP" at "E.D.C.". (IAC "QC")
with support for alphanumeric product codes, as indicated by ASC-DIs.

IV) Choose the appropriate ASC-DI for the sequence "unique product code" <DI><IAC><CIN><REF>
and form the data string,

→ a) here with the REF M4215R73: <25P><QC><COMP><**M4215R73**>

→ b) in case of individual serialization add DI "2S" and serial number e.g. 1234567 for complete coding:
25PQCCOMP**M4215R73**+S1234567 (Additional data element, such as LOT, date, etc. as required)

V) Choose the appropriate medium, e.g. Code 128 for a) or Data Matrix and/or RFID for b)

That's it --► 

...the unique code is generated.

Fig. 28) Serialized unmistakable product code REF. M4215R73 from COMP in ASC syntax coded in Data Matrix and RFID

ASC Data Identifier Maintenance Committee (DIMC)

MHI celebrating 75 Years, Chair of DIMC Bill Hoffman and new DI registration

Material Handling Institute (MHI) was created 1945 to deliver solutions to common industrial challenges for manufacturers in the material handling industry. Patrick Davison, Director, Standards, is proud to announce the 75 years celebration, a remarkable milestone in its history. Right now MHI has got many responsibilities, one is the maintenance of ASC Data Identifiers standardized by ISO/IEC 15418, part ANS MH 10.8.2. Meanwhile ASC Data Identifiers are used globally in rather all business areas. The structure with alphanumeric product codes of variable length gets more and more friends even after a more than 30 years evidence. The responsibility for maintenance of ANS MH 10.8.2 has been assigned to MHI. Under this umbrella the Data Identifier Maintenance Committee (DIMC) has been established for the daily work. The DIMC members are international experts from many countries and business areas working together to achieve global functionality of the ASC Data Identifiers (ASC DI's) for AIDC applications worldwide.
In July 2020 Mr. Bill Hoffman has been confirmed as acting chairman. Requests for assignment of new ASC Data Identifiers get on his desk for processing it with his group of experts as just happened with a request from the health care area (see chapter <New ASC DI "54P">.
ASC DIs are used to identify anything even spare parts as seen at the actual example with not concatenated single data elements of the AIDC supplier Zebra Technologies (Fig. 29).

Fig. 29) Old school spare part label applied with single data elements each in one CODE 39

The sample Fig. 29) shows how long the "old school" style of labels is resisting while other companies have been using 2D symbols for a long time already. Nevertheless, it still works.

URL for Publicly Available Continuous Maintenance version of ASC MH10.8.2 Data Identifiers and Application Identifiers:
http://www.mhi.org/standards/di

ASC DI user question: "Shall a ASC DI stand alone without data?"

This question has not been passed to DIMC yet but it popped up already at the ADC working group of EDIFICE.
In fact, it happens that sometimes No Data are printed after an ASC DI. This would lead to different assumptions.
The sample ISO/IEC 15434 data string below encoded in a Data Matrix symbol shall illustrate such case where ASC DIs are present but some of the data are absent: ----------

[]>$^{R}_{S}$ 06 $^{G}_{S}$ JQCELMIXLP345$^{G}_{S}$2LCZ14800$^{G}_{S}$1PROD77$^{G}_{S}$S76345296$^{G}_{S}$**S**$^{G}_{S}$**S**$^{G}_{S}$**S**$^{R}_{S}$ $^{E}O_{T}$

The sample shows a Licence Plate, a location code, a product code, one serial number headed by "S" and three "S" following indicating a serial number but don't show a data value.
If data are missing, e.g. after ASC DI „S" it might be recognized as
a) the value might be forgotten
b) the DI may have been placed by mistake
c) an absent value might mean there is a part but no serial number
d) it is about an in-house solution not meant for the open supply chain

The sample of a data string with concatenated data elements has been chosen because it is unlikely that a single data element would not have data, like an indicated License Plate without a number below:

J

Conclusion: ASC Data Identifiers define and identify a specific data field. This is true for complete data elements applied with ASC DI and data. For open systems Printing ASC DIs without following data values shall be avoided because valid data elements can be processed at the point of scanning only where the definitions of the ASC DIs are implemented. Probably EDIFICE will recommend to DIMC discussions on a clarification in ANS MH 10.8.2 on this issue.

New ASC DI "54P" for optimization of logistics within the Global UDI project

After registration of ASC DI *"53P – Identifier for Specific Marine Equipment approved under the European Union Directive on Marine Equipment (2014/90/EU and Implementing Regulation (EU) 2018/608"* a new ASC DI has been requested by the coordinating association in health care "FIDE" for optimizing logistical processes in conjunction with the **Global UDI project.**

It is about an ASC DI not directly for product labelling of **Medical Devices (MD),** but for use in ADC containers like ISO/IEC 15434. The new ASC DI shall point directly to the UDI-DI data field of **public UDI data bases** built up by the responsible health care departments of countries and regions like the GUDID in the US and EUDAMED for Europe, etc. MD manufacturers have to register their products jointly with the product **master data in such public UDI data bases**. The product ID stored in the data base is called "UDI-DI" (Unique Device Identification – Device Identifier). On product level the UDI-DIs are encoded in a barcode format of one of the four UDI accredited Issuing Agencies (GS1, HIBCC, ICCBBA and IFA for Europe). The idea of the new ASC DI is to include the data format as stored in the UDI data base in a uniform way. In consequence, same UDI-DI as carried by a GS1, HIBC, ICCBBA ISBT 128 or in an IFA barcode on the product can be carried in one ADC container and the UDI-DIs can be embedded equally flagged with same ASC DI. After discussion and polishing the request by the DIMC, the ASC DI for UDI-DIs has been assigned and published with ANS MH 10.8.2 on 2020-08-27 as follows:

"54P – Identifier for UDI-DI (Unique Device Identification - Device Identifier) for Medical Devices (MD) and In-vitro-Diagnostics (IvD) as the unique key to public UDI data bases (GUDID, EUDAMED, etc.)".

The wording explains it clearly: The data element is refering directly to the specific field in the UDI data base.

Fig. 30) is illustrating the role of the ASC DI "54P" to harmonize UDI-DI data elements with the formats in the data bases.

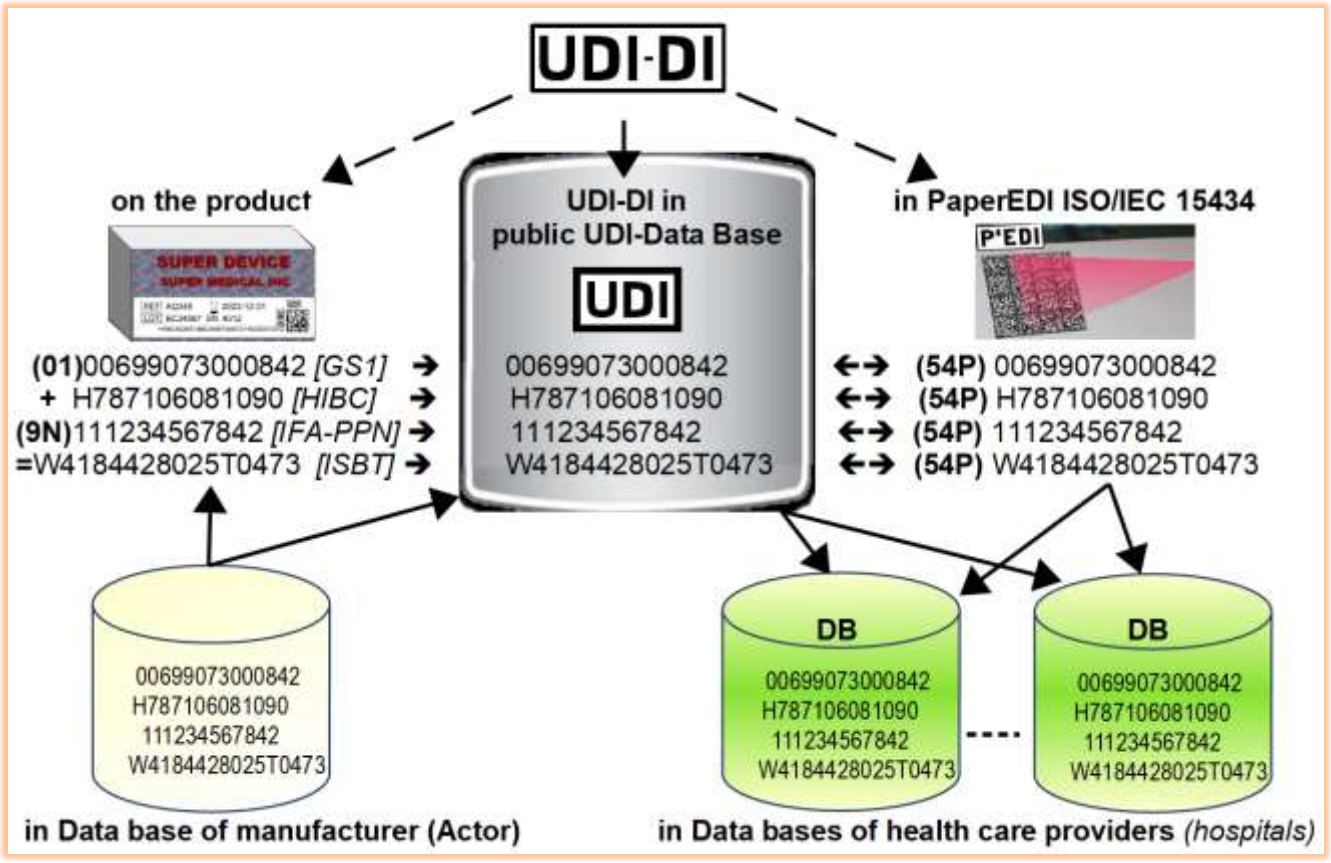


Fig. 30) ASC DI "54P" harmonizing UDI-DIs for ADC envelope (P'EDI) and direct access to public master data

“54P for PaperEDI encoded in an ADC container according to ISO/IEC 15434

The targeted application for the ASC DI “54P” is the so called “PaperEDI” solution to carry shipment contents in one 2D-symbol on ISO 15394 shipment labels or printed on delivery notes. One scan is enough to catch all of the listed products and related date. If the product code is headed by ASC DI “54” the product master data can be accessed at the UDI-Data base and downloaded automatically.

Fig. 30b) Shipment note applied with Data Matrix as P’EDI code carrying all product data of the shipment →

ASC DI “9N” IFA Coding System for UDI in Europe

The IFA Coding System originally was developed for medicinal products but used for Medical Devices (MD) and In-vitro-Diagnostica (IvD) as well. In conjunction with enforcement of the Regulations for MDs and IvDs the IFA GmbH, maintaining the IFA Coding System has been accredited for the UDI-System in Europe. The IFA Coding System is strictly using ASC Data Identifiers embedded in the ASC container ISO/IEC 15434. The registered ASC DI for the coding system is “9N” used for a single product’s label. As UDI-DI existing references can be used like practiced with the HIBC code but also pre-registered national codes. As ASC DIs for the variable product data in the “PI segment” of an UDI product the standard ASC DIs are used like “1T” for LOT, “S” for SN, etc. Fig. 31) below shows a typical UDI label applied with Data Matrix in IFA Coding System structure.

Fig. 31) MD label applied with UDI in IFA Coding System structure, source https://www.ifaffm.de/en/ifa-codingsystem/udi/udi_issuing_entity.html

ASC DI “5R” as a “Digital Logo”

QR is used increasingly for company specific applications and the labelers tend to brand their QR to show who is the originator, not taking care for the encoded data.
Since “5R” has been born, originators are recognizing that they can brand the code not only graphically with their logo but also they can put their brand mark in front of their data stream. The sample below shows the logo of EDC graphically and digitally by aid of ASC DI “5R”.

Fig. 32) Logo optically visible on the code and digital logo in the code “.5RQCDATA:……..” →

Note: Labeler printing logos in a QR should go for the next higher Error Correction Level to compensate the damages of data pattern, nevertheless finder pattern and clock tracks should not be covered by any graphic.

ASC DI “5R” for the Tobacco traceability project

AIDC report 2019 included the , chapter “AIDC for TOBACCO products sector in Europe” already. The Tobacco Products Directive has been published with the Official Journal of the European Union “L96” April 16, 2018.
(see: https://publications.europa.eu/en/publication-detail/-/publication/536e4d37-4140-11e8-b5fe-01aa75ed71a1)

One of the purposes of the regulation is to improve control of the tobacco products by the customs authorities. The regulation defined a specific traceability code applied with a specific structure to secure authentication of the TOBACCO items in relation to transmission and storage of the production information in the repositories. Trusted entities, called “Competent national Issuers” supply a unique data string both for the data base as for the manufacturer for encoding on the product packaging’s.
ASC DIs allow to mark not only single elements uniquely but also specific data strings as used for the Tobacco project. Trusted “Competent Issuers” use the ASC DI “5R” combined with an IAC and the CIN to brand this specific secured data string.

As an example, the data string generated for a security function “123aBcD89012123456712345n4Ts8P19090109” applied with ASC DI “5R” becomes unique worldwide and leads back to the generating issuer by means of the “5R” sequence:

<.><5R><IAC><CIN><:><specific data string>:

<.5RQCABCD123aBcD89012123456712345n4Ts8P19090109>

Fig. 33) Cigarette box with **Dot Code** at the small side of the box carrying the unique data string flagged with ASC DI “5R”.

Fig. 33) Tobacco Dot code flagged with ASC DI “5R”

Data Carrier for TOBACCO

So far just UPC and EAN codes have been applied on the product for the purpose of scanning at Point of Sales. This doesn’t change, but now, according to the regulation, the additional traceability code has to be added on single packages and bundled multipacks. For marking on the levels, different symbologies apply for encoding the UIs.

On unit Level apply ISO/IEC 18004 QR Code, ISO/IEC 16022 Data Matrix but also AIM DotCode (Fig. 34 to 36). The latter for reasons of high volume fast printing processes by ink jet printing systems.

Fig. 34) ISO/IEC 16022 Data Matrix, ISO/IEC 18004 QR Code, AIM DotCode

Fig. 35) ISO/IEC 16022 Data Matrix with Tobacco data Source: E.D.C.

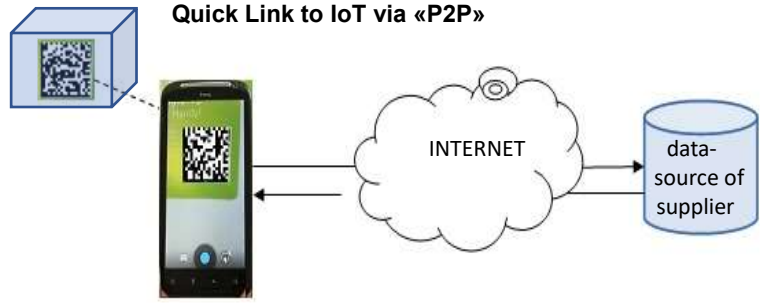
Fig. 36) AIM DotCode placed on unit level package source: Incert

For marking of the upper levels, ISO/IEC 16022 Data Matrix, ISO/IEC 18004 QR Code are the symbologies foreseen by the tobacco regulation in conjunction with ISO/IEC 15459-4, and Code 128 for the transport level (ISO/IEC 15459-1). Where it is the responsibility of the Economic Operator (manufacturer) labeling those levels. Where the “Competent national Issuers” is supplying the unique code string, the labeler has the choice of selecting the best fitting symbology.

ASC DI „34L“ for P2P INTERNET of THINGS access (DIN SPEC 16589)

Quick Link to IoT via “Pointer to Process -P2P”

Internet access with smartphone via QR code is common practice today, but there are even more developments featuring Internet access by regular barcode (or RFID).
This is a rising demand: Using IoT for access to item information by scanning a regular item code applied for item identification and tracking & tracing purposes. A regular URL in a QR Code does not allow identification of a specific product and neither traceability nor security functions, but applications require both, unique item identification in a backward compatible manner AND access to information via Internet.
DIN WG NA 041-01-31 responded to the initiative from Industry & Healthcare experts for a "Light IoT" system developing DIN SPEC 16589 Product to Internet Communication (Pointer to Process- P2P). The key of the solution is an add on to any unique item bar code or RFID Tag, like a UID according to ISO/IEC 15459 using ASC DIs, e.g. DI “25S”. This unique item code will be applied by an ‘add on’, consisting of the ASC P2P DI “34L” and a port URL. Access to the related IoT address will be executed generating the IoT target URL by extracting the P2P URL and appending the item code at the end of the P2P URL.
This is forming the Internet compatible Target URL. The formatting and converting has been standardized by registration of the ASC DI “34L”. DIN SPEC 16589 describes the application of the quick and easy IoT by help of smart phone (Fig 37), by a scanner or by help of a data entry software tool.



The quick & simple link to the data source:
a) scan P2P code
b) convert Item-ID + P2P URL to target-URL (P2P-App)
c) send this target URL to the internet for direct access to sources or dialogs

Note: The labeler of the P2P-Code may target to his own Web page.

Fig. 37) Scanning P2P product code leads to the data source in the web

The backward compatible Quick IoT solution using “Pointer to Process (P2P)” is smart because the item code can be used for item identification AND for IoT access. In addition to it, no additional third-party web services are required, the labeler can target the URL to information or dialogs hosted by himself. Fig. 37) is showing the principle of a P2P IoT application enabling easy access to Material Safety Data Sheets (MSDS), to maintenance instructions, to a dialog for e.g. a repair or maintenance process and many other features the Internet would allow to use.
The P2P solution is included in "DIN 66277 Electronic nameplate", also IEC TC 91 integrated P2P in IEC 62090, Edition 2.0. for automated access to product-relevant information.

Note: For information on DIN SPEC 16589 product-to-Internet communication, see:
https://www.din.de/de/mitwirken/normenausschuesse/nia/din-spec/wdc-beuth:din21:288399037

AIDC- Web and keyboard compatible encoding

Guideline for simple keyboard and WEB interface compatible syntax for AIDC media

Data in AIDC media get structured in order to become globally unique. Structuring is specifically required in case of multiple, concatenated data elements in a code. There are structures available using keyboard compatible character sets only, like HIBC, ISBT, Eurocode, but other structures are using extended character sets like ISO/IEC 15434 and like GS1. GS1 defines the “Group Separator (^{G}s)” as delimiter between data elements and ISO/IEC 15434 is using complex start and stop sequence containing non-keyboard characters and “^{G}s” is defined as separator between data elements. These control characters don’t pass keyboard interfaces.

Problem to solve: “Non printable characters” don’t pass Web and keyboard interfaces

Example – Processing an encoded string structured according to ISO/IEC 15434:
Advantages of this approach are that these sequences never appear "unintentionally”. The disadvantage of this complex data structure is that the non-printable characters are lost in keyboard and web interfaces. At the time when ISO/IEC 15434 was created in 1995 by CEN TC 225, serial interfaces and POS interfaces were still common for handling such data structures. In the meantime, these interfaces hardly play a role anymore, so with today's standard hardware and software of keyboard emulation via USB and web applications, the implementation of e.g. ISO/IEC 15434 is a big challenge.

The problem

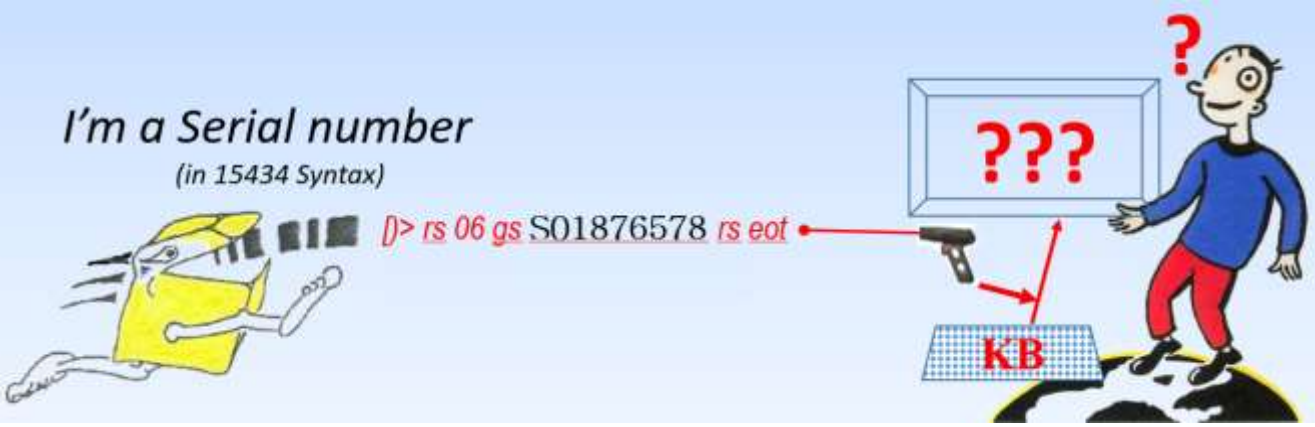


Fig. 38) Problem to be solved: Captured data encoded with "non keyboard characters" do not pass keyboard interfaces

The Solution

To avoid interface problems the "EDIFICE Guideline for Web and keyboard compatible encoding with ASC Data Identifiers" defines the "." (dot) as the flag for following ASC DI data elements and as delimiter the character Circumflex "^". Both are keyboard characters and enable easy scanner and Web connectivity for all kind of interfaces.

Fig. 39) The solution: The Flag Character "."(dot) makes the barcode data unique and passing keyboard & web interfaces

An excerpt from the "**EDIFICE Guideline** for Web and keyboard compatible encoding with ASC Data Identifiers" can be found below.
The guideline is under way to "DIN 16598 Syntax keyboard and Web compatible encoding of data elements in machine readable symbols applied with ASC Data Identifiers".

========== Excerpt of the EDIFICE Guideline ==========

WEB AND KEYBOARD COMPATIBLE ENCODING WITH ASC DATA IDENTIFIERS - Issue 1.0

Although the background of EDIFICE is the High-Tech Industry, the application of
this guideline is not limited to a specific industry sector or subset of Data Identifiers.

1.2 Problems to Solve

1.2.1 **Ambiguity of data elements** applied with ASC Data Identifiers without any Flag Character
Data elements headed by ASC Data Identifiers are not secured against overlapping with encoded data of other nature or other structurers like "IUID" headed by Text Element Identifiers (TEI).

1.2.2 **Non-Web/Keyboard compatibility** of ISO/IEC 15434 Syntax
Unique syntax using control characters outside the keyboard set, like ISO/IEC 15434 Syntax for high capacity media (<rs>, <gs>, <eot>, etc) do not pass such physical or virtual interfaces and may even invoke unwanted functionalities that may be assigned to corresponding keys by the application.

1.3 **The scope of this guideline** is the definition of a unique encoding scheme of data elements applied with ASC Data Identifiers for use in applications where Web and keyboard compatible syntax is required and unambiguity compared to non ASC DI data elements.

3.1 Flag and separator characters and rules

- The Flag-Character is the "." (dot) character: this is the very first character of the data string.
- All data elements are headed by ASC Data Identifiers.
- Data elements shall not contain a "^" (circumflex) character.

If more than one data element is encoded in the same symbol, then the data elements are separated by a "^" (circumflex) character.

3.4 Summary

The table below gives a summary for the usage of the dot character as flag character.

EDIFICE Table 1 - Summary

FLAG CHARACTER	EXPLANATION
•	The "dot" character is the flag character to identify Web and keyboard compatible encoding with ASC Data Identifiers. The separator between encoded data elements is the character "^" (Circumflex)

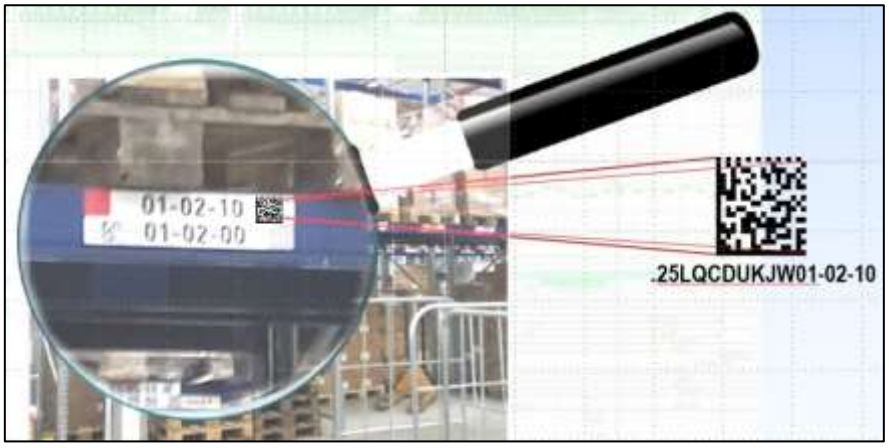
4.1 Keyboard friendly application example with unique serial number

The example in figure 5) shows a globally unique serial number with flag character "." identifying a SN of a test tube.

Guideline Figure 5) UIM on a test tube applied with flag character "." →
(for unique distinction with other 25S… values)

4.2 Keyboard friendly application example of a stock location code

Guideline Figure 6 below shows a warehouse applied with stock location codes.



Guideline Figure 6) - Stock location code (source: Klinikum of the Friedrich Schiller University of Jena (UKJ), Germany)

Data sequence of the example guideline Fig. 6)

. 25LQC DUKJ W01-02-10
- Stock location of UKJ: W01-02-10
- CIN: DUKJ
- IAC: QC
- ASC Data Identifier: 25L
- "**.**" System Identifier for the ASC DI structure

4.3 Keyboard friendly application example with two concatenated data elements Product

Guideline Figure (7) shows two concatenated data elements →

Data sequence of the example Fig. 7)

.25P LE BSA 47147115**^**S8765432
- ASC DI "S" followed by SN 8765432
- Separator "**^**"
- Product reference no.: 47147115
- CIN: BSA
- IAC: LE (EDIFICE)
- ASC Data Identifier: 25P
- "**.**" System Identifier for the ASC DI structure

Note: ***The EDIFICE License Plate Guideline for Transport Units*** *issue June 2020 included the "dot" as well, shown with the sample:* • **nJ LE XYZ 1234567890**

Both documents can be obtained free of charge from: http://wp1.edifice.org/guidelines/adc/

Application ISO/IEC 20248 Digital Signature

Example DigSig secured Object Identification

ISO/IEC 20248-DigSig can be used to verify the contents of AIDC media such as barcodes, 2D and RFID.
Here is a generic example application which can be used anywhere and anytime:

A) The manufacturer adds the product code to identify a 20248-DigSig, but also to verify it via Internet resourse

B) The receiving partner can use it not only to identify the product, but also to verify the contents of AIDC media such as barcode, 2D and RFID.

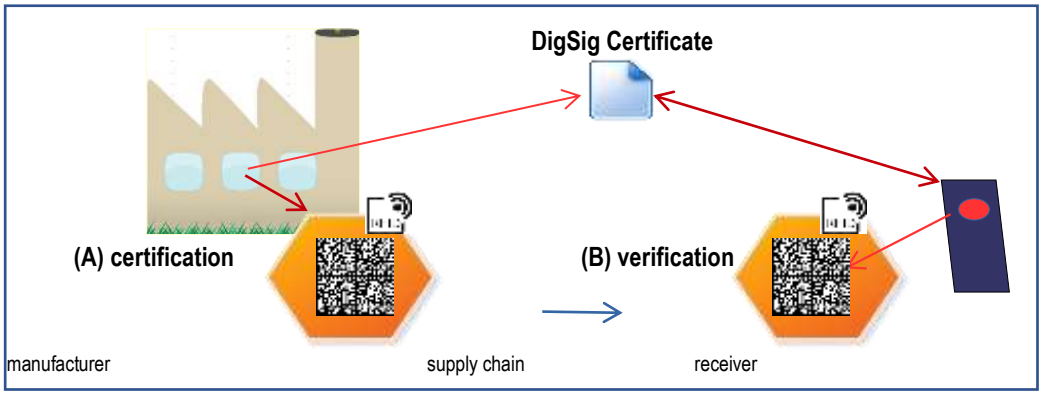


Fig. 40) Illustration of a DigSig application

The example code protected with DigSig contains the following data elements:

data element	*ASC-DI*	*value*	*ASC-data string*
Unique SN (UID)	**25S**	QCTRUE123456	**25S**QCTRUE123456
product reference	**1P**	MOT25X	**1P**MOT25X
production date	**16D**	2017-07-20	**16D**20170720
Additional element:	**6R**	*https://v1.20248.info/?wJgJlkAByOEAEZiABcUOiUS-CcR7en-awDzEaTiV4-kxodnqQZvEdjBZbwRV*	***6R**https://v1.20248.info/?wJgJlkAByOEAEZiABcUOiUS-CcR7en-awDzEaTiV4-kxodnqQZvEdjBZbwRV*

→ The DigSig for the verification of the above data is generated by the manufacturer during marking and provided with the standardized ASC-DI "**6R**" ISO/IEC 20248 digital signature data construct.

The "**DigSig data element**" structured according to 20248 rules is added to the object data. This in a suitable medium such as QR Code, Data Matrix or RFID encoded in "ISO/IEC 15434 Syntax for High Capacity Media" forms the protected code. In Data Matrix the start-[)><$^{R}_{S}$>06<$^{G}_{S}$> and the stop sequence <$^{R}_{S}$><^{E}O$_{T}$> is substituted by the control character "Macro 06"). Figure 41 shows a DatMatrix containing the above data elements for automatic identification of the object/product and DigSig for verification of the data.

*<Macro06>**25S**QCTRUE123456<$^{G}_{S}$>**1P**MOT25X<$^{G}_{S}$>**16D**20170720<$^{G}_{S}$>**6R**https://v1.20248.info/?wJgJlkAByOEAEZiABcUOiUS-CcR7en-awDzEaTiV4-kxodnqQZvEdjBZbwRV*

Fig. 41) ISO/IEC 16022 Data Matrix with object data and DigSig, size 40x40 Module, with X 0,25 = 10x10mm

VERIFICATION at the receiver/user is performed automatically via the Internet by sending DigSig plus data to the verification address of the "**DigSig Verifier**" where the certificate is located. The address information is contained in the DigSig.
→ For transmission to the "DigSig Verifier" via Internet, e.g. via smartphone and "App", the scanned data string is easily converted by pushing the DigSig to the front without DI "6R" and without 15434 start/stop and replacing the separator <$^{G}_{S}$> with the tilde "~". Thus, the data string is perfectly prepared for transmission and verification.

Barcode DigSig Container
The term Barcode DigSig Container is used if the DigSig is embedded in a secured barcode symbol like shown with Fig. 42) For showing that a barcode is DigSig secured
a DigSig emblem can be add adjacent to the symbol.

Fig. 42) Data Matrix applied with DigSig and UID emblem

DigSig Cross Authority Container

Steyn Geldenhuis & Joo-Sang Park

The DigSig Cross Authority Container started as an idea of using barcodes from different authorities in different domains to display information relevant to each of these authority domains in a language that the verifying entity can understand - thereby translating the document. This should use localization settings of mobile phones, web browsers and operating system APIs in general.

However, in the WG2 ad-hoc it was soon pointed out that ISO/IEC 20248 can facilitate this type of functionality to a degree, with the correct setup and additions.

An example is a train ticket issued by a Domain Authority (DA) A as shown in Fig.43). This ticket is described by a ISO/IEC 20248 Data Definition Description (DDD) which defines how the data is encoded in a 2D barcode. It also defines how the data is decoded and presented to the verifying entity in a generic way.

This DDD (produced with English field names) is distributed by means of a X.509 certificate which also contains the public keys and is cryptographically signed by DA-A in order to facilitate non-repudiation.

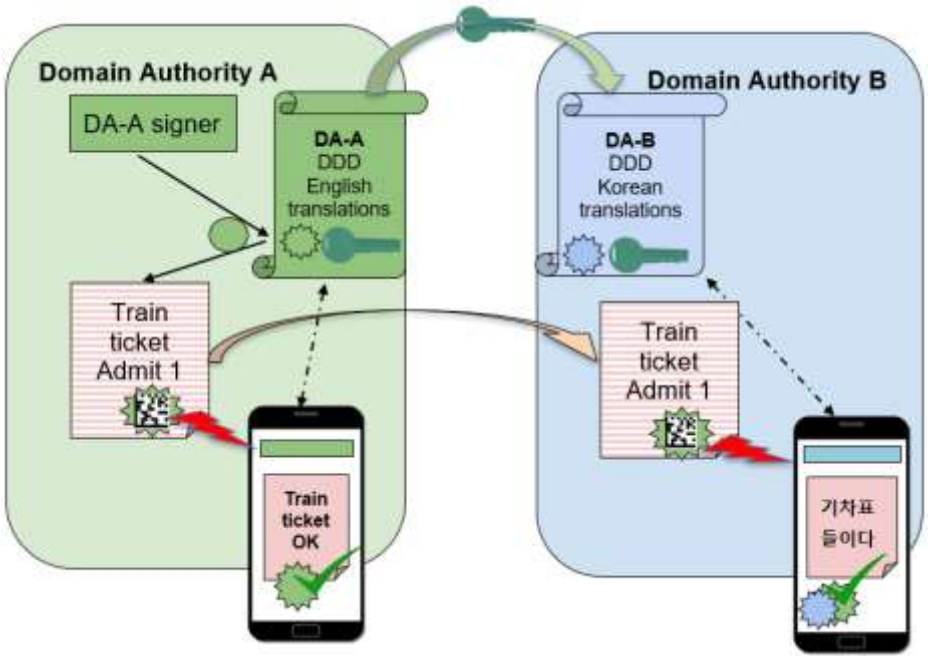


Fig. 43) DigSig secured ticked used in territory A (English) and in B (Korean)

A ticket can then be verified by a verifier that uses DA-A. However, if this ticket crosses a border into DA-B's jurisdiction, this ticket should also be verifiable. There are 2 ways to do this:

1. Simply use the certificate from DA-A containing the DDD and public key.
2. Create a new certificate based on the certificate from DA-A so that it is distributable by DA-B containing a new DDD but reusing the public key from DA-A.

Option 1 can cater for multiple languages and if a language is not supported it defaults to the first defined language in the DDD. This would also imply that DA-B does trust the information in the certificate and by extending DA-A implicitly.

Option 2 has the advantage that DA-B can translate the document on their own without input from DA-A. They would tweak the DDD to suit their needs - as long as they don't change the encoding of the details and include the original public key from DA-A. DA-B can then create a certificate that is trusted in their domain and in their chosen set of languages.

Along with option 2 would be the ability to point the "structdocuri" to a structured document of their choice.

In ISO/IEC 20248's DDD structured document URI is defined by: "structureddocuri":<structured document URI>

ISO/IEC 20248 does however not specify anything other than a URI is used.
It can be augmented by specifying further that it shall contain the following:

1. The language code of the structured document as per 20248.
2. The signature of the structured document template.

The DigSig fields to be populated in the structured document shall be done with DDD data. In the case that the DDD data and the structured document language differ, the default translated DDD data shall be used as specified in ISO/IEC 20248

It is also important to note that this type of use is not limited to the use of barcodes, seeing as ISO/IEC 20248 is AIDC agnostic, but NFC or RAIN RFID are particularly attractive carriers for this use case.
With this in mind, "Barcode Container" might not be an appropriate description for what is aimed to be achieved here.

By using ISO/IEC 20248 and the reissuance of X.509 certificates by a jurisdiction we get data structures that have integrity, translatable, are transferable between jurisdictions, presentable as the original creator of the document intended, and are explicitly trusted by the jurisdiction that adopts this data structure. A working name that might be more suitable would be "Transferable AIDC data structures" or better "Trusted AIDC Data Structures"?

News from SC 31 member and AIDC areas

ISO and CEN committees are liaison partners for AIDC standardization

Mr. Claude Tételin is liaison speaker of SC31 and CEN TC225. He reported about the CEN TC 225 activities:
Since last SC31 plenary the European Standards have been completed:

• EN 17230: **RFID in rail** (see info box CEN TC 225: RFID in Rail).

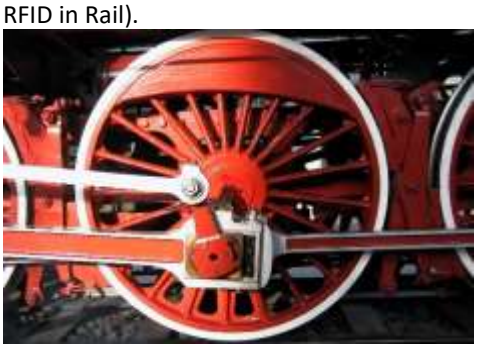


Fig. 44) Wheel of a steam locomotive, synonym of railway but without RFID yet

CEN TC225: RFID in RAIL EN 17230

CONTRIBUTION Erwin Schmidt, Pepperl & Fuchs

The European Standards Institute CEN TC225 AIDC, WG4 Applications has developed the standard EN 17230 "Information technology - RFID in railway applications". The standard is used to identify locomotives and railway waggons with RFID transponders. Two UHF transponders according to ISO / IEC 18000-63 are provided per vehicle on each side of the vehicle. It defines the areas in which the transponders are to be mounted so that they can be read properly by permanently installed readers. The transponder data also contains this information on which side of the vehicle the transponder is mounted.

At the heart of the data are the already existing identification numbers, which follow the International Union of Railways UIC Scheme. For European rail companies, this is the 12-digit European Vehicle Number (EVN). Other railway companies can use different identification numbers. The railway company is identified by the company code. This makes the standard applicable worldwide. For carrying the data, two possible data structures are offered by the standard. Either a data structure according to GS1 with a Global Individual Asset Identifier (GIAI), or the data structure with ASC Data Identifier can be used. For the latter, a special Application Family Identifier (AFI) has been registered for use with this specific application.

• EN 17071 Information technology. Automatic identification and data capture techniques. **Electronic identification plate** has been published in March 2019.

• EN 17099: **Barcode for Fish and seafood products** - Requirements for labelling of fish boxes, distribution units and pallets for fish and seafood products. The EN lists mandatory and optional information and how to encode it according to ISO/IEC 15418 GS1 AIs and ASC DIs.

RFID partnership between IATA and CISC Semiconductor

for ISO/IEC conforming RFID installations for baggage tracking and its quality

Contribution by Josef Preishuber-Pflügl, CISC, SC31/WG4

Logo IATA

CISC Semiconductor recently joined IATA Strategic Partner program to support the current demand of RAIN (UHF RFID) tag and reader testing. CISC will engage in activities around RFID baggage workgroup to understand the requirements, set guidelines and educate the airlines and its partners on benefits of the RAIN technology. The **International Air Transport Association (IATA)** 75th Annual General Meeting (AGM) unanimously adopted a resolution supporting the global deployment of Radio Frequency Identification (RFID) for baggage tracking and the implementation of modern baggage messaging standards to accurately track passengers' baggage in real-time across key points in the journey. This resolution encourages the transition from bar-coded labels to baggage labels including UHF RFID inlay. IATA had also developed a Recommended Practice 1740C guideline, to reflect the latest developments in the UHF RFID technology and a set of tests to ensure global standard of performance to the tags and readers. IATA Recommendation 1740C in particular refers to the WG4 standards ISO/IEC 18000-63, ISO/IEC 15961 and ISO/IEC 15962 and related test standards.

With over 20 years of experience in the different standardization bodies and in implementation of the UHF RFID technology CISC hopes to support the airlines and the industry to understand the technology and to avoid the pitfalls for a smoother transition into UHF RFID.

Item Unique Identification – IUID for the Defense sector

Practiced over ten years but still worth to be mentioned is the IUID project of the United States Department of Defense and shared by the NATO partners. The system for Uniquely Identifying Items **UII** includes a uniquely serialized ID mark, the **IUID** being mandatory for all federal contractors on their government furnished military and non-military equipment with a value of above 5000 USD and a central governmentally driven IUID data base. By help of the IUID code and the data base any IUID labelled equipment can be found whereever it is located or was moved to. So nearest located spare equipment can be found or spare parts or specific tools. After introduction by information sessions and workshops it became very quiet around the project, why? Because it is running smoothly and very effectively, a goal of course for any logistical processes.

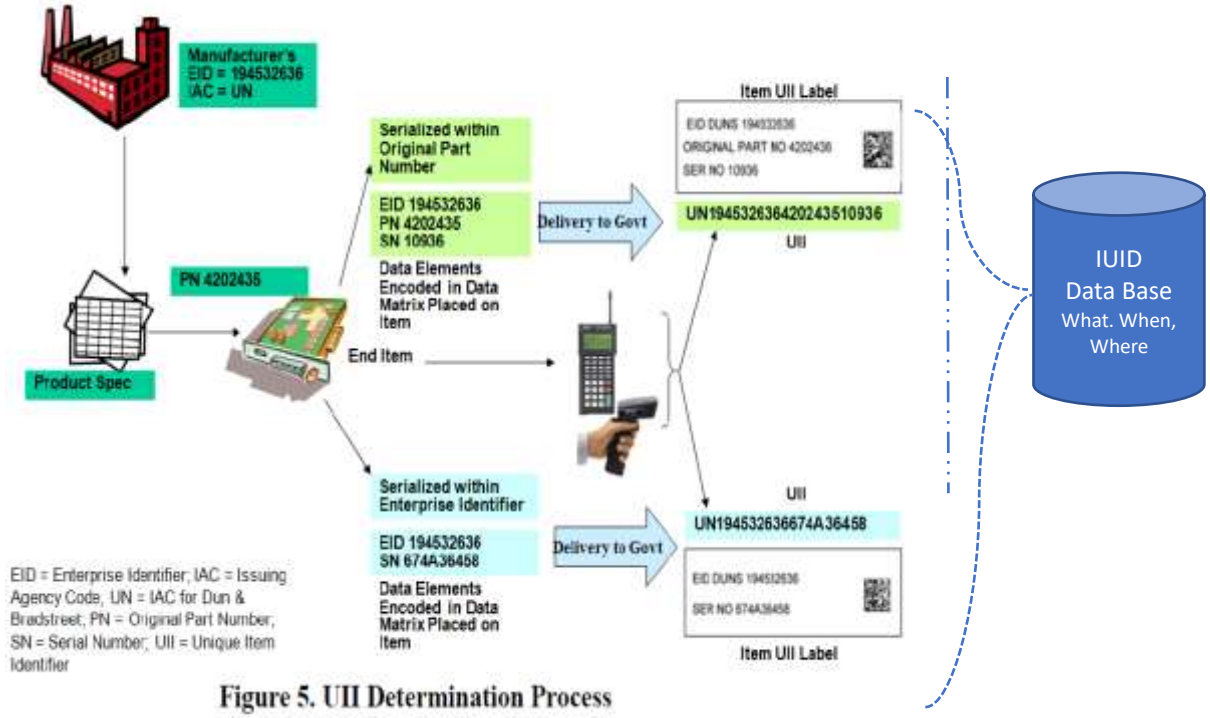


Fig. 45) Chart of Fig. 5. DoD Guide to Uniquely Identifying Items V3.0 - supplemented with IUID data base for illustration

AIDC for MARINE EQUIPMENT required by the European Regulation EU/2018/608

DIRECTIVE 2014/90/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL required declaration of conformity by a specific emblem, the “wheel mark”. It was indicated that the wheel mark might be supplemented by an electronic tag in due time. This happened 2018 already. The Official Journal L 101/64 published the IMPLEMENTING REGULATION (EU) 2018/608 of 19 April 2018 laying down technical criteria for electronic tags for marine equipment. The regulation requires an ISO/IEC 16022 Data Matrix and/or an UHF RFID Tag according to ISO/IEC 18000-6:2004 Type C (ISO/IEC 18000-63). The regulation defines also how to combine the marine emblem “wheel” with the RFID emblem ISO/IEC 29160 and/or a Data Matrix according to ISO/IEC 16022 (Fig. 46).

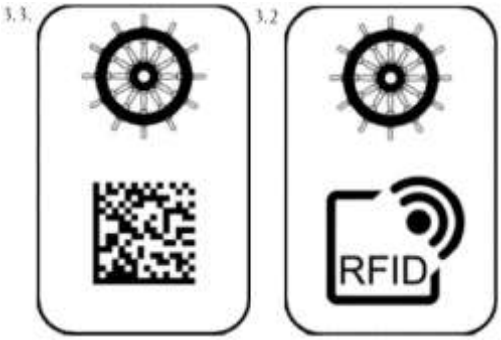


Fig. 46) Marine Equipment emblem for Data Matrix and/or RFID marking, source EU L 101/67, 20.4.2018

The required data elements in the electronic data carrier are the conformity certificate number, the ID of the notified body assigned by the Commission and a proceeding character indicating the type of conformity assessment undertaken. Additional item related data can be added optionally, like product code, the lot or serial number structured in accordance with ISO/IEC 15434 and using ISO/IEC 15418 Identifiers. The electronic tag contains key information, able to provide for a link to the database (https://www.mared.org/) with a full set of information like manufacturer data, certificates, document of compliance, etc. In essence, the tag shall ease control of conformity to EU regulations for increasing safety.

Appendix “Symbologies”

Fig. 46) Han Xin Code

Han Xin Code (ISO/IEC 20830)

After preparation of the HAN XIN code specification by AIM (ISO/IEC 20830) to perform as base for an ISO/IEC standard, HAN XIN was seen as ready to be completed as an ISO/IEC standard. The chairman of WG 1 AIDC Media mentioned the good progress of the Chinese initiative with the Han Xin Code. As the QR Code is performing not only for carrying standard ASCII data formats but japanese typical characters as well, HAN XIN does it for the Chinese character set. The development of HAN XIN shows that the chinese experts of automatic identifcation technologies contribute actively with specific AIDC soltions rather than just to watch developments andertaken by others. Nevertheless it also shows that the know how for AIDC is increasing in the international arena in a fruitful and cooperative manner.

QR Code extension: Rectangular Micro QR “rMQR”

The QR code development team at DENSO WAVE joined the idea of DMRE to add rectangulr formats to the originally square sizes of the code. Tomohiro Watanabe reported that evaluations have proofed, that rectangular formats would fill the gap of marking requirements for smaller sizes with limited hight but increased data volume (see Fig. 47). One more advantage of rectangular matrix codes is for example form fitting for round surfaces. The idea has been persued that the MicroQR code according ISO/IEC 18004 could serve as a basis and becomes supplemented by new formats.
The project has officially started as an ISO/IEC standardization p

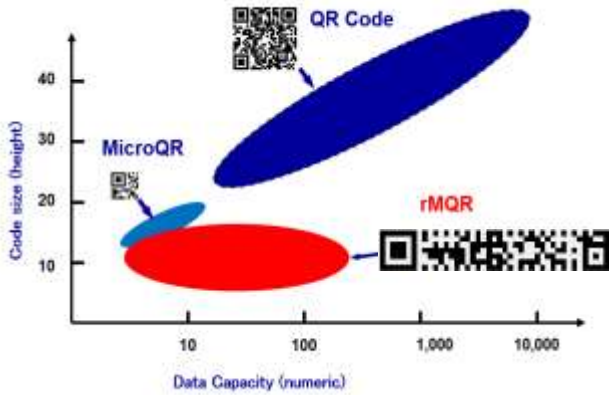


Fig. 47) Target application area for rectangular MicroQR-Codes

Data Matrix rectangular extension: “ISO/IEC 21471 DMRE”

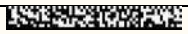
After submission of the DIN Norm DIN 16587 DMRE to ISO, SC31 delegated it to WG1 to produce an ISO/IEC standard for extension of the regular Data Matrix features in terms of sizes and capacities for accommodation of more data on narrow or round surfaces (Fig. 48).

Fig. 48) DMRE on medical devices applied with a UDI Health Industry Bar Code - HIBC as UDI data content (Source: Sprague Ackley, Honeywell) and DMRE with IUID data on a round surface of a tube (Source Harald Oehlmann)

ISO/IEC 16022 Data Matrix includes 6 rectangular sizes already, DMRE will provide additional 18 sizes as an extension. The project has been numbered with ISO/IEC 21471. In the course of the standardization process the number of rectangular formats of Data Matrix has been completed to 18 formats (some samples see table 2) and full list of sizes see table 3). Industries like Pharmaceutical Industries, Electronic Industries, Automotive and others supported the project in order to fill gaps of marking options to be applied to small form factors.
ISO/IEC 21471 DMRE is available by ISO → https://www.iso.org/standard/70947.html

Table 2) Four examples of the 18 rectangular formats of ISO/IEC 21471 DMRE, enabling encoding of higher data volume on surfaces of small hight.

Table 2) Four of the 18 rectangular extensions of Data Matrix with their ratio of size and data capacity

	Format Capacity n/an	mm x mm X=10mil/ 0,25mm	Sample with generic example data as content ▼
1	8x48 36/25	2 x 12mm	 123456789012345678901234567890123456
2	8X64 48/34	2 x 16mm	 123456789012345678901234567890123456789012345678
3	12 x 64 86/63	3 x 16mm	 123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456
4	16 x 64 124/91	4 x 16mm	 123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234
			For all DMRE-formats see table 3) or ISO/IEC 21471

Labeling software as well as scanners for DMRE are available in the market already and it is to expect that DMRE will become a regular add on feature to standard 2D bar code devices.

The new rectangular Data Matrix formats make it possible to solve many marking problems where machine readable marking on narrow surfaces was previously not possible. This enables, for example, medical devices to be labelled and the requirements for their traceability to be met. Until DMRE is published as ISO/IEC 21471, the innovations are accessible in the already published AIM symbol Specification DMRE and DIN 16587. Freely downloadable open source tools for creating DMRE symbols are available on the web page: www.dmre.info
The full list of 24 rectangular symbol sizes of both ISO/IEC 16022 Data Matrix (6 sizes) and ISO/IEC 21471 DMRE (18 sizes) can be seen in table 3)

Table 3) Data Matrix rectangular symbol sizes of ISO/IEC 16022 (DMX) and ISO/IEC 21471 DMRE

DMX/DMRE	Symbol sizea		Maximum data capacity	
	Row	Col.	Numeric	Alphanum.[c]
DMX	8	18	10	6
DMX	8x	32	20	13
DMRE	8	48	36	25
DMRE	8	64	48	34
DMRE	8	80	64	46
DMRE	8	96	76	55
DMRE	8	120	98	72
DMRE	8	144	126	93
DMX	12	26	32	22
DMX	12	36	44	31
DMRE	12	64	86	63
DMRE	12	88	128	94
DMX	16	36	64	46
DMX	16	48	98	72
DMRE	16	64	124	91
DMRE	20	36	88	64
DMRE	20	44	112	82
DMRE	20	64	186	124
DMRE	22	48	144	106
DMRE	24	48	160	118
DMRE	24	64	216	160
DMRE	26	40	140	103
DMRE	26	48	180	133
DMRE	26	64	236	175
	Note: Symbol size does not include quiet zones			

Source: Excerpts of content of ISO/IEC DIS 21471 table 7 and ISO/IEC 16022 table 7

Code in Color: Just Another Barcode (JAB)

Fig. 49) JAB Code formed as an angle(source Waldemar Berchtold, Fraunhofer Institut, Darmstadt, DE)

After presentation of the JAB Code symbology at the ISO/IEC JTC 1/SC 31 Plenary 2018 JAB Code became another SC 31 project dedicated to WG1. The project reference is NP23634. JAB Code, the polychrome matrix code was initiated by the German Federal Office for Information Security and was developed by a team led by Huajian Liu and Waldemar Berchtold from the Fraunhofer Institute for Information Security (Fraunhofer SIT) in Darmstadt. A reference implementation from the developer can be found under www.jabcode.org and the source code is available under www.github.com/jabcode/jabcode. Jabcode itself as well as the reference implementation can be used under the open source license LGPL v2.1. The official project proposal to SC 31 has been submitted by DIN. The proposed project manager for the ISO/IEC JTC 1/SC 31 standardization project is Mr. Berchtold.
In contrast to monochrome matrix codes, with JAB Code the information density can be increased to approximately 3 times the density by using several colors. The proposed design also allows more flexible shapes through docked secondary symbols. With smartphones, 80% of consumers in Germany have a reader that is suitable for reading polychrome matrix codes from hardware with color photo sensors and enough computing power. Worldwide, by 2018, 2.6 billion smartphones are in the possession of consumers as potential readers of JAB codes.

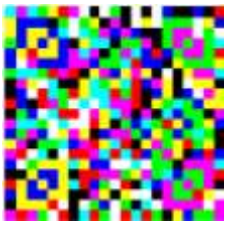
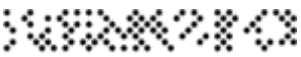


Fig. 50) JAB Code square

JAB Code is not the first attempt to introduce a polychrome barcode. Experts still remember Microsoft's "High Capacity Color Barcode (HCCB)", which is composed of triangles of different colors. This code was introduced by Microsoft in 2007 already but did not get a standard status under AIM or ISO. Ultracode, which was developed by Clive Hohberger after approximately 10 years of research and published as an AIM specification in 2015, is technically more mature. Compared to the Data Matrix and QR Code, Ultracode has twice the information density. Ultracode already contains a reference color palette in the symbol, so that effects such as fading can be recognized and corrected by the reader, within limits. Nevertheless, Ultracode has never found a noteworthy distribution.
JAB Code was brought in by the German Ministry of Interior for primarily use for papers carrying personal IDs and passport photos. JAB Code also uses reference color palettes, but for better readability not only a single-color palette, but redundant 4-fold palette in remote areas. The proven concept of internal detection patterns and raster patterns has been adopted from the QR code. This is more robust than the exposed grid on the outside of the Data Matrix, and allows to print the code without quiet zones

Potential main areas of application for JAB Code are applications with a need for high data density, as well as consumer applications. A high data capacity with limited space is relevant, for example, for ID documents if additional biometric data is to be stored. Other additional, security-relevant attributes such as digital signatures according to ISO/IEC 20248 also result in large amounts of data that "somehow" have to be stored in the symbol. In the consumer sector, the JAB code, with its bright colors and flexible shapes, is likely to inspire product packaging designers in particular.



AIM DotCode release 4.0

The DotCode has not been applied yet for standardisation with ISO but it was under the observation of the WG 1 since the DotCode specification development came under the umbrella of the AIM Technical Committee. DotCode got importance for the TOBACCO industry in conjunction with the requirements of the European TOBACCO regulations (see chapter TOBACCO).
AIM announced the release of rev. 4 of the DotCode, here the original announcement seen at the AIM web page:

<<Pittsburgh, Pennsylvania | July 31, 2019 | AIM, the trusted worldwide industry association for the automatic identification industry, providing unbiased information, educational resources and standards for nearly half a century, has announced the ratification and release of the revised International Symbology Specification – DotCode.

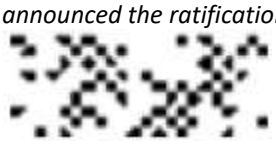


Fig. 51) AIM

DotCode, introduced in 2009, is a unique, variable size, variable shape, matrix (2-D) symbology specifically designed for high-speed marking applications where alignment or connection of individual dots is problematic. Because DotCode decoding does not rely on finding continuous lines, DotCode offers a practical method to provide unique item identification at full production line speeds. The revised (version 4.0) DotCode specification defines expanded

symbology-specific print quality assessment (verification) parameters based on a more granular (1/10 of a point) scale. Most importantly, the new specification defines a revised encoding algorithm to prevent rare but significantly flawed dot patterns that could have been produced under the original DotCode encoder.

George Wright, IV, a member of AIM's Technical Symbology Committee and lead for the project, shared this comment on the relevance of the release, "This fundamental enhancement to DotCode defines a significant encoding improvement based on extensive new testing of the original encoder algorithm and real-world experience in printing and reading DotCode in anti-counterfeit and traceability implementations in the European tobacco industry over the past several years."
DotCode is a code performing for high speed printing processes but lower data volume. Such a code was required by high speed production processes like in the area of the TOBACCO industries. Automatic marking and automatic scanning became essential importance for Tobacco products for tax reasons and anti- counterfeiting reasons, but marking processes are pritty fast, so codes like DotCode are appreciated to solve speed problems. >>

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 MH 10 Data Identifiers and maintenance
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 Unique identification for the Internet of Things

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

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
ISO 17363 Supply chain applications of RFID – Freight containers
ISO 17364 Supply chain applications of RFID – Returnable transport items
ISO 17365 Supply chain applications of RFID – Transport units
ISO 17366 Supply chain applications of RFID – Product packaging
ISO 17367 Supply chain applications of RFID – Product tagging

Selection of AIDC technology and application standards, continued

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 16587 DMRE - Data Matrix Rectangular Extension
DIN Spec 16589 Product to Internet communication - Pointer to Process
DIN 16598 Syntax keyboard and Web compatible encoding of data elements in machine readable symbols applied with ASC Data Identifiers (public for comments 2020-10-15)

Other relevant AIDC and Application standards

CEN 1573 Multi-Industrie-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.eurodatacouncil.org
EDIFICE-Guideline WEB AND KEYBOARD COMPATIBLE ENCODING WITH ASC DATA IDENTIFIERS, www.edifice.org

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

Appendix The UDI Book

Figure 52) UDI book cover sheet

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 language.

URL to the book: https://www.beuth.de/de/publikation/udi-unique-device-identification/320019099
URL to the MDR and IvDR: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017R0745

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- FIDE - European Dental Industry, www.fide-online.org
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