Datamatrix test set for softwares, scanners and encoding n°5

FRANCE mVo

This document is intended for end users, software publishers and pharmaceutical companies. The objectives are to:
- understand the structure of a datamatrix and what it contains,
- allow end users to test their system configuration and scanner,
- enable everyone to understand, interpret and solve the problems identified to date, and in particular encoding problems.

Reminder about the GS1 structure of the datamatrix:

The datamatrix code of a serialized product will contain at the minimum the following information. (Note: This list is not exhaustive since more than 200 possible Application Identifier (AI) and data ordering combinations are allowed.):

- An input tag <FNC1> that identifies a GS1 datamatrix.
- An application identifier or AI (01). This field identifier indicates that the information that will follow is the product code.
- The product code (CIP14/GTIN14) of the specialty.
- An application identifier or AI (17). This field identifier indicates that the information which will follow is a 6-character expiry date.
- The expiry date (in YYMMDD format) of the specialty.
- An application identifier or AI (10). This field identifier indicates that the information which will follow is a batch number whose length varies according to the nomenclature used by the concerned manufacturer.
- The batch number of the specialty (max 20 characters).
- An escape tag or Group Separator <GS> to indicate the end of the previous data field (in this case the batch number whose length is variable).
- An application identifier or AI (21). This field identifier indicates that the information which will follow is a serial number whose length is variable according to the nomenclature used by the concerned manufacturer.
- The serial number of the specialty (max 20 characters).

Remarks :
- Although the GS1 standard does not specify a particular sequencing, the France MVO, in order to reduce errors and to allow direct product identification, **recommends that manufacturers encode and load the data in the following order and syntax** (fixed length fields at the beginning): AI (01) and **CIP 14**, AI (17) and **Expiry Date**, AI (10) and **Batch Number**, Group Separator (#GS), AI (21) and **serial number**. The set-up of a tag <GS> at the end of the serial number is not mandatory if the serial number is placed at the end of the string.
- Note for manufacturers: **please specify, via the encoding software of your datamatrix, that the character string contains escape tags (FNC1, GS...) so that they will be encoded as such rather than as a simple data string.**

ASCII code		1		17		10		21		29	232
Application Identifier (AI)		AI (01)		AI (17)		AI (10)		AI (21)		GS	FNC1
Definition		GTIN		Expiry Date		Batch or Lot Number		Serial Number		Group Separator	Function 1
Digits	2		14	2	6	2	until 20	2	until 20	1	1
			16		8		2 + until 20		2 + until 20	1	1
Examples*	01	01234567890123		17	220331	10	A12W123	21	X12345678	\x1d	\F

Datamatrix test set for softwares, scanners and encoding

The datamatrices presented below* are classified into 2 categories:

- Examples of correctly encoded datamatrices (with test data and fictive samples) that will allow you to test your configuration and scanner.
- Examples of datamatrices with encoding or standard errors. These are the main problems that have been encountered to date to enable everyone to understand why errors occur and how to correct them.

These datamatrices are compatible with Qrafter and Flashcode smartphone applications. You can use these applications to compare the string read by your scanner. If your scanner does not give the same result, it is a configuration error of the scanner (check carefully the reading configuration of the datamatrix in «negative or black background» using case O4). You may have to contact your software publisher for correct settings. In any case, we recommend that you use second-generation readers (configurable ones) that comply with the ISO/IEC 15423 standard.

CAUTION: Do not use this test set to send a transaction to the NMVS in the connected mode as this may trigger mass alerts. These datamatrix tests should be used to check the settings of your scanner or to help you understand datamatrix encoding errors that can locally trigger alerts.

Case	Datamatrix	Examples of correct datamatrixes	FNC1	AI (01)	Product Code (CIP14)	AI (17)	Expiry date	AI (10)	Batch Number	Group Separator (GS)		Serial Number (SN)	Complete string encoded and read by the scanner
O1		This datamatrix is correctly encoded. Check that the batch number is A12W123. If your software returns the value Q12Z123 or Q!@Z!@# for the batch number, it means that your scanner is incorrectly configured and does not match the character set on your keyboard (QWERTY or AZERTY mode). If this happens, contact your software publisher to fix this configuration problem.	\F	01	01234567890123	17	220331	10	A12W123	\x1D	21	X12345678	Encoded string: \F010123456789012317220331110A12W123\x1D21X12345678 String that must be read by the scanner: 010123456789012317220331 10A12W12321X12345678
O2		This datamatrix is almost identical to case O1 but the expiry date is encoded with 00 for the day and March 2022 for the month and year respectively. Encoding 00 for the day should be interpreted as the last day of March (i.e. the 31th of March but could be 28th if it were February). This type of datamatrix, although correct, can generate date interpretation errors because some manufacturers load an unencrypted date into the EU Hub (or central system) that may be different from the one they encoded on the datamatrix (for example, the manufacturer could have uploaded 220331 into the EU Hub and encoded the datamatrix with 220300. The alert code L5: NMVS_FE_FE_LOT_12 can be returned by the system in these cases. For manufacturers, the France MVO recommends that the date be encoded in clear text at the day level. The France MVO also recommends a corresponding load into the EU Hub because encoding 00 is potentially error-prone. For software publishers, the France MVO stresses that no interpretation of the date should be made by the software. An encoding of the datamatrix as 00 must be transmitted as it is to the NMVS and under no circumstances modified or interpreted by the software.	\F	01	01234567890123	17	220300	10	A12W123	\x1D	21	X12345678	Encoded string: \F010123456789012317220300010A12W123\x1D21X12345678 String that must be read by the scanner: 010123456789012317220300 10A12W12321X12345678

Case	Datamatrix	Examples of correct datamatrixes	FNC1	AI (01)	Product Code (CIP14)	AI (17)	Expiry date	AI (10)	Batch Number	Group Separator (GS)	Serial Number (SN)		Complete string encoded and read by the scanner
O3		This datamatrix is strictly identical to the O1 case in terms of encoded information but the order of the information is different (GTIN, batch number, serial number, expiry date). Batch numbers and serial numbers with variable lengths require a separator at the end of each of these fields of information to delimit the reading of the fields. In order to limit as much as possible the risks of encoding/reading errors related to the separator, and although the GS1 standard does not specify any sequencing, the France MVO recommends that manufacturers encode and load unique identifiers in the following order (fixed length fields at the beginning): - AI (01) and CIP14 - AI (17) and Expiry Date - AI (10) and Batch Number - Separator (#GS) - AI (21) and serial number	\F	01	01234567890123	17	220300	10	A12W123	\x1D	21	X12345678		Encoded string: \F010123456789012310A12W123\x1D21X12345678\x1D17220300 String that must be read by the scanner: 010123456789012310A12W123 21X1234567817220300
O4		This datamatrix is strictly identical to the O1 case but in negative print (black background) to test the configuration of your scanner. If your scanner does not return the correct information (same as case O1), check that the configuration allows a negative reading.	\F	01	01234567890123	17	220331	10	A12W123	\x1D	21	X12345678		Encoded string: \F010123456789012317220033110A12W123\x1D21X12345678 String that must be read by the scanner: 010123456789012317220331 10A12W12321X12345678
Case	Datamatrix	Datamatrix encoding or standard errors	FNC1	AI (01)	Product Code (CIP14)	AI (17)	Expiry date	AI (10)	Batch Number	Group Separator (GS)	Serial Number (SN)		Complete string encoded and read by the scanner
E1		Parentheses are placed on the field delimiters. The GS1 encoding standard is not respected for this datamatrix which cannot be interpreted by the NMVS. This is a quality defect because the GS1 encoding standard is not respected. It must be reported and corrected by the manufacturer. The France MVO reminds manufacturers that these quality defects do not comply with the requirements of the Delegated Regulations (Art. 5 and art. 6 of the DR).	\F	(01)	01234567890123	(17)	220331	(10)	A12W123	\x1D	(21)	X123456778		Encoded string: \F(01)01234567890123(17)220331(10)A12W123\x1D(21)X123456778 String readed by the scanner (datamatrix encoding errors are in red): (01)01234567890123 (17)220300 (10)A12W123(21)X12345678
E2		In this example, the manufacturer has encoded the FNC1 as hard characters and not as an "input tag". This mandatory tag cannot be interpreted; the scanner reads it as alphanumeric characters. The data from the datamatrix cannot be read. In some cases, it is also possible to find hard encodings unsuitable for the input tag such as #FNC1, #FNC, #è, #FNC#FNC... The result will be the same as described above. IThis is a quality defect because the GS1 encoding standard is not respected. It must be reported and corrected by the manufacturer. The France MVO reminds manufacturers that: - the input and escape tags after the variable size fields are mandatory, - these quality defects are not in compliance with the requirements of the Delegated Regulations (Art. 5 and Art. 6 of the DR).	FNC1	01	01234567890123	17	220331	10	A12W123	\x1D	21	X123456778		Encoded string: FNC10101234567890123172203311 10A12W123\x1D21X12345678 String readed by the scanner (datamatrix encoding errors are in red): FNC101012345678901237220331 10A12W12321X12345678

Case	Datamatrix	Datamatrix encoding or standard errors	FNC1	AI (01)	Product Code (CIP14)	AI (17)	Expiry date	AI (10)	Batch Number	Group Separator (GS)	Serial Number (SN)	Complete string encoded and read by the scanner
E3		Same type of error as in case E2 but this time it is the group separator tag that is hard coded (#GS) and placed after the batch number . The scanner therefore interprets the datamatrix as follows: GTIN Ok, Expiry date Ok, the batch number is read until the end of the string (A12W123#GS21X12345678) because the #GS is not recognized (ASCII code 29 not encoded). The batch number is therefore incorrect and the serial number has not been read! The error code NMVS_FE_FE_LOT_03, will be returned by the NMVS in this case. In some cases, it is also possible to find inappropriate hard encodings for group separators such as #FNC or also the absence of a group separator tag after a variable length field such as the batch number (the result will be identical to what is described above). This is a quality defect because the GS1 encoding standard is not respected. It must be reported and corrected by the manufacturer. The NMVO reminds manufacturers that these quality defects do not comply with the requirements of the Delegated Regulations (Art. 5 and art. 6 of the DR).	\F	01	01234567890123	17	220331	10	A12W123	#GS	21	X123456778	Encoded string: \F0101234567890123172203311 0A12W123#GS21X12345678 String readed by the scanner (datamatrix encoding errors are in red): 010123456789012317220331 10A1 2W123#GS21X12345678
E4		This datamatrix seems correct but an encoding error is present before the AI (17) in the form of a space at the end of the product code. The AI (17) cannot therefore be interpreted to define the expiry date because the GS1 coding standard is not met. This error can be found at different levels of the character string. Here the expiry date cannot be recognized and neither can the rest of the chain. This is a quality defect because the GS1 encoding standard is not respected. It must be reported and corrected by the manufacturer. The France MVO reminds manufacturers that these quality defects do not comply with the requirements of the Delegated Regulations (Art. 5 and art. 6 of the DR).	\F	01	01234567890123	17	220331	10	A12W123	\x1D	21	X123456778	Encoded string: \F0101234567890123 17220331 10A12W123\x1D21X12345678 String readed by the scanner (datamatrix encoding errors are in red): 010101234567890123-172203311 0A12W12321X1234567
E5		Another error concerns the encoding of the product code. The GS1 standard requires 14 characters for product identification, however in France the CIP number that has been chosen to identify pharmaceuticals is an NTIN with 13 characters onto which a 0 (zero) must be added at the beginning to obtain a CIP14. Some manufacturers have failed to add this 0. When the datamatrix is interpreted, the data read after the AI (01) is interpreted as 14 characters. Here the product code is therefore «12345678901231» (taking the 1 of the next AI (17) and not the «01234567890123». The pharmaceutical product cannot therefore be recognized. This is a quality defect because the GS1 encoding standard is not respected. It must be reported and corrected by the manufacturer. The France MVO reminds manufacturers that these quality defects do not comply with the requirements of the Delegated Regulations (Art. 5 and art. 6 of the DR).	\F	01	1234567890123	17	220331	10	A12W123	\x1D	21	X123456778	Encoded string: \F0112345678901231722033110 A12W123\x1D21X12345678 String readed by the scanner (datamatrix encoding errors are in red): 011234567890123172203311 0 A12W12321X12345678

Case	Datamatrix	Datamatrix encoding or standard errors	FNC1	AI (01)	Product Code (CIP14)	AI (17)	Expiry date	AI (10)	Batch Number	Group Separator (GS)	Serial Number (SN)	Complete string encoded and read by the scanner
E6		Three errors are present in this datamatrix at the batch number level. These are errors of non-compliance with the GS1 standard in the batch numbers. Batch numbers: - must not start with a 0 (zero) because it may not be transcribed or returned and therefore return an error on the batch number. - must only contain unaccented upper- or lower-case characters. - must not contain any spaces. In this case, the batch number begins with a 0, contains an É (capitalized but accented) and a space. NB: It is recommended to not use confusing characters «O», 0 (zero), I capital, l lower case. Depending on the case, it is either a quality defect because the GS1 encoding standard is not respected, or a confusing use of certain characters. It must be reported and corrected by the manufacturer. The France MVO reminds manufacturers that these quality defects do not comply with the requirements of the Delegated Regulations (Art. 5 and art. 6 of the DR).	\F	01	01234567890123	17	220331	10	0É2 2b3	#GS	21	X123456778	Encoded string: \F010123456789012317220331100É2 2b3\x1D21X12345678 String readed by the scanner (datamatrix encoding errors are in red): 010123456789012317220331100É2 2b321X12345678
E7		In this case, we also have to deal with a failure to comply with the encoding standard in terms of the expiry date. The date must be formatted as YYMMDD, here the format is DDMMYY, so the date read and sent will be March 22, 2031 and not March 31, 2022. For manufacturers, the France MVO recommends a clear date encoding at the day level and a corresponding loading into the EU Hub because encoding 00 is potentially a source of errors. For software publishers, the France MVO insists that no interpretation of the date should be made by the software. An encoding of the days of the month in the datamatrix as 00 must be transmitted as is to the NMVS and under no circumstances modified or interpreted by the software. Depending on the case, it is either a quality defect because the GS1 encoding standard is not respected, or a confusing use of certain characters. It must be reported and corrected by the manufacturer. The NMVO reminds manufacturers that these quality defects do not comply with the requirements of the Delegated Regulations (Art. 5 and art. 6 of the DR).	\F	01	01234567890123	17	310322	10	A12W123	\x1D	21	X123456778	Encoded string: \F0101234567890123173103 2210A12W123\x1D21X12345678 String readed by the scanner (datamatrix encoding errors are in red): 010123456789012317310322 10A12W12321X12345678
E8		Datamatrix with an incorrect date (day not existing in the calendar). This is a quality defect. It must be reported and corrected by the manufacturer. The NMVO reminds manufacturers that these quality defects do not comply with the requirements of the Delegated Regulations (Art. 5 and art. 6 of the DR).	\F	01	01234567890123	17	220431	10	A12W123	\x1D	21	X123456778	Encoded string: \F0101234567890123172204 3110A12W123\x1D21X12345678 String readed by the scanner (datamatrix encoding errors are in red): 010123456789012317220431 10A12W12321X12345678

* The product code examples have the following format (01234567890123) in the examples used to avoid confusion with real codes; CIP14 codes for drugs always start with (034009) and are 14 characters long (e.g. 03400912345678). The proposed escape character syntax here (\x1d for GS and \F for FNC1) is that of https://barcode.tec-it.com/fr/DataMatrix. Other encoders may offer different syntaxes.

References:
Les Cahiers CIP-ACL n°26: Datamatrix Marking: recommendations to optimize the quality and reading of GS1 markings and Guide to good practices for reading 2D bar codes - GS1 DataMatrix