

## Data Identifier 12N, Technical Summary

Aug 2, 2017

Data Identifier is constructed as follows: 12N

The allowable characters are the ISO 646 character set. However the following characters have reserved meaning. In order to be used inside a Data Record, they must be placed inside of double quotes (ASCII decimal 34).

*The End of Transmission character, (ASCII decimal 04, an unprintable character, displayed in this document at  $^{EOT}$ ) shall be used at the end of the 12N Label.*

*The File Separator, (ASCII decimal 28, an unprintable character, displays in this document as  $^{FS}$ ) shall be used to delimit flags from the User Data within Data Records, as described later in this document.*

*The Group Separator, (ASCII decimal 29, an unprintable character, displayed in this document at  $^{GS}$ ) is used in the Header, and if any other Data Identifiers from the 10.8.2 standard are to be used, these must be placed after each Data Identifier and its data.*

*The Record Separator, (ASCII decimal 30, an unprintable character displayed in this document as  $^{RS}$ ) is used in combination with the  $^{EOT}$  to indicate the end of the 12N Label (the sequence is  $^{RS}^{EOT}$ )*

*The Unit Separator, (ASCII decimal 31, an unprintable character, displayed in this document at  $^{US}$ ) shall be used to separate data records.*

*The plus character (ASCII decimal 43, displays in DOS as +) when used within User Data, shall be considered a data separator that is being used to concatenate strings of data for an individual Field Identifier (FI), unless it is quoted in double quotes (decimal 34). (see below for descriptions of terms)*

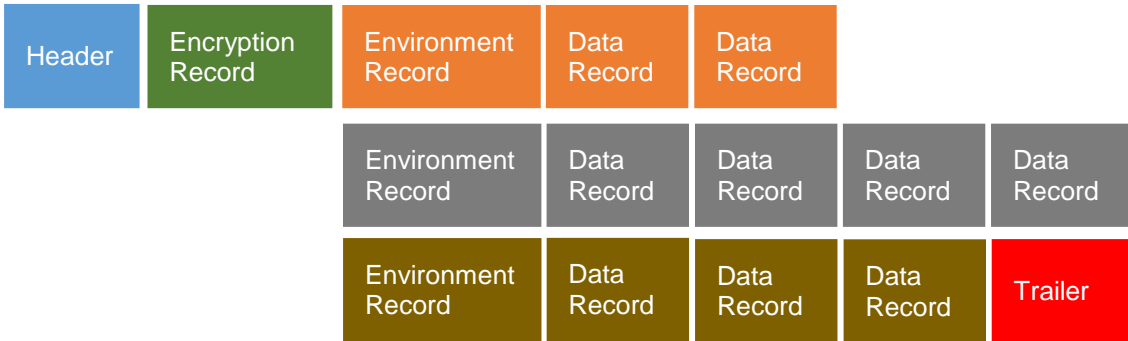
*If other languages are used, the restriction on the data separator (plus sign, ASCII decimal 43) shall be followed.*

Within ISO 15434 compliant data structures, the typical structure is to have a Data Identifier (DI) followed by the relevant data, and then the Group Separator, (ASCII 29). The data following each DI is typically of fairly simple structure, comprised of a few separate words or numbers.

The 12N Data Identifier complies with this 15434 structure. However, many, many different pieces of information can be stored after the initial DI, as this document explains.

**Field Identifiers** (referred to as FIs) are used to indicate the meaning of the data included within the 12N tag, and are analogous to the Data Identifiers used elsewhere in the 15434 standard.

Figure 1 shows the overall structure of the usage of the 12N DI. Although the 12N DI can be used with other DIs, for simplicity, we will only use 12N data in our examples. Each Tag begins with a Header, followed by an optional Encryption Record, which may be followed by an optional Environment Record, and then the actual Data Records. Other Environment Records and Data Records may follow, before the Trailer, which indicates the end of the label.



**Fig. 1. Logical structure of Tag**

Figures 2 and 3 show another view of the structure of the Tags. Each Tag begins with a Header and ends with a Trailer, with the Data Records in between. In Figure 2, after the Header, five Data Records come immediately, and are not preceded by an Environment FI. These first five all use the default Environment settings. After this, an Environment Record is used, which means that the following two Data Records use the settings for that Environment Record.

In Figure 3, the Header is followed by an Encryption Record, which means that any Data Records in the Tag may be (but do not have to be) encrypted using the key provided in the Encryption Record. In this example, no Data Records use the default Environment settings. The first three use the settings from one Environment Record, and the final two Data Records use the settings from a second Environment Record.

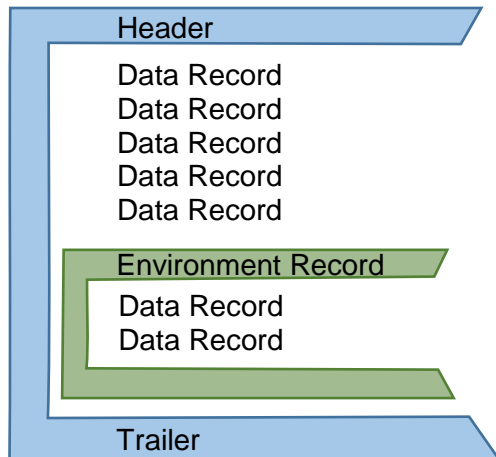


Figure 2: No Encryption FI and one Environment FI

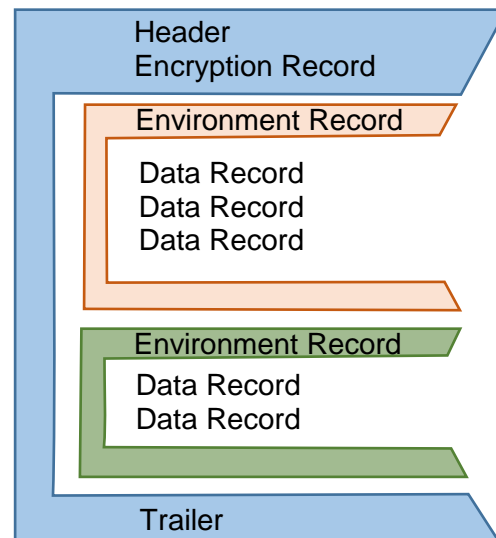


Figure 3: Encryption FI and two Environment FIs

### Terminology:

A **Field Identifier (FI)** is a unique 4 character string assigned by RLA and associated with the name (or value) to be used when displaying User Data. A list of FIs and their associated values can be found at [www.RLA.org/12Nsql](http://www.RLA.org/12Nsql).

A **Data Record** is an FI followed by User Data. The “Company Name” Data Record must appear in each tag.

**User Data** is the user-supplied information following each FI. The User Data may include one or more Flags as described later in this document.

**Unit Separator:** Required at the end of the Header, and after every Data Record (except the final one), Encryption FI, or Environment FI.

**Header:** required; must be “[ ]><sup>R</sup><sub>S</sub>06<sup>G</sup><sub>S</sub>12N” (without the quotes)

- “<sup>R</sup><sub>S</sub>” is the Record Separator (ASCII 30),
- “<sup>G</sup><sub>S</sub>” is the Group Separator (ASCII 29), and
- “12N” is the Data Identifier which signals the use of the 12N standard.

**Trailer:** Tag must end with “<sup>R</sup><sub>S</sub><sup>E</sup><sub>O</sub><sup>T</sup>” (without the quotes)

- “<sup>G</sup><sub>S</sub>” is the Group Separator (ASCII 29), and
- “<sup>E</sup><sub>O</sub><sup>T</sup>” is the End of Transission character (ASCII 04),

## Encryption in 12N

Two levels of encryption are available in the 12N standard.

### 1. Asymmetric Encryption

Asymmetric, or Public Key encryption is available by using the optional Encryption Record, in which the Encryption FI is given, followed by the ID of an X.509 certificate. This certificate contains an asymmetric encryption key which can be used to encrypt any individual Data Records.

The FI is ZENC, and is used as follows: “ZENCx...x<sup>U</sup><sub>S</sub>” where “x...x” represents the Certificate ID of the X.509 certificate containing the Asymmetric Encryption key, (aka “public key”), followed by the Unit Separator (<sup>U</sup><sub>S</sub>).

This ZENC FI applies to all of the data in the Tag, and allows the user to encrypt any individual Data Record or all of the data in the Tag. If the Encryption FI is not present, the entire tag is readable by the public, unless Symmetric encryption is used in Environment FI.

To indicate that an individual record is to be encrypted, the Visibility and Encryption setting must be set, as described below.

### 2. Symmetric Encryption

Additionally, a second form of encryption is available, Symmetric, or Private Key, which can be controlled at the Environment level, and apply only to one Environment, as explained below.

## Environment Record and Settings

**Environment Record:** optional; it consists of the Environment FI (ZENV) followed by 4 Settings indicating Language, Currency, Units, and Visibility and Encryption. Once the Settings are used, they remain in effect until another Environment Record is found. Each Environment Record must provide a value for all 4 Settings.

If no Environment FIs are used, default values for each Setting are used.

The FI usage takes the form “ZENVLLCCCUV<sub>s</sub>”.

- “ZENV” is the Field Identifier that signals that all of the Data Records after it (until the next Environment FI) will use the following Language, Currency, measurement Units, and Visibility and Encryption.
- The string “LLCCCUV” represents the Settings (described below) whose values must be set. All 7 characters must be present.
- “<sub>s</sub>” is the Group Separator.

**Settings:** There are four Settings that must be set with each ZENV Environment FI:

**Language:** “LL” is a two-letter (lower case) string which indicates which Language the User Data is presented in, (e.g. English, German, French, Chinese, etc., reference ISO 639-1:2002). For example, en = English (the default), de = German, etc.

**Currency:** “CCC” is a three letter (upper case) string which indicates which Currency is being used (reference ISO 4217 3-character code). For example, USD = US Dollars (the default), EUR = Euros, GBP = British pounds sterling, CNY = Chinese yuan, etc.

**Units:** “U” is a single (lower case) letter which indicates which measurement system is being used for Units: metric (the default), US standard, imperial, etc.

- i = imperial
- m = metric (the default)
- p = power
- t = time
- u = US Standard

A complete listing of the units available under each option can be found in the “12N Unit Values” document at the RLA website listed above.

**Visibility and Encryption:** “V” represents the Visibility and Encryption setting. SQRL code readers are available with three levels of Visibility access: Consumer (end users), Professional (retailers, installers, field agents, refurbishers, etc.), and Enterprise (for the manufacturer or OEM).

By default, all Data Records are visible to all users: Consumers, Professionals, and Enterprise users. By changing this Setting, everything within the Environment can be restricted to only Enterprise users, or only Enterprise and Professional Users. It is not possible to make data visible only to Consumers or only to Professionals.

This Setting also allows everything within the Environment to be encrypted, either using public key (Asymmetric) or private key (Symmetric) encryption, also known as IUI.

Table 1 below summarizes which users can access the Data Records under each setting of “V.” A value of “E” is the most restrictive, allowing the Data to only be read by Enterprise employees, and furthermore, it requires Asymmetric encryption, so the ZENC Encryption FI must be used, as described above.

A value of “P” (professional, encrypted), is the next most restrictive, allowing access to Professional and Enterprise users, using IUI (symmetric) encryption. “p” is the next most restrictive, allowing unencrypted access to Professional and Enterprise users. It should be noted that determined Consumers (or, more likely, competitors) may find a way to obtain a Professional reader and access such unencrypted Data. Therefore, “p” should be used for data which is not highly sensitive, but technical details not of general interest to Consumers.

Visible to:	Value of "V" Setting:				
	c	C	p	P	E
Consumers	unencrypted	IUI			
Professionals	unencrypted	IUI	unencrypted	IUI	
Enterprise employees	unencrypted	IUI	unencrypted	IUI	Asymmetric

Table 1: Visibility and Encryption Settings

In the case of "E", the address of the Asymmetric key must have already been provided by the ZENC FI. In the case of "P" and "C", the FI may be followed immediately by the Key Label, a character string which will indicate to the user which Private encryption key is to be used to read the information. If the user will automatically know which key to use, this string does not need to be included.

It is the responsibility of the label creator to choose an appropriate encryption algorithm (e.g., AES, Blowfish, CAST5, DES, IDEA, RC2, RC4, RC6, Serpent, Triple DES, Twofish, etc.).

A value of "c" is the least restrictive, allowing access to all users, and is the default value, in place when no Encryption or Environment values are set. "C" is more restrictive, using IUI (symmetric) encryption.

The final possible value for the Setting is "-" which leaves the Visibility and Encryption Setting unchanged from the last Environment FI, or from the default setting, if no previous Environment FIs have been used.

In Figure 2 above, there is no Encryption FI, so everything in the whole Tag is open to read, unless individual Data Records are encrypted, as described below. In Figure 3, access to the entire Code is controlled by the use of the encryption FI, ZENC, and the following Asymmetric public key. In Figure 2, the first five Data Records use the default Environment settings for language (English), currency (US dollars), measuring system (metric), and visibility (Consumer unencrypted). But for the last two Data Records, some of these settings have been changed by the use of the Environment Record. In Figure 3, one set of Environment Settings has been used for the first 3 Data Records, and different Settings has been used for the last two.

## Data Records: Structure and Flags

**Data Record:** the Company Data Record must always be present, but all other Data Records are optional; of the form "XXXXVUT(TTT)<sup>F<sub>s</sub></sup>x...x<sup>U<sub>s</sub></sup>".

- "XXXX" is the Field Identifier of four alphanumeric characters
- "VUT(TTT)<sup>F<sub>s</sub></sup>" represents three optional **Flags**, explained below, and the File Separator "F<sub>s</sub>,"
- "x...x" is the User Data
- "U<sub>s</sub>" is the unit separator at the end of the Data Record. Required for all Data Records except the last one.

**User Data:** The User Data may consist of any alphanumeric characters, and must either come immediately after the Field Identifier, if no Flags are used, or immediately after the File Separator, F<sub>s</sub>, if flags are used.

The only requirement is that if users wish to include the Concatenation Operator (described below) any place within their data, it must be enclosed in double quotation marks (ASCII 34).

**"+" Concatenation Operator:** If multiple pieces of information are to be conveyed that require the same FI, within the User Data, instead of creating two separate Data Records, the two pieces of information may be concatenated together after one FI, by using the Concatenation Operator, "+" (ASCII 43).

For example, if the user wishes to provide multiple phone numbers for customer support, they would appear within the User Data as “8005551212+8005551234.”

### User Data Flags VUT(TTT)<sup>F<sub>s</sub></sup>

**User Data Flags** are optional, and must be placed immediately after the FI.

Data Flags must be followed by the File Separator delimiter “F<sub>s</sub>”, which indicates the end of the Flags, and lets the software know that the next character is the beginning of the User Data.

There are three types of Flags, described below, and either all Flags must be present, or none.

**“V” Visibility Flag:** Required if Flags are used. By using the optional Environment FI (described above), the Visibility and Encryption Settings can be set for all Data Records in the current Environment, but with the Visibility Flag, those can be temporarily over-ridden. The meanings of the Flag values are the same as shown in Table 1 above. If no temporary override is needed, a value of “-” (ASCII decimal 45) should be used.

For example, if the Environment FI sets the Visibility to Professional, the Visibility Flag for an FI can be set to Consumer, which will allow Consumers to see the User Data for that one FI, but the visibility for all subsequent FIs will remain at Professional. Or, if no Environment FI was used, the default Environment Settings are in place, but the visibility for the current Data Record could be set at some other level.

- V = Visibility Indicator:
  - = Unchanged
  - c = Consumer unencrypted
  - C = Consumer IUI (Symmetric) encryption
  - p = Professional unencrypted
  - P = Professional IUI (Symmetric) encryption
  - E = Enterprise, Asymmetric encryption

**“U” Units Flag:** In the Environment FI above, the Units Indicator shows whether metric (the default) or US standard measurements are to be used. In the Units Flag, this alphanumeric character indicates what level of units are to be used: m, cm, mm, etc. Rather than listing “cm”, for example, the single alphanumeric character “1” designates the level from the pre-determined list. The “12N Unit Values” document is available at the RLA website.

For example, when a value of “m” is used in the Units Setting in the Environment, metric units are used. If the Units Flag is 5, that means the User Data is being presented in grams. If the Units Flag is 6, the Data is being presented in kilograms.

Values must be one assigned by the 12N Standard, but possible values are a-z, A-Z, 0-9. The sole exception is that when a Table is used, (described next) the Units Flag should be set to “-”, as no units are required.

**“T(TTT)” Table Designator:** Required if Flags are used.

Many FIs (such as company name, package weight, etc., etc.), do not require any lookup table. When no table information is needed, and the User Data is to be returned “as is,” then a single character should be used: “-” (ASCII decimal 45).

The Table flag is 1 to 4 alphanumeric characters that indicate which 12N lookup table the meaning of the User Data is to be found in, so that the value included in the User Data can be translated into some result that will be meaningful to the end user.

The Table Designator can be one to four characters, such as T, TT, TTT, or TTTT, and possible values for each T are a-z, A-Z, and 0-9, but in addition, it must also be a valid table. If an invalid Table Designator is given, the software will have no way to know what User Data is intended to represent.

For example, the 12N standard includes a table of User Return reasons. If the end customer returned an item because they changed their mind, the User Data would contain the value "U1A," and the software needs to know where to find out what this value represents. The TTTT value would be used to indicate that the RLA User Return reason table is to be consulted.