

Analysis and Design of the GS1 System Based on ITF-14

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ABSTRACT

Commodity activity is the most basic activity of human society and the most important feature of the development of human society. With the increasingly active commodity trade, the GS1 article coding system to improve the efficiency of commodity trade is more and more widely used in the supply chain management and trade field of the whole commodity from product production to product sales. ITF-14 bar code is the 14-bit European bar code standard, which carries the GTIN-14 code in GS1 standard system and is used to identify the packaging carton identification of goods in supply chain management. GS1 system analysis and design based on ITF-14 is oriented to supply chain management, with GS1 identification code as the core, based on ITF-14 data bearing, with data management, exchange and sharing as the purpose of analyzing GS1 system based on ITF-14, to understand the significance of its application in supply chain management and other scenarios. Through the system analysis and design, it is of great significance to master the GS1 standard and analyze, discuss and research the practical complex problems such as supply chain management.

KEYWORDS

GS1 system; ITF-14; Supply chain management

1. INTRODUCTION

The ITF-14 is a 14-bit European item coding bar code standard, which carries the GTIN-14 code in the GS1 standard system and is used for identifying non-retail goods or for supply chain management. The analysis and design of GS1 system based on ITF-14 is oriented to supply chain management, with GS1 identification code as the core, ITF-14 data bearing, and the purpose of data management, exchange and sharing. According to the relevant standards of ITF-14 barcode technology, the applicability of GS1 system in supply chain system management is studied in detail. By analyzing the GS1 system based on ITF-14, we can understand the significance of its application in supply chain management and other scenarios. Through system analysis and design, it is of great significance to master the GS1 standard and protocol, and to make the analysis, discussion and research of practical complex problems such as supply chain management.

2. THE GS1 SYSTEM FOUNDATION

2.1. GS1 Identification

For general online shopping, when consumers take goods, producers need to know the product information and commodity number, and then through a series of logistics company, finally reach consumer hands, then consumers to the product information and buy see information to verify, finally confirm the goods. The above process is the same as the GS1 system, so the GS1 system first consists of the coding system and the most important part, which refers to the product information in various trades, then the data carrier system containing the information of these products, and finally the data

exchange system with customers. That is, GS1 system coding system, data carrier system, data exchange system composed of. The coding system is roughly classified in the following figure below:

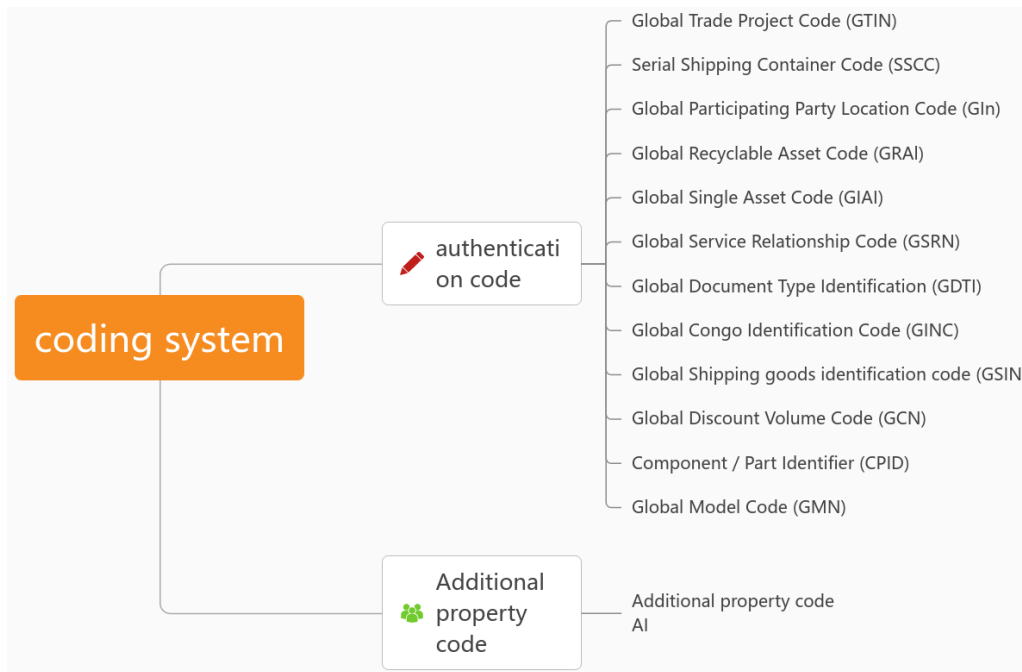


Figure 2-1. GS1 identification

Table 2-1. GS1, and the identifier

ID	Used to identify	example
Global Trade Project Code (GTIN)	Products and services	Soup cans, chocolate bars, music albums
Global Participating Party Location Code (GLN)	Parties and locations	Companies, warehouses, factories, stores
Series Freight Packaging Box Code (SSCC)	Logistics unit	Unit load on the pallet, package
Global Recyclable Asset Code (GRAI)	Recyclable assets	Tray box, crate, suitcase
Global Personal Asset Identifier (GIAI)	property	Medical care, manufacturing, and transportation
Global Service Relationship Code (GSRN)	Service provider and recipient relationships	Loyalty program members, hospital doctors
Global Document Type Identification (GDTI)	document	Tax requirements, transportation forms
Global Congo Identification Code (GINC)	consign for shipment	Logistics units transported by shipping containers
Global Shipping Goods Identification Code (GSIN)	load and transport	The logistics department delivers it to the customer together
Global Discount Volume Code (GCN)	coupon	Digital coupons
Part / Part identifier (CPID)	components and parts	auto parts
Global Model Code (GMN)	product model	medical apparatus and instruments

2.2. GS1 Data Capture

Data capture is that it needs to find the appropriate data carrier, so that it can reflect the product information needed data in the general supply chain management. Therefore, the research data carrier is actually the collection and exchange of its information. The two main contents of GS1 system data carrier system are: bar code symbol and radio frequency label.

2.3. GS1 Data Sharing

2.3.1. Electronic data exchange technology

With the flow of a commodity, all the information it carries also flows to various locations. Whether the information of the commodity is needed or invalid, it should be reasonably standardized.

GS1 EDI (Electronic Data Exchange) provides a global standard for e-commerce messaging, allowing for the automation of business transactions that occur commonly throughout the supply chain. It includes data unification, order and delivery, financial settlement management, and transportation and warehouse management. The main business partners in this area are retailers, manufacturers, material suppliers, and logistics service providers.

2.3.2. XML technology

With the development of e-commerce, the traditional electronic data exchange (EDI) as the main way of data exchange, although it has absolute importance in the standardization of data, the traditional EDI has considerable limitations, such as EDI needs special network and procedures, difficult to read EDI standard data manual. To this end, people began to develop the Internet-based EDI technology-XML technology.

Since the implementation of XML technology, it has been widely used in various fields, because XML, overcomes the inherent limitations of HTML and enables some new applications of the Internet. Some people have even put forward the e-commerce model of eXe

(E is the enterprise, and X is the XML).

3. THE GS1 ENCODING ANALYSIS

The supply chain of general commodities refers to a series of activities generated by the production, processing, transportation and sales of products. The flow chart of the identification code of this series of activities is shown in the figure:

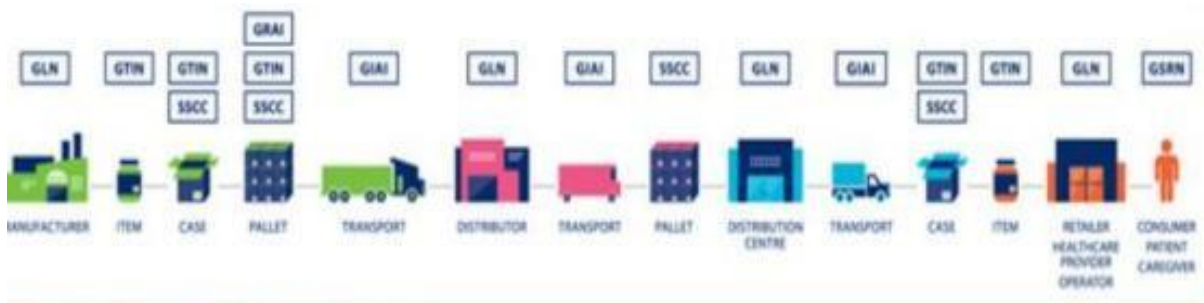


Figure 3-1. Flow chart of product logistics

4. THE ITF-14 BARCODE TECHNOLOGY

4.1. Foreword

In the GS1 standard system, the typical application of the data carrier system of the identification system mainly includes three categories. —The first category is the commodity code EAN / UPC for retailers for in-store retail, Its symbol carrier is usually a GTIN without the packaging indicator position; The second category is the data carrier for GTIN-14 containing packaging indicator bits, Generally, EAN-128 (with AI) or ITF-14; The third category is the data carrier of the logistics unit coding SSCC-18 used for internal control and cargo traceability in the whole supply chain management, EAN-128 (with AI).

With the development of world economic globalization, the application of ITF-14 barcode in supply chain management is gradually extensive. However, in fact, China's talent resources in barcode technology are far from enough, so in the use process of ITF-14, many members of the system are confused in ITF-14 identification code, printing carrier selection, bar code structure size requirements and so on. This paper solves some of the above problems by analyzing ITF-14 bar code, symbol, character code, barcode size and decoding algorithm, hoping to help manufacturers who need to understand ITF-14 bar code technology.

4.2. Barcode Symbol Structure

ITF-14 is a continuous type (bidirectional bar code for information), fixed length, bar code with self-verification function. It does not require high printing accuracy, cheap cost, and because its protection box protects the identification bar code, so ITF-14 is more suitable for directly printing on some rough surface, easy to deformation after external factors, so ITF-14 is also called "box code".

ITF-14 bar code represents the same bar code symbol as the bar code. It is only a bar code applied on the expansion of the storage and transportation package, that is, the protection box is added around the insertion of the bar code.as shown in the figure4.1: At the front is the rectangular protection box and the left blank area, then the start character (narrow bar-narrow space-narrow space), followed by 7 pairs of data characters, then the terminator (wide bar-narrow space-narrow bar), and finally the right blank area and the number for reading.



Figure 4-1. The ITF-14 symbol structure

Pour:

Left blank area: blank area on the left of the barcode, mainly used for the transition scan gun to start the scan.

Start character: The first 4 characters of barcode characters (narrow bar-empty-narrow bar-empty) are used to indicate the beginning of the first barcode symbol.

Data tester: characters located after the start character that allow bidirectional scanning.

Terminator: It is the last 3-digit character (wide bar-narrow space-narrow bar) of the barcode symbol, indicating the end of the message. Right blank area: the blank area within the protection box outside the terminator.

4.3. Character Encoding

4.3.1. Character composition

The identification code of the storage and transportation of packaged goods is different from the GTIN-13 of the store retail EAN-13, and the GTIN-14 is selected because its packing box needs special indicators. "Packaging indicator", "vendor ID code", "Commodity Item Code" and "Check code" jointly constitute the GTIN-14, as shown in Figure 4-2

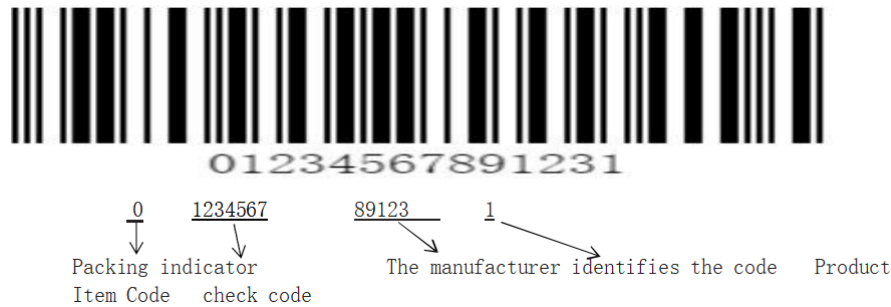


Figure 4-2. for the character composition

4.3.2. Code system characteristics

The cross 25 code code set is the number 0-9 because it is empty, bar cross identification information, the scan read is double To scans and has no barcode interval, so it is a continuous barcode; it can encode up to 8 pairs of data, each character is given by Composition of 5 units (2 wide 3 narrow), a pair of data cross-coded is 5 bars or 5 empty, and bar and empty units have "narrow" and "wide", the "wide" unit in the barcode represents "1" in binary; "narrow" unit indicates "0" in binary; and its symbol check bit is 1. Figure 4.3 (red blank number is five bars, green is five empty units, and only the first few codes are shown in the figure):

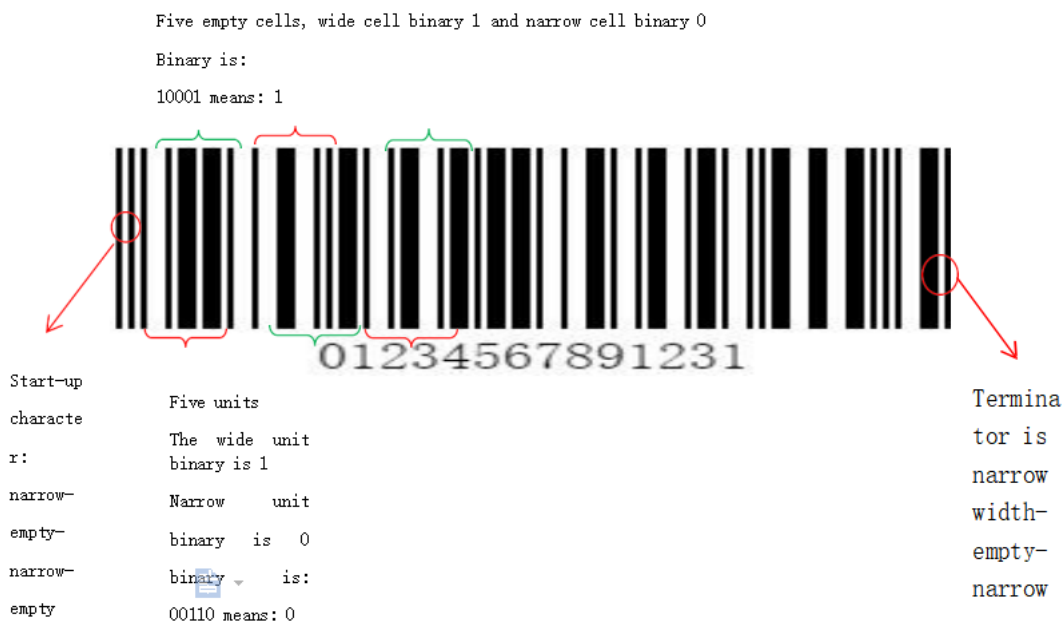


Figure 4-3. The ITF-14 barcode

4.3.3. Verification code and number of digits

In short, if the number of numbers in the data string including the check bit is odd, add a number 0;. According to the cross 25 code bar code specification, the digital content of the bar code type is even-numbered, for example, if an ITF-14 bar code content is 123456789123, add a check bit 1 and become an odd bit, you need to add 0 on the left, and the complete bar code content with the test bit is

01234567891231. The calculation method of cross 25 code is Mod 10, and the specific calculation method is: 10, multiple- $\{[(\text{the sum of the number of odd digits} + (\text{the sum of even words}) * 3)]\}$ of individual digits.

4.3.4. Data character encoding

As shown in Figure 4-3 above, the 0 of the ITF-14 barcode is a narrow cell and 1 is a wide cell; 0 (00110), 1 (10001),

2(01001), 3(11000), 4(00101), 5(10100), 6(01100), 7(00011), 8(10010), 9 (01010); the last digit in the data character encoding is determined by 0/1 parity (except for 0, the value is 12,4,7 rights). See in Table 4-1:

Table 4-1. The ITF-14 character set

data character	Binary representation of the barcode characters
0	0 0 1 1 0
1	1 0 0 0 1
2	0 1 0 0 1
3	1 1 0 0 0
4	0 0 1 0 1
5	1 0 1 0 0
6	0 1 1 0 0
7	0 0 0 1 1
8	1 0 0 1 0
9	0 1 0 1 0
Note: 0 in the table represents a narrow unit and 1 represents a wide cell.	

4.4. Barcode Size

See Table 4-1, ITF-14 Technical requirements:

size:

The magnification coefficient of ITF-14 barcode symbol is 0.625 ~1.2, size X (X is the design width of narrow unit) is 0.495mm~1.016mm, but in order to obtain high barcode printing quality, large X module size when printing area allows is usually selected, the size of X module is 1.016mm (the magnification coefficient is 1.000, the size of each part of the barcode symbol is shown in Figure 4-4);

The height of the bar code should be higher than 32mm;

The blank area interval is greater than or equal to 10 X.

Protection box:

The line width is not less than 4.8mm, and the line width is not affected by the size of module X;

For the reading of the characters:

Character should be used together with the barcode characters;

The start character and the terminator are not recognized by the workers;

If the blank area is not destroyed, the recognition character can be placed anywhere around the barcode character.(unit:mm)



Figure 4-4. ITF-14 barcode dimensions

Table 4-2. Symbol dimensions and quality requirements

application	demand				
	X range of sizes (mm)	Wide and narrow ratio range	blank space minimum width	The smallest height (mm)	Lowest symbol level
Regular distribution (Non-logistics)	0.495~1.016	2.25~3.00	10X	32.0	1.5/10/670(X ≤0.635mm)
other	0.250~0.495	2.25~3.00	10X	12.7	1.5/10/670

Note: X is the design width of narrow cells (narrow or narrow empty strip).
Other applications refer to the trade items (paper, packaging materials, communication equipment, etc.) used by both parties in the supply chain.

4.5. Decoding Algorithm

Since the ITF-14 barcode is the barcode of two width cells, the main task of the decoding algorithm is to determine whether the scanned bar, the empty unit is a wide unit or a narrow unit. The standard decoding algorithm is as follows:

- (1) Record the width of the 10 cells of a character pair. Calculate their sum of S;
- (2) Calculate a threshold RT, $RT = (7 / 64) S$;
- (3) Comparing the width of each cell in the character pair with the threshold value, the cell with a width greater than RT is determined to be a wide cell: the cell with a width less than RT is determined to be a narrow cell.

4.6. Apply

ITF-14 barcode and can only be used to identify the retail goods outside box, namely only in logistics warehousing link (not for POS settlement), we generally in the process of logistics, see the barcode on the carton is basically ITF-14 bar code, such bar code for printing accuracy is not high, suitable for directly printing on the surface is not smooth, stress after easy deformation of material, for different applications, packaging types, ITF-14 bar code application is different, but is two categories:

- (1) Preparation of codes for non-retail quantitative trade items.
- (2) Non-retail goods in multi-level combination packaging.

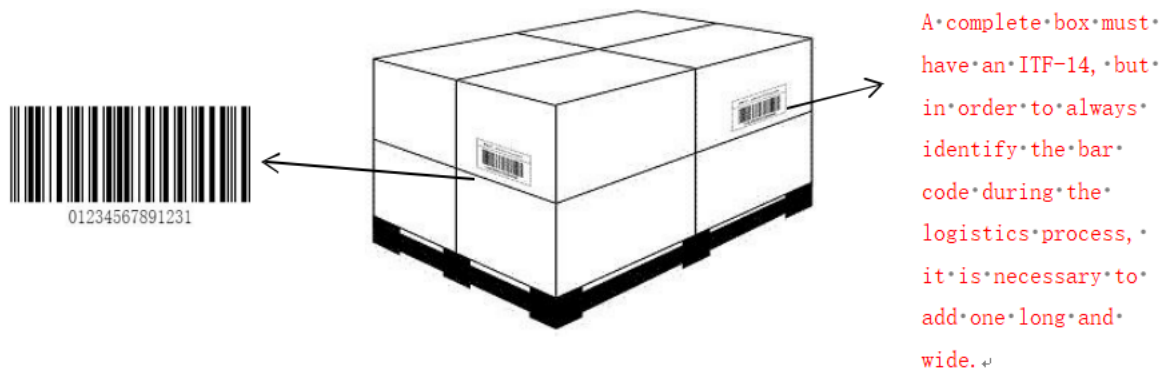


Figure 4-5. The practical application of the ITF-14

Suppose that the character bar code of figure 4-5 ITF-14 above is the even bit character of 123456789123, and the calculation method of the check bit is:

- The sum of odd digits = $1 + 3 + 5 + 7 + 9 + 2 = 27$; the sum of even digits * 3 = $(2 + 4 + 6 + 8 + 1 + 3) * 3 = 72$.
- In step A, the sum of two values should be: $27 + 72 = 99$. Take a number of 9.
- Finally, the check bit is: $10 - 9 = 1$, and the check bit is 1.

Since 1234567891231 is an odd number, so you need to add a 0 at the front, the complete barcode character should be: 01234567891231, which is consistent with the ITF-14 barcode generated in Figure 4-3 above.

5. CONCLUSION

Online trade is more and more developed today, the importance of GS1 system is self-evident. For ITF-14, barcode technology, based on GS1 system, and the application of informatization and standardization of supply chain management of GS1 system is studied. In-depth analysis of the contents of GS1 system supply chain management, discuss the role and significance of GS1 in e-commerce, product information sharing, logistics management, product traceability and other aspects in the process of supply chain management, and finally explain the advantages of ITF-14 in the supply chain management of GS1 system.

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