The Global Language of Business

GS1 US Apparel and General Merchandise

How to Translate a U.P.C. to a GTIN to an SGTIN to an EPC

Universal Product Codes (U.P.C.s) identify products at point-of-sale. Although they contain a great deal of information, industry is moving to supplement the barcode with EPC®-enabled RFID to create increased efficiency throughout the supply chain.

The Benefits of EPC

The use of the Electronic Product Code (EPC®) with Radio Frequency Identification (RFID) is an effective bridge from today's barcode-based systems to RFID without losing your current investment in identification systems, transaction systems, or other information-sharing techniques. EPC-enabled RFID presents a way for your company to extend your current investment in the GS1 Standards to take advantage of the benefits of RFID as a data capture technology, as you identify, capture, and share information within your business and with your trading partners.

Now, how do you create an EPC to create better efficiency in your business? All you need is a Universal Product Code (U.P.C.)* and a copy of the GS1/EPCglobal® Tag Data Standard to get started.

Understanding Your 12-digit U.P.C.

Your U.P.C. barcode is made up of a U.P.C. Company Prefix, an Item Reference Number, and a Calculated Check Digit Reference.

6	1	4	1	4	1	0	0	7	3	4	9

U.P.C. Company Prefix
This number can be found on your GS1 Company Prefix Certificate. It can range from 6 to 10 digits in length.

Item Reference Number
Assigned by the owner of the U.P.C. Company Prefix. These are the numbers that follow your U.P.C. Company Prefix.

Calculated Check Digit Reference
Calculation based on previous 11 digits to ensure the GTIN is created correctly. The Check Digit is always the last number.

Look at your product to find your 12-digit U.P.C. barcode number. Make sure you have your GS1 Company Prefix Certificate and the latest version of the **GS1/EPCglobal Tag Data Standard** to get started.

EPC Encoder/Decoder

This interactive tool translates between different forms of barcode-based identification and corresponding EPC/RFID data.

This tool is helpful in translating identification keys encoded in a barcode into an EPC representing the same identifier, or vice versa (i.e., U.P.C. barcode GTINs translated into EPC form and back).

Visit **EPC Encoder/Decoder** to try the tool today!

*In this publication, the letters "U.P.C." are used solely as an abbreviation for the "Universal Product Code," which is a product identification system. They do not refer to the UPC, which is a federally registered certification mark of the International Association of Plumbing and Mechanical Officials (IAPMO) to certify compliance with a Uniform Plumbing Code as authorized by IAPMO.

Getting Started

Follow This Example

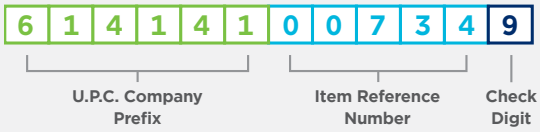
Use this sheet to go step by step through the process using our U.P.C. example as a reference guide. Check the Notes section on the right side to see where to start if you already have your Global Trade Item Number® (GTIN®) or Serialized Global Trade Item Number (SGTIN).

Your Translation

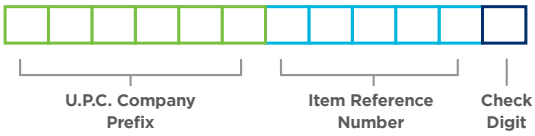
Use these boxes to fill out your information as you read along with the example.

1. Separate Your U.P.C. Into Its Component Parts

First, determine which numbers are your **U.P.C. Company Prefix**, **Item Reference Number,** and **Check Digit**. You can confirm which digits represent your U.P.C. Company Prefix by looking for them on your GS1 US® Company Prefix Certificate. Alternatively, you can look this up using the GS1 Company Database (GEPIR). The final digit is your Check Digit. The digits in between are your Item Reference Number.

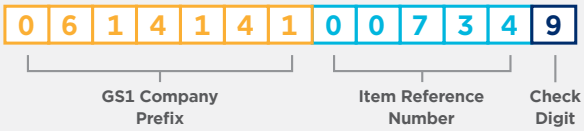


Note Your U.P.C. Company Prefix can be as long as 10 digits (U.P.C. prefixes beginning with 86 are 10 digits long).

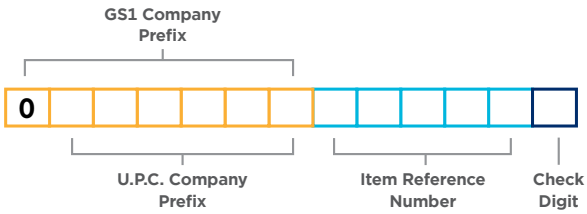


2. Transform Your U.P.C. Company Prefix Into a GS1 Company Prefix

To change your U.P.C. Company Prefix into a **GS1 Company Prefix**, simply add a “0” in front. You should then have 13 digits.



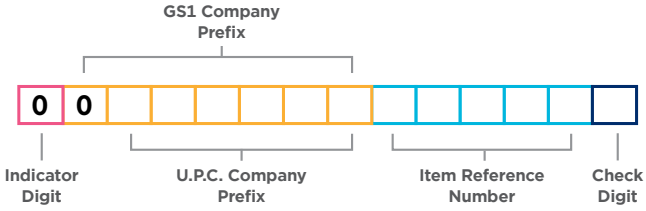
Note GS1 Company Prefixes can be as long as 11 digits.



3. Translate to a GTIN

To translate to a 14-digit GTIN, you need to add an Indicator Digit. This **Indicator Digit** shows different levels of packaging. A “0” indicates you are at item level, so place a “0” in front of your GS1 Company Prefix.

Note If you already have a 14-digit GTIN, you can start at this step.



Continued Example

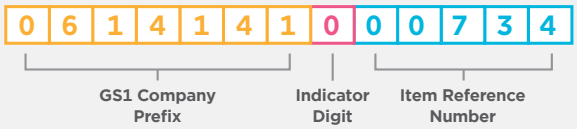
Your Translation

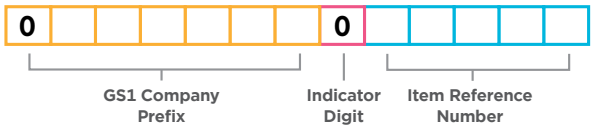
4. Drop Your Check Digit

Check Digits are a way for you to manually make sure you have the right sequence of numbers for your U.P.C., but EPC technology uses other forms of checking. Simply drop your last digit.

5. Move Your Indicator Digit

To speed up the RFID reader performance in finding products from a particular brand owner, we move the Indicator Digit to join the Item Reference Number as its first digit.





6. Add a Unique Serial Number

Serial Numbers are unique numeric strings that can be up to 12 digits (for a 96-bit RFID tag). These numbers are brand-owner driven, so you choose the way you'd like to number them. We advise you keep it simple and not add logic to the serial number itself. GS1 US has published guidelines to help you choose an appropriate method for allocating and assigning serial numbers for EPCs.

EPCs are represented in an internet-friendly format that separates the fields in your EPC with dots, so set your sequence up as follows:

GS1 Company Prefix

Indicator Digit + Item Reference Number

Serial Number

These numbers together are considered your new Serialized GTIN (SGTIN).

Note

For use in a 96-bit RFID tag, the serial number may be from 1 to 12 digits. It must be less than or equal to 274,877,906,943, and the first digit may not be a zero. You may not fill out all of the boxes below, depending on the length of your GS1 Company Prefix and Serial Number.

GS1 Company Prefix

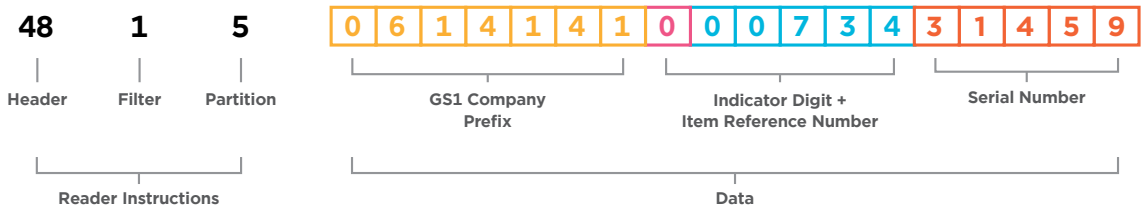
Indicator Digit + Item Reference Number

Serial Number

EPC Structure

Understanding EPC Structure

EPCs are structured into six blocks of information that help the reader understand how to read your code.



Header: Per the GS1/EPCglobal Tag Data Standard, for an SGTIN-96 RFID tag, this value is always the 8-bit binary value corresponding to decimal number 48.

Filter: The filter value lets the reader filter out certain types of RFID tags, allowing you to identify which tags you want to read and which to ignore. As shown in the example below, the filter value of "1" is used to describe a POS item. Reference the GS1/EPCglobal Tag Data Standard for additional information regarding these values.

Partition: The partition value identifies how many digits are in the GS1 Company Prefix.

GS1 Company Prefix: Reference page 1

Indicator Digit + Item Reference Number: Reference page 1

Serial Number: Reference page 1

Continued Example

7. Determine Your Header Value

For this example, we use the header value for a 96-bit SGTIN EPC format, which are the decimal digits "48." All GS1 Identifiers have EPC formats, each with a unique header value that can be found in the GS1/EPCglobal Tag Data Standard. Reference this to find your EPC format header value.

48
Header

0 6 1 4 1 4 1
GS1 Company Prefix

0 0 0 7 3 4
Indicator Digit + Item Reference Number

3 1 4 5 9
Serial Number

Your Translation

Note If you already have an SGTIN, start at this step.

48
Header

0
GS1 Company Prefix

Indicator Digit + Item Reference Number

Serial Number

Continued Example

8. Determine Your Filter Value

Reference the table from the GS1/EPCglobal Tag Data Standard *(shown below)*. Find which type of Filter matches your EPC need. Insert this number after your Header.

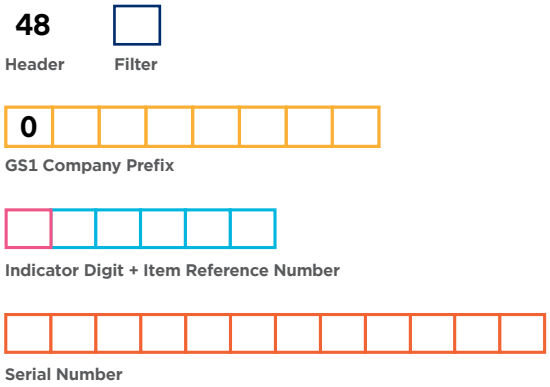
Filter Value Table		
Type	**Filter Value**	**Binary Value**
All Others (see Section 10.1)	0	000
Point of Sale (POS) Trade Item	(1)	001
Full Case for Transport	2	010
Reserved (see Section 10.1)	3	011
Inner Pack Trade Item Grouping for Handling	4	100
Reserved (see Section 10.1)	5	101
Unit Load	6	110
Unit Inside Item or Component Inside a Product Not Intended for Individual Sale	7	111

(From GS1/EPCglobal Tag Data Standard, page 72)

48 Header **1** Filter

Your Translation

Note Note: In most cases, if you have started with a U.P.C., you will be using the POS filter value of 1.



9. Determine Your Partition Value

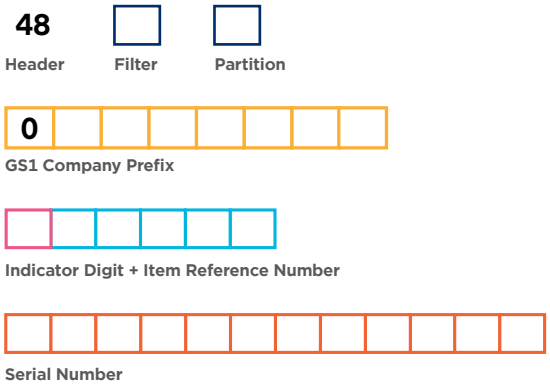
Reference the table from the GS1/EPCglobal Tag Data Standard *(shown below)*. Find the row where the (L) column matches the number of digits in your GS1 Company Prefix. The value of the partition is the first column of that row. Insert this number after your filter value.

SGTIN Partition Table				
Partition Value	**GS1 Company Prefix**		**Indicator/Pad Digit + Item Reference**	
	Bits (M)	**Digits (L)**	**Bits (N)**	**Digits**
0	40	12	4	1
1	37	11	7	2
2	34	10	10	3
3	30	9	14	4
4	27	8	17	5
(5)	24	7	20	6
6	20	6	24	7

(From GS1/EPCglobal Tag Data Standard, page 106)

48 Header **1** Filter **5** Partition

Note Note: It's important that you start with the length (in digits) of your GS1 Company Prefix—Remember that the leading zero we added back in Step 2 counts as a digit.



At this point, you can use software to finish the rest of the process, but for your reference, please continue to Step 10.

Continued Example

10. Translate From Decimal to Binary

RFID readers only read in binary code, so you must translate your decimal numbers to binary bits.

This step is key to correctly encode the EPC into the RFID tag. This is the key piece of information that makes it possible for you to work with the software to develop the binary string.

Binary Translation

00110000
Header (8 bits)

001
Filter (3 bits)

101
Partition (3 bits)

000010010101111011111101
GS1 Company Prefix (24 bits)

00000000001011011110
Indicator Digit + Item Reference Number (20 bits)

00000000000000000001001100101100101111
Serial Number (38 bits)

Your Translation

Note Reference your set of numbers from the previous page to translate.

Be sure to fill the binary values from the right, adding leading zeros as needed.

Binary Translation

Header (8 bits)

Filter (3 bits)

Partition (3 bits)

GS1 Company Prefix (24 bits)

Indicator Digit + Item Reference Number (20 bits)

Serial Number (38 bits)

11. Create a Single String

Compose your numbers back into a single string. Often, this number is expressed in a hexadecimal. Reference the GS1/EPCglobal Tag Data Standard for more information on hexadecimals.

00110000 001 101 000010010101111011111101

00000000001011011110 0000000000000000

00010011001011001011111
Binary

3034257BF400B7800004CB2F
Hexadecimal

Note We are providing this for your reference. It will be mostly invisible to you. This is the part where the software takes over, preparing the binary string to be programmed into the RFID tag.

Binary

Hexadecimal

You're done!

Should you have any questions about translating a U.P.C. to an EPC, visit www.gs1us.org/ApparelGM.

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