UPC IMPLEMENTATION GUIDE: HOW TO DEVELOP AND MAINTAIN A TOP QUALITY UPC

DECEMBER 1991

UNIFORM CODE COUNCIL, INC.

*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 the Uniform Plumbing Code as authorized by IAPMO.

UPC Implementation Guide:
How to Develop and Maintain a Top Quality UPC

Uniform Code Council, Inc.

Copyright (c) 1991
Uniform Code Council, Inc.
All rights reserved.

December, 1991

Acknowledgements

The Uniform Code Council wishes to thank Willard Bishop Consulting, Ltd. for preparing this book and the following companies for their contributions to the document.

Albertson's, Inc.
American Drug Stores
Applied Tactical Systems
Bar Code Graphics
Bar Code Systems, Inc.
Mr. Francis Beck
Borden, Inc.
E. J. Brach Corp.
Burdines, Inc.
The Bureau of Engraving, Inc.
Champion International
Cobbs Manufacturing Co.
Coca–Cola Foods
Coors Brewing Co.
Diagraph Corporation
The Dial Corp.
Durkee–French Foods
J. B. Felter Affiliates
Fleming Companies, Inc.
Food Marketing Institute
Frieda's
General Mills
Giant Food, Inc.
Grocery Mfgrs. of America
Grocery Products Mfgrs. of Canada
Hallmark Cards, Inc.
Heinz U.S.A.
Hershey Chocolate USA
IBM Corporation
Information Resources, Inc.
Intermec Corporation
James River Corporation
The Andrew Jergens Co.
Jewel Food Stores
Kiwi Brands
Kmart Corporation
Koegel Meats
Kraft/General Foods
The Kroger Co.
Laserlight Systems
Leaf, Inc.
L'eggs Products
Lever Brothers Co.
Loblaw Companies Ltd.
Maidenform
3M Corporation
Marsh Company
Meijer, Inc.
Fred Meyer, Inc.
Monarch Marking
Mr. Friendly's IGA
National Assn. of Chain Drug Stores
National Wholesale Druggists Assn.
Neilsen Marketing Research
Oscar Mayer Foods
Preferred Products, Inc.
Procter & Gamble
Publix Super Markets, Inc.
The Quaker Oats Company
Ragu Foods Co.
Ralphs Grocery Company
Ralston Purina
Redmond Products, Inc.
R. J. Reynolds Tobacco
Ross Laboratories
Safeway Inc.
Sara Lee Corporation
Sargento Cheese
Schnuck Markets, Inc.
Shaw's Supermarkets, Inc.
Solo Cup Co.
Spectra Physics Corp.
The Square D Company
Supermarkets General Corp.
Super Value Stores, Inc.
Symbology, Inc.
Symbol Technologies, Inc.
Target Stores
Topco
The Vons Companies
Walgreen Company
Wegmans Food Markets, Inc.
Wm. Wriglery Jr. Company
Winn–Dixie Stores, Inc.

Table of Contents

Page

Introduction:

Who Is This Book Written For? i
Why Should I Read This Book? ii
What Are the Goals Of This Book? iv
Why Do I Need The UCC Technical Manuals? v
What Is The Uniform Code Council?. vii

Chapter I: "So You're New to UPC" 1
What is the UPC? 1
What is the UPC Number? 2
What is the UPC Bar Code? 4
How Do I Apply the UPC to a Product? 6
Steps For Developing a Quality UPC 7
When Should I Change the UPC? 8
How Do I Print the UPC? 11
Key Factors for Determining Print Method 12

Chapter II: "UPC Quality--Getting it Right the First Time" 1
What is UPC Quality? 2
Why is UPC Quality Important? 3
What Factors Affect UPC Quality? 4
What is a UPC Coordinator? 11
Role of a UPC Coordinator – Manufacturer 12
Role of a UPC Coordinator – Retailer 13
What Does UPC "Verification" Mean? 14
How is a Manufacturer Responsible for UPC Quality? 15
How is a Film Master Supplier Responsible for UPC Quality? 17
How is a Printer Responsible for UPC Quality? 18

Chapter III: "For Retailers Only" 1
How Can I Control and Improve UPC Scannability in Stores? 1
What Should I Do When a UPC Will Not Scan? 3

Chapter IV: "About Those Other UPC Applications" 1
What is the System for Random Weight? 1
What is the System for Pharmaceutical Products? 4
What UPC–marking Options Are Available to Retailers? 6
What is the System for Coupons? 9
What About the UPCs on Books and Magazines? 11
What About Industrial and Commercial Applications of the UPC? 15
What is the International Article Numbering System (EAN)? 16

Chapter V: "The Code For Shipping Containers" 1
What are the Benefits of Using Shipping Container Codes? 1
What is the Code for Fixed Content Shipping Containers? 2
What is the Code for Serialized Shipping Containers? 4
What is a UCC/EAN–128 Application Identifier? 8

Appendix A: Glossary of Commonly Used Terms

Appendix B: How To...
How To Calculate the Check Character 1
How To Form Zero–Suppressed Numbers 2
How To Order a Film Master 3
How To Determine a Random Weight Item ID Number 5
How To Determine an Application Identifier 6
Dimensions of Various Size UPC Version A Bar Codes 8

Appendix C: UPC Quality Checklist

Bibliography

Introduction

The Universal Product Code (UPC) serves as the cornerstone of a global new age in retailing. The code has been in place since the early 1970s allowing suppliers and distributors of consumer products around the world to build upon the UPC as they continue to change the fundamental ways of running their businesses. The UPC is now a critical part of the entire product cycle--from manufacturer through distributor to consumer.

The full UPC system includes numbers--for people to read--and bar codes--for machines to read. Both the numbers and the bar code are printed on a consumer package with each unique package showing its own unique number and bar code.

The Uniform Code Council administers the assignment of all UPC manufacturer identification numbers to preserve the uniqueness of each individual item. The full UPC system is intended to provide readers of the code--both people and machines--with a reliable way to make businesses work more effectively through accurate product identification.

Who Is This Book Written For?

This book has been written for two experience levels of UPC users:

- ***The first time user*** can learn what it takes to put a top quality UPC bar code on a consumer product.

- ***The experienced user*** can quickly find answers to specific questions about UPCs.

If you are a first time user, you should read the entire introduction and all of Chapters I and II. Read each remaining chapter in its entirety if it covers any subject of interest to you.

If you are an experienced user, you should at least read Chapter II concerning UPC quality completely. Then go to the Table of Contents to find where your questions are answered in the other chapters.

The Appendices contain a wealth of information that can be important to you now or at a later time. You should become familiar with their contents so that you can refer to them as needed.

Why Should I Read This Book?

Suppliers and distributors of consumer products enjoy great benefits from using top quality UPCs. Attesting to the importance of UPC quality, senior industry executives assert:

> "The Universal Product Code...is the foundation of technological systems which make the U.S. retail system the envy of the world. Yet, its contribution to cost–savings for suppliers, distributors, and consumers hinges totally on the simple quality of the printed symbol itself. Unscannable symbols increase costs rather than reduce them, and they erode consumer confidence in the entire electronic system which is key to efficient retail operations. First priority for all UPC users must be the quality, integrity, and first–scan capability of the symbol itself."
>
> Byron Felter
> President, J.B. Felter Affiliates
> Member of the UCC Board of Governors

"There is a win–win situation for both retailers and manufacturers when accurate data is captured at the checkstand. Improved symbol quality can enhance data substantially. We urge all companies involved with printing symbols to make sure that they meticulously follow the guidelines for symbol quality. We will all benefit."

Byron Allumbaugh
Chairman of the Board
Chief Executive Officer
Ralphs Grocery Company
Member of the UCC Board of Governors

In summary, both manufacturers and retailers are increasingly benefiting from information systems that use UPCs to:

- Gather accurate point–of–sale data.
- Increase store checkout productivity and simplify front–end operations.
- Improve merchandising decisions such as shelf space allocation.
- Improve marketing decisions such as promotion evaluation.
- Reduce operating costs such as excessive inventory levels.

To deliver the benefits––and to help give consumers what they want when they want it––the UPC must be easily readable and contain the correct information. If it fails to meet either requirement, the system reading the bar code simply will not work. For example, a "bad" UPC could cause the wrong price to be charged at the checkout resulting in consumer mistrust.

Any company involved with producing, distributing or selling consumer package goods can benefit from UPC–based technology. But it must also prevent "bad" UPCs. Manufacturers, graphic designers, film master suppliers, printers of packages, wholesalers and retailers all share in the overall responsibility for making the UPC system work. This book is written for each of these audiences––it is written for you––so that you can benefit from the new age of UPC–based technology.

What Are the Goals Of This Book?

The ultimate goal of this book is to improve the first pass read rate of UPCs in the entire consumer product industry. By that measure, you will know whether UPC–related benefits are increasing within your own company. The UPC Implementation Guide is a top level introduction to the Universal Product Code with three immediate goals. These goals are to:

1. Explain important UPC issues in a non–technical fashion.

2. Help you implement, maintain, and use the highest quality UPCs.

3. Refer you to existing Uniform Code Council technical manuals and other published resources for specific technical information.

This book is not intended to replace existing UCC publications. Rather it is meant to complement them by serving as a starting point for you as you do your part to ensure the scannability of UPCs.

Why Do I Need The UCC Technical Manuals?

If you need more technical information about the UPC system, you should refer to the technical manuals published by the Uniform Code Council. These manuals contain all the specific information needed to implement and use the Universal Product Code. A summary of the UCC technical manuals is as follows:

- ***UPC Guidelines Manual*** – Provides information for implementing the UPC numbering system including how to assign UPCs and procedures for use of the UPC.

- ***UPC Symbol Specification Manual*** – Contains detailed technical information about how to translate a UPC number into its machine–readable bar code and how to properly print a UPC.

- ***UPC Symbol Location Guidelines Manual*** – Identifies the proper location for UPCs on consumer packages.

- ***UPC Film Master Verification Manual*** – Serves as a supplement to the UPC Symbol Specification Manual and the UPC Symbol Location Guidelines Manual. It also contains procedures for verifying film master accuracy.

- ***UPC Coupon Code Guidelines Manual*** – Describes how to apply the UPC to manufacturer and store coupons.

- ***UPC Shipping Container Code and Symbol Specification Manual*** – Describes how to identify each shipping container of a product with a special number and a machine–readable bar code.

- *Application Specification for the UCC–128 Serial Shipping Container Code (With Symbol and Shipping Label Guidelines).* – Defines the UCC–128 code used to identify shipping containers with unique, non–standard product mixes.

- *UPC Marking Guidelines for General Merchandise and Apparel* – Describes how to properly use the UPC on branded apparel and general merchandise including proper tag and label location, format, and content.

- *UPC Data Communications Guidelines for General Merchandise and Apparel* – Facilitates the introduction of the UPC into product identification systems in the general merchandise industry.

- *UPC Industrial and Commercial Guidelines Manual* – Provides a broad overview of how to implement UPCs for industrial and commercial products.

What Is The Uniform Code Council?

The Uniform Code Council (UCC) is the not for profit administrative and educational organization that:

- Works with U.S. and Canadian industry to develop and administer product identification and electronic data interchange (EDI) standards.

- Issues a UPC identification number to the owner/controller of a product label, i.e., a manufacturer, retailer, wholesaler, jobber, etc.

- Publishes all UPC technical specifications and guidelines.

- Educates the business community about the Universal Product Code.

Chapter I: "So You're New to UPC"

If you would like to learn the basics of the Universal Product Code, this chapter is meant for you.

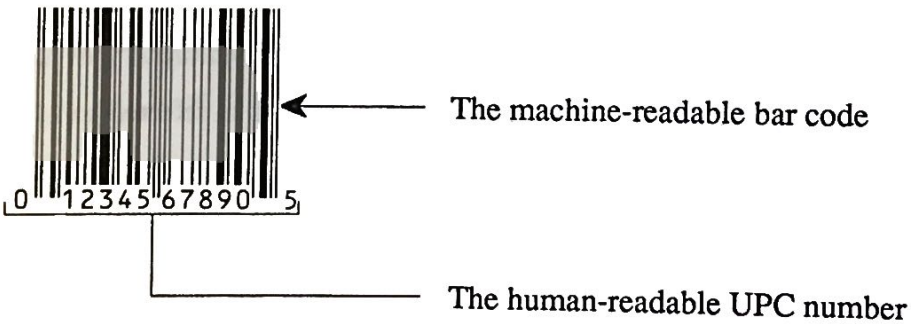
This chapter answers the following questions:

- What is the UPC?
- What is the UPC number?
- What is the UPC bar code?
- How do I apply the UPC to a product?
- When should I change the UPC?
- How do I print the UPC?

What is the UPC?

The UPC consists of two parts--the machine-readable bar code and the human-readable UPC number.

Universal Product Code



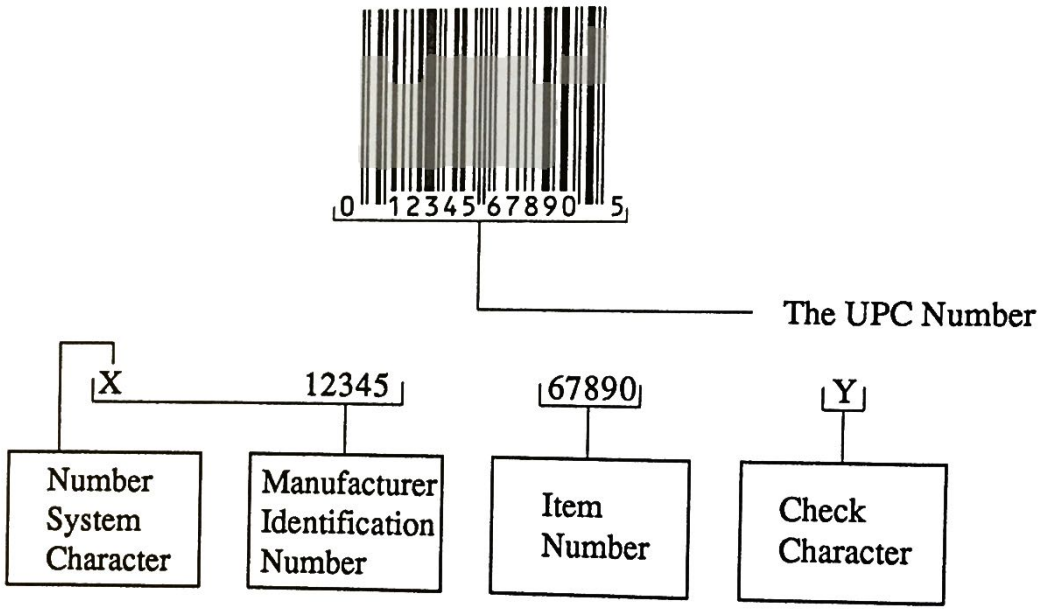
UPCs are frequently incorporated into the package graphics. When this direct printing is not feasible, UPCs are applied to products with tags or adhesive labels.

Tags containing UPCs are often attached to products such as apparel items. UPCs printed on adhesive labels are used on random weight products--produce, meat, deli items--and other consumer products when it is impractical to print a UPC directly on the package.

What is the UPC Number?

The Universal Product Code number is the unique 12 digit identification of an individual consumer product.

Structure of the Universal Product Code Number



The entire UPC number includes a six digit *manufacturer number* assigned by the Uniform Code Council. The first of these six digits is referred to as the *number system character.* This six digit field is followed by a five digit *item number* assigned by the owner/controller of the product label. The 12th and final digit is a *check character.*

Manufacturer Identification Number

The manufacturer identification number is a six digit number assigned by the UCC. One unique manufacturer identification number is assigned to each member company of the UCC.

The first digit is called the number system character. Number system characters "0" through "9" indicate the following categories:

Number System Character	Retail Category or Function
0, 6, 7	Regular UPC codes.
2	Random weight items, such as meat and produce, symbol–marked at store level.
3	National Drug Code and National Health Related Items Code. Note that the symbol is not affected by the various internal structures possible with the NDC or HRI codes.
4	For use without code format restriction and with check digit protection for in–store marking by retailers.
5	For use on coupons.
1, 8, 9	Reserved for uses unidentified at this time.

For more information on the Number System Character, see Chapter IV of this document or the UPC Symbol Specification Manual.

Item Number

The item number is a five digit number assigned and controlled by the manufacturer. A manufacturer may assign any five digits to any item it produces as long as each individual product--one stock-keeping unit--receives its own unique item number.

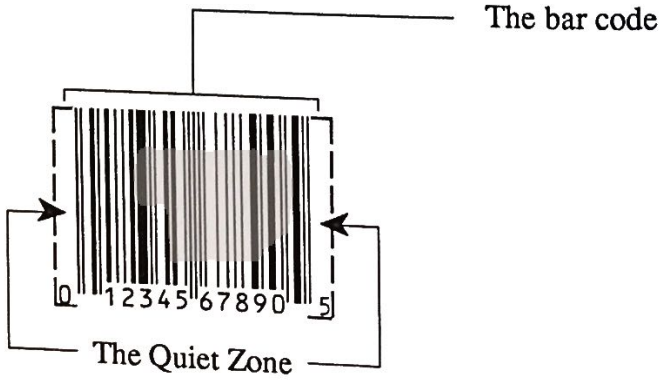
The Uniform Code Council recommends against any meaning or structure being applied to any portion of the item number. An unstructured approach permits the maximum of 100,000 item numbers per manufacturer identification number.

Check Character

The final digit is the single digit check character. It is used to verify the accuracy of the entire UPC number. For example, if a cashier key enters a UPC, the system performs a calculation on the numbers entered and compares the result to the check character to tell the computer that the entire UPC has been entered correctly. When a UPC is scanned, the check character also helps the scanning system verify that it has correctly read the bar code. See Appendix B for an example of how to calculate the check character.

What is the UPC Bar Code?

The UPC bar code is the machine-readable representation of the Universal Product Code number--the bars and spaces.



The important characteristics of the UPC that determine its scannability are its quiet zone, size, contrast between the dark bars and light spaces, and the pattern of varying widths of these bars and spaces.

- **Quiet Zone** – UPCs have an area to the left and right of the bar code that is free of all printing. This quiet zone is necessary because in order to read a UPC, the scanner measures the dark bars and light spaces at a very rapid speed. The quiet zone alerts and prepares the scanner for the bar code that follows. Since UPCs can be scanned from either direction––left to right or right to left––quiet zones are required at both ends.

- **Size** – The Version A UPC––including numbers, bar code, and quiet zone––covers 1.4984 square inches and is 1.469 inches wide by 1.02 inches high at nominal (100%) size. Some UPCs may be larger or smaller than this standard depending on package design and printing conditions. (See Chapter II.) In general, larger UPCs scan better than smaller ones. The minimum size is 1.175 by .816 inches (see Appendix B for the full range of UPC sizes).

  UPC Version E (zero–suppressed) has very limited application for small packages which will not support the Version A symbol. This version, however, is available only under number system character "0". Appendix B illustrates how to form Version E zero–suppressed numbers.

- **Contrast** – Scanners measure and differentiate between dark bars and light spaces. The level of contrast between the bars and spaces helps determine the scannability of a bar code. Although UPCs can be printed in many colors, the combination of colors that provides the greatest contrast and the most reliable UPC is black bars with white spaces.

- **Bar/Space Pattern** – Every number encoded in the UPC bar code has a unique pattern of dark bars and light spaces of varying widths. Accurate printing of these unique patterns is essential.

Other aspects of UPC quality are covered in Chapter II.

How Do I Apply the UPC to a Product?

Applying a UPC to a product need not be a difficult task. Product manufacturers follow six steps to start the UPC implementation process. While these steps are not difficult to follow, they are critical to the development of a quality UPC––one that scans on the first pass.

Steps For Developing a Quality UPC

1. Obtain a Manufacturer Identification Number from the UCC	Once assigned a unique six digit number, use the same number to begin all UPCs. *Note: There is a charge for a manufacturer identification number which includes automatic membership in the UCC and is based on the manufacturer's total sales.*
↓	
2. Assign a 5 Digit Item Number	Assign the next five digits to identify a particular product. Develop controls to ensure that item numbers are not duplicated.
↓	
3. Calculate the Check Digit/ Communicate Entire Number	Calculate the twelfth digit using the check character formula. Accurately communicate all UPC numbers and all related product information to trading partners.
↓	
4. Design the Consumer Package	The package design must contain enough space for a full size UPC and the UPC must be in the correct location. In its final form, the package must not interfere with the UPC in any manner. *Note: Proper UPC bar code location is essential for efficient scanning.*
↓	
5. Choose the Color of the UPC	Black bars on white background provide the best contrast and should be used if possible. If black on white cannot be used, dark bar and light background colors should be chosen which provide the greatest contrast.
↓	
6. Determine the Printing Technique	Many factors affect the choice of printing technique for the UPC such as: type of package, cost, print volume, size of UPC, UPC color, and whether different UPCs will be printed during the same print run. Manufacturers have several on site and off site printing options. This chapter concludes with a discussion of these methods.

When Should I Change the UPC?

As a general rule, manufacturers should never assign more than one UPC to the same product. However, events such as mergers and acquisitions may require new UPCs or shipping container symbols (SCSs) for some products to prevent duplicate identification. This section explains the circumstances under which manufacturers should, and should not, change a UPC package code or shipping container code. ***Note: When any portion of the number changes, the manufacturer must notify all trading partners.***

Mergers and Acquisitions

After a company merger or acquisition, the originally assigned UPCs should continue to be used on all products. However, when new products are introduced or when it becomes necessary to change the UPC on existing products, the owner of the brand--the acquiring company or parent of the merger--has the opportunity to change the UPC. The brand owner should incorporate the correct manufacturer identification number in the UPC and should verify that the item identification number is not already being used.

Reformulated or Repackaged Products

Repackaged products without a change in weight, count or formulation do not require a new UPC. However, when a product's weight or count changes, a new UPC should be assigned.

Promotional Packs

When manufacturers distribute specially designed promotional packages, some packages require new UPCs and/or SCSs while others require no changes at all.

- ***Price-off label*** – An item with a "cents off" statement included on the label.

  These products always require new package and shipping container codes to distinguish them from the regularly labeled product.

- ***Bonus pack*** – An item with more product quantity than the regular size item but sold at the same price as the regular size item, e.g., "20% More Free."

  A bonus pack requires its own unique package code because the increase in product quantity affects the item's unit price. The bonus pack also requires a new shipping container code since weight and cube may differ from the original shipping container.

- ***Free item on or near consumer pack*** – An extra item that is offered at no additional cost when the primary item is purchased, e.g., "Free coffee mug with Brand X coffee." The primary and free items are either bound together so they cannot be separated or they are displayed in separate packages near each other.

  If the two items are bound together, the package requires new package and shipping container codes.

  Note: The original UPC on both the primary item and the free item must be obscured. Only the new UPC package code should be scannable.

If the two items are displayed near each other, the UPC on the primary item should not change, but the UPC on the free item should be obscured.

For more information regarding obscuring patterns, see UPC Symbol Specification Manual, Section 5.11.

Regarding the shipping container code, the supplier should assign a new SCS if the free item is shipped in the same case as the primary item. If the primary and free items are shipped separately, the SCS for the primary item should not change; the shipping case for the free item should also have its own unique SCS.

- ***Free item in consumer pack*** – A free item packed inside a primary item's package with no change in the quantity or size of the primary item. This promotional package is sold at the same price as the regular package.

  The UPC on this new package should be the same as the UPC on the regular package. However, the shipping container requires a new code.

- ***Reconfiguration of a consumer pack*** – A product whose package is reconfigured during a promotion, e.g., a reusable container. This new package contains the same amount of product and is sold at the same price as the regular package.

  When a product's package is simply reconfigured, the UPC package and shipping container code should not change.

- ***Price–off coupon*** – An item with a price off or "instant" coupon in or on the package. The coupon could be for the item on which it appears, or for another item.

  Packages with price off coupons should keep their original package and shipping container codes.

  Note: The coupon's UPC must not be visible to the scanner while the coupon is attached to the package. The coupon UPC can be located on the inside of a package label or the entire coupon can be hidden inside the package.

- ***Holiday packs*** – Products modified for seasonal reasons. These products require unique UPCs for effective reordering and inventory control.

> For more about "when to change a UPC", see UPC Guidelines Manual, Guidelines #4, 8, 10, 27.

How Do I Print the UPC?

Printing technology has advanced since the Universal Product Code was first developed in the early 1970s. Today, there is a wide variety of both on site and off site printing methods that can produce high quality UPCs. The method you choose is based on several factors.

Key Factors for Determining Print Method

1. Package Design	How large is the package? What material is the package made out of? How complex are the package graphics? How many colors are needed to print the package?
↓	
2. Volume	How many UPCs or labels are needed?
↓	
3. Cost	Which method is most cost–efficient?
↓	
4. Flexibility	Do you need more than one type of print job completed? Do the packages require additional graphics?
↓	
5. Operational Efficiency	How much operator intervention, maintenance, lead–time, etc. does each method require?

Before choosing a printing method, manufacturers are strongly encouraged to complete the required steps found in the Manufacturer UPC Quality Checklist (Chapter II). This checklist describes activities––such as designing the package and obtaining a film master––that must be completed before the printing process can begin

The following section describes the popular printing methods––both on site and off site––that are available once the checklist is completed.

Off Site Printing Methods

Manufacturers often contract third party printers to make UPCs for their labels or packages. The printed labels or packages are then shipped to the manufacturer's production facilities. Off site printing generally offers higher volume and lower per unit costs when compared to on site printing. Also, off site printing can offer increased production efficiency because the UPC is part of the package and does not require a label application.

- ***Flexography*** – A film master––an extremely accurate photographic representation of a bar code––is used to make a printing plate which transfers quick–drying ink onto the label or package. Since many printing plates are rubber, flexographic printing can cause ink spread. Ink spread occurs when the rubber printing plate pushes too hard on the print surface.

  The printing plate must be designed to account for the ink spread. This is accomplished by decreasing the actual size of the bars––a process called bar–width reduction. The printer or film master supplier can determine the amount of bar–width reduction which is dependent on the printing equipment used.

  Note: The use of photopolymer plates rather than rubber plates to print the UPC is strongly recommended. Photopolymer plates maintain their shape or size longer than rubber plates, but still require bar–width reduction to compensate for ink spread.

- ***Lithography*** – Uses the same basic printing principles as flexography except that the plate sits on a cylinder. Lithography creates the highest quality bar codes when printing on paper, but it is not as effective on other materials. The plate should be designed to account for ink spread. (See Flexography.)

- *Rotogravure* – Uses the same basic principles as lithography except that the UPC is etched directly on the printing cylinder. Rotogravure UPCs tend to be lower in quality than UPCs produced using flexography and lithography, and need to be corrected for ink spread. (See Flexography.)

- *Silkscreening* – Ink is mechanically pushed through a screen that lets ink pass through in the shape of a bar code. Silkscreening is widely used on health and beauty care items such as shampoo bottles. The main drawback of silkscreening is that it can be slow and it is often difficult to silkscreen on uneven surfaces. Additionally, bar– width reduction must be incorporated into the film master.

On Site Printing

On site printing of UPC labels can occur at either the manufacturer's production site or headquarters location. The principal advantages of on site printing include faster turnaround and greater control and flexibility versus off site printing.

- *Thermal Transfer* – A low cost, quiet printing method that uses small printers similar to those used in direct thermal printing. This method includes an ink ribbon, which prints the UPC on regular paper. A high quality paper is very important in this method in order to print high quality bar codes. Unlike direct thermal bar codes, thermal transfer bar codes do not fade if exposed to light. However, bar codes may smear if not coated with a clear, non–reflective protective substance.

- ***Direct Thermal*** – Another low cost, quiet printing method which produces excellent quality UPCs on special heat sensitive paper. Direct thermal printers are usually very small––desktop or hand–held. Small heating elements inside a printhead are selectively heated and pressed against a special paper to produce the UPC. Maintenance of the equipment is important to ensure UPC quality. *Note: These symbols can fade if they are exposed to light for a long time.*

- ***Laser Printing*** – A computer–controlled printing method that can produce large quantities of identical or different bar codes. The image quality of a laser–produced UPC may vary with environmental conditions such as humidity, although the high contrast of a laser–produced UPC usually overrides most drawbacks and the bar codes scan easily.

- ***Ink Jet*** – An ink cartridge inside a printer sprays the printing surface with bursts of ink to form the UPC. The cartridge never comes into direct contact with the printing surface. While ink jet printing is not especially well–suited for printing UPCs on labels or packages because of ink spread, this method is used successfully for direct printing of 100% nominal size shipping container codes on corrugated shipping containers. An ink jet printer can be computer–controlled, allowing it to print identical or changing bar codes at high rate of speed. High speed, small character ink jet printers used for printing UPCs on products are quite expensive. However, large character ink jet printers used for printing SCSs on shipping containers are relatively inexpensive although they are limited to printing low density bar codes.

- ***Impact Drum*** – A reliable old and somewhat slow method for printing UPCs. This method works very much like a standard typewriter. The UPC is engraved on a drum which is pressed against an ink ribbon to transfer the bar code onto paper. The main disadvantage of impact drum printing is its lack of flexibility when changing bar code size and location.

- ***Dot Matrix*** – One of the least expensive methods of printing a UPC on site. Dot matrix printers are computer–driven and form a character when several pins of a print head simultaneously strike an ink ribbon. The size and spacing of the dots that comprise the character limit dot matrix printers to printing only low to medium density bar codes. There can also be wide variations in the contrast of dot matrix bar codes due to the ink in the ribbon. These variations require that dot matrix UPCs be nominal (100%) size or larger. Additionally, the relatively slow printing process makes it difficult for dot matrix printers to produce large quantities of bar codes or labels. Special care is required for the maintenance and operation of dot matrix printers to ensure adequate UPC quality.

Chapter II: "UPC Quality-- Getting it Right the First Time"

UPC quality is vitally important to the ultimate successful use of the entire Universal Product Code System. To ensure UPC quality, manufacturers, film master suppliers, printers and retailers need to uphold their respective responsibilities when applying a UPC to a product. Many companies have successfully improved UPC quality by giving that responsibility to UPC coordinators, and by using UPC verification procedures.

This chapter answers the following questions about getting UPC quality right the first time:

- What is UPC quality?
- Why is UPC quality important?
- What factors affect UPC quality?
- What is a UPC coordinator?
- What does UPC verification mean?
- How is a manufacturer responsible for UPC quality?
- How is a film master supplier responsible for UPC quality?
- How is a printer responsible for UPC quality?

The following chapter--Chapter III--looks at the retailer's role in ensuring UPC quality.

What is UPC Quality?

UPC quality affects the ability of a point–of–sale (POS) scanning system to easily and correctly read the UPC on the first scan attempt. This means that the UPC must be physically readable by the scanner, must convert into the correct number, and that the POS computer must contain the right information about the UPC number.

The first pass read rate concept has been developed to measure UPC quality in total. If all consumer packages scanned correctly the first time a cashier passes them over the scanning device, the first pass read rate for UPCs would be 100%.

Although point–of–sale scanning is an integral part of the retail industry, only about 85% of the UPCs are correctly read on the first pass over a scanner. This success rate is still the same as it was in the mid 1970s when POS scanning was introduced, even though there have been technological advances in the scanners' ability to read.

Two main issues affect the overall UPC quality: the quality of the UPC itself; and the quality of communications between companies that make and use UPCs. This chapter looks into the factors that contribute to––or detract from––UPC quality for both issues.

Why is UPC Quality Important?

The primary cause of packages not scanning correctly on the first pass is poor quality or inaccurate UPCs. Retailers, manufacturers, and consumers all experience negative consequences when a package has a low quality UPC. In fact, some retailers seeking to recover costs from poor quality UPCs have begun to fine manufacturers. Poor quality UPCs affect:

- **Labor** – Scanning an item more than once is time–consuming for the cashier. One retail chain estimates that it annually spends $4 million on excess labor for products not scanning on the first pass.

- **Ergonomics** – The increased handling of products due to multiple scans can have a cumulative effect on the cashier. A scanner manufacturer estimates that during an eight hour shift, one cashier typically handles an extra one–half ton of merchandise due to the 85% first pass read rate.

- **Customers** – When products do not scan easily at the checkout, shoppers can become frustrated by the time it takes to scan their order. Scanning problems can also cause customers to mistrust the store when they see the cashier running a product over the scanner several times in order to get a "clean" scan. Improving UPC quality will speed up the checkout process and will enhance shopper confidence when packages are scanned only once.

- **Product Movement Data** – Manufacturers and retailers are increasingly using scanner data to support computer–aided reordering systems, and a variety of marketing and merchandising decisions. UPCs are essential to the accuracy of the accumulated data. When a UPC does not scan, a cashier has two manual options:

  – Key enter the UPC number.

  – Enter the price and a department code.

  The accuracy of product movement data is compromised when the cashier enters only the price. The POS computer cannot record the particular product that was purchased. Improving UPC scannability should improve the quality of the scan data consulted when making important decisions.

What Factors Affect UPC Quality?

A wide variety of factors determine UPC quality. These factors affect the ability of a UPC to scan on its first pass over a scanner. Each factor must be addressed by manufacturers, film master suppliers, and printers for high quality UPCs that scan easily and accurately at the point of sale. This section briefly discusses the most significant factors affecting UPC quality.

- **UPC Number Assignment** – Determining and placing an accurate UPC on every product. The UPC must contain the correct manufacturer identification number, item number, and check character. Manufacturers must inform all of their trading partners of each UPC number that they assign.

- **Truncation** – Decreasing the height of a UPC bar code without decreasing its width––cutting off the top of a UPC. The Uniform Code Council strongly recommends against truncation. Any amount of truncation reduces a scanner's ability to read that UPC. The more a UPC is shortened, the more precisely the cashier must present it to the scanner. Truncated UPCs must often be re–positioned or re–scanned, thereby reducing cashier productivity.

  The UCC recognizes that truncation may sometimes be necessary to fit a UPC on a small package––one that cannot hold a "full height" UPC. However, before attempting truncation, manufacturers of small packages must first try to reduce or shrink the UPC within established limits. (See "Magnification" next.)

  Manufacturers who must truncate UPCs usually start with the widest possible UPC and then truncate as little as possible. The location of a truncated UPC on the package is crucial. Follow the UPC symbol location guidelines.

For more about "Truncation" see UPC Symbol Specification Manual, Appendix F.

- **Magnification** – Sometimes a UPC must be printed larger or smaller than the full or standard size. The magnification factor represents the amount a UPC is changed from the nominal (100%) size. Manufacturers of very large packages often use large UPCs. To facilitate scanning on certain substrates such as corrugated and flexible plastic, it is often helpful to print UPCs larger than nominal size. The Uniform Code Council allows UPCs up to 200% of nominal size--a magnification factor of 2.00.

  Conversely, many small packages cannot accommodate a nominal size UPC. Manufacturers of these packages must first try to reduce or shrink the UPC within established limits before resorting to truncation. The UCC allows UPCs to be reduced to 80% of nominal size--magnification factor of 0.80. The capabilities of the printing process largely determine the size of the UPC.

For more about "Magnification" see UPC Symbol Specification Manual, Section 4.2.

- **Package Interference** – The UPC may not be obstructed by the package on which it appears. UPCs that violate quiet zone, show–through, and overwrap guidelines will not scan properly.

- ***Quiet zone*** – An area of the package to the left and right of the UPC that is free of all printing or graphics. The quiet zone alerts and prepares the scanner for the bar code that follows. Since UPCs can be scanned from either direction--left to right or right to left--quiet zones are required at both ends of the UPC. The quiet zone should not contain any wording, graphics, closures, or perforations. Additionally, the UPC should be far enough from the edge of the package to maintain an adequate quiet zone.

- ***Show-through*** – The product or some other material can not be seen through the spaces of the UPC. When the product shows through the UPC, a scanner may read spaces as dark bars, thereby failing to read the UPC. Show-through occurs most often with transparent or translucent packages when the product itself serves as the background for the UPC. Manufacturers should not rely on product to serve as background or bars. In order to prevent show-through, manufacturers should print both the bars and the spaces by overlaying an opaque white background with dark bars.

For more about "show-through" see: UPC Symbol Specification Manual, Section 5.8.

- *Overwrap* – Sections of the package must not cover the UPC. Many packages, such as candy bags, are sealed in the back. The excess package material is folded over the back of the package possibly covering the UPC. To prevent overwrap, manufacturers should position UPCs away from areas that could be covered.

- **Print Contrast and Color** – What the scanner really "sees". A scanner does not "see" colors as our eyes see them. Nor does it measure the contrast between dark bars and light spaces of the UPC. Instead, scanners measure the amount of laser light that these bars and spaces reflect. Lighter colors (white) reflect while darker colors (black) absorb light. The greater the difference in the lightness and darkness between the space and bar colors, the more easily a scanner will be able to read a UPC.

  Black bars on white background provide the best contrast and should be used if the packaging graphics permit. If these colors are not available, dark bar and light background colors should be chosen to provide the greatest possible contrast.

For more about "Print Contrast and Color," see: UPC Symbol Specification Manual. Sections 5.2, 5.5 and Table 5.

- **Voids and Ink Spots** – Voids are poorly inked areas within the bars of a UPC. Voids may cause scanners not to recognize the bars. Ink spots are excess ink or dirt specks that appear in the spaces of a UPC. Ink spots may cause scanners to read a space as a bar. Bars and spaces must be uniform for a scanner to read them properly.

For more about "Voids and Ink Spots" see: UPC Symbol Specification Manual, section 5.6 and 5.7.

- **Bar–Width Reduction** – The physical reduction of bars on a film master or printing plate to compensate for ink spread while printing. Bars in film masters and printing plates are designed to initially be thinner than those in the final printed bar code. Bar–width reduction is often a necessary step when producing UPCs with wet ink printing techniques. These ink based printers use a printing plate to put the UPC on the package. During the printing process, the printing plate transfers quick drying ink onto the label or package.

  Printing plates used in wet ink printing processes will cause "ink spread"––lines printed too thick. Therefore, the bar images on the printing plates must be narrower than the desired end results.

For more about "Bar–Width Reduction" see:

- UPC Symbol Specification Manual, Section 4.2
- UPC Film Master Verification Manual, Section 3.5

- **UPC Location** – Where the UPC is placed on the product is critical. UPC location is one of the greatest causes of multiple scans and decreased point–of–sale productivity. In general, the greater the variation in UPC location from package to package, the more difficulty a cashier has in finding the UPC. The time that cashiers spend looking for UPCs and orienting the package for the scanner results in wasted effort. Following the Uniform Code Council's UPC location standards will improve customer throughput and increase cashier productivity.

  - ***Bottom marking*** – The basic rule of UPC location is to place the UPC in the center of the package's "natural bottom". To determine the natural bottom, consider the design of the container as well as the orientation of the package graphics. In the cases where bottom marking is not possible, certain alternate UPC locations are acceptable.

  - ***UPCs on Lids*** – When bottom marking or printing the UPC on the product label is not feasible, the top or lid of a container becomes a last resort location for a UPC.

  - ***Hang Tags or Pins*** – Products marked only with tags or pins that contain no other graphics, should show the UPC on the tag or pin.

For more about UPC location on all packaged goods see: UPC Symbol Location Guidelines Manual.

For more about UPC location for general merchandise and apparel––including tags and tickets––see: UPC Marking Guidelines for General Merchandise and Apparel.

What is a UPC Coordinator?

The person within a manufacturer's or retailer's organization who is responsible for the successful implementation and use of the Universal Product Code.

Inside a manufacturer's organization, the UPC coordinator ensures that high–quality, easily–scannable UPCs are consistently applied to packages. UPC coordinators in a retail organization strive to ensure that all UPCs scan properly at the checkout. Both types of coordinators need to talk to each other to ensure that the correct data is associated with the UPC in their information systems.

UPC coordinators for both manufacturers and retailers typically have three distinct and important roles.

Role of a UPC Coordinator – Manufacturer

Administrative	
	Establishes and updates corporate UPC specifications and policies.
	Assigns UPC numbers for all products.
	Orders film masters and provides film master suppliers with all necessary information.
	Approves design and placement of UPCs on products.
Liaison	
	Works with several internal departments––marketing, package design, graphic design, advertising, promotion––to ensure that "in–spec" UPCs are correctly applied to all products.
	Works with retailers to ensure that UPCs are on file and scan properly in stores.
	Serves as company liaison with the Uniform Code Council. *Any changes in UPC Coordinator personnel must be provided to the UCC.*
Verification	
	Confirms all UPCs produced by company are accurate and meet UCC specifications.
	Reviews art work and UPC number assignment.
	Confirms that UPCs scan properly. . Checks accuracy of film master . Tests UPC samples from all print runs . Tests UPCs on actual packages for all UPC specifications

Role of a UPC Coordinator – Retailer

	Administrative
	Establishes and updates corporate UPC specifications and policies.
	Controls and updates the UPC number database.
	Monitors scanner maintenance and performance.
	Ensures in–store printing equipment maintenance and performance.
	Assigns UPCs for private label products.
	Liaison
	Forwards UPC requirements and specifications to vendor counterpart.
	Works with buying department to ensure that vendors are following all corporate UPC policies.
	Interacts with stores to ensure that UPCs are scanning properly at the point–of–sale. *Informs manufacturer of problems and works with manufacturer to solve problems.*
	Serves as company liaison with the Uniform Code Council. *Any changes in UPC Coordinator personnel must be provided to the UCC.*
	Verification
	Ensures vendors follow UPC specifications.
	Ensures all product entering the stores scan properly. *UPC Coordinator at many retail organizations scan samples of all new products and packages and routinely review UPCs on established products.*
	Verifies UPCs generated in–store are accurate and meet UCC specifications.

What Does UPC "Verification" Mean?

Verification is the process of measuring a UPC bar code to determine if the UPC meets print quality specifications. Verification alone is not a cure–all but can be part of an overall UPC quality assurance process. Without a quality assurance process, poor quality UPCs may reach retail outlets and cause problems such as those discussed at the beginning of this chapter. A strong quality assurance process will contribute to accurate and efficient distribution systems.

Companies interested in verifying UPCs can choose from a variety of verification devices ranging from small hand–held portables to large bench models. When using one of these devices, the operator generally reads a UPC with the verifier's light pen or scanning gun. The verifier analyzes the UPC and indicates the UPC's print contrast and print quality, and confirms the UPC's encodation, i.e., the UPC number that the bar code represents. Many film master suppliers, verifier manufacturers, and distributors provide this service on a consulting basis.

While verification devices generally provide a good indication of relative bar code quality, their use may be impractical on certain substrates or packaging types. In these instances, verifier results may not directly correlate with actual bar code scannability. If product suppliers or retailers have questions or comments regarding the results produced by a verification device, they should contact the manufacturer of the device.

For a list of companies that manufacture and sell verification equipment, see: "Equipment/Service Providers," a booklet distributed by the Uniform Code Council.

How is a Manufacturer Responsible for UPC Quality?

The quality of a UPC directly reflects upon the manufacturer of the product. If a UPC does not scan properly, the manufacturer's retail customers--and even the consumers --could possibly develop negative feelings about the manufacturer or the product.

Therefore, manufacturers must apply the highest quality UPCs to their products. High quality UPCs that meet established Uniform Code Council specifications will scan properly.

Manufacturers should use the following checklist to ensure that top quality UPCs are properly applied to their packages.

Manufacturer UPC Quality Checklist

	1. Obtain a UPC Manufacturer Identification Number from the UCC
	2. Assign a full UPC number to each product
	3. Give UPC number--including number system character and check character--to package designers.
	4. Determine UPC location on package. Remember, cashiers expect UPCs in consistent locations, so placing the UPC in the proper location on the package is extremely important.
	5. Design adequate space on the package or label for a full size UPC (height and width). If the package is not large enough for a nominal (100%) size UPC, reduce the UPC's size within recommended magnification. If truncation is necessary, truncate only to the degree necessary, and only as a last alternative. Truncated UPCs should never be used on packages large enough to accommodate a full size UPC.
	6. Select color of UPC bars and background. Choose colors that optimize print contrast and reflectance.
	7. Order a film master. Contract a printer, color separator, or engraver to order the film master, or order the film master directly from the film master supplier. (See How To Order A Film Master--Appendix B.)
	8. Check the film master. Confirm that it contains the proper bar-width reduction based on the requirements of the printing process and that the numbers match the bar code.
	9. Give film master to printer, color separator, or printing plate maker.
	10. Review artboards and press proofs. Check for number, location, and UPC dimensional accuracy.
	11. Establish procedure for continually checking UPC quality on all print runs and throughout the package distribution process.

Note: Film masters (check points 7–9) may not be used by all manufacturers.

How is a Film Master Supplier Responsible for UPC Quality?

The film master is an extremely accurate photographic representation of a UPC used to make printing plates. A UPC film master is one of the most important components necessary to implement a high quality, easily scanned UPC. A high quality film master is required to make a high quality printing plate. For processes that require a printing plate, a high quality printing plate is required to print a high quality UPC.

Reputable film master suppliers will create a film master meeting all UCC specifications including the .0002 inch bar–width tolerance. Film master suppliers are among the most knowledgeable people about bar codes and often serve as bar code implementation consultants. In fact, film master suppliers often assist clients by training and solving problems.

Film Master UPC Quality Checklist

	1. Create a film master. A high quality film master that meets all UCC specifications must be delivered to the client.
	2. Train – Film master suppliers teach clients about the basics of the UPC system and show them how to apply a UPC to products or packages.
	3. Problem solve – Many film master suppliers are also known for their ability to solve the bar code related problems that their clients may encounter.

How is a Printer Responsible for UPC Quality?

Printers are responsible for printing high quality UPCs that meet Uniform Code Council specifications and scan easily. The actual printed packages or labels containing UPCs are produced using a high quality printing plate and the printer's expertise in using his equipment.

After receiving an order to print a UPC on packages or labels, a printer has four primary responsibilities.

Printer's UPC Quality Checklist

	1. Inform client of printing options – Printer and client must discuss the capabilities and limitations of various printing methods offered by the printer. This is a crucial step to avoid printing problems before the job starts.
	2. Complete Pre-press Work – Pre-press work includes making printing plates and testing the printing plates and machinery for ink spread. This step is crucial when creating a high quality UPC.
	3. Run Printing Press – Printers are responsible for running their printing presses according to commercially accepted printing standards.
	4. Verify Printed UPC – Printers should verify that samples of the printed UPCs from each print run meet all UCC specifications.

Printing problems can occur because some printing techniques are not appropriate for certain size UPCs or certain package materials. Therefore the printer must tell the client in advance whether the printer can satisfy the request and print UPCs that meet specifications and ultimately scan properly. If the requested print job is not possible, the printer can work with the client to change the UPC size, package material, or printing technique, etc. in order to produce a high quality "in spec" UPC.

UPC QUALITY: DO'S

- Assign a UPC coordinator.
- Choose dark bar and light background colors to provide greatest contrast.
- Design adequate space on package or label for a full size UPC.
- Confirm bar-width reduction on film master.
- Review artboards and press proofs for correct UPC number, contrast, size.
- Follow Uniform Code Council's UPC symbol location guidelines.
- Print UPC on a flat, even surface.
- Print UPC with adequate quiet zones.
- Whenever possible, print bar code lines in the direction of the printing press web.
- Verify print quality of bar codes on all print runs.
- Notify trading partners of all new UPCs and any UPC changes.
- Follow UPC quality checklists in Chapter II of this guide.

UPC QUALITY: DON'TS

- Don't truncate a UPC.
- Don't use the product inside a clear package as the background for a UPC.
- Don't reduce a UPC below 80% of nominal size.
- Don't print a UPC on a rough or uneven surface.
- Don't print a UPC on a package seam, fold, or edge.
- Don't assign final quality assurance responsibility to others. Become actively involved in the UPC verification process.
- Don't end quality assurance checks with the first print run. Continue quality checks in all print runs.

Chapter III: "For Retailers Only"

This chapter is written specifically for retailers. If you want to learn how to ensure the maximum scannability of UPCs in your stores, read on.

This chapter answers two questions that are of particular interest to retailers.

- How can I control and improve UPC scannability in stores?
- What should I do when a UPC will not scan?

How Can I Control and Improve UPC Scannability in Stores?

Poor quality UPCs cause many problems for retailers such as labor inefficiency, cashier stress, consumer mistrust, and lost product movement data. Retailers have a vested interest in controlling and improving the scannability of UPCs.

The following procedures will help to ensure the performance of scanning and printing equipment and maintain the highest quality UPCs. You can use this checklist to more effectively monitor and improve UPC scanning--the first pass read rate--in your stores.

Retailer UPC Quality Checklist

	1. **Verify UPCs on New Product Packages** – Request actual physical samples of all new products--the packages--from vendors. Evaluate each UPC with a verifier or scanner. The UPC coordinator relays the results of each test to the buying department.
	2. **Develop a Program to Detect Variation in Scan Rate** – The program should involve all possible influences on scan rates, i.e., equipment problems, UPC bar code problems, operational or cashier training problems, etc.
	3. **Scan a Random Sample of Packages at a "test" Store** – Designate one store to test scan a random sample of products.
	4. **Re-scan Problem UPCs** – If a randomly chosen product does not scan easily, test scan additional packages of the same item to determine the scope of the scanning problem.
	5. **Collect Information from POS System and Ask Cashiers To Identify Items That Do Not Scan Properly.**
	6. **Report Results to UPC Coordinator** – The test store reports the results of the random scanning tests to the UPC coordinator. POS information and cashier reports are also collected by the UPC coordinator.
	7. **Verify Problem UPCs** – Packages that did not pass in-store scan tests are forwarded to the UPC coordinator for further investigation.
	8. **Inform Manufacturer About the Problem** – The UPC coordinator relays the results of in-store tests to the product's manufacturer. The UPC coordinator often works with the manufacturer to solve UPC quality problems.
	9. **Re-label Items With Problem Symbols** – If a product has an unscannable UPC, re-labeling may be the only way to capture product movement data. Re-labeling occurs in stores and in the distribution center. Although sometimes necessary, re-labeling is costly and undesirable for both the retailer and manufacturer.

What Should I Do When a UPC Will Not Scan?

If you find a UPC that fails to scan properly, you must first determine what caused the scanning problem. If the problem was not caused by your system or personnel, you can conclude that the scanning problem was caused by a poor quality UPC.

Retailer Problem UPC Checklist

	1. Check the File – Make sure the UPC number is correctly "on file" in the scanning data base.
	2. Check the Equipment – Make sure the scanner and POS equipment where the problem was noticed is working properly.
	3. Report the Problem to the Supplier – Retailers and manufacturers often work directly together to solve UPC scanning problems.
	4. (Optional) Report the Problem to the UCC Information Interchange.

The UCC Information Interchange is a free service provided by the Uniform Code Council that assists retailers in reporting a UPC problem to the appropriate manufacturer. *This service is not intended to replace direct communication between retailers and manufacturers.* Instead, the Information Interchange serves as an intermediary between retailers and manufacturers when it is not possible, practical, or desirable for retailers to report UPC problems directly to manufacturers.

If you select this option, the Information Interchange reviews and records the scanning problem. Next, the UCC contacts the supplier of the product about the problem. The supplier completes the communication loop by telling both the retailer and the UCC when the problem has been resolved.

Information Interchange
Phone: (800) 543–8137
Uniform Code Council
8163 Old Yankee Road, Suite J
Dayton, OH 45458

For information concerning retailer specific UPC marking options, refer to Chapter IV.

FOR RETAILERS ONLY: DO'S

- Report all problem UPCs to the manufacturer and/or UCC Information Interchange.
- Test scannability of UPCs on all new products.
- Maintain a correct and up–to–date UPC database.
- Clean and maintain your in–store printer.
- Key enter the printed UPC number when an item fails to scan (in–store).
- Clean scanners regularly (in–store).
- Replace any scratched or worn scanner glass (in–store).
- Train scanner operators in proper scanning techniques (in–store).

FOR RETAILERS ONLY: DON'TS

- Don't assume that other retailers have already identified all problem UPCs.
- Don't assume that all UPC scanning problems are due to poor symbol quality. Check your own POS systems and equipment before contacting the product's manufacturer about the problem.
- Don't clean scanner glass with an abrasive cleaner (in–store).

Chapter IV: "About Those Other UPC Applications"

The Universal Product Code is actually many different number systems, each with a different use. UPCs represent a variety of products such as random weight items, health care items, in–store marked items, coupons, industrial and commercial products, and goods produced and sold in international markets.

This chapter answers the following seven questions:

- What is the system for random weight?
- What is the system for pharmaceutical products?
- What UPC–marking options are available to retailers?
- What is the system for coupons?
- What about the UPCs on books and magazines?
- What about industrial and commercial applications of the UPC?
- What is the International Article Numbering System (EAN)?

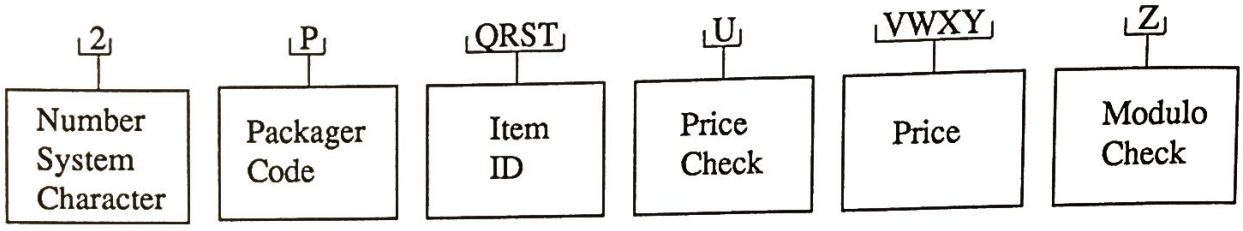
What is the System for Random Weight?

UPC Number System 2 represents all random weight products.

Random weight products are typically perishable items (e.g., meat, produce, bakery, cheese, fish and poultry) that are sold on a price per pound basis. Most random weight products are packaged and price–marked in the store. However, some may be packaged and price–marked by a manufacturer before they are delivered to the store.

There are six components to a 12 digit random weight UPC number.

Random Weight UPC Number



- **Number System Character** – The number system "2" identifies all random weight items sold on a price per pound basis at retail.

- **Packager Code** – This single digit number identifies the packager of the random weight product.

  – Follow these rules when assigning a packager code: Use numbers 0, 1, 2, 3 to indicate that the item was packaged and symbol–marked by the retailer. The retailer can assign these four numbers in any fashion. For example, the retailer may assign a "0" to identify in–store packaged items, a "1" to identify items packaged at a central processing location, a "2" to identify re–wrapped items, etc.

  – Use numbers 4, 5, 6, 7, 8, 9 to indicate that the item was packaged and symbol–marked by a vendor. This allows vendors of an item to identify themselves. However, it is a good idea to reserve the number "9" for items packaged and symbol–marked by a vendor whose identity does not need to be recorded.

- **Item ID** – The four–digit item ID numbers––represented by "QRST" in the example above––identify the individual item. To make it easier for retailers to assign item identification numbers, trade associations representing all random weight commodity categories have pre–assigned item number ranges for each category. These ranges are found in Appendix B: *How To Determine a Random Weight Item ID Number.*

- **Price Check** – This one–digit number is a price check digit for the item price. Most printing scales will calculate this digit automatically. Refer to the UPC Guidelines Manual, UPC Guideline #11, to see how to calculate the price check digit.

- **Price** – The numbers represented by "VWXY" indicate the item's price. For example, numbers "0 1 9 5" indicate that the item sells for $1.95.

- **Modulo Check Character** – This single digit number is used to verify the accuracy of the entire random weight UPC number.

> For more information about Number System 2 refer to the UPC Guidelines Manual, UPC Guideline #11.

What is the System for Pharmaceutical Products?

UPC Number System 3 represents pharmaceutical products.

The Food and Drug Administration (FDA) controls the labeling of all pharmaceutical products--both over-the-counter and prescription products. The FDA requires that a manufacturer or labeler of a pharmaceutical product must assign a 10 digit FDA controlled National Drug Code (NDC) number to their product for all identification purposes. Number System 3 National Drug Code numbers are fully compatible with UPC symbology. All products governed by the National Drug Code have been assigned their own number system--Number System 3 (which precedes the NDC number)--to differentiate them from standard products that are identified by 12 digit UCC controlled numbers. A check character is added to the end of the NDC number.

There are three combinations of Number System 3 UPC/NDC compatible numbers:

		NDC Number			
(A)	3	OXXX	XXXX	XX	X
(B)	3	XXXXX	XXXX	X	X
(C)	3	XXXXX	XXX	XX	X
	UPC Number System Character (1 digit)	Labeler Identification Number (4–5 digits)	Product Identification Number (3–4 digits)	SKU or Trade Package Size (1–2 digits)	Check Character (1 digit)

- **UPC Number System Character** – The Number System 3 identifies products controlled by the FDA. The use of Number System 3 on over–the–counter drug items indicates that the manufacturer has been assigned their National Drug Code number as their UPC by the Uniform Code Council.

- **Labeler Identification Number** – This four or five digit number, assigned by the FDA, identifies the labeler––not necessarily the manufacturer––of the product. It is comparable to the manufacturer identification number in a standard UPC.

- **Product Identification Number** – This three or four digit number, assigned by the labeler, identifies individual products. It is comparable to the item identification number in a standard UPC.

- **SKU or Trade Package Size** – This one or two digit number identifies the trade package size.

- **Check Character** – This one digit number is synonymous with the Check Character in a standard UPC.

Companies with a four digit NDC Labeler Identification Number should use the 1–4–4–2–1 (A) configuration. Companies with a five–digit NDC Labeler Identification Number may select either the 1–5–4–1–1 (B) or 1–5–3–2–1 (C) configuration. Once selected, the labeler must retain the same configuration on all future products.

> For more information about Number System 3, refer to the UPC Guidelines Manual, Guideline #18.

What UPC-marking Options Are Available to Retailers?

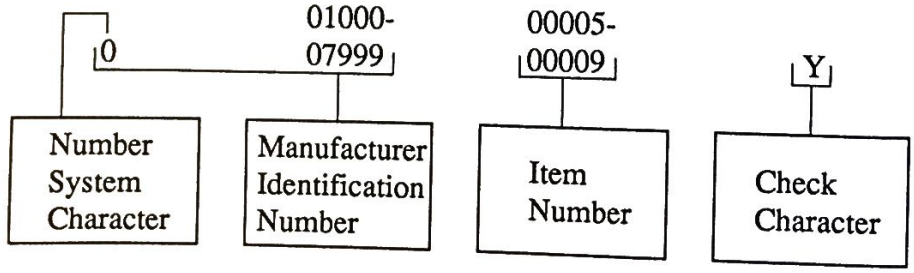
Retailers have three special UPC options.

- **Number System 4** – Products that are labeled by retailers. Retailers apply *Number System 4* UPCs to their own products-- primarily private label products. Since *Number System 4* UPCs are assigned by each individual retail chain, they cannot be scanned by any other retailer.

- **Local Assigned Code** – UPC number variation that retailers can use in-store to apply UPCs to products. The LAC number system may only be used in the store in which it is assigned. Products containing LAC symbols that were applied in one store cannot be sold in another store because each individual store assigns its own LAC numbers.

Local Assigned Code





LAC uses number system "0" and gives retailers 35,000 UPC numbers for in-store marking. The LAC uses 7,000 manufacturer identification numbers--01000 through 07999--and five item numbers--00005 through 00009. Any of the manufacturer identification numbers may be combined with any of the item numbers. These symbols may also be zero-suppressed.

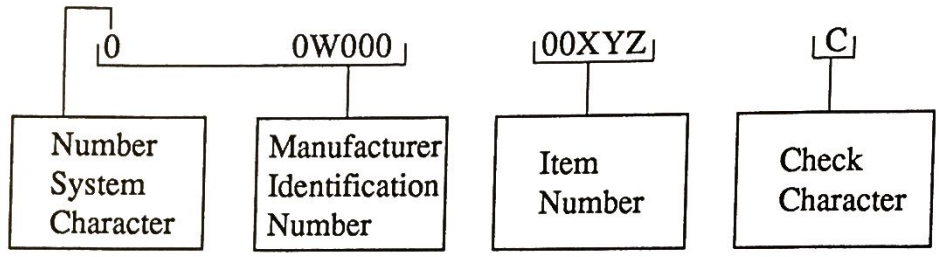
For more information about Local Assigned Codes, refer to the UPC Guidelines Manual, Guideline #23.

- **Retailer Zero Suppressed Code** – UPC variation that gives retailers additional zero suppression capability to mark private label products.

  In most cases, the UCC has given retailers a UPC manufacturer identification number which allows retailers to zero-suppress only five UPCs. Therefore, the RZSC was developed to give retailers the opportunity to apply zero-suppressed symbols to more of their products. The RZSC gives each retailer an additional 4,500 Number System "0" UPC numbers that they can zero-suppress.

Retailer Zero Suppressed Code*
(Version A)





Retailer Zero Suppressed Code*
(Version E)

O W X Y Z C

* • W is restricted to numbers 1 through 5
- X is restricted to numbers 1 through 9
- Y and Z can range from 0 through 9
- C is calculated the same as a standard UPC check character. (See Appendix B)

RZSC uses five manufacturer identification numbers (01000, 02000, 03000, 04000, 05000) combined with 900 item numbers (00100 through 00999) to form 4,500 new UPC product identification numbers. Retailers may zero suppress any of these UPC numbers.

For more information about Retailer Zero Suppressed Codes, refer to the UPC Guidelines Manual, Guideline #24.

What is the System for Coupons?

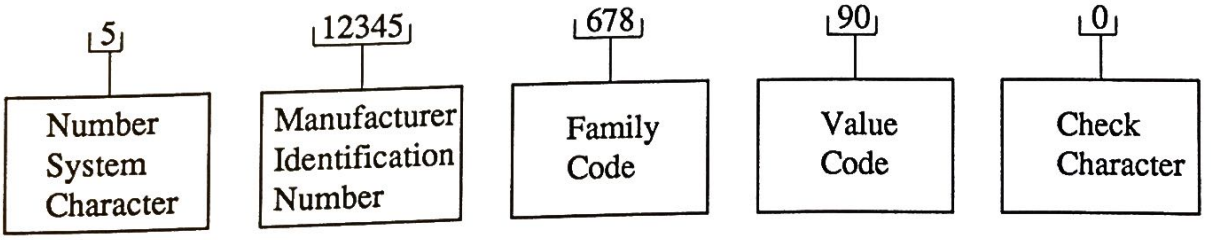
Number System 5 represents the UPC coupon code.

When a Number System 5 bar code is scanned, the POS computer subtracts the value of the coupon from the customer's final total.

The 12 digit UPC coupon code has five parts.

UPC Coupon Code





- **Number System Character** – A "5" in the Number System Character position identifies the bar code as a UPC coupon bar code.

- **Manufacturer Identification Numbers** – This is the five digit manufacturer identification number assigned by the UCC. The manufacturer identification number on a coupon must be the same as the manufacturer identification number on the product the coupon promotes. However, there is one exception--pharmaceutical products (Number System 3) with a four digit Labeler Code. Manufacturers of these items should add a lead "0" to their four digit labeler codes to form the five digit Number System "5" manufacturer identification number.

- **Family Code** – This three digit number designates an item or family of items for which the coupon is redeemable. The coupon family code, coupled with the manufacturer's UPC identification number, is the key to validating that the consumer has purchased the couponed product. In most cases, a POS scanner will validate the coupon only if the manufacturer identification number and the family code number from the coupon match the manufacturer number and family code number for the product that is on file in the retailer's POS system.

There are several very important options and rules for assigning three digit family codes. See UPC Coupon Code Guidelines Manual.

- **Value Code** – This two digit number designates the redemption value of the coupon. Since manufacturers offer coupons valuing more than 99 cents, the value code table contains some value codes that directly represent the coupon's face value (e.g., Value Code Number 10 represents a $ .10 coupon value) and some which do not (e.g., Value Code Number 83 represents a $2.25 coupon value).

> For a complete listing of all UPC Value Codes for coupons, refer to the UPC Coupon Code Guidelines Manual.

> For information about hard–to–handle coupons, refer to the FMI Complex and Hard–To–Handle Coupon Guidelines.

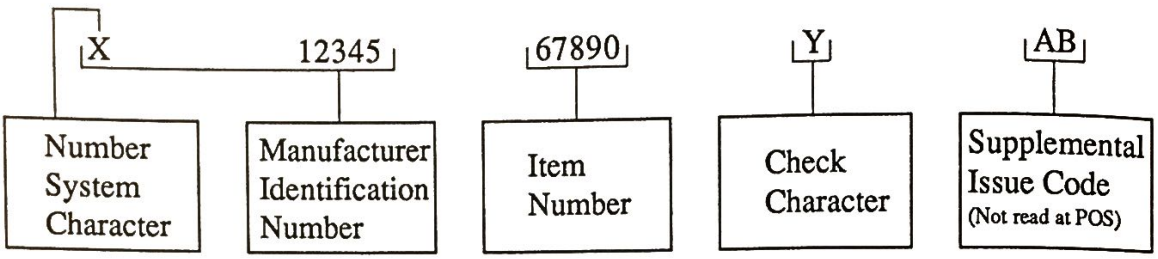
What About the UPCs on Books and Magazines?

UPCs for the publishing industry––periodicals and paperback books––look like standard UPCs. However, manufacturer identification numbers and item numbers in the publishing industry are often assigned in a different manner than similar–looking numbers for standard retail items.

Periodicals

Periodicals––including magazines, comics, and tabloid newspapers––use a 12 digit UPC with a supplemental two digit code indicating the particular issue of the periodical.

UPC for Periodicals



- **Number System Character** – Periodicals use the number system character assigned by UCC.

- **Manufacturer Identification Number** – This six digit number (including number system character) usually identifies the periodical's publisher. However, the publisher occasionally designates this six digit number to identify the periodical's distributor.

- **Item Number** – This five digit number typically identifies the title of the periodical, but not the week or month of its issue. Publishers often encode a five digit BIPAD title identification number in this field. The BIPAD number uniquely identifies each publication. It is the basis for distributing all periodicals in North America. The CPDA--Council for Periodical Distributors Association--administers the BIPAD number system.

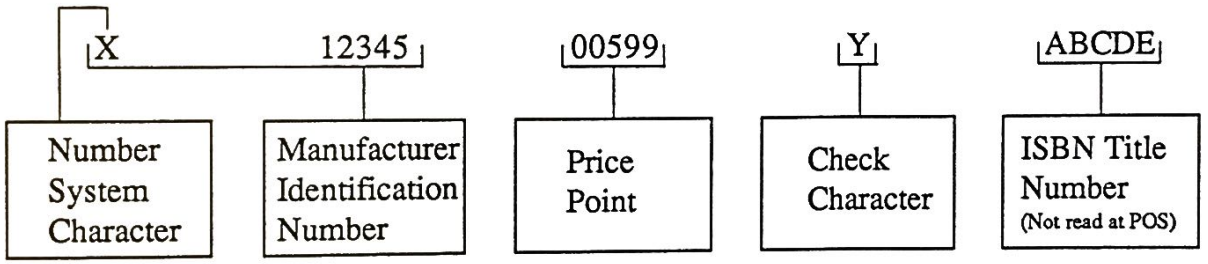
For more information about how to obtain a BIPAD number for a periodical, contact the CPDA at (212) 818-0234.

- **Check Character** – This one digit number verifies the accuracy of the 12 digit UPC. See Appendix B for an example of how to calculate the check character.

- **Supplemental Issue Code** – This two digit add–on code identifies the particular issue of a periodical. This is an optional code that appears beside the regular periodical UPC but is not recognized by the point–of–sale scanner. It is used for overall distribution and for processing returned periodicals.

Mass Market Paperbacks

Mass market paperback books use a 12 digit UPC with a supplemental five digit add–on that identifies the title of the book.



- **Number System Character** – Paperbacks use the number system character assigned by UCC.

- **Manufacturer Identification Number** – This six digit number (including number system character) usually identifies the publisher of a paperback. However, the publisher occasionally uses this number to identify the distributor of the paperbacks.

- **Price Point or Price Category**– The UCC suggests that publishers use the five digit item number to indicate the suggested retail price category of the mass market paperback. Thus, all books with a preprinted, suggested retail price of $5.99 may be represented by an item code of 00599. This item code could also be some other five digit number as long as it remains constant for the same suggested price categories.

- **Check Character** – This one digit number verifies the accuracy of the 12 digit UPC. See Appendix B for an example of how to calculate the check character.

- **ISBN Title Number** – This five digit number is a supplemental add–on to the regular 12 digit UPC paperback code. It is the title portion of the ISBN––International Standard Book Number––that is used throughout the book distribution system, and identifies the title of the book. This add–on is not recognized by point–of–sale scanners. It is used to facilitate ordering, distribution, and inventory practices. The entire 13 digit EAN Bookland ISBN bar code is printed on the inside front cover.

Hard Cover Books and Trade Paperbacks

The book industry has endorsed a coding system for books (particularly those sold through bookstores) which uses a coding structure entirely based on the ISBN. This system is known as "Bookland EAN." However, not all North American scanning systems can read the required EAN (European Article Number) bar code which is an expanded version of a UPC. To accommodate systems that cannot read EAN, some publishers use a 12 digit UPC to identify the book.

> For more information about ISBN, and Bookland EAN contact the ISBN Agency at (908) 464–6800 or the Book Industry Systems Advisory Committee (BISAC) at (212) 929–1393

What About Industrial and Commercial Applications of the UPC?

UPC is also used for non–retail––industrial and commercial––products.

Use of the UPC in non–retail applications has grown at a much slower rate than retail use of the Universal Product Code due to the great variety of industrial products and the complexity of their distribution and sales methods. However, the need to improve productivity in the industrial sector is driving more wide–spread use of UPCs.

The Uniform Code Council has published a new manual in response to the growing interest of manufacturers, distributors, wholesalers, dealers, and end users of industrial and commercial products who want to apply the Universal Product Code to the industrial arena. The Universal Product Code Industrial and Commercial Guidelines Manual provides a broad overview of how to implement UPCs for industrial and commercial products. While the manual is targeted at non–retail channels, it is intended to be compatible with all retail UPC requirements, thereby ensuring maximum future distribution flexibility for industrial and commercial products.

Additionally, in 1991 the Uniform Code Council formed the Industrial/Commercial Advisory Committee (ICAC) to support standards development and implementation in the non–retail sector.

> For more information about industrial and commercial applications of the UPC, refer to the Universal Product Code Industrial and Commercial Guidelines Manual.

What is the International Article Numbering System (EAN)?

UPC is a global system that can be read worldwide. The "U" in UPC stands for "Universal." Although the UPC and EAN bar codes contain the same number of bars and spaces, EAN is a 13 digit number which is a superset of the 12 digit UPC number. Numbering authorities in countries other than the United States and Canada issue EAN numbers. There is a limited, but growing, ability to read EAN in the United States.

The EAN has four main components.

EAN Bar Code



- **EAN Prefix** – This two or three digit number identifies the national numbering organization. The current list is available from the EAN in Brussels.

- **Manufacturer Identification Number** – After the EAN prefix, the next nine numbers are used to identify the product. It is up to each country's numbering organization to determine how to use these numbers. These organizations typically assign a unique four or five digit manufacturer identification number to each member company. This number is comparable to the UPC manufacturer identification number.

- **Item Number** – Product manufacturers use the next four or five digits––the item number––to identify the product. This number is the same as the five digit UPC item number.

- **Check Character** – This one digit number is used to verify that the entire EAN has been read or entered correctly. It serves the same purpose as the UPC check character.

The UCC recommends that retailers develop POS file structures to accommodate 13 digit UPC and EAN numbers. In this case, the twelve digit UPC number would contain a lead "0" inserted before the number system character.

For more information refer to General Specification For the Article Marking, Part 2, EAN Symbol Specifications, available from:

International Article Number Association (EAN)
Rue Royale 29
B–1000
Brussels, Belgium
Tel: 32–2–218–76–74

Chapter V: "The Code For Shipping Containers"

The first four chapters of this book focus on UPCs for consumer products. However, bar codes are also found on the outside of the shipping container. This chapter talks about these important shipping container bar codes and answers four important questions:

- What are the benefits of using shipping container codes?
- What is the code for fixed content shipping containers?
- What is the code for serialized shipping containers?
- What is a UCC/EAN–128 Application Identifier?

What are the Benefits of Using Shipping Container Codes?

Once a manufacturer has assigned UPCs to items, the next logical step is to assign shipping container symbols (SCSs) to shipping containers. A shipping container code gives each case, intermediate package, or standard pallet its own unique identity. All manufacturers and retailers can benefit from using SCSs.

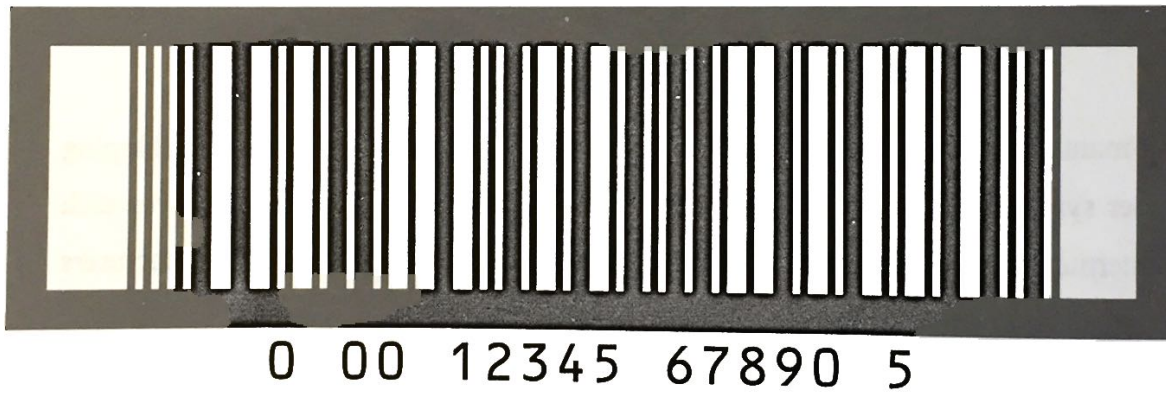
- **Benefits to Manufacturers** – Manufacturers can use SCSs to track production output and shipments. Shipping container codes are an important element of an overall quick response program.

- **Benefits to Retailers** – Shipping container codes complete the retail information loop that is started by UPCs. While UPCs track products moving out of the store, shipping container codes track products moving into the store. SCS coding is the important basis for automated inventory control and re-ordering systems.

What is the Code for Fixed Content Shipping Containers?

Interleaved 2 of 5 is the symbology used to encode the 14 digit shipping container code for fixed content shipping cases.

Interleaved 2 of 5 Symbol and Shipping Container Code



- **Packaging Indicator** – This one digit number indicates whether the UPC item number on products inside the shipping container is the same as the SCS item number on the outside of the case. For example, the packaging indicator "0" indicates that the UPC item numbers on the products inside the case are different from the SCS item number on the outside of the case. Packaging indicators "1" through "7" indicate that the UPC item numbers are identical to the SCS item number. A packaging indicator "9" signifies a variable content case and "8" is reserved for future use.

- **Manufacturer Identification Number** – This seven digit field represents the six digit UPC manufacturer identification number preceded by a lead "0."

- **Item Number** – This is a five digit number assigned and controlled by the manufacturer. This number identifies the contents of the shipping container. This number may be identical to the UPC item number on the product inside the case, or it may be different as determined by the manufacturer.

- **Check Character** – This one digit number verifies the accuracy of the entire SCS number.

A unique combination of packaging indicator and item number must be used to indicate a unique quantity contained or level of packaging.

Manufacturers must ensure that SCSs are placed in the proper location on cases, pallets, etc. Applying the SCS in the proper location optimizes scannability and minimizes damage to the SCS while the shipping container is in transit. The Interleaved 2 of 5 SCS should be placed on the lower portion of all four vertical sides of a container sitting on its natural bottom. Where space does not permit an SCS on all four vertical panels, placing the bar code on the two long vertical panels is acceptable. A single SCS is acceptable when the SCS is applied by an on–line or on–demand printing process such as label application or ink jet printer.

For more about "Interleaved 2 of 5," see:

- UPC Shipping Container Code and Symbol Specification Manual
- UCC Video "UPC Product Code/Shipping Container Code and Symbols"

What is the Code for Serialized Shipping Containers?

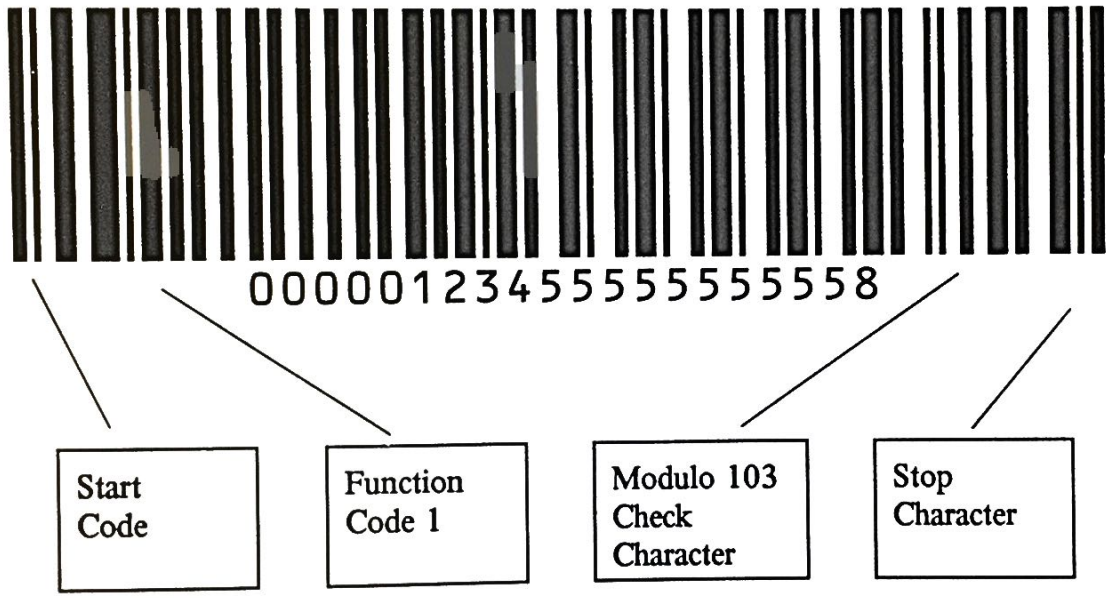
UCC/EAN–128 is the shipping container code for serial numbered shipping containers.

Today, some suppliers offer "pick and pack" merchandise as specified by customers, as an alternative to shipping product in standard quantity containers. This "variable pack" method of supplying retail customers is most common in the apparel and textile industries. With the advent of quick response and automatic re–ordering for replenishing store inventories, more individual shipping containers are likely to contain a mix of products in odd quantities.

Each variable shipping container holds a unique non–standard product mix identified by a unique number. This differs from traditional shipping cases that contain a fixed amount of identical products. The UCC/EAN–128 coding structure in the UCC/EAN–Code 128 symbology is used to identify the contents of each unique shipping container.

Within the UCC/EAN–128 bar code there are two different types of characters––symbol characters and data characters. The four symbol characters are used to facilitate scanning and do not appear in human readable form. There are also 20 data characters in a UCC/EAN–128 bar code which do appear in human readable form.

UCC/EAN–128 Bar Code



- **Start Code and Function Code 1** – The first two symbol characters tell the scanner that a UCC/EAN–128 code follows. The scanner transmits a unique symbology identifier to identify the UCC/EAN–128 symbology.

- **Modulo 103 Check Character** – This character verifies that the entire bar code was scanned properly. The scanner does not transmit the modulo 103 check character to the POS system.

- **Stop Character** – This character tells the scanner that it has reached the end of the UCC/EAN–128 bar code. The scanner does not transmit the stop character to the POS system.

UCC/EAN–128 Serial Shipping Container Code Number



Data Characters

- **Application Identifier** – This two digit number identifies the bar code as a UCC/EAN–128 shipping container bar code and distinguishes it from other UCC and EAN administered codes.

- **Packaging Type** – This one digit number indicates the type of shipping container––carton, pallet, etc.

- **Manufacturer Identification Number** – This seven digit number represents the six digit UPC manufacturer identification number preceded by a lead "0." This structure is fully compatible with EAN assigned manufacturer identification numbers.

- **Case Serial Number** – This nine digit number is assigned by the manufacturer and uniquely identifies the contents of each shipping container. It is normally used in conjunction with an Electronic Data Interchange Ship Notice Manifest (ASC X12 856).

- **Modulo 10 Check Character** – This one digit number verifies the accuracy of the previous 19 UCC/EAN–128 numbers. It protects against errors when the numbers are manually entered.

For more information about calculating the Modulo 10 Check Character, see: Application Specification for the UCC/EAN–128 Serial Shipping Container Code.

Manufacturers must ensure that UCC/EAN–128 bar codes are placed in the proper location on shipping cartons, pallets, etc. Applying the bar code to the proper location optimizes scannability and minimizes damage to the bar code while the shipping containers is in transit. In general, the UCC/EAN–128 bar code should be placed on the lower portion of at least one of the side panels of a carton when the carton is sitting on its natural bottom.

For more about the UCC/EAN–128 Serialized Shipping Container Code, see:

- Application Specification for the UCC/EAN–128 Serial Shipping Container Code

- UCC Video: "UCC–128 Serial Shipping Container Code and Symbol"

What is a UCC/EAN–128 Application Identifier?

A UCC/EAN–128 application identifier is a two, three, or four digit numeric prefix that tells the scanning system the meaning and format of the UCC/EAN–128 data that follows.

The previous section described UCC/EAN–128 as the code giving each carton or pallet a unique serial number identifying the contents of the container. This particular container identification application is distinguished by using the "00" application identifier. However, this is only one of many applications for UCC/EAN–128.

UCC/EAN–128 can provide a wide variety of additional information by using other application identifiers. In the same way as the "00" application identifier tells the scanning system that the data to follow in the bar code identifies the case serial number, other application identifiers tell the system that other types of information are coming.

For example, perishable suppliers and distributors often show dates on shipping containers, e.g., packaging dates, expiration dates, sell by dates, etc. The correct application identifier would tell the scanning system that the next characters to follow signify a particular date, e.g., packaging date, expiration date, or sell by date.

In fact, manufacturers can use more than one application identifier at a time in a single bar code; they can simply add them onto each other. For example, a manufacturer could start with a standard UCC/EAN–128 bar code identifying the contents of the shipping container. Then, a two digit application identifier ("11") could be added indicating that the next digits reveal the container's packaging date. After the packaging date, the manufacturer could add a second application identifier ("320") indicating that the next digits reveal the net weight of the container.

Appendix B contains a list of all Application Identifiers.

For more information about UCC/EAN designated application identifiers contact:

Uniform Code Council, Inc.
8163 Old Yankee Road, Suite J
Dayton, OH 45458
(513) 435–3870

International Article Number Association (EAN)
Rue Royale 29
B–1000
Brussels, Belgium
Tel: 32–2–218–76–74

APPENDIX A

Glossary of Commonly Used Terms

Appendix A
Glossary of Commonly Used Terms

AIM – Automatic Identification Manufacturers. A trade association representing manufacturers of automatic data collection equipment.

Alphanumeric – A character set that contains letters, numbers, and other characters.

ANSI – The American National Standards Institute. A non–governmental organization that manages the formation of voluntary industry standards.

Aperture – The opening in an optical system that establishes the field of view.

Application Specification – A set of rules for using bar codes.

Auto Discrimination – The ability of a scanner to automatically decode different types of bar codes without the operator manually indicating the type of bar code.

Background – The lighter portion of a bar code, including the quiet zone and the spaces between the bars.

Bar – The darker portion or line of a bar code.

Bar Code – A precise arrangement of parallel lines (bars) and spaces both of varying widths. The bar code represents data elements and can be read by a scanner.

Bar Code Character – A group of bars and spaces that represent a letter, number, or other information. A bar code character is one part of a full bar code.

Bar Code Density – The number of characters that can be represented in a linear inch.

Bar Height – The dimension of a bar (line) measured from its top to its bottom.

Bar Width – The thickness of a bar (line) measured from one of its edges to the other.

Bar–Width Reduction (BWR) – Reducing the bar–width on a film master to compensate for ink spread during some printing processes.

Bearer Bar – Bars that are located on the perimeter of some bar codes. These bars do not carry any information. They reduce the probability of a misread when a skewed scanning beam enters or leaves the bar code through the top or bottom edge. They also allow for printing plate support when printing directly on corrugated packaging material.

Character – (See Bar Code Character)

Check Character – A character in a bar code used to mathematically verify the accuracy of the decoded data.

Concatenation – Process of linking two or more bar codes into one long bar code.

Decode – Determining the information encoded in a bar code.

Decoder – The part of the scanning system equipment that interprets the bar code.

Defect – A spot or void in the bar code that adversely affects quality.

EAN – International Article Number system. A standard retail bar code primarily used outside the U.S. and Canada.

EDI – Electronic Data Interchange. The electronic exchange of business data by computer.

Element – A single bar or space in a bar code.

Encode – Converting a number, letter, or special character into a bar code.

FMI – Food Marketing Institute. A trade association representing food retailers and wholesalers around the world.

Film Master – An extremely accurate photographic representation of a bar code used to make printing plates.

First Pass Read Rate – The number of successful scans compared to the number of scan attempts. Usually expressed as a percent.

Font – A specific size and style of printed characters.

GMA – Grocery Manufacturers of America. A trade association representing manufacturers of consumer products.

Horizontal Bar Code – A bar code presented so that the bars and spaces look like a picket fence.

Ink Spread – The result when a printing plate pushes too hard on the printing surface, causing the printed bars to be thicker than they are on the plate. Printing plates must be designed to anticipate ink spread. Ink spread may also occur in printing processes that do not use printing plates when ink contacts a porous substrate.

Interleaved Bar Code – A bar code in which bars represent some characters and spaces represent other characters. For example, under Interleaved 2 of 5, characters in odd positions are represented by bars, and characters in even positions are represented by spaces.

International Article Number Association – The organization that governs the EAN (formerly European Article Number) code structure and symbology.

Item Number – A number within the bar code identifying the particular item or unit.

Labeler Identification Number – This four or five digit number, assigned by the Food and Drug Administration, is part of the UPC for pharmaceutical products. It identifies the labeler––not necessarily the manufacturer of the product. It is synonymous with the manufacturer identification number in a standard UPC.

Laser Scanner – A bar code reading device using low energy laser light to read the bar code.

Light Pen – A hand–held scanning wand used to read a bar code by moving the pen across the bar code.

Magnification – The amount that a bar code is changed from nominal (100%) size. A bar code may be printed larger or smaller than the nominal size within specified limits.

Manufacturer Identification Number – Portion of a UPC number that identifies the product manufacturer. The Uniform Code Council assigns a unique six digit manufacturer identification number to each of its members.

Nominal – The intended value for a particular measurement. When used for bar codes, nominal represents 100% magnification. Bar codes may be larger or smaller than nominal, within specified limits.

Number System Character – A one digit prefix to a UPC manufacturer identification number.

Opacity – The property of a substrate that minimizes show–through from behind.

Orientation – The alignment of a bar code's scan path. The bar code may be horizontal (picket fence) or vertical (ladder).

POS – Point–of–sale. Usually refers to scanning equipment and terminals in a retail store.

Quiet Zone – An area to the left and right of a bar code that is free of all printing or graphics.

Reflectance – The amount of light reflected from a surface compared to the amount of light naturally appearing on that surface. Usually expressed as a ratio.

Scanner – A device that bounces light (usually a laser beam) off of a bar code and measures the reflectance.

SCS – The 14 digit Interleaved 2 of 5 shipping container symbol.

Self-checking Bar Code – A bar code that verifies its own accuracy by using a special math formula.

Serial Number – The 9 digit field of a UCC/EAN-128 shipping container code that is used to reference the contents of a shipping container.

Show-through – The visibility of the package contents or some other material through the spaces of a bar code. Show-through can seriously affect reflectance.

SKU – Stockkeeping unit.

Space – The lighter element of a bar code, usually the background between printed bars.

Spot – Excess ink or specks that appear in the spaces of a bar code.

STAC – Symbol Technical Advisory Committee. A Uniform Code Council standing committee.

Start/Stop Characters – Special bar code characters that tell the scanner to start or stop reading a bar code. The start character is typically found on the left side of a bar code and the stop character is typically found on the right side of a bar code.

Substrate – The material on which a bar code is printed.

Symbol – See Bar Code.

Symbol Location – The site where a bar code is placed on a product, package, or shipping container.

Symbology – Machine–readable languages using bar/space patterns to encode data.

Tolerance – Allowable deviations from the standard value.

Truncation – Decreasing the height of a bar code without decreasing the width.

UCC – Uniform Code Council. The not–for–profit administrative and educational organization that:

- Works with U.S. and Canadian industry to develop and administer product identification and electronic data interchange (EDI) standards.
- Issues a UPC manufacturer identification number to the owner/controller of a product label, i.e., manufacturer, retailer, wholesaler, jobber, etc.
- Publishes all UPC technical specifications and guidelines.
- Educates the business community about the Universal Product Code.

UCC Information Interchange – A service provided by the UCC that facilitates communication of UPC quality problems between retailers and manufacturers.

UPC – Universal Product Code. The 12 digit bar code and number representing consumer products in retail and non–retail applications.

UPC Coordinator – An individual within a manufacturer, wholesaler, or retailer

organization who is responsible for the successful implementation and use of the Universal Product Code.

UPC Symbol – The machine–readable bar code representation of the Universal Product Code.

Verifier – A device that tests the accuracy of a bar code to determine if the bar code meets specifications.

Void – A poorly inked area within a bar (line) of a bar code.

Wand – A hand–held bar code reading device.

"X" Dimension – The width of the narrowest element (bar or space) of a bar code.

APPENDIX B

- How To Calculate the Check Character
- How To Form Zero-suppressed Numbers
- How To Order a Film Master
- How To Determine a Random Weight Item ID Number
- How To Determine an Application Identifier
- Dimensions of Various Size UPC Version A Bar Codes

How to Calculate the Check Character

The check character for each UPC is calculated using a five–step algorithm based on the UPC's first eleven digits. For a sample UPC––0 12345 67890––the check character is calculated as follows.

- ***Step 1*** Starting at the left, add all characters in the odd positions, (first from the left, third from the left, etc.) starting with the number system character. In the example: 0+2+4+6+8+0 = 20.

- ***Step 2*** Multiply the sum obtained in Step 1 by 3. In the example: 20x3 = 60.

- ***Step 3*** Starting from the left, sum all the characters in the even positions (second from the left, fourth from the left, etc.). In the example: 1+3+5+7+9 = 25.

- ***Step 4*** Add the product of Step 2 to the sum of Step 3. In the example: 60 + 25 = 85.

- ***Step 5*** The check character is the smallest number which, when added to the sum of Step 4, produces a multiple of 10. Therefore, the check character of the sample UPC is 5. (85+5 = 90, a multiple of 10).

How to Form Zero-suppressed Numbers

The six explicit characters in a Version E UPC are derived from the Version A UPC as follows: *(Note: Zero-suppression may be accomplished in number system "0" only.)*

- **If a manufacturer's number ends in 000 or 100 or 200,** he has available to him 1,000 item numbers between 00000 and 00999. The six characters are obtained from the first two characters (after the lead "0") of the manufacturer's number followed by the last three characters of the item number, followed by the third character of the manufacturer's number.

- **If a manufacturer's number ends in 300, 400, 500, 600, 700, 800, or 900,** he has available to him 100 item numbers between 00000 and 00099. The six characters are obtained from the first three characters (after the lead "0") of the manufacturer's number followed by the last two characters of the item number, followed by "3."

- **If a manufacturer's number ends in 10, 20, 30, 40, 50, 60, 70, 80, or 90,** he has available to him 10 item numbers between 00000 and 00009. The six characters are obtained from the first four characters (after the lead "0") of the manufacturer's number followed by the last character of the item number, followed by "4."

- **If a manufacturer's number does not end in zero,** then five item numbers between 00005 and 00009 are available. The six characters are obtained from all five characters of the manufacturer identification number (after the lead "0") followed by the last character of the item number.

How to Order a Film Master

A film master is an extremely accurate photographic representation of a bar code and is used by a printer to make a printing plate. The printing plate is used to print the bar code on a package. Therefore, a high–quality film master is essential to producing a high–quality bar code. All manufacturers are strongly encouraged to order film masters from reputable film master suppliers capable of adjusting the film for the intended printing process. Regardless of the source, you must ensure that the film master is the highest possible quality and meets all UCC specifications.

The following eight points cover the minimum amount of information that a film master supplier would require to fill a film master order.

1. **General information about the company ordering the film master.**

   - Company name
   - Contact name and phone number
   - Purchase Order number

2. **Shipping instructions** – How the film master should be shipped to the manufacturer. Possible options include.

   - Overnight delivery
   - Two–day air delivery
   - First Class mail

3. **Type of bar code required,** – i.e. UPC, EAN, Interleaved 2 of 5, UCC/EAN–128.

4. **Film Type** – Artists use black and white film to mount on artboards. Printers require negative or positive film to make a printing plate. The artist or printer should determine which type of film master is needed based upon printing and platemaking methods. They should also indicate whether the film master should read emulsion up or down. For example:

   - Opaque positive camera–ready black and white artwork
   - Negative right reading emulsion up or down
   - Positive right reading emulsion up or down

5. **Size of symbol/magnification**

6. **Bar–width reduction (BWR)** – When ink is printed on a surface, it spreads. A film master supplier can create a master with bars made smaller to compensate for ink spread.

7. **Characters or numbers to be encoded into the bar/space pattern**, i.e.,

   - UPC Version A – 12 digits
   - UPC Version E – 6 digits explicitly encoded, 2 digits implied (number system character "0" and check digit)
   - EAN – 13 digits
   - Interleaved 2 of 5 Shipping Container Symbol – 14 digits

8. **Descriptive information the manufacturer wants printed on the film master and invoice to determine which film master goes to which product.**

How To Determine a Random Weight Item ID Number

Random Weight Category	Item ID Number Range	Number of Possible Item IDs	Trade Association
Turkey	0000–0575	576	National Turkey Federation (703) 435–7206
Poultry	8900–8999 0576–0999	524	National Broiler Council (202) 296–2622
Beef	1000–2699	1,700	National Livestock & Meat Board (312) 467–5520
Veal	2700–2969	270	National Livestock & Meat Board (312) 467–5520
Lamb	2970–3169	200	National Livestock & Meat Board (312) 467–5520
Pork	3170–3999	830	National Livestock & Meat Board (312) 467–5520
Produce	4011–4959	949	Produce Electronic Identification Board (302) 738–7100
Photo	4960–4999	40	Photo Marketing Association Int'l. (517) 788–8100
Cheese	5000–5550	551	International Dairy–Deli Association (608) 238–7908
Bakery	5551–5569 7600–7999 9676–9999	743	International Dairy–Deli Association (608) 238–7908
Dairy–Deli	5570–7599	2,030	International Dairy–Deli Association (608) 238–7908
Seafood	8000–8899 9000–9675	1,576	National Fisheries Institute (202) 296–5090
UCC Reserve	4000–4010	11	Uniform Code Council (513) 435–3870

How to Determine an Application Identifier

AI	Content	Format
00	Serial Shipping Container Code	n2+n18
01	Shipping Container Code	n2+n14
10	Batch Number	n2+an..20
11 (*)	Production Date (YYMMDD)	n2+n6
13 (*)	Packaging Date (YYMMDD)	n2+n6
15 (*)	Best Before/Sell By Date (Quality Related) (YYMMDD)	n2+n6
17 (*)	Use By/ExpirationDate (Safety Related) (YYMMDD)	n2+n6
20	Product Variant	n2+n2
21	Serial Number	n2+an..20
22	HIBCC – Quality, Date, Batch and Link	n2+an..29
23 (**)	Lot Number (Transitional Use)	n3+n..19
30	Quantity Each	n2+n..8
310 (***)	Net Weight, Kilograms	n4+n6
311 (***)	Length or 1st Dimension, Meters	n4+n6
312 (***)	Width, Diameter or 2nd Dimension, Meters	n4+n6
313 (***)	Depth, Thickness, Height or 3rd Dimension, Meters	n4+n6
314 (***)	Area, Square Meters	n4+n6
315 (***)	Volume, Liters	n4+n6
316 (***)	Volume, Cubic Meters	n4+n6
320 (***)	Net Weight, Pounds	n4+n6
400	Customer's Purchase Order Number	n3+an..30
410	Ship To (Deliver To) Location Code Using EAN–13 or DUNS (Dun & Bradstreet) Number with Leading Zeros	n3+n13
411	Bill To (Invoice To) Location Code Using EAN–13 or DUNS (Dun & Bradstreet) Number with Leading Zeros	n3+n13
412	Purchase From (Location Code of the Party from Whom the Goods are Purchased)	n3+n13
420	Ship To (Deliver To) Postal Code Within a Single Postal Authority	n3+an..9
421	Ship To (Deliver To) Postal Code With 3–Digit ISO Country Code Prefix	n3+n3+an..9
8001	Roll Products – Width, Length, Core Diameter, Direction and Splices	n4+n14
8002	Electronic Serial Number For Cellular Telephones	n4 + an..20
90	Internal Applications	n2+an..30
91	Internal – Raw Material, Packaging, Components	n2+an..30
92	Internal – Raw Material, Packaging, Components	n2+an..30
93	Internal – Product Manufacturers	n2+an..30
94	Internal – Product Manufacturers	n2+an..30
95	Internal – Carriers (Waybill, PRO Number, etc.)	n2+an..30
96	Internal – Carriers	n2+an..30
97	Internal – Wholesalers & Retailers	n2+an..30
98	Internal – Wholesalers & Retailers	n2+an..30
99	Mutually Defined Text	n2+an..30

(*) To indicate only year and month, DD can be filled with "00"
(**) Plus one digit for length indication
(***) Plus one digit for decimal point indication

Note: Additional AI's may be added to list. Contact UCC.

Data Value Representation:

a	alphabetic characters
n	numeric characters
an	alpha–numeric characters
a3	3 alphabetic characters, fixed length
n3	3 numeric characters, fixed length
an3	3 alpha–numeric characters, fixed length
a..3	up to 3 alphabetic characters
n..3	up to 3 numeric characters

Dimensions of Various Size UPC Version A Bar Codes

Magnification Factor		Dimensions Determined by Corner Marks	
		Height	Width
0.80		0.816"	1.175"
0.85		0.867"	1.249"
0.90		0.918"	1.322"
0.95		0.969"	1.395"
1.00	NOMINAL SIZE	1.020"	1.469"
1.05		1.071"	1.542"
1.10		1.122"	1.616"
1.15		1.173"	1.689"
1.20		1.224"	1.763"
1.25		1.275"	1.836"
1.30		1.326"	1.910"
1.35		1.377"	1.983"
1.40		1.428"	2.057"
1.45		1.479"	2.130"
1.50		1.530"	2.204"
1.55		1.581"	2.277"
1.60		1.632"	2.350"
1.70		1.734"	2.497"
1.80		1.836"	2.644"
1.90		1.938"	2.791"
2.00		2.040"	2.938"

REPRESENTATIVE VARIATIONS IN FILM MASTER SIZE



M = .80



M = 1.00



M = 1.50



M = 2.00

APPENDIX C

UPC Quality Checklist

- Introduction to UPC
- Visual Inspection
- Measurement Information

UPC QUALITY CHECKLIST

INTRODUCTION TO UPC

UPC CONSUMER PRODUCT CODE	REFER TO:
• Characteristics and Content	UPC Symbol Specification Manual Sections 1.0 – 4.0
• Definition of Terms	UPC Film Master Verification Manual Section 2.1
• Encodation	UPC Film Master Verification Manual Section 3.4
UPC PRINTING CHARACTERISTICS	
• Source Printing	UPC Symbol Specification Manual Sections 4.0 – 4.3
• Symbol Size	UPC Symbol Specification Manual Drawings 2 – 5
• Dimensional Tolerances English Metric	UPC Symbol Specification Manual Chart: Section 4.2 Appendix C
• In–Store Printing	UPC Symbol Specification Manual Appendix A
• Size Illustrations	UPC Film Master Verification Manual Section 3.6
NUMBERING SYSTEM	UPC Guidelines Manual UPC Coupon Code Guidelines Manual
SYMBOL LOCATION	UPC Symbol Location Guidelines Manual UPC Marking Guidelines for General Merchandise UPC Coupon Code Guidelines Manual

UPC QUALITY CHECKLIST

VISUAL INSPECTION

SYMBOL/HUMAN READABLE MATCH	REFER TO:
• Characteristics & Content	UPC Symbol Specification Manual Sections 1.0 – 4.0
• Encodation	UPC Film Master Verification Manual Section 3.4
• Number System & Check Character Location	UPC Symbol Location Guidelines Manual Guideline # 5
NUMBERING SYSTEM VALIDITY	UPC Guidelines Manual UPC Coupon Guidelines Manual
CLEAR AREAS (MARGINS)	
• Illustrations	UPC Symbol Location Guidelines Manual Guideline #5
• Dimensions (English)	UPC Symbol Specification Manual Chart: Section 4.2
SYMBOL LOCATION	UPC Symbol Location Guidelines Manual UPC Marking Guidelines For General Merchandise UPC Coupon Code Guidelines Manual

UPC QUALITY CHECKLIST

VISUAL INSPECTION (CONTINUED)

	REFER TO:
TRUNCATION	
• UCC Position	UPC Symbol Specification Manual Appendix F Appendix G
• Methods of Reducing Symbol Area	UPC Symbol Location Guidelines Manual Guideline #3
MAGNIFICATION	
• Definition	UPC Film Master Verification Manual Section 2.1
• English Dimensions	UPC Symbol Specification Manual Chart: Section 4.2

UPC QUALITY CHECKLIST

MEASUREMENT INFORMATION

	REFER TO:
SYMBOL CONTRAST	
• UPC Optical Characteristics	UPC Symbol Specification Manual Sections 5.0 5.11
• Optical Specifications	UPC Symbol Specification Manual Figure 6 Table 5
MINIMUM REFLECTANCE	
• Optical Specification	UPC Symbol Specification Manual Figure 6 Table 5
EDGE DETERMINATION	
• Physical Specifications	
– Lithography, Gravure, Letterpress	UPC Symbol Specification Manual Table 1 – 2
– Flexography	UPC Symbol Specification Manual Table 3 –4
– Alternate Methods •• English •• Metric	UPC Symbol Specification Manual Chart: Section 4.2 Appendix C
• Optical Specifications	UPC Symbol Specification Manual Figure 6 Table 5

UPC QUALITY CHECKLIST

MEASUREMENT INFORMATION (CONTINUED)

DEFECTS	REFER TO:
• Physical Specifications	UPC Symbol Specification Manual Sections 5.6 – 5.11
DECODE (MANUAL)	
• Characteristics and Content	UPC Symbol Specification Manual Sections 1.0 – 4.0
• Encodation UPC	Film Master Verification Manual Section 3.4
• Encodation Charts	UPC Symbol Specification Manual Drawings 6 – 7

UPC QUALITY CHECKLIST

Quality Factors	Measurement Methods	
	Visual	Instruments
Symbol/Human Readable Match	X	
Numbering System Validity	X	
Clear Areas (Margins)	X	X
Symbol Location	X	
Truncation	X	X
Magnification in Spec	X	X
Symbol Contrast		X
Minimum Reflectance		X
Defects		X
Edge Determination		X
Minimum Edge Contrast		X
Decode (Manual)	X	X

BIBLIOGRAPHY

Allais, David C., "Bar Code Print Quality: Superstition or Science?," Data Capture Case Studies and Technology, Data Capture Press, Duxbury, MA, 1991.

American Association of Nurserymen, Nursery Growers Guide to UPC Bar Code Labeling, A.A.N., Washington, DC.

American Hardware Manufacturers Association, Hardlines Industry Guideline on Bar Coding,. AHMA, Schaumburg, IL, 1991.

Bar Code Systems, Inc., A Guide to Bar Coding, Bar Code Systems, Inc., Atlanta, GA, 1988.

Bureau of Engraving, Inc., Bar Code Technical Reference Guide, Bureau of Engraving, Inc., Minneapolis, MN.

Collins, David Jarrett and Nancy Nasuti Whipple, Using Bar Code: Why It's Taking Over, Data Capture Institute, Duxbury, MA, 1990.

Council for Periodical Distributors Association, Magazine & Paperback Title & Issue Coding, CPDA, New York, NY, August, 1985.

De Santa, Richard, "UPC Council to Set Up Trouble Shooting Service," Supermarket News, March 17, 1980, page 1.

Diagraph Corporation, Implementing the UPC Shipping Container Symbol, Diagraph Corporation, St. Louis, MO.

Erdei, Guillermo E., Codigo De Barras, McGraw Hill, Mexico, 1991.

Food Marketing Institute, Complex and Hard-To-Handle Coupon Guidelines, Food Marketing Institute, Washington, D.C., 1989.

Harmon, Craig K. and Russ Adams, Reading Between The Lines, Helmers Publishing, Inc., Peterborough, NH.

I.D. Systems Magazine, I.D. Systems Buyer's Guide, Helmers Publishing, Inc., Peterborough, NH.

Klick, Dick (Symbology, Inc.), "Conventional Printing of UPC Bar Codes," *Handout at 1991 UPC User Conference*, Chicago, IL, September, 1991.

Merrick, Dennis, "Printing Scannable Bar Codes," Printers News, September, 1988, pp 6–8.

National Retail Federation, NRF Standard Color & Size Code Handbook, NRF, New York, NY.

Smith, Brian H., "Bar Coding: An Overview," Australasian Printer, June, 1987, pp 22–25.

Stamper, Bonney, "No Verification? That's too high a risk to take," Automatic I.D. News, October, 1989, page 33.

Symbology, Inc., The Bar Code Bulletin, Symbology, Inc., Minneapolis, MN, 1991.

Thissen, Carlene, A., Scan Data: Collecting and Maintaining Quality Information, Food Marketing Institute, Washington DC, 1990.

Weiland, Norman R., "On–Demand Printing of UCC Bar Codes", *Speech at 1991 User Conference*, Chicago, IL, September, 1991.

Uniform Code Council Publications

Uniform Code Council, Inc., Application Specification for the UCC–128 Serial Shipping Container Code: (With Symbol and Shipping Label Guidelines, UCC, Inc., Dayton, OH, December, 1991.

UPC Coupon Code Guidelines Manual, UCC, Inc., Dayton, OH, December, 1991.

UPC Film Master Verification Manual, UCC, Inc., Dayton, OH, April, 1986.

UPC Guidelines Manual, UCC, Inc., Dayton, OH, October, 1990.

UPC Marking Guidelines for General Merchandise and Apparel, UCC, Inc., Dayton, OH, January, 1989.

UPC Shipping Container Code and Symbol Specification Manual, UCC, Inc., Dayton, OH, September, 1990.

UPC Symbol Location Guidelines Manual, UCC, Inc., Dayton, OH, January, 1992.

UPC Symbol Specification Manual, UCC, Inc., Dayton, OH, August, 1990.

About the Universal Product Code, UCC, Inc., Dayton, OH.

Read Me First: Getting Started with the Universal Product Code, UCC, Inc., Dayton, OH, December, 1990.

UPC Data Communication Guidelines for General Merchandise and Apparel, UCC, Inc., Dayton, OH.

UCS Standards Manual (Version 3/0), UCC, Inc., Dayton, OH.

WINS Standards Manual (Version 3/0), UCC, Inc., Dayton, OH.

UCS Standards Manual (Version 3/1), UCC, Inc., Dayton, OH.

UCS Implementation Guide, UCC, Inc., Dayton, OH.

UCS/DSD Implementation Guide, UCC, Inc., Dayton, OH.

Direct Store Delivery Store Level Study, UCC, Inc., Dayton, OH, April, 1987.

UCS For Direct Store Delivery – Development Program Report, UCC, Inc., Dayton, OH.

VICS EDI Standards Manual (Version 2003), UCC, Inc., Dayton, OH.

VICS EDI Standards Manual (Version 2040), UCC, Inc., Dayton, OH.

VICS EDI Standards Manual (Version 2050), UCC, Inc., Dayton, OH.

EDI Network/Software Supplier Directory, UCC, Inc., Dayton, OH.

DEX/UCS Service Supplier Directory, UCC, Inc., Dayton, OH.

EDI User Activity Report, UCC, Inc., Dayton, OH.

Press Release: "Retailers Cite Critical Need for Quality UPC Symbols", UCC, Inc., Dayton, OH, March, 1991.

Universal Product Code Industrial and Commercial Guidelines Manual, UCC, Inc., Dayton, OH, June, 1991.

Understanding the Universal Product Code, UCC, Inc., Dayton, OH.

UPC Coupon Code Newsletter, UCC, Inc., Dayton, OH, 1989.

"Updated Number System Character 6 & 7 Announcement!" UPC Bulletin, UCC, Inc., Dayton, OH, June, 1989.

Video: " UCC–128 Serial Shipping Container Code and Symbol"

Video: "UPC Quality Video"

Video: "UPC Quality Video with UPC Code Explanation"

Video: "UPC Coupon Code"

Video: "UPC Product/Shipping Container Code and Symbol"

Video: "UCC/EAN Code 128 Application Identifiers" (Available 1992)

Video: "UCS/WINS"

Video: "USC/DSD"

Video: "VICS EDI"