



The Global Language of Business

Barcode Scanning Equipment Selection Criteria: A guide to choosing appropriate scanning equipment

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1 Purpose

This document is intended to assist the individuals responsible for the selection and procurement of appropriate barcode scanning equipment for use within the supply chain. It should be noted that the selection of appropriate scanning equipment is most successful when conducted as a consultative process that includes feedback, approval and buy-in from all functional areas that may use the chosen barcode scanning equipment.

GS1 Canada has provided this document to address issues that need to be considered when selecting a barcode scanner.

2 Introduction

The ability to electronically and automatically capture information related to a product is essential for accuracy within the supply chain. The use of barcodes enables timely and accurate information to be retrieved at the point of use and enables product traceability across the supply chain.

There are multiple barcodes with different capabilities and used for various applications. In addition, there are multiple barcode scanners enabled with various strengths and weaknesses. The variety of solutions leave trading partners faced with the challenge of needing to fully understand how to select the proper equipment for their unique organizational requirements.

This document aims to categorize the necessary information to enable organizations to accurately select equipment based on their own internal requirements.

Areas that require immediate attention prior to choosing equipment include:

- Adopting the Global Trade Item Number (GTIN) as the product identifier for products.
- Enabling internal databases to allow for 14 digit GTINs
- Validating the types of codes/symbologies that will be scanned at each touch point

The supply chain is comprised of products that filter through numerous touch points – many of which require data capture. As a result, organizations may have a variety of barcode scanning requirements.

For example, warehouse receiving may require a portable, hand-held scanner or a floor mounted portal that is fixed to the docking bay. However, point of sale (POS) requirements may not be the same due to the different symbologies employed for product identification.

There are four common factors to consider when selecting scanning equipment, including:

1. Environment where scanning equipment is used.
2. Ability to scan multiple symbologies (e.g. barcodes).
3. Use – stationary or mobile.
4. Scanner attributes.

NOTE:

GS1 Canada makes no recommendations in the document regarding specific manufacturers. It is simply meant to guide the reader in acquiring the right equipment that meets all of their requirements.

3 Factors

In the following sections, factors that are critical to consider when selecting the most effective barcode scanning equipment for your organization's unique processes are outlined.

Identifying and understanding the unique requirements for each of your business areas will ensure an effective and efficient equipment decision is made so as to meet your organization's needs.

As previously stated, there are four common factors to consider when selecting scanning equipment, including:

1. Environment where scanning equipment is used.
2. Ability to scan multiple symbologies (e.g. barcodes).
3. Application - stationary or mobile.
4. Scanner attributes.

3.1 End Users

One of the most important factors to consider before investing in equipment is end user integration. Without the participation and endorsement of the end user, successful implementation may be jeopardized.

Discussions with the department(s) that will use the barcode scanning equipment may highlight more specific factors that would impact their productivity and use of the scanner.

End user considerations include:

1. Ease of use
2. Weight
3. Connectivity
4. Mobility
5. Durability
6. Reliability
7. Cleanability
8. Fluid resistant/Waterproof
9. Battery life

3.2 Environment

The environment in which the barcode scanning equipment is used will play an important role in the selection process. For example, a POS environment is different than a loading dock, and therefore requires different equipment.

Environmental factors to consider include:

1. Exposure to/use in extreme cold
2. Exposure to/use in extreme heat
3. Subject to harsh chemicals

See [Appendix C: Barcode Scanner Selection Checklist](#) for more information.

3.3 Use Considerations

The application of the barcode scanning equipment must also be considered as usability factors may be subjective. For example, warehouse receiving staff may prefer the flexibility of having mobile scanners, but financial constraints could dictate that fixed or mounted scanning equipment is best suited to your organization to avoid losing or misplacing units.

Factors to consider for the application of the barcode scanning equipment include:

1. Offering mobile scanning equipment
2. Providing fixed or mounted scanning equipment
3. Providing motion activated scanning equipment
4. Incorporating Bluetooth technology to transmit data
5. Incorporating Wi-Fi technology to transmit data
6. Implementing keyboard emulation (transmission of data emulates manual data entry)
7. Including self-contained software in the scanning equipment

The application of your barcode scanning equipment will directly impact day-to-day activities and will affect all parties who use the equipment for data capture, making application considerations key factors in the selection process.

See [Appendix C: Barcode Scanner Selection Checklist](#) for more information.

3.4 Functionality Requirements

Functionality requirements will affect how your barcode scanning equipment and your product and process management systems will integrate.

The following functionality requirements should therefore be considered:

1. Does the scanning equipment include software?
2. Does the manufacturer offer a loan or replacement program?
3. Can the equipment read or scan a linear/2D barcode?
4. Is the equipment an image-based scanner?
5. Is the equipment a linear scanner?
6. Does the scanning equipment require a power supply?
7. Does the equipment have source programmable symbol selection?
8. Is the equipment shielded (that is, does it emit or interfere with other electrical devices)?

See [Appendix C: Barcode Scanner Selection Checklist](#) for more information.

3.5 Unit Attributes

Physical requirements of your barcode scanning equipment will be dictated by its application (i.e. the system, speed and end function). For example, if you need to scan shipments at different loading docks, a Bluetooth connection would provide more options than a fixed cord in order to enable flexibility.

Other unit attributes to consider include:

1. Is it linear scanning equipment?
2. Is it 2D scanning equipment?

3. Is the scanning equipment laser-based?
4. Is the scanning equipment camera-based?
5. Does the scanning equipment have a USB connection?
6. Does the scanning equipment have a serial connection?
7. Does the scanning equipment have a PS2 keyboard connection?

4 Process

Your organization should perform a detailed analysis to ascertain what scanning equipment is most efficient for your unique business processes. This will help to determine what equipment would best support each process' activities.

4.1 Efficient Receiving

Trade units may be marked with only the GTIN – that is, there is no secondary identifier or symbology. This may be encoded in an Interleaved (ITF) symbology (see [Section 5: Symbologies](#)). However, there is a growing demand for a secondary identifier on logistical or product units, such as batch/lot number, expiry date, best before date and/or production date. It should be noted that the ITF is not capable of encoding secondary information and will therefore require the use of the GS1-128 symbology.

Scanning equipment for the pallet and case level may not require 2D or 3D image-based scanners. However, if there is a requirement to scan below the case level (e.g. cases opened and product repacked for distribution), it is recommended that image scanners be considered.

Receiving process touch points include:

1. Receiving from manufacturer
2. Pick and pack from distribution centre to provider
3. Receiving at provider
4. Inventory management

5 Symbologies

This section provides information on the GS1 standards-based symbologies that may pass through different business processes.

Data carrier symbologies allow for encoded information like GTINs, lot information, production, best before and expiration dates. Symbologies allow for the efficient capture of this information with the use of barcode scanning equipment.

Some symbology types can only encode the GTIN, while others have the capability of encoding Application Identifiers (AIs), which allow users to add additional information that can be automatically captured when the barcode is read.

Section 2.0 of the GS1 General Specifications – the core standards document describing how barcodes and identification keys should be used to comply with GS1 standards – identifies the standards rules concerning what data carriers are to be used for particular element strings and applications. Section 2.0 also includes a list of available Application Identifiers (AI). Get more information in the [GS1 General Specifications](#), available in the member section of our website

The GS1 System of standards is comprised of the following data carriers:

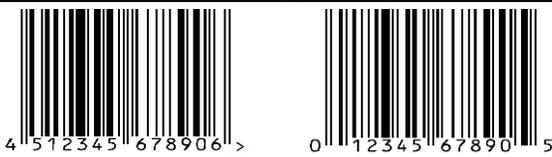
Symbology Name	Type	AI Compatible**
EAN/UPC	Linear	No
ITF 2-of-5	Linear	No
GS1-128	Linear	Yes
GS1 DataBar™	Linear/2D	Yes
GS1 DataMatrix	2D	Yes
GS1 QR Code	2D	Yes

NOTE:

The GS1 DataBar™ is a family of barcodes based on the GS1-128 framework. Different versions of this barcode family have different size restraints and data capabilities.

**AI compatible symbology can carry secondary information, such as Expiry Date, Batch Number, etc.

5.1 GS1 Standard Symbologies

Symbology Name	Symbology Image
EAN/UPC	
ITF (Interleaved 2-of-5)	
GS1-128	
GS1 DataBar Stacked	
GTIN with Lot Number encoded in a GS1 DataBar Composite	
GTIN encoded in a GS1 DataBar Limited	
GTIN and Serial Number encoded in a GS1 DataBar Stacked and Composite and GS1 DataMatrix	 
GS1 QR Code	

5.2 Symbology Use

This section identifies the touch points that GS1 standard symbologies may pass through regarding packaging levels or products used in your business processes. Please note that products identified with the GS1 DataBar™ (except for GS1 DataBar™ Limited) or GS1 DataMatrix symbologies require 2D barcode scanning equipment

	EAN/UPC	Interleaved 2-of-5 (ITF)	GS1-128	GS1 DataBar*	GS1 DataMatrix	GS1 QR Code
Pallet		X	X			
Case	X	X	X			
Item	X			X	X	X
Returnable asset			X	X	X	
Asset			X	X	X	



Requires 2D Reader
 *most DataBar symbologies require 2D readers.

Appendix A: GS1 Canada Contact

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Appendix B: Additional Resources

1. GS1 General Specifications – see your local GS1 Member Organization (GS1 MO) or go to www.gs1.org/barcodes/technical/genspecs for more information.
2. GS1 Canada Solution Providers List - see www.mygs1ca.org under Tools > Solution Providers

Appendix C: Barcode Scanner Selection Checklist

The barcode Scanner Selection Checklist is intended for use following the review of this document's criteria. The Checklist provides organizations with an overview of the specifications and considerations following the selection of a barcode scanner.

Location of Use: _____

Date Completed: ____ / ____ / ____

Please ensure that you check all options that apply while reviewing the following selection checklist.

1. Environmental Specifications

- Extreme Temperature**
Range: _____
- Requires Cleaning**
Method: _____
- Requires Sterilization**
Method: _____
- Harsh Chemical Exposure**

2. Use Considerations

- Portable, self-contained battery**
Battery Life: _____
Spare Battery: Yes/No
- Fixed Mounted** (i.e. floor based, scanner-bed based)
- Wired** (i.e. USB)
Connection Type: _____
- Wi-Fi**
- Bluetooth**
- Motion Activated** (i.e. hands-free)
- Trigger Activated**

3. Functionality Requirements

- Camera-based**
- Charge-coupled Device (CCD)-based**
- Laser-based**
- Linear codes**
 - o UPC/EAN symbols (retail)
 - o GS1-128 (logistic)
 - o ITF (logistic)
 - o GS1 DataBar™ (this code family contains both linear and 2D codes)
- 2D Codes**
 - o GS1 DataMatrix
 - o GS1 DataBar™ (this code family contains both linear and 2D codes)

4. Other

Appendix D: Glossary

Please note that the following glossary of terms and their definitions is based on the glossary found in the GS1 General Specifications, Version 10.

Term	Definition
2-Dimensional Symbology	Optically readable symbols that must be examined both vertically and horizontally to read the entire message. Two-dimensional symbols may be one of two types: matrix symbols and multi-row symbols. Two dimensional symbols have error detection and may include error correction features.
Alphanumeric (an)	Describes a character set that contains alphabetic characters (letters), numeric digits (numbers), and other characters, such as punctuation marks.
Attribute	An Element String that provides additional information about an entity identified with a GS1 Identification Key, such as Batch Number associated with a Global Trade Item Number (GTIN).
Automatic Identification and Data Capture	A technology used to automatically capture data. AIDC technologies include barcodes, smart cards, biometrics and RFID.
Barcode	A symbol that encodes data into a machine readable pattern of adjacent, varying width, parallel, rectangular dark bars and pale spaces.
Check Digit	A final digit calculated from the other digits of some GS1 Identification Keys. This digit is used to check that the data has been correctly composed. (See GS1 Check Digit Calculation.)
Company Number	A component of the GS1 Company Prefix.
Composite Symbology	A GS1 System composite symbol consists of a linear component (encoding the item's primary identification) associated with an adjacent Composite Component (encoding attribute data, such as a batch number or expiration date). The composite symbol always includes a linear component so that the primary identification is readable by all scanning technologies, and so that imager scanners can use the linear component as a finder pattern for the adjacent 2D Composite Component. The composite symbol always includes one of three multi-row 2D Composite Component versions (e.g., CC-A, CC-B, CC-C) for compatibility with linear- and area-CCD scanners and with linear and rastering laser scanners.

Term	Definition
Data carrier	A means to represent data in a machine readable form; used to enable automatic reading of the Element Strings.
Data character	A letter, digit, or other symbol represented in the data field(s) of an Element String.
DataMatrix	A standalone, two-dimensional matrix symbology that is made up of square modules arranged within a perimeter finder pattern. DataMatrix ISO version ECC 200 is the only version that supports GS1 System identification numbers, including Function 1 Symbol Character. DataMatrix Symbols are read by two-dimensional imaging scanners or vision systems.
Direct Part Marking	Direct part marking refers to the process of marking a symbol on an item using an intrusive or non-intrusive method.
Direct print	A process in which the printing apparatus prints the symbol by making physical contact with a substrate (e.g., flexography, ink jet, dot peening).
EAN/UPC Composite Symbology Family	A family of barcodes comprising the UPC-A Composite Symbology, UPC-E Composite Symbology, EAN-8 Composite Symbology, and EAN-13 Composite Symbology.
EAN/UPC Symbology	A family of barcodes including EAN-8, EAN-13, UPC-A, and UPC-E barcodes. Although UPC-E barcodes do not have a separate symbology identifier, they act like a separate symbology through the scanning application software. See also EAN-8 barcode, EAN-13 barcode, UPC-A barcode, and UPC-E barcode.
EAN-13 barcode	A barcode of the EAN/UPC Symbology that encodes GTIN-13, Coupon-13, RCN-13, and VMN-13.
EAN-8 barcode	A barcode of the EAN/UPC Symbology that encodes GTIN-8 or RCN-8.
Element	A single bar or space of a barcode.
Element String	The combination of a GS1 Application Identifier and GS1 Application Identifier Data Field.
Fixed length	Term used to describe a data field in an Element String with an established number of characters.

Term	Definition
Global Standards Management Process	GS1 created the Global Standards Management Process (GSMP) to support standards development activity for the GS1 System. The GSMP uses a global consensus process to develop supply chain standards that are based on business needs and user-input
Global Trade Item Number (GTIN)	The GS1 Identification Key used to identify trade items. The key comprises a GS1 Company Prefix, an Item Reference and Check Digit.
GS1 Application Identifier	The field of two or more digits at the beginning of an Element String that uniquely defines its format and meaning.
GS1 Application Identifier data field	The data used in a business application defined by one application identifier.
GS1 Company Prefix	Part of the GS1 System identification number consisting of a GS1 Prefix and a Company Number, both of which are allocated by GS1 Member Organizations. See also U.P.C. Company Prefix. GS1 Member Organizations assign GS1 Company Prefixes to entities that administer the allocation of GS1 System identification numbers. These entities may be, for example, commercial companies, not for profit organizations, governmental agencies, and business units within organizations. Criteria to qualify for the assignment of a GS1 Company Prefix are set by the GS1 Member Organizations.
GS1 DataBar™ Composite Symbology Family	A family of symbols comprising all the GS1 DataBar™ barcodes when an accompanying Composite Component is printed directly above the linear component.
GS1 DataBar™ Expanded barcode	A barcode that encodes any GS1 Identification Key plus Attribute data, such as weight and “best before” date, in a linear symbol that can be scanned omnidirectionally by suitably programmed Point-of-Sale scanners.
GS1 DataBar™ Expanded Stacked barcode	A barcode that is a variation of the GS1 DataBar™ Expanded barcode that is stacked in multiple rows and is used when the normal symbol would be too wide for the application.
GS1 DataBar™ Limited barcode	A barcode that encodes a GTIN with a leading digit of zero or Indicator digit of one in a linear symbol; for use on small items that will not be scanned at the Point-of-Sale.
GS1 DataBar™ Omnidirectional barcode	A barcode that encodes a GTIN. It is designed to be read by omnidirectional scanners.

Term	Definition
GS1 DataBar™	A family of barcodes, including GS1 DataBar™ Omnidirectional; GS1 DataBar™ Stacked Omnidirectional; GS1 DataBar™ Expanded; GS1 DataBar™ Expanded Stacked GS1 DataBar™ Truncated, GS1 DataBar™ Limited, and GS1 DataBar™ Stacked symbols.
GS1 DataBar™ Stacked Omnidirectional barcode	A barcode that is a variation of the GS1 DataBar™ Symbology that is stacked in two rows and is used when the GS1 DataBar™ Omnidirectional Symbol would be too wide for the application. It is designed to be read by omnidirectional checkout scanners.
GS1 DataBar™ Stacked barcode	A barcode that is a variation of the GS1 DataBar™ Truncated barcode that is stacked in two rows and is used when the GS1 DataBar™ Truncated barcode would be too wide for the application.
GS1 DataBar™ Truncated barcode	A barcode that is a truncated version of the GS1 DataBar™ Omnidirectional barcode. It is used when the GS1 DataBar™ Omnidirectional barcode would be too tall for small item marking applications. It is not intended for omnidirectional checkout scanning.
GS1 DataMatrix	GS1 implementation specification for use of DataMatrix
GS1	Based in Brussels, Belgium, and Princeton, USA, it is the organization that manages the GS1 System. Its members are GS1 Member Organizations.
GS1 Identification Key	A numeric or alphanumeric data field defined by GS1 to ensure the global, unambiguous uniqueness of the identifier in the open demand or supply chain.
GS1 Identification Keys	A globally managed system of numbering used by all GS1 Business Units to identify trade items, logistic units, locations, legal entities, assets, service relationships, consignment, shipments and more. Any identification number that combines GS1 member company identifiers (GS1 Company Prefix) with standards based rules for allocating reference numbers is a key.
GS1 Member Organization	A member of GS1 that is responsible for administering the GS1 System in its country (or assigned area). This task includes, but is not restricted to, ensuring brand owners make correct use of the GS1 System, have access to education, training, promotion and implementation support and have access to play an active role in GSMP.

Term	Definition
GS1 Prefix	A number with two or more digits, administered by GS1 that is allocated to GS1 Member Organizations or for Restricted Circulation Numbers.
GS1 Symbologies using GS1 Application Identifiers	All GS1 endorsed barcode symbologies that can encode more than a GTIN namely GS1-128, GS1 DataMatrix, GS1 DataBar™ and Composite).
GS1 System	The specifications, standards, and guidelines administered by GS1.
GS1-128 Symbology	A subset of Code 128 that is utilised exclusively for GS1 System data structures.
GS1-8 Prefix	A one-, two-, or three-digit index number, administered by GS1, that is allocated to GS1 Member Organizations for the creation of GTIN-8s or for Restricted Circulation Numbers (see RCN-8).
GTIN Application Format	A format for a GTIN-8, GTIN-12, or GTIN-13 used when a GTIN application requires a fixed field length, for example, when a GTIN-13 is encoded in GS1-128 Symbology using the Application Identifier (01).
GTIN-12	The 12-digit GS1 Identification Key composed of a U.P.C. Company Prefix, Item Reference, and Check Digit used to identify trade items.
GTIN-13	The 13-digit GS1 Identification Key composed of a GS1 Company Prefix, Item Reference, and Check Digit used to identify trade items.
GTIN-14	The 14-digit GS1 Identification Key composed of an Indicator digit (1-9), GS1 Company Prefix, Item Reference, and Check Digit used to identify trade items.
GTIN-8	The 8-digit GS1 Identification Key composed of a GS1-8 Prefix, Item Reference, and Check Digit used to identify trade items.
Human Readable Interpretation	Characters that can be read by persons, such as letters and numbers, as opposed to symbol characters within barcodes, which are read by machines.
Identification number	A numeric or alphanumeric field intended to enable the recognition of one entity versus another.
Indicator	A digit from 1 to 9 in the leftmost position of the GTIN-14.

Term	Definition
Interleaved 2 of 5 Symbology	Barcode symbology used for the ITF-14 barcode.
ITF Symbology	See Interleaved 2 of 5 Symbology.
ITF-14 barcode	ITF-14 (A subset of Interleaved 2-of-5) barcodes carry GTINs only on trade items that are not expected to pass through the Point-of-Sale.
Linear barcode	Barcode symbology using bars and spaces in one dimension.
Omnidirectional Linear barcode	A linear barcode symbol designed to be omnidirectionally read in segments by suitably programmed high-volume Omnidirectional Point-of-Sale (POS) scanners.
Primary Packaging	The first level of packaging in direct contact with the product and marked with an AIDC data carrier either on the packaging or on a label affixed to the packaging. May consist of a single item or group of items for a single therapy such as a Kit. For packaging configurations that include a retail consumer trade item, primary packaging is a packaging level below the retail consumer trade item.
Quiet Zone	A clear space which precedes the Start Character of a barcode and follows the Stop Character. Formerly referred to as "Clear Area" or "Light Margin".
Quiet Zone Indicator	A greater than (>) or less than (<) character, printed in the human readable field of the barcode, with the tip aligned with the outer edge of the Quiet Zone.
Scanner	An electronic device to read barcode and convert them into electrical signals understandable by a computer device.
Serial number	A code, numeric or alphanumeric, assigned to an individual instance of an entity for its lifetime. Example: Microscope model AC-2 with serial number 1234568 and microscope model AC-2 with serial number 1234569. A unique individual item may be identified with the combined Global Trade Item Number (GTIN) and serial number.
Symbol	The combination of symbol characters and features required by a particular symbology, including Quiet Zone, Start and Stop Characters, data characters, and other auxiliary patterns, which together form a complete scannable entity; an instance of a symbology and a data structure.

Term	Definition
Symbology	A defined method of representing numeric or alphabetic characters in a barcode; a type of barcode.
Symbology element	A character or characters in a barcode used to define the integrity and processing of the symbol itself (e.g., start and stop patterns). These elements are symbology overhead and are not part of the data conveyed by the barcode.
Symbology identifier	A sequence of characters generated by the decoder (and prefixed to the decoded data transmitted by the decoder) that identifies the symbology from which the data has been decoded.
Trade item	Any item (product or service) upon which there is a need to retrieve pre-defined information and that may be priced, or ordered, or invoiced at any point in any supply chain.
UPC. Company Prefix	A special representation of a GS1 Company Prefix constructed from a U.P.C. Prefix and a Company Number. The U.P.C. Company Prefix is only used to create GTIN-12, Coupon-12, RCN-12, and VMN-12, which are encoded in a UPC-A barcode.
UPC. Prefix	A special representation of the GS1 Prefixes '00 – 09' with the leading zero removed. Used when representing the GTIN-12, Coupon-12, RCN-12, and VMN-12 in a UPC-A barcode.
UPC-A barcode	A barcode of the EAN/UPC Symbology that encodes GTIN-12, Coupon-12, RCN-12, and VMN-12.
UPC-E barcode	A barcode of the EAN/UPC Symbology representing a GTIN-12 in six explicitly encoded digits using zero-suppression techniques.



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