TEC-IT Barcode Software

Barcode Overview

Version 11

Reference

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TEC-IT Datenverarbeitung GmbH
Hans-Wagner-Str. 6
A-4400 Steyr, Austria

t ++43 (0)7252 72720
f ++43 (0)7252 72720 77
office@tec-it.com
www.tec-it.com

WWW.TEC-IT.COM

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TEC-IT Datenverarbeitung GmbH
Hans-Wagner-Str. 6

A-4400 Austria
t.: +43 (0)7252 72720
f.: +43 (0)7252 72720 77
http://www.tec-it.com

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3 Introduction

3.1 Scope of this Document

This document describes barcode symbologies supported by TEC-IT software in a non-product-specific way. Please use this document as add-on or in-depth reference when dealing with barcode related questions in the following TEC-IT products:

► **TBarCode OCX**	A Microsoft® ActiveX® compliant barcode control
► **TBarCode .NET**	A .NET barcode library
► **TBarCode Library**	Barcode DLL for Microsoft® Windows® (and UNIX®)
► **Barcode Studio**	A stand-alone barcode designer for Microsoft® Windows®
► **TBarCode/X**	Barcode generators (SDK) for Linux® and UNIX®
► **TFORMer Designer**	Full-featured label and report design
► **TFORMer Runtime**	Label and reporting engine for various operating systems
► **TFORMer Server**	Industrial output management
► **TBarCode/Embedded**	Barcode-enabled print and spool appliance
► **TBarCode/SAPwin**	Barcode DLL for SAP® R/3®
► **TBarCode/Direct**	Smart PostScript® compatible bar-coding for SAP® R/3®

3.2 Barcode Types

The reason for the many different types of barcodes is that barcodes are used in many different operational areas. Thus it is possible to select the most suitable barcode type to meet the requirements of a particular industry.

3.2.1.1 Linear 1D Barcodes

Figure 1: Linear Barcode Sample

Linear barcodes are known under names like Code 39, Code 128, UPC, EAN, 2of5...

Linear barcodes encode the information in one way (=one dimension), so they are also called one-dimensional barcodes (1D). The information is stored in the relationship of the widths of the bars (spaces) to each other.

In most of these symbologies the height of the bars is not relevant, except for some height-modulated Postal Codes (e.g. Australian Post 4-State or USPS Intelligent Mail® Barcode / IM® Barcode).

3.2.1.2 2D Barcodes (Stacked)

Figure 2: 2D-Stacked Barcode Sample

Two-dimensional barcodes are known under names like PDF417, or Codablock F.

Such stacked or multi-row barcodes store information in two dimensions. Several stacked linear barcodes are used to encode the information.

3.2.1.3 2D Barcodes (Matrix Codes)

Figure 3: 2D Barcode Sample

Two-dimensional barcodes like MaxiCode, Data Matrix or QR-Code encode information in two dimensions. Compared to stacked symbologies the information is not stored by using different bar (space) widths. Instead the position of black (or white) dots is relevant.

3.2.1.4 Composite Codes

Figure 4: Composite Barcode Sample

Composite codes like GS1 DataBar Composite Symbology are combining linear with 2D (stacked) symbologies. The advantage of such codes is that the linear code component encodes the most important information. The 2D component is used for additional data. This separation ensures better migration (e.g. with respect to scanning hardware) between linear and 2D technology.

3.3 Barcode Glossary

As follows you will find a short explanation about technical terms which are used in the barcode technology.

Bar	A bar is represented by the dark or black elements in a barcode.	
Space	The white or lighter elements in a barcode are called spaces.	
Barcode density	The density of the barcode refers to how much space is required for the needed characters (characters per Inch or centimeter)	
Element	Represents both a bar and a space.	
Module	A module is the smallest element of a barcode. The width of the single bars and spaces is a (mostly integer) multiples of the basic width of the module.	
Module width	The width of the barcode's smallest element in millimeter, in inches or in so-called mils (one mil = 1/1000 inch). The module width is usually abbreviated with the letter X.	
X Dimension	The width of the barcode's smallest element (see Module width).	
Quiet zone	An area free of any printing or marks that precedes the start character of a barcode and follows the stop character. The required minimal size of the quiet zone depends on the barcode type. As a rule, the quiet zone should be ten times the dimension of the module width or at least 1/4 inch (6.5 mm).	
Human Readable Text	This term refers to the entire encoded information of a barcode shown in readable form. It is usually printed below the code. For 2D codes no human readable text is used.	
Discrete Codes	Each character begins and ends with a bar. The spacing between characters is not part of the code.	
Continuous Code	The spaces between the characters are also part of the code. An example of a continuous code is the Code 2/5 Interleaved.	
Start and Stop Characters	Distinct characters used at the beginning and end of each barcode symbol that provide the scanner with start and stop reading instructions as well as scanning direction.	
Self-checking Code	Self-checking code uses the same pattern for each character. For example, this can be five elements where two of these elements are wide and three are narrow. Any deviation from this pattern would result in an error.	
Check Digit	One or more characters included within the barcode which are used to perform a mathematical check to ensure the accuracy of the scanned data. Check digits are mandatory with certain codes or are even built into the symbology (as for Code-128)	
Bearer Bars	These are bars printed above and below the symbol. The bearer bars are eliminating partial reads (as drawn in the example on the right). Sometimes the complete symbol is surrounded by bearer bars (e.g. ITF-14).	
Substitution Error	Due to reading errors a character is replaced by another during scanning. Substitution errors can be excluded by adding a check digit.	
Synchronizing Bars	These bars are synchronizing the barcode reader. E.g. UPC-A and EAN-13 have synchronizing bars at the beginning, in the middle and at the end of the symbol.	
No-Read	A failure to decode, resulting in no output.	
Misread	The data output of a reader/decoder does not agree with the data encoded in the barcode field. This yields to substitution errors.	

Table 1: Barcode Glossary

4 Important Barcode Parameters

In this chapter you will find an explanation about the most important barcode parameters.

4.1 Barcode Symbology

The symbology determines the format and the capabilities of the barcode. Check out chapter 6 for a list of supported barcode symbologies. It depends on your application which symbology you should use. For help, deciding the right symbology, you can contact TEC-IT Support.

4.2 Module Width

4.2.1 Introduction

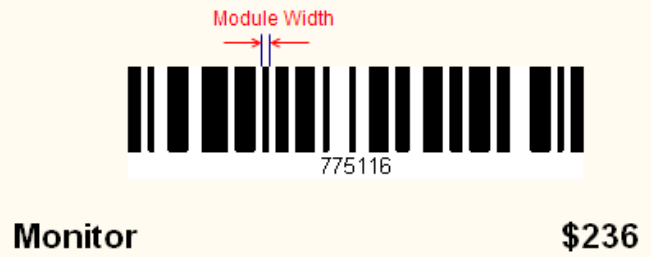


Figure 5: Module Width

The module width (or X dimension) is the width of the smallest bar (or space) in the barcode. The minimal module width depends on the used symbology. In most specifications the recommended module width is at least 0.19 mms.

The default setting in TEC-IT software adapts the module width according to the bounding rectangle of the barcode. The module width is computed automatically by dividing the width of the object by the number of required modules. This depends on the number of data characters to be encoded. The module width decreases as the data content increases.

When adjusting the module width to a fixed value, the resulting barcode can be wider than the bounding rectangle. To avoid clipping, ensure that the entire barcode can be displayed with the maximum data content and enlarge the barcode object if required.

4.2.2 Optimize the Module Width

Printing tolerances can lead to problems when decoding a barcode. A remedy for this problem is to optimize the module width with respect to available printing resolutions.

Assume you want to print a barcode with a resolution of 300 dpi then one pixel equals 0.003333 inch (or 0.08466 mm) in such a case. To avoid raster errors, you should select a module width that is an integer multiple of the pixel width (e.g. for 300 dpi a multiple of 0.08466 mm).

- 200 dpi: 2 modules á one pixel (0.127 mm) = 0.254 mm
- 202 dpi: 2 modules á one pixel (0.1257 mm) = 0.251 mm
- 300 dpi: 3 modules á one pixel (0.08467 mm) = 0,254 mm
- 600 dpi: 5 modules á one pixel (0.04233 mm) = 0,212 mm
- For printer solutions over 300 dpi normally the optimizing of the module width isn't necessary.

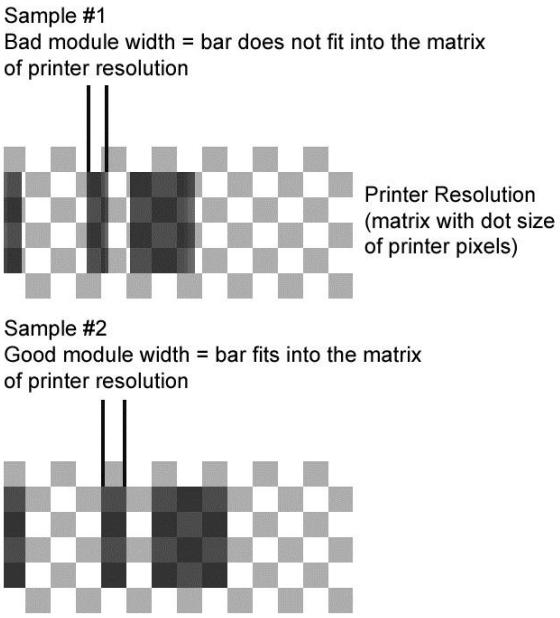


Figure 6: Raster Optimization

4.2.3 Module Width and Reading Distance

The actual reading distance for barcodes depends on two factors: the scanner hardware and the module width of the barcode.

There is no scanner, which can read all barcodes (ranging from high density codes to barcodes with wide tracking) from all distances. Each barcode scanner has an optimum reading distance for barcodes with a certain module width. The correlation between the module width and the reading distance is usually specified by the manufacturer of the barcode scanner. The following table shows such an exemplary specification.

Thus, depending on the module width the optimum reading distance for a specific scanner can be identified. On the other hand, if the reading distance is given by the application, the required module width for printing the barcodes may be adjusted.

Module Width (1 mil = 1/1000 mm)	**Depth of Field (Reading Distance)**
5 mil	7.6 to 15.2 cm / 3 to 6”
7.5 mil	5.1 to 40.6 cm / 2 to 16“
10 mil	3.8 to 55.9 cm / 1.5 to 22”
13 mil	2.5 to 76.2 cm / 1 to 30”
20 mil	2.5 to 106.7 cm / 1 to 42”
55 mil	5.1 to 203.2 cm / 2 to 80”

Table 2: Example for Scanner Specification

4.3 Bar Width Reduction (Pixel Shaving)

Another word for bar width reduction (BWR) is “bar width correction” (BWC) or “pixel shaving”.

Bar width reduction is a common issue with printing bar codes. So called “dot gain” is part of every printing process and leads to enlargement of bars (while the gaps are reduced). Depending on the printing process these aberrations must be compensated with the appropriate bar width reduction.

Sample values for dot gain (to be compensated) are approximately 100µm with flexographic printing, 50µm with intaglio printing and 30µm with offset printing. The smaller the bar codes, the more precise must be worked. Depending on the bar code orientation to the printing direction, the printing accuracy and printing process may change.

Bar width reduction may be applied also for laser printers (e.g. with too high toner saturation) or inkjet printers.

TEC-IT Software allows fine-tuning of the bar width reduction in percent, mm (µm), mils and inch.

4.4 Quiet Zone

A quiet zone (an area free of any printing or marks) should be maintained directly before and after the barcode symbol. The quiet zone helps the scanner to determine the barcode correctly.

As a rule, the quiet zone should be ten times the dimension of the module width or at least 1/4 inch (6.5 mm); the exact value depends on the barcode symbology.

Figure 7: Quiet Zone

4.5 Print Ratio and Ratio Format

The print ratio (the bar/width ratio) is the width relationship of all elements of a barcode – with respect to the smallest element. TEC-IT Software allows fine-tuning of the print ratio by supporting three parameters:

- Print ratio
  The read/write property *Ratio* is used to adjust the print ratio. The value of this property has to comply with the ratio format.
- Format of ratio
  The read-only property *RatioHint* shows the format (syntax) of the print ratio setting. It is intended as a hint for the programmer or user.
- Default print ratio
  The read-only property *RatioDefault* contains the default print ratio for the selected barcode symbology. It most cases the default ratio is the best choice for printing the barcode.

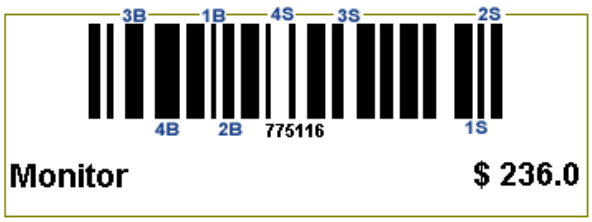


Figure 8: Print Ratio

Example:

The picture above shows a barcode with 4 different bar widths and 4 different space widths. Because TEC-IT software maintains the print ratio of bars and spaces separately, the ratio format is composed as follows: 1B:2B:3B:4B:1S:2S:3S:4S.

The first four values (1B:2B:3B:4B) refer to the 4 different widths of the Bars, the second four values (1S:2S:3S:4S) refer to the 4 different widths of the Spaces. The numbers in the ratio hint (e.g. 1B stands for the smallest bar, 2B for the bar with the next larger width and so on) are only used to denote the order – they have no meaning with respect to the ratio itself.

Now set a new print ratio value. This string must be formatted according to the ratio format, but without the letters: A value of "1:3:5:7.3:1:3:5:7.3" for the *Ratio* indicates that the width of the widest bar (4B) is 7.3 times the width of the smallest bar (7.3:1).

Ratio Format Specifier	Description
nB	The ratio of bar-width n with respect to the width of the smallest bar (bar-width 1)
nS	The ratio of space-width n with respect to space-width 1 (smallest space)
1T	This is specific to the symbology "Plessey Bidirectional". It denotes the ratio of the width of the terminator bar 1 to bar-width 1
nC	This is specific to the symbology "Pharmacode". It denotes the ratio of the width of color-bar n to the width of the smallest bar

Table 3: Print Ratio Adjustment

4.6 Format

Format acts like a "mask" for formatting the barcode data prior to encoding it. Placeholders in the format string can be mixed with constant data characters to build a final data string. With this feature it's possible to:

- Select subsets in Code 128, GS1-128 (even within the code!)
- Insert control characters into the barcode
- Select the required start/stop character for CODABAR
- Change the position of the check digit
- Set the MaxiCode values "date", "preamble", "service class", "postal code" and "country code" directly in the barcode data (with special escape sequences).

Placeholder character	Description
#	Stands for the next data character of the input data (property *Text*)
&	Stands for all remaining data characters in the input data (property *Text*)
^	Stands for the next check digit (use only if check digits will be computed!) ▪ TBarCode 6 (or earlier) computes the check digit for all characters in the input data. ▪ TBarCode 7 (or later) only uses input data left of the check digit placeholder for check digit computation (see examples below!).
A	Switch to Subset A (used in: Code 128, GS1-128) Start- or stop character A (only in: CODABAR)
B	Switch to Subset B (used in: Code 128, GS1-128) Start- or stop character B (only in: CODABAR)
C	Switch to Subset C (used in: Code 128, GS1-128) Start- or stop character C (only in: CODABAR)
C	Enable compatibility mode for CAPTIVA/IBML document scanning software (used in Data Matrix only)
D	Start- or stop character D (only in: CODABAR), Only for *Pharmacode*: encode the Pharmacode directly (bar by bar) Only for *Data Matrix*: use an alternative error correction algorithm for symbols of size 144x144.
E	Translate the Escape Sequences that the input data contains.
J	Only for Japanese Postal codes: the Address B data field can be automatically compressed, i.e. Japanese characters are converted into ASCII characters by a defined rule.

Placeholder character	Description
S	Only for MaxiCode: enables setting the values of Date, Preamble, Service Class, Postal- and Country-Code directly in the barcode data (only in conjunction with escape sequences).
<	Adds quiet zone markers at the left (“<”) and/or at the right (“>”) side of the barcode. These markers are supported by the following barcode types: ▪ EAN 8 and add-on variants (both sides) ▪ EAN 13 and add-on variants (only right side) ▪ UPC-A with 2 and 5 digit add-on (only right side) ▪ UPC-E with 2 and 5 digit add-on (only right side) ▪ ISBN (only right side)
>	

Table 4: Format Placeholders

4.6.1 Format Examples

Input data	Barcode type	Format string	Data used for encoding	Notes
123	Irrelevant		123	
123	Irrelevant	5&	5123	
123	Irrelevant	&6	1236	
123	Irrelevant	q#w#e#	q1w2e3	
123	Irrelevant	#q&	1q23	
123	Irrelevant	&^	123c	
123	Irrelevant	^&	c123	This format string may be used for TBarCode 6 (or earlier). – Newer versions always return 0 in this case.
12345	Irrelevant	####^#	1234c5	When using Modulo 10 for check digit calculation, c will be ▪ Mod-10 (12345) = 5 for TBarCode 6 (or earlier). ▪ Mod-10 (1234) = 0 for TBarCode 7 (or later).
Hello	Code 128	A&	Hello	
Hello	Code 128	A##B&	Hello	
Hello4711	Code 128	A##B&	Hello4711	
Hello4711	Code 128	A##B###C&	Hello4711	
1234567890	GS1-128	#####^#####	12345**7**67890	7 is the check digit computed when using Modulo 10. The check digit computation uses only the digits 12345 (67890 are ignored because this data comes after the ^)

Table 5: Format Examples

red characters represented in subset A
gray characters represented in subset B
green characters represented in subset C
c represents the place of the check digit

4.7 Escape Sequences (Encoding Binary Data)

If you want to use non-printable or special characters in a barcode, you have to use escape sequences. An escape sequence always start with a backslash (‘\’) followed by the sequence itself.

- ► You have to activate the decoding of escape sequences in the barcode properties – per default the translation of escape sequences is turned off.
- ► With activated escape sequences you must use “\\” in the input data to encode a single backslash „\“ in the barcode.

Escape sequence	Description	Valid for Barcode Symbology
\a	Bell (alert)	All
\b	Backspace	
\f	Form feed	
\n	New Line	
\r	Carriage Return	
\t	Horizontal Tab	
\v	Vertical Tab	
\\	The backslash \ itself	
\0	Zero Byte (if subsequent char is non-numeric) Available in TBarCode V10+	
\0ooo	ASCII-character in octal notation: *ooo* … up to 3 octal digits (0..7) First digit is always zero.	
\ddd	ASCII-character in decimal notation: *ddd* … up to decimal digits (0..9) First digit must not be zero.	
\xhh	For encoding bytes or ASCII-characters in hexadecimal notation *hh* … hexadecimal digits (0..F)	
\Crrggbb	Color selection	See Pharmacode
\Ce	Reset the color to default	
\F	FNC1 (Function Number Character 1) used as field separator	GS-128, Codablock-F MicroPDF417: a special FNC1 codeword is inserted when using emulation mode for GS1-128 or Code-128 Data Matrix: a special FNC1 codeword is inserted
\F	Inserts a Gs (Group Separator) or ASCII 1DHex. Don't encode the \x1d directly!	PDF417, MaxiCode and in QR-Code QR-Code: When using format UCC/EAN/GS1 Gs is inserted in Byte Mode, a % is inserted in alphanumeric mode.
\Ennnnnn	**E**xtended **C**hannel **I**nterpretation (ECI). *nnnnnn* … 6 digit ECI number with leading zeros Used for defining the character set (code page) for the subsequent encoded data – see C.1 ECI	MaxiCode, Data Matrix, QR-Code, PDF417, MicroPDF417, Aztec Code
\EB, \EE	Special ECI identifiers for nesting ECIs. \EB (**E**CI **B**egin) opens a nesting level, \EE (**E**CI **E**nd) closes it.	QR-Code
\G	**G**lobal **L**anguage **I**dentifier (GLI), similar to ECI (see \E).	PDF417
\S	Symbol separator character for C128 emulation	
\<FNCx>	Function sequence. Currently *FNC1*, *FNC2*, *FNC3*, and *FNC4* are implemented. \<FNC1> is equal to \F.	
\210	FNC1	Code128, GS1-128, Codablock-F
\211	FNC2	Code128, GS1-128, Codablock-F
\212	FNC3	Code128, GS1-128, Codablock-F
\213	FNC4	Code128, GS1-128, Codablock-F
\x11	DC1	Code93, Code93Ext
\x12	DC2	Code93, Code93Ext
\x13	DC3	Code93, Code93Ext
\x14	DC4	Code93, Code93Ext
\x1e	Rs (Record Separator), ASCII 1EHex	PDF417, QR-Code, Data Matrix, MaxiCode (Mode 3,4 SCM)

\x1d	Gs (Group Separator), ASCII 1DHex	PDF417, QR-Code, Data Matrix, MaxiCode (Mode 3,4 SCM)
\x04	Eot (End of Transmission), ASCII 04Hex	PDF417, QR-Code, Data Matrix, MaxiCode (Mode 3,4 SCM)

Table 6: Implemented Escape Sequences

4.8 Check Digits

The method for the check digit(s) calculation depends on the respective barcode type. In order to make TEC-IT products as user-friendly as possible, a standard method for each barcode type is supplied (where applicable).

► Per default the input can take place with and without a check digit. In the latter case the check digit is calculated automatically and added to the barcode data.

Example (EAN13): If you enter 12 digits (= utilizable data), the 13th digit (= the checksum digit) is computed and added automatically. If you enter 13 digits, the check digit is replaced by your data and isn't calculated.

Check digit enumeration	Enumeration value	Check digit calculation methods
eCDNone	0	No check digit will be computed
eCDStandard	1	Standard check digit of the selected barcode type is used
eCDMod10	2	Modulo 10 (usually used with Interleaved 2of5)
eCDMod43	3	Modulo 43 (suggested for Code39 and Logmars, consist of 1 digit)
eCD2Mod47	4	Modulo 47 (2 digits)
eCDDPLeit	5	Method for DP Leitcode
eCDDPIdent	6	Method for DP Identcode
eCD1Code11	7	Method for Code11 (1 digit)
eCD2Code11	8	Method for Code11 (2 digits)
eCDPostnet	9	Method for USPS Postnet
eCDMSI1	10	Method for MSI (1 digit)
eCDMSI2	11	Method for MSI (2 digits)
eCDPlessey	12	Method for Plessey
eCDEAN8	13	Method for EAN 8
eCDEAN13	14	Method for EAN 13
eCDUPCA	15	Method for UPC A
eCDUPCE	16	Method for UPC E
eCDEAN128	17	EAN 128 internal method (Modulo 103)
eCDCode128	18	Code 128 internal method (Modulo 103)
eCDRM4SCC	19	Method for Royal Mail 4 State
eCDPZN	20	Modulo 11 method for PZN
eCDMod11W7	21	Modulo 11 (weighting = 7)
eCDEAN14	22	Method for EAN 14
eCDMod10Kor	23	Method for Korean Postal Authority - Modulo 10
eCDMod10Pla	24	Method for Planet - Modulo 10
eCDMod10ItlPst25	25	Method for Italian Postal 2/5 (Modulo 10 based)
eCDMod36	26	Modulo 36 (ISO/IES 7064) for DPD Barcode
eCDMod16	27	Modulo 16 for Codabar Barcode
eCDMod10Luhn	28	Modulo 10 with Luhn Algorithm
eCDVIN	29	Method for VIN (North America)

eCDMod10LuhnRev	30	Modulo 10 with Reverse Luhn Algorithm
eCDMod23PPSN	31	Modulo 23 for PPSN
eCDMod10IMPackage	32	Modulo 10 for Intelligent Mail Package Barcode
eCDMod11W10	33	Modulo 11 (using maximum weight 10)
eCDUPU/ eCDSwedishPostal	34	Modulo 11 method for UPU (Universal Postal Union) Method for Swedish Postal Shipment Item ID

Table 7: Check Digit Methods and Enumerators

5 Application Identifiers (AI)

5.1 Introduction

Some barcode symbologies (e.g. GS1-128) use Application Identifiers (AIs) in order to provide information about the structure of the encoded data. Application Identifiers are mostly used in industry-specific barcode symbologies.

An Application Identifier (AI) is a prefix (built from 2 to 4 characters) used to identify the meaning and the format of the data that follows. AIs have been defined by GS1 (formerly UCC/EAN) for identification, traceability data, dates, quantity, measurements, locations, and many other types of information.

The data presented can be alphanumeric or numeric and with fixed or variable data lengths. The symbology character FNC1 is used as field separator in connection with variable length data fields.

- Use FNC1 only with variable length data fields
- Don't use FNC1 after the last data field.

Depending on the barcode symbology you are able to concatenate multiple AIs and encode more data fields into one symbol. If an AI is of variable length type, you have to separate the next data field with FNC1. FNC1 is specified in the barcode data with the escape sequence "\F" (see section 4.7).

- For encoding the FNC1 you have to activate *Translate Escape Sequences*.
- Do not encode the brackets which are usually used to denote an Application Identifier. TEC-IT software generates the brackets automatically for the human readable text. The brackets are not encoded in the barcode itself.

For more information (e.g. a list of all available AIs) please follow the links below:

http://www.gs1uk.org/what-we-do/GS1-standards/Pages/default.aspx
http://www.gs1.org/productssolutions/barcodes/technical/genspecs/index.html
http://en.wikipedia.org/wiki/GS1-128

Additional links can be found in our support area as well:

http://www.tec-it.com/support/links/barcode.aspx

5.2 Examples

5.2.1 Batch Number

A batch number is encoded with AI 10. The format of AI 10 is "n2 + an..20". This means the AI has two digits (10) followed by variable length data with maximum 20 characters.

Description	Value
Data (Text property)	10 + Production Number = 1012345678
Human readable text	(10)12345678
Encoded data	1012345678

5.2.2 Multiple AIs within one Barcode

Two data fields should be encoded in one barcode. Following fields are used:

Description	Value
Batch number AI (10) – format	n2 + an..20
Item number AI (01) – format	n14
Data (Text property)	10+Batch Number+\F+01+Item Number = 1012345678\F0112345678901234
Human readable text	(10)12345678(01)12345678901234
Encoded data	1012345678*FNC1*0112345678901234

► The field separator FNC1 (encoded by the sequence „\F“) has to be used because the batch number is a variable length data field.

5.2.3 GS1-128 with embedded Check Digit

Sometimes it is required to calculate a check digit only for a partial content of a barcode. A good example is the AI 01 (GTIN) in combination with other data fields within an GS1-128 symbol.

Description	Value
AI for GTIN	01
AI for Date	11
GTIN without check digit	1234567890123
Production Date	060606

In our example, the GTIN contains no check digit (e.g. when created based on the EAN-13 number). The check digit has to be generated only for the first 13 digits of the supplied data and not for the full data content.

Since **TBarCode Version 7+** you can use the format property to solve this problem:

Description	Value
Format property:	01#############^11######
Input Data (Text property):	1234567890123060606
Check Digit Method:	EAN-14 (Mod-10)
Calculated Check Digit:	CD = Mod-10 of (1234567890123) = 1
Result:	01 + 1234567890123 + **CD** + 11 + 060606
Data used for encoding:	01123456789012311060606

5.3 GS1 DataBar Expanded / GS1 DataBar Expanded Stacked

The mentioned symbologies use an internal data compression algorithm for specific Application Identifiers. Compression means that the barcode can encode more data or can be made smaller. This optimization takes effect if the AIs are applied in the following predefined order.

5.3.1 AIs with a Fixed Length

5.3.1.1 AI(01) and Weight

AI (01) must begin with an indicator digit of 9 for variable units

Combinations	Description	Max. Weight
AI (01) + AI (3103)	Weight in kg with 3 decimal places (n.nnn kg)	32.767
AI (01) + AI (3202)	Weight in pound with 2 decimal places (n.nn lbs)	999.99
AI (01) + AI (3203)	Weight in pound with 3 decimal places (n.nnn lbs)	22.767

Table 8: Fixed length AIs in RSS Expanded / Expanded Stacked Codes

5.3.1.2 AI(01), Weight and Date

Two or three data elements will be used for the barcode:

Combinations	Description	Addition
AI (01)	Must start with 9 for variable units	
+ AI (310n) or AI (320n)	For declaration of the Weight	n = 0..9
+ AI (11), AI (13), AI (15), AI (17)	For the Date	

Table 9: AIs in GS1 DataBar Expanded / Expanded Stacked Codes

If the date is not required this order of AIs still leads to a better barcode representation.

5.3.2 AIs with Variable Lengths

5.3.2.1 AI (01) and Price

Combinations	Description	Addition
AI (01)	Must start with 9 for variable units	
+ AI (392x)	For the price	x = 0..3
or + AI (393x)	For the price in the ISO currency format	x = 0..3

Table 10: Variable length AIs in RSS Expanded / Expanded Stacked Codes

5.3.2.2 AI (01)

► If AI(01) is needed in the barcode, please ensure it is the first AI encoded (for optimal data representation).

5.4 GS1 Composite Symbology

The GS1 (EAN.UCC) Composite Symbology was designed to hold primary data (like the GTIN or Shipping Container Code) in the linear symbol and additional data in the 2D Composite Component. For specific AI combinations in the 2D add-on symbol it is possible to perform a data compression (as shown below). This leads to a higher data density (= smaller barcode or more encode able characters).

5.4.1 Compressed Sequences of AIs

The following AI-sequences can be compressed for higher data efficiency:

Combinations	Description
AI (11) + AI (10)	Date and Lot-Number
AI (17) + AI (10)	Expiration Date und Lot-Number

Table 11: AIs in Composite Codes

5.4.2 AI (90)

AI (90) and the following data (which starts with an upper-case letter or a digit) may be used for encoding of FACT IDs. Compression takes place only if AI(90) is the first data element of the sequence.

6 Barcode Symbologies

This chapter describes all supported barcode types. For each barcode the following values are specified:

- Symbology Number
  This number is used in some TEC-IT products to specify the barcode symbology. Developers are usually specifying the barcode type via an enumeration which is documented in the respective developer documentation.
- Valid characters
  Lists the available characters or character sets which can be encoded with the symbology.
- Quiet zone
  This is the recommended quiet zone for the barcode symbology in question. Please note that the quiet zone often depends on your individual application.
- Module width
  The recommended minimal module width of the barcode. This value may be adapted to your special requirements.
- Standard print ratio
  This setting describes the print ratio used by TEC-IT software if no custom ratios are adjusted. For most applications you can use this default value.
- Ratio format
  This value serves as a hint for specifying user defined print ratios.
- Default check digit
  Describes which check digit method is used by default for the barcode symbology in question. For 2D codes check digits are not applicable, these codes are using an error correction scheme.
- Possible check digits
  Provides information whether additional or user defined check digits methods may be adjusted
- Size
  Describes the requirements with respect to the symbol size (if available)
- Print control[1]
  Control character sequence used by TBarCode/SAPwin (Barcode DLL for SAP®).

6.1 Linear Symbologies (1D Codes)

6.1.1 Bookland

The Bookland barcode encodes the ISBN number in EAN-13 format followed by a 5 digit supplemental code. The barcode data always consists of the digits ‘978’ (the EAN article identifier), followed by a 9 digit number and one check digit. You can use the EAN-13 with 5 digits add-on for encoding. The 5 digit add-on barcode is used to encode the book price. For more information refer to section 6.1.39

[1] Listed for the most common bar code types. See user manual for the complete list of print controls.

6.1.2 Codabar (Rationalized Version)

Symbology number:	18
Valid characters:	“0”..”9”, “-“, “$”, “:”, “/”, ”.”, ”+”, “A”, “B”, “C”, “D”
Quiet zone:	left/right: 10X
Module width:	X = 0.19 mm
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	None (eCDNone)
Possible check digits:	User supplied (e.g. Modulo 16)
Symbol size:	+/- 0.066mm Module width Deviation
Print control:	C=CODA

This code was invented 1972 by Monarch Marking Systems for retail purposes. 1977 the American Blood Commission defined Codabar 2 as standard symbology for blood banks (=ABC Codabar).

The characters “A”, “B”, “C”, and “D” are useable as start or stop characters only. The barcode uses 2 element-widths and 4 different start/stop-characters (A, B, C, and D). These start/stop characters can be utilized for additional information – e.g. "B1234B". The print ratio should be in the following range: 1:2 -1:3 (Pr >= 2.25:1). Since the symbology is “self-checking” there is no established check sum method.

The symbology is also known as Code 2 of 7, NW-7, ABC Codabar, USD-4, Monarch, Code-27, Ames code, or Rationalized Codabar.

The “rationalized version” uses 2 different element widths in spite of the original symbology, which used 18 different element widths (Standard Codabar).

- Use the format property to determine the Start and Stop characters (see section 9.3).
- FedEx is using a special variant of the Codabar barcode. The format of the encoded number is as follows: XXXX-XXXX-XXXY with a 4-digit ID at the end. The first 12 digits contain the tracking number. The barcode starts with „C“ (start-character) and ends with „D“ (stop-character).

6.1.3 Code 11

Symbology number:	1
Valid characters:	“0”..”9”, “-“
Quiet zone:	left/right: 10X
Module width:	X= 0.191 mm
Standard print ratio:	1:2.24:3.48:1:2.24
Ratio format:	1B:2B:3B:1S:2S
Default check digit:	None (eCDNone)
Possible check digits:	1 check digit (eCD1Code11) – or 2 check digits (eCD2Code11)
Symbol size:	--

This symbology is mainly used in telecommunications for marking equipment and components. It was invented in 1977 by INTERMEC. It is similar to Code 2 of 5 Matrix. The symbology is not self-checking therefore 2 check digits are recommended. Code 11 is a high-density code, but requires also a high-density output device (mainly because of the print ratio utilized).

6.1.4 Code 128

Symbology number:	20
Valid characters:	ASCII-characters between 0..127
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Automatic (symbology specific). Modulo 103 (eCDCode128)
Possible check digits:	Modulo 10, EAN-14
Symbol size:	--
Print control:	C=128

Code 128 is heavily used in all areas. It is a modern high-density symbology and was invented 1981 by Computer Identics.

TEC-IT software analyzes input data and chooses the best suitable barcode representation with the highest data density. This is done by so-called “subset switching”. 3 different internal characters (=subsets) sets are used:

- Code128A = Upper Case + Non-Printable Characters (ASCII 0-31)
- Code128B = Upper / Lower Case + All Printable Characters
- Code128C = Numeric with doubled density

Code128 uses a built-in check digit (Modulo 103). This check digit is part of the code and cannot be omitted. It is never printed in the human readable text. Scanners are checking it when reading a code but do not deliver the check digit to connected systems.

In conjunction with the symbology character "FNC1" this code is also known as GS1-128 barcode – see section 6.1.24.

6.1.5 Code 128 Subset A

Symbology number:	59
Valid characters:	ASCII-characters between 0..127
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Automatic (symbology specific). Modulo 103 (eCDCode128)
Possible check digits:	Modulo 10, EAN-14
Symbol size:	--
Print control:	C=128A

This is a variant of Code128 which uses character set (subset) A. It is suitable for encoding upper case characters + ASCII control sequences. It switches to other Code128 subsets when required.

6.1.6 Code 128 Subset B

Symbology number:	60
Valid characters:	ASCII-characters between 0..127
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Automatic (symbology specific). Modulo 103 (eCDCode128)
Possible check digits:	Modulo 10, EAN-14
Symbol size:	--
Print control:	C=128B

This is a variant of Code128 which uses character set (subset) B. It is suitable for encoding lower & upper case letters. It switches to other Code128 subsets when required.

6.1.7 Code 128 Subset C

Symbology number:	61
Valid characters:	ASCII-characters between 0..127
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Automatic (symbology specific). Modulo 103 (eCDCode128)
Possible check digits:	Modulo 10, EAN-14
Symbol size:	--
Print control:	C=128C

This is a variant of Code128 which uses character set (subset) C. It is suitable for encoding digits. It switches to other Code128 subsets when required.

6.1.8 Code 2 of 5 Standard (Code 2 of 5 Matrix)

Symbology number:	2
Valid characters:	“0”..”9”
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X>= 0.19 mm
Standard print ratio:	1:3:4.5:1:3
Ratio format:	1B:2B:3B:1S:2S
Default check digit:	None (eCDNone)
Possible check digits:	Modulo 10 (eCDMod10)
Symbol size:	--
Print control:	C=25M

This is a self-checking code. It is used for industrial applications, article numbering, photo development, ticketing.

6.1.9 Code 2 of 5 Data Logic

Symbology number:	6
Valid characters:	“0”..”9”
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	--
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	None (eCDNone)
Possible check digits:	Modulo 10 (eCDMod10)
Symbol size:	--

This symbology is proprietary variant of Code 2 of 5 Standard.

6.1.10 Code 2 of 5 IATA

Symbology number:	4
Valid characters:	“0”..”9”
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X>= 0.19 mm
Standard print ratio:	1:3:1
Ratio format:	1B:2B:1S
Default check digit:	None (eCDNone)
Possible check digits:	Modulo 10 (eCDMod10)
Symbol size:	--
Print control:	C=25A

This is a self-checking code. Start/stop-characters are identical to Code 2 of 5 Industry. It supports distance reading (> 1m) and can be printed with very simple printing techniques.

It is used for baggage handling in air-transport applications (International Air Transport Agency = IATA).

6.1.11 Code 2 of 5 Industrial

Symbology number:	7
Valid characters:	“0”..”9”
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X>= 0.19 mm
Standard print ratio:	1:3:1
Ratio format:	1B:2B:1S
Default check digit:	None (eCDNone)
Possible check digits:	Modulo 10 (eCDMod10)
Symbol size:	--
Print control:	C=25I

6.1.12 Code 2 of 5 Interleaved

Symbology number:	3
Valid characters:	“0”..”9”
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X>= 0.19 mm
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	None (eCDNone)
Possible check digits:	Modulo 10 (eCDMod10)
Symbol size:	--
Print control:	C=25L

Code 2 of 5 Interleaved is in wide-spread use (article-numbering, industrial applications).

This self-checking code offers high data capacity due to encoding pairs of numbers (the first digit is encoded in the bars, the second in the spaces). Thus, this symbology can encode only an even number of digits. If the number of digits is odd a leading zero will be inserted automatically.

6.1.13 Code 2 of 7

This symbology is identical with Codabar 2 Widths and is also known as NW-7 or USD-4. See section 6.1.2

6.1.14 Code 25

Uniform Symbology Specification ITF 2-5. Identical to Code 2 of 5 Interleaved. Another alias is USS ITF 2-5.

6.1.15 Code 39 (3of9)

Symbology number:	8
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	None (eCDNone)
Possible check digits:	Modulo 43 (eCDMod43), Modulo 11 Weight 7 (eCDMod11W7)
Symbol size:	H>=15% of L (H>=6.3 mm!) H: Height of the barcode without human readable text L: width of the barcode
Print control:	C=39

Code 39 is in heavy use in industry, organizations and commerce. It was developed 1974 by INTERMEC and got standardized by ANSI MH 10.8 M-1983 and MIL-STD-1189.

► The start- and stop characters “*” (asterisk) are created automatically and must not be included in the input data. They are not displayed in the human readable text.

Code 39 is a self-checking code. Code concatenation is possible (if the first encoded character is a space subsequent barcodes are concatenated by the scanner). Distance-reading is possible (> 1m).

6.1.16 Code 32

Symbology number:	93
Valid characters:	“0” - “9”
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	0,25 <= X <= 0.254 mm
Standard print ratio:	1:2.5:1:2.5
Ratio format:	1B:2B:1S:2S
Default check digit:	Module 10 Luhn Reversed (eCDMod10LuhnRev)
Possible check digits:	Module 10 Luhn Reversed (eCDMod10LuhnRev)
Symbol size:	--

It is used by the Italian Pharma Industry. The code is also called *Italian Pharmacode*.

The Code 32 number, consisting of 9 digits, is converted to an equivalent Code 39 Barcode of 6 characters. The letter the human readable text is prepended by “A” which is not encoded.

6.1.17 Code 39 Extended

Symbology number:	9
Valid characters:	ASCII-characters between 0..127
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	None (eCDNone)
Possible check digits:	Modulo 43 (eCDMod43), Modulo 11 Weight 7 (eCDMod11W7)
Symbol size:	H>=15% of L (H>=6.3 mm!) H: Height of the barcode without human readable text L: width of the barcode
Print control:	C=39E

Code 39 Extended is rarely used because Code 128 offers much better compression. Code 39 Extended uses the same symbology as Code 39 but encodes also lower-case letters and special characters („+A“ results in a lower case „a“ when scanned). Scanner must be configured correctly for decoding Code39 Extended.

► The start- and stop characters “*” (asterisk) are created automatically and must not be included in the input data. They are not displayed in the human readable text.

6.1.18 Code 93

Symbology number:	25
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “$”, “/”, “+”, “%”
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Automatic (symbology specific). Modulo 47 (eCD2Mod47)
Symbol size:	--
Print control:	C=93

Code 93 was invented 1982 by INTERMEC to achieve better information densities (compared to Code 39). Code concatenation is possible (if the first encoded character is a space subsequent barcodes are concatenated by the scanner).

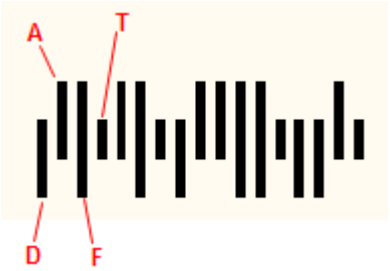
6.1.19 Code 93 Extended

Symbology number:	62
Valid characters:	ASCII-characters between 0..127
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Automatic (symbology specific). Modulo 47 (eCD2Mod47)
Symbol size:	--
Print control:	C=93E

Based upon Code 93 but encodes the complete ASCII character set. One of the four available control characters is used to shift into the ASCII-character table.

6.1.20 DAFT Code

Symbology number:	93
Valid characters:	“D”, “A”, “F”, “T” or “d”, “a”, “f”, “t”
Quiet zone:	left/right: 2 mm
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	None
Symbol size:	--



DAFT Code is no symbology. It is a technique to generate arbitrary postal codes (like for instance the Australian Postal Codes or the Royal Mail 4 State code).

Each input character stands for a specific bar type and there are 4 different bar types:

- “D” or “d”: Descender
- “A” or “a”: Acsender
- “F” or “f”: Full
- “T” or “t”: Transmitter

6.1.21 DOD Logmars

DOD Logmars stands for Department of Defense Logmars. Same as Logmars (see section 6.1.45).

6.1.22 DUN-14

The DUN-14 (Distribution Unit Number) is not a barcode type. It's a numbering system for shipping containers. The DUN-14 uses the ITF-14 or the EAN-14 barcode symbols. Modern installations always use the EAN-14 (EAN-128) to encode the DUN-14.

The DUN-14 encodes the following data:

- The first digit represents the number of units in the container: 1=6 units, 2=10 units, 3=12 units, 4=20 units, 5=24 units. (The digits 6,7 and 8 are standing for other numbers of units.)
- The next 12 digits are representing the product number. In general this is the EAN-13 number without check digit.
- The last digit is the check digit.

6.1.23 DUNS

This is not a barcode standard. DUNS is a nine-digit number assigned and maintained by Dun and Bradstreet to identify unique business establishments. DUNS numbers are assigned worldwide and include US, Canadian, and international organizations.

6.1.24 EAN-128 (GS1-128)

The EAN-128 code was renamed to GS1-128. It is the same as the UCC-128 and sometimes referenced as UCC/EAN-128 in this document.

Symbology number:	16
Valid characters:	ASCII-characters between 0..127 (maximum: 48 characters)
Quiet zone:	left/right: 10X, min. ¼ in
Module width:	see Code128
Standard print ratio:	see Code128
Ratio format:	see Code128
Default check digit:	Automatic (symbology specific). Modulo 103 (eCDEAN128)
Possible check digits:	Modulo 10, EAN-14
Symbol size:	the maximum physical width is 165 mm
Print control:	C=G128 / C=E128

The GS1-128 code is based upon Code-128. It has an FNC1 character at the 1st position (after the start code). This allows scanners and data processing software to differentiate GS1-128 from other symbologies.

The GS1-128 code is in wide spread use (retail, logistics, food and beverage, etc.). It is used for marking transport-units in supply chains. Besides the article-number it encodes quantities, weights, prices, dates, and other information in a structured way. This is supported by the use of so-called Application Identifiers (AIs) – see chapter 5. Within the GS1 system these Application Identifiers (AIs) prefix the encoded data.

► Please note: The TEC-IT barcode software automatically inserts the FNC1 character at the beginning and computes the internal check digit (Modulo 103).

6.1.25 EAN-13

Symbology number:	13
Valid characters:	“0”..”9”, 12 digits + 1 check digit
Quiet zone:	left: 11X, right: 7X
Module width:	X=0.33mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	EAN-13 (eCDEAN13)
Possible check digits:	User supplied
Symbol size:	Standardized symbol sizes (see EAN).
Print control:	C=E13

This code is reserved for the International Article Number[2] administered by the standards organization GS1. The numbers encoded into EAN bar codes are known as Global Trade Item Numbers, for EAN-13 they are called GTIN-13.

EAN 13 is used for identifying articles or products uniquely (often sold at retail point of sale). Encoded are a 2-digit country code, 5-digits manufacturer code and a 5 digits products code. JAN and IAN are identical to EAN-13.

The check digit is calculated automatically if it not specified in the input data (that is when only 12 digits are used for creating the code).

[2] Formerly European Article Number (EAN)

6.1.26 EAN-13 with 2 Digits Add-On

Symbology number:	14
Valid characters:	“0”..”9”, 14 digits + 1 check digit
Quiet zone:	left: 7-10X, right: 5X
Module width:	X=0.33mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	EAN-13 (eCDEAN13)
Possible check digits:	User supplied
Symbol size:	Standardized symbol sizes (see EAN).

This symbology extends EAN-13 with 2 add-on digits (see also EAN-8 with 2 Digits Add-On). The check digit will be calculated automatically if not specified in the input data (e.g. 978020137968612).

6.1.27 EAN-13 with 5 Digits Add-On

Symbology number:	15
Valid characters:	“0”..”9”, 17 digits + 1 check digit
Quiet zone:	left: 7-10X, right: 5X
Module width:	X=0.33mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	EAN-13 (eCDEAN13)
Possible check digits:	User supplied
Symbol size:	Standardized symbol sizes (see EAN).

This symbology extends EAN-13 with 5 add-on digits (see also EAN-8 with 5 Digits Add-On). The check digit will be calculated automatically if not specified in the input data (e.g. 978020137968612345).

6.1.28 EAN-14

Symbology number:	72
Valid characters:	ASCII-characters between 0..127, 13 digits + 1 check digit
Quiet zone:	see GS1-128, ITF-14
Module width:	see GS1-128, ITF-14
Standard print ratio:	see GS1-128, ITF-14
Ratio format:	see GS1-128, ITF-14
Default check digit:	EAN-14 (eCDEAN14)
Possible check digits:	User supplied
Symbol size:	see GS1-128, ITF-14

EAN-14 is used to encode the GTIN (Global Trade Item Number) for numbering trade items. Within the GS1 system you can use 2 symbologies for encoding the GTIN:

- GS1-128 (UCC/EAN-128)
- ITF-14.

EAN-14 uses GS1-128 with Application identifier (AI) 01. The AI is prefixed automatically; it must not be part of the input data. The check digit is calculated automatically if not specified in the input data (that is when only 13 digits are used).

6.1.29 EAN-18

Same as SSCC-18 (see section 6.1.55).

6.1.30 EAN-8

Symbology number:	10
Valid characters:	“0”..”9”, 7 digits + 1 check digit
Quiet zone:	left/right: 7X
Module width:	X=0.33mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	EAN-8 (eCDEAN8)
Possible check digits:	User supplied
Symbol size:	Standardized symbol sizes. See EAN.
Print control:	C=E8

This symbology is derived from the longer EAN-13 bar code and encodes the GTIN-8, which is another set of product identifiers from the GS1 system.

EAN 8 is used for marking small articles with restricted space. It encodes a unique article number, which consists of a GS1 prefix, an item reference (no company prefix) and a checksum digit.

The check digit is calculated automatically if not specified in the input data (that is when only 7 digits are used for creating the code).

6.1.31 EAN-8 with 2 Digits Add-On

Symbology number:	11
Valid characters:	“0”..”9”, 9 digits + 1 check digit
Quiet zone:	left: 7-10X, right: 5X
Module width:	X=0.33mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	EAN-8 (eCDEAN8)
Possible check digits:	User supplied
Symbol size:	Standardized symbol sizes. See EAN.
Print control:	C=E8+2

This symbology extends EAN-8 with 2 add-on digits which are mainly used for encoding the price or the weight. The check digit will be calculated automatically if it not specified in the input data (e.g. 9031101712).

This symbology is also used for bar-coding paperbacks or newspapers. In this case a 2(3) digits country code and a 4(5) article code are encoded.

6.1.32 EAN-8 with 5 Digits Add-On

Symbology number:	12
Valid characters:	“0”..”9”, 12 digits + 1 check digit
Quiet zone:	left: 7-10X, right: 5X
Module width:	X=0.33mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	EAN-8 (eCDEAN8)
Possible check digits:	User supplied
Symbol size:	Standardized symbol sizes. See EAN.
Print control:	C=E8+5

This symbology extends EAN-8 with 5 add-on digits which are mainly used for encoding the price or the weight. The check digit will be calculated automatically if it not specified in the input data (e.g. 0725272072077).

6.1.33 FIN Code (Fahrzeug-Identifizierungsnummer)

This code is identical to the VIN Code (Vehicle Identification Number).

6.1.34 Flattermarken

Symbology number:	28
Valid characters:	“0”..”9”
Quiet zone:	Application dependent
Module width:	2-3 mm
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	None (eCDNone)
Symbol size:	Symbol height between 5 and 10mm
Print control:	C=FLM

This is a special “barcode” used for recognizing the correct sequence of pages in print-shops.

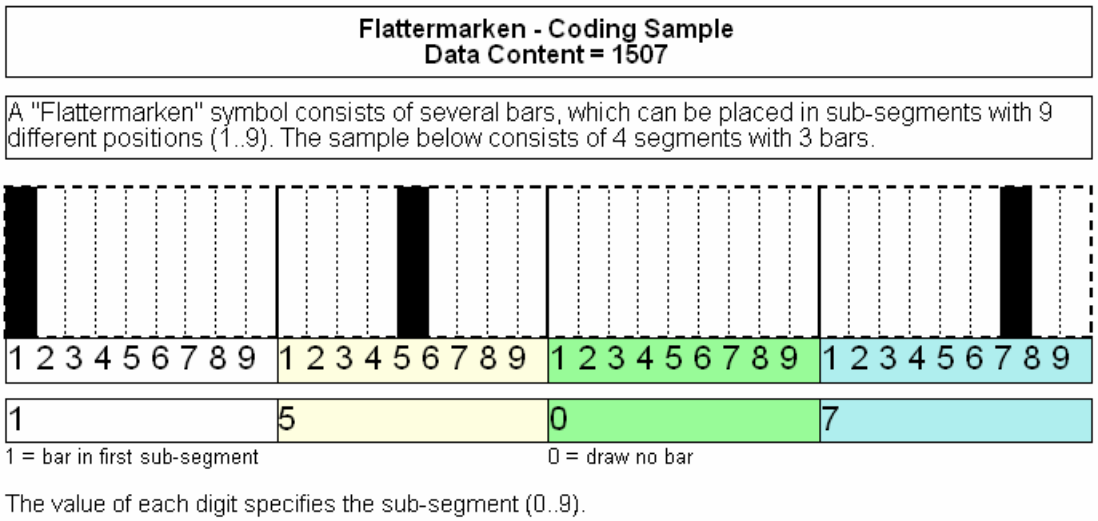


Figure 9: Flattermarken Coding Sample

6.1.35 GS1-128

The GS1-128 is simply another name for the existing EAN-128 (or UCC-128) barcode. The EAN and UCC standardization organizations founded GS1 in order to globalize (and harmonize) their different standards. See section 6.1.24.

6.1.36 GTIN

GTIN stands for Global Trade Item Number and is not a barcode symbology.

A GTIN is used for the unique identification of trade items worldwide within the GS1 (EAN.UCC) system. The GTIN may be encoded in UPC-A, EAN-8, EAN-13, EAN-14, ITF-14 and GS1-128 symbologies.

Depending on the number of digits available in the bar code, the GTIN is divided into GTIN-8, GTIN-12, GTIN-13 and GTIN-14.

6.1.37 HIBC

HIBC is an abbreviation for Health Industry Bar Code. The HIBC is a numbering system – and not a specific barcode symbology. It is used for product identification codes as well as for worldwide identification of shipping units.

The primary code contains the manufacturer id, the article number, the package number and a check digit. The secondary code contains the serial number, the expiration date and the units per package.

The following symbologies are commonly used for encoding: Code 39, Code 128, Codablock F. For more information, please refer to section 6.4 and to http://www.hibcc.org.

6.1.38 I-2/5

Short for Code 2 of 5 Interleaved (see section 6.1.12). It is also known as Code 25.

6.1.39 ISBN Code (ISBN 13)

Symbology number:	69 (without add-on) or 23 (with add-on)
Valid characters:	"0".."9", 12 digits + 1 check digit + optionally 5 add-on digits
Quiet zone:	See EAN13 / EAN13 + 5 Digits
Module width:	See EAN13 / EAN13 + 5 Digits
Standard print ratio:	See EAN13 / EAN13 + 5 Digits
Ratio format:	See EAN13 / EAN13 + 5 Digits
Default check digit:	EAN-13 (eCDEAN13)
Possible check digits:	User supplied
Symbol size:	See EAN13 / EAN13 + 5 Digits
Print control:	C=ISBN

ISBN is the abbreviation of International Standard Book Number. It uses the symbology EAN-13 and can be optionally extended with 5 Add-On Digits. The add-on is used for additional pricing information. For more information, please refer to http://www.isbn.org.

The EAN-13 barcode for a book is generated from the ISBN number assigned to it. When encoding ISBN in an EAN-13 barcode, the ISBN number is preceded by the number 978 and the ISBN check digit is not used (the rightmost digit of the ISBN). When the ISBN number is encoded in the EAN-13 barcode in this way it is often called Bookland. A 5 digit add-on barcode is optional and can contain the price of the book.

► ISBN codes with 10 digits are automatically converted to the newer ISBN with 13 digits!

6.1.39.1 Example

You got the ISBN Number 1-56592-843-1 and a value for the second small barcode (as for the price) of 90000.

Therefore choose the symbology EAN 13 + 5 Digits encode the following data:
97815659284390000. The check digit is calculated automatically (5).

6.1.39.2 ISBN Additional Data

The smaller barcode which is on the right side of the ISBN code is a 5-digit additional code and can be used for additional information (e.g. like pricing).

Example:

Price	Encoded
$10.95	51095
$3.00	50300
$99.99 +	59999

Table 12: ISBN Sample

The preceding digit ”5” (therefore also called EAN-5) marks the price encoded in US Dollar. Bookstores recommend EAN-5. If there is no price, the value 90000 will be encoded instead (EAN-9). This value is used when no additional information is available.

► For scanner in US bookstores ISBN, EAN codes are not readable without the 5 digit add-on (which is called EAN-5 or EAN-9, depending on the first number encoded in the add-on).

First Digit	Description
5	$ US
6	$ Canada
4	$ New Zealand
3	$ Australia
0 & 1	British pounds

Table 13: ISBN Encoding – Country and Currency

Values	Description
59999	Price for $100 and more
90000-98999	For internal purposes (BISG recommend 90000 if no price is given)
99000-99999	Reserved for the industry market
99990-99999	Reserved for Nat’l Ass’n College Stores (NACS)
99990	NACS used books
99991	NACS copies

Table 14: ISBN Encoding – Price Samples

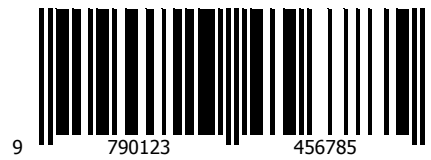
6.1.40 ISBT-128

This is the International Standard for the transfer of information associated with tissue transplantation and Blood Transfusion. It provides a globally unique donation numbering system, internationally standardized product definitions, and standard data structures for bar-coding and electronic data interchange.

It uses (but is not limited to) Code128B. For more information, please refer to http://iccbba.org.

6.1.41 ISMN

Symbology number:	24
Valid characters:	“0”..”9”, 12 digits + 1 check digit
Quiet zone:	See EAN13
Module width:	See EAN13
Standard print ratio:	See EAN13
Ratio format:	See EAN13
Default check digit:	EAN-13 (eCDEAN13)
Possible check digits:	User supplied
Symbol size:	See EAN13



ISMN stands for International Standard Music Number. The ISMN is a standardized international code, which identifies printed music.

The ISMN is preceded by the digits 9790. The ISMN (=EAN-13) check digit is calculated and appended automatically!

For more information, please refer http://www.ismn-international.org/.

6.1.42 ISSN

Symbology number:	26 (without add-on) or 27 (with add-on)
Valid characters:	"0"..."9", 12 digits + 1 check digit + optionally 2 add-on digits
Quiet zone:	See EAN13 / EAN13 + 2 Digits
Module width:	See EAN13 / EAN13 + 2 Digits
Standard print ratio:	See EAN13 / EAN13 + 2 Digits
Ratio format:	See EAN13 / EAN13 + 2 Digits
Default check digit:	EAN-13 (eCDEAN13)
Possible check digits:	User supplied
Symbol size:	See EAN13 / EAN13 + 2 Digits

ISSN stands for International Standard Serial Number. The ISSN is a standardized international code, which identifies any serial publication independently of its country of origin, its language or alphabet, or its frequency, medium, etc.

The ISSN is preceded by the digits 977. The check digit of an 8-digit ISSN code (the last of the 8 digits) must be omitted! A two digit price code, almost always "00", is added to the end. Finally the EAN-13 check digit (calculated automatically by TEC-IT software) is added.

Optionally the issue number can be appended as 2-digit add-on.

For more information, please refer to http://www.issn.org.

6.1.43 ITF-14

Symbology number:	89
Valid characters:	13 digits + 1 check digit
Quiet zone:	left/right: 10X
Module width:	0.051 – 1.02 mm (nominal size)
Standard print ratio:	1:2.5:1:2.5
Ratio format:	1B:2B:1S:2S
Default check digit:	Mod-10 (eCDMod10)
Symbol size:	152.43 x 41.60 mm at nominal size (including Quiet Zone and Bearer Bars)
Print control:	C=I14

ITF-14 encodes the GTIN-14, this is a 14-digit number used to identify trade items at various packaging levels (also referred as GTIN).

ITF-14 is based on the Code 2 of 5 Interleaved symbology. It encodes 14 digits (13 usable digits + 1 modulo 10 check digit). The check digit method complies with the EAN-14 method.

ITF-14 uses "Bearer Bars", these are horizontal or surrounding bars, to prevent misreads.

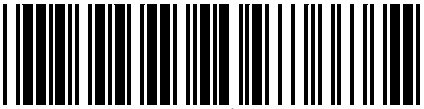
- Symbol size and Bearer Bars are depending on printing method and scanning environment – for details please follow the GS1 specification.
- When using vertical Bearer Bars, they must have at least a distance of 10 modules to the bar code. This is why you have to adjust a minimum of 12 modules for the quiet zone to see a vertical Bearer Bar in TEC-IT Software.

6.1.44 JAN

JAN is the abbreviation for Japanese Article Number. This code uses EAN-13 symbology. The first two digits have to be either 45 or 49 for identifying Japan.

6.1.45 LOGMARS

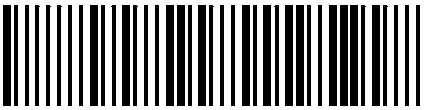
Symbology number:	50
Valid characters:	“0”..”9”, “A”..”Z”, “+“, “-”, “*”, “/”, ”.”, ”$”, Space
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X>=0.19 mm
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	None (eCDNone)
Possible check digits:	Modulo 43 (eCDMod43), Modulo 11 Weight 7 (eCDMod11W7)
Symbol size:	H>=15% of L (H>=6.3 mm!) H: Height of barcode symbol without human readable text L: Width of barcode



This is a special variant of Code 39 used by the U.S. Department of Defense. This standard defines acceptable ranges for a number of variables, include density, ratio, bar height, and size of the human-readable interpretation line. The modulo-43 check digit, which is optional for Code 39, is defined and recommended in the specification.

6.1.46 MSI

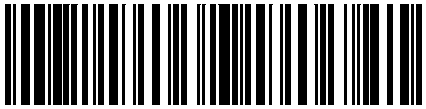
Symbology number:	47
Valid characters:	“0”..”9”
Quiet zone:	left/right: 12X
Module width:	--
Standard print ratio:	1:2:1:2
Ratio format:	1B:2B:1S:2S
Default check Digit:	MSI 1 digit (eCDMSI1)
Possible check digits:	User supplied and MSI 2 digit (eCDMSI2)
Symbol size:	14 digits incl. check digits
Print control:	C=MSI



The MSI-Code is a variant of the Plessey-Code. MSI uses various check digit calculation methods - TEC-IT implemented the 2 most common used. Please contact TEC-IT if you need a different one.

6.1.47 NVE-18 (Nummer der Versandeinheit)

Symbology number:	75
Valid characters:	“0”..”9”
Check digit method:	Modulo10
Default check digit:	Modulo10
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Automatic (symbology specific). Modulo 10 (eCDMod10) and Modulo 103 (eCDEAN128)
Symbol size:	--



NVE stands for “Nummer der Versandeinheit” (a German term for tracking number). This code uses an EAN-128 symbology with a prefixed Application Identifier (AI) 00. The AI “00” is inserted automatically and must not be included in the input data. It is similar to SSCC-18.

6.1.48 NW-7

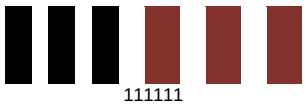
This symbology is identical with Codabar 2 Widths and is also known as Code 2 of 7.

The Japanese version of the Codabar 2 Widths barcode is called NW7. Another name for this symbology is Code 2 of 7 – see section 6.1.2

The following symbols can be encoded in NW7: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, -, $, /, ., +

6.1.49 Pharmacode One-Track

Symbology number:	51
Valid characters:	“0”..”9” or binary
Quiet zone:	left/right: 6 mm
Module width:	2-3 mm
Standard print ratio:	1:3:2:4:2:3
Ratio format:	1B:2B:1C:2C:1S:2S
Default check digit:	None (eCDNone)
Symbol size:	5-10 mm height



This code was invented by Laetus®. It is used in pharmaceutical areas. Pharmacode supports colored bars. The data for the bars/spaces is encoded directly in the property *Text*:

- “0” is used for a narrow bar (the width of these bars are enlarged after a color change, according to ratio 1C)
- “1” is used for a wide bar (the width of these bars are enlarged after a color change, according to ratio 2C)
- “b” is used for a narrow bar
- “c” is used for a wide bar

When using colored bars, the color is specified by the escape sequence **\C***rrggbb* (where *rrggbb* is an RGB value; each letter stands for a hexadecimal digit (0-f); *rr* stands for the red, *gg* for the green, and *bb* for the blue value part). The sequence **\Cx** resets the color to default. The barcode *Format* must be set to *D* and *EscapeSequences* must be activated.

The data for the barcode in the example above is as follows (the color escape sequence is not displayed in the human readable text): 111\C2a3282111.

6.1.50 Pharmacode Two-Track

Symbology number:	53
Valid characters:	numeric [0..9] and generic;
Quiet zone:	left/right: 6 mm
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	None (eCDNone)
Symbol size:	see Notes

This code was invented and specified by Laetus®. Pharmacode assigns numeric values to the bars. It is used for medicine packing in pharmaceutically area; for small labels. Usually Pharmacode is printed without a human readable text.

The dimensions are:

- 2-track bar width: 1 mm
- space bars: 1 mm
- bar height above/below: 4-6 mm
- height of the long bar: 8-12 mm

It offers a high printing tolerance and is readable very fast (200 readings per second).

6.1.51 Pharma Zentralnummer (PZN)

6.1.51.1 PZN7: 6 Digits + 1 Check Digit (valid until 2012/12/31)

Symbology number:	52
Valid characters:	“0”..”9”, 6 digits + 1 check digit
Quiet zone:	see Code 39
Module width:	see Code 39
Standard print ratio:	see Code 39
Ratio format:	see Code 39
Default check digit:	PZN check digit (eCDPZN)
Possible check digits:	User supplied
Symbol size:	see Code 39

6.1.51.2 PZN8: 7 Digits + 1 Check Digit (valid from 2013/01/01)

Symbology number:	113
Valid characters:	“0”..”9”, 7 digits + 1 check digit
Quiet zone:	see Code 39
Module width:	see Code 39
Standard print ratio:	see Code 39
Ratio format:	see Code 39
Default check digit:	PZN check digit (eCDPZN)
Possible check digits:	User supplied
Symbol size:	see Code 39

PZN uses Code 39 as the base symbology. It uses a special check digit and the human readable text always contains the prefix “PZN-“ (which is not encoded in the barcode data).

PZN7 is valid until the end of 2012 and will be replaced by *PZN8* with the beginning of year 2013. *PZN7* numbers will stay valid but are going to be extended to 8 digits by a leading “0”.

6.1.52 Plessey Code

Symbology number:	46
Valid characters:	numeric [0..9] A, B, C, D, E, F
Quiet zone:	left/right: 12X
Module width:	--
Standard print ratio:	1:2:1:2
Ratio format:	1B:2B:1S:2S
Default check digit:	Plessey (eCDPlessey)
Possible check digits:	User supplied
Symbol size:	--

Plessey code is in use primarily in libraries. It is a pulse-width modulated code and was developed by Plessey Company Limited in UK. The basic encoding principle in Plessey Code was used by MSE Data Corporation to construct its MSI barcode.

The check digit is calculated with a polynomial CRC algorithm and is always part of the symbology.

6.1.53 Rational Codabar

Is the same as Codabar – see section 6.1.2.

6.1.54 SCC-14

Shipping Container Code – see DUN-14.

6.1.55 SSCC-18

Symbology number:	48
Valid characters:	“0”..”9”, 17 digits + 1 check digit
Quiet zone:	see EAN 128, sometimes ¼ inch
Module width:	see EAN 128
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Automatic (symbology specific). Modulo 10 (eCDMod10) and Modulo 103 (eCDEAN128)
Symbol size:	see GS1-128
Print control:	C=SSCC18

SSCC-18 is used for encoding the Serial Shipping Container Code. It is used for the unique identification of trade items world-wide. SSCC-18 is based on the GS1-128 symbology with Application Identifier (AI) 00. The check digit is encoded automatically if 17 digits are used for the input data.

The structure of the SSCC-18 is as follows:

- The first two digits represent the Application Identifier (AI). The AI is always ‘00’.
- The next digit is the Packaging Identifier.
- The Packaging Identifier is followed by the ILN (the International Location Number) of the manufacturer (7 digits).
- The next 9 digits represent the Carton Serial Number.
- The last digit is the check digit.

6.1.56 Telepen Alpha

Symbology number:	32
Valid characters:	ASCII characters between 0..127
Quiet zone:	n/a
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	None (eCDNone)
Symbol size:	--

Telepen Alpha is the alphanumeric variant of Telepen.

6.1.57 Telepen

Symbology number:	87
Valid characters:	pairs of digits, pairs of one digit with an 'X'
Quiet zone:	n/a
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	None (eCDNone)
Symbol size:	--

Telepen can encode pairs of characters only. A pair must consist of 2 digits or of one digit and the letter 'X'.

6.1.58 UCC-128

Same as the EAN-128 (see section 6.1.24).

6.1.59 UPC 12 Digits

Same as the UPC-A (see section 6.1.60).

6.1.60 UPC Version A

Symbology number:	34
Valid characters:	"0".."9", 11 digits + 1 check digit
Quiet zone:	9X
Module width:	0,33 mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	UPC-A (eCDUPCA)
Possible check digits:	User supplied
Symbol size:	H=26.26mm; B=37.29mm; variations allowed (see UPC-A spec).
Print control:	C=UA

UPC A is used in the United States for marking of products in retail applications (similar to EAN).

The numbers encoded into UPC bar codes are known as Global Trade Item Numbers, for UPC-A they are called GTIN-12.

UPC-A is mainly used for scanning of trade items at the point of sale. The article number is maintained by GS1 US and identifies manufacturer and product uniquely.

The code (11 digits + 1 check digit) is built from one system-digit, 5 digits manufacturer code and 5 digits product code. The check digit is calculated automatically if not specified in the input data (that is when only 11 digits are used for the code).

6.1.61 UPC Version A, 2 Digits Add-On

Symbology number:	35
Valid characters:	“0”..”9”, 13 digits + 1 check digit
Quiet zone:	left: 9-12X, right: 5X
Module width:	see UPC-A
Standard print ratio:	see UPC-A
Ratio format:	see UPC-A
Default check digit:	UPC-A (eCDUPCA)
Possible check digits:	User supplied
Symbol size:	see UPC-A
Print control:	C=UA+2

It is identical to UPC-A, but with 2 add-on digits. The check digit will be calculated automatically if it is not specified in the input data (e.g. 725272720707**1**2). The check digit is not displayed in the human readable text.

6.1.62 UPC Version A, 5 Digits Add-On

Symbology number:	36
Valid characters:	“0”..”9”, 16 digits + 1 check digit
Quiet zone:	left: 9-12X, right: 5X
Module width:	see UPC-A
Standard print ratio:	see UPC-A
Ratio format:	see UPC-A
Default check digit:	UPC-A (eCDUPCA)
Possible check digits:	User supplied
Symbol size:	see UPC-A
Print control:	C=UA+5

It is identical to UPC-A, but with 2 add-on digits. The check digit will be calculated automatically if it is not specified in the input data (e.g. 725272720707**1**2345). The check digit is not displayed in the human readable text.

6.1.63 UPC Version E

Symbology number:	37
Valid characters:	“0”..”9”, 7 digits + 1 check digit
Quiet zone:	left: 9X, right: 7X
Module width:	--
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	UPC-E (eCDUPCE)
Possible check digits:	User supplied
Symbol size:	--
Print control:	C=UCE

UPC-E is used for product marking and article bar-coding. The code must begin with “0” or “1”. The check digit is computed automatically if it is not specified in the input data (that is when only 7 digits are used for creating the code).

6.1.64 UPC Version E, 2 Digits Add-On

Symbology number:	38
Valid Digits:	“0”..”9”, 9 digits + 1 check digit
Quiet zone:	left: 9-12X, right: 5X
Module width:	see UPC-E
Default check digit:	see UPC-E
Ratio format:	see UPC-E
Check digit method:	UPC-E (eCDUPCE)
Possible check digits:	User supplied
Symbol size:	--
Print control:	C=UCE+2

This code is identical to UPC Version E, but with 2 add-on digits. The check digit will be calculated automatically if not specified in the input data (e.g. 0123456512). The check digit is not displayed in the human readable text.

6.1.65 UPC Version E, 5 Digits Add-On

Symbology number:	39
Valid Digits:	“0”..”9”, 12 digits + 1 check digit
Quiet zone:	left: 9-12X, right: 5X
Module width:	see UPC-E
Standard print ratio:	see UPC-E
Ratio format:	see UPC-E
Default check digit:	UPC-E (eCDUPCE)
Possible check digits:	User supplied
Symbol size:	--
Print control:	C=UCE+5

This code is identical to UPC Version E, but with 2 add-on digits. The check digit will be calculated automatically if not specified in the input data (e.g. 0123456512345). The check digit is not displayed in the human readable text.

6.1.66 UPC SCS (Shipping Container Symbols)

UPC SCS stands for Shipping Container Symbol. ITF-14 is based on Code 2of 5 interleaved as barcode symbology, but is rendered with bearer bars.

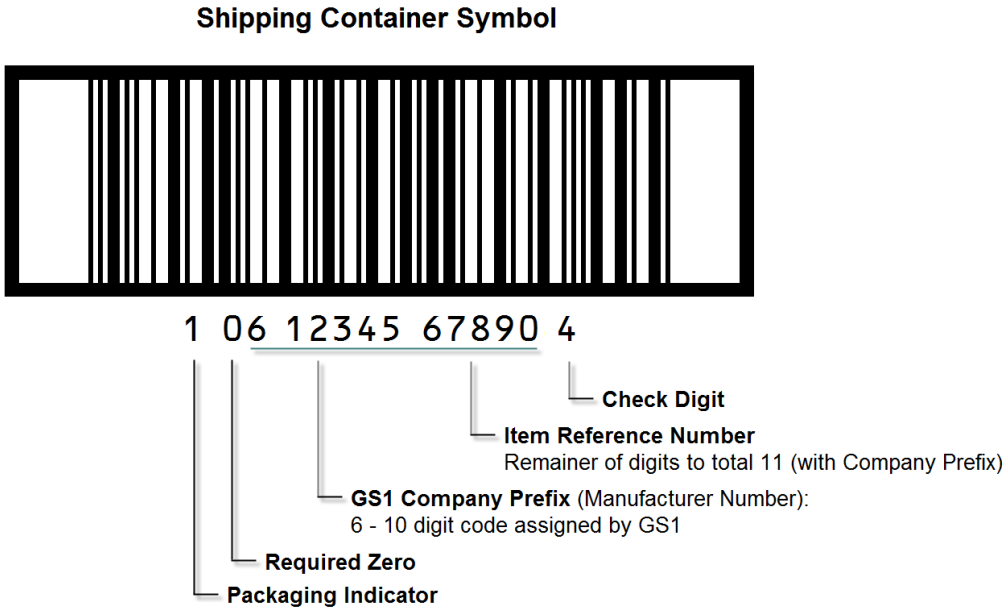


Figure 10: UPC Shipping Container Symbol (SCS)

The UPC Shipping Container Symbol (SCS) is very similar in structure to the Universal Product Code (UPC). Both employ a unique GS1/UCC company prefix (assigned by GS1) and a 1 to 5-digit item number (assigned by the manufacturer, depending on the number of digits in the company-prefix). Each employs a check digit at the end of the code.

The SCS also has a packaging indicator field preceding the UCC company prefix. Its symbology is called Interleaved 2 of 5 (I-2/5) and uses a series of wide and narrow bands and spaces to represent digits and is surrounded on two or four sides by a frame called a bearer.

The packaging indicator (historically called an assortment indicator) can be any single digit (except 8 which is reserved for future use):

Packaging Indicator	Description
0	Is always used when the UPC code on the case and on the individual items inside the case are different or when both a UPC Version A symbol and a UPC Shipping Container Symbol (I-2/5) must appear on the same carton (for products where the shipping container also acts as the package for the consumer product).
1	Is used traditionally when the UPC code on the case and on the individual items inside the case are the same.
1-7	Can be used to signify a range of packaging levels
8	Reserved for future use
9	Is used only to signify a variable content shipment. The 9 indicates to the scanner that a mandatory variable content add-on symbol follows the primary symbol.

Table 15: Shipping Container Symbol Packaging Indicator

6.1.67 USD-4

This symbology is identical with Codabar 2 Widths and is also known as Code 2 of 7 and as NW-7.

6.1.68 USS ITF 2-5

Uniform Symbology Specification ITF 2-5. Identical to Code 2 of 5 Interleaved. Another alias is Code 25.

6.1.69 USS Code 128

USS Code 128 stands for Uniform Symbology Specification Code 128. It is identical to Code 128.

6.1.70 USS Code 39

USS Code 39 stands for Uniform Symbology Specification Code 39. It is identical to Code 39.

6.1.71 VIN Code (Vehicle Identification Number)

Symbology number:	73
Valid characters:	“0”..”9”, “A”..”Z” (without “I”, “O”, and “Q”)
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	None (eCDNone)
Possible check digits:	VIN (eCDVin)
Symbol size:	H>=15% of L (H>=6.3 mm!) H: Height of the barcode without human readable text L: width of the barcode

VIN Code is used for vehicle identification. It is based on Code 39, but does not contain start and stop characters. The set of valid characters consists of digits and upper case letters. The letters “I”, “O”, and “Q” are not allowed because they could be easily mixed up with the digits “0”, and “1”.

VIN Code is implemented differently in Europe and North America. Both kinds are compatible but the North American version is defined more strictly. So the check digit calculation method is only valid for the North American implementation of the code.

6.2 Postal Codes (Linear/1D)

6.2.1 Australian Post Customer

Symbology number:	63
Valid characters:	“0”..”9”, 8 digits
Quiet-zone:	left/right: 6 mm, top/bottom: 2 mm
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Size:	see Notes
Print control:	see Notes
Print control:	C=APC37

This barcode is used by the Australian Post for marking shipments. Special code variants are available for redirections, replies and so on. The barcode height is between 4.2mm and 5.8mm. The module width should be adjusted to 0.47 mms. Usual no readable text is displayed. The length will depend on the use of additional bars (code variants Customer 2 and Customer 3).

Due to its number of bars (37) Australian Post Customer is also called *Australia Post 37-CUST*.

6.2.2 Australian Post Customer 2

Symbology number:	64
Valid characters:	“0”..”9”, “A”..”Z”, “a”..”z”, Space, “#”
Quiet zone:	left/right: 6 mm, top/bottom: 2 mm
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Symbol size:	see Australian Post Customer

This is the same barcode as the Australian Post Standard Customer, but with additional 5 characters for customer specific data. The first 8 characters must be digits. This symbology is also called *Australia Post 52-CUST* (Due to its 52 bars).

6.2.3 Australian Post Customer 3

Symbology number:	65
Valid characters:	“0”..”9”, “A”..”Z”, “a”..”z”, Space, “#”
Quiet zone:	left/right: 6 mm, top/bottom: 2 mm
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Symbol size:	see Australian Post Customer

This is the same barcode as the Australian Post Standard Customer, but with additional 10 characters for customer specific data. The first 8 characters must be digits. This symbology is also called *Australia Post 67-CUST* (Due to its 67 bars).

6.2.4 Australian Post Redirection

Symbology number:	68
Valid characters:	“0”..”9”, 8 digits
Quiet zone:	left/right: 6 mm, top/bottom: 2 mm
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Symbol size:	see Australian Post Customer

6.2.5 Australian Post Reply Paid

Symbology number:	66
Valid characters:	“0”..”9”, 8 digits
Quiet zone:	left/right: 6 mm, top/bottom: 2 mm
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Symbol size:	see Australian Post Customer

6.2.6 Australian Post Routing

Symbology number:	67
Valid characters:	“0”..”9”, 8 digits
Quiet zone:	left/right: 6 mm, top/bottom: 2 mm
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Symbol size:	see Australian Post Customer

6.2.7 Brazilian CEPNet / Brazilian Postal Code

Symbology number:	54
Valid characters:	“0”..”9”, 8 digits + 1 check digit
Quiet zone:	vertical: 1/25 inch horizontal: 1/8 inch
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	POSTNET (eCDPostNet)
Symbol size:	8 digits, 1 check digit

This code is used by the Brazilian Postal Services. An 8 digit ZIP-code is encoded. The check digit is calculated automatically. It cannot be specified in the input data.

The barcode height should be adjusted to 3.2 mms; the module width to 0.423 mms; usually no plain text is displayed. The encoding is based on US Postal codes.

6.2.8 Deutsche Post Identcode

Symbology number:	22
Valid characters:	“0”..”9”, 11 digits + 1 check digit
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	--
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	Automatic (symbology specific). DP Identcode (eCDDPIdent)
Symbol size:	--

This symbology is used by Deutsche Post. The code is basically a Code 2 of 5 interleaved enhanced with a special check digit calculation.

6.2.9 Deutsche Post Leitcode

Symbology number:	21
Valid characters:	“0”..”9”, 13 digits + 1 check digit
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	--
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	Automatic (symbology specific). DP Leitcode (eCDDPLeit)
Symbol size:	--

This symbology is used by Deutsche Post. The code is basically a Code 2 of 5 Interleaved enhanced with a special check digit calculation. It is used for encoding the ZIP-Code, Street and number of the shipment.

6.2.10 DPD Code

Symbology number:	96
Valid characters:	ASCII-characters between 32..127
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Automatic (symbology specific). Modulo 103 (eCDCode128)
Symbol size:	--

DPD Code is used by DPD (*Deutscher Paket Dienst*). It is based on Code 128 and is limited to 28 encoded characters. The encoded data and the human readable text differ slightly.

The barcode data is specified as follows

```
IPPPPPPPTTTTTTTTTTTTTTSSSCCC
```

Whereas the human readable text is defined as:

```
PPPPPPPTTTTTTTTTTTTTTSSSCCCD
```

With:

Character	Description	Data Type	Length
I	Identifier (in **barcode data only**)	Alphanumeric	1
P	Destination postal code	Alphanumeric	7

X	Depot number (first part of the tracking number)	Alphanumeric	4
L	Serial number (second part of the tracking number)	Numeric	10
S	Service Code	Numeric	3
C	Destination Country Code	Numeric	3
D	Check digit modulo 36 (in **human readable text only**)	Alphanumeric	1

Table 16: DPD Format

6.2.11 Italian Postal Code 2 of 5

Symbology number:	94
Valid characters:	“0”..”9”
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X>= 0.19 mm
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	None (eCDMod10ItlPst25)
Symbol size:	--

Italian Postal Code 2 of 5 is based upon Code 2 of 5 Interleaved, but it is limited to 12 digits (11 usable digits + 1 modulo 10 check digit).

6.2.12 Japanese Postal Code

Symbology number:	76
Valid characters:	“0”..”9”, “A”..”Z”, “-“, 7 digits (ZIP code) + additional data
Quiet zone:	left/right/top/bottom: 2 mm
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Symbol size:	--

This code is used by the Japanese Postal system. You can encode 7 digits followed by block and street number (uppercase alphanumeric). The special compaction mode of Japanese characters can be enabled on demand (*Format* parameter “J”) – see below.

This barcode symbology supports two methods to provide the barcode data (with and without data–extraction from the Japanese Address B Field).

6.2.12.1 Direct Encoding Mode

Description	Value
Format Property	“” (default=empty)
Postal code	2730102 (no hyphen ‘-‘)
Address B	3-20-5B604
Barcode text	Postal code + Address B (no space between)
Barcode text	27301023-20-5B604
Encoded data in the symbol	27301023-20-5B604

6.2.12.2 Japanese Extraction Mode

Description	Value
Format Property	”J” (= Enable Japanese Compaction)
Postal code	273-0102 (can contain ‘-‘)
Address B	東３丁目－２０－５　郵便・A&bコーポB604号

Barcode text	Postal code + Address B
Barcode text	273-0102 東３丁目－２０－５ 郵便・A&bコーポB604号
Encoded data in the symbol	27301023-20-5B604 (after compaction)
Encoding	SHIFT JIS (CP932)

- In **TBarCode DLL** you have two possibilities:
  - Provide the data in UNICODE with *BCSetTextW(..)* and use *BCSetCodepage (Shift JIS)*[3].
  - Provide the data in Shift JIS with *BCSetTextA(..)* and use *BCSetEncodingMode (LowByte)*.
- In **TBarCode OCX** and **TBarCode .NET** you set *CodePage* = Japanese Shift JIS.

6.2.12.3 Standard Dimensions

To draw the barcode according to the specification please follow these steps:

- Set the module width to 0.577mm (DLL-function: *BCSetModWidth* (pBC, "577"))
- Set the height of the „Bounding Rectangle“ in the draw function to 3.5 mm
- Switch off the display of the human readable text

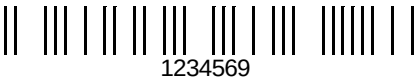
6.2.13 KIX – Dutch Postal Code

Symbology number:	90
Valid characters:	“0”..”9”, “A”..”Z”, “a”..”z”
Quiet zone:	left/right/top/bottom: 2 mm
Module width:	0.38-0.63 mm
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	None (eCDNone)
Symbol size:	--

This code is used by the Dutch Postal system.

6.2.14 Korean Postal Authority

Symbology number:	77
Valid characters:	“0”..”9”, 6 digits + 1 check digit
Check digit method:	Check digit included in the code
Quiet zone:	10X (not exactly specified)
Module width:	--
Standard print ratio:	1:3:4
Ratio format:	1B:1S:2S
Default check digit:	Automatic (symbology specific). Modulo10 (eCDMod10Kor)
Symbol size:	--



This code is used by the Korean Postal system. Encoded are a 6-digit ZIP and 1 check digit.

6.2.14.1 Example

Description	Value
Post number	305-600
Barcode Text property	305600 (no hyphen, 6 digits)
Encoded data in the symbol	0065036
	The check digit (7th digit marked red) will be calculated automatically.

[3] Shift JIS will be the default code page for Japanese Postal in TBarCode SDK 10.2.6 and later.

Parameters: width = 70, height = 4 mm, module width = 0.417 mm

► Hint: Will be scanned from right to left, so the data is encoded in the reverse order. The check digit will be added at the right side, so it is the first digit read by a scanner.

6.2.15 Planet 12

Symbology number:	82
Valid characters:	"0"..."9", 11 digits + 1 check digit
Quiet zone:	left/right: 1/25 inch top/bottom: 1/8 inch
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Modulo 10 Planet (eCDMod10Pla)
Possible check digits:	User supplied
Symbol size:	11 digits + 1 check digit

This code was developed for the United States Postal Services. It is a 3-of-5 variant of the Postnet barcode.

6.2.16 Planet 14

Symbology number:	83
Valid characters:	"0"..."9", 13 digits + 1 check digit
Quiet zone:	left/right: 1/25 inch top/bottom: 1/8 inch
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Modulo 10 Planet (eCDMod10Pla)
Possible check digits:	User supplied
Symbol size:	13 digits + 1 check digit

This code was developed for the United States Postal Services. It is a 3-of-5 variant of the Postnet barcode.

6.2.17 Royal Mail 4 State (RM4SCC)

Symbology number:	70
Valid characters:	"0"..."9", "A"..."Z"
Quiet zone:	left/right: 2 mm
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Possible check digits:	User supplied
Symbol size:	max. 9 digits without check digits
Print control:	C=RM

This code is a height modulated code using 4 different vertical bars. It is used in mass-mailing applications (Cleanmail, Mailsort) of the Royal Mail, United Kingdom and Singapore (also called SinPost barcode). Encoded are ZIPs.

6.2.18 Royal Mail Complex Mail Data Mark (CMDM) Mailmark® Barcode

Symbology number:	119
Valid characters:	“0”..”9”, “A”..”Z”, “ “ (Space), 45 chars fixed length + variable customer part
Quiet zone:	left/right/ top/bottom: 4X
Module width:	0.5 – 0.7 mm
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Symbol size:	12 x 12 mm, 16 x 16 mm, 8 x 24 mm

The *Complex Mail Data Mark* (CMDM) is based upon Data Matrix ECC200 (ISO/IEC 16022, version 2006) and is used by the Royal Mail for postal services. In addition, the CMDM Mailmark™ barcode uses a specific format and data structure defined by the Royal Mail for their purposes.

A CMDM Mailmark™ barcode can be any of the following Data Matrix formats:

- Format 7 (24 x 24 modules), total capacity 51 characters, 6 characters for customer use.
- Format 9 (32 x 32 modules), total capacity 90 characters, 45 characters for customer use.
- Format 29 (16 x 48 modules), total capacity 70 characters, 25 characters for customer use.

6.2.18.1 Data Structure

The CMDM Mailmark™ barcode is differentiated from other Data Matrix symbols by the first 6 characters of the data within the barcode:

- UPU identifier – 1 Characters (J), Country ID – 3 Characters (e.g. GBA, or GB<SPACE>), Product type ID – 1 Character, Version ID – 1 Character

Each field within any CMDM is of a fixed and defined length. The length in total (except customer part) is *45 characters*. Missing or optional attributes must be filled with the *SPACE* character.

► For more information we refer to the Royal Mail Mailmark® barcode definition document.

Sample data content (Format 9, 45 characters Mailmark™ data + 41 characters customer data):

```
JGB 01010000070000900 1B707RH1A 0SN35XX       ABCDEFGHIJ1234567890ABCDEFGHIJ1234567890A
```

6.2.18.2 Customer Content

Each format has a reserved space for customers and/or mailing houses to place information. The amount of space depends on the barcode type and characters/encoding used.

6.2.18.3 Encoding

All data within the Royal Mail defined portion of the CMDM shall comply with the C40 character set (upper case alphanumeric, numeric and SPACE characters) and C40 encodation scheme of Data Matrix. The customer content field does not need to comply with this encoding.

► TBarCode uses the proper encoding if you select the “eBC_CMDM_Mailmark” symbology.

6.2.19 Singapure Post 4-State Customer Code (SinPost)

Singaporean Postcode – identical with Royal Mail 4 State (RM4SCC).

6.2.20 Singapore Post

The Singapore Post 4 State Customer Code is the same as the RM4SCC.

6.2.21 Swedish Postal Shipment Item ID

Symbology number:	118
Valid characters:	2 letters + 8 digits + 1 digit check digit + ”SE”.
Quiet zone:	left/right: 10X
Module width:	X >= 0.28mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	UPU check digit (Universal Postal Union) (eCDUPU)
Symbol size:	H >= 9mm (for details see Swedish Postal spec).

This Code is based upon Code 128 and is used on Swedish Postal labels. The code consists of:

- 2-digit letter prefix
- 8-digit serial number
- 1-digit check digit (mod 11)
- "SE" as application identifier

The check digit is calculated according to weighted modulo 11 method for Universal Postal Union (for 8 digits).

6.2.22 USPS Intelligent Mail® Barcode or IM® Barcode

Symbology number:	85
Valid characters:	“0”..”9”, 20 digits + 0, 5, 9, or 11-digit ZIP Code.
Quiet zone:	vertical: 1/25 inch horizontal: 1/8 inch
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Symbol size:	Up to 31 digits
Print control:	C=IMB

This symbology is also known as

- OneCode 4CB
- USPS 4CB
- 4-CB
- 4-State Customer Barcode
- USPS OneCode Solution Barcode.

The following data is encoded:

- Barcode ID (1st digit: 0-9; 2nd digit: 0-4)
- Special services (range: 000-999)
- Customer ID (range: 000000-999999)
- Sequence number (range: 000000000-999999999)
- Delivery point ZIP code (0, 5, 9, or 11-digit ZIP code)

6.2.23 USPS Intelligent Mail® Package Barcode

Symbology number:	117
Valid characters:	"0".."9" + FNC1, Routing Information: 0, 8, or 12 digits + Tracking Information: 22 to 26 digits.
Quiet zone:	vertical: 1/25 inch horizontal: 1/8 inch
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Modulo 10 (USPS IM Package) (eCDMod10IMPackage)
Possible check digits:	User supplied
Symbol size:	22 to 34 digits

The barcode data consists of Routing Information and Tracking Information. The Routing Information is optional. It is not printed in the human visible text and consists of:

- Postal Code Application Identifier (AI): always **420**
- Destination ZIP Code (5 or 9 digits)

The tracking information is mandatory. It is printed in the human readable text 3 types of tracking information exist: commercial mailer constructs, online constructs, and retail constructs.

- Commercial Mailer Constructs:
  - Channel Application Identifier (**92** or **93**)
  - Service Type Code (3 digits)
  - Mailer Identifier (6 or 9 digits)
  - Serial Number (if Mailer Identifier has 9 digits: 7 or 11 digits, otherwise: 10 or 14 digits)
  - Check Digit
- Online Constructs:
  - Channel Application Identifier (**94**)
  - Service Type Code (3 digits)
  - Source Identifier (2 digits)
  - Mailer Identifier (6 or 9 digits)
  - Serial Number (5 or 8 digits)
  - Check Digit
- Retail Constructs:
  - Channel Application Identifier (**95**)
  - Service Type Code (3 digits)
  - Channel Identifier (1 digit)
  - Device ID (6 digits)
  - Julian Date (4 digits)
  - Serial Number (5 digits)
  - Check Digit

6.2.24 USPS Postnet 5

Symbology number:	40
Valid characters:	“0”..”9”, 5 digits + 1 check digit
Quiet zone:	vertical: 1/25 inch horizontal: 1/8 inch
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	POSTNET (eCDPostNet)
Symbol size:	5 digits, 1 check digit
Print control:	C=PSN5

This code is used by the United States Postal Services for mass-mailing applications. Encoded are a 5 digit ZIP-code. The check digit is calculated automatically. It cannot be specified in the input data.

The barcode height should be adjusted to 3.2 mms; the module width to 0.423 mms; usually no plain text is displayed.

The newer USPS Intelligent Mail® Barcode or IM® Barcode (4-State Customer Barcode) additionally includes a 20 digits tracking code.

6.2.25 USPS Postnet 6

Symbology number:	41
Valid characters:	“0”..”9”, 5 digits + 1 check digit
Quiet zone:	vertical: 1/25 inch horizontal: 1/8 inch
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	POSTNET (eCDPostNet)
Possible check digits:	User supplied
Symbol size:	5 digits, 1 check digit

Same as Postnet 5, but the check digit can be specified freely (the 6th digit). To be used only if the check digit is already part of the input data.

6.2.26 USPS Postnet 9

Symbology number:	42
Valid characters:	“0”..”9”, 9 + 1 check digit
Quiet zone:	vertical: 1/25 inch horizontal: 1/8 inch
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	POSTNET (eCDPostNet)
Symbol size:	9 digits, 1 check digit
Print control:	C=PSN9

This code is used by the United States Postal Services for mass-mailing applications. Encoded are a 5 digit ZIP-code and 4 additional digits. The check digit is computed automatically, it cannot be specified in the input data.

The barcode height should be adjusted to 3.2 mms; the module width to 0.423 mms; usually no plain text is displayed.

The newer USPS Intelligent Mail® Barcode or IM® Barcode (4-State Customer Barcode) additionally includes a 20 digits tracking code.

6.2.27 USPS Postnet 10

Symbology number:	43
Valid characters:	“0”..”9”, 9 digits + 1 check digit
Quiet zone:	vertical: 1/25 inch horizontal: 1/8 inch
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	POSTNET (eCDPostNet)
Possible check digits:	User supplied
Symbol size:	9 digits, 1 check digit

Same as Postnet 9, but the check digit can be specified freely (the 10th digit). To be used only if the check digit is already part of the input data.

6.2.28 USPS Postnet 11

Symbology number:	44
Valid characters:	“0”..”9”, 11 digits + 1 check digit
Quiet zone:	vertical: 1/25 inch horizontal: 1/8 inch
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	POSTNET (eCDPostNet)
Symbol size:	11 digits, 1 check digit
Print control:	C=PSN11

This code is used by the United States Postal Services for mass-mailing applications. Encoded are a 5 digit ZIP-code and 4 to 9 additional digits. The check digit is calculated automatically. It cannot be specified in the input data.

The barcode height should be adjusted to 3.2 mms; the module width to 0.423 mms; usually no plain text is displayed.

The newer USPS Intelligent Mail® Barcode or IM® Barcode (4-State Customer Barcode) additionally includes a 20 digits tracking code.

6.2.29 USPS Postnet 12

Symbology number:	45
Valid characters:	“0”..”9”, 11 digits + 1 check digit
Quiet zone:	vertical: 1/25 inch horizontal: 1/8 inch
Module width:	--
Standard print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	POSTNET (eCDPostNet)
Possible check digits:	User supplied
Symbol size:	1 digits, 1 check digit

Same as Postnet 11, but the check digit can be specified freely (the 12th digit). To be used only if the check digit is already part of the input data.

6.3 2D Symbologies

6.3.1 Aztec Code

Symbology number:	92
Valid characters:	ASCII 0-127 + ISO 8859-1
Quiet zone:	left/right/ top/bottom: 0X
Module width:	--
Print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Size:	--
Print control:	C=AZT

Aztec Code can encode from small to large amounts of data with user-selected percentages of error correction. The symbol size adjusts automatically depending on the amount of input data.

The input data is always analyzed and the appropriate encoding mode is chosen automatically. Mode switching is done as required to produce the most efficient encoding.

6.3.1.1 Character Set

The default interpretation is ISO-8859-1 (Latin-1), which corresponds to ECI 000003.

The special FNC1 character is supported.

6.3.1.2 Layers and Core Type

The compact Aztec code core may be surrounded by 1 to 4 layers, producing symbols from 15×15 through 27×27 pixels. The full core version supports up to 32 layers (that are up to 151×151 pixels).

The core type and the number of layers are controlled by the size parameter.

Size Enumeration	Size Pixel	Core Type	Layers
0	Automatically selected	Automatically selected	Automatically selected
1	15x15	Compact	1
2	19x19	Compact	2
3	23x23	Compact	3
4	27x27	Compact	4
5	31x31	Full	4
6	37x37	Full	5
7	41x41	Full	6
…	…	Full	…
33	151x151	Full	32

Table 17: Aztec Code Symbol Sizes

The full core 1-3 layer versions are not supported; instead the compact version is used.

6.3.1.3 The Maximum Data Capacity of Aztec Code

The Aztec Code specification defines the following:

Numerical data only:	3832
Bytes:	1914
Text characters:	3067 (only uppercase letters used [A..Z])

If you mix the character types the maximum data capacity cannot be predicted exactly (due to internal compression and character set switching - this is by design).

If you use a combination of digits and text (lower & uppercase letters) the maximum data capacity would be about 2500 characters - but this can vary due to your input data. If you want to encode large data amounts we recommend using only capital letters or multiple symbols (structured append).

6.3.1.4 Format

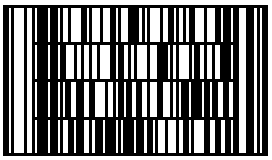
Beside the default format for general purposes Aztec Code supports GS1 and Industry formats.

The GS1 format adds a leading FNC1 in front of the encoded data to signal usage within the GS1 system. The FNC1 is not transmitted but has an influence to the symbology identifier.

If industry format is used, the internal data representation in the bar code will be *<format specifier> + FNC1 + <bar code data>*. In that case the bar code reader transmits "]z2" (symbology identifier for industry standards) followed by the *<format specifier>* and the data.

6.3.2 Codablock F

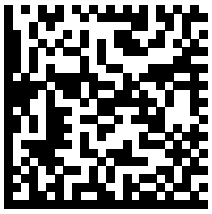
Symbology number:	74
Valid characters:	ASCII 0-127 + ISO 8859-1
Quiet zone:	left/right/ top/bottom: 10X
Module width:	X>=0.19mm
Print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Automatic (symbology specific).
Size:	2 - 44 rows; 4 - 62 characters per row
Print control:	C=CBF



Codablock F is de facto a "stacked" Code128 symbology. It is based upon Code 128 - each row is a single Code 128 symbol extended with row indicator information and additional check digits. The UCC/EAN/GS1 format indicator is supported.

6.3.3 Data Matrix

Symbology number:	71
Valid characters:	Alphanumeric (ASCII 0.. 255) and/or bytes
Quiet zone:	left/right/ top/bottom: 1X
Module width:	--
Print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Size:	.001 till 14.0 square inch
Print control:	C=DMX



Data Matrix is used for encoding large amounts of data and is also ideal for marking small objects. The symbol size adjusts automatically depending on the amount of input data.

It was developed by RVSI Acuity CiMatrix for the Space Shuttle Program and then enhanced by the NASA and the Symbology Research Center.

It is the de-facto standard symbology in the following areas:

- Automotive
- Aviation (SPEC2000)
- Pharmaceutical areas

TEC-IT's Data Matrix implementation complies to

- ECC200
- ANSI/AIM BC11
- ISO/IEC 16022
- Department of Defense UID, MIL-STD-130L
- all other specifications that require ECC200.

6.3.3.1 Encoding Modes

The input data is always analyzed and the appropriate encoding mode is chosen automatically. Mode switching is done as required to produce the most efficient encoding. Supported encoding modes are

- BASE256
- C40
- TEXT
- ASCII.

6.3.3.2 Data Capacity

The data capacity depends on the format of the encoded data:

Format	Data Capacity
Numeric	3116
Alphanumeric	2355
Binary	1556

Table 18: Data Matrix Data Capacity

The maximum data capacity for binary data is equal to 1556 bytes using a Matrix of 144x144 dots. With a dot size of 0.35 mm minimum, you get a symbol size of 50.4 * 50.4 mm.

- The maximum data capacity for a matrix of 120x120 dots = 1048 Bytes.
- The maximum data capacity for a matrix of 96x96 dots = 694 Bytes.

In practice, with a hand-held scanner, you can scan sizes up to 96x96 dots without problems. Symbol sizes of 120x120 dots are ok if you are using (very) good scanners. However – TEC-IT recommends splitting up the 1 KB input data into 2 or more symbols.

6.3.3.3 Code Format

The following code formats are supported by TEC-IT software:

- Default/Standard
- UCC/EAN/GS1 (the internal data is prefixed with an FNC1; this format is used for the "GS1 Data Matrix")
- Industry (a peculiar industry format, which adds FNC1 at 2nd position)
- Macro 05 (the data is prefixed with "[)>" + RS + "05" + GS and suffixed with RS + EOT)
- Macro 06 (the data is prefixed with "[)>" + RS + "06" + GS and suffixed with RS + EOT)
- Reader Programming (the barcode data is used to program the barcode reader)

6.3.3.4 DP Postmatrix (see 6.3.3.6 GS1 Data Matrix

In order to generate a Data Matrix for GS1 applications you have to turn on the UCC/EAN/GS1 code format.

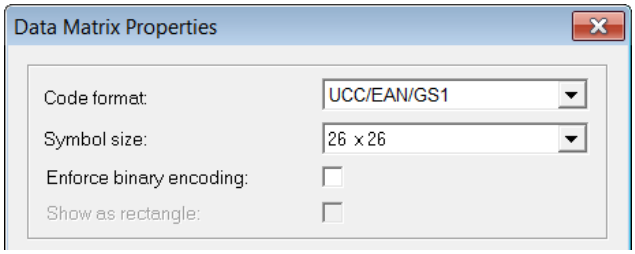


Figure 11: Data Matrix Properties

More information: GS1 Data Matrix Introduction and Technical Overview

- Deutsche Post Premiumadress Data Matrix and 6.3.3.8 Deutsche Post Werbeantwort Postmatrix)

The following unprintable characters are used with the Macro 05/06 modes:

- RS (Record Separator): 0x1e
- GS (Group Separator): 0x1d
- EOT (End of Transmission): 0x04.

6.3.3.5 Compatibility Options

The internal encoding mode switching is highly optimized and should be supported by all bar code readers on the market. If you have problems with your image decoding solution, try the following:

To provide compatibility with CAPTIVA, IBML (and maybe other) document scanning solutions we introduced a compatible mode for these scanners (available from TBarCode V10.0.2).

► To turn on this compatibility mode, enter "C" into the format property (Data Matrix only).

6.3.3.6 GS1 Data Matrix

In order to generate a Data Matrix for GS1 applications you have to turn on the UCC/EAN/GS1 code format.

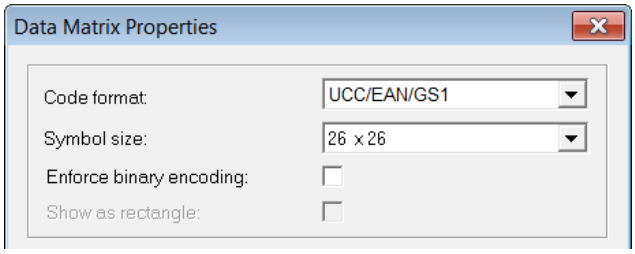


Figure 11: Data Matrix Properties

More information: GS1 Data Matrix Introduction and Technical Overview

6.3.3.7 Deutsche Post Premiumadress Data Matrix

In order to generate a Data Matrix for Deutsche Post *Premiumadress* use the property settings below and follow the example.

- Enforce binary encoding (BASE256 mode)
- Data Matrix Size 22x22 (standard)
- Data Matrix Size 26x26 (enlarged)
- Module width 0.423 mm

- Make sure that the property *"Translate Escape Sequences"* is activated!
- The hexadecimal data must be converted in a **TBarCode** escape format. Before each hexadecimal digit pair you have to set a "\x"!
- By using **TBarCode** select the Encoding mode "*No conversion (Lower bytes only)*" - see "Advanced settings".

The following example refers to the product **TBarCode**. If you want to generate a Data Matrix with **TFORMer** or **Barcode Studio** the workflow is just the same.

Example:

Original data:

```
444541080D02540BE3FF0052232D242D000065000000010100015A31
```

Encoded data:

```
\x44\x45\x41\x08\x0D\x02\x54\x0B\xE3\xFF\x00\x52\x23\x2D\x24\x2D\x00\x00\x65\x00\x00\x00\x01
\x01\x00\x01\x5A\x31
```

Tab *Barcode*

Description	Value
Barcode type:	Data Matrix. The standard symbol size is 22x22 (see Figure 12). To adjust the symbol size, please click on the *Adjust* button.
Barcode data (112 characters):	\x44\x45\x41\x08\x0D\x02\x54\x0B\xE3\xFF\x00\x52\x23\x2D\x24\x2D\x00\x00\x65\ x00\x00\x00\x01\x01\x00\x01\x5A\x31
Translate escape sequences	Make sure that this checkbox is activated.

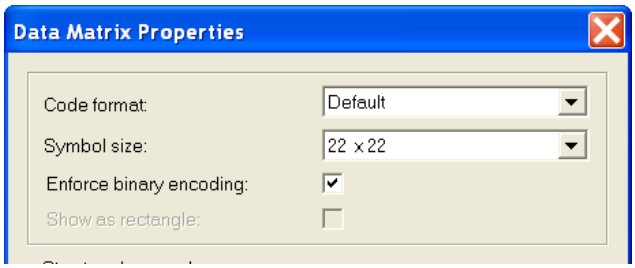


Figure 12: Data Matrix Properties

Tab *Appearance*

Description	Value
Barcode size and module width.	Use the entry Custom – Specify module with from the drop down menu.
Module width [1/1000 mm]	Use the value 423.
Display error if barcode is clipped.	Make sure that you have activated this checkbox.

6.3.3.8 Deutsche Post Werbeantwort Postmatrix

In order to generate a Postmatrix code for Deutsche Post Werbeantwort use the property settings below and follow the example.

- Code format DP Postmatrix
- Postmatrix Size 22x22 (standard)
- Postmatrix Size 26x26 (enlarged)
- No Binary encoding mode (!)
- Module width 0.423 mm

The following example refers to the product **TBarCode**. If you want to generate a Data Matrix with **TFORMer** or **Barcode Studio** the workflow is just the same.

Example:

Original data:

```
DEAW00A01Z690WA52345678000010205001099~JOB4711~850
```

Barcode Properties

Common	Value
Barcode type:	Data Matrix

Data Matrix	Value
Code format:	DP Postmatrix
Symbol size:	26x26
Enforce binary encoding:	Disabled (!)

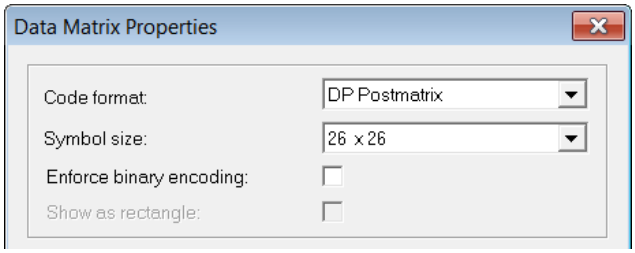
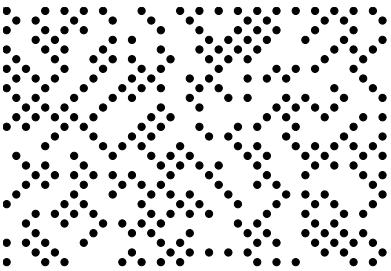


Figure 13: Data Matrix Properties

6.3.4 DotCode

Symbology number:	115
Valid characters:	Alphanumeric (ASCII 0.. 255) and/or bytes
Quiet zone:	left/right/ top/bottom: 3X
Module width:	--
Print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Size:	--



DotCode is 2D dot code symbology designed to be reliably readable when printed by high-speed inkjet or laser dot technologies.

The encoding modes of DotCode are based on the Code128 data encoding (with modes A, B, and C) extended by a so called Binary Mode.

The default interpretation for DotCode data is ECI 000003 representing the Latin-I character set.

The DotCode symbology does not have absolute capacity limits, but a maximum symbol size of 124x124 dots is recommended.

6.3.4.1 Code Format

The following code format is supported by TEC-IT software:

- Auto Discriminate (If the data starts with 2 digits, barcode has GS1 format, otherwise generic format is used)
- Generic Format (barcode data does not fulfill any special format, if it starts with 2 digits, FNC1 is inserted)

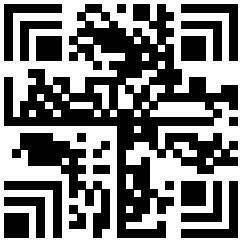
- UCC/EAN/GS1 (the internal data must start with 2 digits and has to apply to a format of an so-called application identifier)
- Industry (a peculiar industry format, which adds FNC1 at 2nd position)
- Macro 05 (the data is prefixed with “[)>” + RS + “05” + GS and suffixed with RS + EOT)
- Macro 06 (the data is prefixed with “[)>” + RS + “06” + GS and suffixed with RS + EOT)
- Macro 12 (the data is prefixed with “[)>” + RS + “12” + GS and suffixed with RS + EOT)
- Custom Macro (the data is prefixed with “[)>” + RS and suffixed with RS + EOT; the rest of the format specifier has to be encoded by the user)
- Reader Programming (the barcode data is used to program the barcode reader)

The following unprintable characters are used with the Macro 05/06 modes:

- RS (Record Separator): 0x1e
- GS (Group Separator): 0x1d
- EOT (End of Transmission): 0x04.

6.3.5 Han Xin Code

Symbology number:	116
Valid characters:	Alphanumeric (ASCII 0.. 255) and/or bytes, Chinese Characters (GB18030)
Quiet zone:	left/right/ top/bottom: 3X
Module width:	--
Print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Size:	--



Han Xin Code is a 2D matrix symbology which is used for encoding large amounts of data and provides a special support for encoding Chinese characters (character set GB18030).

6.3.5.1 Data Capacity

The data capacity depends on the format of the encoded data:

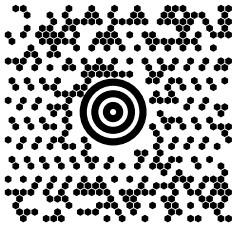
Format	Data Capacity
Numeric	7827
Alphanumeric	4350
Binary	3261
Common Chinese in Region 1 or 2	2174
2-byte Chinese	1739
4-byte Chinese	1044

Table 19: Han Xin Code Data Capacity

The maximum data capacity for binary data is equal to 3261 bytes using a Matrix of 189x189 dots.

6.3.6 MaxiCode

Symbology number:	57
Valid characters:	Alphanumeric (ASCII 0.. 255) and/or bytes
Default Mode:	Mode-4 (standard symbol)
Quiet zone:	left/right/ top/bottom: 1X
Module width:	--
Print ratio:	n/a
Ratio format:	n/a
Default check digit:	Automatic (symbology specific).
Size:	Fix: 1.11 x 1.054 inch
Print control:	C=MXC



MaxiCode is in use (and was invented) by UPS®.

MaxiCode represents data by drawing hexagonal items, which are arranged around a circular center (a so called "Bull's Eye"). Different encoding modes for including postal information (SCM) can be adjusted: UPS Modes are Mode 2 (US Carrier) and Mode 3 (International Carrier).

The printing size is usually set to a fixed value. If you want to change the size of the symbol, adjust a custom module width (default is 0.870 mm).

6.3.6.1 Data Capacity

The data capacity depends on the format of the encoded data:

Format	Data Capacity	Characters
Numeric	138	0-9
Alphanumeric	93	0-9 A-Z (uppercase)

Table 20: Maxi Code Data Capacity

The maximum data capacity of one symbol is 93 alphanumeric characters. By using the UPS® MaxiCode compression software you can extend this value to about 100 characters. The actual quantity of the utilizable data depends on the selected mode, how often special characters are used, whether numeric sequences are used (which can be compressed) and the level of error correction.

With Structured Append you can divide larger quantities of data into several MaxiCode symbols – they are joined by the scanner when being read.

6.3.6.2 Modes

The internal data structure is regulated by different "modes". For standard purposes, data can be encoded with two different error correction levels:

- Mode 4 - SEC / Standard Error Correction
- Mode 5 - EEC = Enhanced E.C.).

The modes for "Structured Carrier Message" (SCM) were defined by the parcel transport service UPS®. If you want to use MaxiCode for UPS, please use these SCM modes.

- Mode 2 - SCM numeric
- Mode 3 - SCM alphanumeric

6.3.6.3 MaxiCode & UPS®

In order to generate a MaxiCode symbol for UPS®, follow the steps below. The following sample uses the properties of the barcode software component **TBarCode OCX**.

Select MaxiCode Mode

> ► Please use mode 2 or 3 (SCM) depending on your postal code. UPS MaxiCode compression works only for these SCM modes.

If you want to encode a numeric Postcode (USA) set the mode to "SCM numeric" (Property *MaxiCode.Mode = 2*). If you want to use letters in the Postcode (e.g. “D12345” for German PLZ) choose mode SCM alphanumeric (Property *MaxiCode.Mode = 3*).

Adjust SCM Fields

- Check "Use preamble" (property *MaxiCode.Preamble*)
- Enter the date into the field preamble date (property *MaxiCode.Date*, refer to “Message Header / Transportation Data” in the UPS® manual)
- Enter Service Class (property *MaxiCode.ServiceClass*), Country Code (property *MaxiCode.CountryCode*) and Postal Code (property *MaxiCode.PostalCode*) into the according text boxes. (refer to Postal Code, Country Code, Class of Service in the UPS® manual)

Alternatively you can pass the values for the SCM fields as shown in following section "Setting SCM Parameters in the Barcode Data itself"

Adjust Data String

- All other UPS® fields must be entered in 'Encoded data' (property *Text*) separated by Gs. At the end of the text Rs and Eot must be added.

Example: the text could look like this:

```
1Z12345677GsUSPNGs123556Gs089GsGs1/1\Gs0GsYGsGsSALT LAKE CITYGsUTRsEot
```

- Then replace all control characters (Gs, Rs, Eot) with their hexadecimal encoding (\xnn):
  Gs → \x1d
  Rs → \x1e
  Eot → \x04.
- Please refer to Escape Sequences for an overview of available escape sequences.

The text should now look like:

```
1Z12345677\x1dUSPN\x1d123556\x1d089\x1d\x1d1/1\x1d10\x1dY\x1d\x1dSALT LAKE
CITY\x1dUT\x1e\x04
```

- This corresponds to the UPS® Data fields: → Tracking Number, SCAC, UPS Account Number, Julian Day of Collection, place holder for Shipment ID Number, Package n/x, Package Weight, Address Validation, Place Holder for Ship To Street Address, Ship To City, Ship To State, End Of Transmission.
- At last check *Translate escape sequences* (property *EscapeSequences*). This is necessary to translate the hexadecimal codes (e.g. \x1d) into the special characters “Rs”, “Gs” and “Eot”.

Setting SCM Parameters in the Barcode Data itself

The parameters for SCM (Structured Carrier Message - used for UPS®) can be set directly in the barcode data string. This allows complete control of all necessary parameters in one step.

Enable extracting of SCM data:

- Set the *Format* property of **TBarCode** to "S"
- Set the *EscapeSequences* property to True.

The values for the properties postal code, country code, service class, preamble and date are then extracted from the barcode data (*Text* property). Values from the text string overdrive the belonging properties in the barcode component.

The *Text* property should contain the whole data string according to UPS standard (see following picture) including preamble, date, postal code, country code, and service class.

Special characters and separators must be replaced by escape sequences (also refer to Escape Sequences).

Gs → \x1d
Rs → \x1e
Eot → \x04.

Example 1

A typical international data string would appear as follows:
[)>Rs01Gs96841706672Gs840Gs066Gs1Z12345677GsUPSNGs123556Gs089GsGs1/1Gs10GsYGsGsSALT LAKE CITYGsUTRsEot

Most of the information is easily identified and can be separated into its component data elements as shown below:

[)>Rs	Message Header
01Gs96	Transportation Data Format Header
841706672 Gs	Postal Code
840 Gs	Country Code
066 Gs	Class of Service
1Z12345677 Gs	Tracking Number
UPSNGs	SCAC
123556 Gs	UPS Account Number
089 Gs	Julian Day Of Collection
Gs	Place holder for Shipment ID Number
1/1 Gs	Package n/x
10Gs	Package Weight
YGs	Address Validation
Gs	Place holder for Ship To Street Address
SALT LAKE CITY Gs	Ship To City
UTRs	Ship To State
Eot	End of Transmission

There are additional characters contained in the data string

- **[)>Rs** is the message header
- **Gs** is used to separate field in a message
- **Rs** is used to separate format types
- **Eot** is the end of transmission character

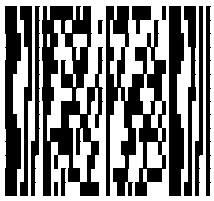
Notice that in example 1, the Shipment ID Number and Ship to Street Address are blank data elements that are separated with a Gs.

The class of service and shipper number fields in the 1Z number have been omitted in the MaxiCode tracking number field to avoid duplication within the symbol.

Figure 14: MaxiCode UPS Encoding

6.3.7 MicroPDF417

Symbology number:	84
Valid characters:	Alphanumeric and/or bytes
Quiet zone:	left/right: 1X
Module width:	--
Print ratio:	1:2:3:4:5:6:1:2:3:4:5:6
Ratio format:	1B:2B:3B:4B:5B:6B:1S:2S:3S:4S:5S:6S
Default check digit:	Automatic (symbology specific).
Size:	--
Print control:	C=MPDF



TBarCode/X control sequence	
For V1.x:	*$_tbcs b84 dThis is a MicroPDF417$_tbce*
For V2.x:	*$_tbcs -b84 –d"This is a MicroPDF417"$_tbce*

This stacked 2D symbology is used to encode large quantities of data.

The input data is always analyzed and the appropriate encoding mode is chosen automatically. Mode switching is done as required to produce the most efficient encoding.

6.3.8 Micro QR-Code

Symbology number:	97
Valid characters:	Alphanumeric and/or bytes, Kanji character set
Quiet zone:	left/right/ top/bottom: 2X or 4X
Module width:	--
Print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Size:	--
Print control:	C=MQR

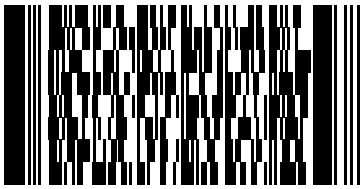
This 2D symbology is a small variant of QR-Code with a reduced number of overhead modules and a restricted range of sizes. It was developed for fast readability (QR = Quick Response) by Denso. The symbol size adjusts automatically depending on input data.

Micro QR-Code has 4 different symbol sizes (M1-M4). The smallest version (=size) M1 is restricted to numeric data and error detection, M2 may contain also alphanumeric values, and M3 and M4 may use the whole range of the QR-Code character sets (bytes, Kanji).

The maximum amount of data is 35 numeric, 21 alphanumeric, 15 byte, or 9 Kanji characters, in conjunction with the lowest error correction level.

6.3.9 PDF417

Symbology number:	55
Valid characters:	Alphanumeric (ASCII 0.. 255)
Quiet zone:	left/right: 2X
Module width:	--
Print ratio:	1:2:3:4:5:6:7:8:1:2:3:4:5:6
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B: 1S:2S:3S:4S:5S:6S
Default check digit:	Automatic (symbology specific).
Size:	X >= 0.19 mm
Print control:	C=PDF



This (stacked) 2D symbology was invented by Symbol Technologies. It is used to encode large quantities of data. It is the de-facto 2D standard symbology in the automotive industry.

The symbol is divided into rows and columns. TEC-IT software adjusts the size automatically depending on the amount of input data. A data density of up to 900 characters per square inch is possible.

The input data is always analyzed and the appropriate encoding mode is chosen automatically. Mode switching is done as required to produce the most efficient encoding.

6.3.9.1 Data Capacity

The data capacity depends on the format of the encoded data. The following limits can only be reached with error correction level 0.

Format	Data Capacity	Characters
Numeric	2710 characters	0-9
Alphanumeric	1850 characters	0-9 A-Z (uppercase)
Binary	1108 bytes	Default encoding: CP437

Table 21: PDF417 Data Capacity

If you mix the character types the maximum data capacity cannot be predicted exactly (due to internal compression and character set switching - this is by design).

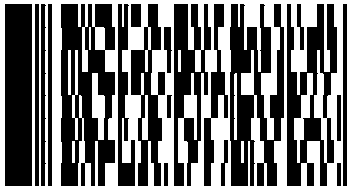
If you use a combination of digits and text (lower & uppercase letters) the maximum data capacity would be about 1100 to 1200 characters - but this can vary due to your input data. If you want to encode large data amounts we recommend using only capital letters or multiple symbols (structured append).

6.3.9.2 How to optimize PDF417 for FAX?

Adjust the resolution of the generated barcode to 200 dpi (FAX devices are usually using 200 dpi). Follow the instructions in chapter **A.4 Optimize Barcode for the Output Device Resolution**. Make sure the row-height of the PDF417 is at least 3 times the module width.

6.3.10 PDF417 Truncated

Symbology number:	56
Valid characters:	Alphanumeric (ASCII 0.. 255) and/or bytes
Quiet zone:	left/right: 2X
Module width:	--
Print ratio:	1:2:3:4:5:6:7:8:1:2:3:4:5:6
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B: 1S:2S:3S:4S:5S:6S
Default check digit:	Automatic (symbology specific).
Size:	--

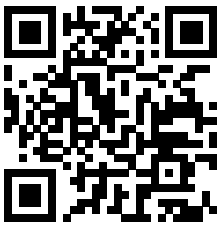


This (stacked) 2D symbology is used to encode large quantities of data.

The symbol is divided into rows and columns. TEC-IT software adjusts the size automatically depending on the amount of input data. A data-density of up to 900 characters per square inch is possible.

6.3.11 QR-Code (Model 2)

Symbology number:	58
Valid characters:	Alphanumeric and/or bytes, Kanji character set
Quiet zone:	left/right/ top/bottom: 4X
Module width:	--
Print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Size:	--
Print control:	C=QRC



Based upon standard: *AIM International ITS/97-001 and ISO/IEC 18004:2000*

This 2D symbology is used to encode large quantities of data and was developed for fast readability (QR = Quick Response Code) by Denso. The symbol size adjusts automatically depending on input data. Special industry formats are supported.

The default interpretation for QR-Code is ECI 000020 representing the JIS8 and Shift JIS character sets. For Latin-1 based character sets refer to QR-Code 2005 (see section 6.3.11.4).

6.3.11.1 Kanji and Chinese Compaction

This symbology supports the compaction of Kanji characters and (in newer specifications) also the compaction of Chinese characters. The compaction of Kanji or Chinese characters can be activated in TEC-IT software – when used, it must be ensured that the input data complies with the Shift JIS X 02 (Japanese) or the GB 2312 (Simplified Chinese) character set.

6.3.11.2 QR–Code Capacity

The data capacity depends on the format of the encoded data:

Format	Data Capacity	Characters
Numeric	7089 characters	0-9
Alphanumeric	4296 characters	0–9 A–Z (upper-case) space $ % * + - , . / :
Binary	2953 bytes	Default encoding: ISO 8859-1 (QR Code 2005)
Kanji	1817 characters	Shift JIS X 0208

Table 22: QR Code Data Capacity

Maximum data capacity for binary data is 2953 bytes using a matrix of 177x177 dots. As an example the symbol version 22 (104x104 dots) can encode approximately 1 KB of data using a low error correction level. The resulting symbol size is about = 37x37 mm when a dot-size of 0.35 mm is used.

The input data is always analyzed and the appropriate encoding mode is chosen automatically. Mode switching is done as required to produce the most efficient encoding.

6.3.11.3 QR–Code Creation Speed

QR-Code is a quite complex symbology and may take a lot of CPU-time when encoding a very large amount of data. You could speed up the encoding process by

- Set the QR-Code mask pattern to a constant value. Changing this setting could affect readability.
- Set the symbol size to a constant value (property *"QRCode.Version"*) if the symbol should have always the same size.
- Set the error correction level to "low" (*"QRCode.ECLevel"*). Changing this setting could affect readability.
- Minimize computing steps: set the configuration properties of **TBarCode** only one time at startup of your program, and do only change the text property for each barcode.

6.3.11.4 Codepages (Character Set)

QR Code was originally developed for Japanese bar code applications. The supported character set of QR Code Model 2 consists of:

- JIS X 0208 - http://en.wikipedia.org/wiki/JIS_X_0208
- JIS X 0201 - http://en.wikipedia.org/wiki/JIS_X_0201

SHIFT JIS / CP932 contains both of these character sets and is the Multi Byte character set used by **TBarCode** for QR-Code.

CP932 table: http://msdn.microsoft.com/de-at/goglobal/cc305152(en-us).aspx

The new ISO/IEC 18004:2006 standard for "QR-Code 2005" defines ISO-8859-1 (Latin-1) as default character set in Byte mode!

- Latin-1 - http://en.wikipedia.org/wiki/ISO/IEC_8859-1

So the "old" QR-Code uses Shift-JIS and the new QR-Code 2005 uses Latin-1 as default character set. QR-Code 2005 is available in TBarCode V10 and later.

6.3.11.5 Encoding Special Latin-1 Characters

If you want to encode special Latin-1 characters such as the "ß" (sharp s) you come to the problem that the SHIFT JIS table does not contain the "ß" (sharp s) character. So with QR Code 1997/2000 version you cannot encode these special Latin-1 characters in the default encoding.

- Encoding the full Latin-1 character set is supported in QR-Code 2005.

Using UTF-8 or ISO-8859-1

One possibility to encode “sharp s” would be to switch to ISO-8859-1 (Latin-1) or UTF-8 encoding.

Disadvantage

Using other code pages or other character sets as the default character set of a 2D bar code can lead to problems on the decoding stage. Barcode readers try to decode the QR Code data by using the default character set (which is SHIFT JIS for QR-Code 97/2000).

Workarounds

You could use UTF-8 or ISO-8859-1 in closed applications. If the data is transmitted in binary form (e.g. a serial bar code reader or an image scanner will transmit the data as sequence of Bytes) you can decode the bar code data as UTF-8 or Latin-1 format by the software, which receives the data.

You may also have luck with intelligent image decoding software (e.g. ZXing) which tries to find out if Latin-1, UTF-8 or Shift JIS is used by auto detection (also SmartPhone reader apps will do that). If you don’t have a closed application or don’t have control about the bar code decoder, this workaround cannot be used.

Note about ECI sequences

Theoretically QR Code can encode data in an user selectable character set. By design of QR Code so called “Extended Channel Interpretation” code words can be used to indicate the character set used for the subsequent data. ECI is part of QR-Code specification and is supported by TBarCode Escape Sequences. The problem is that bar code decoders often ignore ECI and so they are useless.

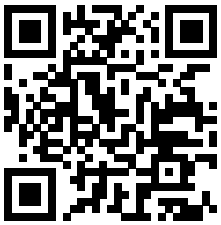
If you want to use UTF-8 without ECI’s you could try to indicate UTF-8 format by prefixing the data with an UTF-8 byte order mark at the start (EF BB BF). But there is no standard for this and you have to verify if your bar code reader / decoding software recognizes this marker.

More information in our FAQ

http://www.tec-it.com/en/support/faq/tbarcode/barcode-dll.aspx

6.3.12 QR-Code 2005

Symbology number:	58
Valid characters:	Alphanumeric and/or bytes, Kanji character set
Quiet zone:	left/right/ top/bottom: 4X
Module width:	--
Print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Automatic (symbology specific).
Size:	--
Print control:	C=QR2



Based upon standard: *ISO/IEC 18004:2006*

QR-Code 2005 is closely similar to QR Code Model 2 and, in its QR Code format, differs only in the addition of the facility for symbols to appear in a mirror image orientation, for reflectance reversal (light symbols on dark backgrounds) and the option for specifying alternative character sets to the default.

The default interpretation for QR-Code 2005 is ECI 000003 representing the *ISO/IEC 8859-1* character set.

QR-Code 2005 is the form of the symbology recommended for new and open systems applications.

6.4 HIBC – Health Industry Bar Code

HIBC bar codes are commonly used by the health industry. HIBC standards do not really describe unique symbologies, but a family of data structures. These data structures may be represented by several symbologies.

There are two categories of HIBC:

- Label Identification Code (LIC) – specified by the Supplier Labeling Standard
- Provider Applications Standard (PAS)

6.4.1 Supplier Labeling Standard Formats

The Supplier Labeling Standard is used for all **HIBC LIC** bar codes. For a full specification please refer to the document *Health Industry Bar Code: Supplier Labeling Standard (HIBC SLS) ANSI/HIBC 2.2 – 2006*. It consists of a Primary and a Secondary data structure which may be encoded together in bar code or split into 2 single symbols.

The **Primary Data Structure** is specified as follows

```
+IIIIP*UL
```

With:

Character	Description	Data Type	Length
+	HIBC Supplier Labeling Flag '+'	"**+**"	1
I	Label Identification Code (LIC)	Alphanumeric, first character is a letter	4
P*	PCN (Labelers Product or Catalog)	Alphanumeric	1 - 13
U	Unit of Measure ID	Numeric	1
C	Check Digit (mod 43) – also used as Link Character in the Secondary Data Structure.		1

Table 23: HIBC LIC - Primary Format

The **Secondary Data Structure** is defined as

```
+R*Q*D*B*LC
```

With:

Character	Description	Data Type	Length
+	HIBC Supplier Labeling Flag '+'	"**+**"	1
R*	Quantity/Date Reference Identifier	"**$**", "**$$**", or 5 digits	1, 2, or 5
Q*	Quantity Field	Numeric	0, 3, or 6
D*	Date Field	Numeric	0, or 5-9
B*	Lot/Batch/Serial Number	Alphanumeric	0-13
L	Link Character – conforms to the check digit in the Primary Data Structure		1
C	Check Digit (mod 43)		1

Table 24: HIBC LIC - Secondary Format

The **Combined Data Structure** (Primary and Secondary data structure in one piece) is defined as

```
+IIIIP*U/R*Q*D*B*C
```

When the fields are as described above and a separator character (“*/*”) is inserted between the Primary and the Secondary data structure.

6.4.2 Provider Application Standard Formats

The Provider Applications Standard is used for all **HIBC PAS** bar codes. For a full specification please refer to the document *Health Industry Bar Code: Provider Applications Standard ANSI/HIBC 1.2 – 2006*. It may consist of a Single or Split Data Field Format. The split format may be encoded together in one bar code or split into 2 single symbols.

The **Single Data Structure** is specified as follows

```
+/F*G*DDDDDC1
```

With:

Character	Description	Data Type	Length
+/	HIBC Provider Applications Standard Flag	“**+/**”	2
F*	„Where“ Flag	Alpha	1 or 3
G*	„What“ Flag	Alpha	1 or 3
D	Application Data	Alphanumeric	1-15
C_1	Check Digit (mod 43) - equal to the "Link Character" of the Second Data Structure.		1

Table 25: HIBC PAS – Single/First Data Structure

The **First Data Structure** is specified as follows

```
+/1F*G*DDDDC1
```

It is much the same as the Single Data Structure but has “**1**” as prefix.

The **Second Data Structure** is defined as

```
+/2DDDDC1C2
```

With:

Character	Description	Data Type	Length
+/	HIBC Provider Applications Standard Flag	“**+/**”	2
2	"2" indicates that this is the second data structure	“**2**”	1
D	Application Data	Alphanumeric	1-15
C_1	Check Digit (mod 43) - conforms to the check digit in the First Data Structure.		1
C_2	Check Digit (mod 43) - equal to the "Link Character" of the Second Data Structure.		1

Table 26: HIBC PAS – Second Data Structure

The **Combined Data Structure** (First and second data structure in one piece) is defined as

```
+/F*G1*D1D1D1/G2*D2D2D2C
```

With:

Character	Description	Data Type	Length
+/	HIBC Provider Applications Standard Flag	"**+/**"	2
F*	„Where" Flag	Alpha	1 or 3
G_1*	„What" Flag for D_1	Alpha	1 or 3
D_1	First Application Data	Alphanumeric	1-15
/	Separator Character between First and Second Data Structure	"**/**"	1
G_2*	„What" Flag for D_2	Alpha	1 or 3
D_2	Second Application Data	Alphanumeric	1-15
C	Check Digit (mod 43		1

Table 27: HIBC PAS – Combined Data Structure

In following you find a list of the bar code symbologies that are able to encode HIBC.

6.4.3 HIBC LIC 128

Symbology number:	98
Valid characters:	"0"..."9", "A"..."Z", "-", ".", Space, "*", "$", "/", "+", "%"
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Modulo 43 (eCDMod43)
Symbol size:	--

HIBC LIC 128 is based on the symbology Code 128. The data format corresponds to the HIBC LIC Format described above. An additional modulo 43 check digit is required.

6.4.4 HIBC LIC 39

Symbology number:	99
Valid characters:	"0"..."9", "A"..."Z", "-", ".", Space, "*", "$", "/", "+", "%"
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	Modulo 43 (eCDMod43)
Symbol size:	H>=15% of L (H>=6.3 mm!) H: Height of the barcode without human readable text L: width of the barcode

HIBC LIC 39 is based on the symbology Code 39. The data format corresponds to the HIBC LIC Format described above. An additional modulo 43 check digit is required.

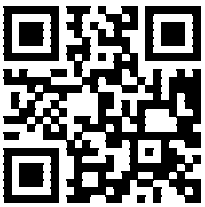
6.4.5 HIBC LIC Data Matrix

Symbology number:	102
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right/ top/bottom: 1X
Module width:	--
Print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Modulo 43 (eCDMod43)
Size:	.001 till 14.0 square inch

HIBC LIC Data Matrix is based on the 2D symbology Data Matrix. The data format corresponds to the HIBC LIC Format described above. An additional modulo 43 check digit is required.

6.4.6 HIBC LIC QR-Code

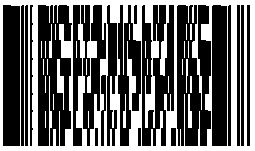
Symbology number:	104
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right/ top/bottom: 4X
Module width:	--
Print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Modulo 43 (eCDMod43)
Size:	--



HIBC LIC QR-Code is based on the 2D symbology QR-Code. The data format corresponds to the HIBC LIC Format described above. An additional modulo 43 check digit is required.

6.4.7 HIBC LIC PDF417

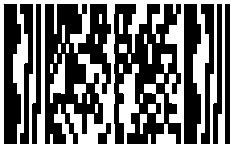
Symbology number:	106
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right: 2X
Module width:	--
Print ratio:	1:2:3:4:5:6:7:8:1:2:3:4:5:6
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B: 1S:2S:3S:4S:5S:6S
Default check digit:	Modulo 43 (eCDMod43)
Size:	X >= 0.19 mm



HIBC LIC PDF417 is based on the 2D symbology PDF417. The data format corresponds to the HIBC LIC Format described above. An additional modulo 43 check digit is required.

6.4.8 HIBC LIC MicroPDF417

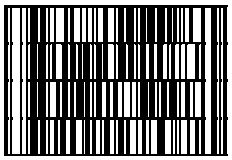
Symbology number:	108
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right: 1X
Module width:	--
Print ratio:	1:2:3:4:5:6:1:2:3:4:5:6
Ratio format:	1B:2B:3B:4B:5B:6B:1S:2S:3S:4S:5S:6S
Default check digit:	Modulo 43 (eCDMod43)
Size:	--



HIBC LIC MicroPDF417 is based on the 2D symbology MicroPDF417. The data format corresponds to the HIBC LIC Format described above. An additional modulo 43 check digit is required.

6.4.9 HIBC LIC Codablock F

Symbology number:	110
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right/ top/bottom: 10X
Module width:	X>=0.19mm
Print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Modulo 43 (eCDMod43)
Size:	2 - 44 rows; 4 - 62 characters per row



HIBC LIC Codablock F is based on the stacked symbology Codablock F. The data format corresponds to the HIBC LIC Format described above. An additional modulo 43 check digit is required.

6.4.10 HIBC PAS 128

Symbology number:	100
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Modulo 43 (eCDMod43)
Symbol size:	--

HIBC PAS 128 is based on the symbology Code 128. The data format corresponds to the HIBC PAS Format described above. An additional modulo 43 check digit is required.

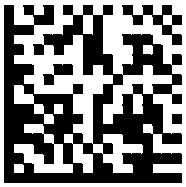
6.4.11 HIBC PAS 39

Symbology number:	101
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right: 10X, min. ¼ inch
Module width:	X >= 0.19 mm
Standard print ratio:	1:3:1:3
Ratio format:	1B:2B:1S:2S
Default check digit:	Modulo 43 (eCDMod43)
Symbol size:	H>=15% of L (H>=6.3 mm!) H: Height of the barcode without human readable text L: width of the barcode

HIBC PAS 39 is based on the symbology Code 39. The data format corresponds to the HIBC PAS Format described above. An additional modulo 43 check digit is required.

6.4.12 HIBC PAS Data Matrix

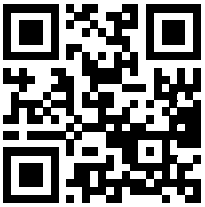
Symbology number:	103
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right/ top/bottom: 1X
Module width:	--
Print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Modulo 43 (eCDMod43)
Size:	.001 till 14.0 square inch



HIBC PAS Data Matrix is based on the 2D symbology Data Matrix. The data format corresponds to the HIBC PAS Format described above. An additional modulo 43 check digit is required.

6.4.13 HIBC PAS QR-Code

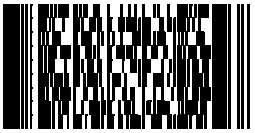
Symbology number:	105
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right/ top/bottom: 4X
Module width:	--
Print ratio:	1:1
Ratio format:	1B:1S
Default check digit:	Modulo 43 (eCDMod43)
Size:	--



HIBC PAS QR-Code is based on the 2D symbology QR-Code. The data format corresponds to the HIBC PAS Format described above. An additional modulo 43 check digit is required.

6.4.14 HIBC PAS PDF417

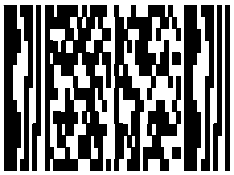
Symbology number:	107
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right: 2X
Module width:	--
Print ratio:	1:2:3:4:5:6:7:8:1:2:3:4:5:6
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B: 1S:2S:3S:4S:5S:6S
Default check digit:	Modulo 43 (eCDMod43)
Size:	X >= 0.19 mm



HIBC PAS PDF417 is based on the 2D symbology PDF417. The data format corresponds to the HIBC PAS Format described above. An additional modulo 43 check digit is required.

6.4.15 HIBC PAS MicroPDF417

Symbology number:	109
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right: 1X
Module width:	--
Print ratio:	1:2:3:4:5:6:1:2:3:4:5:6
Ratio format:	1B:2B:3B:4B:5B:6B:1S:2S:3S:4S:5S:6S
Default check digit:	Modulo 43 (eCDMod43)
Size:	--



HIBC PAS MicroPDF417 is based on the 2D symbology MicroPDF417. The data format corresponds to the HIBC PAS Format described above. An additional modulo 43 check digit is required.

6.4.16 HIBC PAS Codablock F

Symbology number:	111
Valid characters:	“0”..”9”, “A”..”Z”, “-“, “.”, Space, “*”, “$”, “/”, “+”, “%”
Quiet zone:	left/right/ top/bottom: 10X
Module width:	X>=0.19mm
Print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	Modulo 43 (eCDMod43)
Size:	2 - 44 rows; 4 - 62 characters per row

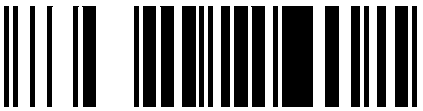
HIBC PAS Codablock F is based on the stacked symbology Codablock F. The data format corresponds to the HIBC PAS Format described above. An additional modulo 43 check digit is required.

6.5 GS1 DataBar Symbologies (RSS Codes)

The sample control sequences refer to the following TEC-IT products only: **TBarCode/X** and **TBarCode Embedded** (SEH ISD 300).

6.5.1 GS1 DataBar (RSS-14)

Symbology number (:	29
Valid characters:	"0"..."9"
Quiet zone:	none required (1X recommended)
Module width:	--
Print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	EAN 14 (eCDEAN14)
Possible check digits:	User supplied
Symbol size:	13 digits, 1 check digit, AI 01 is encoded automatically
Print control:	C=R



GS1 DataBar is used to encode the GTIN (Global Trade Item Number) with Application identifier (AI) "01". The GTIN consists of a packaging indicator (0..9) followed by a 12 digit number (taken from the EAN-13 article number system) followed by a check digit. The check digit on the 14th position is computed automatically if not provided in the input data.

The height of the symbol should be at least 33X in order to support omnidirectional scanning (X = module width). TEC-IT software prefixes the barcode data with the AI "01" automatically - do not provide the AI 01 with your input data.

6.5.2 GS1 DataBar Truncated (RSS-14 Truncated)

Symbology number:	78
Valid characters:	"0"..."9"
Quiet zone:	none required (1X recommended)
Module width:	--
Print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	EAN 14 (eCDEAN14)
Possible check digits:	User supplied
Symbol size:	13 digits, 1 check digit, AI 01 is encoded automatically
Print control:	C=RT

This symbology is similar to GS1 DataBar but the height should be at least 13X. Omni-directional scanning may not be possible.

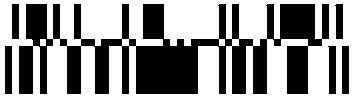
6.5.3 GS1 DataBar Limited (RSS Limited)

Symbology number:	30
Valid characters:	“0”..”9”
Quiet zone:	1X left, 5X right
Module width:	--
Print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	EAN 14 (eCDEAN14)
Possible check digits:	User supplied
Symbol size:	13 digits, 1 check digit
Print control:	C=RL

This symbology is similar to GS1 DataBar, but it is smaller in size and limited to a packaging indicator (first digit) 0 or 1.

6.5.4 GS1 DataBar Stacked (RSS-14 Stacked)

Symbology number:	79
Valid characters:	“0”..”9”, 13 digits + 1 check digit
Quiet zone:	none required (1X recommended)
Module width:	--
Print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	EAN 14 (eCDEAN14)
Possible check digits:	User supplied
Size:	--
Print control:	C=RS



This symbology is similar to GS1 DataBar, but it is split into 2 rows to make the symbol smaller. It is used for pharmaceutical packaging. Omni-directional scanning is not possible.

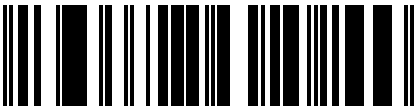
6.5.5 GS1 DataBar Stacked Omni directional (RSS-14 Stacked Omni directional)

Symbology number:	80
Valid characters:	“0”..”9”, 13 digits + 1 check digit
Quiet zone:	none required (1X recommended)
Module width:	--
Print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	EAN 14 (eCDEAN14)
Possible check digits:	User supplied
Size:	--
Print control:	C=RO

This symbology is similar to the GS1 DataBar Stacked and supports omnidirectional scanning.

6.5.6 GS1 DataBar Expanded (RSS Expanded)

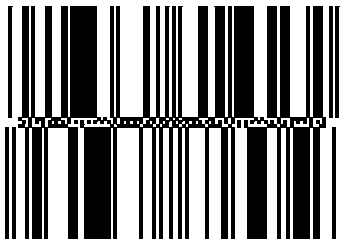
Symbology number:	31
Valid characters:	“A”..”Z”, “a”..”z”, “0”..”9” + ISO 646 character set
Quiet zone:	none required (1X recommended)
Module width:	--
Print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	None (eCDNone).
Possible check digits:	Modulo 10 (eCDMod10). EAN-14 (eCDEAN14)
Size:	Numeric: 74 digits Alphanumeric: 41 characters
Print control:	C=RE



This is a variable length symbology. It encodes up to 74 numeric or 41 alphabetic characters. Data should be encoded with Application Identifiers (AIs). Omni-directional scanning is possible.

6.5.7 GS1 DataBar Expanded Stacked (RSS Expanded Stacked)

Symbology number:	81
Valid characters:	“A”..”Z”, “a”..”z”, “0”..”9” + ISO 646 char set
Quiet zone:	none required (1X recommended)
Module width:	--
Print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	None (eCDNone).
Possible check digits:	Modulo 10 (eCDMod10). EAN-14 (eCDEAN14)
Size:	--
Print control:	C=RX



This is the stacked version of GS1 DataBar Expanded. The number of data segments per row can vary between 4 and 22. The default number of data segments is 4.

6.6 GS1 Composite Symbologies

6.6.1 Data Input

- Please note: For all Composite Symbologies the vertical bar “|” character is used to separate the data of the linear symbol and the 2D composite component.
- Example: 1234567890123|TEC-IT

6.6.2 Data Capacity of GS1 Composite Symbols

6.6.2.1 Linear Component

GS1-128: up to 48 digits
EAN/UPC: 8, 12 or 13 digits
GS1 DataBar 16 digits (2 digits AI01 + 14 digits GTIN)
GS1 DataBar Expanded: up to 74 digits

6.6.2.2 2D Component

CC-A up to 56 digits

CC-B	up to 338 digits
CC-C	up to 2361 digits

The maximum data capacity of the 2D component depends on the number of data columns, which also depends on the type of the linear component.

For instance, GS1 DataBar Stacked allows a 2D component with 2-data columns (CC-A or CC-B). In this case the maximum capacity of a CC-A would be 52 digits with special AI combination at the beginning of the data (AI 11/17 + 10), otherwise the capacity would be 48 digits.

With the other variants having 4 data columns (GS1 DataBar, GS1 DataBar Expanded,...) the maximum data capacity is a little bit higher = 56 digits.

6.6.3 GS1 DataBar Composite Symbology

Symbology number:	29
Valid characters RSS-14:	"0".."9", 13 digits + 1 check digit
Valid characters CC-A/B:	ISO 646 character set, up to 338 characters
Standard print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	EAN 14 (eCDEAN14)
Possible check digits:	User supplied
Encoded data:	1234567890123|TEC-IT

This is a GS1 DataBar barcode with an attached 2D component (CC-A or CC-B). The leading Application Identifier (AI) 01 (for the GTIN) is prefixed automatically by TEC-IT software and must not occur in the input data. The 2D component can encode additional information like lot number, quantity, expiration date …

6.6.4 GS1 DataBar Truncated Composite Symbology

Symbology number:	78
Valid characters RSS-14:	"0".."9", 13 digits + 1 check digit
Valid characters CC-A/B:	ISO 646 character set, up to 338 characters
Standard print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	EAN 14 (eCDEAN14)
Possible check digits:	User supplied
Encoded data:	1234567890123|TEC-IT

This is a GS1 DataBar Truncated barcode with an attached 2D component (CC-A or CC-B).

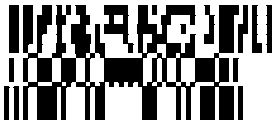
6.6.5 GS1 DataBar Limited Composite Symbology

Symbology number:	30
Valid characters RSS Lim.:	“0”..”9”, 13 digits + 1 check digit
Valid characters CC-A/B:	ISO 646 character set, up to 338 characters
Standard print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	EAN 14 (eCDEAN14)
Possible check digits:	User supplied
Encoded data:	1234567890123|TEC-IT

This is a GS1 DataBar Limited barcode with an attached 2D component (CC-A or CC-B).

6.6.6 GS1 DataBar Stacked Composite Symbology

Symbology number:	79
Valid characters RSS-14:	“0”..”9”, 13 digits + 1 check digit
Valid characters CC-A/B:	ISO 646 character set, up to 338 characters
Standard print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	EAN 14 (eCDEAN14)
Possible check digits:	User supplied
Encoded data:	1234567890123|TEC-IT



This is a GS1 DataBar Stacked barcode with an attached 2D component (CC-A or CC-B).

6.6.7 GS1 DataBar Stacked Omni directional Composite Symbology

Symbology number:	80
Valid characters RSS-14:	“0”..”9”, 13 digits + 1 check digit
Valid characters CC-A/B:	ISO 646 character set, up to 338 characters
Standard print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	EAN 14 (eCDEAN14)
Possible check digits:	User supplied
Encoded data:	1234567890123|TEC-IT

This is a GS1 DataBar Stacked Omni directional barcode with an attached 2D component (CC-A or CC-B).

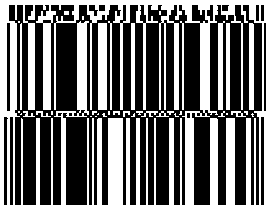
6.6.8 GS1 DataBar Expanded Composite Symbology

Symbology number:	31
Valid characters RSS Exp.:	ASCII characters between 0..127
Valid characters CC-A/B:	ISO 646 character set, up to 338 characters
Standard print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	None (eCDNone).
Possible check digits:	Modulo 10 (eCDMod10). EAN-14 (eCDEAN14)
Encoded data:	1234567890123|TEC-IT

This is a GS1 DataBar Expanded barcode with an attached 2D component (CC-A or CC-B).

6.6.9 GS1 DataBar Expanded Stacked Composite Symbology

Symbology number:	81
Valid characters RSS ES:	ASCII characters between 0..127
Valid characters CC-A/B:	ISO 646 character set, up to 338 characters
Standard print ratio:	1:2:3:4:5:6:7:8:9:1:2:3:4:5:6:7:8:9
Ratio format:	1B:2B:3B:4B:5B:6B:7B:8B:9B: 1S:2S:3S:4S:5S:6S:7S:8S:9S
Default check digit:	None (eCDNone).
Possible check digits:	Modulo 10 (eCDMod10). EAN-14 (eCDEAN14)
Encoded data:	ABCabc123+|TEC-IT



This is a GS1 DataBar Expanded Stacked barcode with an attached 2D component (CC-A or CC-B).

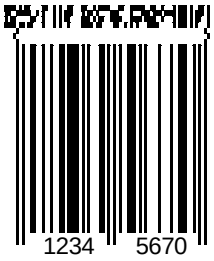
6.6.10 GS1-128 Composite Symbology

Symbology number:	16
Valid characters EAN 128:	ASCII-characters between 0..127
Valid characters CC-A/B/C:	ISO 646 character set, up to 2361 characters
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B1S:2S:3S:4S
Default check digit:	None (eCDNone).
Possible check digits:	Modulo 10 (eCDMod10). EAN-14 (eCDEAN14)
Encoded data:	1234567890|TEC-IT

This is a GS1-128 barcode with an attached 2D component (CC-A, CC-B or CC-C).

6.6.11 EAN-8 Composite Symbology

Symbology number:	10
Valid characters EAN 8:	“0”..”9”, 7 digits + 1 check digit
Valid characters CC-A/B:	ISO 646 character set, up to 338 characters
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	EAN-8 (eCDEAN8)
Possible check digits:	User supplied
Encoded data:	1234567|TEC-IT



This is an EAN-8 barcode with an attached 2D component (CC-A or CC-B).

6.6.12 EAN-13 Composite Symbology

Symbology number:	13
Valid characters EAN 13:	“0”..”9”, 12 digits + 1 check digit
Valid characters CC-A/B:	ISO 646 character set, up to 338 characters
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	EAN-13 (eCDEAN13)
Possible check digits:	User supplied
Encoded data:	123456789012|TEC-IT

This is an EAN-13 barcode with an attached 2D component (CC-A or CC-B).

6.6.13 UPC-A Composite Symbology

Symbology number:	34
Valid characters UPC-A:	“0”..”9”, 11 digits + 1 check digit
Valid characters CC-A/B:	ISO 646 character set, up to 338 characters
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	UPC-A (eCDUPCA)
Possible check digits:	User supplied
Encoded data:	12345678901|TEC-IT

This is an UPC-A barcode with an attached 2D component (CC-A or CC-B).

6.6.14 UPC-E Composite Symbology

Symbology number:	37
Valid characters UPC-A:	“0”..”9”, 7 digits + 1 check digit
Valid characters CC-A/B:	ISO 646 character set, up to 338 characters
Standard print ratio:	1:2:3:4:1:2:3:4
Ratio format:	1B:2B:3B:4B:1S:2S:3S:4S
Default check digit:	UPC-E (eCDUPCE)
Possible check digits:	User supplied
Encoded data:	1234567|TEC-IT

This is an UPC-E barcode with an attached 2D component (CC-A or CC-B).

7 Image Parameters

7.1 Image Types

The barcode can be converted to a bitmap or vector format (see TBarCode API *BCSaveImage*, *SaveImage*, *Barcode.Draw*, *BCSaveImageToBuffer*, *ConvertToStream*, etc).

The following image types with the corresponding compression options (parameter *nQuality*) are available[4].

Please keep in mind that unreadable barcodes may be produced when creating a bitmap with low resolution (see section **A.4 Optimize Barcode for the Output Device Resolution**).

7.1.1 Image Formats

Image Format	Enumeration (def. value)	Note
BMP	eIMBmp (0)	BMP bitmap format
EMF	eIMEmf (1)	Enhancd Metafile vector format (Windows only)
EPS (Bitmap)	eIMEpsDeprecated (2)	EPS with low resolution bitmap (no longer available).
GIF	eIMGif (3)	GIF bitmap format, supported since **TBarCode 7**
JPG	eIMJpg (4)	JPG bitmap format
PCX	eIMPcx (5)	PCX bitmap format
PNG	eIMPng (6)	PNG bitmap format
TIF	eIMTif (7)	TIF bitmap format
EPS (Vector)	eIMEps (8) eIMPEpsVector (8)	EPS / PostScript vector based format
PCL	eIMPcl (9)	PCL 5 (vector based format)
SVG	eIMSvg (10)	SVG vector based format, supported since **TBarCode SDK 11.2**
AI	eIMAi (11)	Adobe Illustrator® V7 format, supported since **TBarCode SDK 11.2**

Table 28: Supported Image Types

7.1.2 Compression Modes

Image format	Compression / nQuality		Remark
BMP	0..1, 0 = uncompressed, 1 = compressed		
EMF	No compression is used.		
EPS	Bitmap EPS: unused Vector EPS: adjust font substitution.		With vector EPS files you can choose between using Windows fonts (0) and only PostScript compatible fonts (1).
JPG	0..100, 0=highest compression, worst quality, 100 =lowest compression, best quality		Value of 100 suggested, especially for high data density
PCX	Not used		In *ConvertToStream* and *ConvertToStreamEx* not supported
PNG	PNGALLFILTERS (0)	Use best filter for each row (highest compression)	To save an image in compressed mode and additional as interlaced file, you have to make a bit wise or operation with the defined constants (or simple adding the numbers). Example: to save a file with maximum compression and interlaced, the quality parameter is calculated as follows: `PNGALLFILTERS |`
	PNGINTERLACE (1)	Interlace filter	
	PNGNOFILTER (2)	No filter will be used (fastest runtime)	
	PNGSUBFILTER (4)	Difference filter with adjacent pixel	
	PNGUPFILTER (6)	Difference filter with pixel from the previous row	
	PNGAVGFILTER (8)	Average filter	

[4] Depending on the API not all image types are available for streaming – see API reference for more information.

	PNGPAETHFILTER (10)	Path filter	PNGINTERLACE
TIF	0.. No compression 1.. LZW * 2.. Pack Bits compression 3.. Group 3 1D compression (CCITT Modified Huffman RLE) 4.. Group 4 2D compression (CCITT Group 4 FAX) * 5.. CCITT Group 3 compression (= CCITT Group 4 FAX) * 7.. JPEG *		* is supported with TBarCode 7 and higher
EPS	No compression is used.		
PCL	No compression is used.		
SVG	No compression is used.		
AI	No compression is used.		

Table 29: Supported Image Compression Modes

8 Character Encoding

8.1 UNICODE ←→ Code Pages

Due to internationalization and localization, strings are often encoded in the UNICODE character set, because it makes it possible to represent characters from many different languages and scripts. However, barcode symbologies are usually able to process only a relatively small set of characters. Whereas most of them are only capable of encoding a fix character set with a fix character encoding – these symbologies are not affected by the encoding topic, some others (particularly 2D symbologies) are able to switch between several code pages.

Because even these barcodes types cannot display all character sets at the same time (unlike UNICODE), **TBarCode** offers the possibility to let the user decide how the input data should be interpreted (see the properties *EncodingMode* and *CodePage*).

8.2 Default Code Pages

Different barcode symbologies use different default character encodings (=code pages).

Symbology	Default Encoding / Default Code Page
PDF417 MicroPDF417	ASCII Extended (Code Page 437)
QR-Code Micro QR-Code Japanese Postal	Shift-JIS (Code Page 932)
Aztec Code CODABLOCK-F Data Matrix DotCode Han Xin Code MaxiCode QR-Code 2005	Latin-1 / ISO 8859-1 / Windows 28591 TBarCode V8 and earlier: ANSI / Windows-1251 (Code Page 1252)

Table 30: Default Code Pages

TBarCode Inform always uses **UTF-8** as default code page.

8.3 Code Page Switching

If a code page unlike the default code page shall be used, there must also be a way to tell the barcode reader how the data should be interpreted. That means that you have to tell the reader, which encoding, which code page has been used for encoding. This is usually done with ECI codes (Extended Character Interpretation) which have to be added to the barcode data (see also section 4.7 Escape Sequences (Encoding Binary Data)).

► Be aware that not all readers are able to handle ECI codes and decode the barcode data in a correct manner. Many of the scanners just ignore the ECIs; others pass them un-translated to the addressee and let it do the work.

9 Frequently Asked Questions

9.1 How to add the Leading and Trailing '*' for Code 39?

No action is required. The asterisks '*' are added automatically to the barcode.

9.2 How to add the Check Digit to Code 39?

Simply select Modulo 43 (or another method) as check digit Method. The automatically computed check digit is appended at the end of the barcode.

9.3 How to add the Leading and Trailing 'A' (or B, C, D) for CODABAR?

Enter A&A in the format string (property *"Format"* – see section 4.6).

9.4 How to use a Specific Subset in Code 128?

Use the corresponding barcode types Code128A, 128B or 128C. The whole code will then be generated in the corresponding subset. If this is not possible with the current data, the software will change subsets as required. If you want to change the subset within the barcode enter A or B or C in the *"Format"* (see section 4.6).

9.5 How to use the Compressed Mode of Code 128?

Use the barcode type Code128 and make sure *"Format"* is empty.

9.6 How to generate a PDF417 symbol with an Aspect Ratio of 3:2?

In order to generate a PDF417 which utilizes the standard aspect ratio of 3:2 there are two possible methods:

9.6.1 Set a Row:Col Ratio of 11:1

```
Set Cols = 2
Set Rows = Cols * 11
```

9.6.2 Maintain a constant Ratio of Row Height / Module Width

Set a row height: module width ratio of 3:1 (default) by setting the module width to 500 (0.5 mm constant value) and PDF417 row height to 1500 (1.5 mm).

9.7 How to set a Specific Module Width?

You can adjust the module width (or X Dimension) by setting the property *ModuleWidth* to the desired value.

Per default the barcode adapts automatically to the object width (= to the dimension of the bounding rectangle). After adjusting module width the resulting barcode width depends on the amount of the encoded data characters and no longer on the width of the bounding rectangle.

- Keep in mind to choose a suitable size of the bounding rectangle to ensure that the barcode is not clipped.
- The dimension of the bounding rectangle must be wide enough to hold the largest data content possible. Use the property *MustFit* to check whether a barcode does not fit into the bounding rectangle.
- The *SizeMode* property (available since TBarCode V7) must be set to Custom Module Width if you want your settings to take effect.

9.8 More FAQ

http://www.tec-it.com/support/faq/barcode/printing-decoding.aspx

http://www.tec-it.com/support/faq/tbarcode/barcode-ocx.aspx

10 Contact and Support Information

TEC-IT Datenverarbeitung GmbH

Address: Hans-Wagnerstr. 6
AT-4400 Steyr
Austria/Europe
Phone: +43 / (0)7252 / 72 72 0
Fax: +43 / (0)7252 / 72 72 0 – 77
Email: mailto:support@tec-it.com
Web: http://www.tec-it.com/support

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Appendix A: Creating Optimal Barcodes

A.1 General

Generating optimal barcodes means to

1. Determine the optimal barcode size required by the application (see section A.2)
2. Maintain a minimal quiet zone to guarantee the readability of the barcode (see section A.3)
3. Produce the best possible output on the target device (see sections A.4)

The last and most important step, the optimization for the output device, is described in detail in sections A.5 and following. It is described how the optimization is supported by TEC-IT barcode software. Furthermore it is described what you should consider when printing barcodes directly or when using barcode images. In the last section the approach for optimizing barcodes is illustrated with some code examples.

A.2 Barcode Size

Primarily the barcode size is determined by the application where the barcode is used. The scanner hardware and the projected reading distance define an upper and lower limit for the barcode size (see also Barcode Reference, section 4.2.3).

In addition, some barcode specifications provide guidelines for the barcode size. This is either:

- An obligatory size with only little tolerance
  (most postal barcodes like USPS Postnet, Australian Post Codes, …)
- A list of recommended sizes or module widths,
  e.g. a standard size and a number of magnification factors to choose from
  (GS1-128, UPC, ITF-14, …)
- A recommended minimum module width
  (Code 128, …)

When using the barcode in an industry or transportation label the required barcode size is usually exactly specified. The label specification provides the required information.

A.3 Quiet Zone

To guarantee the readability of the barcode a certain quiet zone around the barcode should be maintained. The quiet zone depends on the type of the barcode:

- Linear Barcodes
  As a rule of thumb for linear barcodes the quiet zone should be ten times the module width. For some barcode types a recommended minimum is explicitly given by the specification.
- 2D Barcodes
  The quiet zone depends on the actual barcode type. A rule of thumb cannot be given but using 10 times the module width could fix possible problems.
- GS1 DataBar Codes
  Due to the technical nature of these barcodes no quiet zones are required. Only for symbologies with an added composite component you have to maintain a certain quiet zone.

Figure 15: Quiet Zone for Linear Barcode

For more information about quiet zones, please refer to the Barcode Reference, section 4.4.

A.4 Optimize Barcode for the Output Device Resolution

When printing the barcode (or when creating a barcode image) the most important step is to optimize the module width with respect to the output device resolution. A printer can only print whole dots. Therefore the bar and the space widths have to be adjusted, so that they exactly fit the printing raster. If this adjustment is skipped, the resulting output may be inaccurate and the readability of the barcode may suffer. Especially for low output resolutions (e.g. screen output or thermo transfer printing) the optimization is essential. For printers with high resolution the optimization may be negligible. However it is recommended to optimize the barcode in any case.

As a result of the optimization the size of the barcode symbol will be modified very slightly.

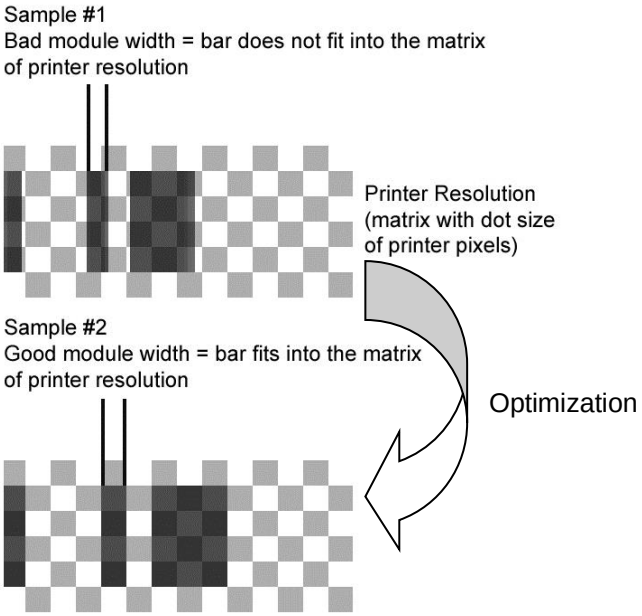

Figure 16: Optimize Barcode for Output Device Resolution

After the optimization the module width is exactly N times the width of a device pixel (for N is an integer greater than 0).

In practice the optimization can be done using different methods. Section A.5 describes all necessary adjustments which are required to enable the automatic optimization in TEC-IT software products. Alternative you can also choose an appropriate module width which fits the printing raster by yourself.

Whenever printing a barcode directly or when using barcode images, you should additionally consider a few rules (see sections A.6 to A.7). Finally, for developers, in section A.9 all programming steps which are required to optimize a barcode are explained with a few code examples.

A.5 Enable Optimization in TEC-IT Software

In TEC-IT software per default the barcode optimization for a given resolution is turned off. Instead all barcodes are created in the exact size as specified. If you want to turn the optimization on, please do the following:

A.5.1 Barcode Studio

With the barcode image designer **Barcode Studio** you have two possibilities to optimize a barcode:

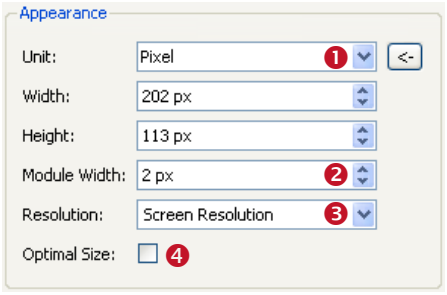

Figure 17: Barcode Optimization in Barcode Studio

The easiest method is to set the check mark in ❹. This will automatically optimize the barcode for the given output resolution (see ❸).
As an alternative you can also set the scaling unit to “Pixel” (see ❶) and then adjust the module width in ❷. Since you can only adjust integer values for the unit “pixel” the barcode must necessarily fit the raster and you will get an optimal barcode for the specified resolution.

A.5.2 TFORMer

In the barcode label software **TFORMer Designer** you can set *Optimal Resolution* to “True” (see ❺). This will optimize the barcode for the printer on which the document is actually printed.

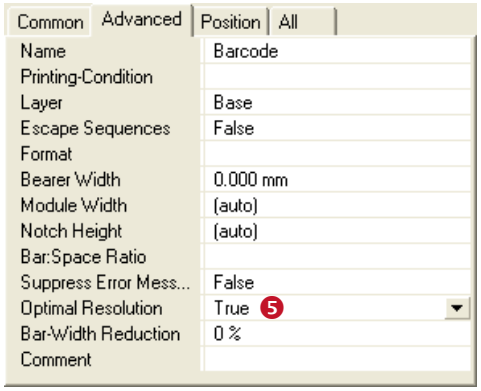

Figure 18: Barcode Optimization in TFORMer Designer

A.5.3 TBarCode

In the barcode generator SDK **TBarCode** you have two different adjustments for optimization: Either you can generate the smallest possible barcode optimized for the selected decoder type and for the specified resolution (see Figure 19).

Or, for any custom sized barcodes, you can turn on the optimization by setting the *OptResolution* property to “true” (see Figure 20).

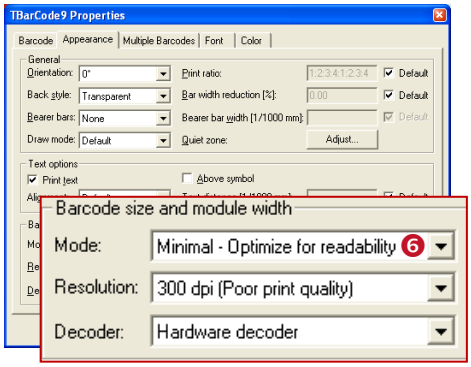

Figure 19: Barcode Optimization in TBarCode OCX (Version 1)

The settings shown in the figure above are available in the properties dialog of the barcode control. The "Minimal" mode ❻ creates all barcodes with the recommended minimum module widths. For the decoder type "Hardware decoder" (e.g. suitable for barcode scanners) this would produce linear and stacked barcodes with a module width of approximately 0.254 mm (= 10 mils) and 2D barcodes like QR-Code or Data Matrix with a module width of about 0.5 mm (≅ 20 mils).

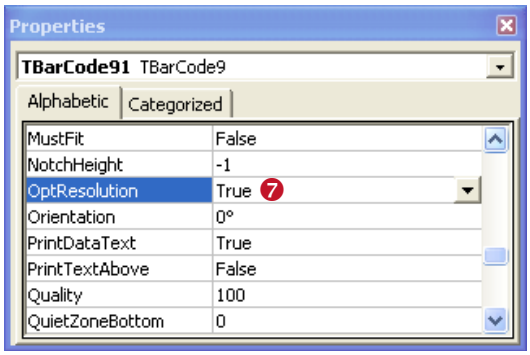

Figure 20: Barcode Optimization in TBarCode OCX (Version 2)

In the application specific property window (and not in the properties page as shown in Figure 19) you will find the property *OptResolution* ❼. When set to "true" the barcode will be optimized for its predefined size.

A.5.4 Application Notes for "Optimal Resolution"

Please note: When enabling the switch "optimal resolution" (see ❹, ❺ and ❼) the barcode will always be reduced to the next smaller size, in which it can be printed in optimal quality.

Under unfortunate circumstances this size reduction might cause the module width to drop below a given minimal module width. Therefore it is recommended to enlarge the bounding rectangle of the barcode to the maximum available area whenever possible. This way you will get the largest possible optimized barcodes on the printout.

However, instead of using *OptResolution* the following approach may sometimes be even more suitable:

- Experienced users can adjust the module width of the barcode manually. E.g. in **TFORMer** you can specify the module width in mm. When doing this you have to take care that the adjusted module width is suitable for the printer resolution.
  Example: printer resolution = 600 dpi
  → One dot has 1/600 inch ≅ 0.0016 inches ≅ 0.0024 mm
  → For this printer you could use N * 0.0024 mm (for N is an integer greater than 0) as module width
  (Hint: You can also use **Barcode Studio** to do the necessary module width calculations!)

- For creating images software developers should use *BCGetOptimalBitmapSize()* instead of *OptResolution.* Using this function you have more control over the output.

A.6 Printing Barcodes Directly

By default TEC-IT software uses the whole available space (the bounding rectangle) to render a barcode. This means that the software computes the module width based on the available space and on the data to be encoded.

For printing with high resolutions such as 600 dpi this approach is OK. Even if the resulting quality of the barcode is not optimal with respect to the printer resolution, the inaccuracies are usually so small, that they do not lead to a noticeable loss in the barcode quality. To get a sense for the occurring deviations you could check the output quality for your settings with **Barcode Studio.**

On the other hand, if the printer resolution is low (equal or smaller to 300 dpi) or the data density is very high – or to be more precisely if the module width in device pixels is very small, the loss of quality may be noticeable. Therefore you should always optimize the barcode quality in such circumstances. In order to do so, you can either adjust the module width so that it exactly fits the printing raster, or you can set the *OptResolution* flag to “true”.

A.7 Barcode Images

When using barcode images you should always generate them in optimal quality, meaning that all spaces and all bars should be represented with a whole number of image pixels. Images are (in principle) device independent. So this should always be possible.

Therefore consider the following:

- Whenever possible use the property *OptResolution* to adapt the module width to the resolution (pixel raster) of the image. Developers also have the possibility to use the function *BCGetOptimalBitmapSize().* Given the requested size of the barcode (in device pixels) it will optimize the width and the height of the barcode.
- Use lossless image formats (like PNG instead of JPG). Don’t use any compression reducing the picture quality.
- Avoid any post processing like scaling/resizing with image editing software! Each post processing step means a potential loss of the barcode quality.

However, when using the images (e.g. when embedding them in a layout) and, in a further consequence, when printing them you have to be aware that

- depending on the size of your source image and
- depending on the required size on your printout and
- depending on the resolution of the printer

the original barcode image will be scaled with a particular scaling factor.

This scaling occurs when the image is rastered for the printer resolution. It may negatively influence the barcode quality of the printout. Therefore, you should ideally always create the barcode image in the same resolution in which it will be printed. As a consequence any scaling between the image and the printout is avoided. If scaling is inevitable for any reason, you should take care that after the scaling the barcode can be rendered with whole device pixels on the target printer.

In section A.7.3 a general approach how to optimize a barcode image for a specific printer resolution is described. But before going into detail we want to explain a few general principles for using barcode images.

A.7.1 Embedding Barcode Images

In general, barcode images are used in order to embed a barcode into arbitrary layouts (e.g. on a HTML page, in a desktop publishing program, in a report generator, etc.).

Therefore you usually specify a rectangular region on the layout in which the image will be inserted. This rectangular region defines the size (in device independent units like mm) in which the barcode will be printed. (Only exception: In HTML you specify the actual printout size indirectly via screen pixels. Nonetheless this pixel size can be translated to a specific target size on your printout – for details see section A.7.2.)

Now, the basic principle is that the printout will always have exactly the same size as specified in the layout. The size of the embedded source image actually does not have any influence on the printout size. However, the quality of the printout will vary depending on different source image dimensions!

Therefore you should ideally always

- Create the image exactly in the same resolution as used for printing (printer resolution).
- If you do not know in which resolution the barcode image will be printed, use a sufficiently high resolution, so that the image is likely to printed in an aspect ratio of 1:1 or that it is being down-scaled for printing (down-scaling a large image usually produces better results on the printout than up-scaling a smaller image).

A.7.2 Barcode Images in HTML

As already stated above, the basic idea for generating high quality barcode printouts is to generate detailed barcode images which are optimized for a specific printer resolution. This approach can also be used for HTML. The high resolution images are only scaled down for display in the browser window. Internally the images keep their high resolution. Thus the browser can generate more accurate printouts compared to using source images in a low screen resolution.

To specify the dimension in which the barcode will be displayed on the HTML page you can use the image attributes “width” and “height”. These attributes specify the display size of images on the screen. Within the HTML code this would look like:

```
<img src="/images/barcode.png" width="250" height="60">
```

The screen size of the barcode image does not only specify the size in which the barcode is displayed in the browser window, it also specifies the size in which the barcode will be drawn on the printout. For translation you need to know:

- All images which are displayed in the web browser are assumed to have a resolution of 96 dpi. Based on that resolution the size on the printout is calculated. This calculation is independent of the printer resolution.

Example:

If a barcode image is displayed with 200 pixels it will appear on your printout with a size of about 53 mm (200 pixels / 96 dpi ≅ 2.083 inches ≅ 52.91 mm).

This means: In order to make sure that the barcode has the correct size on the printout you have to calculate the pixel size that is required for 96 dpi. Therefore divide the size (of the high resolution image) by the printer resolution and then multiply it by 96 dpi. This value must be used as “width” (or as “height”) attribute for the image.

Example:

Image width = 900 pixel
Printer resolution = 600 dpi

900 / 600 * 96 = 144 pixel

```
<img src="/images/barcode.png" width="144" height="60">
```

Please note:

- When using such high resolution images you have to increase the font size for the barcode to make the text look normal.
- Linear barcodes:
  To avoid large file sizes you can use a higher resolution in the horizontal dimension of the barcode image only. Please note: This approach will produce distorted fonts. So switch off the font in the barcode and print the text separately using HTML.
- Instead of generating the barcode image for a dedicated printer resolution you can also produce the barcode with twice or triple the resolution as displayed in the browser window. This will produce a good approximation. With more detailed source images the rasterizing errors are reduced and the printing quality is increased.

A.7.3 Optimizing Barcode Images with Respect to the Printer Resolution

Below we will describe a general approach for optimizing barcode images with respect to the printer resolution. It can be used for all images which are going to be printed. This optimization is only possible if you know the resolution of the target printer.

For optimization the following steps are required:

1. Specify the intended size of the barcode on the printout.
   Please keep in mind that due to the optimization the final barcode size will vary!
   e.g.: barcode width = 5 cm
2. Based on that size calculate the image size (in pixels) for the required printer resolution.
   e.g.: printer resolution = 600 dpi
   → 5 cm / 2.54 ≅ 1.97 inches
   → Calculated image width = 1.97 * 600 ≅ 1181 pixels
3. Now check if the barcode fits the pixel raster of the image, or if it has to be optimized.
   We assume our (linear) barcode uses a total of 101 modules[5].
   → Module width (in pixel) = 1181 / 101 ≅ 11.7
   → This module width cannot be represented with whole device pixels! The image has to be optimized!
4. Optimize the image.
   In order that all bars and spaces can be represented with whole device pixels, we have to use an integer value for the module width. Therefore the calculated pixel size has to be rounded up or down.
   → In our case we will round the module width down to 11 pixels (instead of 11.7). Therefore the barcode will become a little smaller.
   → The actual image width is now 11 * 101 = 1111 pixels.
5. Based on that pixel size the actual barcode size on the printout can be calculated.
   → 1111 / 600 ≅ 1.85 inches ≅ 4.7 cm
6. For HTML only:
   To print the barcode in the correct size, we have to calculate the width of the displayed barcode in screen pixels:
   → Therefore divide the image size by the printer resolution and multiply it by 96 dpi.
   → 1111 / 600 * 96 = 177.76 pixel
   → In the HTML image tag you would specify a width of 178 pixels!

For code examples see sections A.9.1 and A.9.2!

[5] The module count is the number of modules which is required for drawing the barcode. Example: If the barcode consists of a bar, followed by a space and then followed by two bars (making one big bar) we would count 4 modules.
The module count can be retrieved using *CountModules* for linear barcodes and *2DXCols* for 2D barcodes.

Additional considerations:

- If you do not know the resolution of the target printer it is a good approximation to use a sufficiently high image resolution (e.g. 600 dpi). In any case the barcode image should be optimized with respect to the image pixels (see step 4!).
- If you want to save space and therefore intend to create smaller images (e.g. for web applications) you can do that. In this case you should take care, that after up-scaling to the printer resolution, the barcode can be printed with whole printer dots (see also the example in section A.9.3).

Remark:

Another method to get optimal printouts would be to generate all barcode images with exactly 1 pixel module width. Such images have an optimal barcode quality and can be up-scaled to any required size. Since you do not know if the printer driver uses anti-aliasing (and produces half-tones) when up-scaling an image, or if you want to get a readable barcode text, the optimization as described above is recommended.

A.8 Barcode Vector Graphics

In TEC-IT software you do not only have the possibility to use bitmap images, but also vector graphics images. Vector graphics have the advantage, that they do not contain any rastered data, but only structural information about the barcode (positions and sizes of all bars). Therefore:

- All vector graphics can be arbitrarily scaled without gaining any loss of quality.
- The file size is usually rather small (it is independent of the barcode dimensions).
- However, during printing also vector graphics will eventually be rastered. Therefore the module width of the barcode should ideally always be a whole multiple of the dot size of your printer. If the module width does not fit the printing raster, there will be inaccuracies on the printout.

As a vector based file format TEC-IT supports the Encapsulated PostScript® format (or short EPS format). Considering the advantages as stated above it is usually a good idea to use the EPS format instead of bitmap files wherever possible. However, please note that this format is only supported by a few applications!

A.9 Code Examples for Barcode Optimization

For your understanding the following examples show the barcode optimization by code. The first four examples do the optimization by programmatic adaption of the module width. The last sample shows the usage of the function *BCGetOptimalBitmapSize*.

A.9.1 Linear Barcodes

In this example a linear barcode will be optimized for output. We assume the following specification:

Barcode width = 60 mm
Barcode height = 30 mm
Resolution of the output device = 200 dpi (dots per inch)

Based on this specification we first calculate the projected barcode size in target device pixels. This size (actually only the width) is then adjusted so that each bar and each space of the barcode exactly matches the output raster. This is achieved by making sure that the width of one module is a multiple of one device pixel. A similar height adjustment is not necessary because the scanning process is usually not affected by the height of the barcode.

First we calculate the barcode width in device pixels:
Therefore we convert the width (which is given in mm) to inches. Then we multiply the result by the resolution (dots per inch) of the output device.

60 / 25.4 * 200 ≅ 472.44 dots (or pixels)

Then we calculate the module width and adopt it, so that all bars and spaces can be displayed with whole pixels:

```
// 1) Specify the barcode type, the barcode data, etc.
//
//    Do your barcode adjustments here!

// 2) Specify the favored barcode size.
//    To optimize the output quality we will do all calculations in device pixels.
//    Therefore the given size (in this case in mm) must be converted to device pixels
//    with respect to the resolution of the output device.
LONG   ldpi           = 200;
LONG   lBarcodeWidth  = (LONG)ConvertMMToPixel (60.0f, ldpi); // 60 mm --> 472.44 pix
LONG   lBarcodeHeight = (LONG)ConvertMMToPixel (30.0f, ldpi); // 30 mm --> 236.22 pix

// 3) Get the horizontal module count.
//    This function returns the number of modules that was calculated for the given
//    barcode. This is usually an integer! For non-integer values the optimization
//    will not work!
DOUBLE dCountModules  = ::BCGetCountModules ( pBC );
DOUBLE dModuleWidth;

// avoid division by zero
if( dCountModules > 0.0)
{
  // 4) Calculate the current module width:
  //    --> Divide the barcode width by the horizontal module count.
  dModuleWidth = (DOUBLE)lBarcodeWidth/dCountModules;

  // 5) Optimize the module width:
  //    For an optimal barcode the module width must be a multiple of one device pixel!
  //    Thus all decimal places have to be eliminated.
  //    In this case the value is rounded up with the ceil-function.
  dModuleWidth = ceil ( dModuleWidth );

  // 6) Now that you have found the optimal module width
  //    calculate the width of the complete barcode in target device pixels.
  lBarcodeWidth = (LONG)(dCountModules * dModuleWidth);
}

// 7) The optimized barcode width can now be used to draw the barcode or to save
//    the barcode as an image. In this sample the barcode will be saved as an image.
::BCSaveImage ( pBC, "C:\\ MyBarcode.BMP", eIMBmp,
                lBarcodeWidth, lBarcodeHeight, ldpi, ldpi );
```

A.9.2 2D Barcodes

For 2D barcodes we have to do both a vertical and a horizontal size adjustment.

Barcode width = 60 mm
Barcode height = 30 mm (assuming a rectangular 2D barcode like PDF417)
Resolution of the output device = 200 dpi

The following code example shows the complete calculation which is necessary for optimizing a 2D barcode for the given output device resolution:

```
// 1) Specify the barcode type, the barcode data, etc.
//
//    Do your barcode adjustments here!

// 2) Specify the favored barcode size.
//    For optimizing the output quality we will do all calculations in device pixels.
//    Therefore the given size (in this case in mm) must be converted to device pixels
```

```
//    with respect to the resolution of the output device.
LONG   ldpi           = 200;
LONG   lBarcodeWidth  = (LONG)ConvertMMToPixel (60.0f, ldpi); // 60 mm --> 472.44 pix
LONG   lBarcodeHeight = (LONG)ConvertMMToPixel (30.0f, ldpi); // 30 mm --> 236.22 pix

// 3) Get the horizontal and vertical module count[6].
//    This function returns the number of modules that was calculated for the given
//    barcode. This is usually an integer! For non-integer values the optimization
//    will not work!
LONG   lCols = ::BCGet2D_XCols ( pBC );
LONG   lRows = ::BCGet2D_XRows ( pBC );

// avoid division by zero
if( lCols > 0 && lRows > 0 )
{
  // 4) Optimize the barcode width and height:
  //    For an optimal barcode the module width must be a multiple of one device pixel!
  //    Thus all decimal places have to be eliminated.
  //    In this case the value is rounded up with the ceil-function.
  //    Then the module width/height is again multiplied by the module count.
  lBarcodeWidth  = (LONG)ceil((DOUBLE)lBarcodeWidth /(DOUBLE)lCols) * lCols;
  lBarcodeHeight = (LONG)ceil((DOUBLE)lBarcodeHeight/(DOUBLE)lRows) * lRows;
}

// 5) The optimized barcode width and height can now be used to draw the barcode or to
//    save the barcode as an image. In this sample the barcode will be saved as an image.
::BCSaveImage ( pBC, "C:\\MyBarcode.BMP", eIMBmp,
                lBarcodeWidth, lBarcodeHeight, ldpi, ldpi );
```

A.9.3 Prepare a Barcode with a specific Module Width for a Web Page

In the following example we want to create a barcode image with a module width of 15 mils. The printer resolution is assumed to be 600 dpi.

So the module width is 0.015 * 600 = 9 device pixels.

Furthermore we want to generate a rather small image. Therefore we will use just 3 (instead of 9) pixels as module width. This means the barcode image is actually optimized for a resolution of 200 dpi. For printing with 600 dpi the image will be scaled by 3 (3 * 3 = 9 device pixels). That's perfect.

In order to prepare the image, we have to do the following steps:

Step 1: Create the Image

First we calculate the horizontal size of the barcode image in pixels. Therefore we multiply the number of barcode modules width the intended module width (in pixel):

```
' the number of modules in the barcode
CntModules = tbc.CountModules[7]

' one module will be 3 pixels in the generated image
BitmapWidth = 3 * CntModules

' the height of the barcode image is half an inch
BitmapHeight = 100

' convert to bitmap stream
ImgByteArray = ConvertToStream (eIMPng, BitmapWidth, BitmapHeight, ...)
```

Step 2: Scale the Image

Now we calculate the desired display size in the browser, so that the barcode will finally be printed in the correct size on the printout. HTML assumes a screen resolution of 96 dpi. The image was optimized for 200 dpi. Thus we have to scale the image for display in the browser by 96 / 200.

[6] In TBarCode SDK V10 you can use DLL function BCGetOptimalBitmapSize()
[7] In TBarCode SDK V10 you can use COM method GetOptimalBitmapSize()

```
DispWidth  = BitmapWidth  * 96 / 200
DispHeight = BitmapHeight * 96 / 200

<img src="<%="Barcode.asp?" & URLPARAM%>" width="<%=DispWidth%>" height="<%=DispHeight%>”
```

This procedure works for web applications (*ConvertToStream* method) as well as for storing image files (*SaveImage* method).

A.9.4 Create a 2D Barcode Image with the Module Width specified in Pixels

To get a precise image you can adjust the size of the image in pixels according to the required horizontal and vertical size of the barcode. By using the properties *2DXCols* (number of columns in modules) and *2DXRows* (number of rows in modules) the size of the image can be optimized:

```
Dim nScale As Long
Dim nXSize As Long
Dim nYSize As Long

' 1) Initialize the barcode
TBarCode111.Text = "Somedata"
TBarCode111.BarCode = TBarCode11Lib.eBC_MicroPDF417

' 2) Use 5 pixels per module
nScale = 5
nXSize = TBarCode111.Get2DXCols * nScale
nYSize = TBarCode111.Get2DXRows * nScale

' 3) Save the barcode using the optimized size
'    (Please note: The resolution specified by the last two parameters is only stored as
'    information in the image attributes (if supported by the image type).
'    It has no influence on the pixel size of the generated image.)
TBarCode111.SaveImage "C:/MyBarcode.bmp", TBarCode11Lib.eIMBmp, nXSize, nYSize, 72, 72
```

A.9.5 Optimize an Image using BCGetOptimalBitmapSize

The following code snippet shows you how to use the function *GetOptimalBitmapSize()*.

```
Dim lWidth  As Long
Dim lHeight As Long

' 1) Initialize the barcode
TBarCode111.Text = "Somedata"
TBarCode111.BarCode = TBarCode11Lib.eBC_Code128
TBarCode111.Width = 200
TBarCode111.Height = 70

' 2) Optimize the pixel size of the barcode image
TBarCode111.GetOptimalBitmapSize 1, 1, lWidth, lHeight

' 3) Save the barcode using the optimized image width and height
'    (Please note: The resolution specified by the last two parameters is only stored as
'    information in the image attributes (if supported by the image type).
'    It has no influence on the pixel size of the generated image.)
TBarCode111.SaveImage "C:\temp\Doc1.bmp", TBarCode11Lib.eIMBmp, lWidth, lHeight, 72, 72
```

Appendix B: Barcode Quiet Zones

The information contained in this chapter is subject to be changed without notification. We are sorry, but we cannot guarantee that all information is error-free. TEC-IT Datenverarbeitung GmbH is not liable for any damages or lost profits if somebody relies on the information in this chapter.

We recommend the following quiet zones to be used with the listed bar code symbologies. Please consider that quiet zones often depend on a specific label format, so please hold on to your specification (if you have one).

The “X” stands for module width (narrow bar width).

B.1 Linear Symbologies

No.	Barcode Symbology	Vertical quiet zone		Horizontal quiet zone	
		top	bottom	left	right
63	Australian Post Customer	2 mm		6 mm	
64	Australian Post Customer 2				
65	Australian Post Customer 3				
68	Australian Post Redirection				
66	Australian Post Reply Paid				
67	Australian Post Routing				
18	Codabar	–		10X	
2	Code 2 of 5 Standard / Code 2 of 5 Matrix	–		10X, min. ¼ inch	
6	Code 2 of 5 Data Logic				
4	Code 2 of 5 IATA				
7	Code 2 of 5 Industrial				
3	Code 2 of 5 Interleaved				
1	Code 11	–		10X	
8	Code 39	–		10X, min. ¼ inch	
9	Code 39 Extended				
25	Code 93	–		10X, min. ¼ inch	
62	Code 93 Extended				
20	Code 128	–		10X, min. ¼ inch	
59	Code 128 Subset A				
60	Code 128 Subset B				
61	Code 128 Subset C				
22	Deutsche Post Identcode	see Code 39			
21	Deutsche Post Leitcode				
10	EAN-8[8]	–		7X	
11	EAN-8 with 2 digits add-on[8]			add-on: 7-10X	add-on: 5X
12	EAN-8 with 5 digits add-on[8]				
13	EAN-13[8]	–		11X	7X
14	EAN-13 with 2 digits add-on[8]			add-on: 7-10X	add-on: 5X
15	EAN-13 with 5 digits add-on[8]				
72	EAN-14	see EAN-128			
16	GS1-128 (EAN-128)	–		10X, min. ¼ inch	

[8] In TEC-IT software the quiet zones for this symbology are included in the barcode generation algorithm. You need no extra adjustments.

28	Flattermarken	depends on the application			
69	ISBN Code	see EAN-13 P5			
89	ITF-14			10X	
76	Japanese Postal	2 mm	2 mm	2 mm	2 mm
77	Korean Post Authority	–		not exactly specified, but use 10X	
50	LOGMARS	see Code 39			
47	MSI	see Plessey			
75	NVE-18	see EAN-128			
51	Pharmacode One-Track	–		6 mm	
53	Pharmacode Two-Track				
82	Planet 12	see USPS Postnet			
83	Planet 14				
46	Plessey Code	–		12X	
52	PZN (Pharma Zentralnummer)	see Code 39			
70	Royal Mail 4 State (RM4SCC)	–		2 mm	
29	GS1 DataBar (RSS-14)	–		no quiet zone required	
78	GS1 DataBar Truncated (RSS-14 Truncated)				
31	GS1 DataBar Expanded (RSS Expanded)				
30	GS1 DataBar Limited (RSS Limited)				
48	SSCC-18	see EAN-128 (for some label specs it says ¼ inch)			
118	Swedish Postal Shipment ID	–		10X	
32	Telepen Alpha	–		–	
33	UCC / EAN-128 (GS1-128)	–		10X, min. ¼ inch	
17	UPC 12	–		9X	
34	UPC version A[9]	–		9X	
35	UPC version A, 2 digits add-on[9]			add-on: 9-12X	add-on: 5X
36	UPC version A, 5 digits add-on[9]				
37	UPC version E[9]	–		9X	7X
38	UPC version E, 2 digits add-on[9]			add-on: 9-12X	add-on: 5X
39	UPC version E, 5 digits add-on[9]				
40	USPS Postnet 5	1/25 inch		1/8 inch	
41	USPS Postnet 6				
42	USPS Postnet 9				
43	USPS Postnet 10				
44	USPS Postnet 11				
45	USPS Postnet 12				

Table 31: Quiet Zones (Linear Symbologies)

B.2 2D Symbologies

No.	Barcode Symbology	Vertical quiet zone		Horizontal quiet zone	
		top	bottom	left	right
92	Aztec Code	–		–	
74	Codablock F	10X		10x	
71	Data Matrix	1 cell (1X)		1 cell (1X)	
115	DotCode	3 cells (3X)		3 cells (3X)	

[9] In TEC-IT software the quiet zones for this symbology are included in the barcode generation algorithm. You need no extra adjustments.

116	Han Xin Code	3 cells (3X)	3 cells (3X)
57	MaxiCode	1 cell (1X)	1 cell (1X)
84	MicroPDF417	–	1X
97	Micro QR-Code	4 cells (4X)	4 cells (4X)
55	PDF417	2X	2X
56	PDF417 Truncated		
58	QR-Code	4 cells (4X)	4 cells (4X)
79	GS1 DataBar Stacked (RSS-14 Stacked)	–	–
80	GS1 DataBar Stacked Omni directional (RSS-14 Stacked Omni directional)		
81	GS1 DataBar Expanded Stacked (RSS Expanded Stacked)		

Table 32: Quiet Zones (2D Symbologies)

Appendix C: Extended Channel Interpretation (ECI)

C.1 ECI Overview

Here a short overview about the available ECI specifiers for defining the encoding of subsequent bar code data (see also section 4.7.)

ECI Number	Description
ECI 000000 (equates to original GLI 0):	The lower half of the character set (decimal value 0 to 127) equates to ISO/IEC 646: 1991 IRV (equivalent to ANSI X3.4), the upper half (decimal value 128 to 255) equates to Code Page PC437. ISO/IEC 15438 Bar code symbology specification-PDF417: Default character set to 1994 specification with GLI rules.
ECI 000001(equates to original GLI 1):	The lower half of the character set (decimal value 0 to 127) equates to ISO/IEC 646: 1991 IRV (equivalent to ANSI X3.4) and characters 128 to 255 being identical to those values of ISO 8859-1. ISO/IEC 15438 Bar code symbology specification-PDF417: Latin 1 character set to 1994 specification with GLI rules.
ECI 000002	PC437 (code table equivalent to ECI 000000, without the reset-to-GLI 0 logic).
ECI 000003	ISO 8859-1 (code table equivalent to ECI 000001, without the reset-to-GLI 0 logic).
ECI 000004	ISO 8859-2 Latin-2 Central European
ECI 000005	ISO 8859-3 Latin-3 South European
ECI 000006	ISO 8859-4 Latin-4 North European
ECI 000007	ISO 8859-5 Latin/Cyrillic
ECI 000008	ISO 8859-6 Latin/Arabic
ECI 000009	ISO 8859-7 Latin/Greek
ECI 000010	ISO 8859-8 Latin/Hebrew
ECI 000011	ISO 8859-9 Latin-5 Turkish
ECI 000012	ISO 8859-10 Latin-6 Nordic
ECI 000013	ISO 8859-11 Latin/Thai
ECI 000015	ISO 8859-13 Latin-7 Baltic Rim
ECI 000016	ISO 8859-14 Latin-8 Celtic
ECI 000017	ISO 8859-15 Latin-9
ECI 000018	ISO 8859-16 Latin-10 South-Eastern European
ECI 000020	Shift JIS (JIS X 0208 Annex 1 + JIS X 0201)
ECI 000021	Windows 1250 Latin 2 (Central Europe) 2001-02-12
ECI 000022	Windows 1251 Cyrillic 2001-02-12
ECI 000023	Windows 1252 Latin 1 2001-02-12
ECI 000024	Windows 1256 Arabic
ECI 000025	ISO/IEC 10646 UCS-2 (High order octet first)
ECI 000026	ISO/IEC 10646 UTF-8

Table 33: ECI Numbers

► Character set overview: http://www.unicodecharacter.com/charsets/iso8859.html