HP Smart Wand
Users Manual

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First Edition ..... MARCH 1987

Printing History

New editions are complete revisions of the manual. Update packages, which are issued between editions, contain additional material and replacement pages to be merged into the manual by the customer. The data on the title page and the back cover of the manual changes only when a new edition is published. When an edition is reprinted, all the prior updates to the edition are incorporated. No information is incorporated into a reprinting unless it appears as a prior update. The number of the edition does not change.

All pages are original issue.

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1

Introduction

What is a Smart Wand?

A Smart Wand is a peripheral device that attaches to the HP-94 to allow the input of bar code data. It consists of an optical sensor, digitizing electronics, a microprocessor to decode the data, and a line driver. The output from the Smart Wand to the HP-94 is serial ASCII data that represents the bar coded information.

Smart Wand Functions

The Smart Wand will decode bar codes of the following types:

- Code 39 (with optional Full ASCII conversion)
- Interleaved 2 of 5
- UPC/EAN/JAN
- Codabar
- Code 128
- Code 11
- MSI Code

The Smart Wand supports autorecognition of all codes, and each code may be enabled or disabled individually. After the data is decoded, it is transmitted to the HP-94 in a configurable format. A header of 0 to 10 characters may be placed in front of the decoded data, a code ID character may precede the data, and a trailer of 0 to 10 characters may follow the data.

SPECIFICATIONS

Typical Wand Characteristics

Parameter	Low Resolution 39961D	General Purpose 39963D	High Resolution 39965D	NOTES
Nominal Narrow Element Width	0.33 mm (0.013 in)	0.19 mm (0.0075 in)	0.13 mm (0.006 in)	
Wavelength	655 nm	655 nm	820 nm	
Scan Speed	7 - 127 cm/s (3 - 50 in/s)	7 - 127 cm/s (3 - 50 in/s)	7 - 127 cm/s (3 - 50 in/s)	
Tilt Angle	0 - 45 deg	0 - 45 deg	0 - 45 deg	1
Depth of field	0.85 mm (0.035 in)	0.85 mm (0.035 in)	0.85 mm (0.035 in)	2
Ambient light rejection	100,000 Lux	100,000 Lux	100,000 Lux	3, 4

NOTES

1. Tilt angle is measured from perpendicular.
2. Measured at 0 degrees.
3. 100,000 Lux is the equivalent of direct sunlight.
4. Ambient light sources may be tungsten, sodium, mercury, fluorescent, sunlight or any combination thereof.

Electrical Characteristics

Parameter	Minimum	Typical	Maximum	Units	NOTES
Supply Voltage	4.5	5.0	6.0	Volts	5
Idle Current		9.0		mA	
Operating Current		16.0		mA	

NOTE

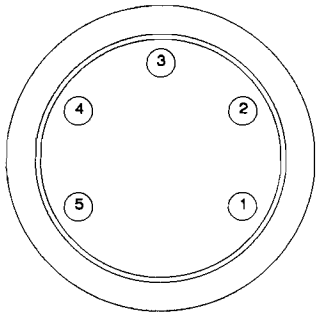
5. Power supply ripple shall be less than 100 mV_{p-p}

Absolute Maximum ratings

Parameter	Minimum	Maximum	Units
Supply Voltage	- 0.5	6.0	Volts
Storage Temperature	- 40	+75	° C
Operating Temperature	0	+55	° C

Pin Diagram

The connector used on the Smart Wand is a 240 degree 5 pin DIN connector.



Pin #	Wire Color	Function	NOTES
1	Red	V_{cc}	Supply Voltage
2	White	Transmitted Data (from the wand)	
3	Black	Ground	
4	Green	Received Data (to the wand)	6
5	N/A	N/C	
Shield	-	Shield	7

NOTES

6. While the wand has a pin for received data, the HP-94 bar code port leaves this pin unconnected.
7. The shield **MUST** be connected to ground.

Certification

FCC Certification (USA Only)

This equipment generates radio frequency energy and if not installed and used properly, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the wand with respect to the receiver
- Move the wand away from the receiver

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20422, Stock No. 044-003450-4.

MODEL	FCC IDENTIFICATION
39965D	FCC ID: CUP6Z939965D HEWLETT-PACKARD
39963D	FCC ID: CUP6Z939963D HEWLETT-PACKARD
39961D	FCC ID: CUP6Z939961D HEWLETT-PACKARD

2

Operating Instructions

Installation

Plug the connector of the HP Smart Wand into the connector on the front edge of the HP-94. Make sure that the wand is securely connected to the HP-94.

How to Scan a Bar Code

Follow these guidelines to ensure successful bar code scanning with the Smart Wand:

1. Turn on the HP-94 and start the application program. (See HP-94 manual for programming instructions).
2. Hold the Smart Wand in a comfortable position, much as you would hold a pencil. (see Figure 1.) The Smart Wand works best when tilted from 10 to 30 degrees from the vertical, although any angle from 0 to 45 degrees will work. (see Figure 2.)

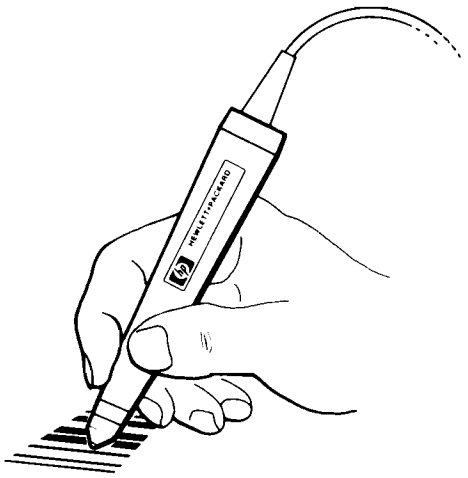


Figure 1. Wand Positioning

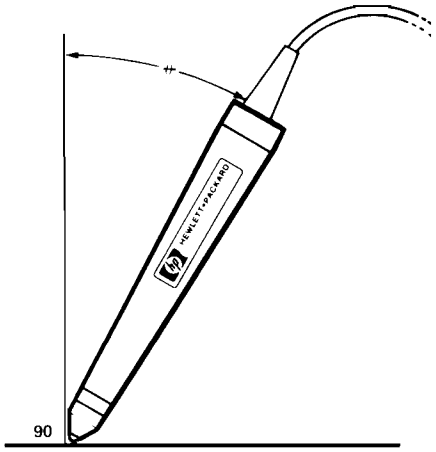


Figure 2. Wand Tilt

3. Place the tip of the Smart Wand on the white margin on either side of the bar code label to be scanned. "Whisk" the wand smoothly and lightly through the bar code label from margin to margin without lifting the tip of the wand from the surface of the label, as if the wand was being used to draw a line through the bar code label. (See Figure 3.)

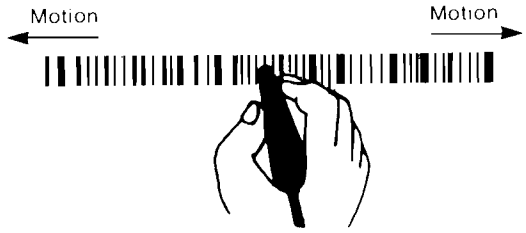


Figure 3. Scanning the Label Smoothly from End to End

4. The application program in the HP-94 should give the user some feedback. If it does not, try scanning again. If there are no positive results after two or three tries, see the following section.

CAUTION Two rapid scans of short bar codes may cause the decoded messages to be concatenated by the `"HNWN;HNBC"` handlers in the HP-94. See the HP-94 Reference manual for details.

The user should allow at least 0.2 seconds between bar code scans.

Troubleshooting

1. Is the Smart Wand powered? If the part number of the wand is 39961D or 39963D, a red light should be visible from the tip. The high resolution wand, part number is 39965D, uses infrared light and no light will be visible. If the wand is off, or suspected to be off in the 39965D, check the following:
   a. Is the HP-94 application program running? The power to the wand socket is controlled by the application program.
   b. Is the Smart Wand connected firmly to the socket?
2. Has the Smart Wand been configured correctly? If not, scan the HP-94 default configuration label.
3. Does the wavelength of the wand match the tag to be scanned? If the wand does not match the label, it may not read. The following combinations are **NOT** recommended:
   a. 39965D with thermally printed labels, or dye based ink printed labels. Thermal transfer labels are OK.
   b. 39963D or 39961D with security (black on black) labels.

   In both of the above cases, the optical signal that is returned from the label is not sufficient to allow measurement of bars and spaces.
4. Does the resolution of the wand match the label? The following combinations are **NOT** recommended:
   a. 39965D with dot matrix printed tags
   b. 39961D with high resolution tags.

   In the first case, the wand will interpret the defects in the printing as extra bars and spaces. The resulting image will not match a valid bar code. In the second case, the resolution of the wand is not sufficient to allow the wand to detect the narrow elements, causing them to disappear. Again, the resulting image of the bar code is not decodable.

5. Is the Smart Wand being held at the correct angle?

   The angle should be from 0 to 45 degrees from the vertical, or from 10 to 30 degrees for best readability.

6. Was the Smart Wand smoothly scanned through the **entire** bar code label at a constant speed?

   Try faster speeds. People tend to scan too slowly.

7. Did the Smart Wand scan off of the bar code label (either above or below the label) before the label was completely scanned?

   Make sure that the complete label was scanned.

8. Was the Smart Wand lifted from the bar code label before the scan was complete?

   Make sure that the wand tip stays in contact with the bar code label throughout the complete scan.

9. Is the bar code label damaged, dirty, or worn such that the wand did not detect all of the bars and spaces?

   If so, try to scan an area of the label that is not damaged.

10. Is the tip of the Smart Wand damaged?

    If so, see the **Tip Replacement** section.

Maintenance

The Smart Wand requires no periodic maintenance.

Tip Replacement

If the tip shows signs of damage or the sapphire ball tip is scratched or broken, the performance of the Smart Wand will be degraded. The replacement part number is 39960-60010.

NOTE Before unscrewing and replacing the tip, disconnect the wand from the HP-94.

3

Bar Code Menu

INTRODUCTION

The bar code menu allows the Smart Wand to be configured by means of manually scanning special bar code labels. The bar code labels in the menu are printed using a uniquely identifiable bar code, so that they will never be confused with standard bar code labels.

One of the Smart Wand default options is to output an escape sequence to the HP-94 after any of the bar code menu labels are scanned. The possible outputs are:

1. ^{E}C \ * The menu label scanned was valid, and the configuration operation is complete.
2. ^{E}C \ + The menu label scanned was valid, and the configuration operation is incomplete.
3. ^{E}C \ - The menu label scanned was invalid, causing a syntax error.

The conditions that cause these outputs are described in the **USAGE INSTRUCTIONS** section.

It is recommended that the application program in the HP-94 use the `"HNWN;HNBC"` handlers for the Smart Wand configuration operations. Before the bar code port is OPENed to `"HNWN;HNBC"`, be sure HNWN is enabled to receive escape sequences by the `CALL SYWN(1,2)` statement.

USAGE INSTRUCTIONS

In order to configure the Smart Wand by using the bar code menus, the Smart Wand must first be placed into the configuration mode by scanning the **enter** label. Bar code menu labels may then be scanned until all of the configuration changes are complete. The user must scan the **exit** label to resume normal reading operation. This protocol provides an extra safeguard against inadvertently configuring the Smart Wand. While the Smart Wand is in the configuration mode, scanning normal bar code labels will generate a syntax error, but will not alter any configuration information.

Bar Code Menu Types

To best use the bar code menus, it is important to understand that the configuration operations from the menu can be divided into three types:

Type 1 A single scan that by itself completes a configuration selection.

Type 2 Two scans, the first specifying a configurable variable, and the second specifying the value of the variable.

Type 3 Multiple scans: The first scan specifying a message component, and the subsequent scans specifying the data contained in the message component. This data must be terminated by the **end of characters** label.

Type 1 is the most commonly used configuration type. An example of a Type 1 label is the **enable decoding** label under the CODE 39 heading. Another example is the **UPC Only** label in the UPC heading. Scans of Type 1 may be done in any order, since each controls a entirely independent function, and each configuration option is complete as soon as the label has been scanned. If the HP-94 application program uses `"HNWN;HNBC"` as recommended above, Type 1 configuration bar codes will cause the HP-94 to sound four high pitched beeps.

Type 2 and Type 3 configuration labels use the number and character menus in Appendix D. A Type 2 example is the **minimum** = label under the CODABAR heading. It is then necessary to scan one of the number labels from the number menu, such as the one labeled **5**. As soon as the number has been scanned, the configuration selection is complete. Note that all of the available numbers are encoded as single labels, rather than forcing the user to build the number argument by scanning individual digits, which could complicate syntax and increase the risk of error. Several menu labels of Type 2 require a single character instead of a number; then the character is scanned from the character menu in the same way.

Type 3 configuration operations begin by scanning a menu label such as **header** = from the MESSAGE COMPONENTS category. Then characters of the buffer (in this case, the header buffer), are scanned one by one from the character menu. The end of the message entered is signified by scanning the **end of characters** label, included on the character menu. As soon as the label has been scanned, that configuration operation is complete.

In general, menu labels of Type 2 and 3 will have nearby text which indicates how arguments are to be supplied. The text may specify a number argument or one or more character arguments. For numerical arguments, a range is also specified. For example, in the SERIAL PORT CONFIGURATION category, the **character delay period** = label specifies that it requires a numerical argument in the range 0 to 32.

If the HP-94 application program uses the `"HNWN;HNBC"` handlers with the escape sequences transmitted as recommended above, both Type 2 and Type 3 configuration operations will cause the HP-94 to sound two high pitched beeps for each bar code scanned, until the configuration operation is completed. The HP-94 will then sound four high pitched beeps.

Two other menu labels are replicated on every page of the menu, the **Configuration dump** label and the **exit** label. The **Configuration Dump** label causes the Smart Wand to transmit its configuration to the HP-94 in a compact 216 byte format. The **exit** label enables the Smart Wand to resume normal bar code decoding.

Syntax Errors

The user may encounter bar code menu syntax errors while using the Smart Wand. The common ways are:

1. Not entering the bar code configuration mode before scanning a configuration label. When not in bar code menu configuration mode, the only menu labels that the Smart Wand will recognize are the **enter** label, the **Set HP-94 Default Configuration** label, and **Hard Reset** label.
2. Scanning normal bar code labels while in the bar code configuration mode. If a normal bar code label is scanned, it will generate a syntax error, but it will not change any configuration values.
3. Scanning arguments of the wrong type, in the wrong order, or numerically out of range.

As soon as a syntax error occurs, the user may continue the configuration operation by scanning the correct menu tags. The user may also restart the configuration session by scanning the **enter** label again to clear the error, and then begin scanning the first label in the configuration sequence. For example, suppose the user scans the **trailer** = label, and then the **UPC Only** label. Since the Smart Wand was expecting a character argument, it responds with a syntax error. The user may correct the error by scanning character labels and continuing the configuration operation, or may start over by scanning the **enter** label and the **trailer** = label again, followed by character labels from the character menu, and ending with the **end of characters** label to complete the configuration.

If the HP-94 application program uses the `"HNWN;HNBC"` handlers as recommended, then syntax errors will cause four low pitched beeps.

As long as each configuration operation is individually completed, the configuration operations may be carried out completely independently. There is no constraint against moving from category to category while configuring separate items. However, the user may not interrupt a Type 2 or a Type 3 configuration scan sequence to begin another. If this is attempted, a syntax error will occur, the second configuration operation will be ignored, and the user will have to recover from the syntax error to continue the interrupted configuration operation, as described above.

BAR CODE SELECTION

Before a particular bar code symbology may be decoded by the Smart Wand, it must be enabled. Once a bar code symbology is enabled, bar code symbols of that type may be decoded, depending also upon the enabled decoding options. The Smart Wand will not decode any bar code labels of symbologies that are not enabled.

Default: The decoding of all bar code symbologies is enabled.

Code 39

Enabled

Disabled

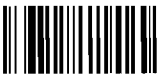
Interleaved 2 of 5

Enabled

Disabled

Type 1 Label: These bar code labels complete a configuration operation.

UPC/EAN


Enabled

Disabled

Codabar

Enabled

Disabled

Type 1 Label: These bar code labels complete a configuration operation.

Code 128

Enabled

Disabled

Code 11

Enabled

Disabled

Type 1 Label: These bar code labels complete a configuration operation.

MSI Code

Enabled

Disabled

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

CHECK CHARACTER VERIFICATION AND TRANSMISSION

Code 39 and Interleaved 2 of 5 Only

The Smart Wand has the option of verifying that the check character printed as the last character was valid. If this verification option is enabled, and the check character is valid, then the check character may either be deleted from the message or transmitted along with the message. If the check character is incorrect, then the bar code label will be ignored, or if No-Read recognition is enabled, a No-Read message will be transmitted. Whenever the check character verification has been turned off, all bar code labels will be read, whether or not a check digit is present, and all of the decoded characters will be transmitted.

Default: Check character verification disabled for Code 39 and Interleaved 2 of 5.
Check characters are removed from a valid Code 39 or Interleaved 2 of 5 message, **when** verification is enabled.

Code 39 Check Character Verification

Enabled

Disabled

Interleaved 2 of 5 Check Character Verification

Enabled

Disabled

Type 1 Label: These bar code labels complete a configuration operation.

Check Character Transmission for Code 39 and Interleaved 2 of 5

Transmitted

Deleted

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

Code 11 Check Characters

Code 11 has an option of including either one or two check characters. When only one check character is enabled, it is the "C" check character, and only labels with a valid "C" check character will be read. When two check characters are enabled, both the "C" and the "K" check characters must be present in the label.

NOTE See Appendix A for a description of the "C" and "K" check characters.

Default: Code 11 has 1 check character

Number of Code 11 Check Characters

1 Character

2 Characters

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

MINIMUM AND MAXIMUM LENGTH CHECKING

Code 39, Codabar, Code 128, Code 11, MSI Code

The length to be checked includes any check characters but does not include the start and stop characters. If the length of the label does not fit within the minimum and maximum values, the label will be ignored. If the user wants to check for a specific length, then the minimum and the maximum may be set to the same number. Setting the maximum less than the minimum is not allowed, and will cause a syntax error.

Default: Minimum length = 1
Maximum length = 32

Code 39 Length

Minimum =

Maximum =

Range = 1 - 32

Codabar Length

Minimum =

Maximum =

Range = 1 - 32

Type 2 Label: Scan a number from the number menu in Appendix D to complete the configuration operation.

Code 128 Length

Minimum =

Maximum =

Range = 1 - 32

Code 11 Length

Minimum =

Maximum =

Range = 1 - 32

Type 2 Label: Scan a number from the number menu in Appendix D to complete the configuration operation.

MSI Code Length

Minimum =

Maximum =

Range = 1 - 32

Type 2 Label: Scan a number from the number menu in Appendix D to complete the configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

MINIMUM AND MAXIMUM LENGTH CHECKING (cont.)

Interleaved 2 of 5

The minimum and maximum length checking for Interleaved 2 of 5 is different from the length checking for the other codes in that the lengths must be even numbers. If the length checking conditions are not met, then a No-Read is sent, if it is enabled. There are four mutually exclusive options available to the user to check the length of Interleaved 2 of 5 labels:

1. The allowed length of the labels may be set to variable, with the minimum length set to 4 and the maximum length set to 32. The minimum and maximum values may then be set to other even values between 4 and 32 to narrow the range of lengths to be read. Reading labels of length 2 is not available as an option when label length is variable.
2. The labels may be checked to see if they are exactly 2 characters long, with no other lengths readable. The minimum and maximum values do not apply.
3. The labels may be checked to see if they are either exactly 6 or exactly 14 characters long, with no other lengths readable. Again, the minimum and maximum lengths do not apply.
4. The labels may be checked for a particular even length from 4 to 32. This may be done by scanning the **Length** = label, or by setting the minimum and the maximum length to the same value.

Setting the maximum to less than the minimum, or setting either the minimum or maximum to an odd number is not allowed, and will cause a syntax error.

Default: Minimum length = 4
Maximum length = 32

Interleaved 2 of 5 Length Checking

Variable | 6 or 14 only | 2 only

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter (Clear Error) | Configuration Dump | Exit

MINIMUM AND MAXIMUM LENGTH CHECKING (cont.)

Interleaved 2 of 5 Length Limits

Minimum =

Maximum =

Range = 4 - 32, even numbers only.

Type 2 Label: Scan a number from the number menu in Appendix D to complete the configuration operation.

Interleaved 2 of 5 Specific Length

Length=

Range = 4 - 32, even numbers only.

Type 2 Label: Scan a number from the number menu in Appendix D to complete the configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

CODE ID CHARACTER SELECTION

All decoded bar code messages may have a single character which identifies the code symbology added to the beginning of each message. This character is configurable, and may be any single ASCII character. This code ID character may be suppressed or transmitted with the bar code message.

Default ID characters:	Code 39	"a"
	Interleaved 2 of 5	"b"
	UPC/EAN	"c"
	Codabar	"d"
	Code 128	"e"
	Code 11	"f"
	MSI Code	"g"

Default Mode: Characters suppressed.

Code 39

ID Character =

Interleaved 2 of 5

ID Character =

Type 2 Label: Scan a character from the ASCII character menu in Appendix D to complete the configuration operation.

UPC/EAN

ID Character =

Codabar

ID Character =

Type 2 Label: Scan a character from the ASCII character menu in Appendix D to complete the configuration operation.

Code 128

ID Character =

Code 11

ID Character =

Type 2 Label: Scan a character from the ASCII character menu in Appendix D to complete the configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

CODE ID CHARACTER SELECTION (cont.)

MSI Code

ID Character =

Type 2 Label: Scan a character from the ASCII character menu in Appendix D to complete the configuration operation.

Code ID Character

Transcribed

Suppressed

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

UPC/EAN OPTIONS

The UPC and EAN codes have several options:

1. All versions (UPC A, UPC E, EAN 8, or EAN 13) may be automatically recognized and decoded.
2. The code to be scanned may be restricted to only UPC-A and UPC-E. In this case, if either an EAN-13 or an EAN-8 label is scanned, it will not be decoded.
3. UPC-E labels may be expanded into the UPC-A format.
4. Supplemental encodations may be enabled. If they are enabled, then the label must be scanned in the forward direction, supplemental encodations last. If the label is scanned backwards, or the label does not have a supplemental encodation, then the label will not be decoded. There are three options:
   a. Two digit supplemental encodations may be enabled.
   b. Five digit supplemental encodations may be enabled.
   c. Two or five digit supplemental encodations may be enabled.
5. Automatic recognition of supplemental encodations may be enabled. This allows the user the option of scanning a label either with or without supplemental encodations, and having all of the data decoded. If supplemental encodations are present in the label, the label must be scanned in the forward direction, supplementals last. If the label is scanned in the opposite direction, with the supplementals first, or the scan misses the supplemental digits, then only the basic UPC label will be decoded.

Default: UPC-E not expanded
Decode UPC and EAN codes
No supplemental encodations
When supplemental encodations are enabled, they will be required, not automatically recognized.

UPC-E Expansion

Expanded

Not Expanded

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

UPC/EAN OPTIONS (cont.)

UPC verses UPC/EAN

UPC Only

UPC or EAN

Type 1 Label: These bar code labels complete a configuration operation.

Supplemental Digit Selection

No supplements

Two Digit

Five Digit

Two or Five Digit

Type 1 Label: These bar code labels complete a configuration operation.

Supplemental Recognition

Supplements Required

Automatically Recognize Supplements

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter (Clear Error)

Configuration Dump

Exit

CODABAR START / STOP CHARACTER TRANSMISSION

For Codabar the Smart Wand has the option to either transmit the start/stop characters with the message or to suppress them from the message. Codabar is the only code that has alphabetic information contained in the start/stop characters.

Default: Start/Stop characters are transmitted with the message.

Start/Stop Character Transmission

Transmitted

Suppressed

Type 1 Label: These bar code labels complete a configuration operation.

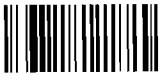
CODE 39 FULL ASCII CONVERSION

Code 39 has an option that allows the reader to decode the full ASCII character set using only the 43 characters of the Code 39 character set. This is done by pairing Code 39 characters. See Appendix A for the details. When Code 39 Full ASCII conversion is enabled, all valid character pairs will be converted into their respective ASCII symbols before being transmitted. When disabled, all decoded characters will be transmitted without being converted.

Default: Full ASCII conversion disabled.

Full ASCII Conversion

Enabled



Disabled

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

MESSAGE BUFFERS

There are several buffers in the Smart Wand that are user configurable. They are the header buffer, the trailer buffer, and the No-read message buffer.

After a good read:

Header 0 - 10 Characters	Code ID Character 0 - 1 Characters	Decoded Data 1 - 62 Characters	Trailer 0 - 10 Characters

After a misread with No Read Messages enabled:

Header 0 - 10 Characters	No Read Message 0 - 10 Characters	Trailer 0 - 10 Characters

The contents of each of these buffers is described below:

HEADER Buffer - a character string from 0 to 10 characters long that is appended to the beginning of each decoded data string, before the code ID character.

Default: None (Empty buffer)

TRAILER Buffer - a string from 0 to 10 characters long that is added to the end of the decoded data message, the No-Read message, the bar code menu responses, and configuration data bytes message.

Default: $_{CR}$ $_{LF}$

No-Read MESSAGE buffer - 0 to 10 characters that are transmitted when the user scans a label but it was not decoded. This buffer is only transmitted if the No-Read RECOGNITION is enabled.

Default: None (Empty buffer)

MESSAGE BUFFERS (cont.)

Message Buffers

Header =

0 - 10 Characters

Trailer =

0 - 10 Characters

No-Read Message =

0 - 10 Characters

Type 3 Label: Scan characters from the ASCII character menu in Appendix D followed by the **End of Characters** label to complete the configuration operation.

NO-READ RECOGNITION

The Smart Wand can be configured to output the contents of the No-Read message buffer whenever it detects bars and spaces that do not correspond to a recognized bar code.

Default: No-Read recognition is disabled.

No-Read Recognition

Enabled

Disabled

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

SERIAL PORT

BAUD RATE

The baud rate at which the Smart wand communicates to the HP-94 is programmable. The range is from 150 baud to 9600 baud.

Default: 9600 baud

NOTE If the Smart Wand's baud rate is changed, the HP-94's baud rate must also change to the same value for communication to continue. This is accomplished by sending the appropriate escape sequence to the HP-94's `"HNWN;HNBC"` handlers. See the description of the `PRINT #` statement in the HP-94 manual for details.

The new configuration of the serial port is effective immediately after the scan.

Baud Rate

150 Baud

300 Baud

600 Baud

1200 Baud

2400 Baud

4800 Baud

9600 Baud

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

SERIAL PORT (cont.)

PARITY SELECTION

The parity of the transmitted data may be configured.

Default: 0's

NOTE If the Smart Wand's parity is changed, the HP-94's parity must also be changed to the same value. This is accomplished by sending the appropriate escape sequence to the HP-94's `"HNWN;HNBC"` handlers. See the description of the `PRINT #` statement in the HP-94 manual for details.

The new configuration of the serial port is effective immediately after the scan.

Parity

0's

1's

Even

Odd

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

SERIAL PORT (cont.)

STOP BITS SELECTION

One or two stop bits may be transmitted at the end of each character byte.

Default: 1 Stop Bit

NOTE The Smart Wand will communicate with the HP-94 with either 1 or 2 stop bits enabled.

Stop Bits

1 Stop Bit

2 Stop Bits

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

SERIAL PORT (cont.)

INTERCHARACTER DELAY

The Smart Wand has a programmable delay between transmitted characters. If the intercharacter delay is disabled, then there will be no delay between characters. If the delay is enabled, then the delay period, configured independently, specifies the number of milliseconds that elapses between completion of transmission of one character and beginning of transmission of the next.

Default: Delay enabled
Delay period = 1 millisecond

Range: 1 to 32 milliseconds

Intercharacter Delay

Enabled

Disabled

Type 1 Label: These bar code labels complete a configuration operation.

Delay Period =
1 - 32 milliseconds

Type 2 Label: Scan a number from the number menu in Appendix D to complete the configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

RESETS

Hard Reset

Whether caused by power up reset, or by scanning **Hard Reset** from the bar code menu, hard reset causes the same process to occur. Self tests are performed, the Smart Wand is configured according to the options stored in non-volatile memory, and error conditions are cleared.

Soft Reset

Soft reset causes error conditions to be cleared . The effects of soft reset are shown below.

- status bits are cleared
  - last scan was backward
  - last message check character was not valid
  - bar code menu configuration mode exited
  - no output buffer overflow
  - no pending transmissions
  - output buffer cleared

Self Tests

The Smart Wand performs a series of self tests after power up. A checksum test is performed on the contents of the non-volatile memory (EEPROM) to verify that the configuration data it contains is valid. If this check passes, then the Smart Wand sets its configuration to the values stored in EEPROM. It then executes the ROM and RAM self tests, if they are enabled, as described below. If the EEPROM checksum test fails, the test is repeated until either it passes or 10 trys have failed. After 10 failures, the EEPROM fault message is transmitted with the following configuration: 9600 Baud, 1 stop bit, 0's parity, and no intercharacter delay.

EXTERNAL EEPROM FAULT $^{C}_{R}$ $^{L}_{F}$

The configuration stored in the EEPROM is loaded and and the self tests continue as if the EEPROM test had passed. The user should scan the **HP-94 Default Configuration** label to clear the error.

The next step is to perform the ROM and RAM self tests if they are enabled. In the Smart Wand the default is to skip these tests, although the user may enable them. The ROM self test is a checksum verification, and the RAM self test consists of several checkerboard read/write tests and an addressing test. If either of these fails, the appropriate self test failure message is transmitted. If both of these tests pass, or if the tests were disabled, the hard reset message is transmitted to the HP-94, concluding the hard reset process. (The default state of the Smart Wand is to transmit the hard reset message, but it may be disabled.) The hard reset message is transmitted on the serial port using recalled configuration. The hard reset message is as follows:

RESETS (cont.)

ready 12.x ^{C_R} ^{L_F}

where "x" is the revision number of the software.

If the RAM or the ROM self tests fails, a message is transmitted to the HP-94 using the configuration 9600 baud, 0's parity, 1 stop bit, and no intercharacter delay. The possible messages are below. After any self test failure, the Smart Wand is completely inactive to any input except a power up reset.

INTERNAL ROM SELF TEST FAILED ^{C_R} ^{L_F}

EXTERNAL RAM SELF TEST FAILED ^{C_R} ^{L_F}

RESETS **ROM, RAM Self Test**

Hard

Soft

Enabled

Disabled

Type 1 Label: These bar code labels complete a configuration operation.

Hard Reset Message

Enabled

Disabled

Type 1 Label: These bar code labels complete a configuration operation.

NOTE The **Hard Reset** label is different from other menu labels in that the user does not need to scan the **enter** label before this label is scanned. It will work if the user is in or out of the configuration mode. This label also causes the Smart Wand to exit the configuration mode; therefore, if other features need to be configured, the user will need to scan the **enter** label to re-enter the configuration mode.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

BAR CODE MENU SCAN RESPONSE

In normal operation, the Smart Wand will output an escape sequence to the HP-94 when it has scanned a configuration label. The transmission of these escape sequences may be disabled. The escape sequences allow the HP-94 to give the user audio feedback during Smart Wand configuration. The three possible conditions that may occur are that the menu scan was valid and the operation is still incomplete; that the menu scan was valid and the operation is complete; or that a syntax error has occurred. The escape sequence responses to the above conditions are as follows:

Valid scan, operation incomplete:	$^{E}C \setminus +$	= 1B,5C,2B hex
Valid scan, operation complete:	$^{E}C \setminus *$	= 1B,5C,2A hex
Syntax error:	$^{E}C \setminus -$	= 1B,5C,2D hex

Default: Menu responses enabled, with configured trailer appended to the message.

Bar Code Menu Scan Response

Enabled

Disabled

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

CONFIGURATION DUMP

The configuration of the Smart Wand may be examined by scanning the **Configuration dump** label. The output is 212 bytes of data, which are described in the **OUTPUT FORMATS** section.

Configuration Dump

Type 1 Label: These bar code labels complete a configuration operation.

FIXED SERIAL PORT CONFIGURATION AT HARD RESET

When enabled, hard reset causes the serial port configuration to be set to the following values, regardless of the previously configured values:

9600 Baud, 0's Parity, and 1 Stop Bit.

The configuration of the intercharacter delay is not affected, and it will remain at the previously configured value and state.

When disabled, the serial port configuration at hard reset is the last configured setting.

Default: Fixed serial port configuration at hard reset is enabled

Fixed Serial Port Configuration at Hard Reset

Enabled

Disabled

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

SMART WAND DEFAULT CONFIGURATION FOR HP-94

The Smart Wand configuration may be set to the HP-94 default. The items that are reconfigured are as follows:

1. Intercharacter delay is enabled, delay period is 1 mS.
2. ROM and RAM self tests are disabled.
3. Fixed serial port configuration at hard reset is enabled.
4. Baud rate is 9600.
5. Parity is 0's.
6. Stop bits are 1.
7. Hard reset message is enabled.
8. Menu scan response is enabled.
9. No Read recognition is disabled.

NOTE The **HP-94 Default Configuration** label is different from other menu labels in that the user does not need to scan the **enter** label before this label is scanned. It will work if the user is in or out of the configuration mode. This label also causes the Smart Wand to exit the configuration mode; therefore, if other features need to be configured, the user will need to scan the **enter** label to re-enter the configuration mode.

HP-94 Default Configuration

Type 1 Label: These bar code labels complete a configuration operation.

Configuration Mode

Enter
(Clear Error)

Configuration
Dump

Exit

4

Data Output Formats

The format of the decoded messages that are transmitted from the Smart wand to the HP 94 can vary depending upon which type of bar code was scanned by the user. The data is transmitted to the HP-94 as if the user scanned the bar code in the forward direction, even if the bar code was scanned backwards. The start and stop characters are not transmitted, with the exception of Codabar, where their transmission is optional.

The generic output formats for the Smart Wand are as follows:

After a good read:

Header 0 - 10 Characters	Code ID Character 0 - 1 Characters	Decoded Data 1 - 62 Characters	Trailer 0 - 10 Characters

After a misread with No Read Messages enabled:

Header 0 - 10 Characters	No Read Message 0 - 10 Characters	Trailer 0 - 10 Characters

After a Configuration Data Bytes request:

E_C	\	[	212 Data Bytes	]	Trailer 0 - 10 Characters

Individual Bar Code Type Output Formats

Each bar code type has a different data format, depending upon which decoding options have been selected. The exception is Code 128, which has no decoding options. The output formats for each of the bar code types are described on the following pages.

CODE 39

Decoding Options	Check Character?	Output Format	Message Length
Check character verification off	no	a...a	1...32
Check character verification off	yes	a...ac	1...32
Check character verification on	no	no output	
Check character verification on Check character transmission on	yes	a...ac	1...32
Check character verification on Check character transmission off	yes	a...a	0...31

key: a = message character
c = check character

INTERLEAVED 2 OF 5

Decoding Options	Check Character?	Output Format	Message Length
Check character verification off	no	dd...dd	2...32
Check character verification off	yes	dd...dc	2...32
Check character verification on	no	no output	
Check character verification on Check character transmission on	yes	dd...dc	2...32
Check character verification on Check character transmission off	yes	dd...d	1...31

key: d = message digit
c = check character

NOTE Due to the structure of Interleaved 2 of 5, an even number of characters must be printed in the bar code label. An even number of data characters will be transmitted except if check character verification is on and check character verification is suppressed. In this case, the check character is stripped off and an odd number of characters will be transmitted.

UPC/EAN

Code	Decoding Options	Output Format	Length
UPC A	Standard	Andddddddddddc	13
UPC A	with 2 digit supplement	Andddddddddddcss	15
UPC A	with 5 digit supplement	Andddddddddddcsssss	18
UPC E	Standard	E0dddddd	8
UPC E	with 2 digit supplement	E0ddddddss	10
UPC E	with 5 digit supplement	E0ddddddsssss	13
UPC E	Expanded	Andddddddddddc	13
UPC E	with 2 digit supplement	Andddddddddddcss	15
UPC E	with 5 digit supplement	Andddddddddddcsssss	18
EAN 13	Standard	Fffddddddddddc	14
EAN 13	with 2 digit supplement	Fffddddddddddcss	16
EAN 13	with 5 digit supplement	Fffddddddddddcsssss	19
EAN 8	Standard	FFfdddddc	9
EAN 8	with 2 digit supplement	FFfddddddcss	11
EAN 8	with 5 digit supplement	FFfddddddcsssss	14

key: A = character "A"
F = character "F"
E = character "E"
n = number system digit
f = flag digit
d = data digit
c = checksum digit
s = supplemental digit

CODABAR

Decoding Options	Output Format	Length
Start / Stop characters transmitted	sa...as	2...34
Start / Stop characters not transmitted	a...a	1...32

key: a = message character
s = start/stop character ("A", "B", "C", or "D")

NOTE The leading start/stop character may differ from the trailing start/stop character.

CODE 128

Decoding Options	Output Format	Length
-	a...a	1...62

key: a = message character

NOTE The check character printed is not transmitted.

CODE 11

Decoding Options	Output Format	Length
One check character	a...ac	1...33
Two check characters	a...ack	1...34

key: a = message character
c = first check character
k = second check character

NOTE All characters encoded are transmitted, including the check character or characters.

MSI Code

Decoding Options	Output Format	Length
-	d...dc	1...32

key: d = message digit
c = MSI modulo 10 check character

NOTE All characters encoded are transmitted, including the check character.

CONFIGURATION DATA BYTES FORMAT

When the user scans the **Configuration Dump** label, the Smart Wand will transmit information to the HP-94 that represents the complete configuration of the Smart Wand. If the bar code menu responses are enabled, the information is preceded by the characters ^{E}C \ * which tell the HP-94 that the **Configuration Dump** label was scanned correctly. The selected trailer character(s) are appended to the menu scan response. These characters can be considered the preamble to the data characters.

^{E}C	\	*	Trailer 0 - 10 Bytes

The next three bytes, ^{E}C \ [, are a delimiter, followed by 212 bytes of data, a second delimiter], and the selected trailer again.

^{E}C	\	[	212 Data Bytes	]	Trailer 0 - 10 Bytes

The bytes are numbered starting with the first delimiter character after the preamble. The characters 4 through 215 are paired and in the range of '0' through '?' in the ASCII table. The pairs represent one byte of information by encoding the upper nibble of the data byte in the lower nibble of the first character, and the lower nibble of the data byte in the lower nibble of the second character. The upper nibble of the paired characters is set to '0110'. The HP-94 deletes the parity bit, so the user only sees seven bits of data. For example, if the data 7E hex is to be sent, the two characters sent would be '7>' whose values are 37 hex and 3E hex.

The meaning of each of the data bytes follows.

Bytes 1-3 Header information

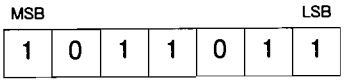
Byte # 1 ^{E}C

MSB						LSB
0	0	1	1	0	1	1

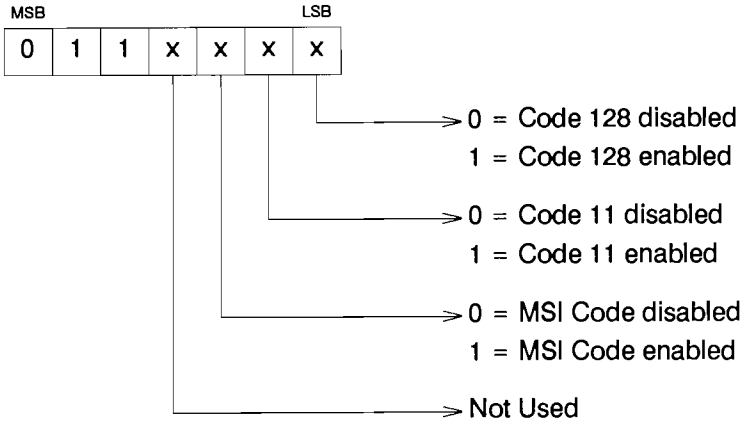
Byte # 2 \

MSB						LSB
1	0	1	1	1	0	0

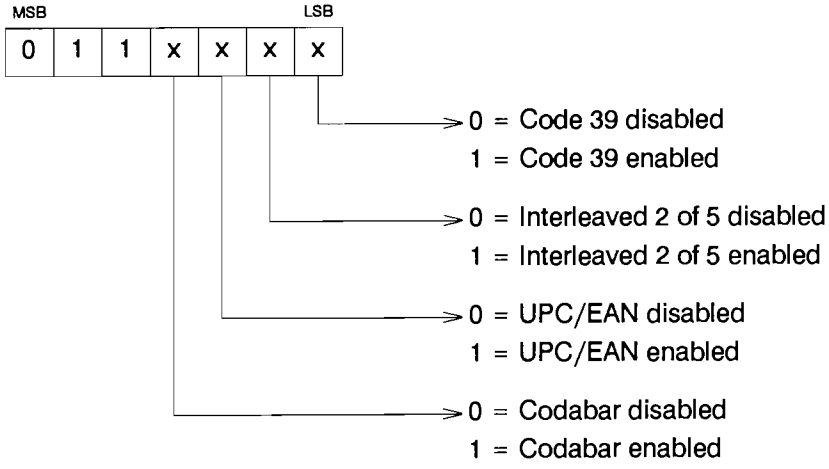
Byte # 3 [



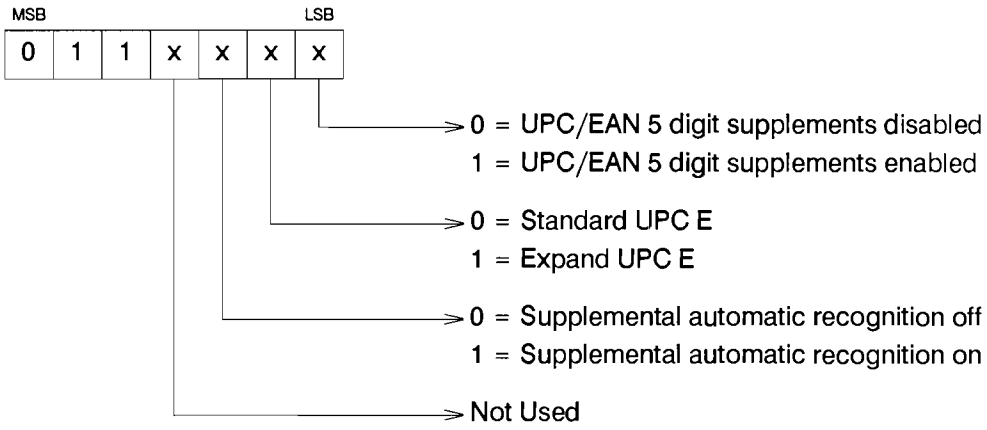
Byte # 4 Code Selection



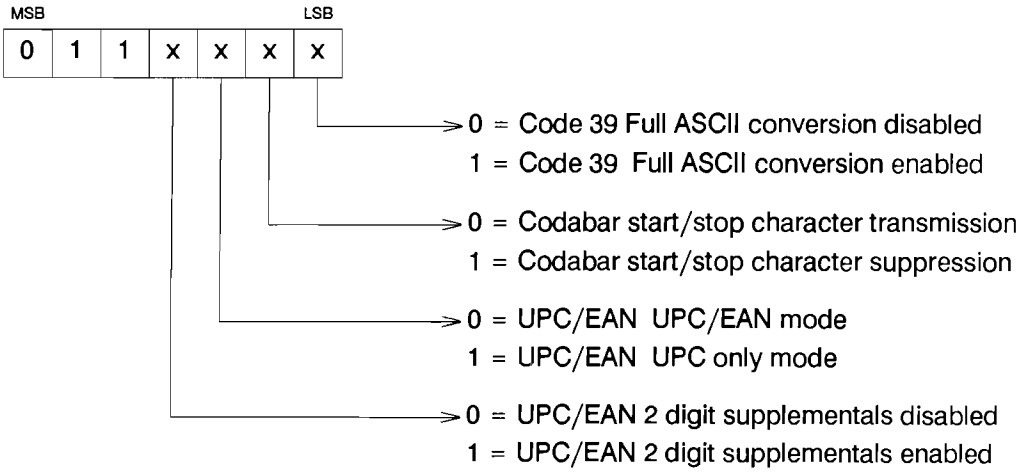
Byte # 5 Code selection



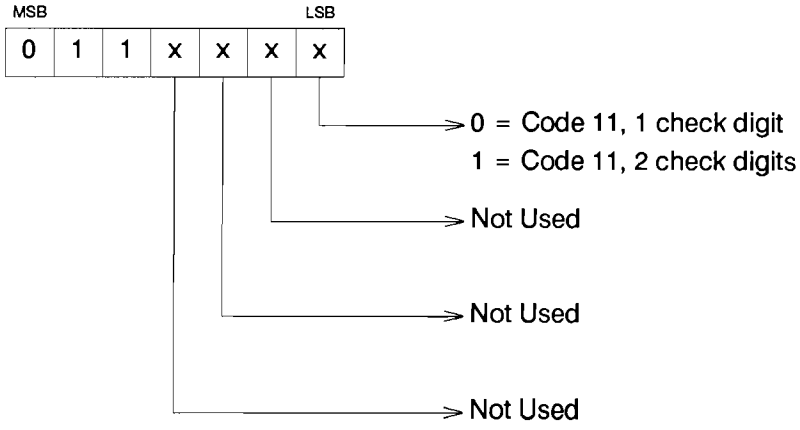
Byte # 6 Decoding Options



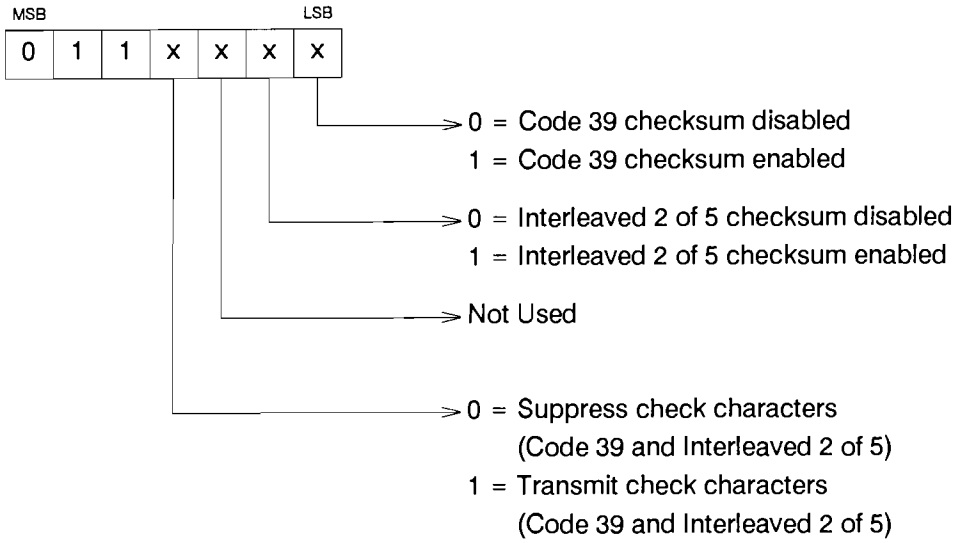
Byte # 7 Decoding Options



Byte # 8 Check character verification flags



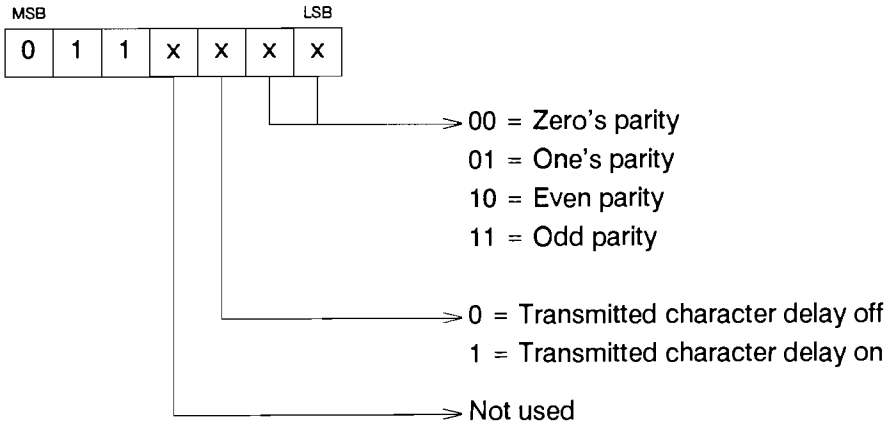
Byte # 9 Check character verification flags



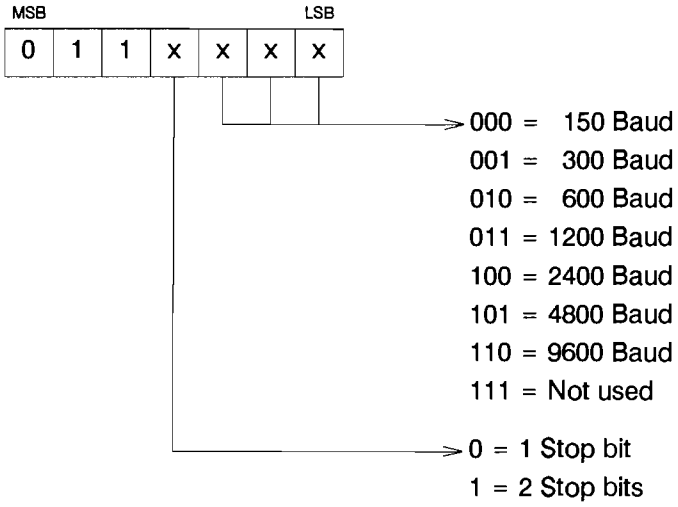
Byte # 10 Not used

Byte # 11 Not used

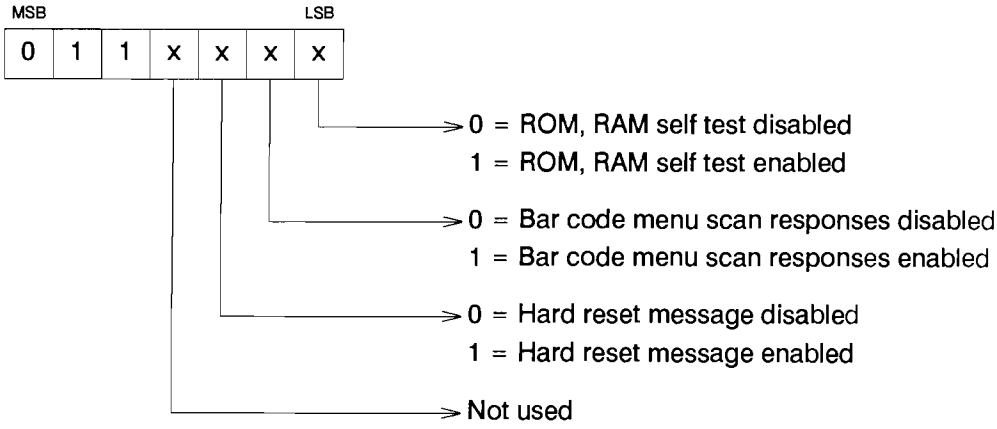
Byte # 12 Serial port configuration



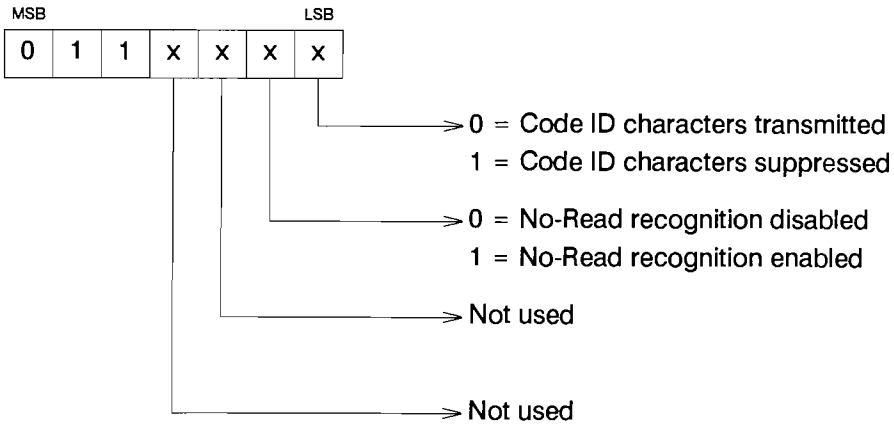
Byte # 13 Serial Port configuration



Byte # 14 General configuration



Byte # 15 General configuration



Byte # 16 Not used

Byte # 17 Not used

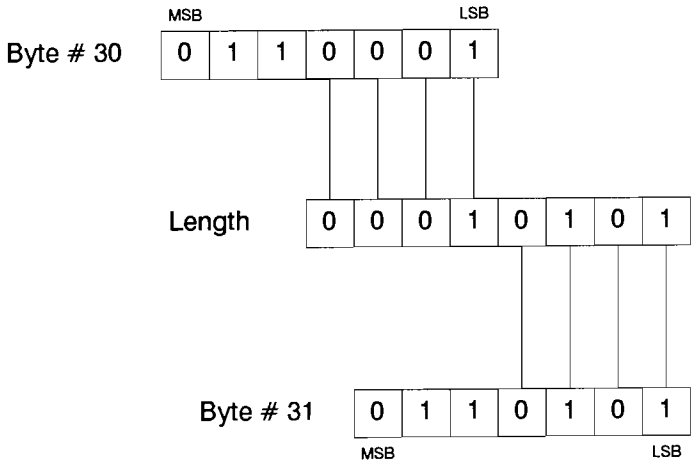
Byte # 18 Not used

Byte # 19 Not used

Bytes 20 - 55 contain 8 bit values of configurable variables

The format of the data storage is with the upper nibble of the eight bit value in the lower nibble of the first byte, and the lower nibble in the lower nibble of the second byte. All values are stored in hexadecimal. See the example below:

The number for the Code 39 maximum length is stored in bytes # 30 and # 31. In this example the length has been set to 21 characters. 21 decimal equals 15 in hexadecimal, or 0010101 in binary.

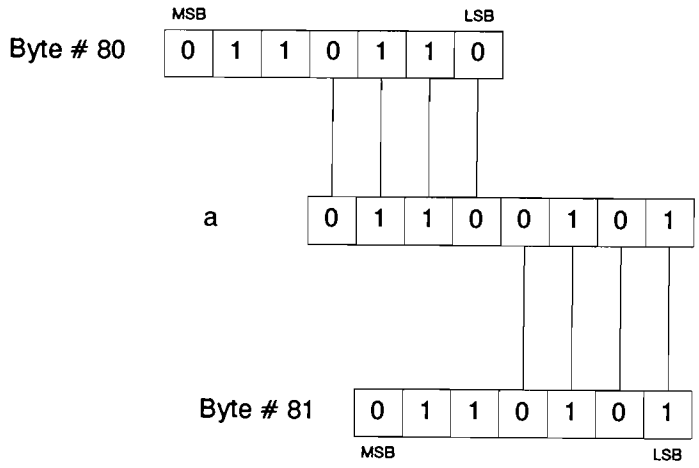


Byte numbers	Description
20, 21	Intercharacter delay period
22, 23	Not used
24, 25	Not used
26, 27	Interleaved 2 of 5 message length
28, 29	Code 39 minimum length
30, 31	Code 39 maximum length
32, 33	Interleaved 2 of 5 minimum length
34, 35	Interleaved 2 of 5 maximum length
36, 37	Codabar minimum length
38, 39	Codabar maximum length
40, 41	Code 128 minimum length
42, 43	Code 128 maximum length
44, 45	Code 11 minimum length
46, 47	Code 11 maximum length
48, 49	MSI code minimum length
50, 51	MSI code maximum length
52, 53	Not used
54, 55	Not used

Bytes 56 - 215 represent several buffers that contain variable data strings. The storage format of each character in the buffer is the same as for bytes 20 - 55, where two bytes are used to represent each character.

Each buffer contains a variable length string. The end of the string is marked by the first byte in the buffer in which bit 7 (MSB) is equal to 1. It is then possible for several positions in the buffer following this marker byte to have no meaning. Nevertheless, fixed length fields are used in the table, long enough for the maximum allowable string lengths.

For example; if the character "a" is the first character in the Header Character buffer, locations #80 and #81, then the data would be stored as follows:

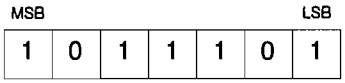


Byte Numbers	Description
56, 57	Not used
58, 59	Not used
60, 61	Not used
62, 63	Not used
64, 65	Not used
66, 67	Not used
68, 69	Not used
70, 71	Not used
72, 73	Not used
74, 75	Not used
76, 77	Not used
78, 79	Not used
80, 81	Header character #1
82, 83	Header character #2
84, 85	Header character #3
86, 87	Header character #4
88, 89	Header character #5
90, 91	Header character #6
92, 93	Header character #7
94, 95	Header character #8
96, 97	Header character #9
98, 99	Header character #10
100, 101	Header character #11
102, 103	Header character #12
104, 105	Trailer character #1
106, 107	Trailer character #2
108, 109	Trailer character #3
110, 111	Trailer character #4
112, 113	Trailer character #5
114, 115	Trailer character #6
116, 117	Trailer character #7
118, 119	Trailer character #8
120, 121	Trailer character #9
122, 123	Trailer character #10
124, 125	Trailer character #11
126, 127	Trailer character #12

Byte Numbers	Description
128, 129	No Read Message character #1
130, 131	No Read Message character #2
132, 133	No Read Message character #3
134, 135	No Read Message character #4
136, 137	No Read Message character #5
138, 139	No Read Message character #6
140, 141	No Read Message character #7
142, 143	No Read Message character #8
144, 145	No Read Message character #9
146, 147	No Read Message character #10
148, 149	No Read Message character #11
150, 151	No Read Message character #12
152, 153	Code 39 ID character
154, 155	Interleaved 2 of 5 ID character
156, 157	UPC/EAN code ID character
158, 159	Codabar ID character
160, 161	Code 128 ID character
162, 163	Code 11 ID character
164, 165	MSI code ID character
166, 167	Not used
168, 169	Not used
170, 171	Not used
172, 173	Not used
174, 175	Not used
176, 177	Not used
178, 179	Not used
180, 181	Not used
182, 183	Not used
184, 185	Not used
186, 187	Not used
188, 189	Not used
190, 191	Not used

Byte Numbers	Description
192, 193	Not used
194, 195	Not used
196, 197	Not used
198, 199	Not used
200, 201	Not used
202, 203	Not used
204, 205	Not used
206, 207	Not used
208, 209	Not used
210, 211	Not used
212, 213	Not used
214, 215	Not used

Byte # 216]



Byte # 217 ... Configured Trailer

A

Bar Code Symbology

A bar code is a self contained message with information encoded in the physical widths of bars and spaces in a printed pattern. Data is usually stored in the form of a series of dark and light spaces which are printed on a media, usually a paper product in the form of a label or a document.

There are many ways data can be encoded and formatted within the printed pattern. The following will discuss and illustrate various bar codes.

STANDARD CODE 39

Code 39 is an alphanumeric barcode which has characters that are constructed of nine elements, five bars and four spaces. Of these nine elements, two of the bars and one of the spaces are wider than the rest. Wide elements represent binary ones (1), and narrow elements represent binary zeros (0). The character set table shows each of the available characters with their corresponding check character values.

To enable a decoder to distinguish between the wide and narrow elements a minimum wide to narrow ratio is needed. Depending upon which resolution has been used for the printing of the barcode, the width of the wide element should be at least two times greater than the narrow element. A ratio of three to one is even better. All elements of the same type should be printed the same size. (The width of a narrow bar should be the same as a narrow space.)

Code 39 is printed discretely, there is a space between each character (the intercharacter gap) which contains no information. The width of this space should be approximately equal to the narrow element width. The structure of Code 39 makes it self checking, but there is an option present to add a check character to each message. The check character is the modulus 43 sum of all of the character values in a given message and is printed as the last character in the message. (See Character set table)

EXAMPLE

Message:	HP39963D							
Characters:	H	P	3	9	9	6	3	D
Value:	17	25	03	09	09	06	03	13
Sum of character values:	85							
85 ÷ 43 =	1 remainder 42							
42 =	% check character							
Final message:	HP39963D%							

Code 39 Character Set

ASCII Character	Binary Word	Bars	Spaces	Check Character Value
0	000110100	00110	0100	0
1	100100001	10001	0100	1
2	001100001	01001	0100	2
3	101100000	11000	0100	3
4	000110001	00101	0100	4
5	100110000	10100	0100	5
6	001110000	01100	0100	6
7	000100101	00011	0100	7
8	100100100	10010	0100	8
9	001100100	01010	0100	9
A	100001001	10001	0010	10
B	001001001	01001	0010	11
C	101001000	11000	0010	12
D	000011001	00101	0010	13
E	100011000	10100	0010	14
F	001011000	01100	0010	15
G	000001101	00011	0010	16
H	100001100	10010	0010	17
I	001001100	01010	0010	18
J	000011100	00110	0010	19
K	100000011	10001	0001	20
L	001000011	01001	0001	21
M	101000010	11000	0001	22
N	000010011	00101	0001	23
O	100010010	10100	0001	24
P	001010010	01100	0001	25
Q	000000111	00011	0001	26
R	100000110	10010	0001	27
S	001000110	01010	0001	28
T	000010110	00110	0001	29
U	110000001	10001	1000	30
V	011000001	01001	1000	31
W	111000000	11000	1000	32
X	010010001	00101	1000	33
Y	110010000	10100	1000	34
Z	011010000	01100	1000	35
-	010000101	00011	1000	36
SPACE	011000100	01010	1000	38
*	010010100	00110	1000	-
$	010101000	00000	1110	39
/	010100010	00000	1101	40
+	010001010	00000	1011	41
%	000101010	00000	0111	42

EXTENDED CODE 39 (Full ASCII conversion)

The full 128 character ASCII character set can be encoded by pairing Code 39 characters. Enabling Extended Code 39 causes the following characters to be output for each character pair.

Extended Code 39 Character Set

ASCII Character	Character Pair	ASCII Character	Character Pair	ASCII Character	Character Pair	ASCII Character	Character Pair
NUL	%U	SP	Space	@	%V	`	%W
SOH	$A	!	/A	A	A	a	+A
STX	$B	"	/B	B	B	b	+B
ETX	$C	#	/C	C	C	c	+C
EOT	$D	$	/D	D	D	d	+D
ENQ	$E	%	/E	E	E	e	+E
ACK	$F	&	/F	F	F	f	+F
BEL	$G	'	/G	G	G	g	+G
BS	$H	(	/H	H	H	h	+H
HT	$I	)	/I	I	I	i	+I
LF	$J	*	/J	J	J	j	+J
VT	$K	+	/K	K	K	k	+K
FF	$L	,	/L	L	L	l	+L
CR	$M	-	/M	M	M	m	+M
SO	$N	.	/N	N	N	n	+N
SI	$O	/	/O	O	O	o	+O
DLE	$P	0	0 or /P	P	P	p	+P
DC1	$Q	1	1 or /Q	Q	Q	q	+Q
DC2	$R	2	2 or /R	R	R	r	+R
DC3	$S	3	3 or /S	S	S	s	+S
DC4	$T	4	4 or /T	T	T	t	+T
NAK	$U	5	5 or /U	U	U	u	+U
SYN	$V	6	6 or /V	V	V	v	+V
ETB	$W	7	7 or /W	W	W	w	+W
CAN	$X	8	8 or /X	X	X	x	+X
EM	$Y	9	9 or /Y	Y	Y	y	+Y
SUB	$Z	:	/Z	Z	Z	z	+Z
ESC	%A	;	%F	[	%K	{	%P
FS	%B	<	%G	\	%L	|	%Q
GS	%C	=	%H	]	%M	}	%R
RS	%D	>	%I	^	%N	~	%S
US	%E	?	%J	_	%O	DEL	%T

NOTE The Code 39 characters $ / + % will represent the corresponding ASCII characters if they are followed by a digit, a space, itself or one of the other three special characters, or a stop character.

%X, %Y, and %Z decode as ASCII DEL.

INTERLEAVED 2 OF 5

Interleaved 2 of 5 code is a numeric only bar code. Each character of this code is represented by five elements, two wide and three narrow. Wide elements are decoded as binary one (1), and narrow elements are decoded as binary zero (0). The wide to narrow element ratio should be between two and three.

Whether or not the elements used to encode a character are bars or spaces depends upon the location of the character within the message. The first character of the message is encoded into the bars immediately following the start character. The second character of the message is encoded into the spaces between the bars of the first character, thus eliminating the intercharacter space. Because of this, Interleaved 2 of 5 is a continuous bar code.

Due to the interleaving of the characters, the number of characters in an Interleaved 2 o f 5 message must be even. (The check character, if used, must be included in the character count.) If the message has an odd number of characters, add a leading zero (0) to the message.

Interleaved 2 of 5 Character Set

ASCII Character	Binary Word	Check Character Value
1	10001	1
2	01001	2
3	11000	3
4	00101	4
5	10100	5
6	01100	6
7	00011	7
8	10010	8
9	01010	9
0	00110	0
Start	0000 *	
Stop	100 *	

NOTE * Alternate bars and spaces, not interleaved

Interleaved 2 of 5 has an optional modulus 10 check character, which is printed at the end of the message. The value of the check character is determined by the following six step procedure.

1. Identify even and odd positioned characters in the message with the rightmost data character always defined as an even positioned character.
2. Sum the numeric values of the odd positioned characters.
3. Sum the numeric values of the even positioned characters and multiply this total by three.
4. Sum the odd and even totals from steps two and three.
5. Determine the smallest number which, when added to the sum in step four, will result in a multiple of ten. This number is the value of the check character.
6. Determine if the number of characters (message plus check character) is even or odd. If it is odd, add a leading, nonsignificant zero to the message to produce an even number of characters.

EXAMPLE

Message:	2632534
Characters:	2 6 3 2 5 3 4
Position:	E O E O E O E
Sum of odd positions:	6 + 2 + 3 = 11
Sum of even positions:	2 + 3 + 5 + 4 = 14
Sum of even positions times three:	14 × 3 = 42
Sum of even and odd:	11 + 42 = 53
Smallest number to reach a multiple of 10:	7
Check character:	7
Tag to be encoded:	26325347
Number of characters:	even, no leading zero needed

UPC/EAN/JAN Codes

The UPC and the EAN/JAN codes have several features in common.

- Numeric data only
- Two bars and two spaces per character
- Seven modules per character
- Four level code (a bar or a space can be one, two, three, or four modules wide)
- Dark module = binary one
- Light module = binary zero
- Integral check character
- Nominal module bar/space width = 0.013 in (0.33 mm)
- Worst case module width = 0.009 in. (0.23 mm)

The Universal Product Code (UPC) specifications include three versions: A, D, and E. Version A, the regular version, is used to encode a twelve digit number. Version E, the zero suppressed version, is a six digit code used for marking small packages. Version D, the variable length version, is not commonly used for package marking. It is used in limited special applications. Versions A and E are supported by the Smart Wand, Version D is not.

Both Version A and E may include either a 2 digit or a 5 digit supplemental encodation. These extra digits are primarily used on periodicals and books. Supplemental encodations are supported.

UPC-A

Version A encodes a twelve digit number. The first number encoded is the number system character, the next ten digits are the data characters, and the last digit is the check character.

The number system character is printed in human readable form to the left of the UPC symbol. Five of the ten possible numbers have been assigned:

UPC Number System Characters

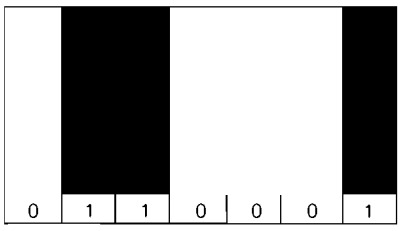
0	Regular UPC Codes
2	Random weight items which are symbol marked at the store level
3	National Drug Code and National Health related Items Code
4	For use without code format restrictions and with check digit protection for in store marking of non food items
5	For use on coupons

NOTE Numbers 1, 6, 7, 8, 9 are presently reserved.

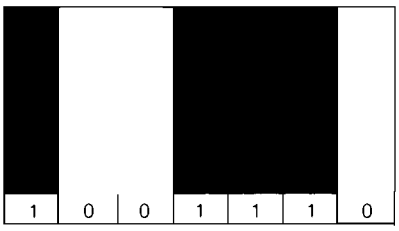
The UPC-A symbol is physically constructed as follows:

- Left hand guard bars, encoded 101
- Number system character, encoded as a left hand character
- First five data characters, encoded as left hand characters
- Center guard pattern, encoded 01010
- Last five data characters, encoded as right hand characters
- Check character, encoded as a right hand character
- Right hand guard bars, encoded 101

The following is an example of left hand and right hand characters:



Lefthand 5



Righthand 5

The bars represent binary ones(1), while the spaces represent binary zeroes (0). The characters on the left hand side of the symbol always have odd parity, so the number of modules that are bars are always odd, while the parity of the right hand side of the tag always have even parity, and the number of modules that are bars on the right hand side of the tag is always even.

The following is the table for the character patterns, for both the left hand and right hand characters.

UPC A Character Set

Left Hand Character	Decimal Number	Right Hand Character
0001101	0	1110010
0011001	1	1100110
0010011	2	1101100
0111101	3	1000010
0100011	4	1011100
0110001	5	1001110
0101111	6	1010000
0111011	7	1000100
0110111	8	1001000
0001011	9	1110100

UPC-E

Version E allows zeros to be removed from the data to be encoded, resulting in a shorter tag. The encodation of the data characters is different than Version A.

The Version E even parity characters are the same as the Version A left hand characters. The odd parity characters are the right hand characters reversed.

UPC E Character Set

Odd Parity	Decimal Number	Even Parity
0001101	0	0100111
0011001	1	0110011
0010011	2	0011011
0111101	3	0100001
0100011	4	0011101
0110001	5	0111001
0101111	6	0000101
0111011	7	0010001
0110111	8	0001001
0001011	9	0010111

UPC E Parity Pattern

Check Character	Data Location Number					
	1	2	3	4	5	6
0	E	E	E	O	O	O
1	E	E	O	E	O	O
2	E	E	O	O	E	O
3	E	E	O	O	O	E
4	E	O	E	E	O	O
5	E	O	O	E	E	O
6	E	O	O	O	E	E
7	E	O	E	O	E	O
8	E	O	E	O	O	E
9	E	O	O	E	O	E

To encode the ten data characters into six characters the following must be true:

- The number system character must be zero.
- There must be at least four zeros in the data characters.

The physical structure of the UPC-E symbol is as follows:

- Left hand guard bars, encoded 101
- Six data characters, encoded as in the following table
- Right hand guard bars, encoded 10101

To determine how to encode the data characters, first the UPC-A check character must be found. Once known, it is used to set the pattern of even and odd parity to be used to encode the characters from the UPC E Parity Table.

JAN Codes

The JAN codes are the same as the EAN codes, with the flag characters set to '49'

EAN 13

EAN 13 is used to encode thirteen characters. The first two characters are the flag characters that identify the country of origin, the next ten characters are the data characters, and the last character is the check character.

The physical structure of the EAN-13 is as follows:

- Left hand guard bars, encoded 101
- Second flag character, encoded as in the following tables
- First five data characters, encoded as in the following tables
- Center guard pattern, encoded 01010
- Last five data characters, encoded as right hand characters
- Check character, encoded as a right hand character
- Right hand guard bars, encoded 101

The thirteenth digit, is encoded in the pattern of parity in the second flag character and the first five data characters. The left hand A and the left hand B character sets are used.

EAN Character Set

Data	Left Hand A	Left Hand B	Right Hand
0	0001101	0100111	1110010
1	0011001	0110011	1100110
2	0010011	0011011	1101100
3	0111101	0100001	1000010
4	0100011	0011101	1011100
5	0110001	0111001	1001110
6	0101111	0000101	1010000
7	0111011	0010001	1000100
8	0110111	0001001	1001000
9	0001011	0010111	1110100

The following table shows which character set, A or B, to use to encode the second flag character and the first five data characters

Character Set to use for Encodation of the First Flag Character of EAN 13

First Flag Character	Second Flag Character	Data Characters 1	2	3	4	5
0	A	A	A	A	A	A
1	A	A	B	A	B	B
2	A	A	B	B	A	B
3	A	A	B	B	B	A
4	A	B	A	A	B	B
5	A	B	B	A	A	B
6	A	B	B	B	A	A
7	A	B	A	B	A	B
8	A	B	A	B	B	A
9	A	B	B	A	B	A

NOTE The UPC-A symbol is a subset of the EAN 13 symbols. A UPC-A symbol is an EAN 13 symbol with the first flag character set to zero

EAN 8

The EAN 8 symbol encodes two flag characters, five data characters, and a check characters. The physical structure of EAN 8 is as follows:

- Left hand guard bars, encoded 101
- Two flag characters, encoded as left hand A characters
- First two data characters, encoded as left hand A characters
- Center guard pattern, encoded 01010
- Last three data characters, encoded as right hand characters
- Check character, encoded as a right hand character
- Right hand guard bars, encoded 101

UPC/EAN Check Character Generation

The check character for the UPC/EAN codes is generated by the following method:

1. Designate the rightmost character odd.
2. Sum all of the characters in the odd positions and multiply the result by three.
3. Sum all of the characters in the even positions
4. Add the odd and even totals from steps two and three.
5. Determine the smallest number that when added to the result from step four, will result in a multiple of 10. This is the check character.

EXAMPLE UPC A

Number system character =	0
Message characters =	0123456789
Message =	0 0 1 2 3 4 5 6 7 8 9
Position =	O E O E O E O E O E O
Sum of odd positions =	0 + 1 + 3 + 5 + 7 + 9 = 25
Sum of odd positions times three =	25 × 3
Sum of even positions =	0 + 2 + 4 + 6 + 8 = 20
Sum of even and odd =	75 + 20 = 95
Smallest number to give a multiple of 10 =	5
Check character =	5
Tag to be encoded =	001234567895

EXAMPLE EAN 13

Flag characters =	20
Message characters =	0123456789
Message =	2 0 0 1 2 3 4 5 6 7 8 9
Position =	E O E O E O E O E O E O
Sum of odd positions =	0 + 1 + 3 + 5 + 7 + 9 = 25
Sum of odd positions times three =	25 × 3 = 75
Sum of even positions =	2 + 0 + 2 + 4 + 6 + 8 = 22
Sum of even and odd =	75 + 22 = 97
Smallest number to give a multiple of 10 =	3
Check character =	3
Tag to be encoded =	2001234567893

EXAMPLE EAN 8

Flag characters =	20
Message characters =	12345
Message =	2 0 1 2 3 4 5
Position =	O E O E O E O
Sum of odd positions =	2 + 1 + 3 + 5 = 11
Sum of odd positions times three =	11 × 3 = 33
Sum of even positions =	0 + 2 + 4 = 6
Sum of even and odd =	33 + 6 = 39
Smallest number to give a multiple of 10 =	1
Check character =	1
Tag to be encoded =	20123451

Supplemental Encodations (UPC/EAN)

Either two digit or five digit supplemental encodations may be used with UPC A, UPC E, EAN 13, or EAN 8. The supplementals are encoded using the odd and even character sets from UPC E.

Two Digit Supplementals

The parity of the encoded digits depends upon the numbers to be encoded

Two Digit Supplemental Parity Patterns

Odd - Odd Parity	Odd - Even Parity	Even - Odd Parity	Even - Even Parity
00	01	02	03
04	05	06	07
08	09	10	11
12	13	14	15
16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31
32	33	34	35
36	37	38	39
40	41	42	43
44	45	46	47
48	49	50	51
52	53	54	55
56	57	58	59
60	61	62	63
64	65	66	67
68	69	70	71
72	73	74	75
76	77	78	79
80	81	82	83
84	85	86	87
88	89	90	91
92	93	94	95
96	97	98	99

The physical structure of the two digit supplemental is as follows:

- Left hand guard bars, encoded 1011
- First data character, encoded using parity from above table
- Character delineator, encoded 01
- Second data character, encoded with parity from above table

Five digit supplementals

To determine the parity pattern for the five digit supplementals, use the following steps:

1. Designate the rightmost character odd
2. Sum all of the characters in the odd positions and multiply the result by three.
3. Sum all of the characters in the even positions and multiply the result by nine.
4. Add the results from steps two and three. The number in the units position is the number of the parity pattern.

Five Digit Supplemental Parity Pattern

Number	Parity Pattern
0	EEOOO
1	EOEOO
2	EOOEO
3	EOOOE
4	OEEOO
5	OOEEO
6	OOOEE
7	OEOEO
8	OEOOE
9	OOEOE

EXAMPLE

Step 1: Supplemental encodation = 12345

Step 2: $1 + 3 + 5 = 9;\ 9 \times 3 = 27$

Step 3: $2 + 4 = 6;\ 6 \times 9 = 54$

Step 4: $27 + 54 = 81$

Parity number is 1

Parity pattern is EOEOO

The physical structure of the five digit supplemental is as follows:

- Left hand guard bars, encoded 1011
- First data character, encoded in the proper parity pattern
- Character delineator, encoded 01
- Second data character, encoded in the proper parity pattern
- Character delineator, encoded 01
- Third data character, encoded in the proper parity pattern
- Character delineator, encoded 01
- Fourth data character, encoded in the proper parity pattern
- Character delineator, encoded 01
- Fifth data character, encoded in the proper parity pattern
- Character delineator, encoded 01

CODABAR

Codabar is a discrete, numeric code with special characters and four different start/stop characters. Each character is encoded as seven elements, with two or three of the elements wide. Codabar has no check character. The following table shows the Codabar character encodation. The numbers in the table correspond to the width of the element. A 0 means the element is narrow, and a 1 means the element is wide.

Codabar Character Encodation

Character	B	S	B	S	B	S	B
0	0	0	0	0	0	1	1
1	0	0	0	0	1	1	0
2	0	0	0	0	1	0	1
3	1	1	0	0	0	0	0
4	0	0	1	0	0	1	0
5	1	0	0	0	0	1	0
6	0	1	0	0	0	0	1
7	0	1	0	0	1	0	0
8	0	1	1	0	0	0	0
9	1	0	0	1	0	0	0
-	0	0	0	1	1	0	0
$	0	0	1	1	0	0	0
:	1	0	0	0	1	0	1
/	1	0	1	0	0	0	1
+	0	0	1	0	1	0	1
A	0	0	1	1	0	1	0
B	0	1	0	1	0	0	1
C	0	0	0	1	0	1	1
D	0	0	0	1	1	1	0

NOTE The start/stop characters are A, B, C, and D.

CODE 128

Code 128 is a continuous, multilevel, full ASCII code. Each of the Code 128 characters consists of three bars and three spaces. The bars and spaces may be one, two, three, or four modules wide. The total length of each code 128 character is eleven modules, with the total length of the bar modules odd, and the total length of the space modules even.

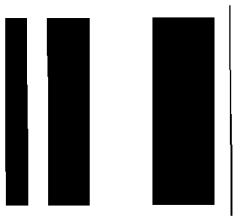
The character set consists of 103 different characters, three different start characters, and one unique stop character. With the three different start characters, there are three different code subsets available. They are:

1. Using the "A" start character - All upper case alphanumeric characters plus all of the ASCII control characters.
2. Using the "B" start character - All upper and lower case alphanumeric characters.
3. Using the "C" start character - Double density numeric characters, all number pairs from 00 to 99.

The stop character is different than the other characters because it consists of 4 bars and 3 spaces.

The user can switch from Code A to Code B or from Code B to Code A by using the SHIFT character. This will switch the code character set for one character. If the user wants to change character sets for more than one character, the CODE A, CODE B, or CODE C characters must be used.

The following is an example of the barcode pattern that is a "K" in Code A, a "k" in Code B, and a "43" in Code C.



Code 128 Barcode Pattern

A check character is mandatory for Code 128. The check character is a modulus 103 sum of the characters, weighted by position in the message. The check character is calculated by summing the value for the start character with the products from the value of the message characters times their position in the message, with the character that follows the start character in the first position. The stop character is not included in the calculation. The result is divided by 103, and the character that corresponds to the remainder is the check character.

EXAMPLE:

Message: CODE 128
Start character: CODE A

Character	Value	Position	Total
CODE A	103	-	103
C	35	1	35
O	47	2	94
D	36	3	108
E	37	4	148
	0	5	0
1	17	6	102
2	18	7	126
8	24	8	192
			908

908 ÷ 103 = 8 remainder 84

The character that corresponds to 84 is DC4

Tag to be encoded is (CODE A)CODE 128(DC4)

Code 128 Character Set

VALUE	CODE A	CODE B	CODE C	BAR PATTERN					
				B	S	B	S	B	S
0	SPACE	SPACE	00	2	1	2	2	2	2
1	!	!	01	2	2	2	1	2	2
2	"	"	02	2	2	2	2	2	1
3	#	#	03	1	2	1	2	2	3
4	$	$	04	1	2	1	3	2	2
5	%	%	05	1	3	1	2	2	2
6	&	&	06	1	2	2	2	1	3
7	'	'	07	1	2	2	3	1	2
8	(	(	08	1	3	2	2	1	2
9	)	)	09	2	2	1	2	1	3
0	*	*	10	2	2	1	3	1	2
11	+	+	11	2	3	1	2	1	2
12	,	,	12	1	1	2	2	3	2
13	-	-	13	1	2	2	1	3	2
14	.	.	14	1	2	2	2	3	1
15	/	/	15	1	1	3	2	2	2
16	0	0	16	1	2	3	1	2	2
17	1	1	17	1	2	3	2	2	1
18	2	2	18	2	2	3	2	1	1
19	3	3	19	2	2	1	1	3	2
20	4	4	20	2	2	1	2	3	1
21	5	5	21	2	1	3	2	1	2
22	6	6	22	2	2	3	1	1	2
23	7	7	23	3	1	2	1	3	1
24	8	8	24	3	1	1	2	2	2
25	9	9	25	3	2	1	1	2	2
26	:	:	26	3	2	1	2	2	1
27	;	;	27	3	1	2	2	1	2
28	<	<	28	3	2	2	1	1	2
29	=	=	29	3	2	2	2	1	1
30	>	>	30	2	1	2	1	2	3
31	?	?	31	2	1	2	3	2	1
32	@	@	32	2	3	2	1	2	1
33	A	A	33	1	1	1	3	2	3
34	B	B	34	1	3	1	1	2	3
35	C	C	35	1	3	1	3	2	1
36	D	D	36	1	1	2	3	1	3
37	E	E	37	1	3	2	1	1	3
38	F	F	38	1	3	2	3	1	1
39	G	G	39	2	1	1	3	1	3
40	H	H	40	2	3	1	1	1	3

Code 128 Character Set (cont)

VALUE	CODE A	CODE B	CODE C	BAR PATTERN					
				B	S	B	S	B	S
41	I	I	41	2	3	1	3	1	1
42	J	J	42	1	1	2	1	3	3
43	K	K	43	1	1	2	3	3	1
44	L	L	44	1	3	2	1	3	1
45	M	M	45	1	1	3	1	2	3
46	N	N	46	1	1	3	3	2	1
47	O	O	47	1	3	3	1	2	1
48	P	P	48	3	1	3	1	2	1
49	Q	Q	49	2	1	1	3	3	1
50	R	R	50	2	3	1	1	3	1
51	S	S	51	2	1	3	1	1	3
52	T	T	52	2	1	3	3	1	1
53	U	U	53	2	1	3	1	3	1
54	V	V	54	3	1	1	1	2	3
55	W	W	55	3	1	1	3	2	1
56	X	X	56	3	3	1	1	2	1
57	Y	Y	57	3	1	2	1	1	3
58	Z	Z	58	3	1	2	3	1	1
59	[	[	59	3	3	2	1	1	1
60	\	\	60	3	1	4	1	1	1
61	]	]	61	2	2	1	4	1	1
62	^	^	62	4	3	1	1	1	1
63			63	1	1	1	2	2	4
64	NUL	`	64	1	1	1	4	2	2
65	SOH	a	65	1	2	1	1	2	4
66	STX	b	66	1	2	1	4	2	1
67	ETX	c	67	1	4	1	1	2	2
68	EOT	d	68	1	4	1	2	2	1
69	ENQ	e	69	1	1	2	2	1	4
70	ACK	f	70	1	1	2	4	1	2
71	BEL	g	71	1	2	2	1	1	4
72	BS	h	72	1	2	2	4	1	1
73	HT	i	73	1	4	2	1	1	2
74	LF	j	74	1	4	2	2	1	1
75	VT	k	75	2	4	1	2	1	1
76	FF	l	76	2	2	1	1	1	4
77	CR	m	77	4	1	3	1	1	1
78	SO	n	78	2	4	1	1	1	2
79	SI	o	79	1	3	4	1	1	1
80	DLE	p	80	1	1	1	2	4	2

Code 128 Character Set (cont)

VALUE	CODE A	CODE B	CODE C	BAR PATTERN					
				B	S	B	S	B	S
81	DC1	q	81	1	2	1	1	4	2
82	DC2	r	82	1	2	1	2	4	1
83	DC3	s	83	1	1	4	2	1	2
84	DC4	t	84	1	2	4	1	1	2
85	NAK	u	85	1	2	4	2	1	1
86	SYN	v	86	4	1	1	2	1	2
87	ETB	w	87	4	2	1	1	1	2
88	CAN	x	88	4	2	1	2	1	1
89	EM	y	89	2	1	2	1	4	1
90	SUB	z	90	2	1	4	1	2	1
91	ESC	{	91	4	1	2	1	2	1
92	FS	|	92	1	1	1	1	4	3
93	GS	}	93	1	1	1	3	4	1
94	RS		94	1	3	1	1	4	1
95	US	DEL	95	1	1	4	1	1	3
96	FNC 3	FNC 3	96	1	1	4	3	1	1
97	FNC 2	FNC 2	97	4	1	1	1	1	3
98	SHIFT	SHIFT	98	4	1	1	3	1	1
99	CODE C	CODE C	99	1	1	3	1	4	1
100	CODE B	FNC 4	CODE B	1	1	4	1	3	1
101	FNC 4	CODE A	CODE A	3	1	1	1	4	1
102	FNC 1	FNC 1	FNC 1	4	1	1	1	3	1

Code 128 Start Characters

		B	S	B	S	B	S
103	START (CODE A)	2	1	1	4	1	2
104	START (CODE B)	2	1	1	2	1	4
105	START (CODE C)	2	1	1	2	3	2

Code 128 Stop Character

	B	S	B	S	B	S	B
STOP	2	3	3	1	1	1	2

CODE 11

Code 11 is a numeric, high density code with one special character (-). Each character is encoded with five elements, either two wide and three narrow, or one wide and four narrow. The wide elements are a binary one (1), and the narrow elements are a binary zero.

Code 11 Character Encodation

	B	S	B	S	B
0	0	0	0	0	1
1	1	0	0	0	1
2	0	1	0	0	1
3	1	1	0	0	0
4	0	0	1	0	1
5	1	0	1	0	0
6	0	1	1	0	0
7	0	0	0	1	1
8	1	0	0	1	0
9	1	0	0	0	0
-	0	0	1	0	0
S/S	0	0	1	1	0

Code 11 has two check digits, "C", and "K". The first check digit "C", is the modulo 11 sum of the weighted products with the weights changing from 1 to 10. The second check digit "K", is also the modulo 11 sum of the weighted products with the weights changing from 1 to 9. The character (-) is assigned the value of 10.

When the data message is 10 digits or less, usually only the "C" check digit is used.

EXAMPLE

DATA =	1	2	-	1	2	3	4	5	-	6	7	8	9	0	C	K
"C" Weights =	4	3	2	1	10	9	8	7	6	5	4	3	2	1		
"K" Weights =	6	5	4	3	2	1	9	8	7	6	5	4	3	2	1	

Calculate "C" $(1\times0) + (2\times9) + (3\times8) + (4\times7) + (5\times6) + (6\times10) + (7\times5) + (8\times4) + (9\times3) + (10\times2) + (1\times1) + (2\times10) + (3\times2) + (4\times1) = 305$

$305 \div 11 =$ 27 remainder 8
"C" = 8

Calculate "K" $(1\times8) + (2\times0) + (3\times9) + (4\times8) + (5\times7) + (6\times6) + (7\times10) + (8\times5) + (9\times4) + (1\times3) + (2\times2) + (3\times1) + (4\times10) + (5\times2) + (6\times1) = 350$

$350 \div 11 =$ 31 remainder 9
"K" = 9

Tag to be encoded = 12-12345-6789089

MSI CODE

MSI Code is a numeric, continuous code. Each character consists of four bits, using a straight binary encodation. Each bit is encoded in the following way: if the bit is a 1, the pattern to be used is a wide bar followed by a narrow space. If the bit is to be a 0, the pattern is a narrow bar followed by a wide space. The following table is the bit patterns:

MSI Character Set

Decimal	BCD
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

The start character is a single "1" bit. (wide bar/narrow space).

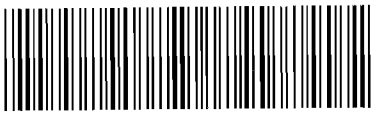
The stop character is a narrow bar/narrow space/narrow bar.

The check digit is a straight modulo 10 checksum. All of the characters are added up, and the smallest number to be added to the result to give an even multiple of ten is the check digit.

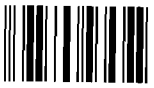
There is an optional modulo 11 checksum, it is NOT supported on the Smart Wand.

SAMPLE BAR CODE LABELS

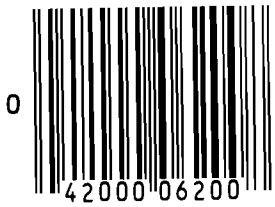
Code 39



Full ASCII
Code 39



Interleaved
2 of 5

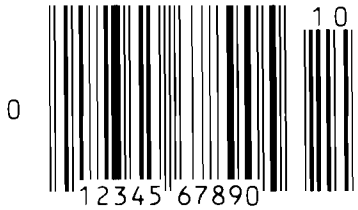


UPC-A

UPC-E

EAN 8

EAN 13

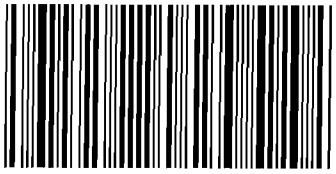


UPC-A w/ 2 digit
Supplemental

UPC-A w/ 5 digit
Supplemental

Codabar

Code 128



Code 11

MSI Code

B

Bar Code Standardization References

Reference	Standard
American National Standards Institute (ANSI) 1430 Broadway New York, NY	ANSI MH10.8M-1983 Specifications for Bar Code Symbols on Transport Packages and Unit Loads • Code 39 • Interleaved 2 of 5 • Codabar
Automotive Industry Action Group (AIAG) North Park Plaza Suite 830 17117 West Nine Mile Road Southfield, MI 48075	AIAG - B - 1 1984 Bar Code Symbology Standard • Code 39
Department of Defense (LOGMARS) Director AMC Packaging, Storage, and Containerization Center - Attention: SDSTO-TA Tobyhanna, PA 18466-5097	MIL - STD - 1189A • Code 39
Automatic Identification Manufacturers, Inc. 1326 Freeport Road Pittaburgh, PA 15238	Uniform Symbology Specification (USS) • USS-39 (Code 39) • USS-I 2/5 (Interleaved 2 of 5) • USS-Codabar • USS-128 (Code 128)
Health Industry Bar Code Council 111 E. Wacker Drive Suite 600 Chicago, IL 60601	HBIC Standard • Code 39

Reference	Standard
Uniform Code Council, Inc 7051 Corporate Way Suite 201 Dayton, Ohio 45459-4294	UPC Symbol Specification • UPC Code UPC Shipping Container Symbol Specification Manual • Interleaved 2 of 5
International Article Numbering Association (EAN) Rue de Colonies 54, BTE 8 1000 Bruxilles	Article Numbering, and Symbol Marking • EAN Code
Japan Industrial Standard Organization The Distribution Code Center No. 3 TOC-Bldg 7-23-1 Nishigotanda Shinagawa-ku, Tokyo 141	JIS B 9550-1978 • JAN Code

C

U.S. ASCII Character Codes

ASCII Char.	Character Code			
	DEC	Binary	OCT	HEX
NUL	0	00000000	000	00
SOH	1	00000001	001	01
STX	2	00000010	002	02
ETX	3	00000011	003	03
EOT	4	00000100	004	04
ENQ	5	00000101	005	05
ACK	6	00000110	006	06
BEL	7	00000111	007	07
BS	8	00001000	010	08
HT	9	00001001	011	09
LF	10	00001010	012	0A
VT	11	00001011	013	0B
FF	12	00001100	014	0C
CR	13	00001101	015	0D
SO	14	00001110	016	0E
SI	15	00001111	017	0F
DLE	16	00010000	020	10
DC1	17	00010001	021	11
DC2	18	00010010	022	12
DC3	19	00010011	023	13
DC4	20	00010100	024	14
NAK	21	00010101	025	15
SYN	22	00010110	026	16
ETB	23	00010111	027	17
CAN	24	00011000	030	18
EM	25	00011001	031	19
SUB	26	00011010	032	1A
ESC	27	00011011	033	1B
FS	28	00011100	034	1C
GS	29	00011101	035	1D
RS	30	00011110	036	1E
US	31	00011111	037	1F

ASCII Char.	Character Code			
	DEC	Binary	OCT	HEX
space	32	00100000	040	20
!	33	00100001	041	21
"	34	00100010	042	22
#	35	00100011	043	23
$	36	00100100	044	24
%	37	00100101	045	25
&	38	00100110	046	26
'	39	00100111	047	27
(	40	00101000	050	28
)	41	00101001	051	29
*	42	00101010	052	2A
+	43	00101011	053	2B
,	44	00101100	054	2C
-	45	00101101	055	2D
.	46	00101110	056	2E
/	47	00101111	057	2F
0	48	00110000	060	30
1	49	00110001	061	31
2	50	00110010	062	32
3	51	00110011	063	33
4	52	00110100	064	34
5	53	00110101	065	35
6	54	00110110	066	36
7	55	00110111	067	37
8	56	00111000	070	38
9	57	00111001	071	39
:	58	00111010	072	3A
;	59	00111011	073	3B
<	60	00111100	074	3C
=	61	00111101	075	3D
>	62	00111110	076	3E
?	63	00111111	077	3F

U.S. ASCII Character Codes (continued)

ASCII Char.	Character Code			
	DEC	Binary	OCT	HEX
@	64	01000000	100	40
A	65	01000001	101	41
B	66	01000010	102	42
C	67	01000011	103	43
D	68	01000100	104	44
E	69	01000101	105	45
F	70	01000110	106	46
G	71	01000111	107	47
H	72	01001000	110	48
I	73	01001001	111	49
J	74	01001010	112	4A
K	75	01001011	113	4B
L	76	01001100	114	4C
M	77	01001101	115	4D
N	78	01001110	116	4E
O	79	01001111	117	4F
P	80	01010000	120	50
Q	81	01010001	121	51
R	82	01010010	122	52
S	83	01010011	123	53
T	84	01010100	124	54
U	85	01010101	125	55
V	86	01010110	126	56
W	87	01010111	127	57
X	88	01011000	130	58
Y	89	01011001	131	59
Z	90	01011010	132	5A
[	91	01011011	133	5B
\	92	01011100	134	5C
]	93	01011101	135	5D
^	94	01011110	136	5E
_	95	01011111	137	5F

ASCII Char.	Character Code			
	DEC	Binary	OCT	HEX
`	96	01100000	140	60
a	97	01100001	141	61
b	98	01100010	142	62
c	99	01100011	143	63
d	100	01100100	144	64
e	101	01100101	145	65
f	102	01100110	146	66
g	103	01100111	147	67
h	104	01101000	150	68
i	105	01101001	151	69
j	106	01101010	152	6A
k	107	01101011	153	6B
l	108	01101100	154	6C
m	109	01101101	155	6D
n	110	01101110	156	6E
o	111	01101111	157	6F
p	112	01110000	160	70
q	113	01110001	161	71
r	114	01110010	162	72
s	115	01110011	163	73
t	116	01110100	164	74
u	117	01110101	165	75
v	118	01110110	166	76
w	119	01110111	167	77
x	120	01111000	170	78
y	121	01111001	171	79
z	122	01111010	172	7A
{	123	01111011	173	7B
|	124	01111100	174	7C
}	125	01111101	175	7D
~	126	01111110	176	7E
DEL	127	01111111	177	7F

D

Bar Code Configuration Menus

CODE 39

Selection

Enabled

Disabled

Check Character Verification

Enabled

Disabled

Full ASCII conversion

Enabled

Disabled

Length limits: number, 1 - 32

Minimum =

Maximum =

INTERLEAVED 2 of 5

Selection

Enabled

Disabled

Check Character Verification

Enabled

Disabled

Length checking

Length =

Variable

Length checking

6 or 14 Only

2 only

Length limits: even number, 4 - 32

Minimum =

Maximum =

UPC/EAN

Selection

Enabled

Disabled

UPC verses UPC/EAN

UPC only

UPC or EAN

Supplemental digit selections

No supplements

Two Digit

Supplemental digit selections

Five Digit

Two or Five Digit

Supplemental Recognition

Supplements Required

Automatically Recognized

UPC E Expansion

Expanded

Not Expanded

CODABAR

Selection

Enabled

Disabled

Start/Stop Character Transmission

Transmitted

Suppressed

Length limits: number, 1 - 32

Minimum =

Maximum =

CODE 128

Selection

Enabled

Disabled

Length limits: number, 1 - 32

Minimum =

Maximum =

CODE 11

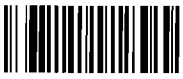
Selection

Enabled

Disabled

Length limits: number, 1 - 32

Minimum =


Maximum =

Check Digit Verification

1 Digit

2 Digits

MSI CODE

Selection

Enabled

Disabled

Length limits: number, 1 - 32

Minimum =

Maximum =

FIXED SERIAL PORT CONFIGURATION AT HARD RESET

Enabled

Disabled

SERIAL PORT

Baud Rate Selection

150 Baud

300 Baud

600 Baud

1200 Baud

2400 Baud

4800 Baud

9600 Baud

Parity

0's

1's

Even

Odd

Intercharacter delay

Enabled

Disabled

Delay period =

Stop Bits

1 Stop Bit

2 Stop Bits

MESSAGE BUFFERS

Header, 0 - 10 characters

Header =

Trailer, 0 - 10 characters

Trailer =

No-Read Message, 0 - 10 characters

No-Read Message =

MISCELLANEOUS OPTIONS

Code ID Character

Enabled

Disabled

No-Read Messages

Enabled

Disabled

Check Character Transmission

Transmitted

Deleted

Bar Code menu scan response

Enabled

Disabled

Resets

Hard

Soft

Hard Reset Message

Enabled

Disabled

ROM, RAM self test

Enabled

Disabled

CODE ID CHARACTER SELECTION

Code 39 ID =

Interleaved 2 of 5 ID =

UPC/EAN ID =

Codabar ID =

Code 128 ID =

Code 11 ID =

MSI Code ID =

Code ID Character Transmission

Transmitted

Suppressed

HP-94 CONFIGURATION

HP-94 Default Configuration

Enter Configuration Mode

Configuration Dump

Exit Configuration Mode

NUMBER MENU

0

10

20

30

1

11

21

31

2

12

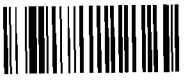
22

32

3

13

23


33

4

14

24

40

5

15

25

50

6

16

26

60

7

17

27

70

8

18

28

80

9

19

29

90

NUMBER MENU (cont.)

CHARACTER MENU

"a"

"b"

"c"

"d"

"e"

"f"

"g"

"h"

"i"

"j"

"k"

"l"

"m"

"n"

"o"

"p"

"q"

"r"

"s"

"t"

"u"

"v"

"w"

"x"

"y"

"z"

"0"

"1"

"2"

"3"

"4"

"5"

"6"

"7"

"8"

"9"

End of Characters

CHARACTER MENU (cont.)

"A"

"B"

"C"

"D"

"E"

"F"

"G"

"H"

"I"

"J"

"K"

"L"

"M"

"N"

"O"

"P"

"Q"

"R"

"S"

"T"

"U"

"V"

"W"

"X"

"Y"

"Z"

" "

"!"

""""

"#"

"$"

"%"

"&"

" ' "

"("

")"

End of Characters

CHARACTER MENU (cont.)

"*"

"+"

","

"-"

"."

"/"

":"

"<"

"="

">"

"?"

"@"

"["

"\"

"]"

"^"

"_"

"`"

"{"

"|"

"}"

"~"

DEL

NUL

SOH

STX

ETX

EOT

ENQ

ACK

BELL

Backspace

HT

LF

VT

FF

End of Characters

CHARACTER MENU (cont.)

CR

SO

SI

DLE

DC1

DC2

DC3

DC4

NAK

SYN

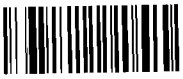
ETB

CAN

EM

SUB

ESC


FS

GS

RS

US

End of Characters