Technical Explanation for Code Readers/OCR

CSM_CodeReder_TG_E_1_1

Introduction

What Is a Barcode?

According to the definition by ANSI (American National Standards Institute), a barcode is a display of information in the form of bars (black portions) and spaces (area between the bars) of varying widths.
Barcodes first emerged in the 1970s, and have come to be employed in a variety of different industries and applications, beginning with the fields of distribution and logistics.
There are a number of varieties of barcodes such as the JAN/EAN codes, CODE128 which are used to manage barcodes for POS, and CODE39 which is used extensively in the industrial field ,and NW-7 which is used in distribution. These barcodes are all governed by ISO/IEC international standards.
When the quality of the barcode printing is not good, the data may be read incorrectly, so it is important to take care in printing labels etc.

Features of Barcodes

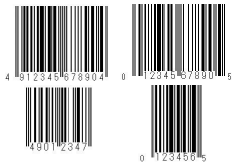
Highly flexibility due to its widespread use internationally
Indespensible identification system for international transport, POS, etc.

High Speed Processing
An effective tool for classification processes in high speed production lines etc.

Great variety of models
There are a variety of different readers, including the Pen model, Handy model, Stationary model, CCD model, laser model and camera model etc.

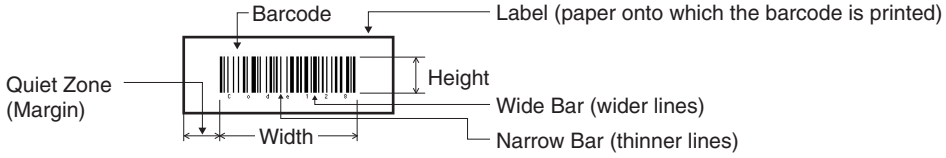
Visible Information
By printing characters in addition to the barcode, it is possible to confirm information just by looking at it.

Major Types and Application of Barcodes

Type	Pattern	Characters	Application	International standards
JAN/EAN		Numbers	POS Barcodes	ISO/IEC15420
CODE39		Numbers, alphabet, partially used symbols	Widely used in industries	ISO/IEC16388
Codabar (NW-7)		Numbers, Stop codes (A to D) Symbols (-,+,$,:,/,.)	Membership cards for blood bank management, parcel delivery, libraries	ISO/IEC16390
ITF		Numbers, Stop codes (A to D) Symbols (-,+,$,:,/,.)	Membership cards for blood bank management, parcel delivery, libraries	ISO/IEC15390
CODE128		All ASCII 128 characters	Auxiliary Barcodes	ISO/IEC15417

✻ Also STF, CODE93, in addition to those above.

Structure of Barcode Label (Example)



For details, refer to the
"Fundamentals of Barcodes: Barcode Structure and Print Methods (Cat. No. Q204)",
"Fundamentals of Barcodes: Barcode Types (Cat. No. Q205)",
"Fundamentals of Barcodes: Laser-type Barcode Readers (Cat. No. Q206)" and
"Fundamentals of Barcodes: CCD-type Barcode Readers (Cat. No. Q207)".

What Is a 2 Dimensional Code?

Barcodes require a great deal of space to express a lot of information, which means that they are difficult to use on small items and for stock control. For example, in the case of small goods for cell phones, these are generally in such high density packaging that barcode labels won't even fit. Also, since barcodes become difficult to read if they are dirty or damaged, a great deal of care need to be taken to maintain the quality of the printing.
In order to solve these problems, the 2 dimensional code was developed which by expressing information in 2 dimensions, makes it possible to include a lot of information at high density in a small space, and can be read even where the print quality is low or it is dirty. Information management including traceability of all the items is ensured by the fact that the 2 dimensional codes are applied directly to goods and products using direct marking by means of a laser marker etc. In addition, for 2 dimensional codes as well, ISO/IEC international standards have progressed to the point where they are now applicable globally.

Features of 2 Dimensional Codes

Very high information density in comparison to barcodes
- The same information can be expressed with 1/10~1/100 as much density as the barcode.
- Marking in extremely small spaces which was impossible with barcodes is possible.

Large amount of information
- 7 KB of information can be held, expressing approx. 7000 characters in number form.
- Kanji can also be used, making it possible to use as a portable data file.

Information can be printed directly onto items
- Direct marking on an item by using a laser enables realizing "unite items with their information".

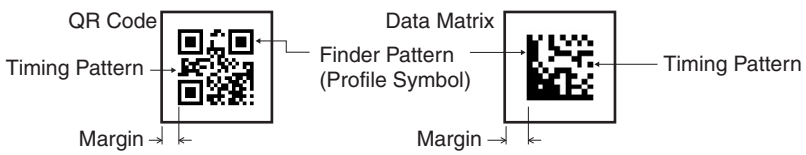
High flexibility in the angle and direction of reading
- Using a 2 dimensional CCD scanner enables reading data from 360 degrees.
- Since there are no limits on the direction for reading 2 dimensional code, work efficiency can be increased.

Protected against dirt and scratches due to error correction functions
- If a code is dirty or damaged, there are functions to restore data from the readable data available, but this is only possible depending on the restoration level setting. As such, in contrast to barcodes, there are no erroneous readings.
- The error correction level can be set at the time of encoding, and a code can be restored from more than 1/2 of the damaged code at its ultimate level.

Major Types of 2 Dimensional Codes

Type	Form	Features	Error correction rate/(error) restoration rates	International standards	Reader
Data Matrix 	L-shaped profile pattern and diagonal timing pattern 	Allows symbols to be made compact	Data structures of older version and ECC200 are different. ECC200 has a 30% error correction rate.	ISO/IEC16022	CCD Image Reader
QR Code 	Three profile smbols 	Enables high-speed reading, and is not affected by direction	Four selectable correction rates; 7%, 15%, 25% and 30%.	ISO/IEC18004	
MAXI codes 	◎ Concentric circles in center 	Data structure enables high-speed profile	Primary message; 25% Secondary message: Standard Level SEC (15%) Extended Level EEC (21%)	ISO/IEC16023	
PDF417 	Stack Format 	Suitable for large data volumes, readable by laser scanners	Contains seven correction levels	ISO/IEC15438	Laser Scanner CCD Image Reader

Structure of 2 Dimensional Code (Example)



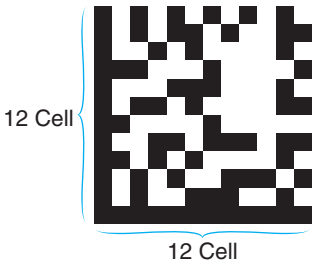
For details, refer to the
"2D Code Fundamentals Introduction (Cat. No. Q208)" and
"2D Code Fundamentals Code Types (Cat. No. Q209)".

Further Information

2 Dimensional Code Reader

Data Matrix ECC200

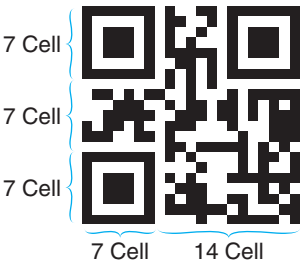
The relationship between symbol size (number of cells) and the amount of information is shown on the right. The following sample shows a 12 × 12 symbol size.



Symbol size	Max. amount of information that can be expressed ✱1				
	Numbers	Alphanumeric characters	Alphanumeric symbols	JIS8 characters	Chinese characters (Shift JIS)
10×10	6	3	3	1	-----
12×12	10	6	5	3	1
14×14	16	10	9	6	3
16×16	24	16	14	10	5
18×18	36	25	22	16	8
20×20	44	31	28	20	10
22×22	60	43	38	28	14
24×24	72	52	46	34	17
26×26	88	64	57	42	21
32×32	124	91	81	60	30
36×36	172	127	113	84	42
40×40	228	169	150	112	56
44×44	288	214	190	142	71
48×48	348	259	230	172	86
52×52	408	304	270	202	101
64×64	560	418	372	278	139
8×18	10	6	5	3	1
8×32	20	13	12	8	4
12×26	32	22	20	14	7
12×36	44	31	28	20	10
16×36	64	46	41	30	15
16×48	98	72	64	47	23

QR Code Model 2

The relationship between symbol size (number of cells) and the amount of information is shown on the right. The following sample shows a 21 × 21 symbol size.



Symbol size (Version) ✱2	Error correction level	Max. amount of information that can be expressed ✱1			
		Numbers	Alphanumeric characters (capital only)	JIS8 characters	Chinese characters (Shift JIS)
21×21 (Version 1)	L (7%)	41	25	17	10
	M (15%)	34	20	14	8
	Q (25%)	27	16	11	7
	H (30%)	17	10	7	4
25×25 (Version 2)	L (7%)	77	47	32	20
	M (15%)	63	38	26	16
	Q (25%)	48	29	20	12
	H (30%)	34	20	14	8
29×29 (Version 3)	L (7%)	127	77	53	32
	M (15%)	101	61	42	26
	Q (25%)	77	47	32	20
	H (30%)	58	35	24	15
33×33 (Version 4)	L (7%)	187	114	78	48
	M (15%)	149	90	62	38
	Q (25%)	111	67	46	28
	H (30%)	82	50	34	21
37×37 (Version 5)	L (7%)	255	154	106	65
	M (15%)	202	122	84	52
	Q (25%)	144	87	60	37
	H (30%)	106	64	44	27
41×41 (Version 6)	L (7%)	322	195	134	82
	M (15%)	255	154	106	65
	Q (25%)	178	108	74	45
	H (30%)	139	84	58	36
45×45 (Version 7)	L (7%)	370	224	154	95
	M (15%)	293	178	122	75
	Q (25%)	207	125	86	53
	H (30%)	154	93	64	39
49×49 (Version 8)	L (7%)	461	279	192	118
	M (15%)	365	221	152	93
	Q (25%)	259	157	108	66
	H (30%)	202	122	84	52
53×53 (Version 9)	L (7%)	552	335	230	141
	M (15%)	432	262	180	111
	Q (25%)	312	189	130	80
	H (30%)	235	143	95	60
57×57 (Version 10)	L (7%)	652	395	271	167
	M (15%)	513	311	213	131
	Q (25%)	364	221	151	93
	H (30%)	288	174	119	74

Source 2 Dimensional Code Symbol - QR Code Specifications JISX0510

*1. Regarding Max. Amount of Information
Even the same two dimensional could have different data amount depending upon their symbol size.
In other words, if the amount of data increases, the the symbol size must also increase. Also, in terms of the information handled by the code, the maximum allowable amount of information could depend on the used characters font. The maximum number of characters for the same sized symbol changes in QR code and Data Matrix in such orders as "number only">"number and alphanumeric characters">"Chinese characters".

*2. Regarding Version (QR Code)
The number representing the symbol size is "version" in QR Code . Version one is minimum and defined by number of cells in one side of square 21 × 21, and as the number of cells increase the version number also increases.