American National Standard

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for information systems –

optical character recognition (OCR) – matrix character sets for OCR-MA

ANSI X3.111-1986

american national standards institute, inc.
1430 broadway, new york, new york 10018

This standard has been adopted for Federal Government use.

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X3.111-1986

American National Standard
for Information Systems –

Optical Character Recognition (OCR) – Matrix Character Sets for OCR-MA

Secretariat

Computer and Business Equipment Manufacturers Association

Approved April 24, 1986

American National Standards Institute, Inc

Abstract

This standard provides the description of the positions and the sizes of dot patterns to be used in the application of matrix printing and recognition for optical character recognition systems. The three different groups, designated OCR-MA1, OCR-MA2, and OCR-MA3, are used to describe the character sets that can be achieved with different matrix resolutions. The four matrix resolutions covered by this standard are 5 × 7, 7 × 7, 7 × 9, and 9 × 9 (columns × rows).

American National Standard

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Foreword

(This Foreword is not part of American National Standard X3.111-1986.)

This standard presents matrix character sets for use in optical character recognition systems. These characters are meant to be similar in shape to those shown in American National Standard Character Set for Optical Character Recognition (OCR-A), ANSI X3.17-1981. However, there are variations in conformance to OCR-A shapes for the different sets of characters depending on the matrix resolution of the printed characters. The character set chosen will depend upon the application. This standard defines the character shapes created by printing devices that generate characters by means of a matrix of dots with a contrasting background. Unlike OCR-A, where the emphasis is on reading performance, this standard has been written to reduce printing constraints to a level that will allow lower resolution printers to be usefully applied for OCR applications.

Matrix printing is increasingly being used because of the ease of generating characters of this type with the use of digital computers. This need was recognized by the European Computer Manufacturers Association with the creation of ECMA-51, Implementation of the Numeric OCR-A Font with 9 X 9 Matrix Printers, and ECMA-42, Alphanumeric Character Set for 7 X 9 Matrix Printers. The need was also recognized by the German Standards Institute with the creation of DIN 66008, Font A for Optical Character Recognition: Character Representation by Dots within 9 X 9 Matrix Dimensions. As in this standard, the characters were defined by a specific combination of "dots" on a fixed grid. This American National Standard limits the printer to a specific placement of dots on a grid, and the print quality requirements that shall be met regardless of the dot matrix used.

Three different groups (OCR-MA1, OCR-MA2, and OCR-MA3) are defined and the character sets for these groups are shown in Table 1. OCR-MA1 can be met with 5 X 7, 7 X 7, 7 X 9, and 9 X 9 matrices. OCR-MA2 can be met with 7 X 7, 7 X 9, and 9 X 9 matrices. The OCR-MA3 characters can be obtained with the 7 X 9 and the 9 X 9 matrices.

In all cases, the 9 X 9 matrix is the recommended matrix for the best scanning results. The 7 X 9 matrix is the first alternate, the 7 X 7 is the second alternate, and the 5 X 7 is the last alternate recommended. The 9 X 9 matrix characters, illustrated in Figures 7 through 58, and the 7 X 7 matrix characters, illustrated in Figures 110 through 139, are designed to increase printer throughput by imposing the restriction that there are no dots on adjacent horizontal positions.

Matrices with resolutions of higher densities than 9 X 9 are not specifically covered in this standard. However, higher resolution printers can create characters that meet the requirements of this standard. Often this can be accomplished by using a group of small dots closely spaced to create the same effect as one larger dot. High resolution matrix printers can also be used to create OCR-A characters that fall within the quality requirements and characters shape requirements of ANSI X3.17-1981.

Suggestions for improvement of this standard will be welcome. They should be sent to the Computer and Business Equipment Manufacturers Association, 311 First Street, NW, Suite 500, Washington, DC 20001.

This standard was processed and approved for submittal to ANSI by Accredited Standards Committee on Information Processing Systems, X3. Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the X3 Committee had the following members:

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A special thanks is given to Norm Weiland for the preparation of the innumerable draft manuscripts and character layouts.

Contents

American National Standard for Information Systems –

Optical Character Recognition (OCR) – Matrix Character Sets for OCR-MA

1. Scope, Purpose, and Application

1.1 Scope. This standard describes the matrix of dot placement and size limits for OCR-MA alphanumeric characters and symbols for optical character recognition (OCR) systems.

1.2 Purpose. The purpose of this standard is to establish a set of characters that can be generated by printing systems that produce characters with a matrix of dots and shall be used in optical character recognition systems. There are three different character groups illustrated to provide for the capability of many types of matrix printing devices and applications.

1.3 Application. This standard specifies the dot placement and size of OCR-MA. The standard does not specify the means to create characters. Both the impact and nonimpact printing technologies can be used to create these characters. This standard may be used as a design basis for devices used to print or read OCR-MA. The different character groups are provided to accommodate printer manufacturers and applications.

In any particular application, the indiscriminate use of more characters than actually required may result in additional costs and poorer performance. The smallest character group (OCR-MA1) is designed to accommodate minimum numeric requirements, and it includes the character group described in Implementation of the Numeric OCR-A Font with 9 X 9 Matrix Printers, ECMA-51. Character group OCR-MA2 is primarily intended for applications using the character set in the NRMA Voluntary Retail Identification Standard Specification A. Character group OCR-MA3 is sufficient to handle the majority of OCR-MA applications, and it is the largest number of characters that can be accomplished at reasonable cost.

The implementation of a successful OCR system involves consideration beyond the scope of this standard. These considerations include such things as paper, ink characteristics, and character placement. These subjects are discussed in detail in American National Standard for Paper Used in Optical Character Recognition (OCR) Systems, ANSI X3.62-1979, American National Standard for Optical Character Recogntion (OCR) Inks, ANSI X3.86-1980, American National Standard for Optical Character Recognition (OCR) Character Positioning, ANSI X3.93M-1981, and American National Standard for Information Systems – Optical Character Recognition (OCR) – Guidelines for OCR Print Quality, ANSI X3.99-1983.

2. Referenced and Related Standards

2.1 Referenced American National Standards. This standard is intended to be used in conjunction with the following American National Standards. When these standards are superseded by a revision approved by the American National Standards Institute, Inc, the revision shall apply.

ANSI X3.4-1986, Information Systems – Coded Character Sets – 7-Bit American National Standard Code for Information Interchange (7-Bit ASCII)

ANSI X3.17-1981, Character Set for Optical Character Recognition (OCR-A)

ANSI X3.93M-1981, Optical Character Recognition (OCR) Character Positioning

ANSI X3.99-1983, Information Systems – Optical Character Recognition (OCR) – Guidelines for OCR Print Quality

2.2 Related Standards. These standards listed here for information only and are not essential for the completion of the requirements of this standard:

ANSI X3.62-1979, Paper Used in Optical Recognition (OCR) Systems

ANSI X3.86-1980, Optical Character Recognition (OCR) Inks

ECMA-42, Alphanumeric Character Set for 7 X 9 Matrix Printers[1]

ECMA-51, Implementation of Numeric OCR-A Font with 9 X 9 Matrix Printers[1]

DIN 66008, Font A for Optical Character Recognition, 9 X 9 Dot Matrix[1]

NRMA Voluntary Retail Identification Standard Specification A[2]

3. Definitions

dot. A generally circular area of suitable contrast to the background used to form a matrix.

dot spacing. The nominal distance between the centers of dots in adjacent row positions or adjacent column positions.

matrix. A rectangular array of printed dots organized in rows (horizontal) and columns (vertical). The matrix notation shall be the number of columns by (X) the number of rows.

4. Characters

4.1 Character Shapes. The character shapes for OCR-MA shall be similar to those for OCR-A, as defined in ANSI X3.17-1981, and shall be specified in one size only. This size is similar to size I in OCR-A. The nominal character width, when measured from the centerline of the first column position to the centerline of the last column position shall be 0.055 inch (1.40 mm). The nominal character height, when measured from the centerline of the bottom row position to the centerline of the top row position, shall be 0.094 inch (2.39 mm). The stroke width shall be determined by dot size limitations.

4.1.1 Dot Size. The dot size shall be determined by measuring the largest and smallest span of the dot in any direction through the center of the dot. The minimum dimension for dot size shall be 0.012 inch (0.305 mm) and the maximum dimension shall be 0.020 inch (0.508 mm). The dots shown in this standard are round, but any shape meeting the minimum and maximum dimensions shall be allowed. The dots may also be created by combining smaller dots as long as the group of dots meets the minimum or maximum dimensional requirements. This is illustrated in Figure 1.

4.1.2 Dot Spacing. The spacing of dots used to form OCR-MA characters has a significant effect on the print quality of the characters. Closer spacing provides a more consistent stroke width. Dot locations are controlled by the dimensions on the matrices shown in Figures 2 through 5. The figures show the nominal point locations for the center of the dot.

4.1.3 Dot Placement Limits (DPL). To create a character that meets the requirements of this standard, dots (1) shall be located on the nominal matrices so they totally cover a diameter of 0.008 inch (0.20 mm) that is centered on the nominal matrix centerpoint location, and (2) shall not extend more than 0.012 inch (0.30 mm) from imaginary lines connecting all of the adjacent nominal matrix centerpoint locations of a character. These are the dot placement limits (DPL).

When constructed on a transparency for visual use, the DPL is called a DPL measuring gage. The DPL is unique for each character set. Examples of DPL gages are shown in Figures 156 through 162. Figures 156 through 159 illustrate the DPL gages for the number two. Figures 160 through 162 illustrate the DPL gages for the letter A.

The DPL measuring gage shall be constructed in all cases using the nominal matrices shown in Figures 2 through 5. The minimum DPL shall be constructed by creating a circle with a diameter of 0.008 inch (0.20 mm) at the intersection of the nominal centerlines for each nominal dot placement location. The maximum DPL shall be created by generating a circle with a diameter of 0.024 inch (0.61 mm) and moving it along all of the imaginary lines connecting the adjacent nominal dot-placement locations of a character.

NOTE: Since a dot has a maximum size of 0.020 inch (0.51 mm) it will not completely fill in the maximum DPL. The DPL is to measure dot location and character shape only. It is not used to measure the size of dots.

4.2 Character Repertoire. The character sets for the three OCR-MA character groups (OCR-MA1, OCR-MA2, and OCR-MA3) are shown in Table 1. Since the use of an unnecessarily large number of characters may result in greater cost and lower performance, the user should consult with the manufacturers of the reading and printing equipment regarding the minimum set required for an optimum OCR system.

4.2.1 Alternate Character Shapes. In the case of the 7 X 9 number 8, 9 X 9 number 0, and letter P and R, alternate character shapes have been specified. When alternate character shapes exist, the user should consult with the manufacturers of the reading and printing equipment to determine which character shape is required for an optimum OCR system.

[1] Available from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

[2] Available from the National Retail Merchants Association, 100 West 31st Street, New York, NY 10001.

Table 1
OCR-MA Character Repertoire

Character	Shape	Name	Character Groups		
			1	2	3
1		Number one	X	X	X
2		Number two	X	X	X
3		Number three	X	X	X
4		Number four	X	X	X
5		Number five	X	X	X
6		Number six	X	X	X
7		Number seven	X	X	X
8		Number eight	X	X	X
9		Number nine	X	X	X
0		Number zero	X	X	X
A		Letter A	–	X	X
B		Letter B	–	–	X
C		Letter C	–	X	X
D		Letter D	–	X	X
E		Letter E	–	–	X
F		Letter F	–	–	X
G		Letter G	–	–	X
H		Letter H	–	–	X
I		Letter I	–	–	X
J		Letter J	–	–	X
K		Letter K	–	–	X
L		Letter L	–	–	X
M		Letter M	–	X	X
N		Letter N	–	X	X
O		Letter O	–	–	X
P		Letter P	–	X	X
Q		Letter Q	–	–	X
R		Letter R	–	X	X
S		Letter S	–	–	X
T		Letter T	–	–	X
U		Letter U	–	X	X
V		Letter V	–	–	X
W		Letter W	–	–	X
X		Letter X	–	X	X
Y		Letter Y	–	X	X
Z		Letter Z	–	–	X
⌐		Symbol hook	X	X	X
⌂		Symbol chair	X	X	X
Ψ		Symbol fork	X	X	X
+		Plus sign	X	X	X
–		Minus sign	X	X	X
.		Period (decimal point)	X	X	X
/		Slant	–	X	X
$		Dollar sign	X	X	X
>		Greater than sign	–	X	X
"		Quotation mark	–	X	X
,		Comma	–	–	X
¥		Yen sign	–	–	X
<		Less than sign	–	–	X

4.2.2 Character SPACE. The character SPACE is a blank area in a line of print, having a width equal to the character pitch (if the characters are printed 10 to the inch, the character pitch is 1/10 inch (2.54 mm)).

When a blank area is bounded by narrow characters (the first or last columns in the matrix do not contain dots) the narrow characters shall be assigned a width of 0.069 inch (1.75 mm) for the purpose of determining the number of SPACE characters between the printed characters.

4.3 Use of Characters. Data interchange applications shall follow the nominally assigned information content of ANSI X3.4-1986 (ASCII). Three special characters have been provided that are recommended for use when control symbols are required. These symbols are hook (⍐), fork (⍋), and chair (⍒).

4.4 Relative Character Spacing. Details of character spacing are addressed in ANSI X3.93M-1981. For character positioning, a reference line for vertical positioning and a reference line for horizontal positioning shall be used. The reference line for vertical positioning, relative to line spacing, is the "baseline." The reference line for horizontal positioning, relative to line spacing, is the "centerline." In all cases, for OCR-MA, the baseline shall be the bottom horizontal line in any matrix, indicated by position 0.0000 inch (0.000 mm) in Figures 2 through 5, and the centerline shall be the middle vertical line in any matrix, indicated by the position that marks 0.0275 inch or 0.698 mm in the figures.

The characters in a row are properly aligned vertically when their baselines are collinear. Certain characters are displaced above the common baseline. The vertical locations of these characters are determined by the dot placement on the matrices.

4.4.1 Line Spacing. In order to maintain an adequate separation between lines of characters, the nominal number of lines per inch (25.4 mm) shall not exceed 6. To ensure a sufficient separation between lines of characters, the minimum distance from the lowest vertical extension of one line of characters to the highest vertical extension of the next lower line of characters shall be 0.025 inch (0.64 mm). The line spacing that can be successfully scanned by an OCR reader differs from reader to reader. The user is advised to consult with the OCR equipment manufacturer when the line spacing is denser than 3 lines per inch (25.4 mm).

4.4.2 Character Spacing. Character spacing less than the minimum spacing specifications may prevent the OCR reader from totally recovering after reading the previous character. Character spacing that approaches the maximum allowable spacing may result in a recognized character space. The nominal spacing between the vertical centerlines of adjacent characters should be 0.100 inch (2.54 mm) to 0.110 inch (2.79 mm) for efficient printing and equipment reading of matrix OCR-MA characters. Minimum spacing between the vertical centerlines of any adjacent characters shall be 0.090 inch (2.29 mm). Maximum spacing between the vertical centerlines of any adjacent character shall be 0.180 inch (4.57 mm). The user is advised to consult with the OCR equipment manufacturer to determine the reader's character spacing specifications.

4.4.3 Minimum Character Separation. The minimum distance between the outside edge of any dot printed in the last used column of a character matrix and the outside edge of any dot printed in the first used column of the next character matrix shall be 0.014 inch (0.36 mm).

4.5 Print Quality. For details of print quality, see ANSI X3.99-1983. In general, the print quality for OCR-MA characters shall meet the requirements of quality range *y* as stated in ANSI X3.99-1983. Exceptions to ANSI X3.99-1983 are detailed in this section.

4.5.1 Measurement of Print Image Contrast. Since matrix characters are created with dots on a specific matrix, measurements of the contrast as related to the background medium (print contrast signal) and measurements of contrast within a character (contrast variation ratio) shall be taken from the nominal centerpoint location of the dots on the matrix. This means that certain features within the character body that would be considered nonallowable voids in OCR-A shall be allowed in OCR-MA. A void that falls on a line between the nominal centerpoints of two adjacent dots shall be allowed. This type of void may occur on a horizontal line between dots located in adjacent columns, on a vertical line between dots located in adjacent rows, or on a sloped line between dots located in different columns and rows. An example of this condition can be observed from Figures 13, 116, and 146, showing the dot locations for the character 7.

4.5.2 Print Contrast Signal (PCS). The print contrast signal (PCS) is an expression that relates the contrast between selected points of interest within a printed character, and the background medium. The PCS value of a Point P is defined by the equation:

$$PCS = \frac{R_w - R_p}{R_w}$$

where

R_w = the maximum reflectance of the background medium found within 0.060 inch (1.50 mm) of the edge of a printed character.

R_p = the reflectance from a measured area centered on Point P, the nominal centerpoint location of any of the dots that form the character.

For OCR-MA, the reflectance values for R_w and R_p shall be measured within a circular area (aperture) of 0.008 inch (0.20 mm) in diameter.

The minimum PCS of all dots with a nominal dot size equal to or greater than 0.014 inch (0.36 mm) shall be 0.50. The minimum PCS of all dots with a nominal dot size less than 0.014 inch (0.36 mm) and equal to or greater than 0.012 inch (0.30 mm) shall increase proportionally from 0.50 for a 0.014-inch (0.36-mm) dot to 0.60 for a 0.012-inch (0.30-mm) dot. This is shown graphically in Figure 6.

4.5.3 Contrast Variation Ratio. The variation of contrast in a character is expressed by the contrast variation ratio (CVR), which is defined as:

$$\text{CVR} = \frac{\text{PCS max}}{\text{PCS min}}$$

where

PCS min = the lowest PCS level of an area covered by a circle 0.008 inch (0.20 mm) in diameter, located on any nominal center-point location of the dots in a character.

PCS max = the highest PCS level of an area covered by a circle 0.008 inch (0.20 mm) in diameter, located on any nominal center-point location of the dots in a character.

The CVR shall be less than or equal to 1.8.

4.5.4 Voids. Voids are areas where the printing process does not deposit sufficient material on the printed media. Voids have significantly higher reflectance than other areas of the printed image. Voids shall be allowed if they do not reduce the PCS min, as described in 4.5.3, below a value of 0.50.

4.5.5 Spot. Spots are areas located within 0.060 inch (1.50 mm) of a printed character, that contrast with the printed media. Spots may be allowable or nonallowable based on size and PCS level. For adjacent characters, spots should be related to the closest character. Spots shall be allowed if they have an area less than the area described by moving a circle, 0.008 inch (0.20 mm) in diameter, along a straight line for a distance of 0.004 inch (0.10 mm), and if they have a PCS value less than 0.30.

4.5.6 Edge Irregularity. It is inherent that edge irregularities will occur in characters created with a matrix of dots with a dot spacing that is greater than one-half of a dot size. Edge irregularities shall be allowable when it is obvious that they occur as a result of correct matrix printing as illustrated in this standard. Edge irregularities that occur owing to smearing or uncontrolled ink spread shall be subject to the same limitations for quality range *y* that is specified in ANSI X3.99-1983.

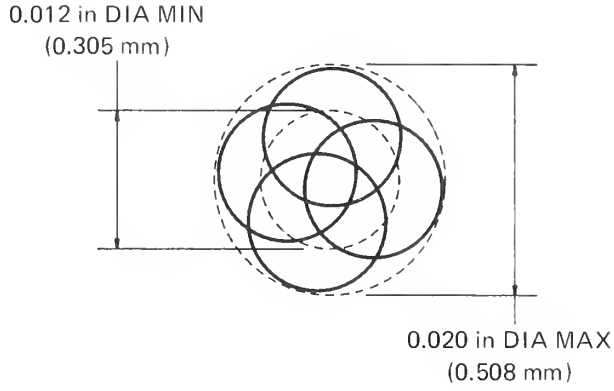


Figure 1
Dot Size Dimensions

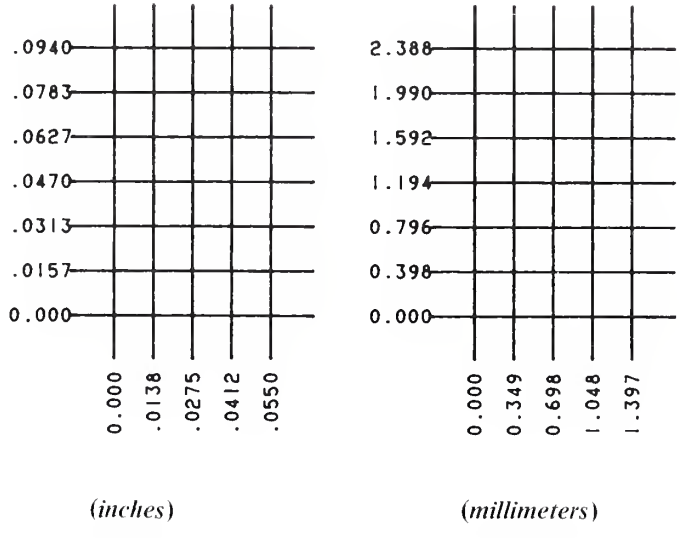


Figure 2
5 X 7 Matrix Dimensions

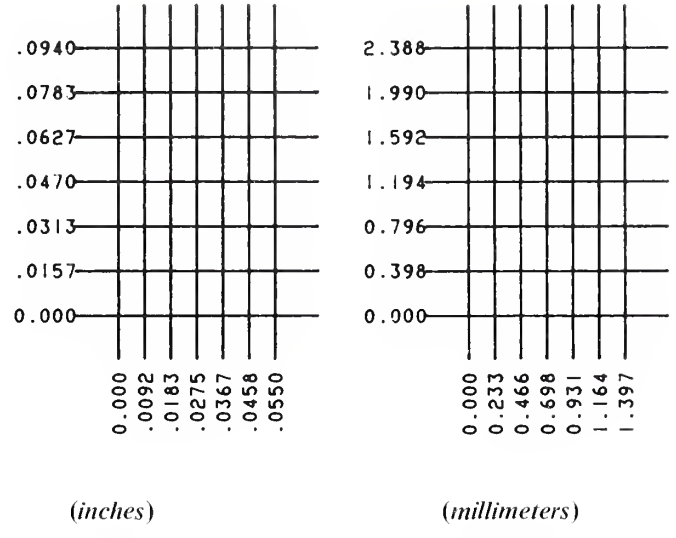
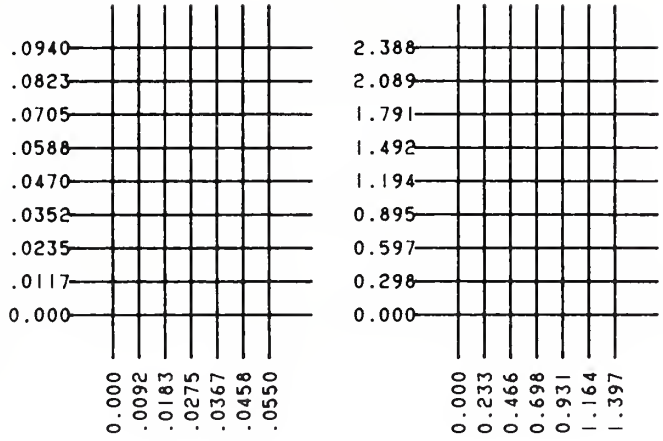
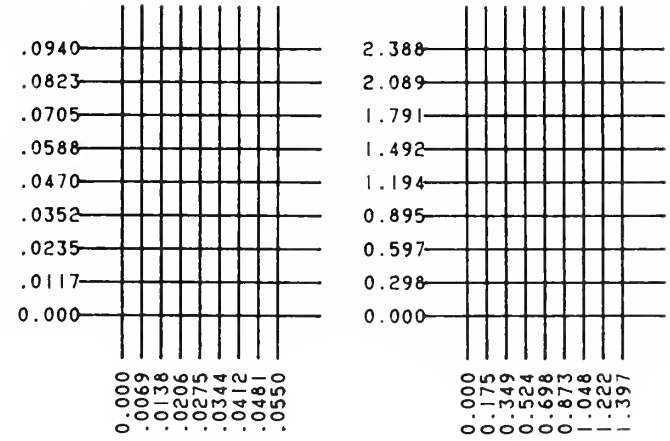


Figure 3
7 X 7 Matrix Dimensions



(*inches*) (*millimeters*)

Figure 4
7 X 9 Matrix Dimensions



(*inches*) (*millimeters*)

Figure 5
9 X 9 Matrix Dimensions

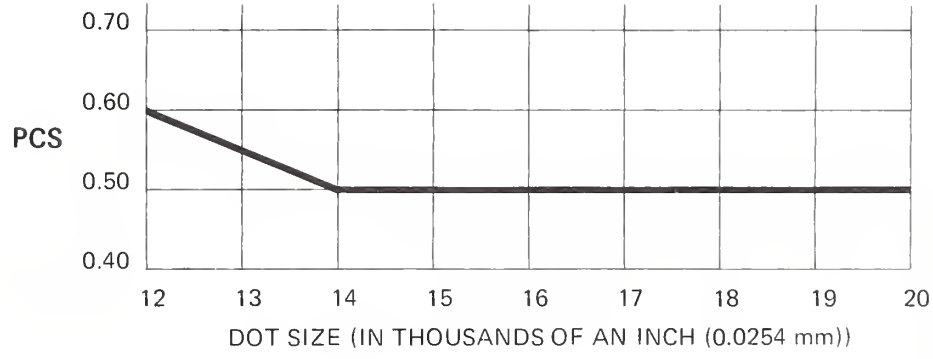


Figure 6
Minimum PCS as a Function of Dot Size

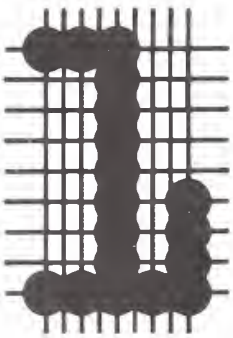


Figure 7
Number One
9 X 9

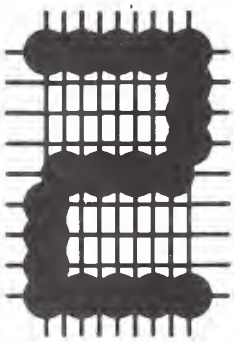


Figure 8
Number Two
9 X 9

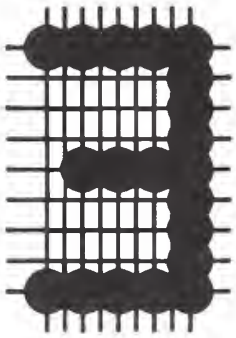


Figure 9
Number Three
9 X 9

Figure 10
Number Four
9 X 9

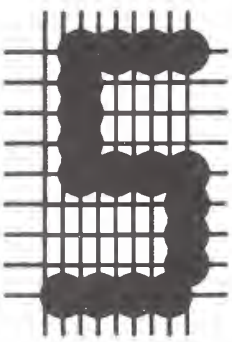


Figure 11
Number Five
9 X 9

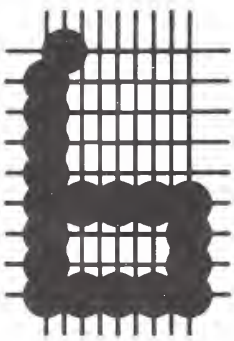


Figure 12
Number Six
9 X 9

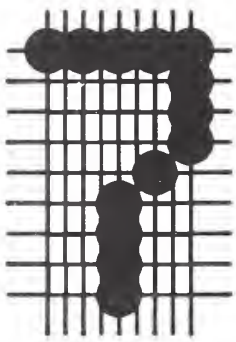


Figure 13
Number Seven
9 X 9

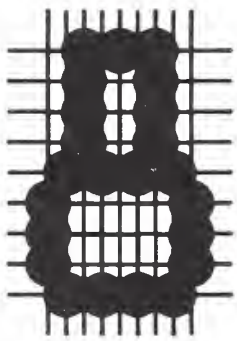


Figure 14
Number Eight
9 X 9

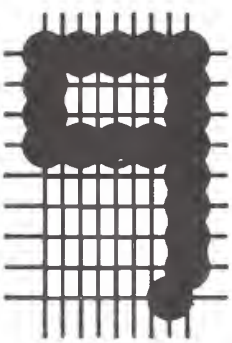


Figure 15
Number Nine
9 X 9

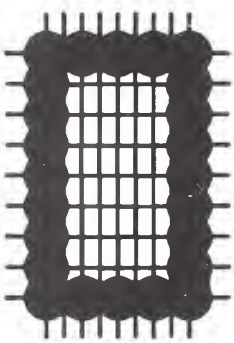


Figure 16
Preferred Number Zero
9 X 9

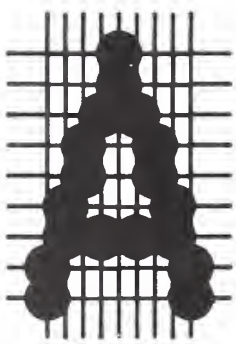


Figure 17
Letter A
9 X 9

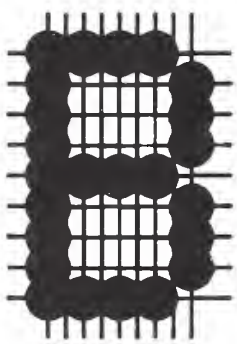


Figure 18
Letter B
9 X 9

Figure 19
Letter C
9 X 9

Figure 20
Letter D
9 X 9

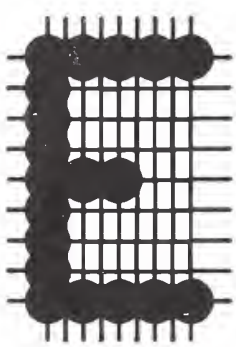


Figure 21
Letter E
9 X 9

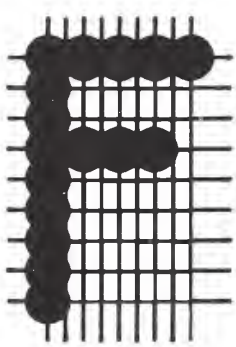


Figure 22
Letter F
9 X 9

Figure 23
Letter G
9 × 9

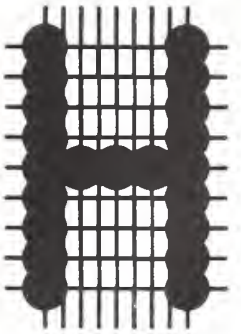


Figure 24
Letter H
9 × 9

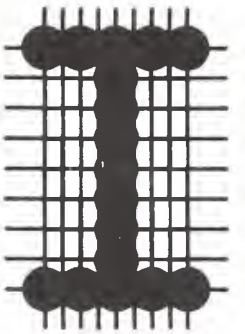


Figure 25
Letter I
9 × 9

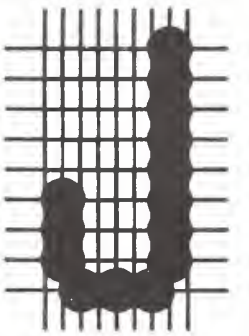


Figure 26
Letter J
9 × 9

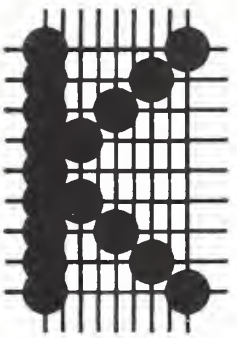


Figure 27
Letter K
9 × 9

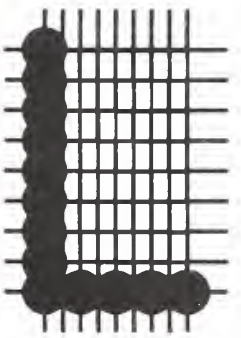


Figure 28
Letter L
9 × 9

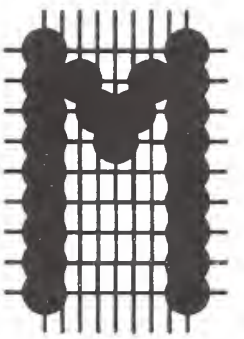


Figure 29
Letter M
9 × 9

Figure 30
Letter N
9 × 9

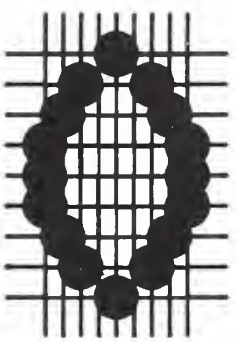


Figure 31
Letter O
9 × 9

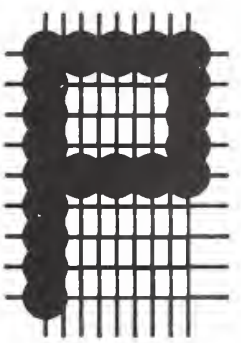


Figure 32
Preferred Letter P
9 × 9

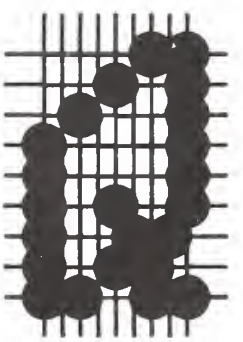


Figure 33
Letter Q
9 × 9

Figure 34
Preferred Letter R
9 × 9

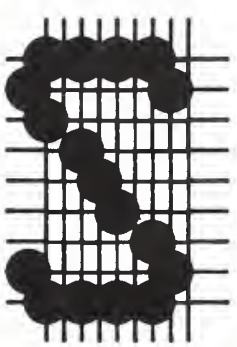


Figure 35
Letter S
9 × 9

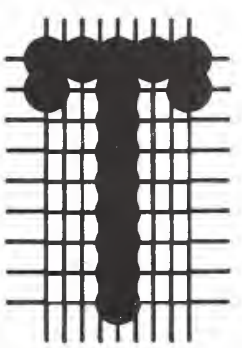


Figure 36
Letter T
9 × 9

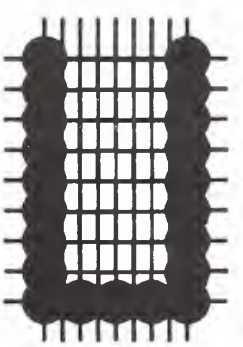


Figure 37
Letter U
9 × 9

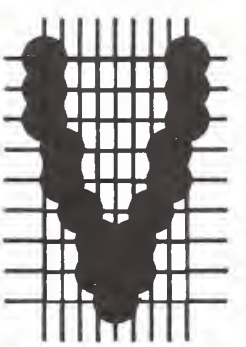


Figure 38
Letter V
9 × 9

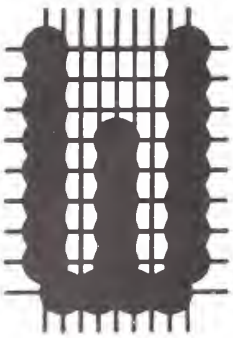


Figure 39
Letter W
9 × 9

Figure 40
Letter X
9 × 9

Figure 41
Letter Y
9 × 9

Figure 42
Letter Z
9 × 9

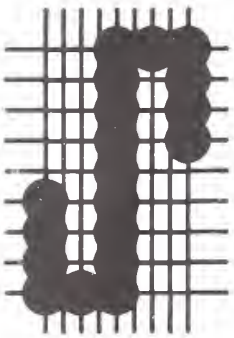


Figure 43
Symbol Hook
9 × 9

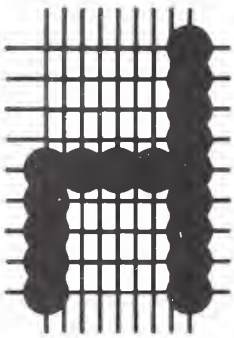


Figure 44
Symbol Chair
9 × 9

Figure 45
Symbol Fork
9 × 9

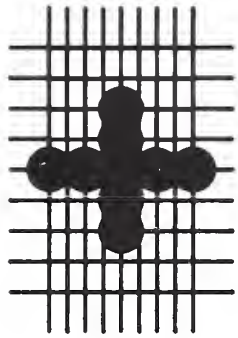


Figure 46
Plus Sign
9 × 9

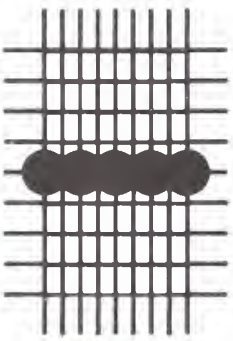


Figure 47
Minus Sign
9 × 9

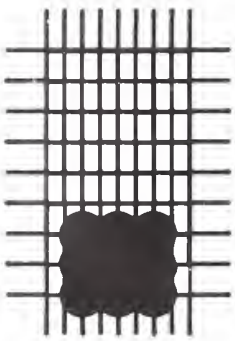


Figure 48
Period (Decimal Point)
9 × 9

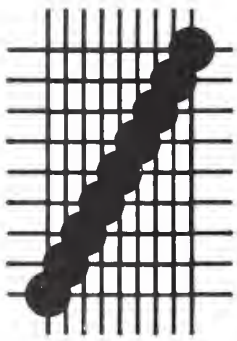


Figure 49
Slant
9 × 9

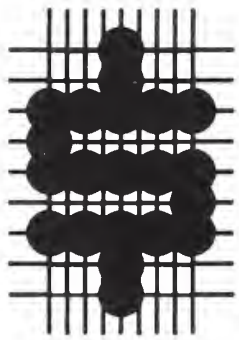


Figure 50
Dollar Sign
9 × 9

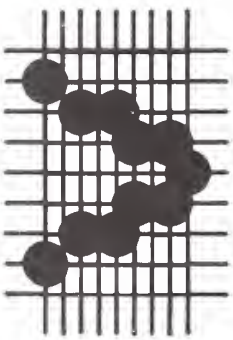


Figure 51
Greater Than Sign
9 × 9

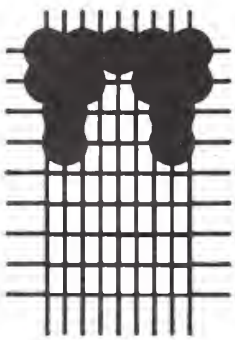


Figure 52
Quotation Mark
9 × 9

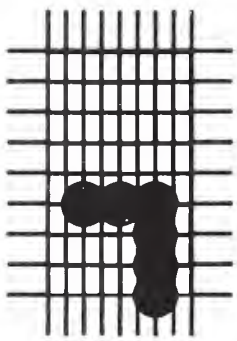


Figure 53
Comma
9 × 9

Figure 54
Yen Sign
9 × 9

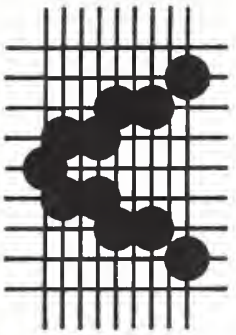


Figure 55
Less Than Sign
9 X 9

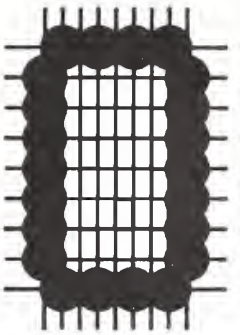


Figure 56
Alternate Number Zero
9 X 9

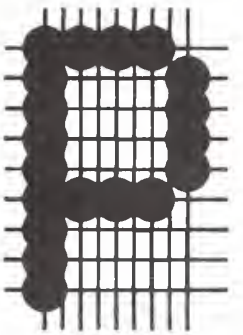


Figure 57
Alternate Letter P
9 X 9

Figure 58
Alternate Letter R
9 X 9

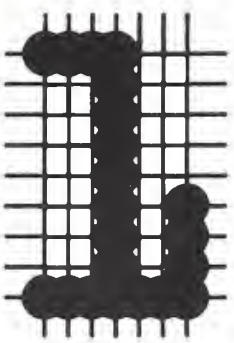


Figure 59
Number One
7 X 9

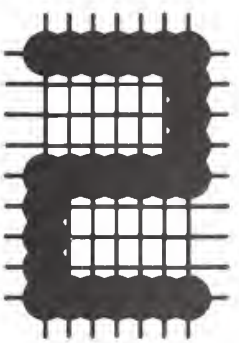


Figure 60
Number Two
7 X 9

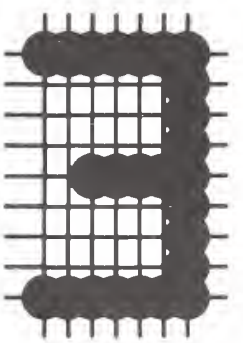


Figure 61
Number Three
7 X 9

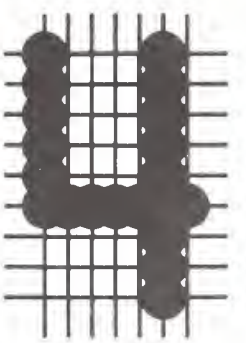


Figure 62
Number Four
7 X 9

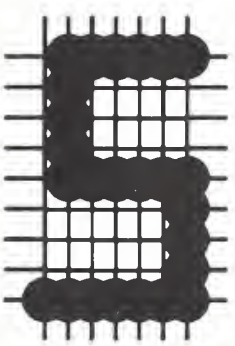


Figure 63
Number Five
7 X 9

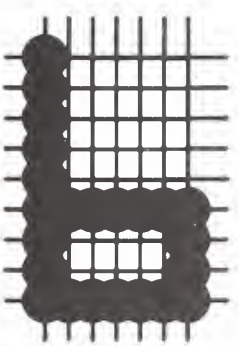


Figure 64
Number Six
7 X 9

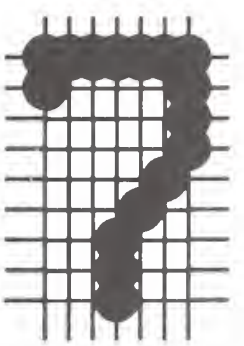


Figure 65
Number Seven
7 X 9

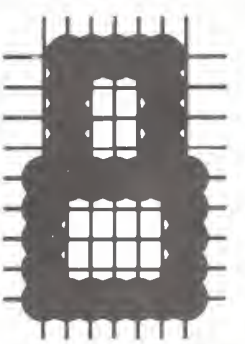


Figure 66
Preferred Number Eight
7 X 9

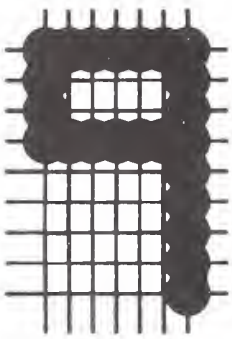


Figure 67
Number Nine
7 X 9

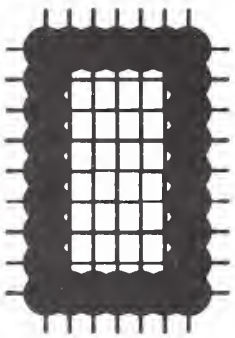


Figure 68
Number Zero
7 X 9

Figure 69
Letter A
7 X 9

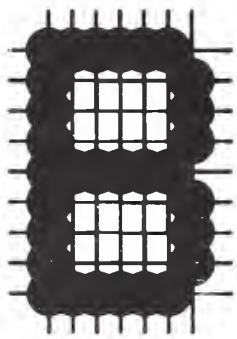


Figure 70
Letter B
7 X 9

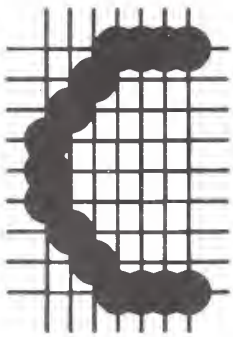


Figure 71
Letter C
7 X 9

Figure 72
Letter D
7 X 9

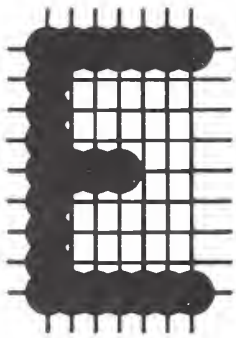


Figure 73
Letter E
7 X 9

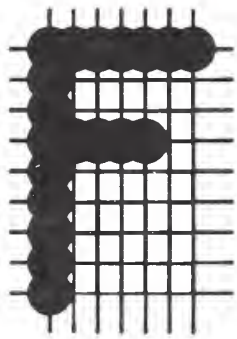


Figure 74
Letter F
7 X 9

Figure 75
Letter G
7 X 9

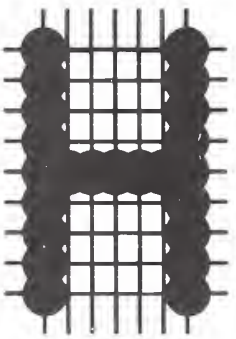


Figure 76
Letter H
7 X 9

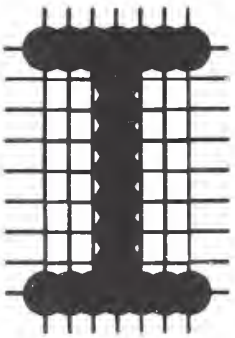


Figure 77
Letter I
7 X 9

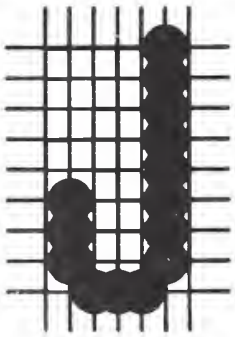


Figure 78
Letter J
7 X 9

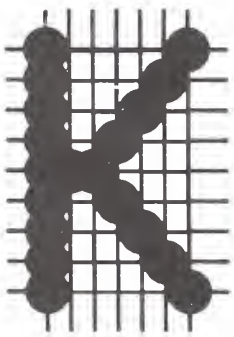


Figure 79
Letter K
7 X 9

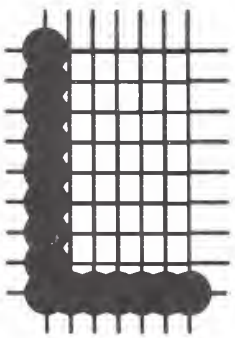


Figure 80
Letter L
7 X 9

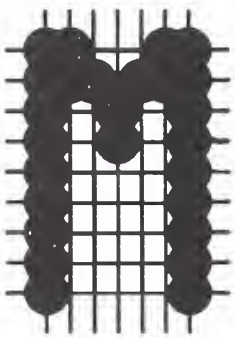


Figure 81
Letter M
7 X 9

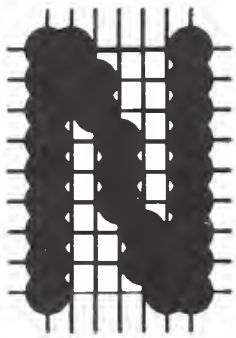


Figure 82
Letter N
7 X 9

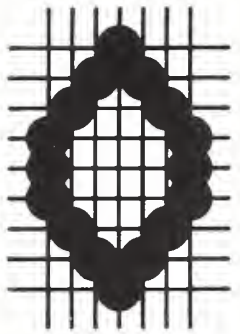


Figure 83
Letter O
7 X 9

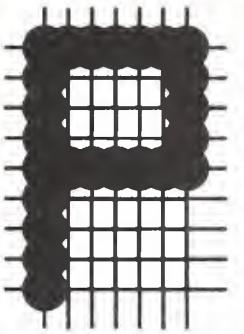


Figure 84
Letter P
7 X 9

Figure 85
Letter Q
7 X 9

Figure 86
Letter R
7 X 9

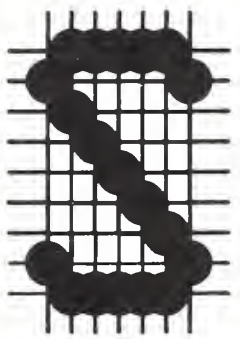


Figure 87
Letter S
7 X 9

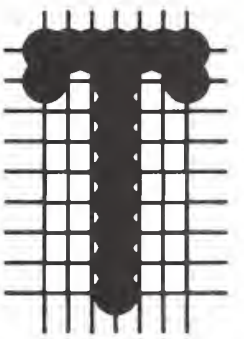


Figure 88
Letter T
7 X 9

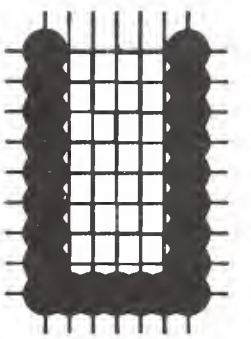


Figure 89
Letter U
7 X 9

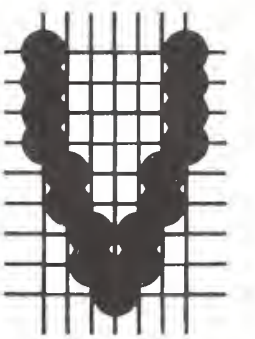


Figure 90
Letter V
7 X 9

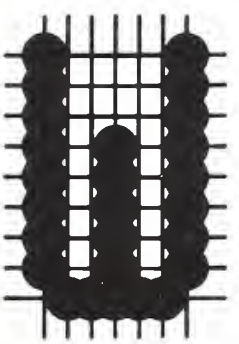


Figure 91
Letter W
7 X 9

Figure 92
Letter X
7 X 9

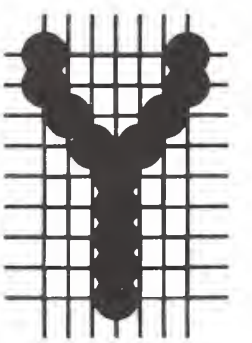


Figure 93
Letter Y
7 X 9

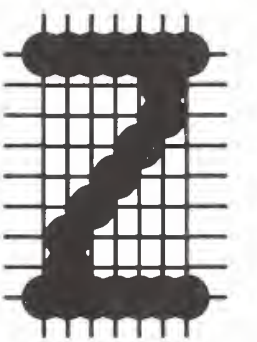


Figure 94
Letter Z
7 X 9

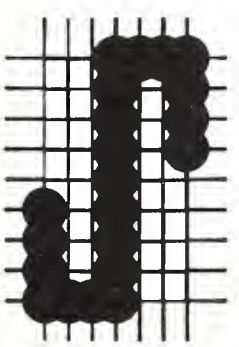


Figure 95
Symbol Hook
7 X 9

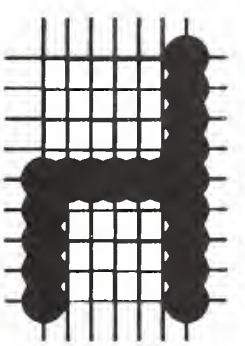


Figure 96
Symbol Chair
7 X 9

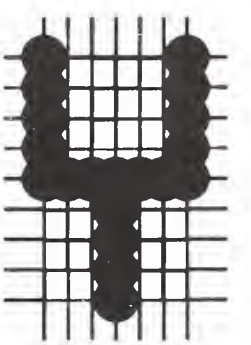


Figure 97
Symbol Fork
7 X 9

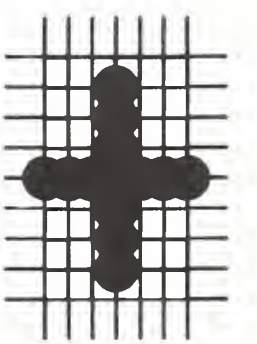


Figure 98
Plus Sign
7 X 9

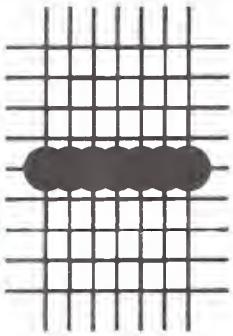


Figure 99
Minus Sign
7 X 9

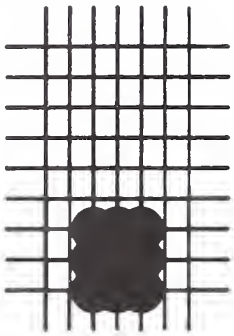


Figure 100
Period (Decimal Point)
7 X 9

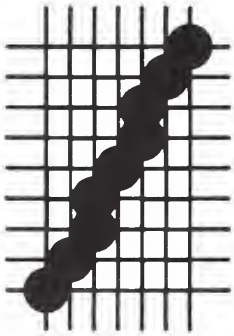


Figure 101
Slant
7 X 9

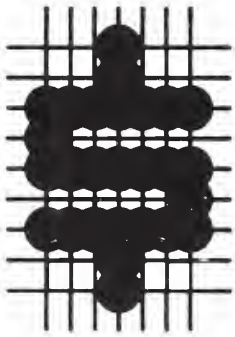


Figure 102
Dollar Sign
7 X 9

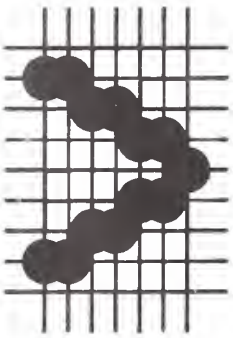


Figure 103
Greater Than Sign
7 X 9

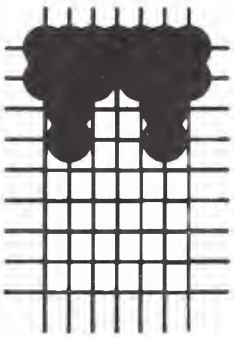


Figure 104
Quotation Mark
7 X 9

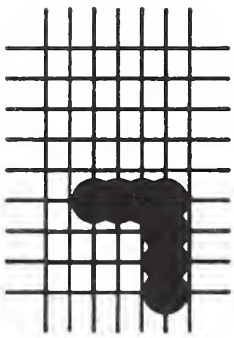


Figure 105
Comma
7 X 9

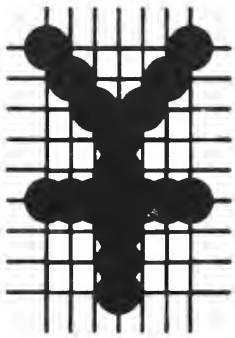


Figure 106
Yen Sign
7 X 9

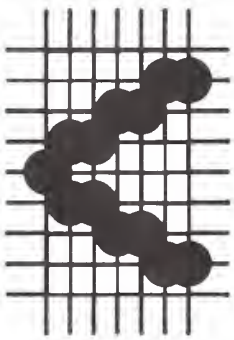


Figure 107
Less Than Sign
7 X 9

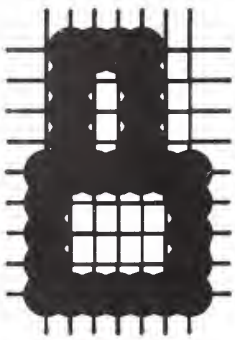


Figure 108
Alternate Number 8
7 X 9

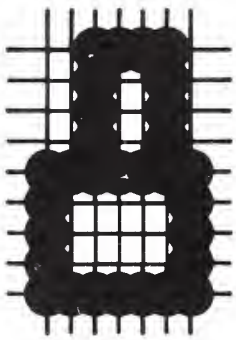


Figure 109
Alternate Number 8
7 X 9

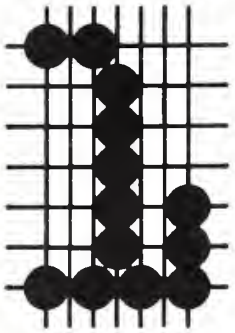


Figure 110
Number One
7 X 7

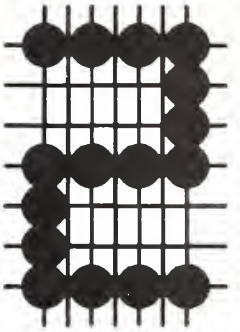


Figure 111
Number Two
7 X 7

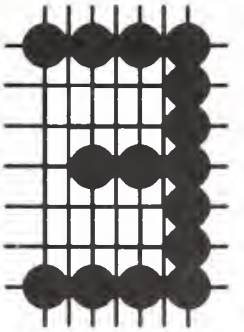


Figure 112
Number Three
7 X 7

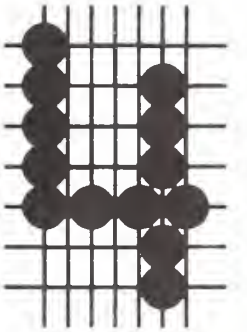


Figure 113
Number Four
7 X 7

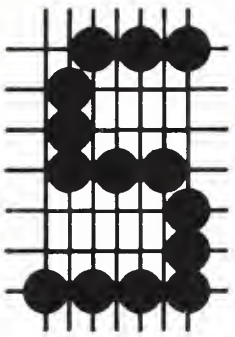


Figure 114
Number Five
7 X 7

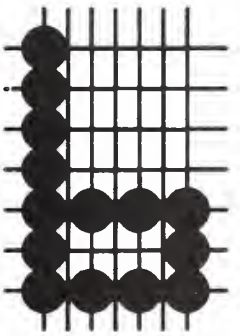


Figure 115
Number Six
7 X 7

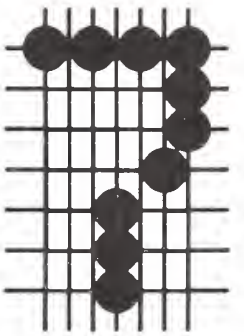


Figure 116
Number Seven
7 X 7

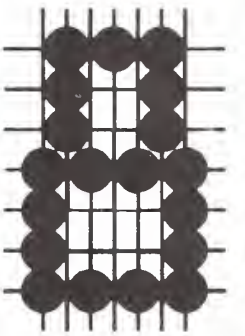


Figure 117
Number Eight
7 X 7

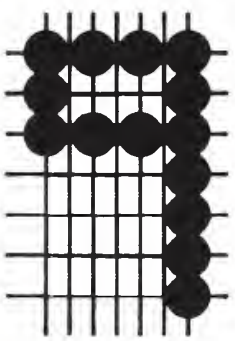


Figure 118
Number Nine
7 X 7

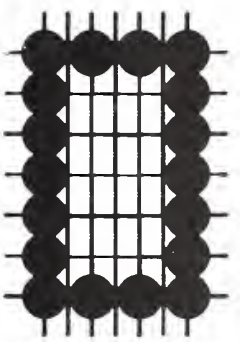


Figure 119
Number Zero
7 X 7

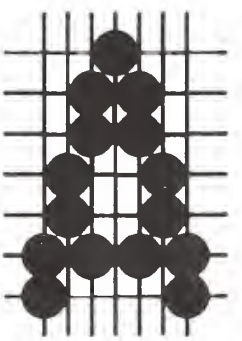


Figure 120
Letter A
7 X 7

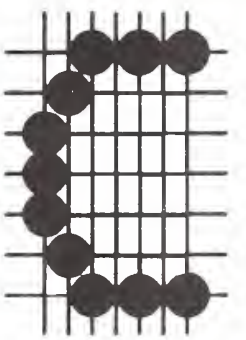


Figure 121
Letter C
7 X 7

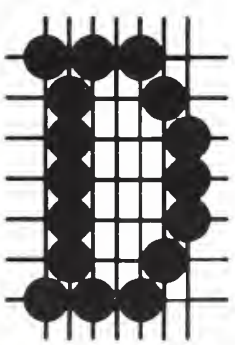


Figure 122
Letter D
7 X 7

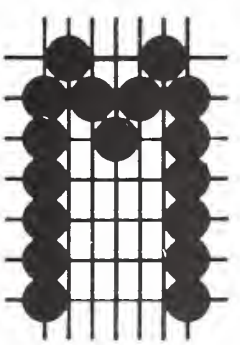


Figure 123
Letter M
7 X 7

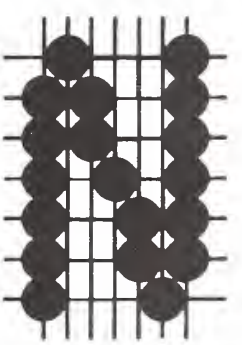


Figure 124
Letter N
7 X 7

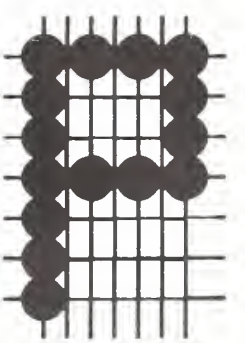


Figure 125
Letter P
7 X 7

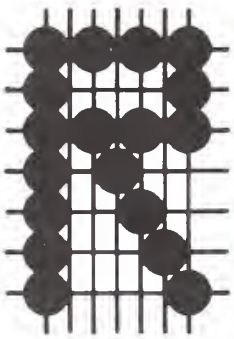


Figure 126
Letter R
7 X 7

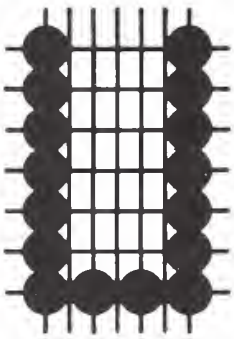


Figure 127
Letter U
7 X 7

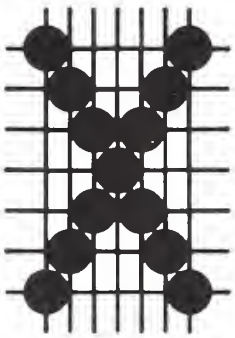


Figure 128
Letter X
7 X 7

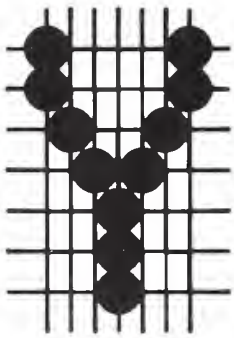


Figure 129
Letter Y
7 X 7

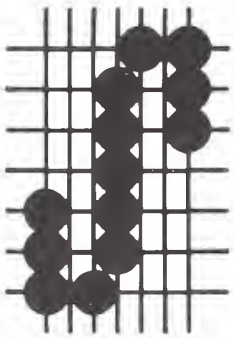


Figure 130
Symbol Hook
7 X 7

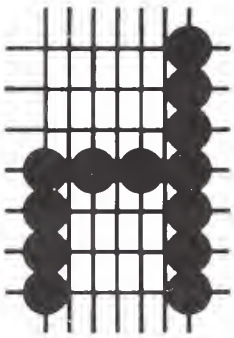


Figure 131
Symbol Chair
7 X 7

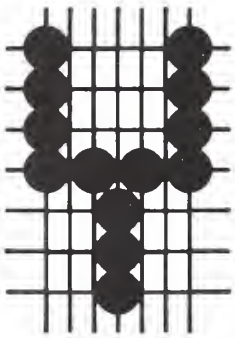


Figure 132
Symbol Fork
7 X 7

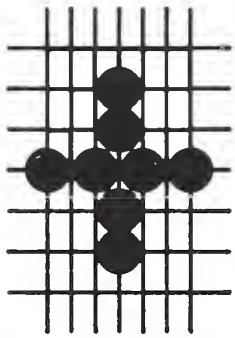


Figure 133
Plus Sign
7 X 7

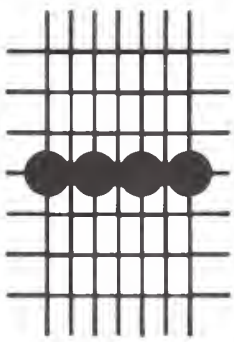


Figure 134
Minus Sign
7 X 7

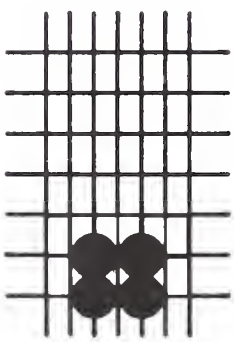


Figure 135
Period (Decimal Point)
7 X 7

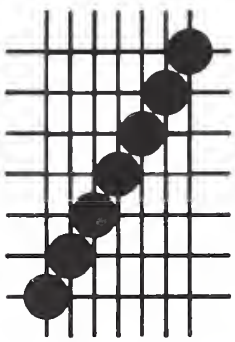


Figure 136
Slant
7 X 7

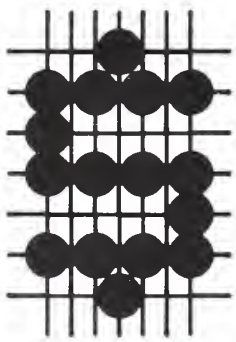


Figure 137
Dollar Sign
7 X 7

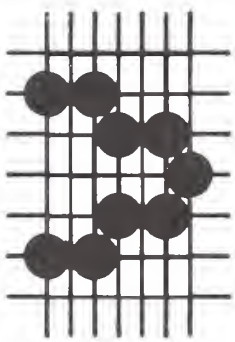


Figure 138
Greater Than Sign
7 X 7

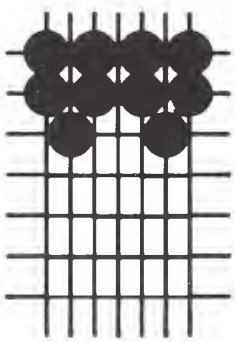


Figure 139
Quotation Mark
7 X 7

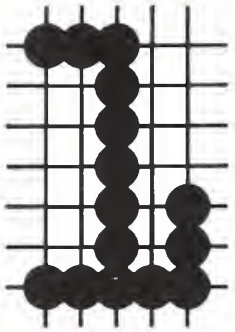


Figure 140
Number One
5 X 7

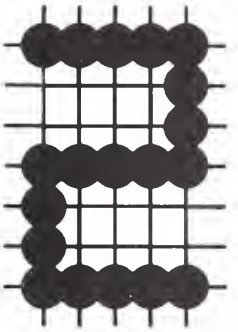


Figure 141
Number Two
5 X 7

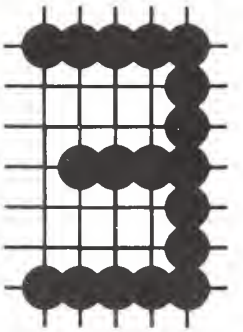


Figure 142
Number Three
5 X 7

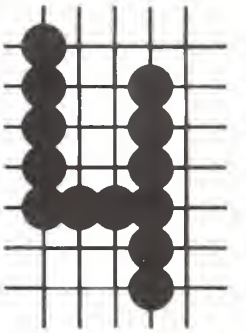


Figure 143
Number Four
5 X 7

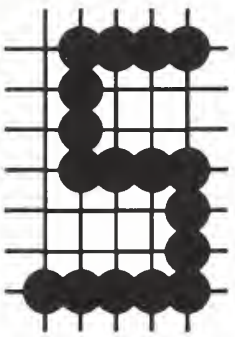


Figure 144
Number Five
5 X 7

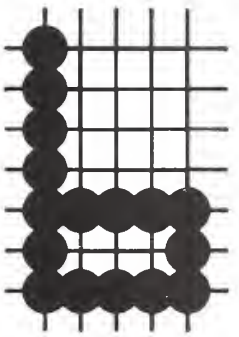


Figure 145
Number Six
5 X 7

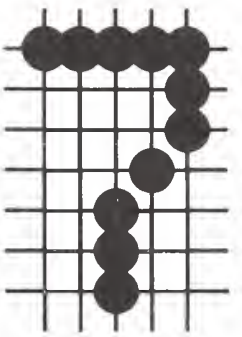


Figure 146
Number Seven
5 X 7

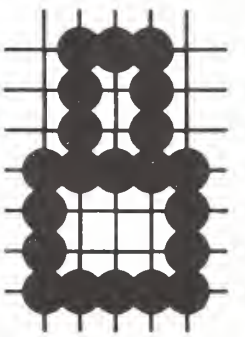


Figure 147
Number Eight
5 X 7

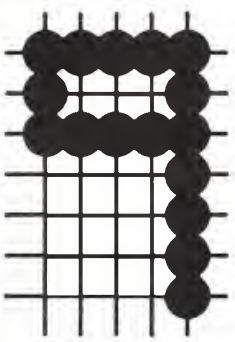


Figure 148
Number Nine
5 X 7

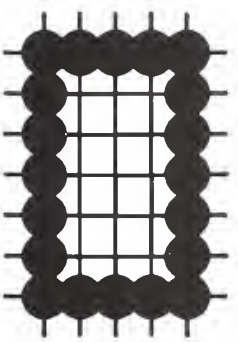


Figure 149
Number Zero
5 X 7

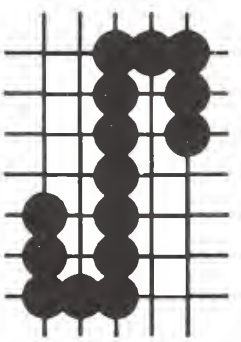


Figure 150
Symbol Hook
5 X 7

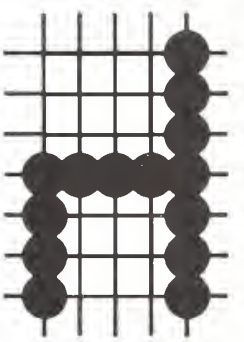


Figure 151
Symbol Chair
5 X 7

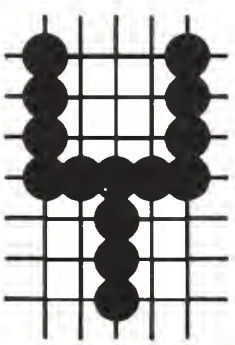


Figure 152
Symbol Fork
5 X 7

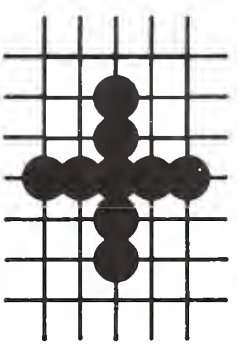


Figure 153
Plus Sign
5 X 7

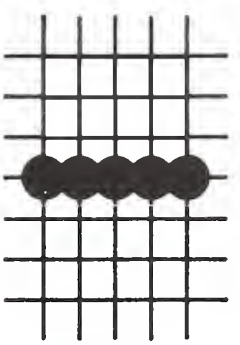


Figure 154
Minus Sign
5 X 7

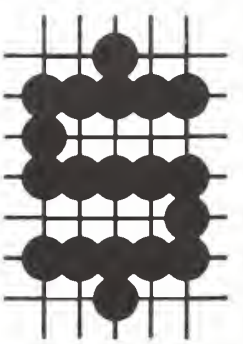


Figure 155
Dollar Sign
5 X 7

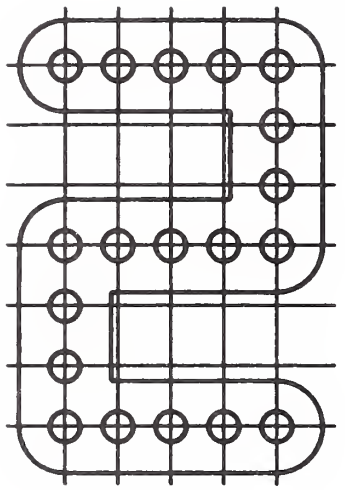


Figure 156
5 X 7 Number Two
Dot Placement Limits

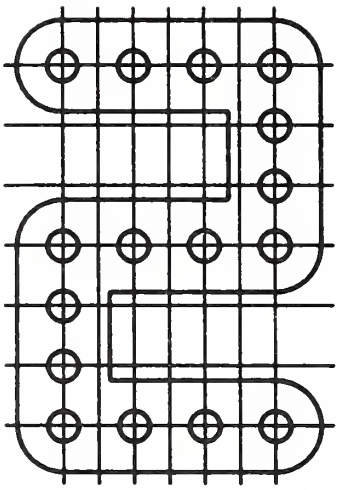


Figure 157
7 X 7 Number Two
Dot Placement Limits

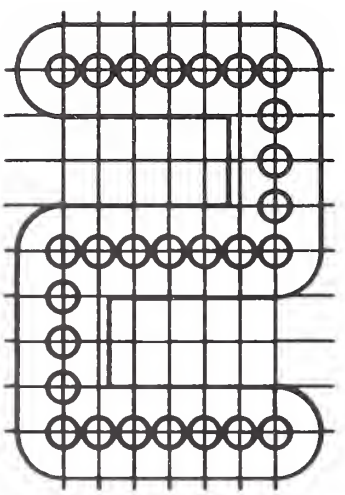


Figure 158
7 X 9 Number Two
Dot Placement Limits

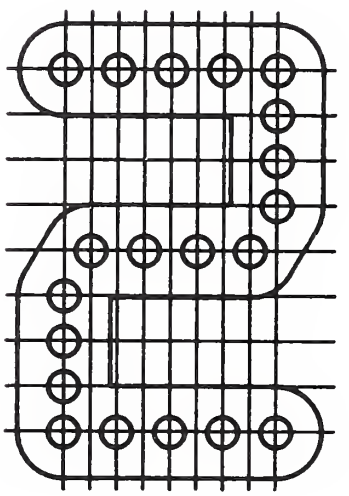


Figure 159
9 X 9 Number Two
Dot Placement Limits

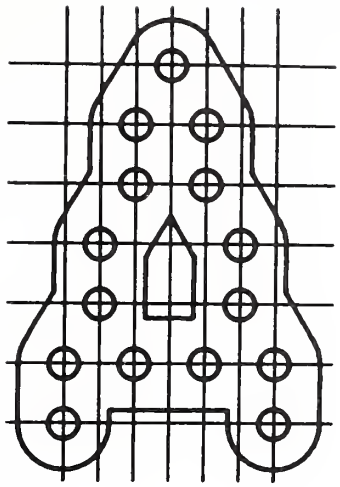


Figure 160
7 X 7 Letter A
Dot Placement Limits

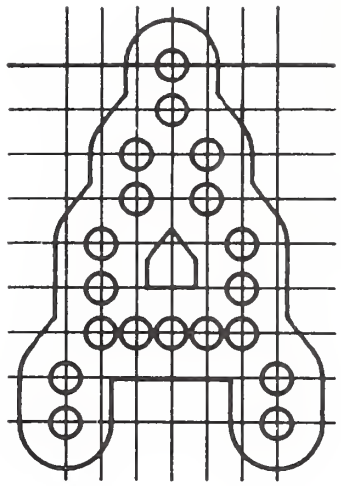


Figure 161
7 X 9 Letter A
Dot Placement Limits

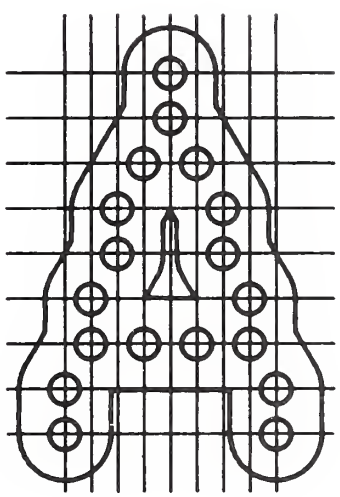


Figure 162
9 X 9 Letter A
Dot Placement Limits

Appendix (This Appendix is not part of American National Standard X3.111-1986, but is included for information only.)

Correspondence to the ASCII Code Table

Figure A1 is included to indicate a correspondence between the characters of this standard and those graphics used in Table 8 of American National Standard for Information Systems – Coded Character Sets – 7-Bit American National Standard Code for Information Interchange (7-Bit ASCII), ANSI X3.4-1986. Note that the three symbols, Hook, Fork, and Chair, can be used as control symbols or to represent the characters, tilde, underline, and grave accent, respectively. For forms interchange applications using these characters, there has to be agreement as to their use. If the abstract symbols are to be transmitted, they should be assigned to the code table positions as shown in Figure A1.

Figure A1 is given as an example for reference purposes only, and no specific correspondence is prescribed between the characters of this standard and those of ANSI X3.4-1986, other than that which is understood by the users.

b_7	0	0	0	0	1	1	1	1
b_6	0	0	1	1	0	0	1	1
b_5	0	1	0	1	0	1	0	1

b_4	b_3	b_2	b_1	(1)	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE		0		P	(5)	
0	0	0	1	1	SOH	DC1		1	A	Q		
0	0	1	0	2	STX	DC2	"	2	B	R		
0	0	1	1	3	ETX	DC3		3	C	S		
0	1	0	0	4	EOT	DC4	$	4	D	T		
0	1	0	1	5	ENQ	NAK		5	E	U		
0	1	1	0	6	ACK	SYN		6	F	V		
0	1	1	1	7	BEL	ETB		7	G	W		
1	0	0	0	8	BS	CAN		8	H	X		
1	0	0	1	9	HT	EM		9	I	Y		
1	0	1	0	10	LF	(2) SUB			J	Z		
1	0	1	1	11	VT	ESC	+		K			
1	1	0	0	12	FF	FS	,	<	L	(3) ¥		
1	1	0	1	13	CR	GR	-		M			
1	1	1	0	14	SO	RS	.	>	N			(6) ~
1	1	1	1	15	SI	US	/		O	(4) ¥		

NOTES:

(1) b_1 is the low-order bit.

(2) This code is used to represent an OCR reject and has no associated symbol.

(3) This code position normally contains a non-OCR character, the Reverse Slash. Its assignment to the Yen Sign is not intended to preclude the use of the Reverse Slash, except where the Yen Sign is required for specific OCR applications.

(4) This code position normally contains a non-OCR character, the Underline. Its assignment to the Symbol Fork is not intended to preclude the use of the Underline, except where the Symbol Fork is required for specific OCR applications.

(5) This code position normally contains a non-OCR character, the Acute Accent. Its assignment to the Symbol Chair is not intended to preclude the use of the Acute Accent, except where the Symbol Chair is required for specific OCR applications.

(6) This code position normally contains a non-OCR character, the Tilde. Its assignment to the Symbol Hook is not intended to preclude the use of the Tilde, except where the Symbol Hook is required for specific OCR applications.

Figure A1
Correspondence between OCR-MA Repertoire and ASCII Code Table

X3.115-1984 Unformatted 80 Megabyte Trident Pack for Use at 370 tpi and 6000 bpi (General, Physical, and Magnetic Characteristics)
X3.116-1986 Recorded Magnetic Tape Cartridge, 4-Track, Serial 0.250 Inch (6.30 mm) 6400 bpi (252 bpmm), Inverted Modified Frequency Modulation Encoded
X3.117-1984 Printable/Image Areas for Text and Facsimile Communication Equipment
X3.118-1984 Financial Services – Personal Identification Number – PIN Pad
X3.119-1984 Contact Start/Stop Storage Disk, 158361 Flux Transitions per Track, 8.268 Inch (210 mm) Outer Diameter and 3.937 inch (100 mm) Inner Diameter
X3.120-1984 Contact Start/Stop Storage Disk
X3.121-1984 Two-Sided, Unformatted, 8-Inch (200-mm), 48-tpi, Double-Density, Flexible Disk Cartridge for 13 262 ftpr Two-Headed Application
X3.122-1986 Computer Graphics Metafile for the Storage and Transfer of Picture Description Information
X3.124-1985 Graphical Kernel System (GKS) Functional Description
X3.124.1-1985 Graphical Kernel System (GKS) FORTRAN Binding
X3.125-1985 Two-Sided, Double-Density, Unformatted 5.25-inch (130-mm), 48-tpi (1,9-tpmm), Flexible Disk Cartridge for 7958 bpr Use
X3.126-1986 One- or Two-Sided Double-Density Unformatted 5.25-inch (130-mm), 96 Tracks per Inch, Flexible Disk Cartridge
X3.127-1987 Unrecorded Magnetic Tape Cartridge for Information Interchange
X3.128-1986 Contact Start-Stop Storage Disk – 83 000 Flux Transitions per Track, 130-mm (5.118-in) Outer Diameter and 40-mm (1.575-in) Inner Diameter
X3.129-1986 Intelligent Peripheral Interface, Physical Level
X3.130-1986 Intelligent Peripheral Interface, Logical Device Specific Command Sets for Magnetic Disk Drive
X3.131-1986 Small Computer Systems Interface
X3.132-1987 Intelligent Peripheral Interface – Logical Device Generic Command Set for Optical and Magnetic Disks
X3.133-1986 Database Language –NDL
X3.135-1986 Database Language – SQL
X3.136-1986 Serial Recorded Magnetic Tape Cartridge for Information Interchange, Four and Nine Track
X3.139-1987 Fiber Distributed Data Interface (FDDI) Token Ring Media Access Control (MAC)
X3.140-1986 Open Systems Interconnection – Connection Oriented Transport Layer Protocol Specification
X3.141-1987 Data Communication Systems and Services – Measurement Methods for User-Oriented Performance Evaluation
X3.146-1987 Device Level Interface for Streaming Cartridge and Cassette Tape Drives
X3.147-1987 Intelligent Peripheral Interface – Logical Device Generic Command Set for Magnetic Tapes
X3.153-1987 Open Systems Interconnection – Basic Connection Oriented Session Protocol Specification
X11.1-1977 Programming Language MUMPS
IEEE 416-1978 Abbreviated Test Language for All Systems (ATLAS)
IEEE 716-1982 Standard C/ATLAS Language
IEEE 717-1982 Standard C/ATLAS Syntax
IEEE 770X3.97-1983 Programming Language PASCAL
IEEE 771-1980 Guide to the Use of ATLAS
ISO 8211-1986 Specifications for a Data Descriptive File for Information Interchange
MIL-STD-1815A-1983 Reference Manual for the Ada Programming Language
NBS-ICST 1-1986 Fingerprint Identification – Data Format for Information Interchange

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X3/TRI-82 Dictionary for Information Processing Systems (Technical Report)

American National Standards for Information Processing

X3.1-1976 Synchronous Signaling Rates for Data Transmission
X3.2-1970 Print Specifications for Magnetic Ink Character Recognition
X3.4-1986 Coded Character Sets — 7-Bit ASCII
X3.5-1970 Flowchart Symbols and Their Usage
X3.6-1965 Perforated Tape Code
X3.9-1978 Programming Language FORTRAN
X3.11-1969 General Purpose Paper Cards
X3.14-1983 Recorded Magnetic Tape (200 CPI, NRZI)
X3.15-1976 Bit Sequencing of the American National Standard Code for Information Interchange in Serial-by-Bit Data Transmission
X3.16-1976 Character Structure and Character Parity Sense for Serial-by-Bit Data Communication in the American National Standard Code for Information Interchange
X3.17-1981 Character Set for Optical Character Recognition (OCR-A)
X3.18-1974 One-Inch Perforated Paper Tape
X3.19-1974 Eleven-Sixteenths-Inch Perforated Paper Tape
X3.20-1967 Take-Up Reels for One-Inch Perforated Tape
X3.21-1967 Rectangular Holes in Twelve-Row Punched Cards
X3.22-1983 Recorded Magnetic Tape (800 CPI, NRZI)
X3.23-1985 Programming Language COBOL
X3.25-1976 Character Structure and Character Parity Sense for Parallel-by-Bit Data Communication in the American National Standard Code for Information Interchange
X3.26-1980 Hollerith Punched Card Code
X3.27-1978 Magnetic Tape Labels and File Structure
X3.28-1976 Procedures for the Use of the Communication Control Characters of American National Standard Code for Information Interchange in Specified Data Communication Links
X3.29-1971 Specifications for Properties of Unpunched Oiled Paper Perforator Tape
X3.30-1986 Representation for Calendar Date and Ordinal Date
X3.31-1973 Structure for the Identification of the Counties of the United States
X3.32-1973 Graphic Representation of the Control Characters of American National Standard Code for Information Interchange
X3.34-1972 Interchange Rolls of Perforated Tape
X3.37-1980 Programming Language APT
X3.38-1972 Identification of States of the United States (Including the District of Columbia)
X3.39-1986 Recorded Magnetic Tape (1600 CPI, PE)
X3.40-1983 Unrecorded Magnetic Tape (9-Track 800 CPI, NRZI; 1600 CPI, PE; and 6250 CPI, GCR)
X3.41-1974 Code Extension Techniques for Use with the 7-Bit Coded Character Set of American National Standard Code for Information Interchange
X3.42-1975 Representation of Numeric Values in Character Strings
X3.43-1986 Representations of Local Time of Day
X3.44-1974 Determination of the Performance of Data Communication Systems
X3.45-1982 Character Set for Handprinting
X3.46-1974 Unrecorded Magnetic Six-Disk Pack (General, Physical, and Magnetic Characteristics)
X3.47-1977 Structure for the Identification of Named Populated Places and Related Entities of the States of the United States for Information Interchange
X3.48-1986 Magnetic Tape Cassettes (3.81-mm [0.150-Inch] Tape at 32 bpmm [800 bpi], PE)
X3.49-1975 Character Set for Optical Character Recognition (OCR-B)
X3.50-1986 Representations for U.S. Customary, SI, and Other Units to Be Used in Systems with Limited Character Sets
X3.51-1986 Representations of Universal Time, Local Time Differentials, and United States Time Zone References
X3.52-1976 Unrecorded Single-Disk Cartridge (Front Loading, 2200 BPI) (General, Physical, and Magnetic Requirements)
X3.53-1976 Programming Language PL/I
X3.54-1986 Recorded Magnetic Tape (6250 CPI, Group Coded Recording)
X3.55-1982 Unrecorded Magnetic Tape Cartridge, 0.250 Inch (6.30 mm), 1600 bpi (63 bpmm), Phase encoded
X3.56-1986 Recorded Magnetic Tape Cartridge, 4 Track, 0.250 Inch (6.30 mm), 1600 bpi (63 bpmm), Phase Encoded
X3.57-1977 Structure for Formatting Message Headings Using the American National Standard Code for Information Interchange for Data Communication Systems Control
X3.58-1977 Unrecorded Eleven-Disk Pack (General, Physical, and Magnetic Requirements)
X3.60-1978 Programming Language Minimal BASIC
X3.61-1986 Representation of Geographic Point Locations
X3.62-1987 Paper Used in Optical Character Recognition (OCR) Systems
X3.63-1981 Unrecorded Twelve-Disk Pack (100 Megabytes) (General, Physical, and Magnetic Requirements)
X3.64-1979 Additional Controls for Use with American National Standard Code for Information Interchange
X3.66-1979 Advanced Data Communication Control Procedures (ADCCP)
X3.72-1981 Parallel Recorded Magnetic Tape Cartridge, 4 Track, 0.250 Inch (6.30 mm), 1600 bpi (63 bpmm), Phase Encoded
X3.73-1980 Single-Sided Unformatted Flexible Disk Cartridge (for 6631-BPR Use)
X3.74-1981 Programming Language PL/I, General-Purpose Subset
X3.76-1981 Unformatted Single-Disk Cartridge (Top Loading, 200 tpi 4400 bpi) (General, Physical, and Magnetic Requirements)
X3.77-1980 Representation of Pocket Select Characters
X3.78-1981 Representation of Vertical Carriage Positioning Characters in Information Interchange
X3.79-1981 Determination of Performance of Data Communications Systems That Use Bit-Oriented Communication Procedures
X3.80-1981 Interfaces between Flexible Disk Cartridge Drives and Their Host Controllers
X3.82-1980 One-Sided Single-Density Unformatted 5.25-Inch Flexible Disk Cartridge (for 3979-BPR Use)
X3.83-1980 ANSI Sponsorship Procedures for ISO Registration According to ISO 2375
X3.84-1981 Unformatted Twelve-Disk Pack (200 Megabytes)(General, Physical, and Magnetic Requirements
X3.85-1981 1/2-Inch Magnetic Tape Interchange Using a Self Loading Cartridge
X3.86-1980 Optical Character Recognition (OCR) Inks
X3.88-1981 Computer Program Abstracts
X3.89-1981 Unrecorded Single-Disk, Double-Density Cartridge (Front Loading, 2200 bpi, 200 tpi) (General, Physical, and Magnetic Requirements)
X3.91M-1987 Storage Module Interfaces
X3.92-1981 Data Encryption Algorithm
X3.93M-1981 OCR Character Positioning
X3.94-1985 Programming Language PANCM
X3.95-1982 Microprocessors — Hexadecimal Input/Output, Using 5-Bit and 7-Bit Teleprinters
X3.96-1983 Continuous Business Forms (Single-Part)
X3.98-1983 Text Information Interchange in Page Image Format (PIF)
X3.99-1983 Print Quality Guideline for Optical Character Recognition (OCR)
X3.100-1983 Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment for Packet Mode Operation with Packet Switched Data Communications Network
X3.101-1984 Interfaces Between Rigid Disk Drive(s) and Host(s)
X3.102-1983 Data Communication Systems and Services — User-Oriented Performance Parameters
X3.103-1983 Unrecorded Magnetic Tape Minicassette for Information Interchange, Coplanar 3.81 mm (0.150 in)
X3.104-1983 Recorded Magnetic Tape Minicassette for Information Interchange, Coplanar 3.81 mm (0.150 in), Phase Encoded
X3.105-1983 Data Link Encryption
X3.106-1983 Modes of Operation for the Data Encryption Algorithm
X3.110-1983 Videotex/Teletext Presentation Level Protocol Syntax
X3.111-1986 Optical Character Recognition (OCR) Matrix Character Sets for OCR-M
X3.112-1984 14-in (356-mm) Diameter Low-Surface-Friction Magnetic Storage Disk
X3.113-1987 Programming Language FULL BASIC
X3.114-1984 Alphanumeric Machines; Coded Character Sets for Keyboard Arrangements in ANSI X4.23-1982 and X4.22-1983

(Continued on reverse)

March 1987