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FEDERAL INFORMATION
PROCESSING STANDARDS PUBLICATION

1971 OCTOBER 1

SUBSETS
OF THE STANDARD CODE
FOR INFORMATION
INTERCHANGE

CATEGORY: HARDWARE STANDARD

SUBCATEGORY: INTERCHANGE CODES
AND MEDIA

U.S.
DEPARTMENT
OF
COMMERCE

National
Bureau
of
Standards

Foreword

The Federal Information Processing Standards Publication Series of the National Bureau of Standards is the official publication relating to standards adopted and promulgated under the provisions of Public Law 89-306, and under Office of Management and Budget Circular A-86. The entire series constitutes the FEDERAL INFORMATION PROCESSING STANDARDS REGISTER.

This series is used to announce Federal Information Processing Standards, and to provide standards information of general interest and an index of relevant standards publications and specifications. Publications that announce adoption of standards provide the necessary policy, administrative, and guidance information for effective standards implementation and use. The technical specifications of the standard are usually attached to the publication, otherwise a source of copies is cited.

Comments covering Federal Information Processing Standards and Publications are welcomed, and should be addressed to the National Bureau of Standards, Center for Computer Sciences and Technology, Office of Information Processing Standards, Washington, D.C. 20234. Such comments will be either considered by NBS or forwarded to the responsible activity as appropriate.

LEWIS M. BRANSCOMB, *Director*

Abstract

This publication provides three subsets of 95, 64 and 16 graphic characters derived from the Federal Standard Code for Information Interchange (FIPS 1), which was adopted from the American Standard Code for Information Interchange (ASCII) X3.4-1968. These subsets are for use in Federal printers, display devices, punched card equipment, and other data processing or communication equipments which utilize a character subset less than the full 128-character set of FIPS 1.

Key words: American Standard Code for Information Interchange; ASCII; coded character subsets; codes; data communication; data interchange; data processing; Federal Information Processing Standards; graphic character subsets; graphic subsets; information interchange; information processing; standards; subsets.

Federal Information

Processing Standards Publication 15

1971 October 1

ANNOUNCING THE STANDARD FOR

SUBSETS OF THE STANDARD CODE
FOR INFORMATION INTERCHANGE

Name of Standard. Subsets of the Standard Code for Information Interchange. (FIPS 15)

Category of Standard. Hardware Standard, Interchange Codes and Media.

Explanation. Subsets of 95, 64 and 16 graphic characters are provided in this standard. These are derived from the Federal Standard Code for Information Interchange (FIPS 1) which in turn was adopted from the American National Standard Code for Information Interchange (ASCII, American National Standard X3.4–1968).

The memorandum of the Secretary of Commerce on "Application of Federal ADP Code and Media Standards" dated March 7, 1969, contained in FIPS PUB 7, states in paragraph 5c: "If the full character set of ASCII cannot be applied, the largest possible character subset should be used, and the ASCII collating sequence observed." That memorandum also states, in paragraph 8b: "Use of one or more of these ASCII subsets is a powerful tool in bridging the conversion gap prior to the procurement or utilization of hardware with full ASCII capability." This FIPS PUB amends FIPS PUB 7 by requiring one of the three specific subsets described herein when a subset is used. It is emphasized that the coded representation of the 95-character subset, the 64-character subset and the 16-character subset in input/output media and data communications will conform to the specifications cited in other applicable Federal Information Processing Standards.

Approving Authority. Office of Management and Budget.

Maintenance Agency. Department of Commerce, National Bureau of Standards (Center for Computer Sciences and Technology).

Cross Index.

    a. FIPS PUB 1, Code for Information Interchange.
    b. FIPS PUB 2, Perforated Tape Code for Information Interchange.
    c. FIPS PUB 3, Recorded Magnetic Tape for Information Interchange (800 CPI, NRZI).
    d. FIPS PUB 7, Implementation of the Code for Information Interchange and Related Media Standards.
    e. FIPS PUB 14, Hollerith Punched Card Code.

Applicability. These character subsets are intended to be used for all printers, display devices, punched card equipment, and other data processing or communication equipment in those systems or applications that do not require the full 128-character set contained in FIPS 1. The use of the 64- or 16-character graphic subsets in lieu of the full set of 95 graphics, where appropriate, can

result in advantageous combinations of increased speed of printing or display, decreased costs, decreased complexity, and efficient manipulation.

Implementation Schedule. All applicable equipment ordered on or after the date of this FIPS PUB must be in conformance with this standard unless a waiver has been obtained in accordance with the procedure described below. This requirement applies to the equipment acquired even though the use within any given application may in fact use less characters than specified in the application subset. Printers of the "chain" or "train" or other replaceable symbol technology must be provided with the ability to conform to one of the subsets herein but may also be provided with optional subsets having a different number of characters than those specified herein in order to increase either the printer repertoire of symbols or the printer speed in local use. Data processing systems employing such special equipment must still retain the ability to interchange information by use of one or more of the subsets specified herein. Exceptions to this standard are made in the following cases:

a. For equipment installed or on order prior to the date of this FIPS PUB.

b. Where procurement actions are into the solicitation phase (i.e., Request for Proposals or Invitation for Bids have been issued) on the date of this FIPS PUB.

c. Where 48 character punched card equipment is leased to replace like equipment and where such action satisfies systems requirements and results in reduced costs to the government (e.g., punched card equipment obtained through third party leasing agreements or Government-wide procurement contracts).

Waiver Procedure. Heads of agencies may waive the provisions of the implementation schedule. Proposed waivers relating to the procurement of equipment which uses non-conforming subsets, will be coordinated in advance with the National Bureau of Standards. Letters should be addressed to the Director, Center for Computer Sciences and Technology, National Bureau of Standards, Washington, D.C. 20234. They should describe the nature of the waiver and set forth the reasons therefor.

Sixty days should be allowed for review and response by the National Bureau of Standards. The waiver is not to be made until a reply from the National Bureau of Standards is received; however, the final decision for granting the waiver is a responsibility of the agency head.

Specifications. Federal Information Processing Standard 15 (FIPS 15), Subsets of the Standard Code for Information Interchange, 1971 October 1. (affixed)

Qualifications. Compatibility with Full Character Set: Systems and applications employing standard character subsets should experience no difficulty in forwarding information via standard media or communications, to systems employing the full 128-character set.

Subset Recording: Systems and applications employing standard character subsets, will use the standard media and the standard code for recording the characters of the subset in input/output and interchange operations. Three (3) input/output media standards have been approved as Federal Information Processing Standards (FIPS 2, 3 and 14). The adoption of additional input/output media standards will be announced in future FIPS PUBS.

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**Federal Information
Processing Standard 15**

1971 October 1

SPECIFICATIONS FOR

SUBSETS OF THE STANDARD CODE
FOR INFORMATION INTERCHANGE

1. **Name of Standard.** Subsets of the Standard Code for Information Interchange.

2. **Category of Standard.** Hardware Standard, Interchange Codes and Media.

3. **Specifications.** This specification provides standard subsets of the Code for Information Interchange (FIPS 1). Each subset is defined in detail in separate sections of this specification which follow.

Section 1—95-Character Graphic Subset
Section 2—64-Character Graphic Subset
Section 3—16-Character Graphic Numeric
    Subset

4. **Appendix.** Factors which were considered in the establishment of these subsets are explained in an appendix to this specification. Also information is provided concerning the employment of these subsets in computers and devices based on internal codes of four or six bits.

Section 1

SPECIFICATIONS FOR
95-CHARACTER
GRAPHIC CHARACTER SUBSET

Explanation. This graphic character subset is derived from the Federal Standard Code for Information Interchange (FIPS 1) which in turn was adopted from the American National Standard Code for Information Interchange (ASCII). This character subset is intended to be used in those systems or applications whose needs are adequately served by a 95-character graphic subset of the standard 128-character set contained in FIPS 1. This 95-character graphic subset contains all of the characters in columns 2, 3, 4, 5, 6 and 7 of the FIPS 1 code table, except the character Delete (DEL) in position 7/15. Figure 1 shows the 7-bit code table of FIPS 1 with the 95-character graphic subset of this standard outlined. It is emphasized that the coded representation of this 95-character subset in input/output media and data communications will conform to the specifications cited in other applicable Federal Information Processing Standards.

FEDERAL STANDARD CODE FOR INFORMATION INTERCHANGE

FIPS-1 — SHOWING 95-CHARACTER GRAPHIC SUBSET

Column →	0	1	2	3	4	5	6	7
$b_7 b_6 b_5$ →	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
Row ↓								
0	NUL	DLE	SP	0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	"	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
10	LF	SUB	*	:	J	Z	j	z
11	VT	ESC	+	;	K	[	k	{
12	FF	FS	,	<	L	\	l	|
13	CR	GS	-	=	M	]	m	}
14	SO	RS	.	>	N	<	n	~
15	SI	US	/	?	O	_	o	DEL

Bits: $b_1 \to$, $b_2 \to$, $b_3 \to$, $b_4 \to$

FIGURE I

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Section 2

SPECIFICATIONS FOR
64-CHARACTER
GRAPHIC CHARACTER SUBSET

Explanation. This graphic character subset is derived from the Federal Standard Code for Information Interchange (FIPS 1) which in turn was adopted from the American National Standard Code for Information Interchange (ASCII). This character subset is intended to be used in those systems or applications whose needs are adequately served by a 64-character graphic subset of the standard 128-character set contained in FIPS 1. This 64-character graphic subset contains all of the characters in columns 2, 3, 4 and 5 of the FIPS 1 code table. Figure 2 shows the 7-bit code table of FIPS 1 with the 64-character graphic subset of this standard outlined. It is emphasized that the coded representation of this 64-character subset in input/output media and data communication will conform to the specifications cited in other applicable Federal Information Processing Standards.

FEDERAL STANDARD CODE FOR
INFORMATION INTERCHANGE

FIPS–1

SHOWING 64-CHARACTER GRAPHIC SUBSET

Column → Row ↓	b₄ b₃ b₂ b₁	0 (000)	1 (001)	2 (010)	3 (011)	4 (100)	5 (101)	6 (110)	7 (111)
0	0 0 0 0	NUL	DLE	SP	0	@	P	`	p
1	0 0 0 1	SOH	DC1	!	1	A	Q	a	q
2	0 0 1 0	STX	DC2	"	2	B	R	b	r
3	0 0 1 1	ETX	DC3	#	3	C	S	c	s
4	0 1 0 0	EOT	DC4	$	4	D	T	d	t
5	0 1 0 1	ENQ	NAK	%	5	E	U	e	u
6	0 1 1 0	ACK	SYN	&	6	F	V	f	v
7	0 1 1 1	BEL	ETB	'	7	G	W	g	w
8	1 0 0 0	BS	CAN	(	8	H	X	h	x
9	1 0 0 1	HT	EM	)	9	I	Y	i	y
10	1 0 1 0	LF	SUB	*	:	J	Z	j	z
11	1 0 1 1	VT	ESC	+	;	K	[	k	{
12	1 1 0 0	FF	FS	,	<	L	\	l	|
13	1 1 0 1	CR	GS	-	=	M	]	m	}
14	1 1 1 0	SO	RS	.	>	N	<	n	~
15	1 1 1 1	SI	US	/	?	O	_	o	DEL

Bits: b₇ b₆ b₅

FIGURE 2.

Section 3

SPECIFICATIONS FOR
16-CHARACTER
GRAPHIC NUMERIC SUBSET

Explanation. This numeric subset is derived from the Federal Standard Code for Information Interchange (FIPS 1) which in turn was adopted from the American National Standard Code for Information Interchange (ASCII). This subset is intended to be used in those systems or applications whose needs are adequately served by a 16-character numeric subset of the standard 128-character set contained in FIPS 1. This 16-character graphic numeric subset contains the ten numerals from the top ten positions of column 3 and six symbols Asterisk, Plus, Comma, Hyphen (Minus), Period (Decimal Point) and Slant, from the bottom six positions of column 2. Figure 3 shows the 7-bit code table of FIPS 1 with the 16-character graphic subset of this standard outlined. It is emphasized that the coded representation of this 16-character subset in input/output media and data communications will conform to the specifications cited in other applicable Federal Information Processing Standards.

Special Information. Systems and applications employing this limited 16-character set, when receiving information via standard media or communications from systems employing the full 128-character set, the 95-character graphic set or the 64-character graphic subset, should ignore all characters outside of this numeric subset. This feature is desirable in most instances, but is not mandatory for applications requiring some other interpretation of the characters outside of this numeric subset.

FEDERAL STANDARD CODE FOR
INFORMATION INTERCHANGE
FIPS–1
SHOWING 16-CHARACTER NUMERIC SUBSET

					Column →	0	1	2	3	4	5	6	7
						0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b₁→	b₂→	b₃→	b₄→	Row →								
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
1	0	0	0	1	SOH	DC1	!	1	A	Q	a	q
0	1	0	0	2	STX	DC2	"	2	B	R	b	r
1	1	0	0	3	ETX	DC3	#	3	C	S	c	s
0	0	1	0	4	EOT	DC4	$	4	D	T	d	t
1	0	1	0	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
1	1	1	0	7	BEL	ETB	'	7	G	W	g	w
0	0	0	1	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
0	1	0	1	10	LF	SUB	*	:	J	Z	j	z
1	1	0	1	11	VT	ESC	+	;	K	[	k	{
0	0	1	1	12	FF	FS	,	<	L	\	l	—
1	0	1	1	13	CR	GS	-	=	M	]	m	}
0	1	1	1	14	SO	RS	.	>	N	<	n	~
1	1	1	1	15	SI	US	/	?	O	—	o	DEL

b₇ b₆ b₅
Bits

FIGURE 3.

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Appendix

The Code for Information Interchange (FIPS 1) contains 128 characters of which 95 in the last six columns (columns 2 through 7) are designated as a graphic subset. Contained in this graphic subset are two cases (upper and lower) of the alphabetic letters A through Z, the numerals 0 through 9, and common punctuation, mathematical, and business symbols.

Not all applications have need for the full 128 characters contained in the standard code set. Some require only the graphics (95 characters). Others need only use a single case alphabet, the numbers, and certain special symbols (64 characters). Further, some applications dealing with data of a mathematical or numeric nature need only the numerics and certain mathematical symbols (16 characters).

Accordingly, it is necessary to recognize the economies to be achieved in providing adequate subsets of the standard code which are consistent with the requirements of these various applications. Likewise, it is essential in order to facilitate the interchange of data and equipment within the Federal government that a family of discrete subsets be identified and standardized. The consequences and costs of an unlimited number of subsets are of such a magnitude that it is reasonable and practical to establish a limited group of subsets which meet most data systems requirements.

This fundamental consideration was taken into account in the development of the standard code for information interchange. Characters were positioned in the Code in such a manner as to facilitate the identification and use of subsets. Columns 2 through 7 form the 95-character graphic subset. Columns 2 through 5 provide a 64-character subset. The ten numerals in column 3 and the six mathematical symbols at the bottom of column 2 provide the 16-character numeric subset. (These six mathematical symbols were placed in column 2 instead of column 3 so that they would collate lower than the numerals in the context of the full character set. Also they were assigned to the bottom of the column so that their low order four bits are distinct from the low order four bits of the ten numerals, in order to be distinguishable in those instances where numerics are coded by four bits in internal machine environments without further manipulation.)

It is also recognized that many computers and devices already in the Federal inventory and even some new equipment are based upon an internal code of four or six bits. In these instances the standard code can be represented internally by six bits by suppressing bit $b6$, and can be represented by four bits by suppressing bits $b7$, $b6$, and $b5$. These limited internal representations are then expanded to the standard seven bits when transmitting data to other devices.

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