

**DX Products
Programmer's
Reference Manual**

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PREFACE

The *DX Products Programmer's Reference Manual* supplies the reader with sufficient information to process or produce a word processing-formatted file on a Digital Equipment Corporation PDP-11 computer running either the RSTS/E or RSX-11M operating system.

The information described in this manual applies to version V06C or more recent of the RSTS/E system, version 3.1 of the RSX-11M system, and version V3.1 or more recent of the word processing systems.

A knowledge of either the RSTS/E or RSX-11M operating system is recommended for understanding the information presented in this reference manual. Additional information may be obtained from the following documents:

RSTS/E V06C System User's Guide, DIGITAL part number DEC-11-ORSUB-A-D including DEC-11-ORSEB-A-DN1, for information applicable to the RSTS/E operating system.

Introduction to RSX-11M, DIGITAL part number AA-2555C-TC, for information applicable to the RSX-11M operating system.

DX/RSTS Products User's Guide, DIGITAL part number AA-5476C-TC, for operating instructions applicable to the DX Products.

WPS-8 Word Processing System Reference Manual (Version 2.7), DIGITAL part number AA-5267B-TB, and *WPS-8 Word Processing System Reference Manual (Version 3.0) Addendum*, DIGITAL part number AD-5267B-T1, for both operating instructions and background material applicable to the PDP-8 word processing system (WPS-8).

WPS-11M Word Processing System Reference Manual, DIGITAL part number AA-D727A-TC, for both operating instructions and background material applicable to the PDP-11 word processing system (running under the RSX-11M operating system).

Word Processing System Communications Options User's Manual, DIGITAL part number AA-5264C-TK, for operating instructions applicable to DIGITAL's word processing system communications capabilities.

All numbers used in this document are specified in decimal representation unless otherwise noted.



CHAPTER 1 INTRODUCTION

The *DX Products Programmer's Reference Manual* describes characteristics of word processing files that are stored on a Digital Equipment Corporation PDP-11 running the RSTS/E (Resource Sharing Timesharing System/Extended) or the RSX-11M (Resource Sharing Executive) operating system. This manual specifies the requirements to be met in creating a word processing file from a nonword processing input medium.

Figure 1-1 illustrates the layout of a word processing file as stored in the RSTS/E or RSX-11M file structure. The following three word processing file characteristics, shown in Figure 1-1, are described in this manual.

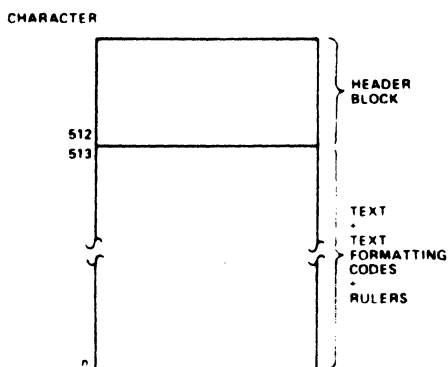


Figure 1-1 General Organization of Word Processing File Stored in the RSTS/E and RSX-11M System

1. **Header block**, or the first 512 characters of each file. A header block contains the origination and modification dates of the word processing file plus values that control the appearance of printed output. These output-controlling values are derived from the word processing Print Menu settings. Chapter 2 describes the interpretation of file header blocks.
2. **Text formatting codes**, or particular characters and character combinations that indicate how succeeding text is to be formatted (underlined, boldfaced, or page ending, for example). The formatting codes themselves are not interpreted as part of the word processing file's text. Text formatting codes may appear anywhere in the text portion of a file (but not in the header). Chapter 3 describes the interpretation of text formatting codes.
3. **Rulers**, or coded information that specifies vertical line spacing (half space, single space, space and one half, double space), the locations of left and right margin positions, and the locations and types of tab settings (left-aligned, right-aligned, decimal-aligned). Rulers may appear anywhere in the text portion of a file (but not in the header). Chapter 4 describes the interpretation of rulers.

CHAPTER 2 FILE HEADER BLOCK

The first 512 characters of each word processing file stored in the RSTS/E or RSX-11M system constitutes a header block. Of these 512 characters, the first 256 specify when the file was created and edited in addition to how it is to be formatted when printed (derived from the word processing Print Menu settings). The second 256 header block characters are available for use by the applications programmer. Text of the word processing file follows the header. Figure 2-1 illustrates the layout of a file header block.

The contents of a file header block are described in Table 2-1 by character position. Where applicable, the word processing Print Menu two-letter abbreviation is given in parentheses.

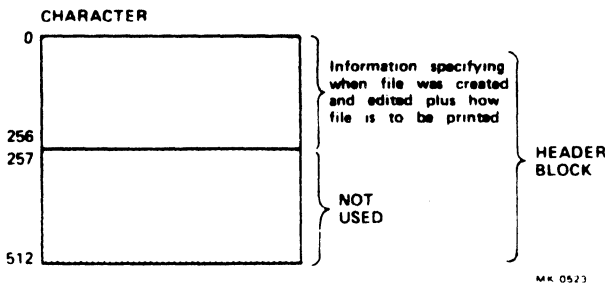


Figure 2-1 General Organization of File Header Block

The value of each character in a file header block

is encoded to facilitate accurate transmission from the word processing system to the PDP-11. To obtain the correct value, decode each character according to the following:

1. If the value of the file header block character is 95, replace the value with 0.
2. If the value of the file header block character is not 95, subtract 31.
3. If the file header block information occupies two characters, multiply the decoded value of the first character by 64 and add the decoded value of the second character.

Example: Character positions 11 and 12 (the number of blocks in the file) contain 32 and 43, respectively. Decode the values 32 and 43 as follows:

1. Subtract 31 from 32 to obtain 1.
2. Subtract 31 from 43 to obtain 12.
3. Multiply 1 by 64 and add 12 to obtain 76, the number of blocks in the file.

When printed, the values in a file header are interpreted as tabulated in the Appendix, Word Processing Character Interpretation. The values 32 and 43, given in character positions 15 and 16 in the above example, will be printed as a space and a plus sign (+).

Table 2-1 Contents of File Header By Character Position

Character Position	Contents	Character Position	Contents
1-2	-255	33-34	Protection code used only by the WPS-11M word processing system.
3-4	8	35-38	Reserved.
5-6	0	39-40	1, if the word processing Print Menu settings have been initialized; 0, otherwise. If 0, system-supplied Print Menu setting values are supplied when the file is printed.
7-8	0	41-42	Number of original copies to be printed (CP). System-supplied value = 1.
9-10	40	43-44	Print margin (PM). Number of spaces to be added to the left of each printed page. System-supplied value = 0.
11-12	Number of blocks in the file.	45-46	Number of extra, blank half-lines to be used between printed lines (EX). System-supplied value = 0.
13	Day file was created	47-48	Top margin (TM). Number of lines between the top edge of each page and the first text line printed. System-supplied value = 6.
14	Month file was created.	49-50	Bottom margin (BM). Number of lines between the last line of text and the bottom edge of each page. System-supplied value = 6.
15-16	Year file was created minus 1900.		
17	Last day file was edited.		
18	Last month file was edited.		
19-20	Last year file was edited minus 1900.		
21-22	Version number (number of times file has been edited).		
23-24	Reserved.		
25	Hour when file was last edited.		
26	Minute when file was last edited.		
27-28	Number of lines used per page.		
29-30	Elapsed time in the most recent editing session (in minutes).		
31-32	Total amount of time spent editing (in minutes).		

Table 2-1 Contents of File Header By Character Position (Cont)

Character Position	Contents	Character Position	Contents
51-52	Page size (PS). Number of lines that can fit on a page from the top edge to the bottom (6 lines = 1 inch). System-supplied value = 66. Page size cannot exceed 200.	73-74	1, if output is to be overstruck; 0, if output is to be struck just once (DA). System-supplied value = 0.
53-54	Pitch (PI). Number of characters that can be printed per inch. System-supplied value = 10.	75-76	1, if two printing wheels are to be used; 0, if only one wheel is to be used (TW). System-supplied value = 0.
55-56	Number of first page to be printed (FR). System-supplied value = 1.	77-78	Output device destination (DD). The possible settings are: 0, for a letter quality printer, 1, for a draft printer, 2, for whatever device is attached to the host communications interface, 3, for a line printer attached to the host system.
57-58	Number of last document page to be printed (TO). System-supplied value = 0, meaning last page of document.		
59-60	Number assigned to first page in file (IP). System-supplied value = 1.		
61-62	Reserved.		
63-64	1, if pagination is automatic; 0, if by user (AP). System-supplied value = 1.	79-80	Column margin (CM). Number of spaces to be added between multiple columns. System-supplied value = 0.
65-68	Reserved.	81-82	Replacement character for extra print wheel position 1.
69-70	0, to print continuously; 1, to stop before printing the first page; 2, to stop before printing each page (SE). System-supplied value = 0.	83-84	Replacement character for extra print wheel position 2.
71-72	Reserved.	85-256	Reserved.



CHAPTER 3 TEXT FORMATTING CODES

Text formatting codes are particular two-character combinations that control the appearance of the succeeding text. For example, a text formatting code precedes text that is to be underlined. Formatting codes may appear anywhere in the text portion of a file (but not in the header).

A text formatting code begins with either of the two characters { (left brace) or | (vertical bar) (printable characters are represented in a file by the ASCII codes listed in Appendix A). Table 3-1 lists

the interpretation of all text formatting codes.

The “enter” codes in Table 3-1 signify modes governing the text characters that follow. The “leave” codes in Table 3-1 signify the end of a mode applicable to the previous text characters. The underline, superscript, and subscript modes are mutually exclusive: if one is in effect, the corresponding “leave” code must be used before another “enter” code may occur.

Table 3-1 Interpretation of Text Formatting Codes

Code	Interpretation	Code	Interpretation
{%	Enter underscore.	{+	Enter subscript.
{#	Enter bold face.	{“	Leave bold face.
{’	Enter “justify.” (In this context, justify means a sequence of information inserted by the word processing software and not by the user. Examples include invisible hyphens and spaces added as a result of tabs.)	{\$	Leave underscore.
		{&	Leave justify.
		{(	Leave superscript.
{)	Enter superscript.	{*	Leave subscript.

NOTE

The second character of the following codes is represented in a text file by its corresponding ASCII value given in Table A-1 less 100 (octal).

Table 3-1 Interpretation of Text Formatting Codes (Cont)

Code	Interpretation	Code	Interpretation
| G	Word wrap needed. (Succeeding text does not properly conform to the ruler.)	| N	Start ruler.
| H	Begin overstrike sequence.	| O	End ruler.
| I	Tab.	| ;	{
| J	End of line.	| <	|
| L	End of page.	| =	}
| M	End overstrike sequence.	| >	~

A word processing file stored on the RSTS/E or RSX-11M system begins and ends with no modes in effect. It ends with the following code sequence: set bold face, word wrap needed, clear bold face.

The appearance of a space or the text formatting code for end of line, end of page, or word wrap

needed, have special interpretation if certain modes are in effect (as a result of the user of an "enter" code). Table 3-2 lists the interpretation of the character or code when modes are in effect. To obtain the interpretation listed in the third column of Table 3-2, the only mode that may be in effect is the one listed in the second column.

Table 3-2 Interpretation of Formatting Characters When Certain Modes Are in Effect

Character or Code in Text	Mode in Effect	Interpretation
Space	Justify	Indicates space was added to make the text conform with margin settings and tabs.
End of line	Justify	Indicates the end of a word processing "word wrapped" line.

Table 3-2 Interpretation of Formatting Characters When Certain Modes Are in Effect (Cont)

Character or Code in Text	Mode in Effect	Interpretation
End of line (Cont)	Justify/Underline	Indicates the end of a hyphenated line.
	Superscript	Marks a paragraph (as a result of pressing the gold and the PARA MARKER keys).
	Subscript	Ends a centered line.
End of page	No specified mode has been entered	Divides the text into pages resulting from a word processing NEW PAGE mark.
	Justify	Divides the text into pages resulting from a word processing PAGE MARKER .
	Superscript	Initiates a word processing header, footer, page number reset, multiple column printing request, or comment.
	Subscript	Terminates a word processing header, footer, page number reset, multiple column printing request, or comment.
Word wrap needed	Boldface	Indicates that all text between a word wrap needed code and the beginning of the next ruler is not in conformance with the current ruler.
Word wrap needed	Any except boldface	Indicates that all text between a word wrap needed code and the next nonjustified line ending is not in conformance with the current ruler.

NOTE

When the justify mode is in effect, each successive printable character is interpreted as a word break point, or a point where a hyphen may be inserted to end the line. When an overstrike sequence is in effect, only printable characters may occur.

CHAPTER 4 RULER CODES

A word processing ruler is information that indicates the text's vertical line spacing (half space, single space, space and one half, double space) and the locations of left and right margin positions. It may also include the locations and types of tab settings (left-justified, right-justified, decimal-aligned). An unlimited number of rulers may appear anywhere in text portion of a file (but not in the header). Each ruler has effect until the appearance of another ruler or the end of the file.

As stored in a RSTS/E or RSX-11M word processing file, a ruler is composed of two parts: (1) information used to format the previous text, and (2) information used to format the succeeding text. The two parts may be viewed as a "joined ruler," separated by the @ character. The first part of a joined ruler is the same as the last part of the previous ruler (to facilitate conforming text to a ruler when scrolling in a backward direction on the word processing system). The "joined ruler" begins with a start ruler code (| N) and ends with an end ruler code

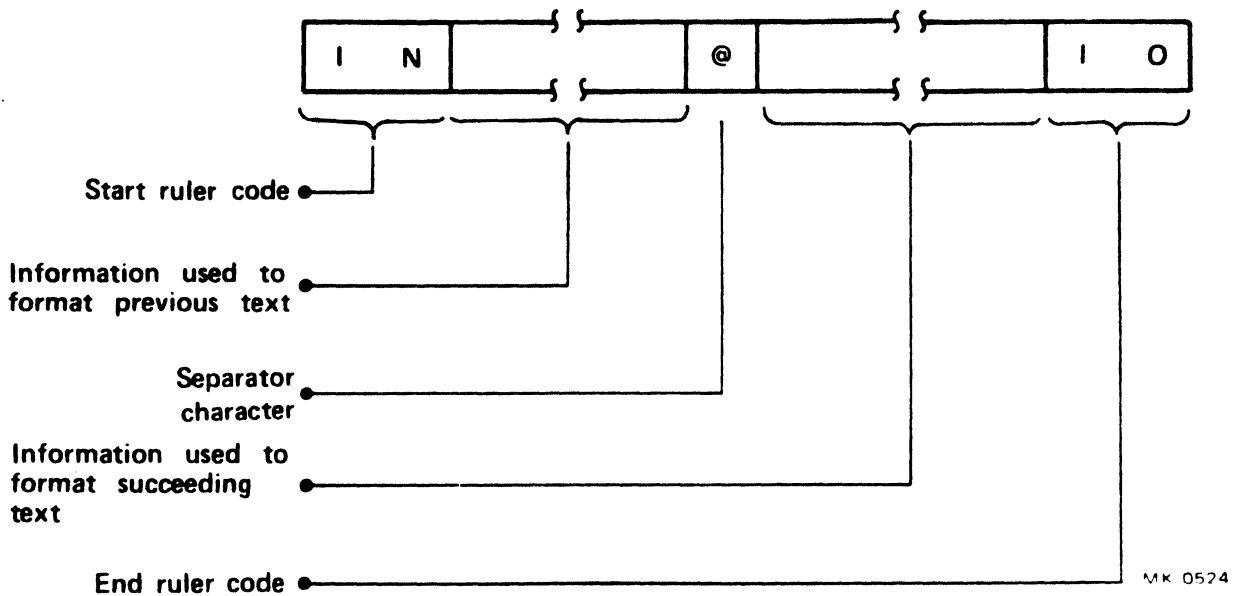


Figure 4-1 General Organization of a Ruler

(|O). Figure 4-1 shows an example of a ruler as stored in a RSTS/E or RSX-11M word processing file.

Each ruler may contain several settings. Each setting is indicated by a number and a letter. The number specifies the character or column position

to which the setting applies, while the letter denotes the particular setting. The numbers are represented in hexadecimal form; the letters are represented in upper case. Table 4-1 lists the hexadecimal numbers used in a ruler with their equivalent decimal values. Table 4-2 lists the codes for all available ruler settings.

Table 4-1 Hexadecimal Ruler Numbers With Decimal Equivalents

Hexadecimal	Decimal	Hexadecimal	Decimal
0	0	8	8
1	1	9	9
2	2	:	10
3	3	;	11
4	4	<	12
5	5	=	13
6	6	>	14
7	7	?	15

Table 4-2 Ruler Setting Codes

Text Ruler Code	Displays on Word Processing Screen As	Meaning
A	.	Decimal-aligned tab
B	>	Right-justified tab
C	T	Left-justified tab
D	L	Single-spaced left margin
E	R	Ragged right margin
F	D	Double-spaced left margin
G	J	Justified right margin
H	W	Automatic word wrap indent
I	P	Automatic paragraph indent
J	C	Centering point
K	N	Space and one half-spaced left margin
L	H	Hyphenation zone
M	F	Half-spaced left margin

The following example illustrates how to interpret a ruler as stored in the RSTS/E or RSX-11M system.

The text that precedes this example ruler was formatted according to the IN1L5W41R portion as follows.

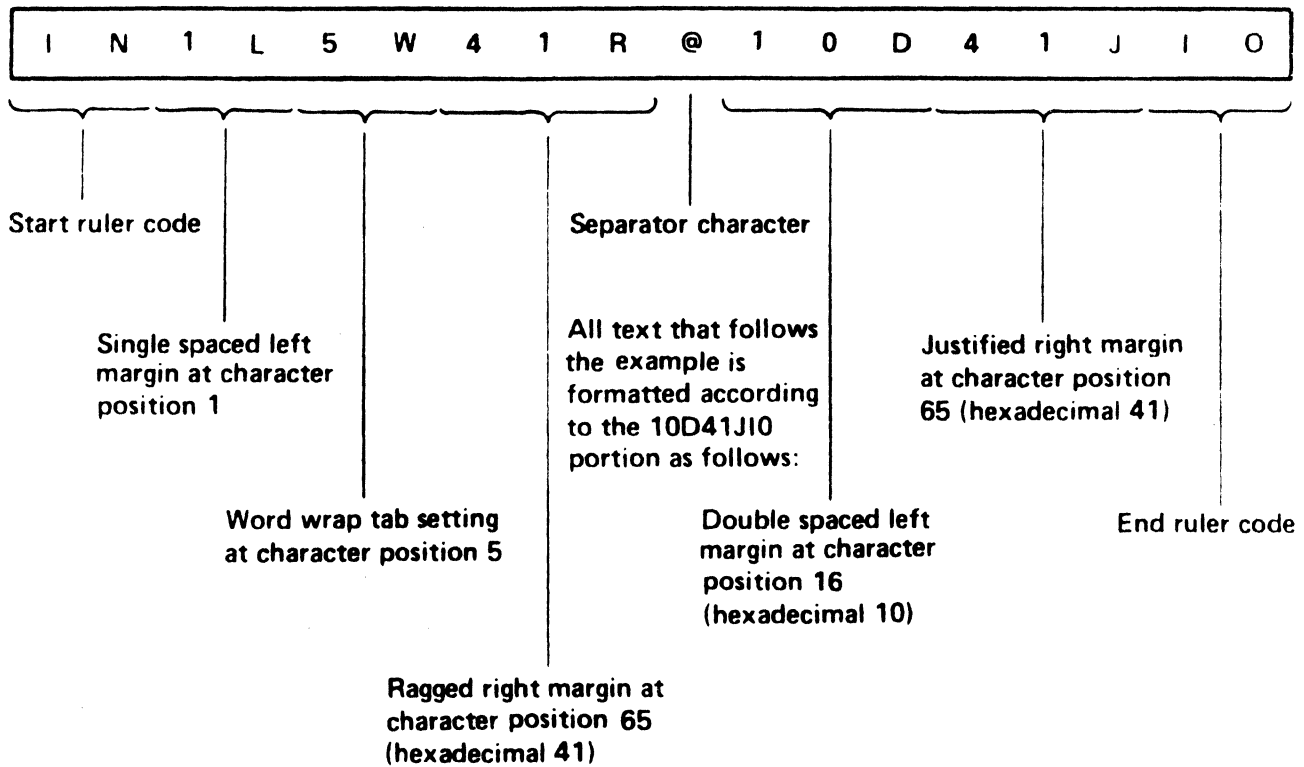


Figure 4-2 Interpretation of Example Ruler

APPENDIX WORD PROCESSING CHARACTER INTERPRETATION

Information in word processing files stored in the RSTS/E or RSX-11M file structure is represented as a series of 7-bit ASCII (American Standard Code for Information Interchange) characters in

the 32 through 95 range. Each character is stored right-justified in an 8-bit PDP-11 byte. Table A-1 gives the octal and decimal equivalent values for all permissible word processing characters.

Table A-1 Word Processing Character Set

Octal Value	ASCII Character	Decimal Value	Octal Value	ASCII Character	Decimal Value
000	Null	0	054	,(comma)	44
040	Space	32	055	-	45
041	!	33	056	.	46
042	"	34	057	/	47
043	#	35	060	0	48
044	\$	36	061	1	49
045	%	37	062	2	50
046	&	38	063	3	51
047	'(single quote)	39	064	4	52
050	(	40	065	5	53
051	)	41	066	6	54
052	*	42	067	7	55
053	+	43			

Table A-1 Word Processing Character Set (Cont)

Octal Value	ASCII Character	Decimal Value	Octal Value	ASCII Character	Decimal Value
070	8	56	121	Q	81
071	9	57	122	R	82
072	:	58	123	S	83
073	;	59	124	T	84
074	<	60	125	U	85
075	=	61	126	V	86
076	>	62	127	W	87
077	?	63	130	X	88
100	@	64	131	Y	89
101	A	65	132	Z	90
102	B	66	133	[	91
103	C	67	134	\	92
104	D	68	135	]	93
105	E	69	136	^	94
106	F	70	137	_	95
107	G	71	140	\	96
110	H	72	141	a	97
111	I	73	142	b	98
112	J	74	143	c	99
113	K	75	144	d	100
114	L	76	145	e	101
115	M	77	146	f	102
116	N	78	147	g	103
117	O	79	150	h	104
120	P	80	151	i	105

**Table A-1 Word Processing
Character Set
(Cont)**

Octal Value	ASCII Character	Decimal Value
152	j	106
153	k	107
154	l	108
155	m	109
156	n	110
157	o	111
160	p	112
161	q	113
162	r	114
163	s	115
164	t	116
165	u	117
166	v	118
167	w	119
170	x	120
171	y	121
172	z	122

The following characters are represented in a text file by the equivalent code listed in Table 3-1, Interpretation of Text Formatting Codes. While these characters may appear on the display screen and in printed output, they must be encoded for inclusion in a text file.

**Table A-1 Word Processing
Character Set
(Cont)**

Octal Value	ASCII Character	Decimal Value
173	{	123
174	|	124
175	}	125
176	~	126

The null character is used in word processing files stored in the RSTS/E or RSX-11M system as a padding character.



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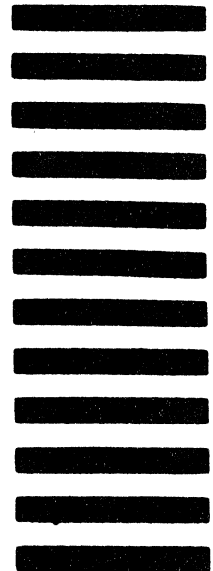


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