

PROGRAMMING AND OPERATING MANUAL



**REAL-TIME EXECUTIVE SYSTEM
DRIVER DVR 15**



FOR

HP 7261A MARK SENSE CARD READER

30 AUGUST 1974

HEWLETT  PACKARD

Automatic Measurement Division

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Change 1

SOFTWARE MANUAL CHANGES

RTE SYSTEM DRIVER DVR15
Programming and Operating Manual

MANUAL IDENTIFICATION:

Manual Printed: 30 August 1974
Manual Part Number: 09601-93014

CHANGE DESCRIPTION:

The purpose of this change is to correct a manual error.

To incorporate the change, proceed as follows:

1. Page 3-1, Paragraph 3-8, step a. Change "nn, DVR11" to *nn* , DVR15.
2. Insert this MANUAL CHANGE NOTICE between front cover and title page of manual.





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SECTION I

GENERAL INFORMATION

1-1. GENERAL DESCRIPTION

1-2. This manual contains information and procedures that allow the user to write application programs using FORTRAN or Assembly language and RTE Driver DVR15. Section III provides information required when configuring DVR15 into a Real-Time Executive (RTE) Operating System.

1-3. The driver is entered through a FORTRAN or Assembly language call to control an HP 7261A Card Reader (via a HP 12986A Card Reader Interface Kit) in a Real-Time Executive Operating System environment. The driver may be used for reading Hollerith data, packed binary data, or column binary image data into an area of memory (input buffer) designated by the user. The user initiates the reading of a card by executing a calling sequence. The driver can convert binary-coded-decimal (BCD) cards, standard HP EBCDIC (extended binary-coded-decimal interchange code) cards, and EBCDIC-RDTS (remote data transmission system) cards. The HP 7261A will read cards having "clock-on-data" or "clock-after-data" marks with 80 column type minimum clock-mark spacing. With an HP 7261A option 003, 40, or 80 column punched cards, or 40 column marked cards without clock marks can be read. If the card is read successfully, the driver returns control to the user's program. The user may request card reader status informing and the most recent transmission count at any time by executing a special calling sequence.

1-4. OPERATING ENVIRONMENT

1-5. The operating environment for this software must be:

- a. HP 2100 Series Computer
- b. RTE Operating System
- c. HP 12986A Interface Kit

Refer to the HP 12986A Operating and Service Manual (HP Part No. 07261-90001) for interface kit hardware details.

1-6. COMPONENTS

1-7. The following components are included with Driver DVR15:

- a. This manual
- b. Driver DVR15 binary tape, HP Part No. 09601-16021.



SECTION II

APPLICATION INFORMATION

2-1. GENERAL

2-2. This section details the calls to the driver and describes any results of the hardware/software marriage where the hardware may influence software techniques.

2-3. CALLING SEQUENCES

2-4. The HP 7261A Card Reader is operated in the Real-Time Executive Operating System through FORTRAN or Assembly language programs calling DVR15. These calls are listed in Tables 2-1 and 2-2 and described in Paragraphs 2-5 through 2-9.

2-5. READ CALL

2-6. This calling sequence (Table 2-1) reads one card through the specified card reader. If the read operation is performed satisfactorily, the driver returns control to the "return point". To read a deck of cards, it is necessary to execute the calling sequence repeatedly (once for each card).

2-7. The maximum possible transmission count after any read operation is as follows:

Hollerith: 80 characters of 40 words
Packed Binary: 60 words
Column Image Binary: 80 words

2-8. The number of words or characters transferred during any read operation is as follows:

Hollerith: Buffer length (IBUFL) or the number of characters on the card (not including trailing blanks), whichever is smaller.
Packed Binary: Buffer length (IBUFL) or the count in rows 12-5 of column 1 of the card, whichever is smaller.
Column Image Binary: Buffer length (IBUFL) or the number of used columns on the card (not including trailing blanks), whichever is smaller.

2-9. STATUS REQUEST

2-10. This calling sequence (Table 2-2) causes two words in the Equipment Table (EQT) to be copied into the specified pair of memory locations (ISTA1 and ISTA2). After the information has been copied, control returns to the "return point".

Table 2-1. HP 2892A Read Calls (DVR15)

Assembly Language	
<pre> EXT EXEC . . JSB EXEC DEF *+5 DEF ICODE DEF ICNWD DEF IBUFR DEF IBUFL <return point> . . </pre>	<p>Where:</p> <p>ICODE = Function Code 1 = Read Request</p> <p>ICNWD = Control Word</p> <p>Bits 0 } = Logical Unit Number. The card reader thru 5 } may be assigned up to three logical unit numbers: LU #N = reader, subchannel 0 LU #M = reader, subchannel 1 LU #L = reader, subchannel 2.</p> <ol style="list-style-type: none"> To convert EBCDIC punch set, address reader as subchannel 0. To convert BCD punch set, address reader as subchannel 1. To convert EBCDIC-RDTS punch set, address reader as subchannel 2. <p>Bits 6 } = Type of data to be read and 7 } 0 or 2 = Hollerith 3 = Packed Binary 1 = Column Image Binary</p> <p>Bits 8 } = Not used thru 15 }</p> <p>IBUFR = Address of data storage buffer's first word for Read call.</p> <p>IBUFL = Size of input buffer. Size may be expressed either as a number of words or as a number of characters. The sign of IBUFL tells the driver how to interpret length specification as follows:</p> <p>+ = words - = characters</p> <ol style="list-style-type: none"> If IBUFL is expressed as a number of words, transmission count placed in EQT by driver at end of Read operation is also expressed as number of words. Likewise, if IBUFL is expressed as a number of characters, transmission count is expressed as a number of characters. An IBUFL should be expressed as a number of characters only when reading in Hollerith code. An IBUFL of zero in Hollerith code causes an immediate return to user's program (return point) with a transmission count of 0 in EQT.
FORTRAN	CALL EXEC (ICODE, ICNWD, IBUFR, IBUFL)

Table 2-2. HP 2892A Status Call (DVR15)

Assembly Language	
<pre> EXT EXEC . . JSB EXEC DEF **4 or [*+5] DEF ICODE DEF ICNWD [DEF STAT2] <return point> . . </pre>	<p>Where:</p> <p>ICODE = Function Code 13 - Status Request</p> <p>ICNWD = Logical Unit Number</p> <p>ISTA1 = Card Reader status flags. See Table 2-3 for format.</p> <p>ISTA2 = Most recent transmission count. May be omitted from calling sequence.</p>
FORTRAN	CALL EXEC [13,LU,ISTA1,ISTA2 (optional)]

2-11. After a Status request, ISTA1 contains the card reads status flags and ISTA2 contains the most recent transmission count. The format of ISTA1 is described in Table 2-3.

2-12. DATA FORMAT

2-13. The driver accepts Hollerith data, packed binary data, or column binary image area. These modes are described in Paragraphs 2-14 through 2-22.

2-14. HOLLERITH

2-15. In the Hollerith mode, card codes are converted to ASCII octal equivalents and stored in the input buffer. Each word in the buffer accommodates two codes. The octal equivalent of a code from an odd-numbered card column is always stored in bits 8 through 15 of a buffer word while the octal equivalent of the code from the next highest even-numbered card column is stored in bits 0 through 7 of the same word. Codes are stored in the input buffer consecutively starting with the first (lowest) buffer word. For example, the codes from card columns 1 and 2 are always stored in the first buffer word, the codes from card column 3 and 4 are always stored in the second buffer word, etc. Trailing blanks, though actually read into the buffer, are not included in the transmission count returned by the driver at the end of the read operation.

2-16. The driver accepts all 64 standard Hollerith card codes. Table 2-4 shows the octal equivalents for each code. Note that there are two octal equivalents for each code. The lesser value applies if the code is stored in bits 0-7 of a word while the greater value applies if the code is stored in bits 8-15.

2-17. All non-valid card codes enter the input buffer as the ASCII code for the question mark.

Table 2-3. Status Information (ISTAT)

Bits	Function																		
15-14	Card reader availability code 0 = available 1 = disabled (down) 2 = currently busy 3 = waiting for an available DMA channel																		
13-8	Equipment code always = 11 (octal)																		
7-0	Status flags. Meaning when on (1 = on, 0 = off)																		
	<table border="0"> <thead> <tr> <th>Bit</th> <th>Status</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Card reader is on-line but not ready or card reader is off line.</td> </tr> <tr> <td>1</td> <td>An illegal card code is encountered during previous read operation or card reader has hardware trouble.</td> </tr> <tr> <td>2</td> <td>Not used</td> </tr> <tr> <td>3</td> <td>Not used</td> </tr> <tr> <td>4</td> <td>Pick failure or card motion error was sensed during previous read operation.</td> </tr> <tr> <td>5</td> <td>Previous read request was rejected because hopper empty and END OF FILE switch was on during Read operation.</td> </tr> <tr> <td>6</td> <td>Not used</td> </tr> <tr> <td>7</td> <td>The previous read operation left the input hopper empty and the END OF FILE switch was on during the read operation.</td> </tr> </tbody> </table>	Bit	Status	0	Card reader is on-line but not ready or card reader is off line.	1	An illegal card code is encountered during previous read operation or card reader has hardware trouble.	2	Not used	3	Not used	4	Pick failure or card motion error was sensed during previous read operation.	5	Previous read request was rejected because hopper empty and END OF FILE switch was on during Read operation.	6	Not used	7	The previous read operation left the input hopper empty and the END OF FILE switch was on during the read operation.
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6	Not used																		
7	The previous read operation left the input hopper empty and the END OF FILE switch was on during the read operation.																		

2-18. With the following six exceptions, every internal ASCII code relates directly to the corresponding key on an IBM 029 keyboard. Note that although the internal ASCII ! character corresponds with the IBM 029 key, the standard and RDTs ASCII octal equivalents are different.

Internal ASCII Character	029 Key	Hollerith Code	ASCII Octal Equivalents (Standard)	ASCII Octal Equivalents (for RDTs)
[¢	12-8-2	133 or 554	Unassigned
/	00-8-2	0-8-2	134 or 560	134 or 560
]	-	11-8-7	135 or 564	136 or 570
↑		12-8-7	136 or 570	41 or 204
←		0-8-5	137 or 574	137 or 574
!	⊥	11-2-8	41 or 204	135 or 564

Table 2-4. EBCDIC Hollerith-to-ASCII Octal Equivalents

Character		ASCII Octal Equivalent		Character		ASCII Octal Equivalent	
EBCDIC HOLLERITH	ASCII	Bits 15-8 (offset)	Bits 7-0 (true)	EBCDIC HOLLERITH	ASCII	Bits 15-8 (offset)	Bits 7-0 (true)
A	A	404	101	6	6	330	066
B	B	410	102	7	7	334	067
C	C	414	103	8	8	340	070
D	D	420	104	9	9	344	071
E	E	424	105		(space)	200	040
F	F	430	106	I	I	204	041
G	G	434	107	"	(quote)	210	042
H	H	440	110	#	#	214	043
I	I	444	111	\$	\$	220	044
J	J	450	112	%	%	224	045
K	K	454	113	&	&	230	046
L	L	460	114	'	(apostrophe)	234	047
M	M	464	115	((240	050
N	N	470	116))	244	051
O	O	474	117	*	*	250	052
P	P	500	120	+	+	254	053
Q	Q	504	121	,	(comma)	260	054
R	R	510	122	-	(hyphen or minus)	264	055
S	S	514	123	.	(period)	270	056
T	T	520	124	/	/	274	057
U	U	524	125	:	:	350	072
V	V	530	126	;	;	354	073
W	W	534	127	<	<	360	074
X	X	540	130	=	=	364	075
Y	Y	544	131	>	>	370	076
Z	Z	550	132	?	?	374	077
0	0	300	060	@	@	400	100
1	1	304	061	¢	(cent)	554	133
2	2	310	062	¬	(not mark)	564	135
3	3	314	063		(vertical bar*)	570	136
4	4	320	064	_	(underscore**)	574	137
5	5	324	065	0-8-2	\	560	134

*NUMERIC Y
**NUMERIC W

2-19. PACKED BINARY

2-20. In the packed binary mode, every four card columns are read into ("packed into") three buffer words. See Figure 2-1. The relocatable decks produced by assemblers and compilers are in packed binary format. A full 80-column packed binary card fills a 60-word input buffer. In rows 12-5 of the first column of each card is a three-digit octal number (row 12, high order bit), specifying how many words of data are on the card. The count includes itself, since it is read into the input buffer along with the other data.

2-21. COLUMN BINARY IMAGE

2-22. In the column binary image mode, the information in each card column is read into bits 0-11 of a separate buffer word (bits 12-15 are set to zeroes). Refer to Figure 2-2. The columns are stored in the input buffer consecutively starting with the first (lowest) buffer word. For example, card column 1 is always read into the first buffer word, card column 2 is always read into the second buffer word, etc.

2-23. REJECTION OF A READ REQUEST

2-24. Either of the following conditions causes a Read request to be rejected:

- a. The request code of other parameter is illegal.
- b. The specified card reader is not ready.

When a Read request is rejected, the status information in the Equipment Table (EQT) is updated and control passes to the operating system (not to the user's program).

2-25. DRIVER ORGANIZATION

2-26. INITIATOR SECTION

2-27. Upon entry to the initiator section, the RTE system transfers the user calling sequence to the storage block defined by the EQTN entry. The A-Register contains the I/O address of the Mark Sense Reader interface card. The initiator section then configures itself for the appropriate device and DMA channels, checks the user parameters for validity and initiates the data transfer.

2-28. If the operation is successfully initiated, control is transferred back to the system with a \emptyset in the A-Register. If the operation is rejected, control is passed back to the system with the A-Register set as follows:

- (A) = Error Code*
- 0 = No errors, operation initiated
 - 1 = Illegal Request
 - 2 = Control request undefined
 - 3 = Device inoperable
 - 4 = Immediate completion (zero characters are requested in ASCII mode. No card is fed)

*See appropriate RTE Software and Operating and Service Manual

2-29. COMPLETION SECTION

2-30. Upon entry to the completion section, the A-Register contains either the card reader channel number or the DMA channel number.

2-31. Entry to the completion section is caused by one of the following three interrupts:

- a. An error in the Optical Mark Reader is detected.
- b. The end-of-card is detected.
- c. DMA interrupts after 80 columns of data have been input.

2-32. The completion section then performs one of the following tasks depending upon the type of interrupt:

a. If a reader error is detected, the completion section determines the cause and takes the following steps:

1. Turns off DMA.
2. Updates status bits in Equipment Table (EQT5).
3. Sets A-Register $15\ 1_8$ if pick failure, or 3_8 of transmission error.
4. Sets B-Register (transmission log) to \emptyset .
5. Sets availability code (AV) in Equipment Table to 1_8 .
6. Returns control to system through EXEC.

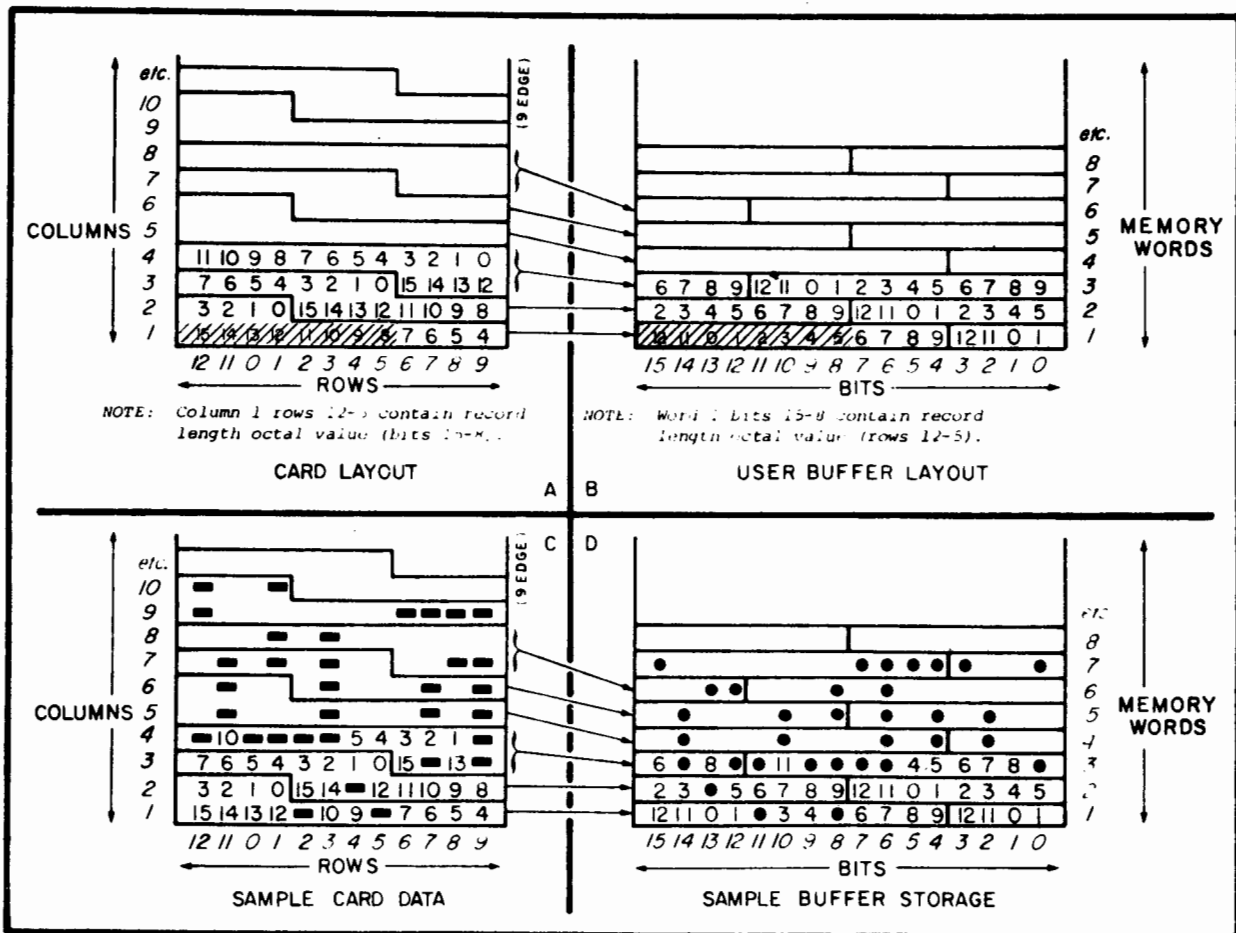
b. When end-of-card is detected, the completion section does the following:

1. Clears DMA.
2. Edits and transfers the accumulated data from the internal buffer into the user's buffer according to the Read function.
3. Sets the B-Register (transmission log) to the number of characters or words transferred.
4. Sets the availability code (AV) to 0_8 in the Equipment Table.
5. Restores the contents of the previously saved registers.
6. Sets the A-Register = \emptyset_8 to indicate successful completion.
7. Returns control to the system through EXEC.

c. When DMA interrupts, the completion section does the following:

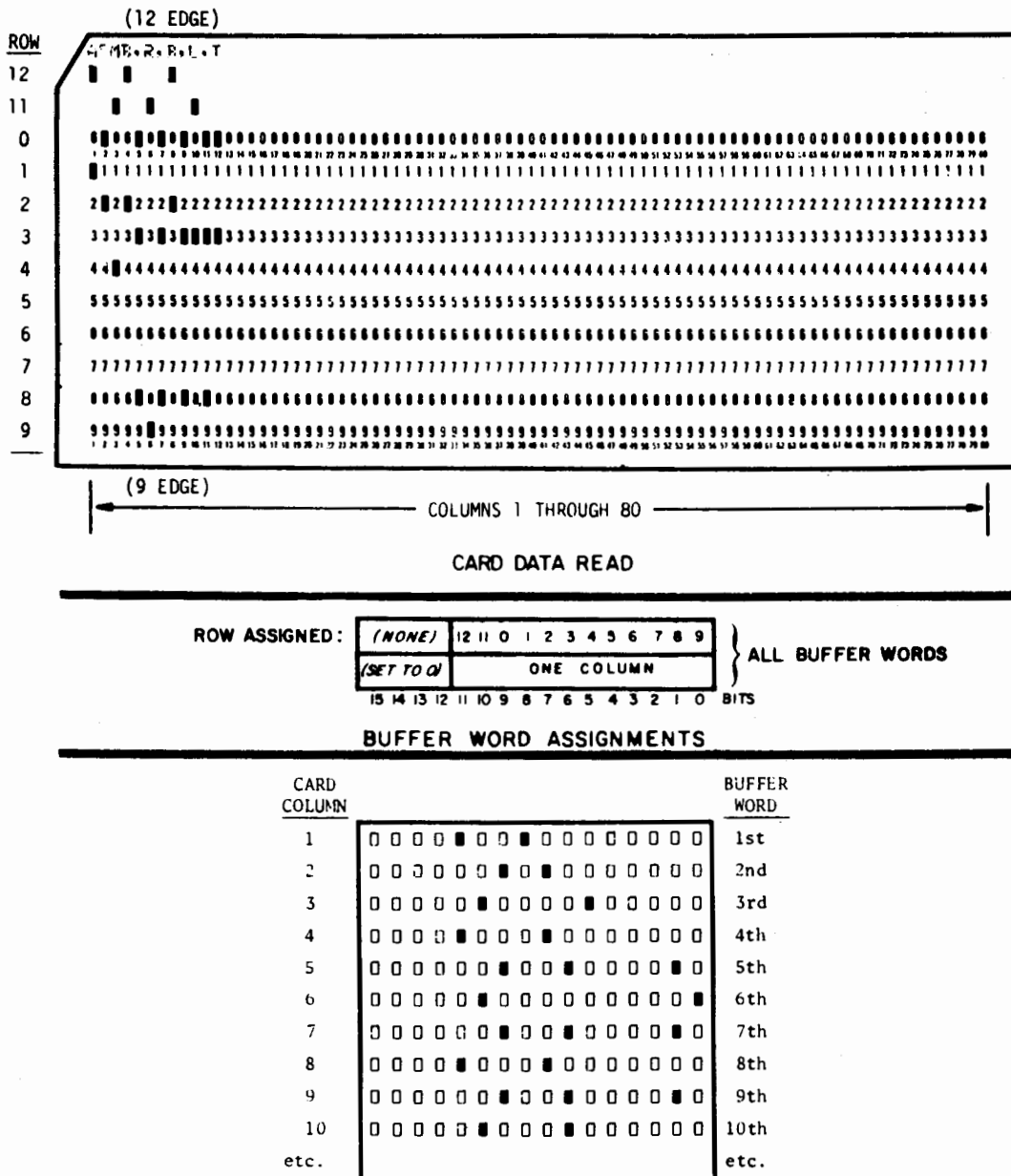
1. Turns off DMA
2. Clears the flag on the device.
3. Makes a continuation exit to await the device end-of-card interrupt.





TP29030-95001-1

Figure 2-1. Reading Packed Binary



BUFFER WORDS AFTER DATA TRANSFER

TP29030-95001-2

Figure 2-2. Reading Column Binary Image

SECTION III

CONFIGURATION INFORMATION

3-1. GENERAL

3-2. This section provides configuration information for Driver DVR11 and is intended to augment the data provided in the Real-Time Executive Software System Programming and Operating Manual.

3-3. REAL-TIME GENERATION

3-4. The driver is loaded into the RTE System during system generation as described in the appropriate RTE Software Manual. At this time, the following items must be supplied by the operator to configure the HP 2892A Card Reader into the system being generated.

3-5. PROGRAM INPUT PHASE

3-6. Driver DVR15 must be loaded during this phase.

3-7. TABLE GENERATION PHASE

3-8. In this phase, the following three entries must be made:

- a. An Equipment Table entry for each HP 7261A Card Reader:

*EQUIPMENT TABLE ENTRY

.
nn,DVR15
.

where "nn" is the select code of the card reader interface card

- b. A Device Reference Table entry for each HP 2761A Card Reader

*DEVICE REFERENCE TABLE

.
xx = QQT#?
m
.

where xx is a logical unit number. Response "m" is a number that corresponds to the "nn,DVR15" position in the Equipment Table

c. An Interrupt Table entry for each card reader interface card:

*INTERRUPT TABLE

.
.
nn

.
.
where "nn" is again the select code of the interface card.