

NATIONAL RADIO ASTRONOMY OBSERVATORY
CHARLOTTESVILLE, VIRGINIA

ELECTRONICS DIVISION INTERNAL REPORT No. 153

PAPER TAPE PRODUCTION FOR PROGRAMMING
PROGRAMMABLE READ-ONLY MEMORIES

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JANUARY 1975

NUMBER OF COPIES: 100

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I. INTRODUCTION

This report describes the procedure for preparing paper tapes to program programmable read only memories (PROM's). This tape may be sent to the distributors for programming Intels 1702A; Advanced Micro Devices AM27S08, 27S09; Signetics 82123/82S123, and others.

Most distributors program PROM's purchased from them free of charge if a paper tape is supplied. The 1702A can also be programmed by the University of Virginia, Control and Computer Systems Lab, Department of Electrical Engineering at a charge of \$8.00 per PROM, if the tape is supplied. For further information on this service contact Dr. E. A. Parrish, Department of Electrical Engineering.

Figure 1 is the form used by the PROM programmer. These are available from the digital group.

II. FORMAT OF TAPE PRODUCED

The format of the paper tape produced by this method, see Fig. 2, is as follows:

The method produces an 1" wide paper tape using an 8 bit ASCII code.

A leader of at least 25 rubouts is produced, a carriage return and three line feeds, another carriage return and line feed.

Following the leader there are 32 "word fields" for the TTL types and 256 "word fields" for the MOS types in consecutive sequence, starting with word field 0 (all address lines low). If there are to be a string of all zero words at the beginning or end of the PROM, for tapes sent to the University of Virginia, these words can be left out and verbal instructions given to the university programmer.

Each word field consists of 10 consecutive characters, the first of which is the start character B. Following the start character are 8 data characters (P's (1) or N's (0)) representing the eight binary bits to be programmed, and the the stop character F. Within the word field a P results in a high level output and an N results

in a low level output. The first data character corresponds to the desired output for data bit 8 (MSB), the second for bit 7 (NMSB), etc.

Between every four word field (after the F and before the B of the fifth word) is punched a carriage return and line feed. This allows a printout to be produced as the tape is made.

Following the word fields is punched a carriage return, two line feeds, and two dollar signs (\$\$). These dollar signs are added by the ModComp operating system and are ignored by the University's programmer. They may or may not interfere with the operation of the distributor's programmer. In any event they are easily eliminated in the production of the tape. This will be explained later.

Following the two dollar signs you must produce a trailer of at least 25 rubouts.

III. PRODUCTION OF CARD DECK

The ModComp computer located on the third floor of the Ivy Road building is used to produce this tape. It must be supplied with an IBM card deck consisting of control cards and data cards listed below:

Data cards are punched with the following format:

```
,aaa,aaa,aaa,aaa  
  }  
  word  
  field
```

A comma is punched in column 1, followed by a maximum of seven word fields per card separated by commas. No comma is placed after the last word field on the card. A word field consists of the three digit octal equivalent of the data to be programmed into the PROM. (i.e. if 01110010 were to be programmed 162 would be the corresponding word field.) Word fields are listed in consecutive sequence beginning with address 0.

These cards are placed among the control cards as follows.

```
$JOB
$EXEC SEDIT
ASS SI=CR
RAND
data cards go here
$$
CHA (,0) (FBNN) 7 100
GOTO 1
CHA (,1) (FBNP) 7 100
GOTO 1
CHA (,2) (FBPN) 7 100
GOTO 1
CHA (,3) (FBPP) 7 100
GOTO 1
CHA (0) (NNN) 14 100
GOTO 1
CHA (1) (NNP) 14 100
GOTO 1
CHA (2) (NPN) 14 100
GOTO 1
CHA (3) (NPP) 14 100
GOTO 1
CHA (4) (PNN) 14 100
GOTO 1
CHA (5) (PNP) 14 100
GOTO 1
CHA (6) (PPN) 14 100
GOTO 1
CHA (7) (PPN) 14 100
GOTO 1
CHA ( ) (F) 1 100
NOC
ASS SO=TY
COPY
EXIT
$ASS CI=CI
```

IV. PRODUCTION OF PAPER TAPE

This deck is given to the ModComp operator. The teletype is turned to local and the tape punch is turned on. A leader of at least 25 rubouts is produced by depressing the "RUBOUT" and repeat "REPT" keys simultaneously until the leader is punched.

The teletype is turned to "line" and the operator starts the card reader and runs the program. The program will punch the word fields and the carriage returns, line feeds, and "\$\$" described earlier, and then stop.

At this point the teletype is turned to local.

If the two dollar signs are to be removed the backspace ("B.SP.") button on the teletype is pushed twice. Then the "RUBOUT" and "REPT" keys are depressed to produce a trailer of at least 25 rubouts.

- ROM PROGRA -

P OF

CHIP TYPE _____ DWG. NO. _____ DATE _____ REV. NO. _____ DATE _____

PROGRAMMER _____ TITLE _____

ROM ADDRESS	23 22 21 20 19 18 17 16				15 14 13 12 11 10 9 8				7 6 5 4 3 2 1 0				← ROM SYSTEM OUTPUT	
ADDRESS	7 6 5 4 3 2 1 0				7 6 5 4 3 2 1 0				7 6 5 4 3 2 1 0				← ROM CHIP OUTPUT	
OCTAL	1 0 2 1 0 2 1 0				1 0 2 1 0 2 1 0				1 0 2 1 0 2 1 0				OPERATION — DESCRIPTION	

FIGURE 1

FIGURE 2

LEADER OF AT LEAST 25 RUBOUTS

CR (Carriage Return)

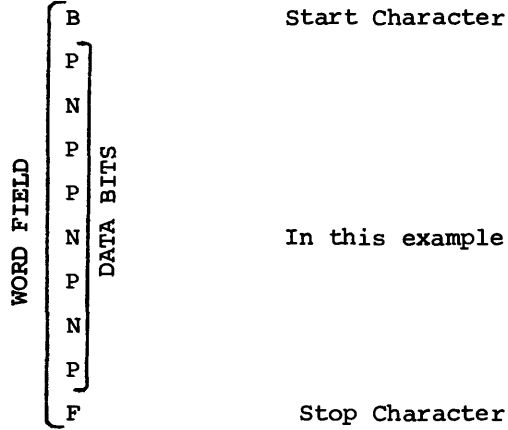
LF (Line Feed)

LF

LF

CR

LF



B

.

.

F

B

.

.

F

B

.

.

F

CR

LF

B

.

.

.

.

F

CR

LF

LF

\$

\$

\$

TRAILER of at least 25 rubouts.

Remaining word fields

Remaining word fields

These may be removed