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MANART USER'S GUIDE

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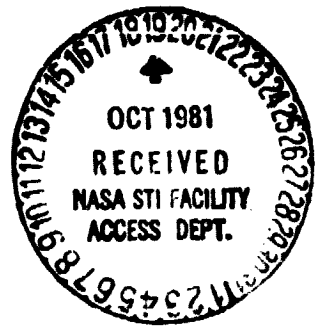

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

This manual contains a comprehensive description of the MANART conversion program. This program is written in XDS Sigma 5 FORTRAN IV language for execution on the Sigma 5 computer. A general introduction is presented in Section 1 to familiarize the reader with the basic concepts of MANART. Section 2 gives a description of the program's operation. The inputs and outputs of the program are discussed in Sections 3 and 4 with special emphasis on the control cards. Section 5 lists the error messages output by the program with an explanation of each.

17. KEY WORDS

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MANART USER'S GUIDE

1. INTRODUCTION

The program MANART has been written to convert the output of the Banning ARTWORK program into a format which may be used for production of circuit masks on a Mann Pattern Generator. The output from ARTWORK is a series of points between which a Gerber Plotter exposes lines of various widths to outline and fill the desired shapes, while Mann Generator requires commands explicitly defining rectangular areas that must be exposed to compose the required shapes. MANART converts the tape of Gerber point data to shape data, sorts the shape data by coordinates, and writes this data sequence on tape in the format required by the Mann generator.

2. DESCRIPTION OF OPERATION

The amount of processing required of MANART is greatly reduced by using special ARTWORK options to generate the Gerber input tape. These options, which are detailed in Section III, produce a tape in which shapes have been broken into rectangles, and the coordinates of outlines of these rectangles are listed in such a manner that rectangle edges which must be overlapped to compose a complex shape can be easily identified. The coordinates of each set of points defining such a rectangle are read and the defined area is broken into sub-blocks which can be covered by the aperture of the Mann generator. Each such sub-block is entered into a list and sorted on increasing Y-coordinate. When all required blocks have been entered in this list, those blocks having the same Y-coordinate are sorted on increasing X-coordinate. The sorted list is then translated into the required Mann generator format and output to the proper Mann tape file.

The Mann Generator tape is managed in such a manner that up to 100 masks can be filed on a single tape. Each mask is assigned a file which begins and ends with identifying comments. An index referencing each file is maintained in the tape's first file. This index is updated as files are added or replaced.

Figure 2-1 depicts a sample run deck for the execution of the MANART program.

3. INPUT REQUIREMENTS

The input requirements detailed in this section must be fulfilled for normal operation of MANART.

3.1 I/O Unit Assignments

The following I/O assignments must be made to user DCB's:

2 - Gerber Plotter input tape

5 - Card reader

6 - Line printer

8 - Mann Pattern Generator tape (should be in 9-track BCD)

9 - Sequential scratch storage file

3.2 Card Reader Inputs

Control data and definitions of Gerber aperture sizes must be input from the card reader. The first data card must have the following five parameters specified in format I5:

ISKIP - Number of previously created Gerber data files (excluding title/index file) to be skipped on the Gerber tape before writing files created by current run.

NOLEV - Number of levels of Gerber Plotter data to be processed.

NAPER - Number of Gerber Plotter apertures which are to be defined.

IBIAS - X-coordinate of the origin of the ARTWORK data within the Mann reference frame. PRF normally makes some negative coordinate assignments which must be biased so that all Mann coordinates are positive.

JBIAS - Y-coordinate of the origin of the ARTWORK data within the Mann reference frame.

IMIR - Mirror Image

All apertures used by ARTWORK to create line set data for the Gerber tape must be defined to MANART in a format similar to that used by ARTWORK. This form contains the following information left justified on an individual card for each aperture:

Dnn.sss

where nn = aperture number

sss = diameter of aperture nn in mils.

The number of cards specified by NAPER will be read for aperture definitions.

Each of the next seven cards is used as a line of the tape's title comments. All characters between and including columns 2 and 71 of these cards will be printed as comments identifying the tape when it is used by the pattern generator. The title cards are followed by 4 cards of titie information for each level of commands to be processed. These cards are written as comments in the first data block of the level's file. The first of the four cards must begin with the four characters "XFIL", and it is this line of characters which is also entered into the index formed in the tape's file.

3.3 Gerber Tape Input

The following options must be selected when the ARTWORK program produces a tape of Gerber Plotter commands which are to be used to drive MANART:

KOUTL 1

KFSMA 1

KSMA 1

BORMAX = 0.00002

In addition, the smallest round aperture which is listed in the input data must be defined as

D10.002.

4. OUTPUT FORMAT

The output tape produced by MANART is formatted into blocks of 512 BCD characters. The tape title file, which is rewritten each time the program is run, contains the seven lines of title comments and 105 lines of index comments (unused index lines will contain blanks). All comment lines are preceded by a quotation mark and followed by a semicolon to insure that they are properly recognized and printed on the Mann teletype.

The succeeding data files contain the four lines of identification comments followed by sorted Mann pattern command sets. Each such set is complete in that both coordinates, both aperture dimensions, and the aperture rotation are specified. The command data sets generated are for a Mann pattern generator with coordinate increments of 0.25 mil aperture increments of 0.5 mil, and without aperture rotation. After all data sets have been output, a file complete message and end-of-file command is written.

5. ABNORMAL DATA MESSAGES

Improper data input from either the Gerber tape or the aperture definitions will be noted by the error messages and indicators listed in Table 1. Except as noted, the program will exit immediately following the output of one of the messages. Error messages containing the field of Gerber characters indicated by g's will have the First Gerber command of the illegal set of points filled into this field.

TABLE 1

ERROR MESSAGES

MANN TAPE WRITE ERROR AT xxx - TRY ONCE MORE

For: xxx = 116 - Error during writing of tape title block. Tape will be backspaced and write attempted a second time. Double failure causes program exit.

xxx = 126 - As above during writing of file complete message.

xxx = 180 - As above during writing of file title block.

xxx = 793 - As above during writing of file complete message.

ERROR TERMINATION - IER = 121

Error occurred during read of data files which are to be skipped.

ERROR TERMINATION - IER = 800

End-of-file does not follow stop command on Gerber tape.

FIRST DATA COMMAND INCORRECT
ILLEGAL GERBER COMMAND DATA "gggggggggggggggggggggggggggg"
ERROR TERMINATION - IER = 0

First command of Gerber tape is not 'N998G01D02M00***'.

ODD APERTURE IN DATA SET
ILLEGAL GERBER COMMAND DATA 'gggggggggggggggggggggggggggg'
ERROR TERMINATION - IER = xxx

The aperture resulting from the processing of Gerber data is an odd multiple of 0.25 mil. Field xxx contains the program statement number preceding the point at which this condition was detected.

APERTURE Dnn NOT DEFINED PROPERLY
ILLEGAL GERBER COMMAND DATA 'gggggggggggggggggggggggggggg'
ERROR TERMINATION - IER = xxx

For: xxx 0 - Aperture number nn specified by Gerber data has not been defined.

xxx 212 - Aperture number nn specified by Gerber data is not an even multiple of 0.25 mil.

IRRECOVERABLE ERROR IN WRITE TO MANN TAPE

Write error occurred during output of Mann command data.

TABLE 1

ERROR MESSAGES
(continued)

ILLEGAL GERBER COMMAND DATA 'gggggggggggggggggggggggggg'
ERROR TERMINATION - IER = xxx

For:	xxx = 0	-	Program does not recognize characters 5 through 8 of indicated Gerber command as being either point data, stop command, or aperture change command.
	xxx = 320	-	Shape being processed is too wide for Mann generator stage.
	xxx = 340	-	Shape being processed is too high for Mann generator stage.
	xxx = 400	-	Gerber data contains non-orthogonal line set data.
	xxx = 419	-	Vertical line being processed is too long for Mann generator stage.
	xxx = 429	-	Horizontal line being processed is too long for Mann generator stage.

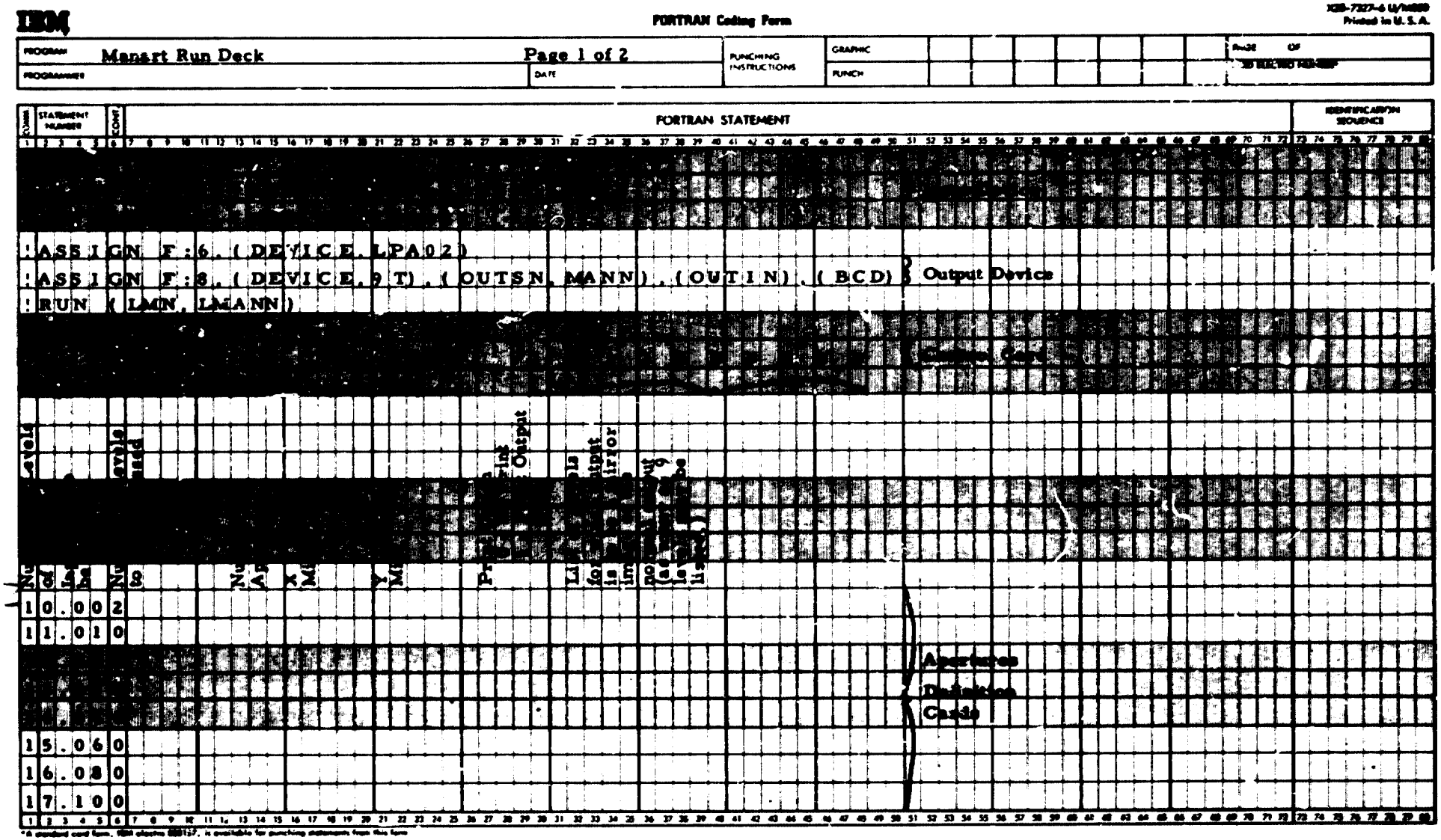

Figure 2-1. Sample run deck for MANART program.

IBM FORTRAN Coding Form

PROGRAM Manart Run Deck | Page 2 of 2 | PUNCHING INSTRUCTIONS | GRAPHIC | PUNCH | PAGE OF

PROGRAMMER | DATE

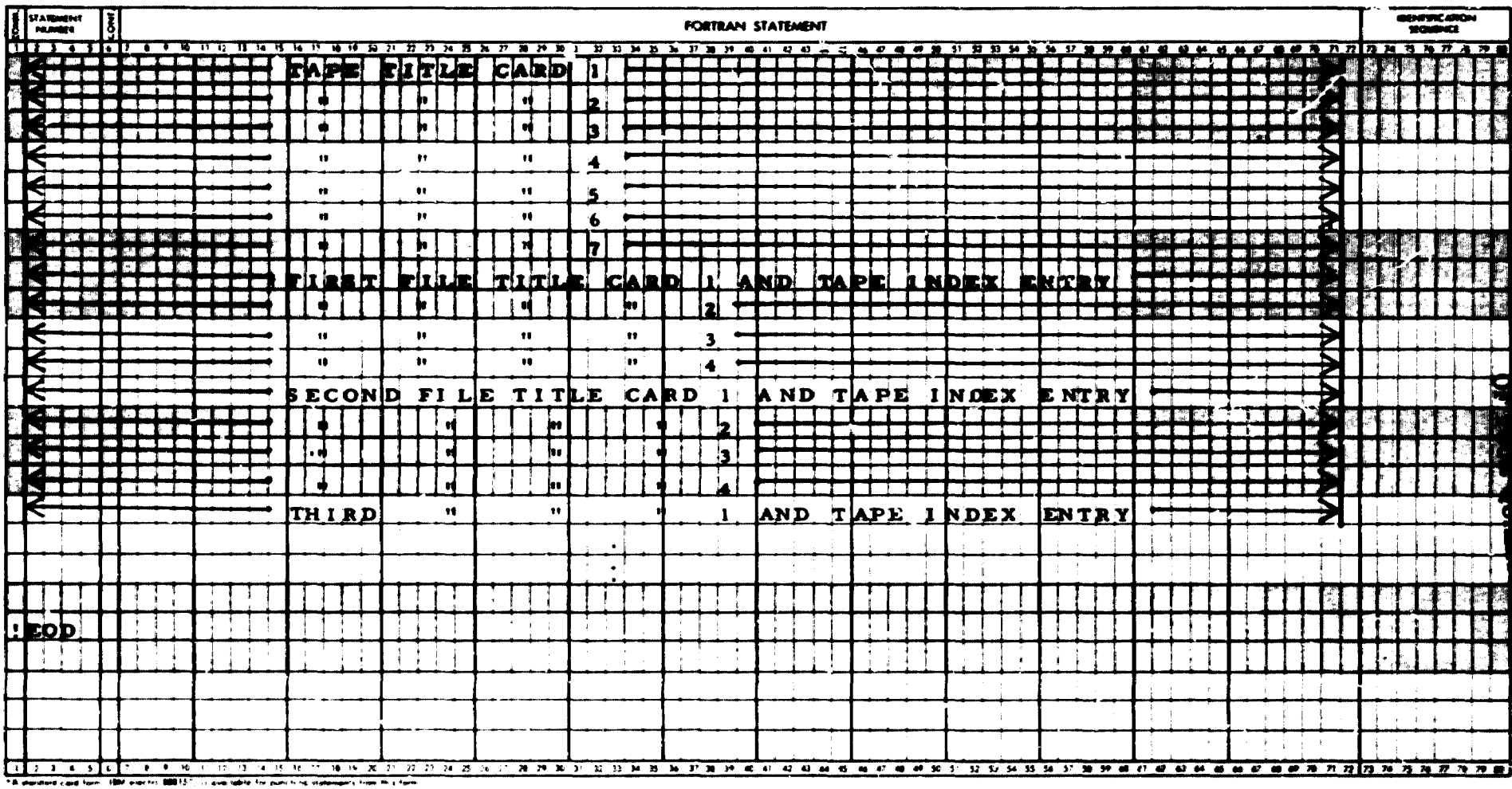

Figure 2-1. Sample run deck for MANART program (continued)