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Systems Reference Library

IBM 7070/7074 AUTOCHART Programming System

AUTOCHART is a system designed to use data processing methods in the production, maintenance, control, and distribution of program flowcharts and other types of tabular or graphic information. The user codes the original in the Autochart language and the computer processes this coding to produce a file of charts, which is printed offline on an IBM 1401 Data Processing System.

In order to modify flowcharts, it is only necessary to code the changes for an updating run. Each flowchart can have up to 50 blocks and a file can contain a maximum of 250 charts. An IBM 7070/7074 Data Processing System with a minimum of 10,000 words of core storage, six magnetic tape units, and an IBM 1401 System with 132 print positions are required.

The Autochart language is machine independent and can be used to prepare flowcharts for any system.

Preface

This manual contains all of the information that the user needs to code and operate the Autochart system. This information is the type found in a reference manual and in an operations manual.

The manual is divided into the following sections:

GENERAL DESCRIPTION — describes the basic requirements of the Autochart input language and processor.

CODING THE SYSTEM — describes in detail the coding specifications required to code most standard charts and tables.

USING THE SYSTEM — describes the function and purpose of the various Autochart runs.

DETAIL REFERENCE MATERIAL — describes some special features of the system that are not required for normal charting procedures and some of the methods by which the charting is accomplished.

SYSTEM OPERATION — describes in detail the methods used to operate the Autochart system.

APPENDIX A: TYPICAL CHART — contains an original rough chart, the Autochart coding required to produce this chart, a listing for the chart, and the chart as produced by the Autochart system.

APPENDIX B: DETAIL CARD LAYOUT — a tabular summary of the contents and function of each card type used with the system.

APPENDIX C: AUTOCHART OUTPUT OVERLAY

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General Description

The Autochart system eliminates much of the routine involved in drawing and maintaining up-to-date flowcharts and certain other graphic information. When the Autochart system is used, the documentation for a program project can be maintained, controlled, and distributed because all information is kept on magnetic tape and the system contains complete file-maintenance capability. The system input is a simple, easily learned language; the system output is a printed chart which is standardized for clarity and readability and is suitable for publication (a 50 percent reduction is easily legible as shown in Appendix A).

Figure 1 shows an example of a simple flowchart produced by Autochart and Figure 2 shows examples of tabular and graphic information produced by the 7070/7074 Autochart Processor.

The initial step in preparing an Autochart requires a rough layout of the chart on an IBM Flowchart

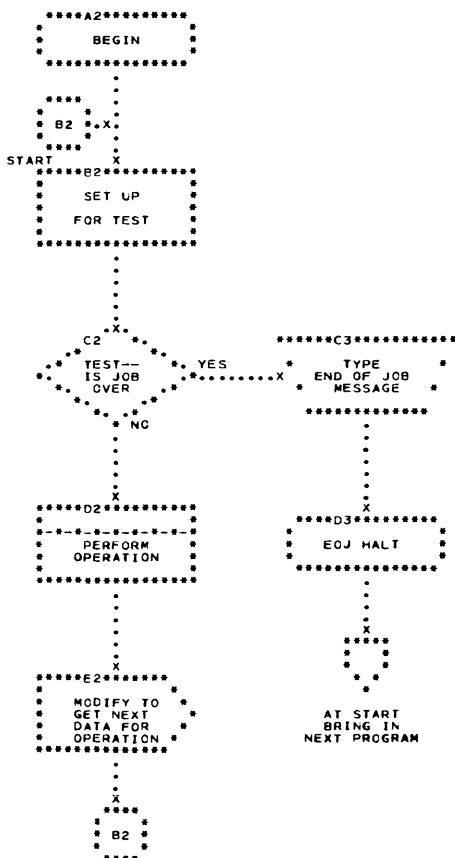


Figure 1. Sample Autochart

Worksheet (Form X20-8021). Figure 3 illustrates the worksheet used to prepare the sample chart shown in Figure 1. If the chart to be processed is a flowchart, the Autochart language is used to describe the type of blocks, location of blocks, interconnection between

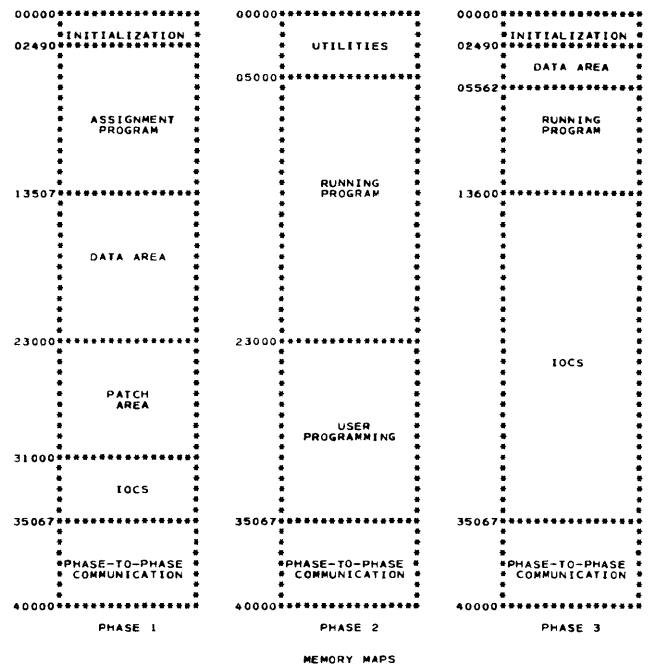


TABLE 17 END OF FILE TEST			
01	FILE A END OF FILE	YES	YES NO NO
02	FILE B END OF FILE	YES	NO YES NO
03	PROCESS FILE A		X
04	PROCESS FILE B		X
05	PROCESS (CONTINUE)		X
06	WRITE FILE A EOF MESSAGE		X
07	WRITE FILE B EOF MESSAGE		X
08	WRITE END OF JOB MESSAGE	X	
09	HALT	X	

DECISION TABLE

Figure 2. Example of Tabular and Graphic Chart

IBM FLOWCHART WORK SHEET (AUTOCHART)

PROGRAMMER: _____ PROGRAM NO.: _____ DATE: 17 JUL 63

CHART ID: A1 CHART NAME: SAMPLE CHART PROGRAM NAME: AUTOCHART

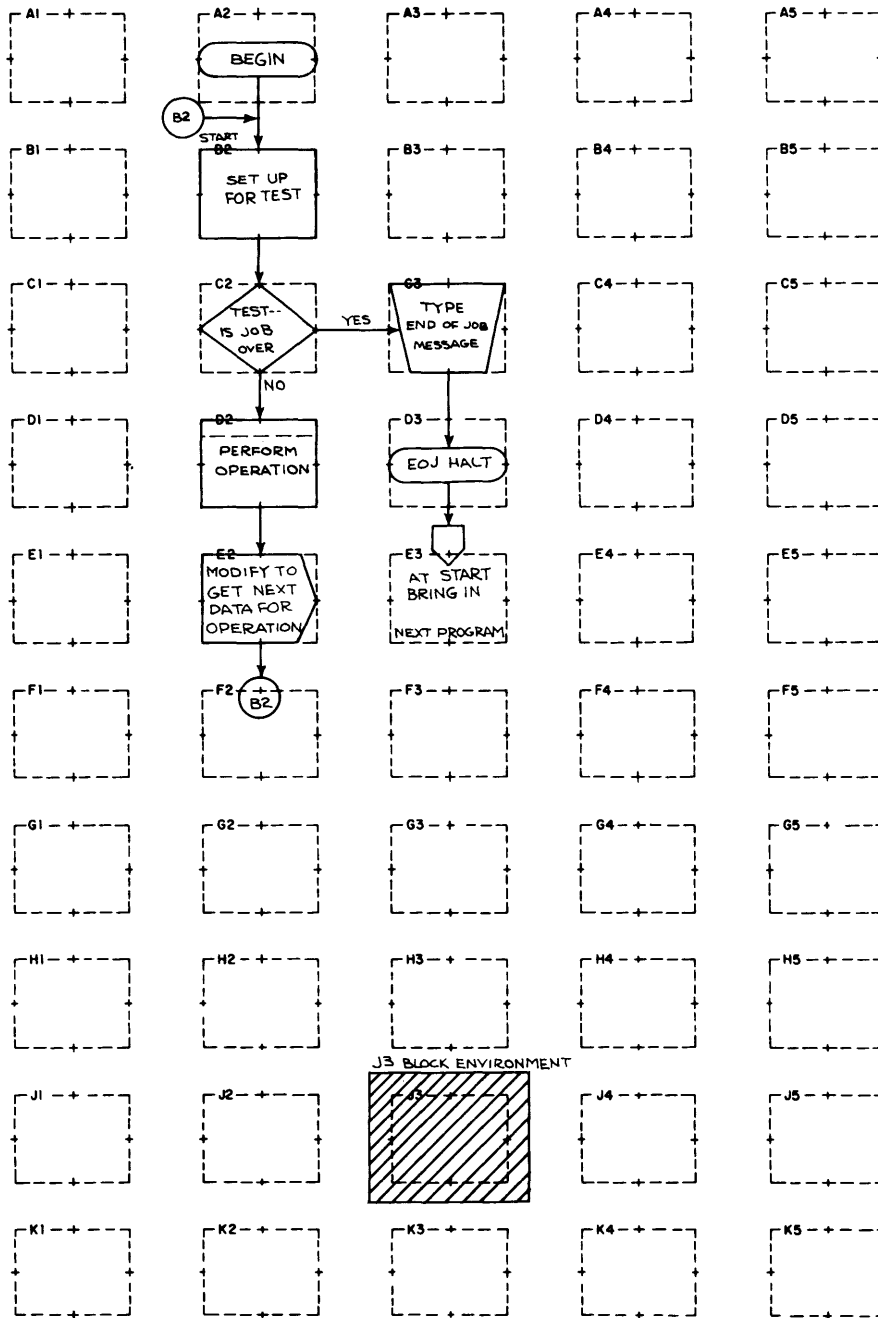


Figure 3. Flowchart Worksheet and Page Layout

blocks (flowlines), and any other information that has been drawn or written on the worksheet. If the chart is not a flowchart, the Autochart language is used to describe the lines to be drawn, and the textual information to be contained on the chart.

The Autochart system uses seven standard symbols as basic building blocks to produce a flowchart. These program flowchart symbols, which are shown in Figure 4, conform to the proposed American Standards Association

X3.6/12 standard on flowchart symbols for information processing. In addition to these blocks, the system also produces flowlines and connectors to indicate flow between blocks. Offpage connectors (pentagons) are specified by the programmer; onpage connectors (circles) are usually generated by the system if a designated flowline cannot be drawn, but it is also possible for the user to specify onpage connectors.

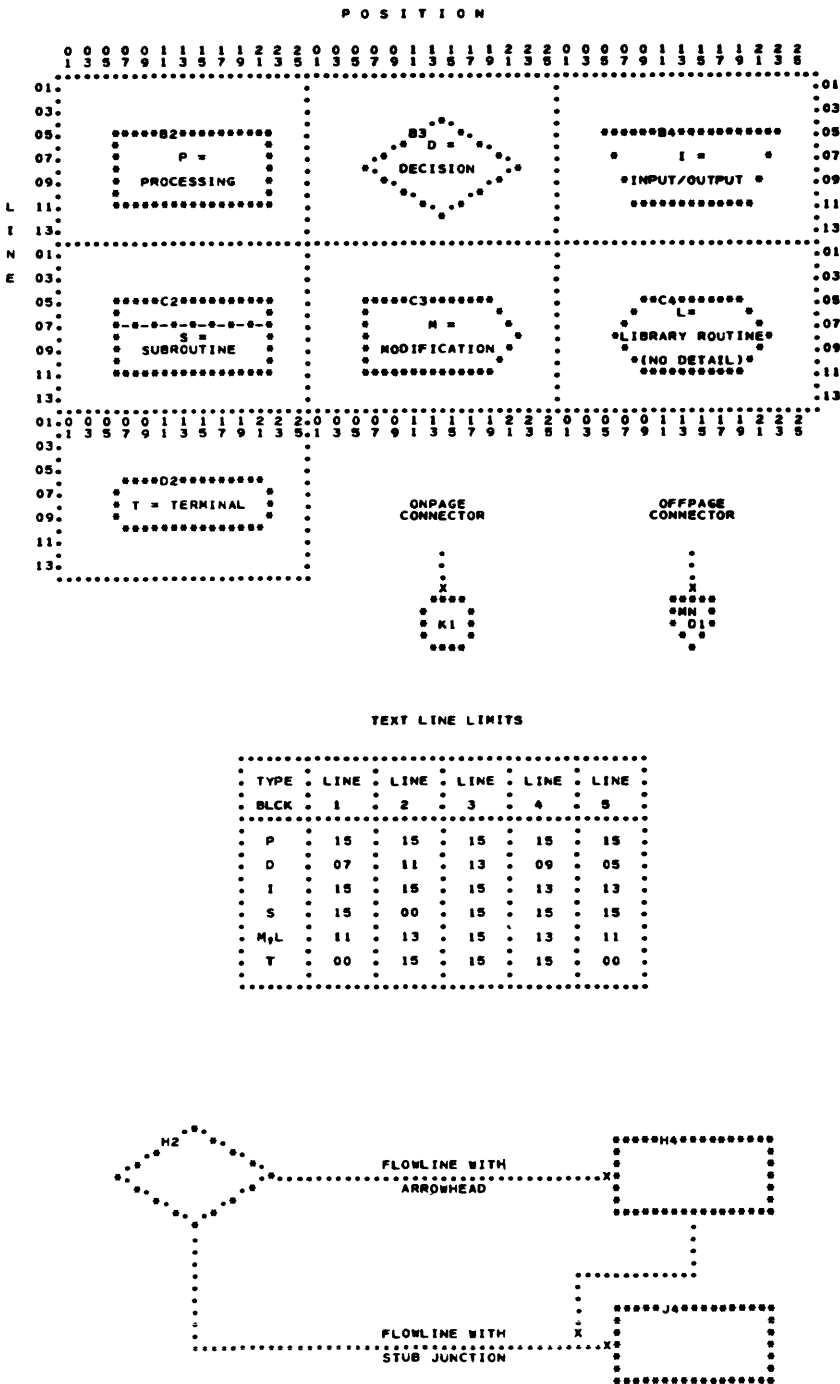


Figure 4. Autochart Symbols

Each Autochart output sheet is divided into 50 block environments arrayed 10 deep and 5 across. A grid system consisting of rows A-K (omitting I) and columns 1-5 is employed to indicate block locations on a chart. The coordinates defined by rows and columns provide a unique location for each block environment. For example, the block environment at the top left corner of the chart is given the location A1. Similarly, the block environment at the bottom right corner of the chart has, as its location, K5. The IBM Flowchart Worksheet contains these block locations.

A block environment is a rectangular area 26 print positions wide and 14 lines deep. The relation of a block environment to the worksheet is shown in Figure 3 (see location J3). The contents of the block environment are detailed in Figure 5. As an example, a processing block represented by the asterisks in Figure 5 is located in the center of the block environment. The short dotted lines (called line stubs) found at the midpoints of each side of the block show where the flowlines can enter and leave. The character X at the entry to a block represents an arrowhead and shows the direction of flow. Figure 4 illustrates flowlines and line junctions with arrowheads. The shaded print positions in Figure 5 represent the location of specific fields within a block environment. These fields are:

- The Label or Tag (a cross reference to the program listing)
- Flowline Conditional information (YES-NO; ON-OFF, etc.)

Block Location (A1, B1, etc.)

Block Number (a number which may be assigned to the block by the user for easy reference in a supporting write-up)

In addition to the 50 block environments, there are five print lines above row A and six print lines below row K. These additional areas are used only for connectors.

Input Language

Autochart uses a simple language which is capable of describing a complex chart in detail. The chart is coded and punched into cards for processing. Since the basic elements of any flowchart are the blocks and the narrative descriptions associated with them, the Autochart language provides this kind of information to the processor when a flowchart is coded. When other graphic information is being coded, only the lines and text are specified by the input language.

The input language uses five different card types. Three of these card types are required to code flowcharts and the remaining two card types are used to code other kinds of charts and to provide more flexibility in the coding of the flowcharts. The three basic cards used in an Autochart run are:

Header Card (card type 1) supplies header information and chart identification. One header card is required for each chart that is introduced or changed during a run.

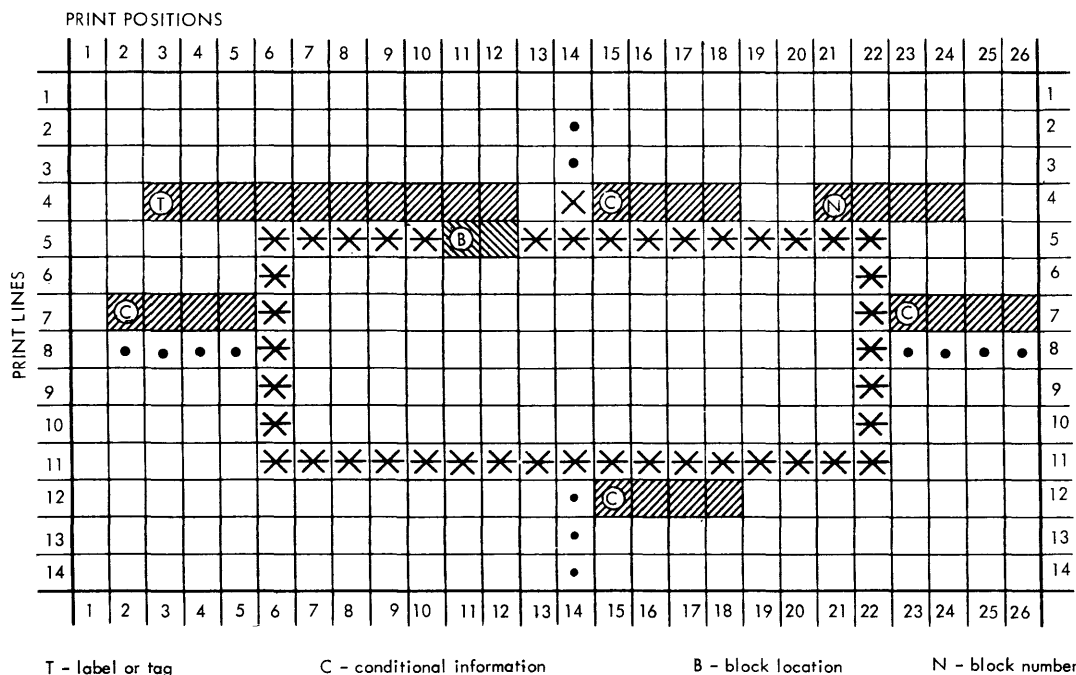


Figure 5. Block Environment

Block Layout Card (card type 2) specifies the shape of the block, its symbolic tag or label, all flowlines which leave the block, and any conditional information associated with the flowlines. One block layout card is required for each block that is introduced or changed during a run.

Block Text Card (card type 3) supplies the information that appears inside the block. One block text card is required when text is introduced or changed during a run.

These three types of cards normally provide enough information to allow the Autochart system to draw a complete flowchart which includes automatically generated lines and connectors. The other two types of input cards are:

Line Card (card type 4) causes vertical or horizontal lines to be drawn anywhere on the chart. These lines are drawn at places where the system would not automatically draw a line. They are also used to construct specialized figures.

Comments Card (card type 9) places comments anywhere on the chart. These comments include textual information that has not been specified by card type 3.

A sixth card, the run control card, is required for each Autochart run. This card is described in "Run Control Card."

Processor

The Autochart system is a two-phase program. Phase 1 contains a sorting routine for sorting the input data file and a file maintenance program for updating a file of charts. Phase 2 contains the main processor program which produces the actual chart. During Phase 2, each Autochart page is constructed in core storage according to the information supplied by the input language. The processor produces a chart exactly as coded and determines the routing of the flowlines. When a flowline cannot be drawn, the processor will produce an onpage connector or will place a message in the output which states that the line or connectors cannot be drawn because of space limitations.

Multiple Autochart jobs can be stacked on a single input file and batch-processed, if desired. The system

also contains an automatic error-restart capability and a system editor routine for ease in modifying the system configuration.

Processing Runs

There are five types of processing runs which are used to produce and maintain the charts produced by the Autochart system. The run types and their functions are:

Initial Run performs the initial processing of the charts.

File Maintenance Run updates charts and permits the following actions:

Altering blocks

Changing block definitions and flowlines

Moving blocks and associated text and comments

Inserting blocks

Altering text

Changing chart identifications

Inserting or deleting charts

Updating cross reference between charts automatically

Process Selected Run extracts selected charts from a file of charts and writes these charts on an output tape for printing.

Process All Run writes all charts from a file of charts on an output tape for printing.

File Maintenance/Process All Run combines functions of the File Maintenance and Process All Runs.

Output Format

All types of runs except Process All produce a new master tape. All runs produce a chart output which consists of following five categories of information on the output file:

1. File Error list when coding errors are found
2. Blocks Moved list (if any)
3. Header List where applicable
4. New Master Listing with error messages for each chart. *Any record marks or group marks are replaced by a \$ in the listing*
5. Print image of chart

More details on item 1 and 4 are described in the section titled, "Messages."

Coding the System for Flowcharts

The information in this section of the manual provides the user with enough detailed information to code the Autochart system for most standard charts. The section contains a description of the format and function of each type of card used with the Autochart system, all information required to code these cards, and a description of the methods used to correct or alter existing files. The specialized use of connectors, the routing of lines, an optional priority system used with line placement, and other more detailed information not normally required in the production of most flowcharts are covered in the section of this manual titled, "Detailed Reference Material."

The five input card types are coded on the Autochart Coding Sheet (Form X28-6771) shown in Figures 6 and 7. Figure 6 also contains the coding to produce the chart sample in Figure 1. All characters allowed in the 7070 character set, except the record mark, can be used in coding a chart. A typical chart is illustrated in Appendix A, and the card formats are summarized in Appendix B.

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Header Card (Card Type 1)

The Header card provides information for the heading and identification line which is placed at the top of each chart.

IBM		AUTOCHART CODING SHEET										Page <u>1</u> of <u>1</u>									
Chart Ident <u>AB</u>		CHART HEADER (1), BLOCK LAYOUT (2), BLOCK TEXT (3)										Date									
Program Name		Chart Name										Programmer									
1	2	3	4	5	6	10	20	21	30	40	50	55	56	60	70	71	77	78	79	80	
AB	1																				
SYMBOLIC LABEL (TAG)		BLOCK		FLOWLINE EXIT		FLOWLINE EXIT		FLOWLINE EXIT		FLOWLINE EXIT		FLOWLINE EXIT		FLOWLINE EXIT		FLOWLINE EXIT		FLOWLINE EXIT			
CHART IDENT	BLOCK	NUMBER	NEW	LOC	LOCATION	CONDI- TION	LINE CTL	CON- NECTOR	TYPE CON	TO	LOCATION	CONDI- TION	LINE CTL	CON- NECTOR	TYPE CON	TO	LOCATION	CONDI- TION	LINE CTL	CON- NECTOR	TYPE CON
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
AB	A2	01	T		BB2T																
AB	B2	02	P		BC2T																
AB	C2	03	D		RC3L	YES															
AB	D2	04	S		BE2T																
AB	E2	05	M		BB2T			BR	F												
AB	C3	06	T		BD3T																
AB	D3	07	T		BXXX				S												
Text Line 1		Text Line 2		Text Line 3		Text Line 4		Text Line 5		Text Line 6		Text Line 7		Text Line 8		Text Line 9		Text Line 10			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
AB	A2																				
AB	B2																				
AB	C2																				
AB	D2																				
AB	E2																				
AB	F2																				
AB	G2																				
AB	H2																				
AB	I2																				
AB	J2																				
AB	K2																				
AB	L2																				
AB	M2																				
AB	N2																				
AB	O2																				
AB	P2																				
AB	Q2																				
AB	R2																				
AB	S2																				
AB	T2																				
AB	U2																				
AB	V2																				
AB	W2																				
AB	X2																				
AB	Y2																				
AB	Z2																				

Figure 6. Code Sheet, Front

IBM
AUTOCHART CODING SHEET
LINE (4), COMMENTS (9)

Chart Ident _____ Page _____ of _____
Date _____
Program Name _____ Chart Name _____ Programmer _____

Line Coordinate Points

Comments

PRINTED IN U. S. A.

Figure 7. Code Sheet, Back

Format

The card type 1 format is as follows:

COLUMN	FIELD
1-2	CH ID
3	CD TYPE (1)
4	NO.
5	(not used)
6-20	Program Name
21-55	Chart Name
56-70	Programmer
71-77	Date
78-79	NEW ID
80	REF

where:

- CH ID** specifies the chart identification; it must be present in every header card.
- NO.** specifies the number of duplicate charts to be printed. The options are:
(blank) – One copy of chart (no duplicates)
1 . . . 9 – Number of additional charts produced
(e.g., "5" will produce a total of 6 charts)
- NEW ID** specifies the new chart identification when the chart identification is changed. The requirements for this field are described under the heading, "Changing a Master File."
- REF** specifies the options of printing the block locations in the block location fields (see Figure 5). The options are:

- (blank) – All block locations are printed except in consecutive unused rows at the bottom of the chart.
- X – Block locations are printed in all environments that contain a block.
- A – No block locations are printed.

Requirements

- One header card is required for each chart.
- Only one header card should have any given chart identification. All card types for a particular chart must have the same chart identification as the header card.
- Only the chart identification field and one other field must be specified by the user. The contents of all other fields may be used at the discretion of the user.

Block Layout Card (Card Type 2)

The Block Layout card is associated with a single block environment and specifies the type of block, its tag or label, its reference number, and any flowlines that leave the block.

Format

The card type 2 format is as follows:

COLUMNS	FIELD	SUBFIELD	FIELD OR SUBFIELD
1-2			CHART IDENT
3			CD TYPE (2)
4-5			BLOCK LOCATION
6-15			SYMBOLIC LABEL or TAG
16-18			BLOCK NUMBER
19			TYPE (except during move)
19-20			NEW LOC (move only)
21-35			
36-50			FLOWLINE EXIT
51-65			
66-80			
	21		
	36		SIDE (subfield)
	51		
	66		
	22-24		
	37-39		TO LOCATION (subfield)
	52-54		
	67-69		
	25		
	40		JUNCTION (subfield)
	55		
	70		
	26-29		
	41-44		CONDITION (subfield)
	56-59		
	71-74		
	30		
	45		LINE CTL (subfield)
	60		
	75		
	31-34		
	46-49		CONNECTOR ID (subfield)
	61-64		
	76-79		
	35		
	50		TYPE CON (subfield)
	65		
	80		

where:

CHART IDENT

contains the chart identification which must be the same as the contents of the **CH ID** field of the header card.

BLOCK LOCATION

specifies the block environment in which the block is placed.

SYMBOLIC LABEL (TAG)

specifies the information, if any, which is inserted in the label or tag field of the block environment. (See Figure 5.)

BLOCK NUMBER

specifies the number, if any, assigned to the block by the user as reference from supporting text. These numbers are placed in the block number field of the block environment. (See Figure 5.) Columns 16-17 are normally used; column 18 provides a decimal insert number (e.g., 10.1).

TYPE

specifies the type of block to be placed in the block environment (see Figure 4 for illustrations). The options are:

- P – Processing block
- D – Decision block
- I – Input/Output block
- M – Modification block
- S – Subroutine block (detail is shown in other charts)
- L – Library Routine block (no detail is shown in other charts)
- T – Terminal block (start, halt, interrupt or logical connector)
- \$ – Imaginary block (all fields can be specified in a block environment, but no block will be drawn)

NEW LOC

specifies the new location of a block when that block is moved during a run. The **BLOCK LOCATION** field specifies the old location of the block.

FLOWLINE EXIT

specifies the destination of the flowlines leaving a block, the line conditions, and the connector identification and type. The following subfields are used.

SIDE

specifies the side of the block from which a line is to exit. The options are:

- T – exits from top
- R – exits from right
- B – exits from bottom
- L – exits from left

TO LOCATION

specifies the block environment to which a line is going and the side (options similar to the **SIDE** field) of the block which is entered by the line. For example, C2T in the **TO LOCATION** subfield specifies that a line goes to block environment C2 and enters the top of the block located in that environment.

This three-position field is also used to designate offpage connectors:

- (blank) – offpage entry
- XXX – offpage exit

The **SIDE** and **TYPE CON** must also be specified to obtain these connectors.

JUNCTION

when coded “J” indicates that the line is planned to junction, with an arrowhead, at the line stub specified by the **TO LOCATION** subfield. Arrowheads at junctions of lines away from the line stub are inserted automatically, but arrowheads at the line stub must be specified by the user as desired and required for clarity. For example, C2T in the **TO LOCATION** subfield, and J in the **JUNCTION** subfield specifies that the line joins a line stub with an arrowhead at the top of the block in environment C2.

CONDITION

specifies the conditional line information (YES – NO, HIGH – LOW, etc.) Normally four positions allowed; on left or right side this may be limited to three positions if a vertical line exists.

LINE CTL

specifies various options in drawing a flowline:

- (blank) – normal flowline or connectors
- N – no line, just line stubs at terminal ends of the flowline
- \$ – no line or line stubs
- 1 . . . 9 – line drawing priority (this will be described under “Automatic Generation of Lines”)

CONNECTOR ID

specifies the characters to be placed inside a connector symbol. If the field is left blank and an onpage connector is required, the block location specified by the **TO LOCATION** subfield is inserted automatically in the connector. If the field is left blank and an offpage connector is specified, no information is inserted in the connector.

When a block is referenced in the **CONNECTOR ID** subfield for an offpage connector, the following format should be used:

XXYY

where:

- XX is the chart identification
- YY is the block location

If this format is used, the block references are automatically changed to reflect any subsequent changes in chart identification or block location.

TYPE CON

specifies the different types of connectors. Two common options are Regular (R) and Special (S). Normally, this subfield is used only to specify offpage connectors; onpage connectors are generated automatically when needed. The special cases in which onpage connectors are specified by the user are discussed in the section of this manual titled, “Detailed Reference Material.”

Requirements

1. Except for the coding of offpage entry connectors, it is necessary to specify only the exits from a block

because entries into a block are specified in the `FLOWLINE EXIT` field of another block layout card. The offpage connectors are specified on the card associated with the block that they either enter or leave.

2. Regular connectors (R) are placed close to their associated blocks; they allow a block to be placed in an adjacent environment.

3. Special connectors (S) are totally within the block environment adjacent to the environment with which it is associated; they prevent the placement of a block in that adjacent environment (e.g., a special connector to the right of a block location B2 prevents the placement of a block in environment B3).

4. When a designated line between blocks cannot be drawn and no onpage connector is specified, a regular or special onpage connector is generated by the Autochart system. If neither a line nor an onpage connector can be drawn, the system produces a line-not-drawn message.

5. To designate an offpage entry connector from another chart, the `TO LOCATION` subfield is left blank. The connector symbol points in the direction of flow. The `SIDE` and `TYPE CON` subfields must also be specified.

6. To designate an offpage exit connector to another chart, `XXX` is coded in the `TO LOCATION` subfield. The connector symbol points in the direction of flow. The `SIDE` and `TYPE CON` field must also be specified.

Block Text Card (Card Type 3)

The Block Text card provides the text which appears within a block.

Format

The card type 3 format is as follows:

COLUMN	FIELD
1-2	CHART IDENT
3	CD TYPE (3)
4-5	BLOCK LOCATION
6-20	
21-35	
36-50	TEXT LINE 1-5
51-65	
66-80	

where:

`CHART IDENT` and `BLOCK LOCATION` fields are the same as in the Block Layout card.

`TEXT LINE`

fields specify the five lines of text (maximum) that can be inserted in a block.

Requirements

1. Each text line within a block has a maximum of 15 characters.

2. Except for Text Line 1 there must be a significant character in one of the first five positions of the text line.

3. If the Text Line field is left-justified and if the

low-order position (e.g., column 20) is not a \$, then the line will be centered within the text area.

4. If either the high-order position of the Text Line field is blank or the low-order position is a \$, the line will not be centered. The \$ in the low-order position will be replaced by a group mark which does not print.

5. The terminal block provides space for only the middle three Text Lines (2-4).

6. The maximum number of characters for each Text Line in each type of block is summarized in Figure 4.

7. If Text Lines are not centered or if the above limits are violated, the sides of blocks may be overlaid by text information.

8. Text Lines 1 and 2 for a subroutine block are special cases:

- Line 1, columns 6-15 may contain the subroutine name; columns 17-20 may be used for chart and connector identification (e.g., `ABK1`). If this connector identification is used, it will be updated automatically.
- Line 2 must not be used.

Line Card (Card Type 4)

The line card is used to specify vertical and horizontal lines that are not drawn automatically by the system.

Format

The card type 4 format is as follows:

COLUMN	FIELD
1-2	CHART IDENT
3	CD TYPE (4)
4-9	
10-15	
16-21	
22-27	
28-33	
34-39	
40-45	BLCK, LINE, POS
46-51	
52-57	
58-63	
64-69	
70-75	
76-78	(not used)
79	CHAR
80	ARROW

where:

`CHART IDENT`

is the same as in the Block Layout card.

`BLCK, LINE, and POS`

specify the block environment and the print line and position within the environment that contains either the starting point or the termination point of a line segment.

`CHAR`

specifies the type of character which forms the line. If no character is specified, the line is formed by periods and an arrowhead at end of line (. . . X).

`ARROW`

specifies that no arrowhead is to be inserted at the termination of each line if an N is placed in this field; otherwise all lines terminate with an arrowhead.

Requirements

1. Any adjacent pair of point designations (BLCK, LINE, and POS fields) define a vertical or horizontal segment of a line (e.g., A1 01 08 A3 01 10 causes a horizontal line segment to be drawn from A1 environment print line 01 and print position 08 to A3 environment print line 01 and print position 10).

2. If the last point designation for a line segment is the first point designation for another line segment, that designation does not have to be repeated.

3. Slanted or skew lines cannot be specified. If a slanted line segment is specified, it is ignored and any remaining line segments are processed.

4. More than one line (a group of consecutive line segments) can be specified on one card by leaving one or more blank point designations between line specifications.

Comments Card (Card Type 9)

The comments card provides the facility to place special comments at any place on the chart.

Format

The card type 9 format is as follows:

COLUMN	FIELD
1-2	CHART IDENT
3	CD TYPE (9)
4-9	BLCK, LINE, POS
10	TYPE
11-80	COMMENTS

where:

CHART IDENT

is the same as in the Block Layout card.

BLCK, LINE, and POS

specify the block environment and the print line and print position within the environment that will contain the first character of the comment.

TYPE

specifies the type of comment. The options are:

- (blank) – Regular Comment starts at the location specified and extends from left to right across the chart. This comment is never moved automatically.
- H – Horizontal Comment starts at the location specified and extends horizontally across the chart. This comment is moved automatically if its starting point is located in a block environment that is moved. The comment card cannot be changed in the same run in which it is moved.
- V – Vertical Comment starts at the location specified and extends vertically down the chart. This comment is moved automatically if its starting point is located in a block environment that is moved. The comment card cannot be changed in the same run in which it is moved.
- S – Scanned Comment is identical to the Horizontal Comment except that it is scanned for a block identification. All valid block identifications are updated automatically to reflect changes in chart

identification or block locations. The block identification must be in the following format to be updated:

XXYY

where:

is a group mark (punched 12-7-8)

XX is a chart identification

YY is a block location (if YY is not a valid block location these two positions are ignored in any changes.)

COMMENTS

contains the textual information associated with the comment.

Requirements

1. The comment may continue through one or more block environments.

2. Any non-blank characters in the comment will replace any chart material specified by card types 2, 3, or 4; blanks do not replace existing characters.

3. A maximum of 70 characters can be specified by each comments card.

Changing a Master File

The master file consists of 80 character, card image, records. Each record corresponds to a single line on an Autochart code form. The first record for each chart in the master file is a chart header (card type 1).

Any chart can be changed by *preparing a header card for the chart and preparing change cards*. Through the use of the header and change cards, the Autochart system permits the user to make the following changes or additions to the master file:

CHANGE	CARD TYPES INVOLVED
Delete a chart	1
Delete a master file record	2, 3, 4, or 9
Delete a field	1, 2, or 3
Delete a block and its associated text	2 and 3
Change a field	1, 2, or 3
Move a block and its associated text	2
Change a line or comment	4 or 9
Change a chart identification	1
Add a chart	1 and at least one of 2, 3, 4 and/or 9
Add a block	2 and 3
Update Interchart cross reference	Automatically, if specified correctly with initial entry

The cards which are altered to produce the desired change are identified by the contents of the control field:

1. Card type 1 – columns 1-3.
2. Card types 2 and 3 – columns 1-5.
3. Card types 4 and 9 – columns 1-9.

An entire chart is identified by the control field of a type 1 card. The control field identification in the change card must be identical to the one in the record to be changed.

When changing a master file, the order of the cards in the input change file is not significant because the processor always sorts the input file. Sorting, however,

does require additional processing time. One requirement is that the run control card must be the first card in the input change file (see section, "Using the System"). For any change except "delete a chart," the header card must have its control field and one other field punched.

Delete a Chart

A type 1 card is prepared with the chart identification in the control field. All other fields must be blank. All records for the chart are deleted from the master file.

Delete a Master File Record

A type 2, 3, 4, or 9 card is prepared with the record identification in the control field. All other fields must be blank. If there are two or more records in the file with identical control fields, both must be treated separately. For example, to retain the first one and delete the second, duplicate the first card and prepare a delete card for the second. In these cases, the order of the input change file is significant.

Delete a Field

A type 1, 2, or 3 card is prepared with the record identification in the control field and with a \$ inserted in the first character position of the field to be deleted. All other positions in the field must be blank. (Subfields cannot be deleted.) Other fields in the record are not affected; they may be changed or deleted independently.

Delete a Block and Associated Text

Both the type 2 and type 3 records associated with that block must be deleted. Only the record identification field should be coded in each.

Change a Field

A type 1, 2, or 3 card is prepared with the record identification in the control field and the appropriate information inserted in the field to be changed. Other fields in the record are not affected. When a subfield of the type 2 card is being changed, the entire FLOWLINE EXIT field must be specified. Type 4 and 9 records cannot have fields changed; an entirely new card must be specified to replace or delete the old one.

Move a Block

The move-a-block feature simplifies the coding required to make changes which involve relocation of blocks. Only one type 2 card is required for each block

that is moved. The old block location is specified in columns 4 and 5 of the control field; the new location is specified in columns 19 and 20. This coding causes the type 2 block card, its associated type 3 text card and the H, V, or S type 9 comments cards to be moved from the old location to the new location. All valid cross references to the moved block are also changed to the new location. Other features and requirements in moving a block are as follows:

1. Except for the block type in column 19, all other complete fields in the type 2 card can be used to specify changes in the *same card* (see "Change a Field").

2. The contents of the text lines of a block cannot be changed in any way during the same run in which the block is moved (either at the old or the new location).

3. The block may be moved only to a block environment not previously used or to one that has an existing block moved out to another location in the same run. Specified connectors may require respecification if space at the new location limits their placement.

4. When a block is moved, flowlines in the *old master file* are changed automatically to reflect the new locations.

5. When a block is moved, flowlines in the new input type 2 cards *are not changed*; in fact, flowline specifications in the new input take precedence over any automatic changes.

6. Flowlines that should not be changed to the new block locations must be respecified in a type 2 change card. For example, when a block is moved and another block is inserted in its place but still in the line of flow, the flowline from the block preceding the inserted block should be respecified to enter the inserted block. (Otherwise, the flowline would go around the inserted block and enter the moved block.)

7. All new input cards which refer to a moved block must specify the *new location*. This even includes any cross references newly specified in cards from the same or other charts.

8. In order to improve line placement, a side analysis is made on all flowlines to and from moved blocks in the *old master file*. Sides with specified connectors are excluded from the analysis. As a result, flowlines may be respecified automatically by Autochart to obtain a potentially more direct line path between the blocks. Stub junctions (JUNCTION subfield) are deleted if the TO LOCATION is changed. Other characteristics of the chart such as other lines, blocks or connectors may still prevent drawing the line. Any flowlines which are specified in type 2 new input cards in the same run are not altered; therefore, the user may specify a line

in the new input file and prevent any side analysis on that line.

9. Line cards are never changed by a move. Such changes must be made by the user.

10. A maximum of 250 moved blocks per file can be processed.

Change a Line or Comment

The type 4 and 9 records must be replaced completely by a new type 4 or 9 card with the full control field the same as the one being replaced.

Change a Chart Identification

The old chart identification is coded in the control field of the type 1 card and the new chart identification is coded in NEW ID field (columns 78 and 79) of the same card. The corresponding CH ID field in all cards for the chart are automatically changed. Any change, add, or delete cards included in the same run, however, must use the *old chart identification*. If this change in chart identification changes the sequence, the records for that chart will be relocated in the file accordingly. All cross references in the old master file are changed to the new chart identification.

Add a Chart

All cards (including a type 1 card) for the new chart are placed with the new input for a file maintenance type run.

Add a Block

The type 2 and 3 cards are prepared with the control field and other fields as required to specify a new block.

Update Interchart Cross References

In order to obtain automatic updating of block identifications when blocks are moved or chart identifications are changed, the user must follow Autochart Identification Conventions. These conventions consist

of defining a block identification by specifying the chart identification and block location in the following format:

XXYY

where:

XX is the chart identification,

YY is the block location

The chart identification, XX, must consist of any two non-blank characters. The block location, YY, must be a valid block location or a double group mark (**)*; otherwise, no change will be made in the four-position block identification (XXYY). These identifications must be specified initially by the user; all changes are then made automatically by Autochart to reflect changes in either chart identification or block location. Whenever such changes are made, it is advisable to use a File Maintenance/Process All run so that charts with only cross reference changes are included in the new chart output.

Autochart Identification Conventions

In order to facilitate the automatic updating of interchart cross references, Autochart Identification Conventions have been adopted. They are summarized and illustrated in Figure 8.

Sample of Move-a-Block

Figures 9, 10, and 11 illustrate the features of move-a-block and also show how interchart cross references are changed automatically. Figure 9 represents the chart before the changes. The text within each block indicates the moves that are to take place. Figure 10 is the resulting chart after the moves have been made; the chart identification is also changed. All changes except those noted were made by the move-a-block feature. Figure 11 contains the coding required to make these changes.

* **, a group mark, is punched 12-7-8 in one column.

AUTOCHART IDENTIFICATION CONVENTIONS
(XXYY, WHERE XX=CHART ID AND YY=BLOCK LOCATION)

TYPE IDENTIFICATION	TYPE CARD	FIELD NAME (SEE CODING FORM)
1. OFF-PAGE CONNECTOR A. ENTRY AND EXIT ID B. ENTRY CROSS REFERENCE	2 2	FLOWLINE EXIT CONNECTOR ID FLOWLINE EXIT CONDITION
2. SUBROUTINE REFERENCE A. START OF EXPANSION B. RETURN FROM EXPANSION	3* 2	TEXT LINE 1 COLUMNS 17-20 FLOWLINE EXIT CONDITION

* CORRESPONDING TO A TYPE 2 CARD WITH 'S' BLOCK TYPE

SAMPLE CHART OF ABOVE USAGE

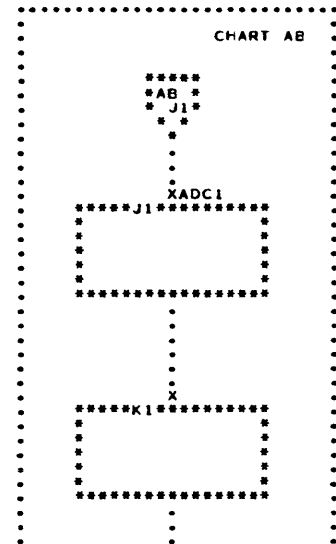
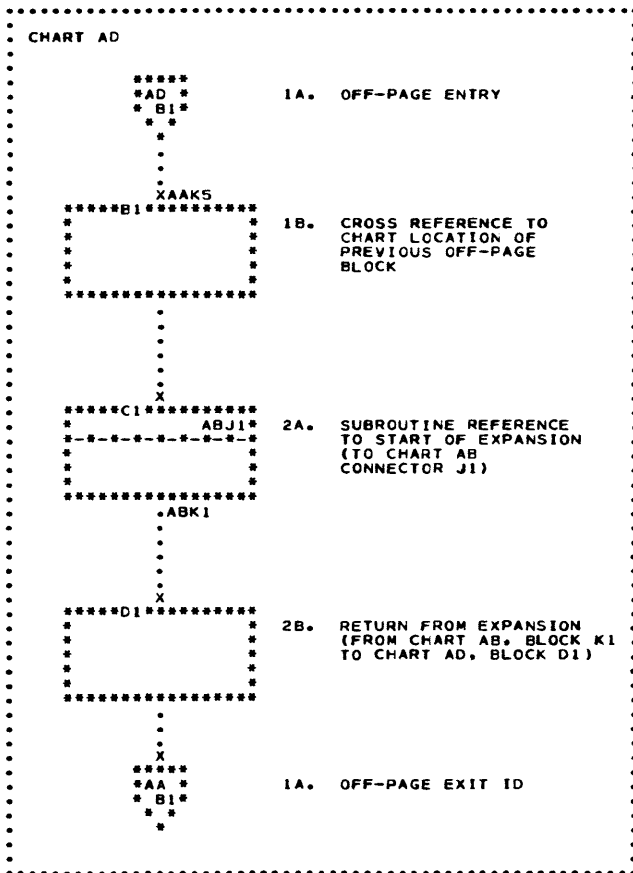


Figure 8. Autochart Identification Conventions

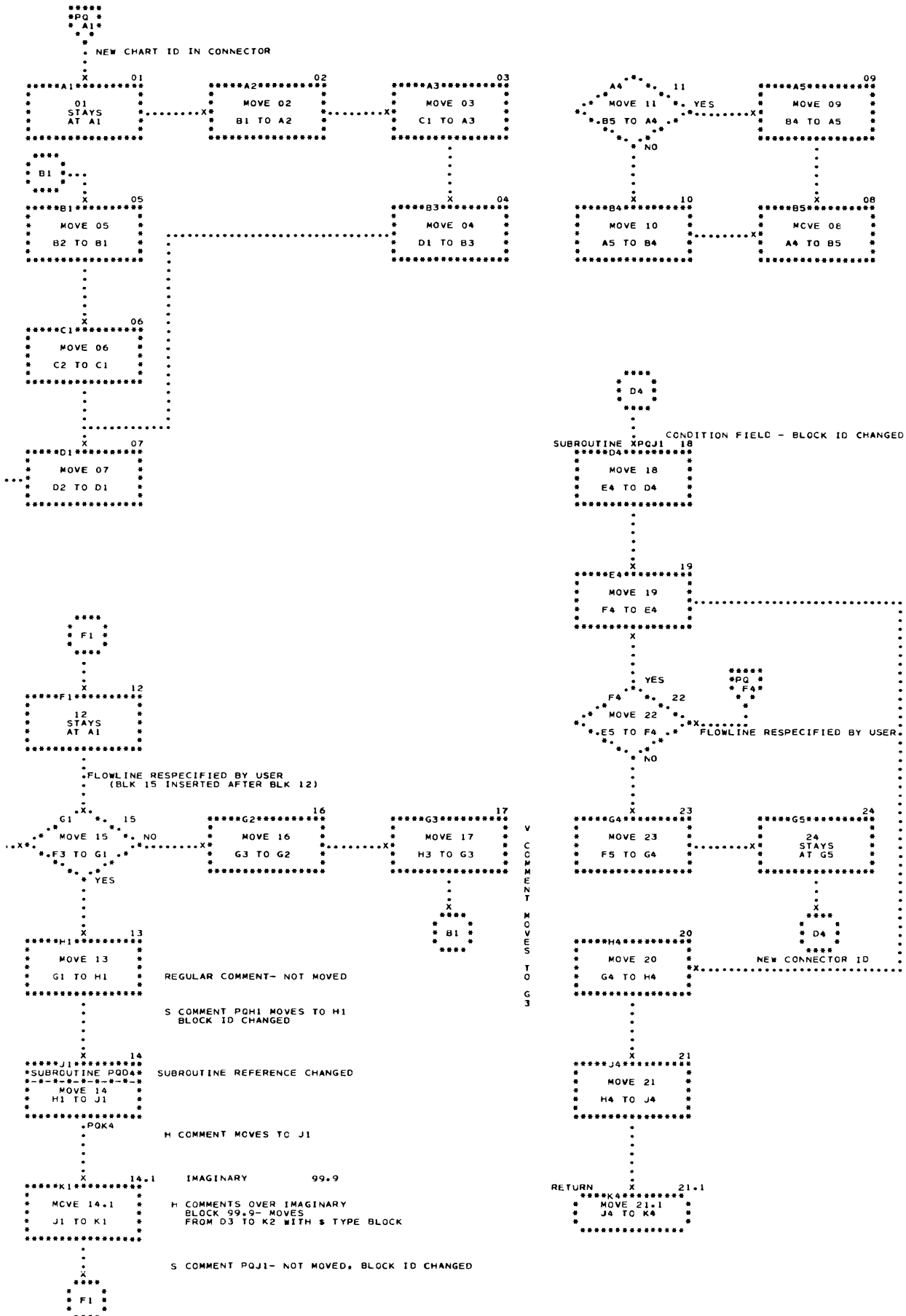


Figure 10. Sample Move-a-Block: After Change



AUTOCHART CODING SHEET

Chart Ident _____
Program Name _____

CHART HEADER (1), BLOCK LAYOUT (2), BLOCK TEXT (3)
Chart Name MOVE-A-BLOCK CHANGE CODING

Page _____ of _____
Date _____
Programmer _____

ID		PROGRAM NAME		CHART NAME		PROGRAMMER		DATE		NEW																		
1	2	3	4	5	6	7	8	9	10	11	12																	
PM	1										PQ																	
CHART IDENT	BLOCK TYPE	SYMBOLIC LABEL (TAG)	BLOCK		FLOWLINE EXIT				FLOWLINE EXIT				FLOWLINE EXIT				FLOWLINE EXIT											
			NUMBER	TYPE	LOCATION	TO LOCATION	CONDI-TION	LINE CIL	CON-NECTOR ID	TYPE CON	TO LOCATION	CONDI-TION	LINE CIL	CON-NECTOR ID	TYPE CON	TO LOCATION	CONDI-TION	LINE CIL	CON-NECTOR ID	TYPE CON								
PM ₂	B1	A2	13	21	22	23	24	33	34	37	40	41	44	50	51	52	55	56	60	61	65	67	70	71	77	78	79	80
PM ₂	C1	A3																										
PM ₂	D1	B3																										
PM ₂	B2	B1																										
PM ₂	C2	C1																										
PM ₂	D2	D1																										
PM ₂	G1	H1																										
PM ₂	H1	J1																										
PM ₂	F3	G1																										
PM ₂	G3	G2																										
PM ₂	H3	G3																										
PM ₂	A4	B5																										
PM ₂	A5	B4																										
PM ₂	B4	A5																										
PM ₂	B5	A4																										
PM ₂	D3	K2																										
PM ₂	E4	D4																										
PM ₂	F1	E4	8G1T																									
PM ₂	F4	F4																										
PM ₂	E5	F4																										
PM ₂	F5	G4																										
PM ₂	G4	H4																										
PM ₂	H4	J4																										
PM ₂	J1	K1																										
PM ₂	J4	K4																										

Figure 11. Sample Move-a-Block: Coding

This section of the manual provides the user with enough information to enable him to efficiently plan and implement the use of the Autochart system. Before using the system, however, the user should be aware of the following items:

1. The collating sequence (low to high) of the 7070/7074 is as follows:

(blank), special characters, 0⁺, A-I, 0⁻, J-R, S-Z, #, 0-9.

This is fully explained in the publication, *IBM 7070/7074 Data Processing System*, Form A22-7003.

2. Since only two characters are provided for chart identification, careful assignment of chart identification for different phases or sections of a project is desirable in order to prevent duplicate chart identifications and illogical sequences in the file.

3. The total processing time varies, depending mostly upon sorting of the input file. Consequently, pre-sorting columns 1-2 will significantly reduce the processing time of a disordered input file.

The Autochart system provides five types of processing runs. Each run is designed to facilitate a different stage in chart production. Each run is controlled by the run control card and each run can handle a maximum of 250 charts per file.

Run Control Card

The run control card specifies the type of processing desired and contains a check feature to insure that the correct master tape is processed during an FM, FA, PS, or PA run. A modified initial run control card becomes the label record for the file. The format of the run control card is as follows:

COLUMN	FIELD
1-3	(not used)
4	NUMBER OF DUPLICATES
5	(not used)
6-19	PROGRAMMER
20	QUALIFICATION INDICATOR
21-22	RUN TYPE
23	LISTING
24-30	CURRENT DATE
31-35	LEVEL
36-39	(not used)
40	NEW PROJECT-LEVEL OPTION
41-60	PROJECT NAME
61-70	(not used)
71-75	must be blank
76	ARROWHEAD OPTION
77-78	must be blank
79	MASTER FILE OPTION
80	REF

where:

NUMBER OF DUPLICATES

specifies the number of duplicates desired during a PA or FA run. The options are:

(blank) — one copy of chart produced (no duplicates)
1...9 — number of additional charts produced

These specifications take precedence over any in the chart header card.

QUALIFYING INDICATOR

specifies whether qualifying statements are to be placed on each chart. Qualifying statements may be used to specially classify charts. Two 28-position statements are permitted. For example:

Qualifying Statement A (QUALA) — "COMPANY CONFIDENTIAL"
Qualifying Statement B (QUALB) — "ACCURACY NOT VERIFIED"

They are printed at the top of each chart in a file according to the option specified in the run control card. The options are:

(blank) — no statement
1 — a one-line statement (QUALA only)
2 — a two-line statement (QUALA and QUALB)

The contents of the statement are specified by the user in a system change control card (refer to the section of this manual titled, "System Operations").

RUN TYPE

specifies the type of processing desired. The options are:

IR — Initial Run
FM — File Maintenance
PS — Process Selected
PA — Process All
FA — File Maintenance and Process All
SY — Systems Run

LISTING

specifies whether the new master listing will be produced in the Autochart output. The options are:

(blank) — listings included
N — listings deleted (if N is specified, the output consists only of charts and error messages).

LEVEL

specifies the number of times the master file has been revised. The user assigns a level to the IR run and the level is increased by 1 during each FM and FA run.

NEW PROJECT — LEVEL OPTION

specifies whether the project name and level number are to be changed. If the field contains a dollar sign (\$), the name and number are taken from the control card. If the field is blank, the name and number are taken from the old master file and the level is increased by one for FM and FA runs and automatic checks are made to verify that the proper file is being processed.

PROJECT NAME

specifies the name of the project. It is assigned in the initial run control card and becomes the part of the label record that is checked in all subsequent runs.

ARROWHEAD OPTION

specifies, if it contains an N, that all arrowheads are deleted from all lines in a file (both flowlines and card type 4 lines). This feature may be used for non-flowchart figures (e.g., organization charts).

MASTER FILE OPTION

The options are:

(blank) — produce an operator message to save the new master for IR, FM, and FA runs only.
N — In an IR run, eliminate the operator message to save the initial output master file tape.
S — In a PS run, produce an operator message to save the selected output master file.

REF

specifies whether or not block locations are inserted in the block environments of the charts that are printed as an output from the run. The options are:

- (blank) – the notations in the REF field of the header card of each chart apply.
- A – no block locations are inserted.
- X – block locations are inserted only in block environments that contain a block.

The LEVEL and PROJECT NAME fields on the run control card must be identical to the corresponding fields in the label record on the master tape except where it is to be changed using the option in column 40 of the same run control card.

Initial Run (IR)

The initial run provides the initial processing of charts at the beginning of a project and is normally used only once. The input tape for the IR run consists of the run control card followed by the cards for each chart. The IR run produces two outputs. One output contains the processed charts and the other contains the initial master file of chart specifications. The initial master file of chart specifications is referred to as the old master tape during a subsequent FM or FA run.

File Maintenance Run (FM)

The FM run allows the user to keep the master file up to date by changing, adding, or deleting charts. The old master tape is one input to the FM run. The second input tape for the FM run consists of the run control card followed by a header card for each chart the user is changing and any new input or change cards. The header card must have the control field and at least one other field punched (except when deleting a chart). The format of the new input cards is identical to the input cards used for the IR run. The change card formats are explained under "Changing a Master File." The user can update a maximum of 250 charts in a single FM run. The FM run produces two outputs. One output contains the processed charts (only charts changed or added are included) and the other contains the new master file of all chart specifications. The new master file tape is referred to as the old master tape on subsequent FM or FA runs.

Process Selected Charts Run (PS)

The PS run allows the processing of any number of selected charts from a sequence of charts on the master tape without any changes to the file. The input to the PS run consists of the run control card followed by a

header card for each chart to be processed on the new input file and the old master file of chart specifications. The output consists of the processed charts. A selected new master file may also be obtained by specifying the master file option "S" in the run control card (column 79); this option can be used to produce a new selected master file from an existing one.

Process All Charts Run (PA)

The PA run processes all the charts on the master file tape without change. The input to the PA run consists of the run control card and the old master file to be processed. The output consists only of the processed charts. An "N" in column 23 of the run control card will eliminate the listing of the master file.

File Maintenance and Process All Charts Run (FA)

The FA run provides the option of processing all charts and either altering, adding, or deleting selected charts in one run. This run combines the features of both the FM and PA runs. The input tape for the FA run consists of a run control card followed by new input or change cards. The second input is the old master tape. Only charts for which there are chart header cards and change cards are altered in the FA run. The run produces two outputs. One output consists of all the charts on the new master tape. The other output consists of the new master tape.

The specification of duplicates on the run control card overrides any specifications of duplicates by the header card for each chart.

Merging Two Master Files

Any two master files can be merged by mounting one of them as the new input tape and the other as the old master tape. This merging is possible because the label record on a master file is an "OM" run control card that functions the same as an FA run control card. The project name of the new master is taken from the new input file. The level number of the new input file will be incremented by 1 on the new master.

The files being merged *must not* contain charts that have identical chart identifications (column 1-2). Any such charts would be merged together by the sort routines in Phase I of Autochart; therefore, a preliminary run is necessary to change the chart identification on some of the files when different charts have the same identification.

This section of the manual provides the user with more detailed information about certain features of the Autochart system. This information gives the user more freedom in the coding of flowcharts and allows him to use the system to its fullest in the preparation of other graphic material.

Automatic Generation of Lines

When the Autochart system attempts to generate an automatic line from the FLOWLINE EXIT specification, the only information supplied to the system is the source and termination points of that line. The system processes these two points and attempts to determine whether a line can be drawn between the points. Lines to adjacent blocks between adjacent sides and line stubs for all other lines are drawn as the type 2 card is processed. All other lines are generated after processing all type 2 and 3 cards.

The generation of an automatic line begins after all blocks and line stubs have been placed in the block environments. Each line stub represents an entry or an exit from a block and consists of either three periods at the top or bottom of the block or four periods at the left or right of the block. The system then attempts to draw the automatic lines in a specified sequence according to the block in which each line originates. The sequence of automatic line generation is line 4, 3, 2, 1 within a type 2 card; it is by block environments K5-K1, J5-J1, . . . , B5-B1, A5-A1 within a chart. If automatic lines cannot be drawn, connectors are usually generated to indicate the logic flow. In cases in which neither lines nor connectors can be generated, the system produces a line-not-drawn message.

There are four restrictions placed on the automatic drawing of lines by the system:

1. The area of the chart (called search area) in which a line can be drawn.
2. The paths that automatically generated lines can take through a block environment (called basic routes).
3. The number of line segments searched. This limits the time to search for a line. An improper specification or a line combination requiring many search paths may lengthen the search to an impractical amount of processing time. A constant is used to limit the search.

4. A maximum of 50 automatic lines to non-adjacent sides can be drawn per chart.

Search Areas

The search for a line path is normally limited to a rectangular area between the terminal line stubs. The ends of these stubs are on opposite corners of the rectangle. The equal signs (=) in Figure 12a outline a normal search area for a proposed line from the right side of block A1 to the top of block D4. Note that the search area for a flowline from the bottom of one block to the top of another one in the same column is a single line.

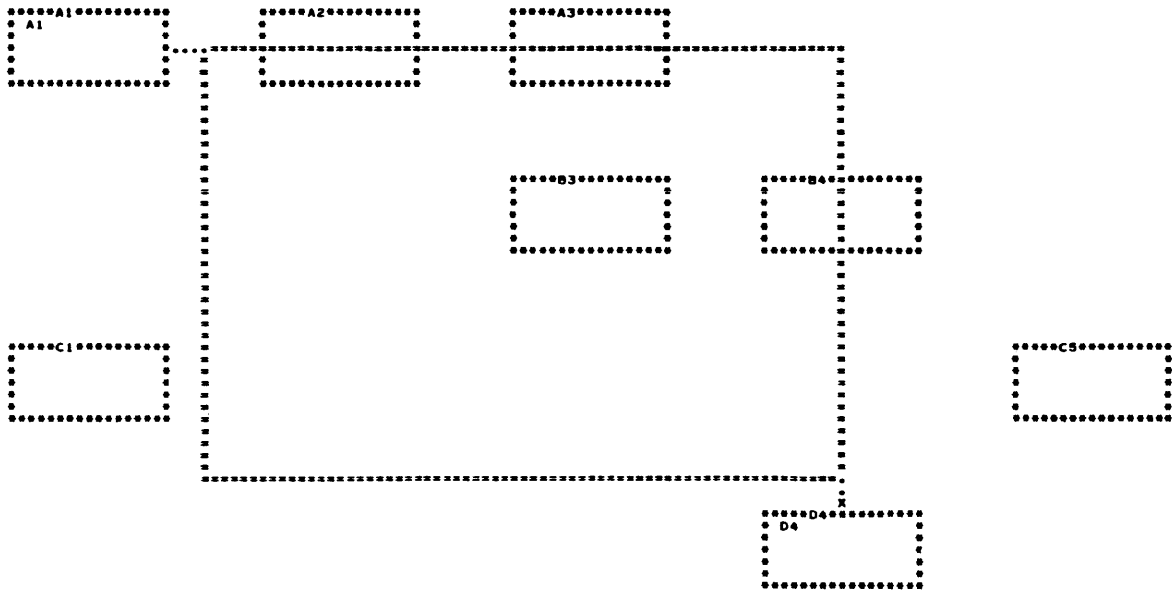
An expanded search area is used when the terminal points of a proposed line are on the same side of their respective blocks (both right, both top, etc.). The expanded search area extends to the edge of the chart in the direction of the stubs (e.g., right stubs extend the search to the right limit of the chart). The other dimensions of the search area are not changed from the normal search area dimensions. The use of an expanded search area allows the system to draw a higher percentage of lines to the same side of two different blocks than would be possible if only the normal search area were used. The equal signs (=) in Figure 12b outline the expanded search area formed when attempting to generate a line from the right of block environment F1 to the right of block environment K2.

Basic Routes

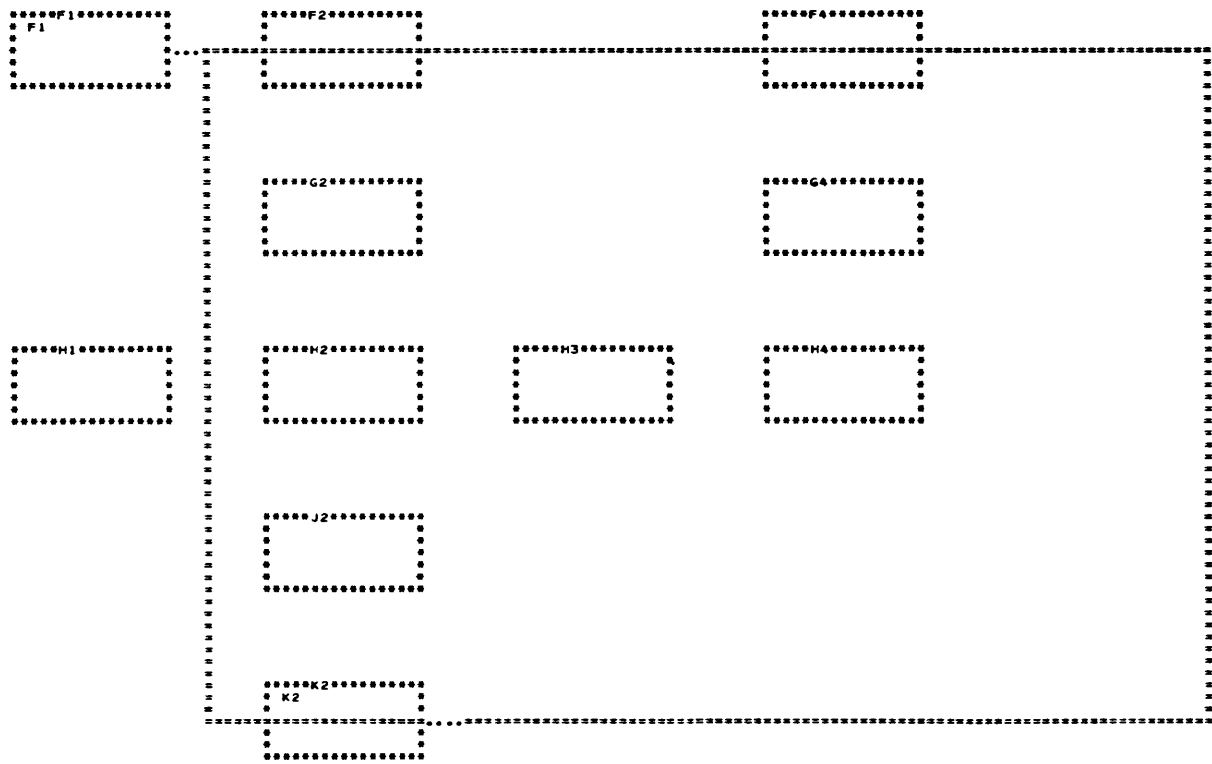
The basic routes through any block environment are shown in Figure 13. The points of intersection of these basic routes (= on Figure 13) define the nine possible turning points within each environment. Generated lines are drawn only along these basic routes and change direction only at the turning points.

Drawing the Line

The system attempts to generate a line by determining the availability of contiguous line segments which travel along the basic routes within the search area. A line segment is unavailable if any of its constituent points is already contained in another line not going to the same destination, in a block outline, in a connector, or in a line stub. Since line and comment cards are processed after automatic lines they could replace positions of a generated line. Connectors may block



A. NORMAL SEARCH AREA



B. EXPANDED SEARCH AREA

Figure 12. Search Areas

**BLOCK ENVIRONMENT
PRINT POSITIONS**

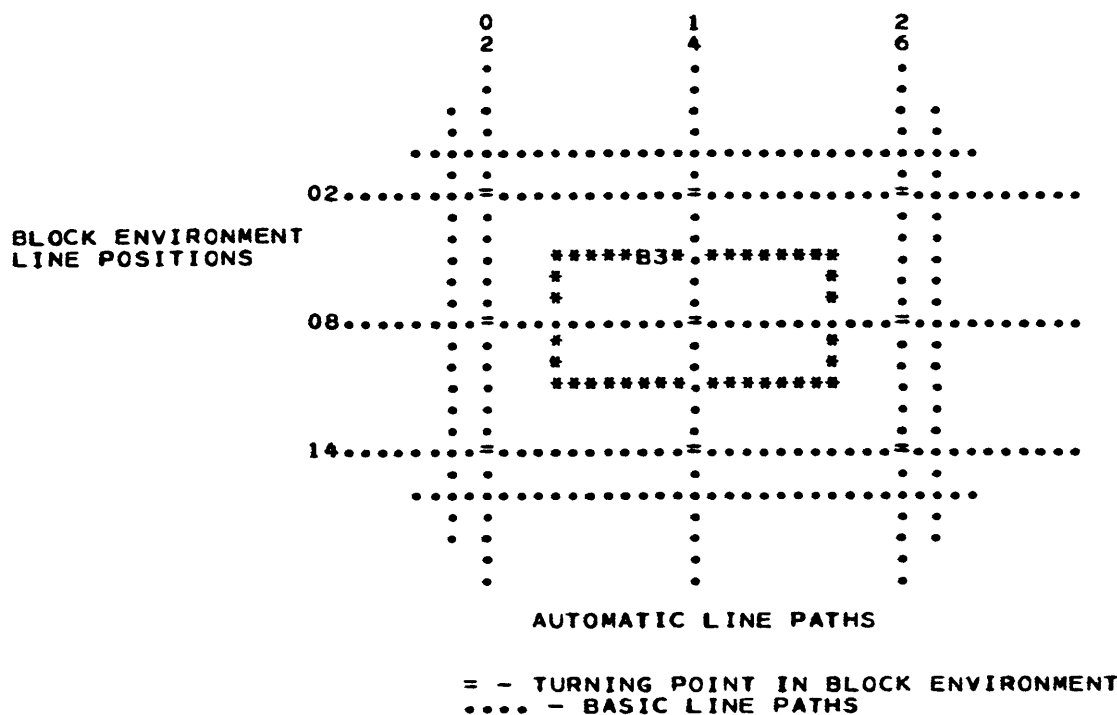


Figure 13. Automatic Line Paths

a line or another connector even though they are not directly in the path. The decisions and actions in the process of searching for a route for an automatic flowline are shown in Figure 14. The system searches along one basic route until that route is blocked. When the route is blocked, the system causes the line search path to change direction and continues the search until the system discovers a path, if one exists, between the terminal line stubs.

If the Autochart system cannot find a free route for the specified line, it investigates the possibility of an expanded search area. If a line cannot be drawn in an expanded search area, the system then investigates the possibility of crossing lines. Lines may be crossed only in the center of a block environment.

If the Autochart system can find no route for an automatically generated line, it generates a set of connectors to indicate the logic flow. Generation of connectors depends upon the availability of space. The system attempts first to generate a special connector at each terminal point. If this is not possible, the system attempts to generate regular connectors. If neither type of connector can be generated, the system produces a message indicating the lines could not be drawn.

Line Junctions

In seeking a route for an automatically generated line, the Autochart system determines whether a line has already been generated to the destination point. If such a line has already been generated and if the present line can conveniently join the existing line, the system joins the flowlines.

The system usually provides arrowheads for line junctions unless those junctions occur at a line stub. To place an arrowhead at the point of junction of a line and a line stub, the user must punch a J in the appropriate JUNCTION subfield in the block layout card.

Line junctions involving expanded lines are special cases. Depending on the line searching conditions, a junction may or may not be possible. When a regular line can join an expanded line, an arrowhead is produced. When an expanded line can join another line, it is not always possible for an arrowhead to be produced. In these cases, a type 9 comment card may be used to add the arrowhead, if desired.

Line Priority

The user can often cause the system to generate a greater number of lines or force the generation of arrowheads as desired by employing a priority assign-

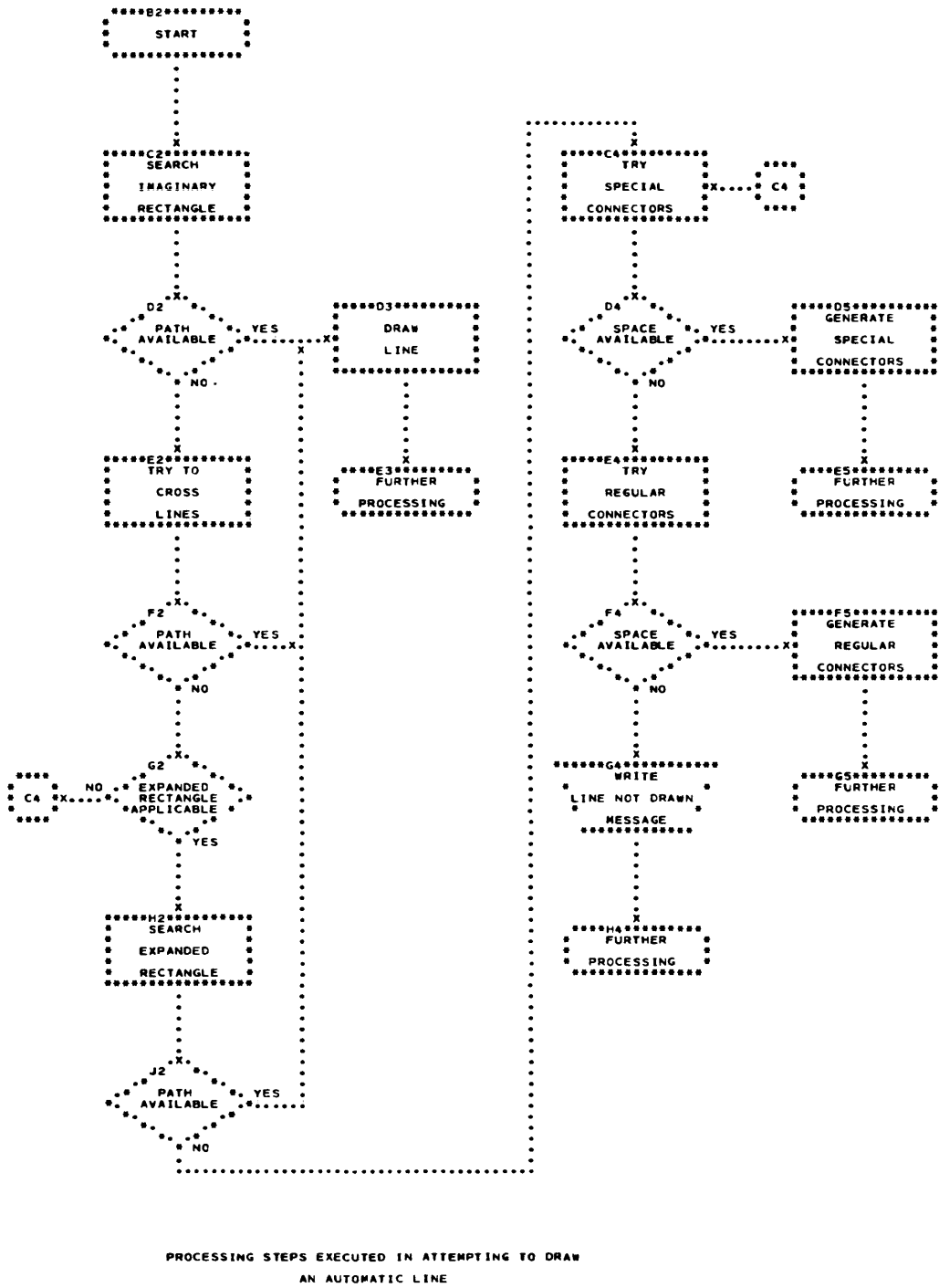
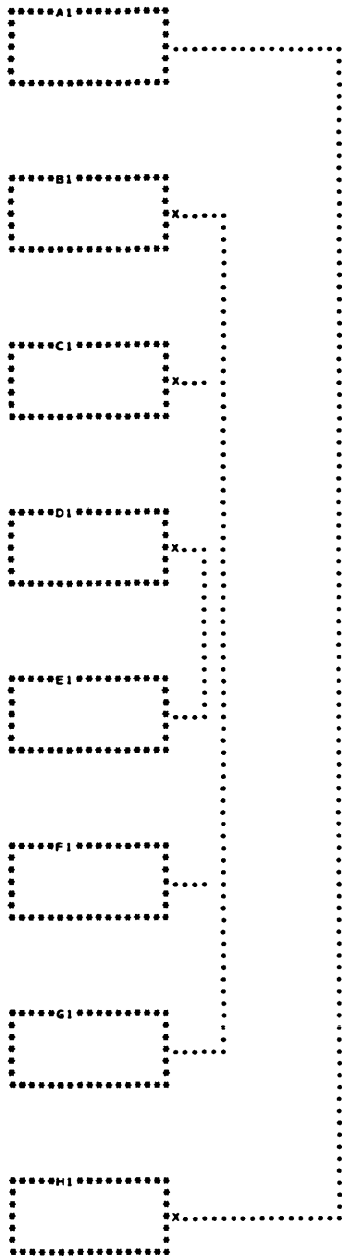
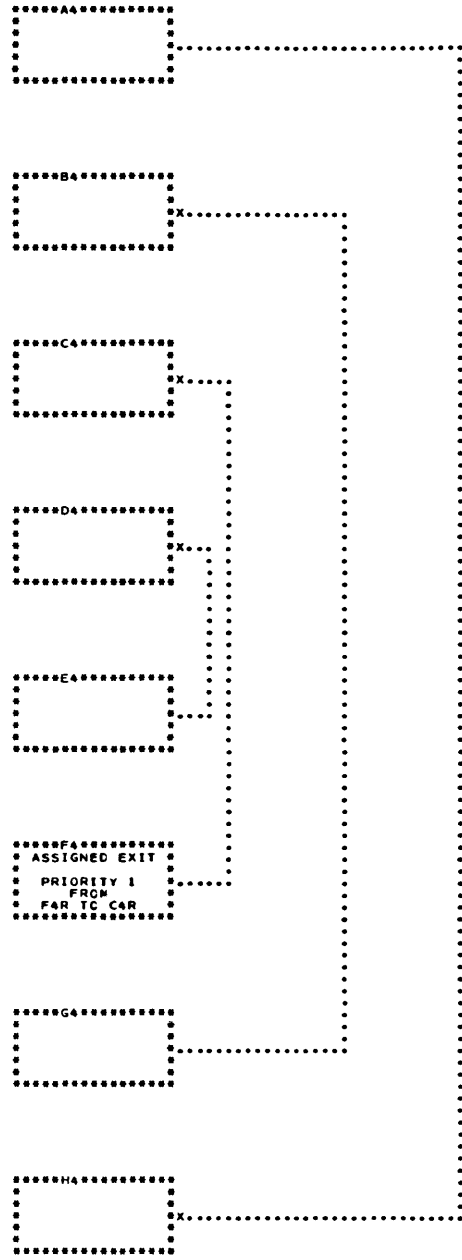


Figure 14. Automatic Line Processing



A. NO PRIORITY



B. PRIORITY

Figure 15. Priority: Lines

ment code to override the normal order (K5-K1, . . . , A5-A1) of drawing automatically generated lines to non-adjacent sides. In order to employ the priority system, the user specifies a priority of 1-9 in the appropriate LINE CTL subfield of a block layout card. ("1" is highest, blank is lowest.) When a priority system is employed, the operation is as follows:

1. The system processes all priority - 1 lines before priority - 2 lines, etc.
2. If several lines have the same priority, the processing of this group of lines proceeds in the normal sequence before the next priority group is processed.
3. If no priority is specified, the lines are processed in the normal sequence.

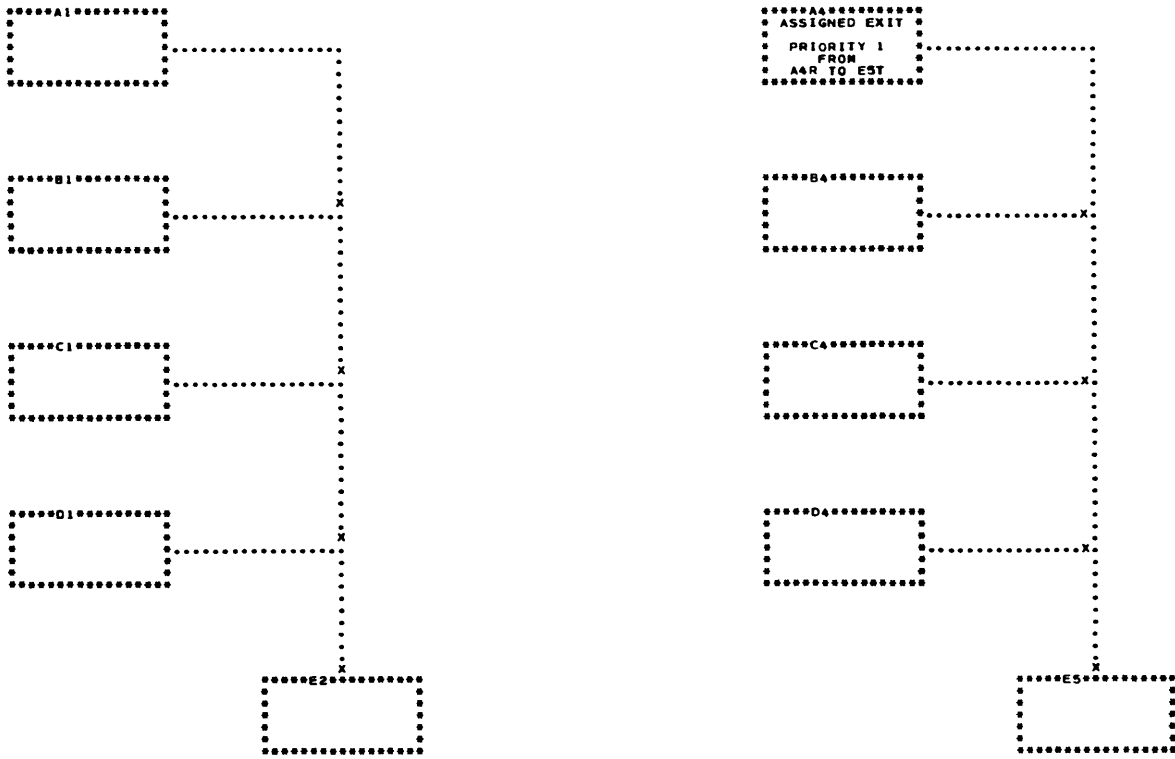
The significance of specifying priority in the control of automatically generated lines and in the placement of line junctions is shown in Figures 15 and 16. Figure 15 shows how a priority specification for one line allows the drawing of a sequence of lines that would not normally be permitted. In this example, the lines are produced in an expanded search area.

As shown in Figure 15a (no priority), the first line drawn is from G1 right to B1 right. The next line the system attempts to draw is from F1 right to C1 right. The stub from E1, however, prevents any line from being drawn in the channel nearest the blocks in col-

umn 1 and the line from C1 right to B1 right already occupies the channel nearest the blocks in column 2. For this reason the line from F1 right to G1 right cannot be drawn (only the stubs appear). The remaining lines specified are drawn as shown. The assigning of a priority of 1 to the line from F4 right to C4 right (see Figure 15b - priority) allows all lines in the figure to be drawn automatically. The line from F4 right to C4 right is drawn first, and the remaining lines are drawn in normal sequence.

Figure 16 shows how a priority specification for one line allows a normal junction of flowlines instead of inline junctions (i.e., arrowheads which do not point into a common line).

As shown in Figure 16a (no priority) the line from D1 right to E2 top is drawn first, followed by the drawing of the lines from C1, B1, and A1 in normal sequence. This sequence of drawing the lines creates inline junctions. To eliminate the inline junctions, the line from A4 right to E5 top on Figure 16b (priority) is assigned a priority of 1. This line is drawn first, followed by the remaining lines in normal sequence. As can be seen from the figure, the junctions are no longer inline junctions. Since only one line (A4R to E5T) has a priority assigned, any priority (1-9) could have been assigned to get the same result.



A. NO PRIORITY

B. PRIORITY

Figure 16. Priority: Line Junctions

Connector Specifications

Onpage connectors are normally generated automatically by the Autochart system and generally there is no need to specify any onpage connectors. In order to give the user more freedom in the production of flowcharts, however, the Autochart system provides a means of specifying onpage connectors. In the specification of onpage connectors, the user has the option of specifying any combination of onpage connectors (regular or special) in relation to the blocks involved. For example, the user can specify a special connector to be attached to the block from which the line is going (called the from-block), or he may specify a regular connector for the from-block and a special connector for the to-block, or any other configuration.

The configuration is specified by the contents of TYPE CON subfield (refer to section entitled, "Coding the System"). The character that is inserted in this subfield for each configuration of onpage connectors is as follows:

CODE	CONDITION
S	Special connectors attached to both the <i>to blocks</i> and <i>from blocks</i> .
R	Regular connectors attached to both the <i>to blocks</i> and <i>from blocks</i> .
T	Special connector attached to the <i>to block</i> and a regular connector attached to the <i>from block</i> . ^o
F	Special connector attached to the <i>from block</i> and a regular connector attached to the <i>to block</i> . ^o

^oOffpage must be either S or R.

The following are two examples of unusual connector usage:

1. When an onpage and an offpage connector of the same type are both specified or generated at the same side of a block, only the offpage connector is produced.

2. If a connector is specified in a flowline from one side of a block to the same side of the same block, one onpage entry connector is produced.

The block references in the TO LOCATION subfield are used as the identification which is placed in an onpage connector. If the user wishes to override this reference, he must specify the desired identification in the CONNECTOR ID subfield.

Connector Placement

When a connector is attached to a block, a specified area of the chart is set aside to contain that connector. The position of this area in relation to the block to which the connector is attached is always the same whether a connector is generated automatically by the system or if it is generated by specification of the user. Figure 17 shows the placement of regular and special onpage and offpage connectors in relation to a block environment.

The conditions for use of regular connectors are as follows:

1. A regular connector can be placed to the left of any block in column 1.
2. No regular connector can be placed to the right of any block in column 5.
3. Two horizontally adjacent blocks cannot have a regular connector to the right of the left block and also to the left of the right block.
4. Two vertically adjacent blocks cannot have a regular connector to the bottom of the upper block and also to the top of the lower block.
5. Two vertically adjacent blocks cannot have a regular connector to the left of the upper block and to the top of the lower block.

The conditions for use of special connectors are:

1. Special connectors can be placed above row A or below row K.
2. No special connector can be placed to the left of any block in column 1.
3. No special connectors can be placed to right of any block in column 5.

Remote Connectors

Remote connectors are similar to other connectors in all characteristics except one. The exception is that they are at a distance from the block with which they are associated.

Remote connectors are used primarily to connect the flowlines from several separate blocks to a single offpage connector. Alternatives to the use of a remote connector in this situation are to specify several separate offpage connectors or to generate some single special symbol by using the line and comments cards.

Remote connectors can be generated automatically with a combination of the imaginary block and the automatic line generation of Autochart. The line priority feature may also be applied in generating remote connectors. By specifying connectors and lines into and out of imaginary blocks, connectors can be placed at a distance from the block they serve.

Figure 18a shows the exits from three blocks (A1, B1, and C1) exiting from the chart via a single offpage connector. The configuration shown was achieved by specifying the exits from the three decision blocks to the *bottom* of the imaginary block D2 (outlined in equal signs). The offpage connector was specified from the *bottom* of the imaginary block. Since no block is drawn the lines are routed through the block area.

Figure 18b shows the same configuration as Figure 18a, but with the addition of a priority specification to eliminate the arrowhead junctions that occurred within the main flowline. In generating Figure 18b, the line from A4 to the bottom of imaginary block D5 was

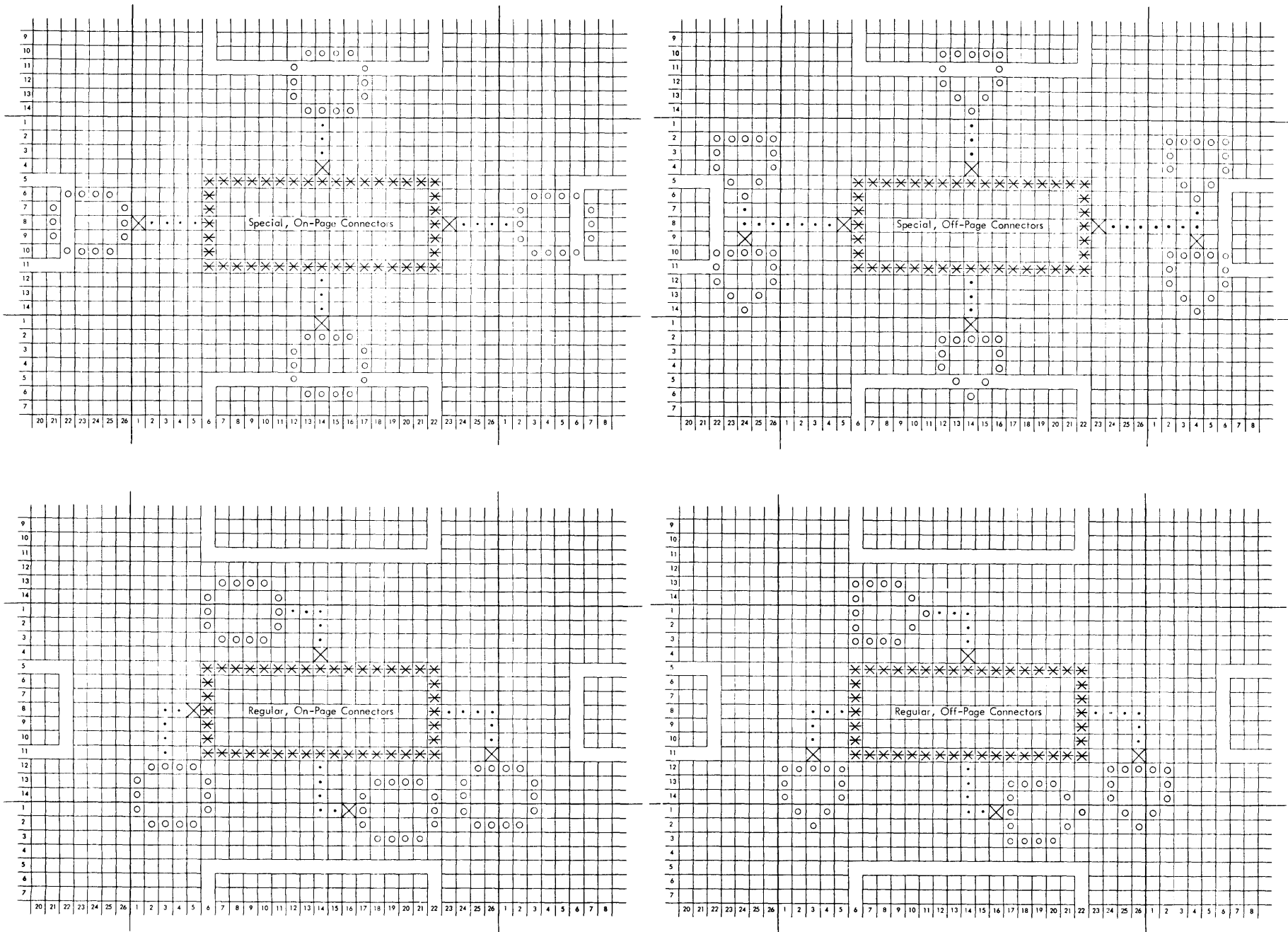


Figure 17. Connector Placement

assigned a priority which caused it to be drawn before the lines from B4 and C4.

Figure 18c illustrates another use of the remote connector. This application places the connector symbol in an open place on the chart where it can be seen easily even though the connector is associated with a block which is somewhat distant. (Block H3 is two

block environments away from the offpage connector.) The connector itself was specified to enter the top imaginary block F3. The line leading from the top of the connector to block H3 was specified from the top of the imaginary block to the top of H3. This line was assigned a priority which caused it to be generated before the lines generated from G2 and G4.

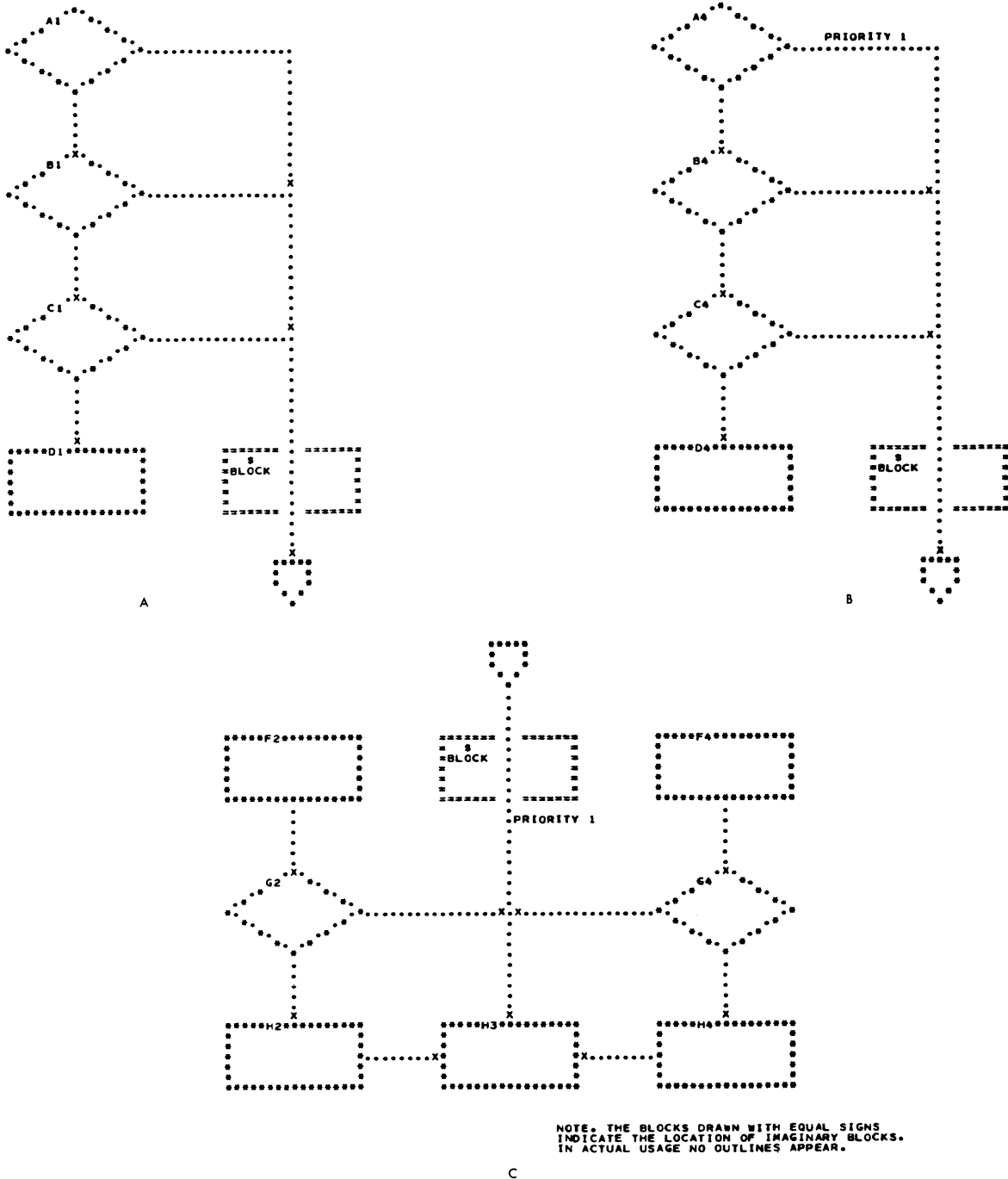


Figure 18. Remote Connectors

System Operations

This section describes the operational requirements and procedures for Autochart processing and system runs. The information in this section allows the operator to process any of the Autochart runs and to interpret any typeouts or printouts that are produced.

Input Processing

Input to Autochart must be on magnetic tape which necessitates a peripheral card-to-tape operation prior to an Autochart processing run. The records in the input tape must be unblocked, Binary Coded Decimal (BCD), card images (80 or 84 character records). The first record on the input tape must be the run control card.

Autochart also allows stacked (multifile) input. The first record of each file must be a run control card and a tape mark must follow each file on the tape. When jobs are stacked, the peripheral operator should place a special EN control card following the last file. The format of this card is:

COLUMN	FIELD
1-3	LEO
6-16	REMOVE TAPE
21-22	EN
41-55	END STACKED RUN

Use of the special EN card causes the system to type an end-of-run message after all files have been processed.

Output Processing

Output from Autochart is on magnetic tape. The tape is blocked with five logical records to one tape record. The chart output tape should be printed under program control at *eight lines per inch* on an IBM 1403 Printer with 132 print positions. Printing at eight lines per inch requires a special carriage control tape which allows the carriage to be restored to the top of a print sheet. For standard paper (11 inches long) the carriage tape is 88 line spaces long, contains a single 1 punch, and must not contain a 12 punch. Two 11-inch sheets are required for each chart. Any standard tape-to-print program which deblocks records can be used. If stacked (multifile) input is used, the chart output is similarly stacked. Master tapes are never stacked.

Usually the chart output tape need not be saved because a Process All or a Process Selected run can be used to recreate the output to obtain additional copies.

Tape Configuration

Six tapes are required for Autochart processing. The following list gives the tape, its function, and its tape unit address as assigned on the released system tape. The address assignment may be altered by the user in a System Run.

1. System — This is the system tape (tape unit 10).
2. Run Input — The new input to each run is read from this tape, which is the one created in the peripheral card-to-tape operation prior to the Autochart run. The run control card must always be the first record on this tape (tape unit 13).
3. Work — Two work tapes are required. The initial master tape created by an IR run and the new master tape created by an FM or an FA run are always produced on one of the work tapes as indicated in a type-writer message at end of job (tape units 11 and 12).
4. Old Master — This tape contains the chart specifications to be processed (tape unit 21).
5. Chart Output — This tape contains the charts produced by any run (tape unit 20, tape unit 22 for alternate output).
6. New Master — This tape contains the updated chart specification from an FM or FA run (tape unit 11 or 12).

System Runs

The system runs are used to copy or modify the system tape. The modifications include various options, tape unit assignments, and work tape density. The distributed tape is 556 BPI; it has the following format:

FILE NO.	CONTENTS	
1	Phase 1 and 2	} Autochart System in card image format
2	Storage Dump and Tape Print	
3	Systems Editor	
4	Program listing in program carriage control format	
5	Source cards in card image format	

Systems Duplicate Run

A duplicate copy of the system tape without any changes in tape configurations can be obtained by very simple procedures.

1. Mount the old system tape (distributed card image version or any subsequent storage image version) on any tape unit except 5.

2. Mount a tape for the new systems tape on tape unit 5 of the same channel.
3. Manually set tape unit 5 to desired density.
4. Set alteration switch 2 ON.
5. Load old system tape.

The new system tape of the Autochart program will be on unit 5, in storage image format as one file.

Initial System Run

The system as distributed has a standard configuration of tape assignments for the system; however, these may be altered in the initial system run or in any subsequent system runs. The System Run control card and any System Change control cards are mounted on UNITA (tape 13 on distributed version). The initial system tape can be mounted on any magnetic tape unit except 13 or any tape unit 5 and loaded to start the run. The new system tape will be produced on tape unit 5 of the channel from which the initial system tape is loaded.

The system run deck must be put on tape according to the following specifications:

1. Unblocked, card-image (80 characters) records.
2. Binary Coded Decimal (BCD) mode.
3. Even parity.
4. Density as required by system tape and 7070/7074 setup.

The system run control card must be the first record on UNITA (13, initially). It has the following contents:

COLUMN	CONTENTS
1-20	(not used)
21-22	"SY" - designates a system run control card
23	"X" specifies low density for the new system tape.
24-30	(must be blank)
31-35	Version of current system
36-40	Change level of current system tape
41-80	(not used)

If changes to the system configuration or system options are required, any one or more of the system change control cards should follow the system control card on tape UNITA (13, initially).

The system change control cards are summarized in Figure 19. All system change control cards are typed out during a system run.

Subsequent System Run

The method is identical to the initial system run except that the system tape input will be in storage image format. The system run control cards will be on UNITA according to assignment of previous system run (initially 13).

Columns 6-10	Field Length (Starting at Column 21)	Meaning	Assignments on distributed tape
7070 or 7074	XXXX	A four-digit constant controls the number of search attempts for a given line so that excessive time is not used. For 7074 the suggested one is 9995; for 7070 it is 5000. If columns 21-25 are blank, the suggested values are substituted. If columns 21-24 are punched, then its value is substituted for the standard one.	9995
UNITA	XX	Input or change tape, channel and unit	13
UNITB	XX	Chart output tape	20
UNITC	XX	Old master tape	21
UNITD	XX	Work tape or new master	11
UNITE	XX	Work tape or new master	12
UNITF	XX	Alternate output unit (channel same as UNITB)	22
DENS	XX	HI - Input, work, and outputs high density LO - Input, work, and outputs low density	LO
QUALA	(28 character maximum)	Qualifying Indicator A prints on charts as indicated by run control card (see USING THE SYSTEM section of this manual)	blanks
QUALB	(28 character maximum)	Qualifying Indicator B, a second line similar to QUALA	blanks

Figure 19. System Change Control Cards

Operational Procedures

The operational procedures fall into the following three categories:

1. Pre-processing which transfers the contents of the cards to tape.
2. IBM 7070/7074 operations which process the Autochart run and produce the output tapes.
3. Post-processing which prints the Autochart output tape.

The operation procedures may be combined for many jobs. This is discussed under the heading, "Stacked Job Processing."

Preprocessing

The input deck must be put on tape according to the following specifications:

1. Unblocked, card-image (80 or 84 character) records.
2. Binary Coded Decimal (BCD) mode.
3. Even parity.
4. Density as required by system tape and 7070/7074 setup.
5. An end-of-file indication (tape mark) must separate each file on the new input tape.

Inputs can be stacked several files to a tape. An EN control card (described under "Input Processing" in this manual) should be placed following the tape mark of the last file.

7070 /7074 Operations

The tapes (assigned UNITA through UNITF) are required for Autochart and vary according to the run being executed. By run type, the required tapes are:

1. System Run and Duplicate Run
 - System Tape
 - UNITA Run Input
 - Updated System Tape (unit 5 on same channel as System Tape)
2. All Other Runs
 - System Tape
 - UNITA Run Input (stacked)
 - UNITB Chart Output (stacked)
 - UNITC Old Master (not required for IR)
 - UNITD Work Tape
 - UNITE Work Tape
 - UNITF Alternate Chart Output (not stacked)

All Alteration/Overflow switches should be OFF for a normal run.

Alteration Switch 1 ON causes the output for a job to be written on the alternate tape instead of the normal chart output tape. For this condition, all messages referencing the output tape are altered to refer to the proper tape unit. The use of this alteration switch allows the operator to separate certain outputs during a stacked run.

Alteration Switch 2 is used for a system duplicate run.

Alteration Switch 3 should never be ON during an Autochart run. This switch is used for testing purposes

and destroys the new master tape on consecutive runs.

Alteration Switch 4 allows temporary patches in 7070 standard program card format which are to be made on the system. The cards are placed into the console card reader (7501) in the following order:

1. Patches to Phase 1 (if any),
2. Execute card for Phase 1,
3. Patches to Phase 2 (if any),
4. Execute card for Phase 2.

The cards must be in that order and only alter processing for a single run.

To initiate processing, perform machine setup as follows:

1. Set status keys to RUN mode.
2. Set tape density switch.
3. Mount Systems Tape.
4. Load System Tape via the Load Program or use keyboard:

```
0000 - 8C01U10004
0001 - 0100300010
0002 +5100C10002
```

where:

C = Channel
U = Unit

5. Depress COMPUTER RESET and START.

To provide for stacked runs, the chart output is not rewound automatically at the beginning of a run. The operator must rewind UNITB or UNITF at the beginning of a series of jobs.

Figure 20 summarizes the procedures used for restart options following error messages or unscheduled halts. Automatic storage prints are produced on failures to restart. If the failure is due to program malfunction, the storage print should be included with the APAR which is submitted by the IBM systems engineer.

MESSAGE AND HALT CONDITIONS	OPERATIONAL OPTIONS AND ACTIONS	
	START	COMP RESET, START
(error message) JOB DISCONTINUED	Restart Phase	Go to next job
PROG CHECK JOB DISCONTINUED	Restart Phase	Take Storage Print
(first unscheduled halt or error)	-	Restart Phase
(second unscheduled halt or error)	-	Take Storage Print
(storage print unscheduled halt)	-	Get STOR PRINT FAIL message
STOR PRINT FAIL	Retry Storage Print	Go to next job
END PRINT	Call Tape Mark & Tape Print Utility	Go to next job

Figure 20. Restart Option Summary

Post Processing

The chart output tape from an Autochart run must be printed according to the following specifications:

1. Density as generated by the system and peripheral requirements.
2. Carriage spacing: 8 lines per inch.
3. Carriage tape: Autochart carriage tape (see "Output Processing").
4. Paper setting: standard.
5. Carriage control: program.
6. Sense switch: for tape-to-printer operation.

Stacked Job Processing

When working with stacked jobs, the following operating instructions must be followed between jobs:

1. Mount a new master tape, if applicable, and
2. Depress COMPUTER RESET and START to begin processing the next job.

The flowchart in Figure 21 illustrates the logic of stacked job processing; it also illustrates programmed restart. Blocks representing manual operations are marked: MANUAL PROCEDURE.

Summary of Input/Output Requirements

The following table summarizes these requirements:

INPUT/OUTPUT	TAPE UNIT	IR	FM	FA	PS	PA
Old Master	C		X	X	X	X
Run Control Card	A	X	X	X	X	X
Header Card		X	X	X	X	
Type 2, 3, 4 or 9 Cards		X	X	X		
New Master	D or E	X	X	X	X2	
Processed Charts	B or F	X	X1	X	X2	X

NOTE: X1, only for these charts added or changed by user.
 X2, only for these charts specified by header cards.
 Unit F in place of B if alteration switch 1 is on.

Messages

Messages in the Autochart system can appear either on the chart output tape or on the console typewriter output. Messages on the chart output tape either precede the file of charts or are associated with the input listing for a given chart. The messages typed out by the console typewriter consist of either normal typeouts, which contain information typed during every run and indications of minor contingencies (e.g., tape unit not ready, etc.), or typeouts which require operator intervention. The typeouts which require operator intervention consist of the catastrophic errors (e.g., invalid characters, incorrect system tape, wrong length record, etc.), and may require the premature termination of the run.

The message types are listed as follows:

1. Messages associated with chart output tape
2. Typewriter messages
3. Systems run typewriter messages

Messages Associated with Chart Output Tape

An asterisk (*) preceding a message below indicates that there is a flag "ERR" in left margin of the listing to warn the user to take corrective action before the next run.

ANOTHER REEL FOLLOWS

This message is placed as the trailer record on the output file when an end of reel is encountered while writing charts on the file. It alerts the peripheral operator and user to expect continuation on another reel.

AUTOCHART VERSION xxxxx MODIFICATION LEVEL yyyy

This first line of an output listing shows the version and level of the Autochart system being used.

*BLANK ID

A chart identification is sensed which contains either one or two blanks. If this condition is sensed for a chart header card, none of the cards for that chart are processed. If sensed for a card other than a chart header card, the card is deleted.

BLOCKS MOVED FROM — TO

Appears as a heading line for a list of moves for a particular chart. (One for each chart having moves specified.)

*CHART xx DELETED

Improper specification of a head card may cause this. It is not really an error if the user specified that the given chart be deleted (a standard option of the FM and the FA runs). The "xx" refers to the chart identification of the deleted chart.

*CHART xx NOT ON MASTER

The master tape does not contain the chart specified for processing. The "xx" refers to the chart identification of the chart not on the master tape.

CHART zz IS NOW aa

When a chart ID is changed:

zz is old chart ID
 aa is new chart ID

CHARTS SELECTED

This is a header line which precedes the list of charts selected for processing during a PS run.

*CONNECTOR EXCEEDS CHART

A connector is specified which extends beyond the boundaries of the chart; e.g., a connector to the right of any block in column 5 would cause this message to appear. Processing of the flowline is terminated when the error condition is sensed; therefore, either one or neither of the connectors may be drawn.

***COORDINATE MISSING**

Only one set of line coordinate points is specified for a line on the line card (at least two sets of line coordinate points are required to define a line). No processing is effected for the single set of line coordinate points. Under certain conditions, this message may also appear in conjunction with the skew line message.

***DUPLICATE CHART FOLLOWING CARDS IGNORED**

Multiple charts with the same chart identification are sensed. The charts with a common identification are not processed.

***FIFTY LINES EXCEEDED**

More than 50 automatic lines connecting non-adjacent sides were specified for a given chart. Lines in excess of 50 are not processed.

INITIAL MASTER FILE

This is a header line which precedes the list of charts on the initial master tape.

***INVALID BLOCK TYPE X, CARD IGNORED**

An invalid block type is specified on the block layout card. The card is ignored; it remains on the master file and the field must be corrected. The "x" refers to the character erroneously specified as a block type.

***INVALID CARD TYPE**

A card type other than one of the standard Autochart types is sensed. The card is deleted from the file.

***INVALID BLOCK LOCATION**

An invalid block environment is specified in columns 4-5 of Autochart card types 2, 3, 4, or 9. The card is deleted from the file.

***INVALID CHART LOCATION xxyyyy**

An invalid block environment or an invalid point within a block environment is specified on a line or a comment card. The "xx" refers to the invalid block environment, the "yyyy" to the invalid point within the environment. The field containing the erroneous specification is not processed; other fields, if any, are processed.

***INVALID CONNECTOR TYPE X**

A character other than one of the standard Autochart indicators is specified in the TYPE CON field. The "x" indicates the incorrect character. The flowline exit or entry containing the invalid specification is not processed; other flowline exits or entries, if any, are processed.

***INVALID DUPLICATE NUMBER**

A non-blank, alphabetic character is specified as the number of duplicate charts desired. Only the original chart is processed.

***INVALID FLOWLINE, FIELD DELETED**

An invalid flowline exit has been detected, the invalid field is deleted from the card and processing continues. If the card is a change card deleting the invalid field, it may cause it to look like a delete card, thus causing the block to be deleted.

***INVALID SIDE X**

An invalid side is specified in a block layout card. The "x" refers to the character incorrectly specified as a side. Processing of the flowline is terminated when the error is sensed. Other flowline exits, if any, are processed. The flowline should be corrected.

NEW MASTER FILE

This is a header line which precedes the list of charts on the new master tape.

***NO CHART SPECIFICATIONS**

The specifications for a chart consist of only the chart header card. The message follows the header.

***NO CHARTS PROCESSED**

This indicates that no charts were processed for the job just completed. Such a condition can arise from lack of input or improper input.

***NO HEADER FOLLOWING CARDS IGNORED**

No chart header card precedes the other cards for a given chart. The chart with no header is not processed. (This message also can occur if the user has included extraneous, other than header cards, in his input to the PS run.)

***NO LINE OR CONNECTOR CAN BE DRAWN FOR**

XXX AND XXX
XXX AND XXX

This series of messages occurs at the end of the input listing if Autochart is unable to draw an automatic line and also cannot generate a connector set in place of that line. Each "xxx" refers to a terminal location (block environment and side) which could not be processed.

***NO MATCH FOR THIS BLOCK DELETE CARD**

A type 2 or 3 delete is encountered which has no match on the master file. It is deleted from the file.

***NO MATCH FOR THIS BLOCK MOVE CARD**

A card is encountered which specifies a block move for a non-existent block. It is considered to be an error and deleted from the file. The user should be

warned that new cross references to the block may be wrong; the whole run may be invalid.

***OVERLAPPING CONNECTOR IN FLOWLINE EXIT X**

A connector is specified which overlays some portion of another connector or some portion of a block. The "x" indicates the number (1-4) of the flowline exit which could not be drawn. Processing of the flowline is terminated when the error is sensed; therefore, either one or neither of the connectors may be drawn.

***RUN CARD DOES NOT MATCH OLD MASTER**

RC LEVEL — XXXXX — RC PROJ
OM LEVEL — XXXXX — OM PROJ

This is printed on the output listing to inform the user that the level and project specified on the run control card does not agree with the level and project of the old master.

***SKEW LINE XXXXXX XXXXXX**

A line segment specified on the line card is neither vertical nor horizontal. The skew segment of the line is not processed; however, any vertical or horizontal segments specified on the card are processed. The "x's" represent the skew coordinates.

***ZZ DUPLICATE CHART, CHK REFERENCES**

Warns user that two charts exist on the file with the same ID and may be sorted together. This may invalidate the entire run due to changed cross references which may be in error.

ZZ2 XX TO YY INVALID MOVE, CHK REFERENCES**

An invalid move specification has been encountered.

zz is chart ID
xx is old location
yy is proposed new location

The message occurs if either location is invalid. No move is executed. The user should be warned that new cross references to a moved block may be wrong and the whole run may be invalid as a result.

***250 CHARTS EXCEEDED OTHERS NOT PROCESSED**

The user attempted to place more than 250 charts on the master tape. Charts in excess of 250 are not processed.

Typewriter Messages

AUTOCHART XX

YYYYYYYYYYYYYYYYYYYY ZZZZZZZZZZZZZZZZ

This message always appears for each run. It is a header line which identifies the program being executed. The "xx" refers to the run type being processed: IR, FM, PS, PA, FA or OM. The "y's" represent the project name specified in the run control

card of the job being processed. The "z's" represent the programmer name specified in the same run control card.

CHART XX HAS NN INVALID ALPHA CHARACTERS

Invalid alphabetic characters are sensed by Autochart. Invalid alphabetic characters may arise from internal processing errors. The "xx" refers to the chart containing "nn" invalid characters.

INITIAL MASTER ON TAPE XX

This message always occurs during an IR run. It indicates that the initial master is on tape unit xx.

INVALID RUN TYPE JOB DISCONTINUED

Run type not one of the following: IR, FA, FM, PA, PS, SY, or OM.

JOB DISCONTINUED

This message usually follows another error message. There are two options:

START — To restart the job
COMPUTER RESET, START — To process the next job

JOB COMPLETED

This indicates that the processing has proceeded to the end of the job. Mount next old and new masters and depress COMPUTER RESET and START to go to next job.

MOVE TABLE IS EXCEEDED BY XXX CARDS JOB DISCONTINUED

Move table overflow has occurred. "xxx" indicates the number of cards over 250. The job is discontinued.

NEW MASTER ON TAPE XX

This message occurs during FM and FA runs only. It indicates that the new master is on tape unit "xx".

OUTPUT EOR, MOUNT NEW XX

The chart output tape has reached the end-of-reel condition before all chart output is written on that tape. The operator should mount a tape on unit xx and depress the START key to continue processing. The output for the job being processed may bridge reels. Programmed restart is inoperative for the job whose output bridges reels. If printing the listing, it will continue on the new reel; if printing the chart, it will start the chart again on the new reel and continue the job.

PROGRAM CHECK JOB DISCONTINUED

The program has detected some type of error. The job is not allowed to continue.

POSITIONING FAIL

This message occurs when Autochart is unable to properly position the stacked input tape during a restart condition. The operator may depress START to retry repositioning once. Should the retry fail, the job currently being run is incompletely processed. At this point, the operator may elect to manually position the tape and restart the system or to terminate the run, leaving the current file and subsequent files, if any, unprocessed. The message, JOB DISCONTINUED, is not typed.

RESTART X

A programmed restart of the Autochart system has been initiated. The "x" is a code identifying the type of restart executed.

- 1 – Stacked input not yet EOF (Phase 1)
- 2 – Stacked input EOF (Phase 1)
- 3 – Phase 2

RUN CARD DOES NOT MATCH OLD MASTER

```
RC LEVEL  nnnnn
OM LEVEL  nnnnn
RC PROJ   xxxxxxxxxxxxxxxxxxxx
OM PROJ   xxxxxxxxxxxxxxxxxxxx
```

This series of timeouts can occur during any run except IR. It occurs if the LEVEL and PROJECT NAME fields specified on the run control card do not match the corresponding fields on the old master tape. The "n's" refer to the level numbers, the "x's" to the project names. (RC is run card, OM is old master.)

SELECTED MASTER ON TAPE XX

This message occurs during a PS run only. It indicates that the new master is on tape unit "xx".

SHORT TAPE III JOB DISCONTINUED

Typed upon encountering an end-of-file condition while writing out a new master file. Only the output file has multi-reel capability. The master files must be single reel (250 charts maximum).

STOR PRINT FAIL

This message occurs when both an attempt at restarting the Autochart program and one attempt at taking a storage and/or tape print have failed. The operator may depress START to attempt execution of the utility program once more or may depress COMPUTER RESET and START to process the next job. Irrespective of the option the operator elects, the job being run at the time that this message occurs is incompletely processed.

SYSTEM TAPE ERROR

An error is encountered in loading the system tape. Such an error may be caused by a tape unit malfunction or by a bad tape record.

TAPE XX 1ST REC IS EOF JOB DISCONTINUED

No input cards follow the run control card for an IR, FM, FA, or a PS run. It also occurs if an end-of-file condition is sensed in reading the first record on any tape at any time during execution of the program. The "xx" refers to the tape at end of file.

TAPE XX NOT READY

This message can occur during any run if a tape unit required by Autochart is not in ready status. The operator should make the appropriate unit (indicated by "xx") ready and depress the START key.

TAPE XX READ FAIL

Execution of the read command is attempted 100 times before this message is typed. The operator can successively depress START, each depression effecting a series of 100 additional attempts. The message, JOB DISCONTINUED, is typed if the third series of additional attempts did not eliminate the error; in this case, the standard job discontinued options apply. The "xx" refers to the tape from which a record cannot be read properly.

TAPE XX WRITE FAIL

Execution of the write command is attempted 60 times before this message is typed. The operator can successively depress START, each depression effecting a series of 60 additional attempts. The message, JOB DISCONTINUED, is typed, if the third series of additional attempts did not eliminate the error; in this case, the standard job discontinued options apply. The "xx" refers to the tape on which a record cannot be written properly.

TEST XX

Typed whenever a run is started with alteration switch 3 ON. Used for testing only. xx is run type. Input is stacked, output is stacked, and new master is not saved. Job should be restarted after turning alteration switch 3 OFF.

WLR TAPE XX JOB DISCONTINUED

This indicates a wrong length record. It occurs if other than a card-image record (80 or 84 characters) is read. The xx refers to the tape unit.

System Runs Typewriter Messages

AUTOCHART SYSTEM RUN

Indicates the beginning of an Autochart system run.

AUTOCHART SYSTEM RUN COPY

Indicates a system duplicate run (alteration switch 2 on).

CARD IGNORED

An invalid system run option card has been found. The first 35 characters of the card in error are typed preceding the card ignored message.

nn WRITE FAILS

nn is the number of temporary write failures encountered while writing the new system tape. It is a warning message only, the tape is usable.

RUN COMPLETED

This indicates a successful completion of a system run or system duplicate run.

SYSTEM TAPE ERROR. RUN DISCONTINUED

A permanent read error is encountered in reading the old system tape.

TAPE xx FAILING

Indicates a permanent read or write error on tape xx.

VERSION/LEVEL DO NOT MATCH — RUN DISCONTINUED

The version and level fields of the system run control card do not match the current system tape. The run is discontinued. This can also be caused by an invalid system run (e.g., previous patches not in the system).

VERSION xxxxx MODIFICATION LEVEL yyyy

xxxxx is the current version and yyyy is the modification level of the system tape being copied.

Appendix A: Typical Flowchart Sample

Figures 22 through 24 illustrate the steps in obtaining an Autochart:

1. Rough draft on Flowchart Worksheet
2. Coding Forms for Chart
3. Listing of the coding and output chart

A careful study of this sample provides the user with an understanding of the steps required to obtain an Autochart.

Appendix B: Detail Card Layout

Tables 1 through 8 detail the layout of each card used in Autochart processing. These tables summarize the card layouts for easy reference. Note that all of these tables were prepared using the Autochart System.

Appendix C: Autochart Output Overlay

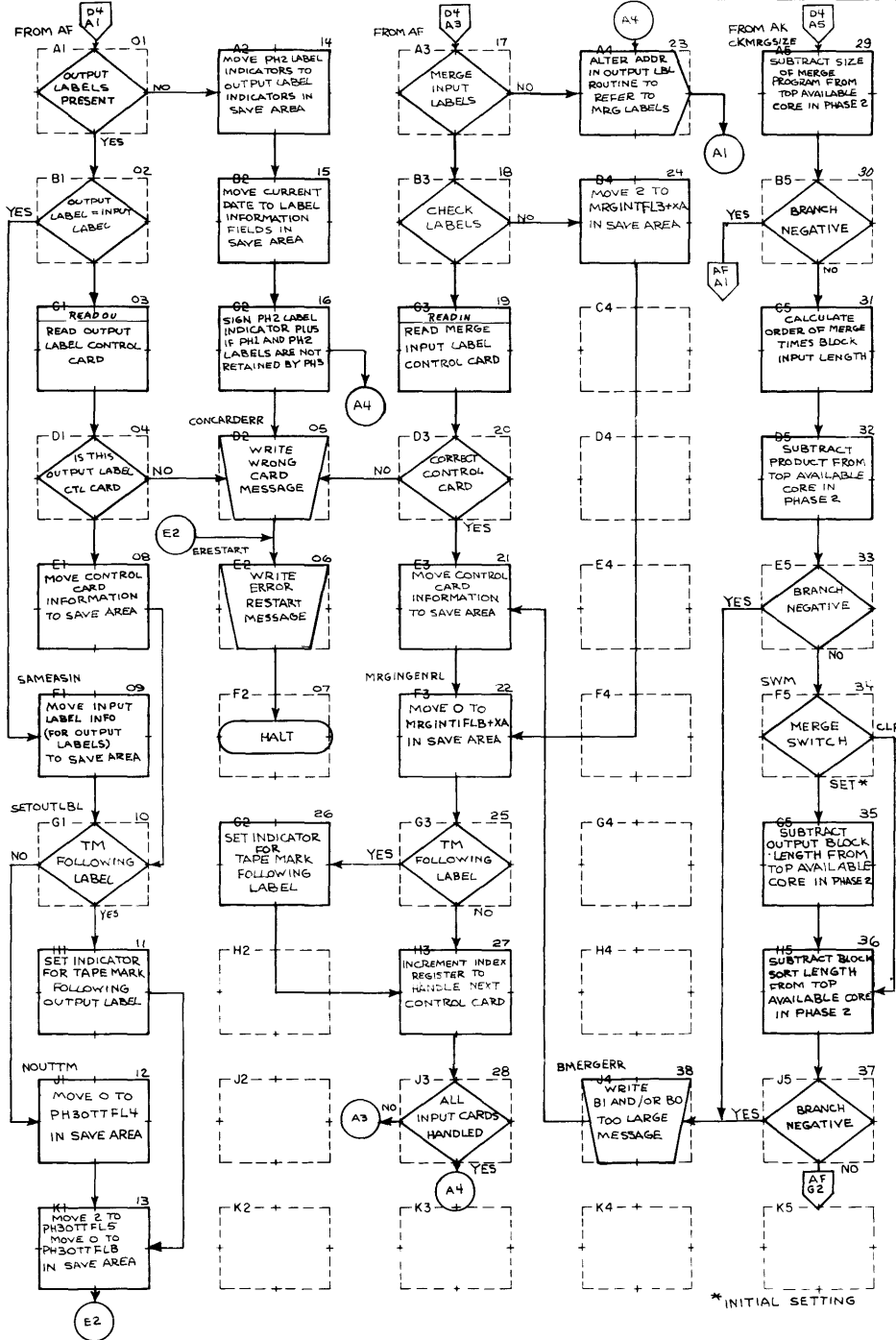
Figure 25 is a reproduction of a transparent overlay sheet (Form X28-6770). This overlay can be used with the actual printed output charts to aid in positioning or changing lines and comments.

IBM FLOWCHART WORK SHEET (AUTOCHART)

Form X20-801.
Printed in U.S.A.

PROGRAMMER: _____ PROGRAM NO.: _____ DATE: 17 JUL 63

CHART ID: D4 CHART NAME: TYPICAL FLOWCHART PROGRAM NAME: _____



• Figure 22. Typical Chart: Worksheet



AUTOCHART CODING SHEET

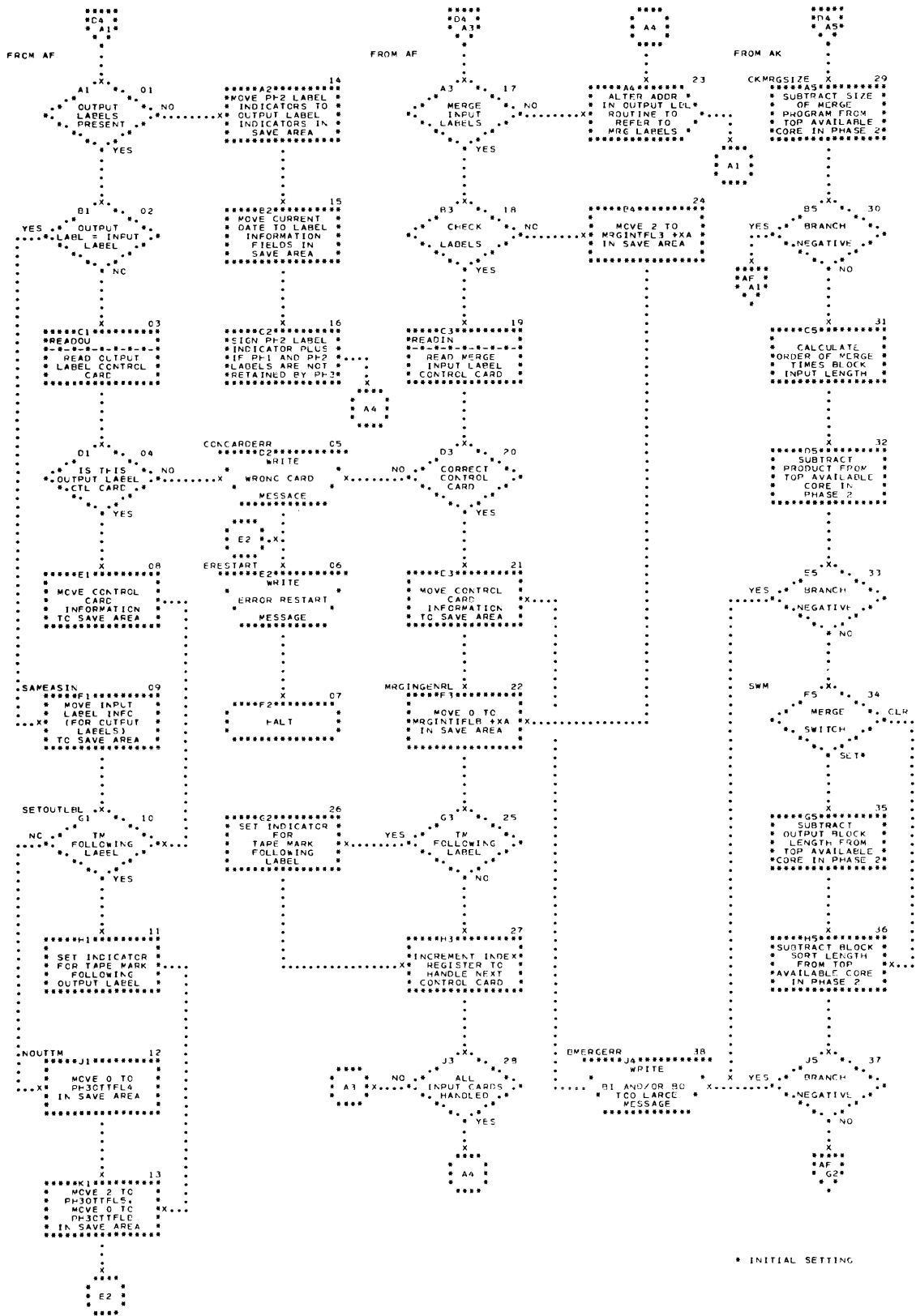
Chart Ident D4
Program Name AUTOCHART

CHART HEADER (1), BLOCK LAYOUT (2), BLOCK TEXT (3)
Chart Name TYPICAL CHART

Page of
Date 7/17/63
Programmer J. DOE

CHART IDENT	BLOCK TYPE	BLOCK LOCATION	SYMBOLIC LABEL (TAG)	BLOCK		FLOWLINE EXIT				FLOWLINE EXIT				FLOWLINE EXIT				FLOWLINE EXIT				
				NUMBER	NEW LOC	LINE CT	CON-NECTOR ID	TYPE CON	LOCATION TO JUNCTION	CONDI-TION	LINE CT	CON-NECTOR ID	TYPE CON	LOCATION TO JUNCTION	CONDI-TION	LINE CT	CON-NECTOR ID	TYPE CON	LOCATION TO JUNCTION	CONDI-TION	LINE CT	CON-NECTOR ID
D4	A1	01	D T			D4A1	RA2L	NØ														
D4	A2	14	P BB2T																			
D4	A3	17	D RA4L	NØ																		
D4	A4	23	M RA1T			A1	T															
D4	A5	29	CHKMRG SIZE	P T		D4A5	SB5T															
D4	B1	02	D LF1L	YES																		
D4	B2	15	P BB2T																			
D4	B3	18	D RB4L	NØ																		
D4	B4	24	P BF3R																			
D4	B5	30	D LXXX	YES		AFA1	BC5T	NØ														
D4	C1	03	S BB1T																			
D4	C2	16	P RA4T			A4	T															
D4	C3	19	S BB3T																			
D4	C5	31	P BD5T																			
D4	D1	04	D RD2L	NØ																		
D4	D2	05	C#NCLDERR	I BE2T																		
D4	D3	20	D LD2R	NØ																		
D4	D5	32	A BEST																			
D4	E1	08	P RG1R																			
D4	E2	06	T BF2T																			
D4	E3	21	P BF3T																			
D4	E5	33	D LW4RJ	YES																		
D4	F1	09	P BG1T																			
D4	F2	07	T																			
D4	F3	22	P BG3T																			
D4	F5	34	D RH5R	CLR																		
D4	G1	10	D LJ1L	NØ																		
D4	G2	16	P BH1L																			
D4	G3	25	D LG2R	YES																		
D4	G5	35	P BH5T																			
D4	H1	11	P RK1R																			
D4	H3	27	P BJ3T																			
D4	H5	36	P BJ5T																			
D4	J1	12	P BK1T																			
D4	J3	28	D LA3T	NØ		A3	SBA4T	YES		A4	S											
D4	J4	38	T LF3R																			
D4	J5	37	D BXXX	NØ		AFG2	SLJ4R	YES														
D4	K1	13	P BE1T			E2	F															

• Figure 23a. Typical Chart: Coding Sheets (Page 1)



* INITIAL SETTING

● Figure 24a. Typical Chart

```

D4 2A1      C1 D T      0A1SRA2L NO      BBIT YES
D4 2A2      14 P BB2T
D4 2A3      17 D RA4L NO      RB3T YES      T      0AA35
D4 2A4      23 M RA1T      A1 T
D4 2A5 CKMRG5IZF 25 P T      0AA55BB5T
D4 2B1      C2 D LF1L YES      RC1T NO
D4 2B2      15 P BC2T
D4 2B3      18 D RB4L NO      BC3T YES
D4 2B4      24 P BF3R
D4 2B5      30 D LXXX YES      AFA1RBC5T NO
D4 2C1      03 S B01T
D4 2C2      14 P RA4T      A4 T
D4 2C3      16 S BD3T
D4 2C4      21 P DD5T
D4 2D1      04 D RD2L NO      BE1T YES
D4 2D2 CONCARDER905 1 RE2T
D4 2D3      20 D LD2R NO      BE3T YES
D4 2D4      32 P BE5T
D4 2E1      08 P RG1R
D4 2E2 ERESTART 06 I BF2T
D4 2E3      21 P BF3T
D4 2E4      33 D LJ4R JYES      BF5T NO
D4 2F1 SAMEASIN 09 P RG1T
D4 2F2      07 T
D4 2F3 MRGNGENR22 P BG3T
D4 2F4 SWM      34 D RMR CLR      RG5T SET*
D4 2G1 SETOLTLBL 10 D LJ1L NO      BH1T YES
D4 2G2      26 P BH3L
D4 2G3      25 D LG2R YES      BH3T NO
D4 2G4      35 P RH5T
D4 2H1      11 P RK1R
D4 2H3      27 P BJ3T
D4 2H4      36 P RJ5T
D4 2J1 NOLITM   12 P BK1T
D4 2J3      28 D LA1T NO      A3 SDA4T YES A4 S
D4 2J4 RMERCEHR 38 I LE1R      N
D4 2J5      37 D DXXX NO      AFG2SLJ4R YES

D4 2K1      13 P RE2TJ      E2 F
D4 2A1      OUTPLT      LABELS      PRESENT
D4 2A2 MOVE PH2 LABEL INDICATORS TO OUTPLT LABEL INDICATORS IN SAVE AREA
D4 2A3      MERGE      INPUT      LABELS
D4 2A4 ALTER ADDR IN OUTPUT L9L ROUTINE TO REFER TO MRC LABELS
D4 2A5 SUBTRACT SIZE OF MERGE PROGRAM FROM TCP AVAILABLE CORE IN PHASE 2
D4 2B1      OUTPLT      LABEL = INPUT LABEL
D4 2B2 MOVE CURRENT DATE TO LABEL INFORMATION FIELDS IN SAVE AREA
D4 2B3      CHECK      LABELS
D4 2B4      MOVE 2 TO MRGINTFL3 +XA IN SAVE AREA
D4 2B5      BRANCH      NEGATIVE
D4 2C1 READCU      1      READ OUTPLT LABEL CONTROL CARD
D4 2C2 SIGN PH2 LABEL INDICATOR PLUS IF PH1 AND PH2 LABELS ARE NOT RETAINED BY PH3
D4 2C3 READIN      1      READ MERGE INPUT LABEL CONTROL CARD
D4 2C4      CALCULATE ORDER OF MERGE TIMES BLOCK INPUT LENGTH
D4 2D1      IS THIS OUTPUT LABEL CTL CARD
D4 2D2 WRITE      WRONG CARD MESSAGE
D4 2D3      CORRECT CONTROL CARD
D4 2D4 SUBTRACT PRODUCT FROM TCP AVAILAABLE CORE IN PHASE 2
D4 2E1      MOVE CONTROL CARD INFORMATION TO SAVE AREA
D4 2E2 WRITE      ERROR RESTART MESSAGE
D4 2E3      MOVE CONTROL CARD INFORMATION TO SAVE AREA
D4 2E4      BRANCH NEGATIVE
D4 2F1 MOVE INPLT LABEL INFO (FOR OUTPLT LABELS) TO SAVE AREA
D4 2F2      HALT
D4 2F3      MOVE 0 TO MRGINTFLB +XA IN SAVE AREA
D4 2F4      MERGE SWITCH
D4 2G1      TM FOLLOWING LABEL
D4 2G2 SET INDICATOR FOR TAPE MARK FOLLOWING LABEL
D4 2G3      TM FOLLOWING LABEL
D4 2G4 SUBTRACT OUTPLT BLOCK LENGTH FROM TCP AVAILABLE CORE IN PHASE 2
D4 2H1      SET INDICATOR FOR TAPE MARK FOLLOWING OUTPUT LABEL
D4 2H2      INCREMENT INDEXREGISTER TO HANDLE NEXT CONTROL CARD
D4 2H3 SUBTRACT BLOCK SORT LENGTH FROM TCP AVAILAABLE CORE IN PHASE 2
D4 2J1      MOVE 0 TO PH3CTFL4 IN SAVE AREA
D4 2J2      ALL INPUT CARDS HANDLED
D4 2J4 WRITE      DI AND/OR PC TOO LARGE MESSAGE
D4 2J5      BRANCH NEGATIVE

D4 2K1 MOVE 2 TO PH3CTFL5. MOVE 0 TO PH3CTFLB IN SAVE AREA
D4 4F4 C6C1E4CC1E3CB23
D4 4J4 08C1F41C01
D4 5A1 C1C1 FROM AF
D4 5A2 01C1 FROM AF
D4 5A3 01C1 FROM AF
D4 5A4 01C1 FROM AF
D4 4RS 1401 * INITIAL SETTING
    
```

CARD COLUMN(S)	FIELD NAME	CONTENTS	COMMENTS
1-3	NOT USED	BLANK	
4	NUMBER OF DUPLICATES	1,2,....8,9 BLANK	NUMBER OF DUPLICATES DESIRED WHEN EXECUTING A PA OR AN FA RUN. NO DUPLICATES ARE PRODUCED.
5	NOT USED	BLANK	THE PROGRAMMERS NAME FOR IDENTIFYING JOBS.
6-19	PROGRAMMER	ANY CHARACTERS	
20	QUALIFICATION INDICATOR	1 2 BLANK	QUALA IS PRINTED AT THE TOP OF EACH CHART CHART. QUALA + QUALB ARE PRINTED ON EACH CHART (SEE SYSTEM CHANGE CONTROL CARDS) NO QUALIFYING STATEMENTS ARE PRINTED.
21-22	RUN TYPE	IR- INITIAL RUN FM- FILE MAINTENANCE PS- PROCESS SELECTED PA- PROCESS ALL FA- FILE MAINTENANCE/ PROCESS ALL	THE TYPE OF PROCESSING DESIRED. (SEE SYSTEM CHANGE CONTROL CARDS)
23	LISTING	N	INSTRUCTS AUTOCHART TO DELETE THE INPUT LISTING WHICH NORMALLY PRECEDES EACH CHART ON THE OUTPUT. THIS IS EFFECTIVE ONLY DURING A PS, PA, FM, OR FA RUN. AN INPUT LISTING NEVER PRECEDES A DUPLICATE CHART ON THE OUTPUT FILE.
24-30	CURRENT DATE	ANY CHARACTERS	THIS FIELD APPLIES ONLY TO FM AND FA RUNS. THE CONTENTS OF THE CURRENT DATE FIELD IN THE RUN CONTROL CARD ARE INSERTED INTO THE HEADER LINES OF CHARTS WHICH HAVE HEADER CARDS INCLUDED IN THE RUN INPUT.

Table 1a. Run Control Card (Page 1)

CARD COLUMN(S)	FIELD NAME	CONTENTS	COMMENTS
31-35	LEVEL	ANY NUMERIC CHARACTERS	THIS FIELD IS THE DEVICE USED BY AUTO-ART TO PROTECT MASTER TAPES. THE ORIGINAL LEVEL IS ESTABLISHED BY THE USER ON AN IR RUN. ALL FM AND FA RUNS INCREMENT THIS FIELD BY +1. (SEE EXPLANATION *)
40	PROJECT NAME/LEVEL OPT.	NEW PROJECT/LEVEL OPT.	\$ CAUSES THE PROJECT NAME AND LEVEL ON THE RUN CONTROL CARD TO BE PLACED IN THE FIRST RECORD OF THE NEW MASTER FILE.
41-60	PROJECT NAME	ANY CHARACTERS	THE PROJECT NAME ESTABLISHED BY THE USER ON AN IR RUN. THE SAME NAME MUST BE RETAINED FOR ALL SUBSEQUENT RUNS. (SEE EXPLANATION *)
76	ARROWHEAD OPTION	N OR BLANK	N, SPECIFIES THAT NO ARROWHEADS WILL BE DRAWN
79	MASTER FILE OPTION	N (IR RUN ONLY) S (PS RUN ONLY)	THE INITIAL MASTER TAPE, USUALLY A PART OF THE INITIAL RUN OUTPUT, IS NOT TO BE SAVED. NO MESSAGE REGARDING THE INITIAL MASTER FILE IS TYPED AND THE TAPE IS NOT UNLOADED. SPECIFIES THAT THE SELECTED CHARTS NEW MASTER FILE IS TO BE SAVED FOLLOWING THE RUN.
80	REFERENCE	BLANK A X	THE SPECIFICATIONS REGARDING BLOCK REFERENCES ON EACH CHART APPLY. ALL BLOCK REFERENCES ARE REMOVED FROM ALL ENVIRONMENTS OF ALL CHARTS PROCESSED DURING THIS RUN. ALL BLOCK REFERENCES ARE REMOVED FROM ALL ENVIRONMENTS WHICH DO NOT CONTAIN A BLOCK FOR ALL CHARTS PROCESSED DURING THIS RUN.
<p>* BOTH THE LEVEL AND THE PROJECT NAME FIELDS SPECIFIED ON THE RUN CONTROL CARD MUST BE IDENTICAL TO THE CORRESPONDING FIELDS ON THE OLD MASTER TAPE OR A MESSAGE WILL BE TYPED AND THE MACHINE WILL HALT. THE PROJECT NAME AND LEVEL FOR BOTH THE CHANGE AND OLD MASTER FILE IS TYPED. THE OPERATOR CAN CONTINUE THE JOB BY PRESSING START. IF THE RUN CONTROL CARD (COL 40) CONTAINS A \$ THE TYPEOUT AND HALT DO NOT OCCUR BUT THE PROJECT NAME AND LEVEL FIELDS ON THE RUN CARD ARE PLACED IN THEIR RESPECTIVE FIELDS ON THE NEW MASTER FILE (1ST RECORD). THE INFORMATION NORMALLY TYPED IS PLACED ON THE OUTPUT LISTING.</p>			<p>USUALLY A PROJECT NAME REMAINS CONSTANT FROM START TO COMPLETION. THIS OPTION WILL ALLOW IT TO BE CHANGED HOWEVER. THE LEVEL FIELD IS INCREMENTED BY THE PROGRAM DURING EACH FM OR FA RUN, TO DETERMINE WHAT LEVEL TO SPECIFY IN THE RUN CONTROL CARD LOOK AT THE RUN HEADER LINE (2ND LINE ON FIRST PAGE) ON THE OUTPUT OF THE LAST RUN. IF THE LAST RUN WAS AN FM, FA OR OM, THE LEVEL TO BE SPECIFIED IS THAT LEVEL + 1. FOR ALL OTHER RUNS THE LEVEL SPECIFIED SHOULD BE EQUAL TO THE LEVEL OF THE LAST RUN.</p>

Table 1b. Run Control Card (Page 2)

CARD COLUMN(S)	FIELD NAME	CONTENTS	COMMENTS
1-2	CHART IDENTIFICATION (CH ID)	ANY TWO NON-BLANK CHARACTERS (SEE NOTE)	THE SAME CHARACTERS MUST BE SPECIFIED FOR ALL OTHER CARDS FOR THE CHART.
3	CARD TYPE (CD TYPE)	1 = CHART HEADER (SEE NOTE)	THE AUTOCHART CODE FOR THE CHART HEADER CARD.
4	NUMBER OF DUPLICATES (NC.)	0,1.....8,9 BLANK	THE NUMBER OF DUPLICATES OF THIS CHART DESIRED WHEN EXECUTING A PS OR AN FM RUN. NO DUPLICATES ARE PROCESSED. SEE THE 'RUN TYPES' SECTION OF THIS MANUAL FOR DESCRIPTION OF THE USE OF THE NUMBER OF DUPLICATES FIELD.
5	NOT USED	BLANK	
6-20	PROGRAM NAME	ANY CHARACTERS	NAME OF THE PROGRAMMING SYSTEM WHICH THE CHART ILLUSTRATES.
21-55	CHART NAME	ANY CHARACTERS	NAME OF THE CHART
56-70	PROGRAMMER	ANY CHARACTERS	NAME OF THE PROGRAMMER
71-77	DATE	ANY CHARACTERS	THE CURRENT DATE
78-79	NEW CHART IDENTIFICATION (NEW ID)	ANY TWO NON-BLANK CHARACTERS BLANK	THE NEW CHART IDENTIFICATION TO BE INSERTED ON ALL CARDS OF A GIVEN CHART WHEN EXECUTING AN FM OR AN FA RUN. NO NEW IDENTIFICATION DESIRED.
80	REFERENCE (REF)	A X BLANK	THE BLOCK REFERENCES NORMALLY PRINTED WITH EACH BLOCK ARE ELIMINATED. THE BLOCK REFERENCES ARE ELIMINATED FROM ALL ENVIRONMENTS WHICH DO NOT CONTAIN A BLOCK. ALL BLOCK REFERENCES ARE PRINTED. THE SPECIFICATION OF THIS FIELD MAY BE OVERRIDDEN BY THE MASTER REFERENCE FIELD OF THE RUN CONTROL CARD.

NOTE- THIS FIELD MUST ALWAYS BE PUNCHED.

Table 2. Header Card

CARD COLUMN(S)	FIELD NAME	CONTENTS	COMMENTS
1-2	CHART IDENTIFICATION (CHART IDENT)	TWO ALPHAMERIC CHARACTERS (SEE NOTE)	THE CHART IDENTIFICATION ESTABLISHED ON THE HEADER CARD FOR THIS CHART.
3	CARD TYPE (CD TYPE)	2 = BLOCK LAYOUT (SEE NOTE)	THE AUTOCHART CODE FOR THE BLOCK LAYOUT CARD.
4-5	BLOCK LOCATION	A1,....,A5,B1,....,B5,....,K1,....,K5 (OMITTING I) (SEE NOTE)	THE BLOCK ENVIRONMENT INTO WHICH THE BLOCK IS TO BE PLACED.
6-15	SYMBOLIC LABEL (TAG)	UP TO TEN ALPHAMERIC CHARACTERS	THE LABEL OR TAG FROM THE LISTING ASSOCIATED WITH A BLOCK. LABELS CAN BE PLACED ANYWHERE IN THE TEN-CHARACTER FIELD. THIS FIELD IS PLACED, UNEDITED, ONTO THE CHART.
16-18	BLOCK NUMBER	XXX	EACH X CAN BE ANY CHARACTER. THE TWO HIGH-ORDER POSITIONS ARE THE BASIC BLOCK NUMBER. THE LOW-ORDER POSITION ALLOWS DECIMAL INSERTION OF ADDITIONAL BLOCK NUMBERS.
19	BLOCK TYPE (BLK TYPE)	P = PROCESSING BLOCK D = DECISION BLOCK S = SUBROUTINE BLOCK I = INPUT/OUTPUT BLOCK T = TERMINAL BLOCK M = MODIFICATION BLOCK \$ = IMAGINARY BLOCK	PROCESSING BLOCK DECISION BLOCK SUBROUTINE BLOCK INPUT/OUTPUT BLOCK TERMINAL BLK (START,HALT OR LOGICAL CONNECTOR) MODIFICATION BLOCK IMAGINARY BLOCK-NO BLOCK OUTLINE SPECIFICATION OF AN IMAGINARY BLOCK PLACES NO BLOCK OUTLINE IN THE ENVIRONMENT. OTHER FEATURES OF THE BLOCK LAYOUT CARD CAN BE USED.
19-20	NEW LOCATION	ANY VALID BLOCK LOCATION	NEW LOCATION FOR A MOVED BLOCK
21-35	FLOWLINE EXIT	INFORMATION TO SPECIFY EXITS FROM BLOCKS.	SUBFIELDS OF THIS FIELD ARE DISCUSSED IN DETAIL UNDER SEPARATE HEADINGS.

NOTE- THIS FIELD MUST ALWAYS BE PUNCHED.

Table 3a. Block Layout Card (Page 1)

CARD COLUMN(S)	FIELD NAME	CONTENTS	COMMENTS
21	SIDE	T = TOP B = BOTTOM R = RIGHT L = LEFT	SIDE OF THE BLOCK FROM WHICH THE FLOWLINE EXITS. ALSO, FOR OFF-PAGE ENTRY CONNECTORS, SIDE OF BLOCK AT WHICH ENTRY IS MADE.
22-24	TO LOCATION	MMN XXX(ACTUAL CHARACTERS) BLANK	MM REPRESENTS ANY VALID BLOCK ENVIRONMENT(A1, J3,K5,ETC.) TO WHICH THE EXIT GOES AND N REPRESENTS THE BLOCK SIDE(T,B,R, OR L) AT THAT LOCATION. USED TO SPECIFY AN OFF-PAGE, EXIT CONNECTOR. USED TO SPECIFY AN OFF-PAGE, ENTRY CONNECTOR.
25	JUNCTION	J	INDICATES THAT THE EXIT FLOWLINE TERMINATES AT A JUNCTION WITH ANOTHER LINE. (THIS ALLOWS THE INSERTION OF AN ARROWHEAD AT THE JUNCTION POINT.)
26-29	CONDITION	UP TO FOUR CHARACTERS	USED TO INDICATE A CONDITIONAL EXIT FROM A BLOCK (E.G., YES, ON, EOF, ETC.).
30	LINE CONTROL (LINE CTL)	N \$ 1,2,.....8,9 BLANK	SPECIFIES THAT THE AUTOMATIC LINE TO A NON-ADJACENT BLOCK IS NOT TO BE DRAWN(THE STUBS ARE STILL DRAWN). SPECIFIES THAT NEITHER THE AUTOMATIC LINE TO A NON-ADJACENT BLOCK NOR THE LINE STUBS FOR THAT AUTOMATIC LINE ARE TO BE DRAWN. THE PRIORITY OF DRAWING AUTOMATIC LINES. MULTIPLE LINES OF IDENTICAL PRIORITY ARE ALLOWED. TYPE 1 PRIORITY IS HIGHEST, TYPE 9 LOWEST. ALL TYPE 1 PRIORITY LINES ARE PROCESSED FIRST, ETC. AUTOMATIC LINES ARE PROCESSED IN THE USUAL ORDER.
31-34	CONNECTOR IDENT. (CONNECTOR ID)	UP TO FOUR CHARACTERS BLANK	USED TO IDENTIFY OFF-PAGE CONNECTORS. ALSO USED IF NON-STANDARD IDENTIFICATION IS DESIRED FOR ON-PAGE CONNECTORS. NO IDENTIFICATION IS INSERTED INTO AN OFF-PAGE CONNECTOR AND STANDARD (BLOCK REFERENCE) IDENTIFICATION IS USED FOR ON-PAGE CONNECTORS.

Table 3b. Block Layout Card (Page 2)

CARD COLUMN(S)	FIELD NAME	CONTENTS	COMMENTS
35	TYPE CONNECTOR (TYPE CON)	R T F S FOR OFF-PAGE CONNECTORS, SPECIFY R FOR REGULAR AND S FOR SPECIAL.	REGULAR CONNECTORS FOR BOTH EXIT AND ENTRY TO ENTRY SPECIAL, FROM EXIT REGULAR FROM EXIT SPECIAL, TO ENTRY REGULAR SPECIAL CONNECTORS FOR BOTH ENTRY AND EXIT
36-50			
51-65	FLOWLINE EXITS	ALL SAME AS COLUMNS 21-35	
66-80			

Table 3c. Block Layout Card (Page 3)

CARD COLUMN(S)	FIELD NAME	CONTENTS	COMMENTS
1-2	CHART IDENTIFICATION (CH ID)	TWO ALPHAMERIC CHARACTERS (SEE NOTE)	THE CHART IDENTIFICATION ESTABLISHED ON THE HEADER CARD FOR THIS CHART.
3	CARD TYPE (CD TYPE)	3 = BLOCK TEXT (SEE NOTE)	THE CODE FOR THE BLOCK TEXT CARD.
4-5	BLOCK LOCATION	A1.....A5,B1.....B5.....K1.....K5 (OMITTING I) (SEE NOTE)	THE BLOCK ENVIRONMENT OF THE BLOCK INTO WHICH THE TEXT IS TO BE PLACED.
6-20	TEXT LINE 1	THE TEXT WHICH IS TO APPEAR ON THE FIRST LINE OF THE BLOCK.	NOT USED FOR TEXT IN TERMINAL BLOCK
21-35	TEXT LINE 2	THE TEXT WHICH IS TO APPEAR ON THE SECOND LINE OF THE BLOCK.	NOT USED FOR TEXT IN SUBROUTINE BLOCK.
36-50	TEXT LINE 3	THE TEXT WHICH IS TO APPEAR ON THE THIRD LINE OF THE BLOCK.	
51-65	TEXT LINE 4	THE TEXT WHICH IS TO APPEAR ON THE FOURTH LINE OF THE BLOCK.	
66-80	TEXT LINE 5	THE TEXT WHICH IS TO APPEAR ON THE FIFTH LINE OF THE BLOCK.	NOT USED FOR TEXT IN TERMINAL BLOCK

NOTE- THIS FIELD MUST ALWAYS BE PUNCHED.

Table 4. Block Text Card

CARD COLUMN(S)	FIELD NAME	CONTENTS	COMMENTS
1-2	CHART IDENTIFICATION (CH ID)	TWO ALPHAMERIC CHARACTERS (SEE NOTE)	THE CHART IDENTIFICATION ESTABLISHED ON THE HEADER CARD FOR THIS CHART.
3	CARD TYPE (CD TYPE)	4 = LINE (SEE NOTE)	THE CODE FOR THE LINE CARD.
4-9	INITIAL POINT	BLOCK ENVIRONMENT, PRINT LINE, AND PRINT POSITION (SEE NOTE)	POINT ON A CHART AT WHICH A LINE BEGINS.
4-5	BLOCK LOCATION (BLCK)	A1,...,A5,B1,...,B5,...,K1,...,K5 (OMITTING I)	THE BLOCK ENVIRONMENT IN WHICH A LINE BEGINS.
6-7	START LINE (LINE)	01,02,...,13,14	THE PRINT LINE IN THE BLOCK ENVIRONMENT ON WHICH THE LINE BEGINS.
8-9	START POSITION (POS)	01,02,...,25,26	THE PRINT POSITION IN THE BLOCK ENVIRONMENT AT WHICH THE LINE BEGINS.
10-15	TO POSITION	BLOCK ENVIRONMENT, PRINT LINE, AND PRINT POSITION	POINT ON THE CHART AT WHICH THE FIRST SEGMENT OF A LINE IS TO END.
10-11	BLOCK LOCATION (BLCK)	A1,...,A5,B1,...,B5,...,K1,...,K5 (OMITTING I)	THE BLOCK ENVIRONMENT IN WHICH THIS SEGMENT ENDS.
12-13	LINE	01,02,...,13,14	THE PRINT LINE IN THE BLOCK ENVIRONMENT ON WHICH THIS SEGMENT ENDS.
14-15	POSITION (POS)	01,02,...,25,26	THE PRINT POSITION IN THE BLOCK ENVIRONMENT AT WHICH THIS SEGMENT ENDS.
16-21 22-27 28-33 34-39 40-45 46-51	TO POSITION	ALL SAME AS 10-15	FOR MULTIPLE SPECIFICATIONS OF LINES ON A SINGLE LINE CARD, BLANK 'TO POSITION' FIELDS MUST APPEAR BETWEEN EACH LINE SEGMENT.

NOTE- THIS FIELD MUST ALWAYS BE PUNCHED.

Table 5a. Line Card (Page 1)

CARD COLUMN(S)	FIELD NAME	CONTENTS	COMMENTS
52-57			
58-63	TO POSITION	ALL SAME AS 10-15	FOR MULTIPLE SPECIFICATIONS OF LINES ON A SINGLE LINE CARD, BLANK 'TO POSITION' FIELDS MUST APPEAR BETWEEN EACH LINE SEGMENT.
64-69			
70-75			
76-78	NOT USED	BLANK	
79	CHARACTER (CHAR)	ANY PRINTABLE CHARACTER BLANK	THE CHARACTER WITH WHICH THE LINE(S) ARE TO BE DRAWN. AUTOCHART USES ITS STANDARD LINE CHARACTER, THE PERIOD, TO DRAW THE LINE(S).
80	ARROWHEAD (ARROW)	N BLANK	INDICATES THAT THE LINE(S) SPECIFIED ON THE LINE CARD ARE TO BE DRAWN WITHOUT AN ARROWHEAD. AUTOCHART AUTOMATICALLY INSERTS THE ARROWHEAD AT THE TERMINAL END OF THE LINE(S).

Table 5b. Line Card (Page 2)

CARD COLUMN(S)	FIELD NAME	CONTENTS	COMMENTS
1-2	CHART IDENTIFICATION (CHART IDENT)	TWO ALPHAMERIC CHARACTERS (SEE NOTE 1)	THE CHART IDENTIFICATION ESTABLISHED ON THE HEADER CARD FOR THIS CHART.
3	CARD TYPE (CD TYPE)	9 = COMMENT (SEE NOTE 1)	THE CODE FOR THE COMMENTS CARD.
4-9	INITIAL POINT	BLOCK ENVIRONMENT, PRINT LINE, AND PRINT POSITION. (SEE NOTE)	POINT ON THE CHART AT WHICH THE COMMENT BEGINS.
4-5	BLOCK LOCATION (BLCK)	A1.....A5,B1.....B5.....K1.....K5	THE BLOCK ENVIRONMENT IN WHICH THE COMMENT LINE IS TO BEGIN.
6-7	START LINE (LINE)	01,02.....13,14	THE PRINT LINE IN THE BLOCK ENVIRONMENT ON WHICH THE COMMENT IS TO BEGIN.
8-9	START POSITION (POS)	01,02.....25,26	THE PRINT POSITION IN THE BLOCK ENVIRONMENT AT WHICH THE COMMENT IS TO BEGIN.
10	CONNECTOR TYPE	BLANK H V S	HORIZONTAL (WILL NOT MOVE) HORIZONTAL-GETS MOVED IF THE BLOCK IN THE SAME ENVIRONMENT AS ITS START POINT IS EVER MOVED. VERTICAL -MOVES SAME AS H TYPE. COMMENT IS ORIENTED VERTICALLY ON THE PAGE. SCANNABLE - MOVES SAME AS V OR H TYPE. IF IT CONTAINS A VALID CHART REFERENCE.(SEE NOTE 2)
11-80	COMMENTS	ANY CHARACTERS	ALL NON-BLANK CHARACTERS ARE PLACED ON THE CHART. BLANKS WILL NOT OVERLAY ANY EXISTING MATERIAL.

NOTE 1- THIS FIELD MUST ALWAYS BE CODED.

NOTE 2- (IE. ID+BLK.LOC), PRECEDED BY A GROUP MARK, IT WILL BE SCANNED AND MAINTAINED IF THE CHART ID IS CHANGED OR THE BLOCK IS MOVED BY THE USER.

Table 6. Comment Card

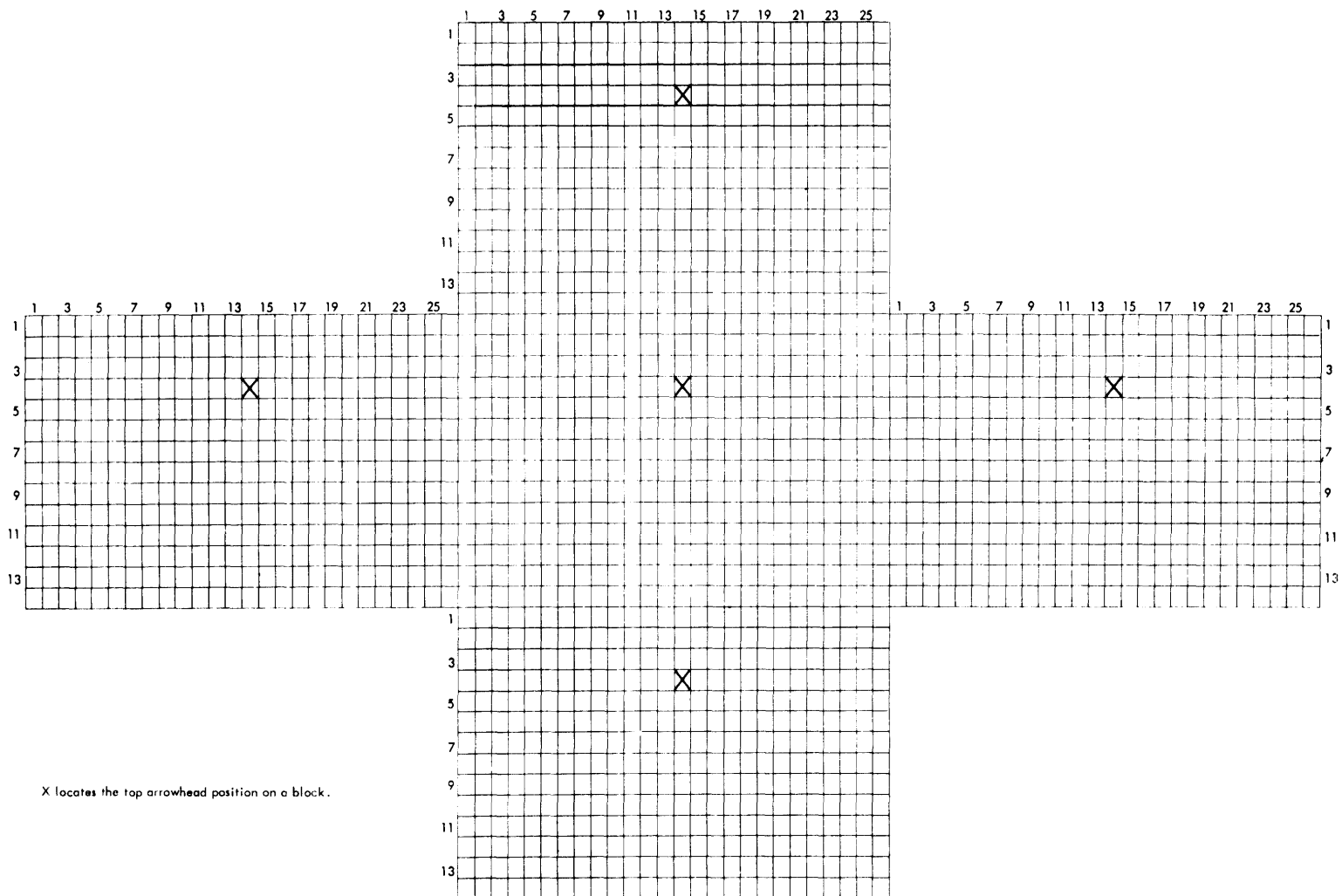
COLUMNS	CONTENTS	COMMENTS
1-20	BLANK	NOT USED
21-22	SY	INDICATES A SYSTEMS RUN CARD TYPE
-23	X OR BLANK	X, SPECIFIES LOW DENSITY SYS. TAPE
24-30	BLANK	NOT USED,(MUST BE BLANKS)
31-35	XXXXX	VERSION OF CURRENT SYSTEM
36-40	NNNNN	LEVEL OF CURRENT SYSTEM
41-80	BLANK	NOT USED

Table 7. System Run Control Card

COLUMNS 6-10	VARIABLE FIELD STARTS AT COL 21	COMMENTS
7070 7072 7074	XXXX	LINE COUNTER SETTING TO STOP PATH SEARCH DURING LINE GENERATION. (NUMBER OF SEARCH POINTS WHEN SEEKING A PATH.) IF BLANK, THE COUNTER IS SET AT 5000 FOR 7070 AND AT 9995 FOR 7072 OR 7074 COUNTER IS SET TO 9995 ON DISTRIBUTED TAPE (APPROX. 11 SECONDS ON 7074)
UNITA	CU	CHANNEL AND UNIT- INPUT OR CHANGE TAPE
UNITB	CU	CHANNEL AND UNIT- OUTPUT TAPE
UNITC	CU	CHANNEL AND UNIT- OLD MASTER TAPE
UNITD	CU	CHANNEL AND UNIT- WORK TAPE
UNITE	CU	CHANNEL AND UNIT- NEW MASTER TAPE
UNITF	U	TAPE UNIT NUMBER- ALTERNATE OUTPUT TAPE (SAME CHANNEL AS OUTPUT,UNITB)
DENS	HIGH	INPUT, WORK, AND OUTPUT TAPES ARE TO BE HIGH DENSITY
	LOW	INPUT, WORK, AND OUTPUT TAPES ARE TO BE LOW DENSITY
QUALA	(28 CHARACTERS)	QUALIFYING STATEMENT A* (FOR INSTANCE, COMPANY CONFIDENTIAL)
QUALB	(28 CHARACTERS)	QUALIFYING STATEMENT B* (FOR INSTANCE, NOT CHECKED FOR ACCURACY)

* QUALIFYING STATEMENTS ARE TWO 28-CHARACTER LINES OF TEXT SPECIFIED BY THE USER THAT ARE PRINTED ABOVE EACH CHART (HORIZONTALLY CENTERED) WHEN SO SPECIFIED IN THE RUN CARD.

Table 8. System Change Card



X locates the top arrowhead position on a block.

Figure 25. Autochart Output Overlay



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