

ECMA
EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

STANDARD ECMA-4

FLOW CHARTS

2nd Edition-September 1966

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BRIEF HISTORY

A Technical Committee of ECMA met for the first time in 1960, to prepare a Standard for Flow Charts. The work has led in November 1964 to the issue of the Standard ECMA-4. In view of the changes entered in the final version of the ISO Recommendation (R 1028) for Flow Chart Symbols, the present revised 2nd Edition of this Standard has been issued. It is in full agreement with this ISO Recommendation.

THIS VERSION SUPERSEDES THE VERSION DATED Nov. 1964.

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1. INTRODUCTION

1.1 General

Today flow charts are in wide use for the diagrammatic representation of processes. They consist of symbols with appropriate text, and connecting lines. Such a representation can be followed more easily than a narrative description, chiefly because of its two-dimensional structure. It also simplifies checking for completeness and logical consistency.

This Standard for Flow Charts is not intended as a primer in flow charting, but is designed to ensure the general intelligibility of the diagrammatic part of flow charts. Note that the diagrammatic part has no meaning by itself until supplemented by the insertion of appropriate text into the symbols, and that this text will not be standardized. The standard is not rigid in that some freedom of adaption is permitted under certain circumstances.

The proposed graphical forms of the symbols were chosen bearing in mind the following objectives :

The number of basic graphical forms should be small.

The symbols should be easily drawn freehand, by means of template or by any automatic process (see Appendix IV).

Those symbols which may contain a varying amount of text should be easily adaptable in size.

1.2 Types of Flow Charts

In connection with data processing there arises a need for two basic types of flow charts. They are named respectively

Program Flow Chart and Data Flow Chart.

The full name is used only, when it is necessary to specify the type explicitly.

A program flow chart describes the flow of control within any computer program, i.e., the order in which the various program steps are to be executed. Therefore, it mainly consists of

- (a) flow lines connecting successive program steps,
- (b) operational symbols for the actual processing steps,
- (c) flow control symbols defining the path to be followed under various conditions.

In so far as the plugboard wiring of a calculator or tabulator can be represented by a flow-chart, this standard is satisfactory. Other operations of plug-board control are not amenable to standardization, since they are too closely involved with the design of particular machines.

A data flow chart shows the flow of data through a processing system. Therefore, it mainly consists of

- (a) flow lines indicating transfer of data or transport of data media;
- (b) data symbols, namely symbols for data media and storage media;
- (c) operational symbols.

Two levels of data flow-charting for punched card equipment may be distinguished :

- (a) The presentation of the basic logical operations to be carried out on the data in order to solve the problem.
- (b) The presentation of the processing functions required to implement this solution, in which the symbols stand for the work done in each machine operation, whether simple or complex.

In flow charts of level (a), it may be desirable to show the intended assignment of one or more logical operations to processing function which will appear as one symbol at level (b). Such a function may be carried out by one machine or by a group operated closely together. (See Appendix III).

A simple example (see Appendix I) illustrates to some extent, the basic differences between the two types of flow chart. This example makes use of symbols which will be defined later; therefore, additional remarks have been inserted into the charts to make them self-explanatory.

There may be several flow charts of both types to one problem, varying in the degree of detail as well as in their particular aim. Sometimes, also, flow charts are used which contain symbols belonging to both types of flow chart, and connecting lines, representing either control flow or data flow. In this case, care should be taken to distinguish clearly between them. Nevertheless, the ensuing Standard will discuss the two types of flow chart separately.

1.3 Conventions

The following convention applies to the flow lines in both program and data flow-chart :

- (a) The direction of flow is mainly
 - left to right
 - top to bottom.

If arrow heads are missing, these directions are assumed.

- (b) Arrows indicating the flow should be used whenever increased clarity will result.
- (c) If a symbol contains more than one line of text, then they are to be read from top to bottom, irrespective of the direction of the flow lines.

- (d) A junction is indicated by meeting of two incoming and one outgoing flow lines.
- (e) For the sake of clarity there should be no mixture of incoming and outgoing lines at one edge of a symbol.
- (f) Flow lines may cross; in this case they have no logical inter-relation.
- (g) While the standard does not make exact specifications about height to width ratios, it does require the user not to vary these to such an extent that the symbol is not immediately recognizable. For this reason it is also suggested that within a single flow chart the height to width ratios are held constant.

1.4 Presentation of the Standard

The following pages are divided into two vertically. The right hand side is reserved exclusively for definitive symbols of the Standards. Diagrams appearing on the left hand side are either illustrations of the use of the symbols or permitted extensions.

1.5 Maintenance of the Standard

It is foreseen that the Standard may require maintenance from time to time.

Special circumstances may arise which are not covered by the Standard. Should users find themselves in such a situation, they are requested to communicate with ECMA. In the meantime other symbols may be used provided that they cannot be confused with symbols already contained in the Standard (see Appendix II). They must be clearly defined, and their definition must be stated with the flow chart in which they are used.

2. SYMBOLS FOR PROGRAM FLOW CHARTS

2.1 Operational Symbols

2.1.1 General Operational Symbol

The General Operational Symbol is used for any operation which creates, alters, transfers or erases data, or any other operation for which no specific symbol has been defined in the Standard. It can also replace any of the symbols for program flow chart.

REMARK :

- (1) The term "data" is not restricted to I/O data, it also includes instructions, indicators, etc.

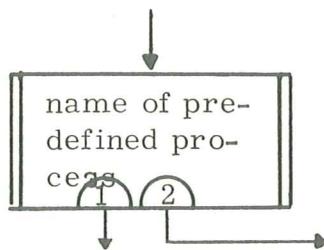
2.1.2 Predefined Process Symbol

The Predefined Process Symbol is used when a named section of program is considered as a single operation for the purpose of this flow chart, e.g. a subroutine.

REMARK :

- (1) In cases where the predefined process has more than one entry or exit, the symbol may show these and should include the reference to the used entry or exit.

Example :



2.1.3 Input/Output Symbol

The Input/Output Symbol is used where it is desired to stress I/O operations.

2.1.4 Preparation Symbol

The Preparation Symbol is used when it is desired to accentuate that an operation partially or completely determines the selection of a particular exit at given Branch Symbols (see 2.2.1). The Preparation Symbol is commonly used in the following ways :

Prepare a Decision

The creation or alteration of an indicator, or a quantity, which appears either in a Branch Symbol, or in another Preparation Symbol;

Set a Switch

Setting one or more switches by selecting one exit in each of them.

Initialize a routine

For example setting account, clearing registers, etc.

2.2 Flow Control Symbols

The Flow Control Symbols are used to represent the points where flow lines diverge or converge.

2.2.1 Branch Symbol

The Branch Symbol has one entry line and more than one exit line. In passing through this symbol, one and only one exit will be used.

The Branch Symbol is commonly used in the following two ways :



Decision

The symbol contains a description of the test on which the selection of an exit is based. The various possible results of this test may be shown against the corresponding exits.

Switch

The symbol contains the name of the switch. The possible settings may be shown against the exits. When reaching this symbol, one exit is already set (see 2.1.4).

2.2.2 Flow Line Symbol

This symbol connects successive program steps.
(See par. 1.3 convention a)

Crossing of flow lines
(see par. 1.3 convention f)



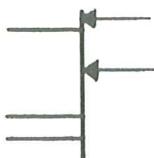
Junction of flow lines
(see par. 1.3 convention d)

Examples :

Simple junction

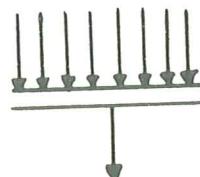
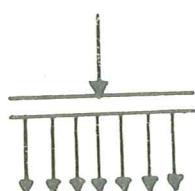


Multiple junction



2.2.3 Parallel Mode Symbol

There may be occasions, in a program flow chart, when two or more paths of control operate simultaneously, and it is necessary to define their relation. In this case the Parallel Mode Symbol is used. After it has been reached through all the entry lines, all the exit lines are used in parallel and/or arbitrary sequence. There are two special cases :



2.3 Auxiliary Symbols

2.3.1 Connector Symbol

The Connector Symbol represents an exit to, or an entry from another part of the flow chart. Related exit(s) and entry must have the same identifier.



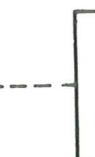
2.3.2 Terminal Symbol

The Terminal Symbol is used for the beginning of a flow line, e.g. the start of a program or the entrance to a subroutine. It is also used for the end of a flow line, e.g. the end of a program, the exit from a subroutine, the return to a control program or interrupt.



2.3.3 Comment Symbol

The Comment Symbol is designed to contain additional information which it is desired to include at this point of the chart.



REMARK :

- (1) This symbol may be attached to flow lines and to any other symbol. The information may be either text or reference to text elsewhere.

3. SYMBOLS FOR DATA FLOW CHARTS

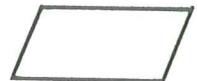
3.1 Data Symbols

The main task for data symbols is to represent the existence of certain data; as a by-product, they may also give some information about the medium on which the data is held. The process of writing on, or reading from a medium

is not represented explicitly, since the flow lines connecting the symbols imply this.

When the data is implicitly indicated by the preceding and following operational symbols, the symbol for the data element may be omitted.

3.1.1 General Data Symbol



3.1.2 Specific Data Symbols

a) Source document

The general data symbol (3.1.1) is considered to suffice for this purpose.

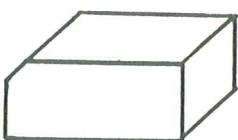
b) Printed Document Symbol



c) Punched Card Symbol
(see also Appendix III)



d) Punched Card Deck Symbol
(see also Appendix III)



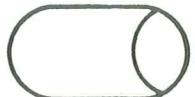
e) Punched Tape Symbol



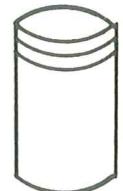
f) Magnetic Tape Symbol



g) Magnetic Drum Symbol



h) Magnetic Disk Symbol



i) Core Symbol



j) Display Symbol



3.2 Operational Symbol

The main purpose of an Operational Symbol is to indicate the operation performed on the preceding data in order to obtain new data; as a by-product, it may also give some information about the hardware unit which is used for this operation. When the operation is sufficiently indicated by the preceding and following Data Symbol, the Operational Symbol may be omitted (e.g., card-to-tape conversion).

3.2.1 General Operational Symbol

The General Operational Symbol may be used for any operation on data.



3.2.2 Specific Operational Symbols

(a) Merging

DEFINITION :

The formation of an ordered set of items from two or more ordered sets sequenced according to a common key.

(Shown here with two entry lines only)



(b) Extracting

DEFINITION :

The selection from a single set of items of one or more subsets, each of which meets some criterion. If the single set is sequenced, the subsets will be sequenced accordingly.

(Shown here with two exit lines only)



(c) Collating

DEFINITION :

Merging with extracting.

(Shown here with two entry lines and two exit lines only)



(d) Sorting / Sequencing

DEFINITION :

To arrange a set of items in sequence according to a certain key. (The entry line and the exit line are not part of the symbol.)



(e) Manual Intervention Symbol

The Manual Intervention Symbol is used for the introduction of information at the time of processing by manual action, e.g., by operating a keyboard or a console, or equivalent action.



3.2.3 Manual Operation Symbol

This Manual Operation Symbol represents any offline process geared to the speed of a human being.



3.3 Data Transfer Symbols

3.3.1 Flow Line Symbol

The Flow Line Symbol indicates transfer of data or transport of data media. (See par. 1.3, convention a).

REMARKS :

- (1) If it should be necessary to stress transportation of data medium, this may be represented as follows :



- (2) When the process described by a flow line takes place beyond the time scale of the flow chart, the line may be shown dotted :



- (3) Crossing of flow lines
(see par. 1.3, convention f)



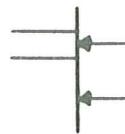
Junction of flow lines
(see par. 1.3, convention d)

Examples :

Simple junction



Multiple junction



3.3.2 Communication Link Symbol

The Communication Link Symbol is used when the information is transmitted by a telecommunication link. (See par. 1.3, convention a).



3.4 Auxiliary Symbols

3.4.1 Connector Symbol

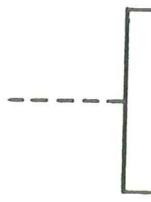
The Connector Symbol represents an exit to, or an entry from another part of the flow chart. Related exit(s) and entry must have the same identifier.

3.4.2 Comment Symbol

The Comment Symbol is designed to contain additional information which it is desired to include at this point of the chart.

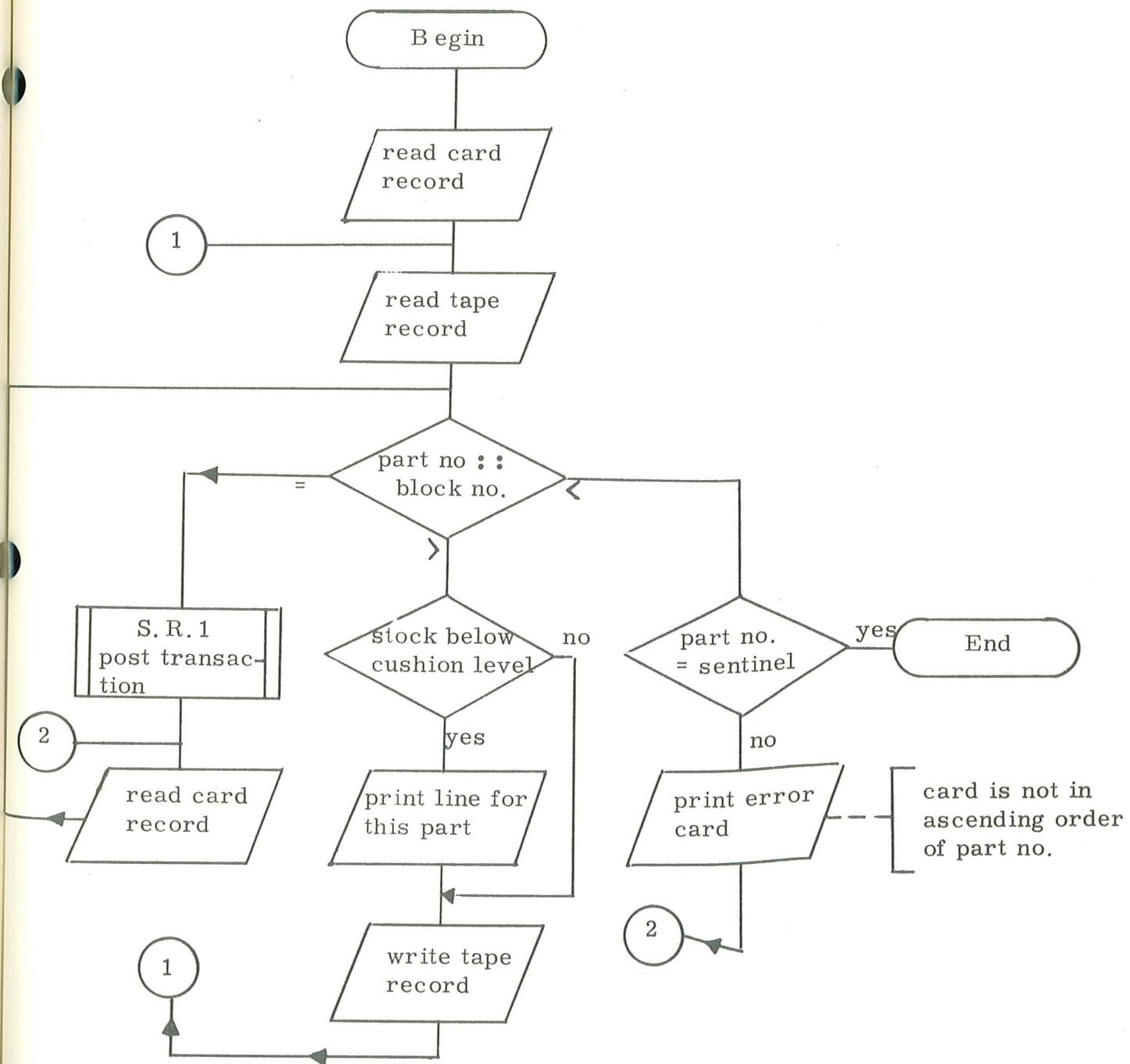
REMARK :

- (1) This symbol may be attached to flow lines and to any other symbol. The information may be either text or reference to text elsewhere.



Program Flow Chart

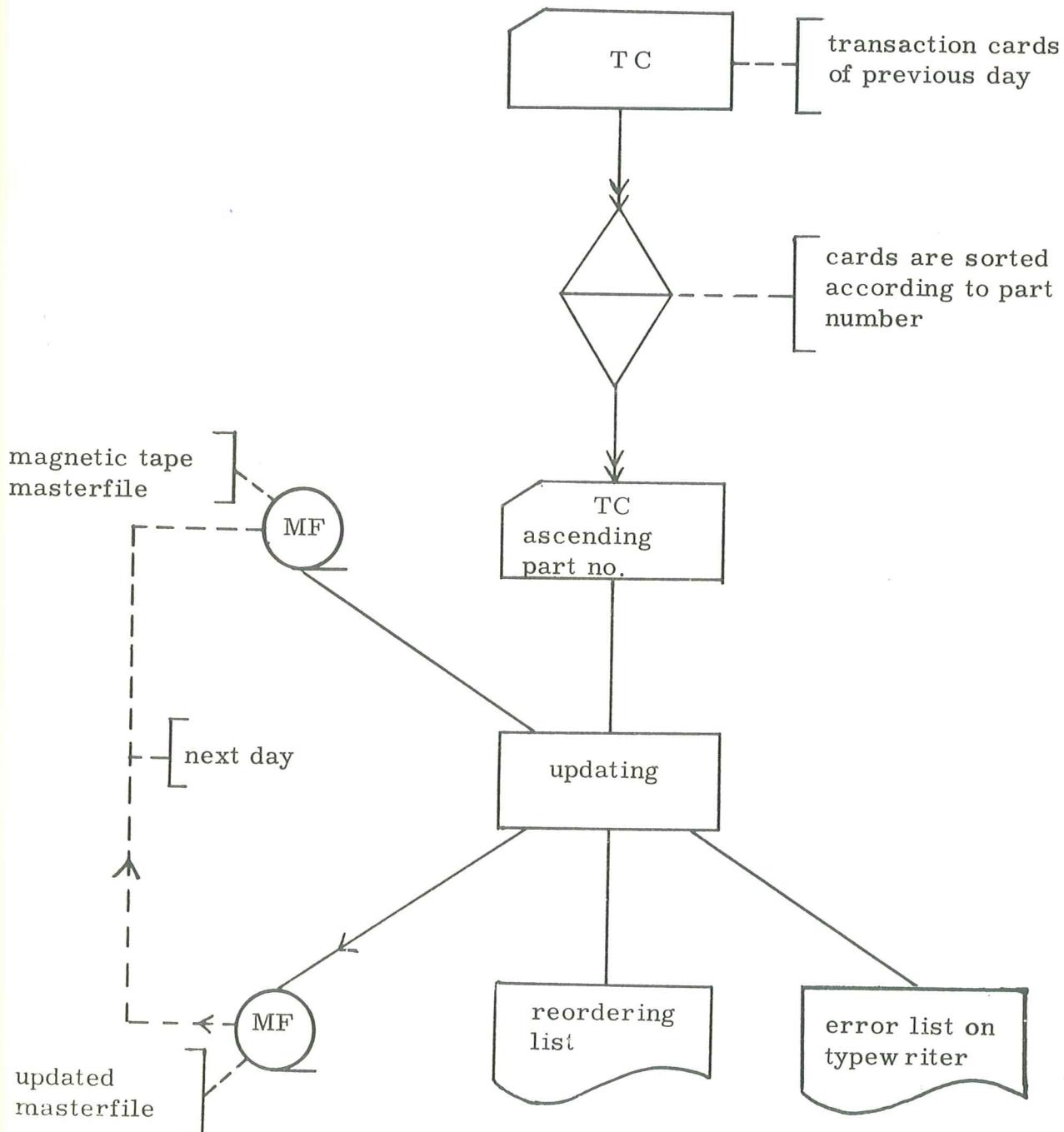
This program flow chart might represent the updating process shown in the data flow chart on preceding page.



A P P E N D I X I

A STOCK CONTROL EXAMPLE

Data Flow Chart

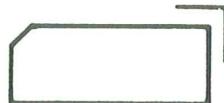


APPENDIX II

RESERVED SYMBOLS

If it is wished to extend the Standard to cater for new concepts or individual requirements, then care must be taken not to use any of the following symbols with any other meaning than that indicated in the ISO Recommendation :

File of cards :



Offline Storage :



Online Storage :



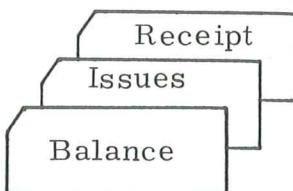
Auxiliary Operation :



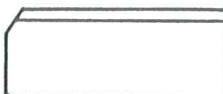
APPENDIX III

SPECIAL PUNCHED CARD CONVENTIONS

1. The sequencing of card types may be shown by partially superimposing two or more Punched Card Symbols :



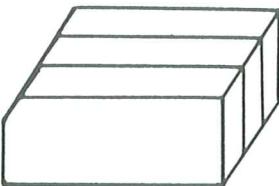
2. Interpreted card can be shown as follows :



3. Reproduced card can be shown as follows :



4. The Punched Card Deck Symbol may be sub-divided to express the passage of two or more complete files in a given order through the following operation :



APPENDIX IV

EXAMPLE OF A FLOW CHART PRODUCED BY A COMPUTER

It is well known that flow charts can be produced on high speed printers. In this case all flow lines and all symbols are drawn by means of discontinuous strokes. This must not be understood as dotted line in the sense of par. 3.4.1 (c).

