

ECMA

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

STANDARD FOR FLOW CHARTS

November 1964

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STANDARD FOR FLOW CHARTS

November 1964

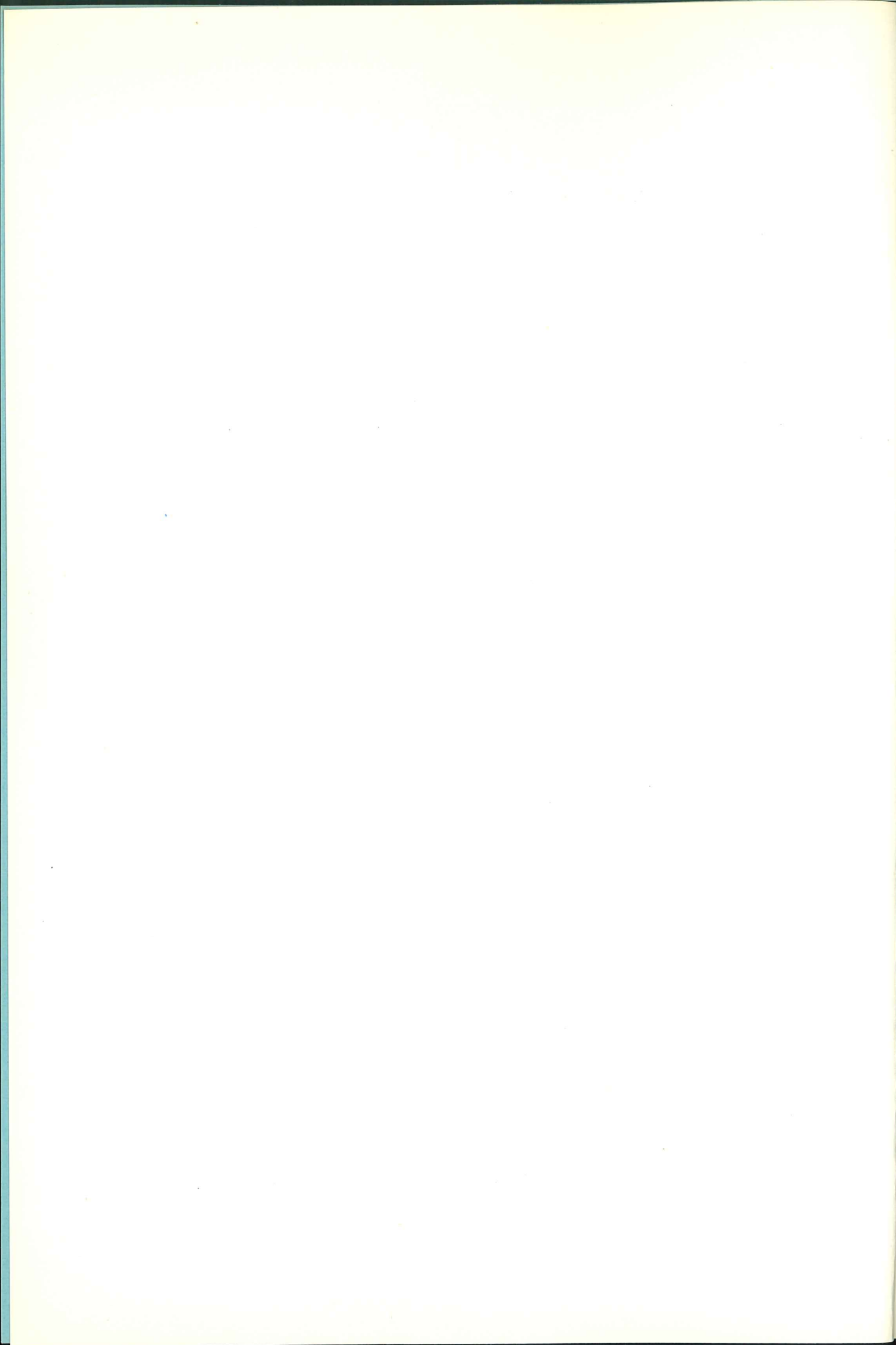


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BRIEF HISTORY

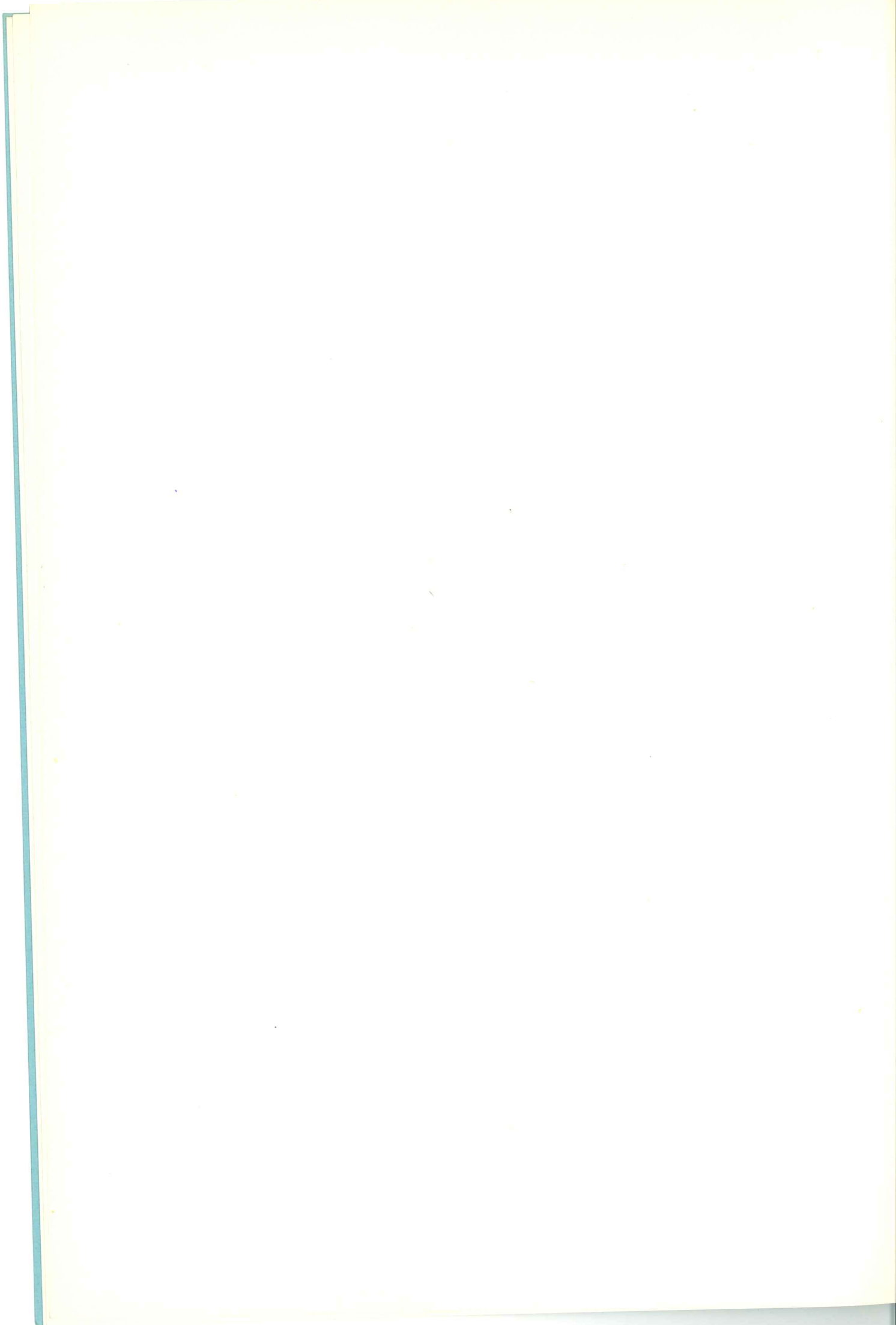
A Technical Committee of ECMA met for the first time in 1960, to prepare a standard for Flow Charts.

Representatives of the following companies participated in the work of the committee:

Compagnie des Machines Bull
N. V. Electrologica
Ferranti Ltd
IBM-WTEC
I. C. T. Ltd
I. T. T. Europe Inc.
Ing. C. Olivetti & Co. S. p. A.
S. E. A.
Siemens & Halske AG.
Sperry Rand International Corp.
Telefunken Aktiengesellschaft

The work has led to the production of this Standard ECMA-4 on Flow Charts. In addition, this Technical Committee has collaborated with the following organizations:

American Standards Association (ASA)
Deutscher Normen Ausschuss (DNA)
International Organization for Standardization (ISO)



1. INTRODUCTION

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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.

The Standard for Flow Charts presented here 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.

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

plugboard 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 a 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 rather trivial 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 Presentation of the Standard

The following pages are divided into two vertically. The right hand side is reserved exclusively for definitive symbols of the Standard. Diagrams

appearing on the left hand side are either illustrations of the use of the symbols or permitted extensions.

1.4 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

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2.1 Use of the Symbols

The following general rules apply to the symbols and flow lines in program flow charts:

The direction of flow is mainly downward and/or to the right. If arrow heads are missing, this direction is assumed.

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.

For the sake of clarity, there should be only one line entering, and one line leaving a symbol, if not stated differently within the definition of the symbol. Furthermore, there should be no mixture of incoming and outgoing lines at one edge of a symbol.

2.2 Operational Symbols

2.2.1 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.

REMARK:

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



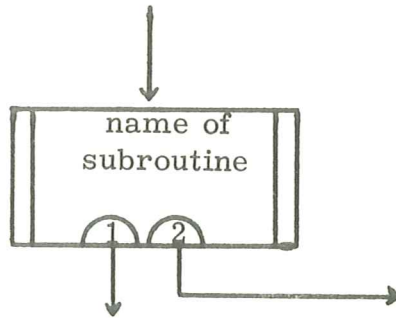
2.2.2 Subroutine (Predefined Process) Symbol

The Subroutine Symbol is used when a section of program is considered as a single operation for the purpose of this flow chart.

REMARK:

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

Example:



2.2.3 Input/Output Symbol

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

2.2.4 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 2.3.1).

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

Prepare a Decision

The creation or alternation 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.

2.3 Flow Control Symbols

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



2.3.1 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 are shown against the corresponding exits.

Switch

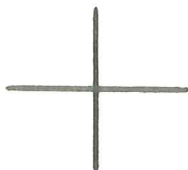
The symbol contains the name of the switch. The possible settings are shown against the exits. When reaching this symbol, one exit is already set (see 2.2.4).

2.3.2 Junction Symbol

The Junction Symbol has more than one entry line and only one exit line. The symbol consists of a dot at the point of intersection, and an arrow head on the exit line.

REMARKS:

- (1) The angles between the lines at the point of intersection, and the direction of the exit line, are not subject to any restriction.
- (2) In contrast to the Junction Symbol, two crossing lines without any logical inter-relation are represented as shown below:



2.3.3 Synchronization (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 Synchronization 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:



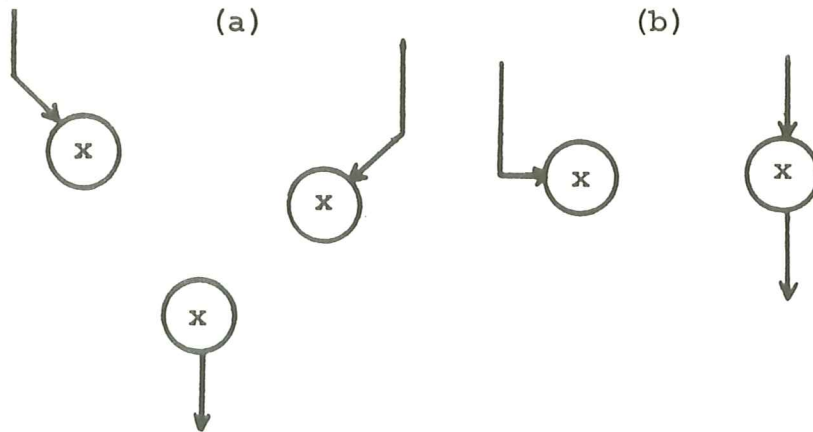
2.4 Auxiliary Symbols

2.4.1 Connector Symbol

The Connector Symbol is a substitute for a connection flow line, "x" standing for any identifying character, or group of characters.

REMARKS:

- (1) "Tail" and "head" may be on the same or on separate sheets. In the former case the direction of the tail may point towards the related head. In the latter case there should be a note with the tail about the location of the related head.
- (2) The concepts of Connector and Junction may be combined as shown:



2.4.2 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 or the return to a control program.

2.4.3 Comment Symbol

The Comment Symbol is designed to contain additional information which it is desired to include at this



point of the chart, "x" standing for this information.

REMARK:

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

3. SYMBOLS FOR DATA FLOW CHARTS

=====

3.1 Use of the Symbols

The following general rules apply to the symbols and flow lines in data flow charts:

If a symbol contains more than one line of text, these lines are to be read in downward succession, irrespective of the direction of the flow lines.

For the sake of clarity, there should be no mixture of incoming and outgoing lines at one edge of a symbol.

3.2 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 processes of writing on, or reading from a medium, are 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.

3.2.1 General Data Symbol

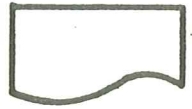


3.2.2 Specific Data Symbols

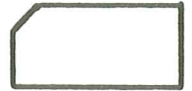
a) Source document

The general data symbol (3.2.1) is considered to suffice for this purpose.

b) Printed Document Symbol

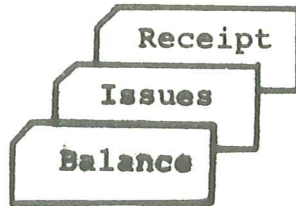


c) Punched Card Symbol



REMARKS

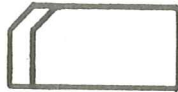
(1) The sequencing of card types may be shown by partially superimposing two or more Punched Card Symbols:



(2) Interpreted card:



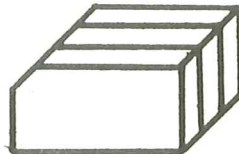
(3) Reproduced card:



d) Punched Card Deck Symbol

REMARK:

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



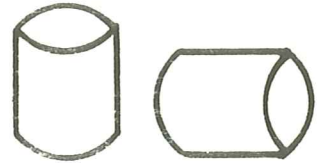
e) Punched Tape Symbol



f) Magnetic Tape Symbol



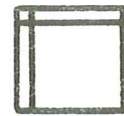
g) Magnetic Drum Symbol



h) Magnetic Disk Symbol



i) Ferrite Core Symbol



j) Pictorial Display Symbol



3.3 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).

3.3.1 General Operational Symbol

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



3.3.2 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).



(f) Manual Intervention Symbol

The Manual Intervention Symbol is used for the introduction or transcription of data by manual action by operating a keyboard or a console, or equivalent action.

REMARK:

(1) This symbol may be used for key-punching.



3.3.3 Manual Operation Symbol



3.4 Flow Lines

In data flow charts all transfers are normally shown by a full line, with single open arrow heads where these are required. If it should be necessary to distinguish between different types of flow lines, these may be represented as follows.

3.4.1 Data Transfer

DEFINITION:

Transfer of data without transportation of the respective data medium.



3.4.2 Data Medium Transport

DEFINITION:

Transportation of a data medium.



3.4.3 Communication Link

3.4.4 Delayed Transfer or Transport

When the process described by a flow line takes place beyond the time scale of the flow chart, the line may be shown dotted.



3.4.5 Junction Symbol

The Junction Symbol has more than one entry line and only one exit line. The symbol consists of a dot at the point of intersection, and an arrow head on the exit line.



REMARKS:

- (1) The angles between the lines at the point of intersection, and the direction of the exit line, are not subject to any restriction.
- (2) In contrast to the Junction Symbol, two crossing lines without any logical interrelation are represented as shown below.



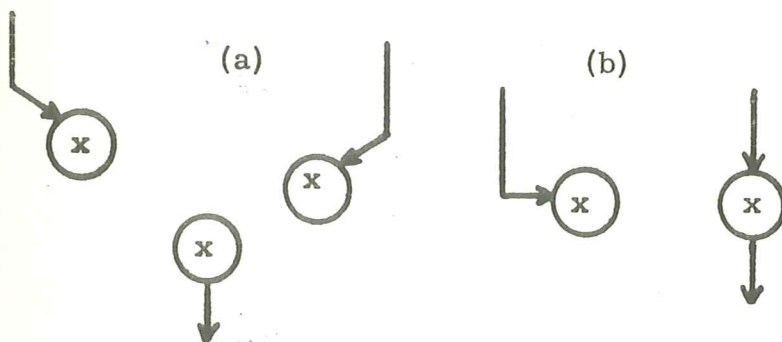
3.5 Auxiliary Symbols

3.5.1 Connector Symbol

The Connector Symbol is a substitute for a connecting flow line, "x" standing for any identifying character or group of characters.

REMARKS:

- (1) "Tail" and "head" may be on the same or on separate sheets. In the former case the direction of the tail may point towards the related head. In the latter case there should be a note with the tail about the location of the related head.
- (2) The concepts Connector and Junction may be combined as shown:



3.5.2 Comment Symbol

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

REMARK:

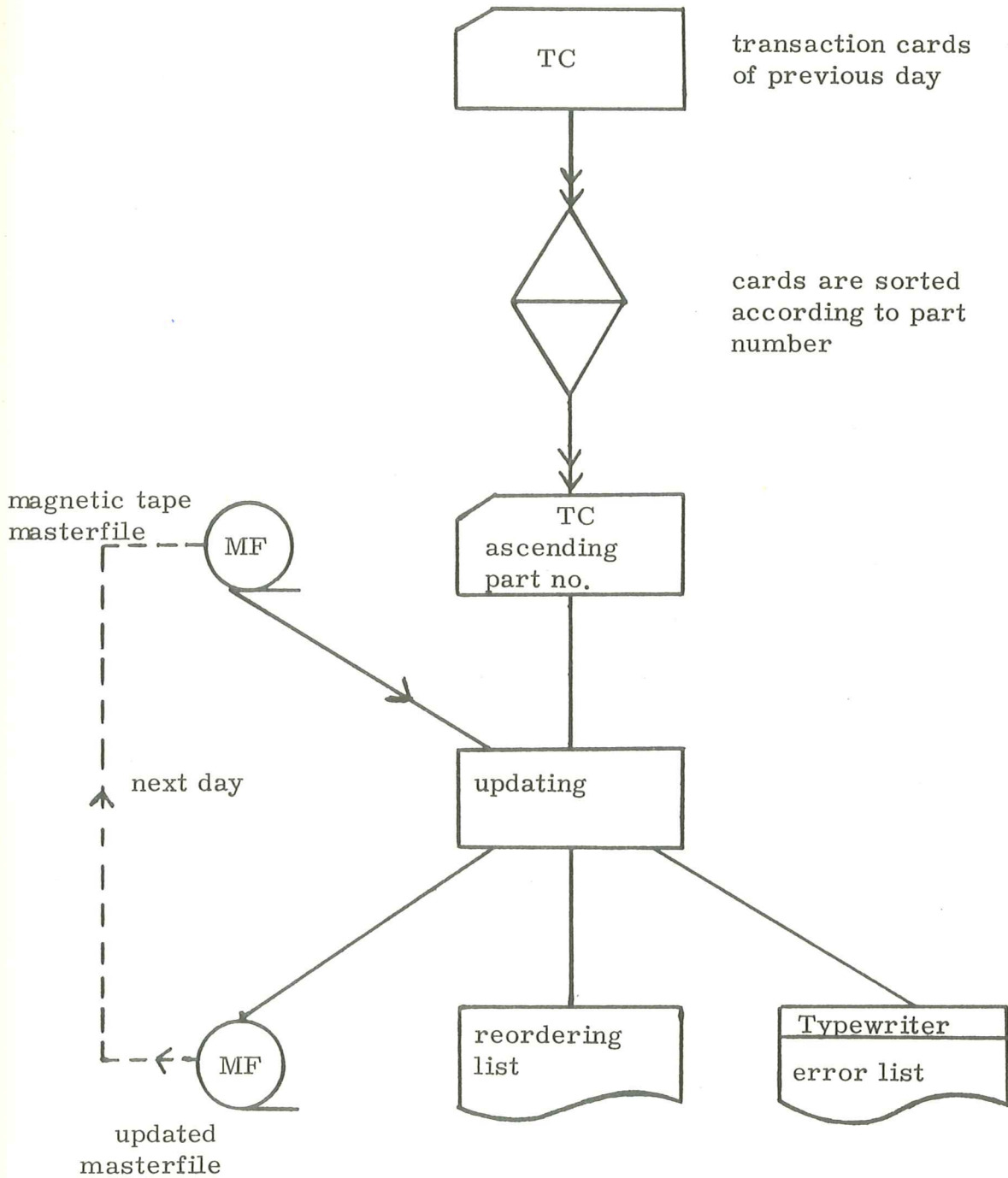
- (1) This symbol may be attached to flow lines and to any other symbol. "x" may be either text or reference to text elsewhere.



APPENDIX I

A STOCK CONTROL EXAMPLE

Data Flow Chart

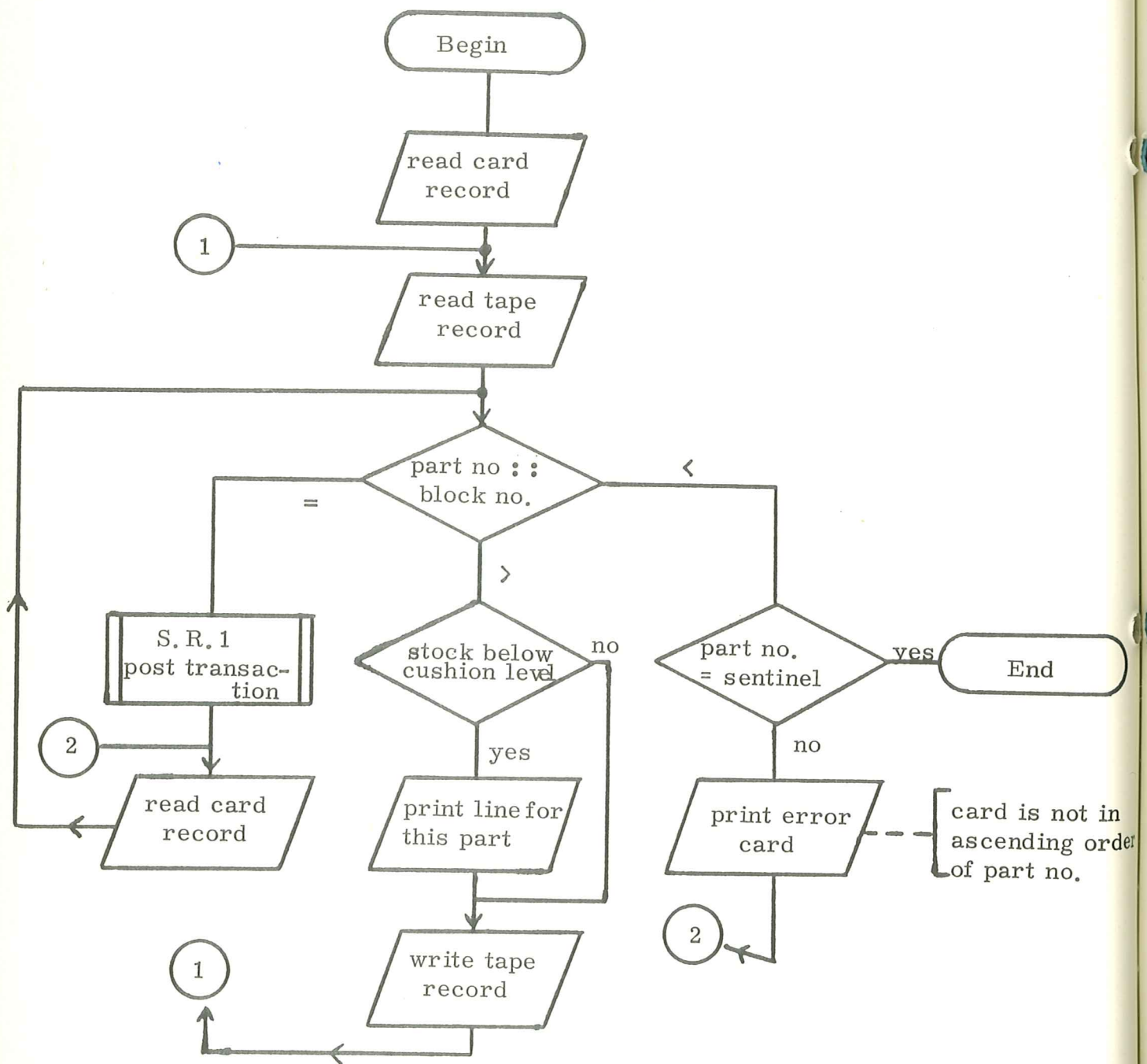


APPENDIX I

A STOCK CONTROL EXAMPLE

Program Flow Chart





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



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 beside them.

File of cards	:	
Offline Storage	:	
Online Storage	:	
Auxiliary Operation	:	

not in
ng order
no.

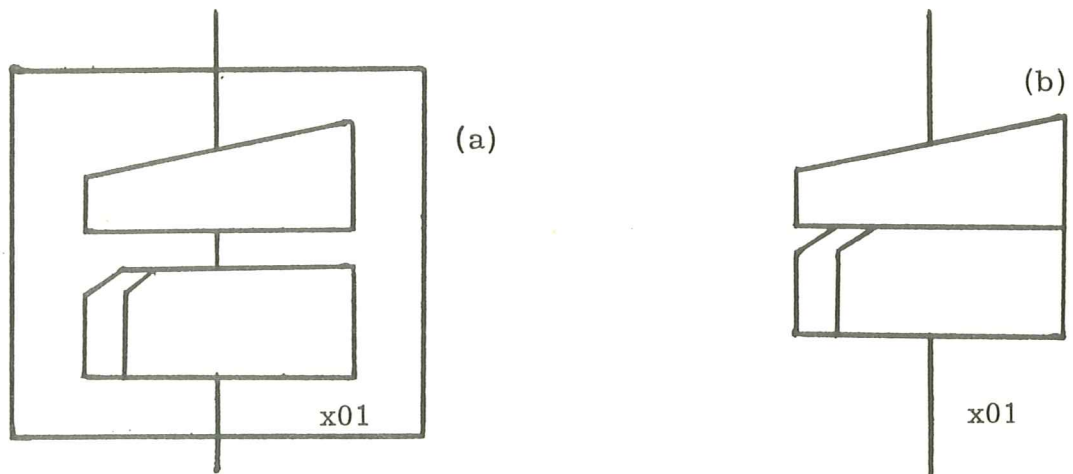
APPENDIX III

Indication of processing functions on flow charts of logical operations

Alternative methods are suggested for showing the combination of two or more logical operations on a single processing function:

- a) The operational Symbols may be enclosed in a full-line box, which may contain any necessary narrative such as the identification of the machine to be used.
- b) Provided ambiguous shapes are not introduced, it is possible to place the operational symbols in direct contact.

Example: Manual punching with gang punching derived from a non manual source.



REMARK:

- (1) The assignment of a machine or group of machines to a single operation may be shown by writing a machine identification in or outside the operational symbol.

Examples:



