PART 2 : AUXILIARY EQUIPMENT

CONTENTS

1. PAPER TAPE PREPARATION EQUIPMENT

This section describes the processes and equipment used in the manual preparation of punched paper tape from documents or manuscript.

1.1 General

In order to ensure the greatest possible accuracy, the manual preparation from manuscript of paper tape suitable for input to LEO III is done in three sequential stages, carried out by three operators, as follows:

(i) Perforation where a 5- or 7-track paper is produced from the manuscript. This process is described in 1.2.

(ii) Verification where a second (7-track) tape is produced whose accuracy is virtually ensured by arranging for any discrepancy with the first tape to be revealed by comparison, corrected and marked. This process is described in 1.3.

(iii) Scrutiny As a final safeguard the second tape is checked by a third operator at any points where the first two operators disagreed so that the second tape can if necessary be further amended and then be regarded as the final correct tape. This process is described in 1.4.

1.2 Perforation

This is the process by which a first tape is produced from the manuscript data, by the use of one of two types of keyboard perforator.

1.2.1 Alpha/Numeric Perforator

This consists of a keyboard on which one key is provided for each character in the LEO III paper tape code except 'alignment mark' and 'doubtful block mark'. This keyboard controls the paper tape punching equipment.

When a key is depressed the corresponding character is punched on to 7-hole paper tape. The keyboard is locked to prevent simultaneous depression of two or more keys.

A 'feed blank' key is provided which causes blank tape (i.e. sprocket holes only) to be punched repeatedly for as long as the key is depressed.

The LEO III paper tape code is given in Appendix A and the Perforator Keyboard layout in Appendix B.

1.2.2 Numeric - only Perforator

This is a simplified version of the alpha/numeric perforator described above, which may be used to perforate data which does not contain alphabetic characters.

Keys are provided for the following characters only: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, -, NE, BE, Erase.

When any key is depressed the corresponding character is punched on to 5-hole paper tape.

The pattern which is punched is the same as that in tracks 1 to 5 of the 7-hole paper tape code, i.e. the quartet value and parity bit only, with the exception of the minus sign which is punched as quartet value 12 and parity.

The 'feed blank' key is provided as for the full alpha/numeric perforator.

The 5-hole paper tape code is given in Appendix A and the Perforator keyboard layout in Appendix B.

1.3 Verification

The verification process consists of an attempt by a second operator using a verifier to produce a second tape from the initial manuscript data. During this process the first tape produced is read and compared automatically by the verifier, character by character, with the tape being prepared by the second operator. If any discrepancy arises the verifier keyboard locks and the operator must take corrective action before proceeding, as described below. At the end of the process the tape produced by the verifier should be error free.

1.3.1 The Verifier

The verifier consists of a keyboard, similar to that of a perforator, which is linked to a paper tape punch.

A paper tape reader is also connected, via verification circuits to the keyboard and punch. A diagram of the verifier keyboard is given in Appendix B.

To use the verifier, the original perforated tape is fed to the paper tape reader, and the verifier operator commences to perforate on the second tape from the original manuscript data.

As each key on the verifier keyboard is depressed (except the 'feed blank' key which does not cause comparison) the next character is read from the first tape (erase characters and blank tape are ignored). If this agrees with that set up on the keyboard the character is punched on the second tape, otherwise the keyboard is locked and a red 'error' lamp lit.

The operator must now determine the cause of disagreement. If necessary she may operate the 'feed blank' key to run out the tape on the punch in order to examine it since this key is not included on the keyboard lock.

The operator, having determined the error, classifies it in one of four groups and takes action as follows for each group:

(a) Checker's error: If the operator decides that the discrepancy was caused by her own error, she presses the 'Reset' button on the verifier. This releases the keyboard without punching the character set up on it and without moving on the tape in the reader. The red light goes out and the operator may now make a further attempt to verify this character.

(b) Perforator's error - wrong character: If the operator decides that the discrepancy was caused by the original perforator having incorrectly perforated a character (other than in (c) and (d) below) she presses the 'wrong character' key on the verifier. (This is a spring return key). This causes the following sequence of operations to take place:

(i) An 'Erase' character is punched - this acts as a marker for later scrutiny.

(ii) One row of 'blank tape' is punched - this is to enable later manual correction if necessary. Both the characters in (i) and (ii) are ignored by the computer.

(iii) The character on the keyboard is punched.

(iv) The keyboard is released and the red light goes out. The tape in the reader is moved on ready to verify the next character.

(c) Perforators error - character(s) omitted: If the operator decides that the discrepancy was caused by the original perforator omitting one or more characters, she depresses the 'character omitted' key on the verifier. This causes 'erase', 'blank tape', and the character on the keyboard to be punched and the keyboard released. The read lamp remains on.

The operator then punches any further omitted characters. Each one will be automatically preceded by 'erase' and 'blank tape'. No tape is read during this operation. When she has finished she returns the 'character omitted' key to its normal position. The red light now goes out, and the operator may then make a further attempt to verify the character still on the reader.

(d) Perforators error - character(s) inserted: If the operator decides that the perforator originally inserted spurious characters, she presses the 'character inserted' key on the verifier and holds it down. This causes 'erase' and 'blank tape' to be punched, and the next character on the tape to be read and compared with that set up on the keyboard. This continues automatically until a character is read which agrees with that on the keyboard.

For each discrepancy 'erase' and 'blank tape' are punched and when agreement is reached the character is punched, the keyboard is released and the red light goes out. The operator may now release the spring return 'character inserted' key and continue to verify the next character which will have been read from the tape.

1.3.2 Modes of Verification

The verifier has a three-position switch with settings as follows:

(i) Check Alpha/Numeric: In this position a 7-hole tape as produced by a full alpha/numeric perforator (see section 1.2.1) may be read and compared with the keyboard settings. A 7-hole tape incorporating the verifier operators corrections is produced.

(ii) Check Numeric: In this position a 5-hole tape as produced by a numeric perforator (see section 2.2) may be read and compared with the keyboard settings.

Allowance is automatically made for the special treatment of minus signs.

Parts of the verifier keyboard are locked so that only numeric keys may be depressed. A 7-hole tape incorporating the verifier operators corrections is produced. This is the normal LEO III 7-hole code.

(iii) Copy Tape: When the switch is in this position 5- or 7-hole tape may be read and copied direct on to 7-hole tape without the use of the keyboard.

If 5-hole tape is being copied holes will be punched in tracks 6 and 7 of the output tape for every character, thus all characters will have a control quartet of 3.

No allowance is made for the special treatment of minus signs which will therefore be punched as 3/12 characters.

1.4 Scrutiny

In this process a third operator examines the supposedly error-free tape produced by the verifier to ensure that the verifier operator, in over-riding the perforator operator, took the correct action.

At every disputed point the verifier has punched an 'erase' character to mark the point and 'blank tape' to enable the scrutineer to make further corrections if necessary. To aid the scruntineer a machine called a 'scrutiniser' is provided which recognises the 'erase' characters marking the disputed points on the tape.

1.4.1 The Scrutiniser

This equipment consists of a photo-electric paper tape reader and certain scrutinising circuits.

The tape is read at a rate of 20 characters/second until either:

(i) Parity error is found - the tape then stops and a red 'parity alarm' is lit. The scrutineer then corrects the error manually.

(ii) 'Erase' character is recognised - the tape then stops and a red, 'scrutineer alarm' is lit. The scrutineer then inspects the tape to ensure that the verifier operator has taken the correct action. If not, she corrects the tape manually, making use of the blank tape provided for the purpose.

When the scrutineer has dealt with the error, if any, the equipment may be restarted. This resets all alarms. To assist the scrutineer to find the place in the manuscript against which to check any doubtful tape, a counter is provided which counts the number of block ends passed. This is reset to zero each time the scrutiniser is restarted except after parity alarms.

1.4.2 Checking Computer-Produced Tapes

As it is anticipated that the scrutiniser may be used to check computer-produced tapes, it needs to be provided with a facility for dealing with a 'doubtful block' character (code 1/15) although this is not normally present in manually prepared tapes.

The character is punched by the Master Programme at the beginning of blocks which are to be ignored, and may thus be cut out of the tape by the scrutineer.

When a 'doubtful block' character is detected a red 'doubtful block' alarm appears on the scrutiniser so that the scrutineer can erase the block from the tape.

The 'erase' character will not normally be present in computer-prepared tapes.

2. KIMBALL TAG TO PAPER TAPE CONVERSION UNIT

The equipment described in this section produces punched paper tape, suitable for use on LEO III, from Kimball tags. The tags are mostly used in the retail clothing trade, tags bearing information about each garment being attached to it in sets.

2.1 Layout of Information on Kimball Tags

The digits 0 to 9 and 'space' can be represented in each of 29 columns on the Kimball tag, its value being determined by the position of one or two holes punched in the column. For the full character code see Appendix A.

Kimball tags which can be read by the conversion unit are punched either in 4- or 5-hole columns (parity is optional) as shown in fig. 1. Specified columns are used as a control column to indicate whether a tag has 4- or 5-hole columns when mixed packs are being read. A tag with a mixture of 4 and 5 columns must not be used.

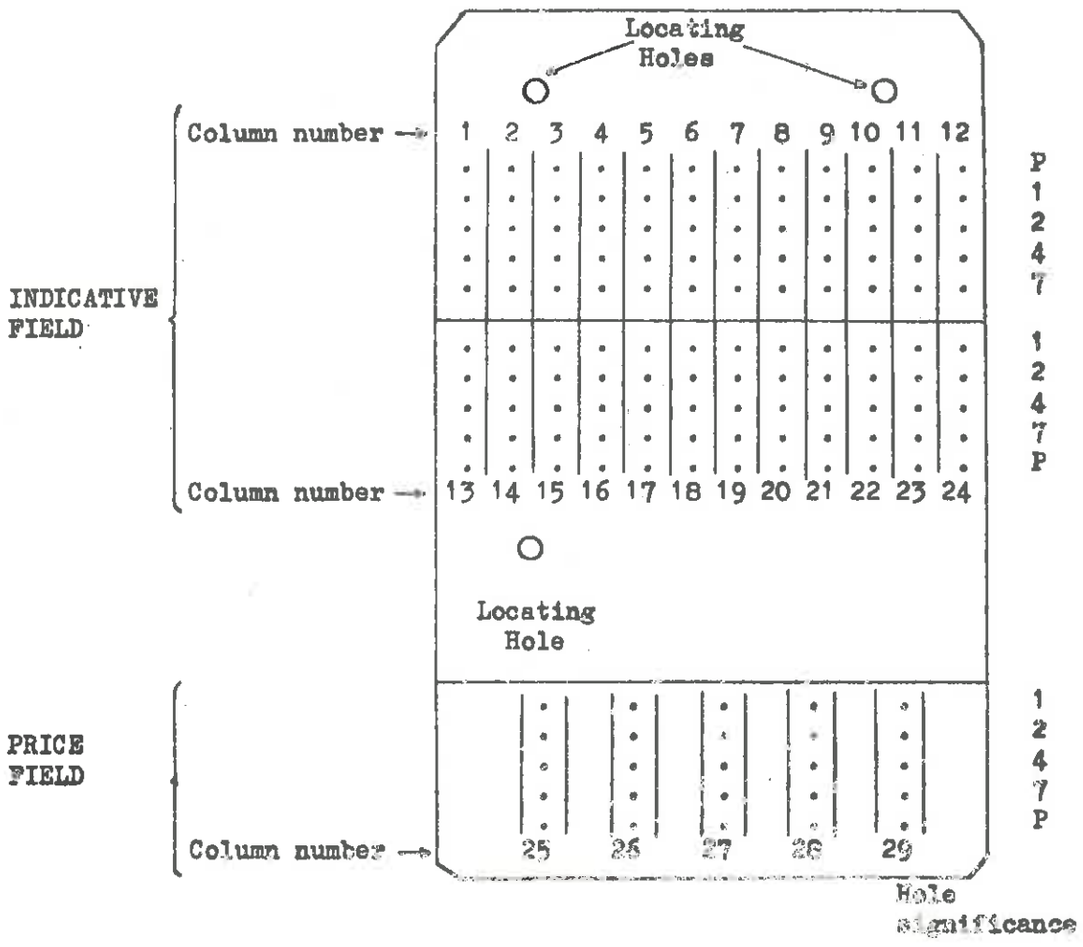


Fig. 1 Layout of Kimball tag (enlarged).

2.2 The Conversion Unit

Tags are fed from the bottom of the input stack by a system of push arms, and when the card is under the reading station, the three location holes on the tag (see fig. 1) are engaged by three rods, which hold the tag in the correct position for reading. The tags are read mechanically. For each possible information hole on the tag (see fig. 1) there is a corresponding read wire. When the tag is in the reading position, the array of read wires descends on the tag and where there is a hole, passes through and completes an electrical circuit which energises a relay, there being a relay associated with each read wire. Thus the result of reading a tag is a pattern of energised relays, corresponding to the information holes on the read tag.

The unit reads up to 29 columns from each tag, checks each column for parity, and routes each item of information through a plugboard which rearranges the information as required, and intersperses it with fixed information if necessary, punching from each tag a paper tape block of up to 32 characters.

The unit can read and convert tags at the rate of 150 tags per minute.

2.3 Details of Conversion

Columns 1 to 29 of the tag are read and checked for parity. Columns may be 4-hole or 5-hole punched (see Appendix A), and the mode of punching is specified by the plugboard (see section 2.4). If mixed packs are being read, then for any particular tag the mode of punching is specified by the absence or presence of a parity hole in a control column on that tag. The control column is usually column 19 but may be specified by the plguboard. If 5-hole columns (i.e. including parity hole) are read, a check is made that two holes are present in each column. If 4-hole columns (i.e. without parity hole) are read, a check is made that at least one and not more than two holes are present in each column.

If any column fails the parity check the reader halts with the error lamp lit. On pressing the Restart key a doubtful block character is punched, followed by a block end character.

The characters are converted to LEO III paper tape code, both 'space' and 'zero' being converted to paper tape character '0'.

The characters are re-ordered as required by routing through the plugboard. Any character may be suppressed and 'Number End' characters may be inserted anywhere (subject to a 32 character per block maximum - including block end).

Block end characters are inserted automatically after conversion of each tag.

2.4 The Plugboard

The plugboard performs the following functions:

(i) Specifying whether each tag is to be read as 4- or 5-holes, or in the case of mixed packs specifying which column is to be used as a control column.

(ii) Suppressing the error alarm on any column or columns of a 5-row tag.

(iii) Selecting up to 31 characters for punching from the following:

29 characters from tag

NE character

The selected characters may be punched in any specified order. One particular character may appear several times in the output block if required, or may not appear at all. A diagram of the plugboard is given in Appendix C.

Links may be set as follows:

(i) Any tag column can be plugged to any tape character position.

This determines the position within the paper tape block in which the information in the column will appear.

(ii) Number end may be plugged to any tape character position.

2.5 Form of Paper Tape Produced

The tape is punched in LEO III paper tape code (see Appendix A to part 1) no discrimination being made between 'space' and '0', both being punched as '0'. Blocks may contain a maximum of 32 characters, including a 'block end' character, which is automatically punched at the end of a block. A block of information on paper tape corresponds to the information contained on one Kimball tag, characters being ordered as specified by the plugboard layout.

If any column of the tag being read fails the parity check, the reader halts after the tag is punched on the tape and a 'doubtful block' character punched following the error block.

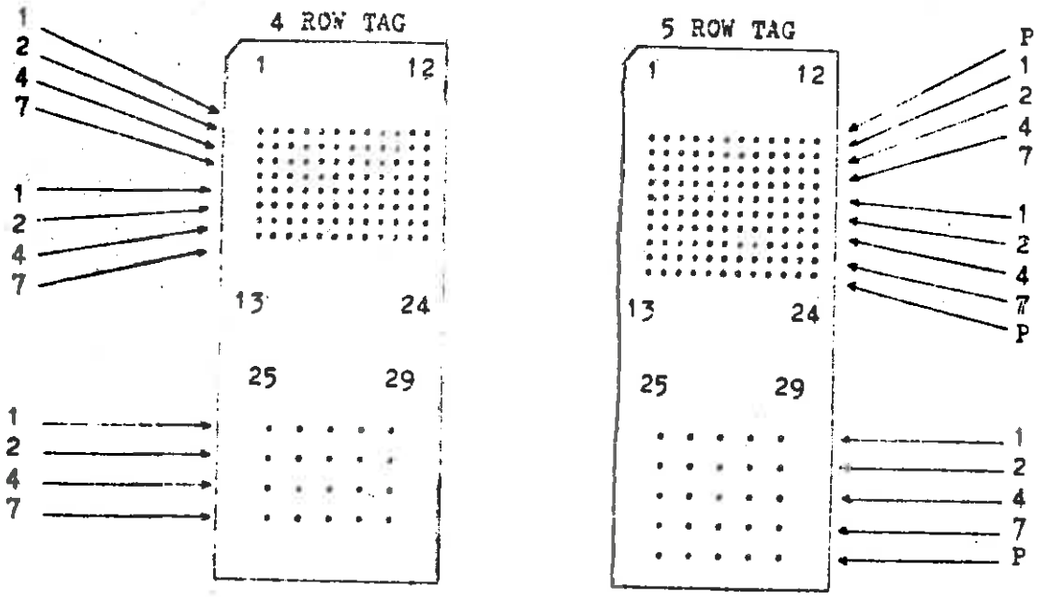
A sentinel block may be punched at the beginning of each tape by pressing a button on the unit before commencing to read tags.

The block consists of five '/' (3/1) characters, followed by ten characters determined by the settings of ten master switches, and terminated by a block end.

Each master switch may be set to punch one of the following twelve characters:

0 1 2 3 4 5 6 7 8 9 ₨ £

APPENDIX A : TAG LAYOUT AND CODES



The actual size is 2.3" x 1.1"

4 ROW TAG CODE:

	Blank	0	1	2	3	4	5	6	7	8	9
1 Row			0		0		0			0	
2 Row				0	0			0			0
4 Row	0	0				0	0	0			
7 Row	0	0							0	0	0

5 ROW TAG CODE:

Parity Row			0	0		0			0		
1 Row			0		0		0			0	
2 Row				0	0			0			0
4 Row	0	0				0	0	0			
7 Row	0	0							0	0	0

In certain applications 10 and 11 pence are recorded by the omission of 5 and 7 pence from the pricing system, i.e.

6 pence is represented by character 5

8 pence is represented by character 6

9 pence is represented by character 7

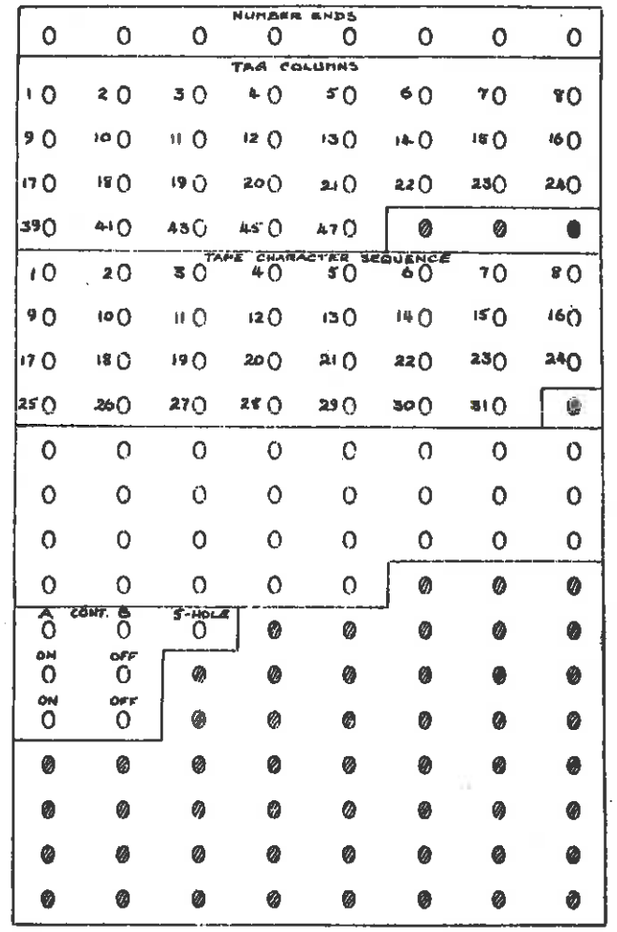
10 pence is represented by character 8

11 pence is represented by character 9

This or any similar convention will not be recognised by the convertor, but must be dealt with by programme.

Information read by this unit is punched onto paper tape according to the LEO III code (see Appendix A, Part 1).

APPENDIX C.1 : KIMBALL TAG PLUGBOARD LAYOUT



O holes which may be plugged

● holes which correspond to tape positions etc. but which may not be plugged

⌀ holes which are not used

Any tag column can be plugged to any tape character position.

A number end may be plugged to any tape character position.*

Any tag column may be plugged to a 'suppression' hole.

If mixed packs are being used, a choice of two columns is offered to be used as control columns. These are wired inside the equipment to correspond to holes 'A' and 'B'.

To specify a control column, either 'A' or 'B' as appropriate may be plugged to 'on'.

When packs of all 5-hole tags are being use '5-hole' is plugged to 'on'.

If neither '5-hole' nor 'A' nor 'B' is plugged to 'on' 4-hole tags are assumed.

3. LEO DOCUMENT READER (LECTOR)

3.1 General

The LEO Document Reader is a machine designed to convert information marks entered on pre-printed documents into punched paper tape suitable for presentation to the computer. Information marks are made on the documents using pen, pencil or ballpoint pen.

3.2 The Document

3.2.1 General

Each document contains a maximum of 16 columns in which information marks can be made. The column positions are referred to by number from 1 to 16, column 1 being the right-hand one. A mark consists of a short horizontal line drawn across a column of the document, the range of values which can be assigned to each row of the document being a function of the column values and their combinations. The correlation between information marks and the characters punched on the tape is controlled by a plugboard on the Document Reader (see 3.6).

Certain pre-printed marks must be present on each document. These are location marks and end of document mark. They are held in a non-information column, referred to as column 0. Their positioning and function is described below. Information rows may be spaced according to the requirements of the user.

3.2.2 Stationery : Size and Quality

Documents may be from 5 to 10 inches in width and 6 to 18 inches in length, with the proviso that the length must exceed the width by at least 1 inch.

The paper used should be sized and well calendered, with a matt finish.

3.2.3 Location Marks

Column 0 must be 'live' and contain pairs of location marks used to initiate and terminate the reading process for each row of the document.

The right-hand edges of the location marks must be parallel to the edge of the document.

For the specification of these marks and any other marks on the document, see the Document Specification details.

3.2.4 End of Document Marks

The end of document mark consists of a pair of horizontal lines at the bottom of the column containing the location marks. These are used to initiate and terminate the reading of a horizontal line entered midway between the end of document marks under each 'live' column. Failure to detect this mark in a column designated as 'live' gives rise to a Misread Alarm.

3.2.5 Information Marks

Information marks are horizontal lines entered centrally in a column level with the mid-point of a pair of location marks. If an information mark is entered in error it can be cancelled by blocking in the area below the mark.

As an aid to entering information marks it is possible to pre-print the document with guides, an example of this being the broken semi-circles printed on the specimen document (Appendix A). In this case the mark is entered by drawing the diameter of the semi-circle.

Document marks can, if required, be produced by the Anelex printer, using the hyphen character. Marks so produced are acceptable only if the printer is operated at the slower speed and if location marks are spaced more widely apart than is usual when documents are marked by hand.

3.2.6 Optional Printing

Printing may be entered across the columns, except between a pair of location marks. This printing will in no way affect the reading of the document. Outside the information area the document may contain any legend desired.

3.3 Principles of Document Reading

The sixteen column positions are scanned simultaneously by the reading heads row by row, the reading of any column position not in use being inhibited by a plugboard link. For the purpose of reproducing information marked on the document, the columns are treated as four groups of four columns. As each document row is read, one character is punched on paper tape for each quartet of columns, representing the marks held in that quartet on the document. A mark entered on the document in a column will cause a bit to be punched in the character representing the quartet in which the column lies. The correlation between the relative significance of any column within a quartet and the binary significance of the corresponding bit of the character punched is determined by plugboard links.

3.4 Reading Speeds

The speed of the Document Reader is dependent on the type of document being read, but it is generally accepted as being in the region of thirty times faster than manual data preparation methods.

3.5 Paper Tape Produced

3.5.1 General

Information read from the documents is reproduced on paper tape. The layout of the blocks punched is determined by the plugboard setting (see 3.6.3). Permissible block layouts and their significance are described below.

3.5.2 Information Blocks

For every information row on the document, up to four characters, representing the value of the column or combination of columns marked, may be perforated, plus two characters in binary-coded decimal specifying the row number, and a 'number end' character. Fewer characters may be perforated for each row by reducing the number of information characters or by omitting the row number or number end character. An information block on paper tape represents the information entered on one document. The block concludes with the block end cycle described below. (See Appendix C)

3.5.3 Block End Cycle

The information from a complete document is followed on paper tape by a block end cycle. This cycle consists of a LEO III block end character (3/14) followed by rows of blank tape or 'space' characters making up the cycle to the number of characters produced by any line of information on the document, according to the plugboard setting.

3.5.4 Eject Document Cycle

If a document is stopped while it is being read, caused by miscounting or misreading, it is cleared into the reject hopper by pressing the 'eject document' key. In this case an 'eject document cycle' will be punched before the block end cycle.

The 'eject document cycle' starts and ends with a 'doubtful block' character and is made up to the number of characters punched for any row of the document by the insertion of space characters.

3.5.5 Sentinel Blocks

This section refers to the LEO III application where tapes produced by the Document Reader are intended to be fed to a programme run under the control of the Master Programme.

Each reel of paper tape fed to a commercial programme run on LEO III under the control of the standard software programmes should start and finish with a special identifying sentinel block. These blocks consist of five '/' characters followed by ten variable characters and a LEO III block end character. At least 4 inches of tape must be run out before any sentinel block is perforated. A sentinel block is produced by pressing the 'sentinel key' whilst the ten variable characters are read from a specially marked document. (The columns to be marked are specified in the area 1K-12N of the plugboard). Each sentinel block must contain the appropriate reel number within the file to be read. Sentinel types are as follows:

(i) 'Start of reel' sentinels, one of which should occur at the start of every reel within the file.

(ii) 'End of reel' sentinels, one of which should occur at the end of every reel within the file apart from the last reel of the file.

(iii) 'End of file' sentinels, one of which should be perforated at the end of the last reel of the file immediately after the commercial programme's own end sign block if such a block is to be punched.

3.6 Plugboard

3.6.1 General

Signals from the reading heads are assembled by the package circuitry and routed via the plugboard to the Teletype punch.

3.6.2 Plugboard Layout

The plugboard has 336 positions, laid out in a 14 x 24 matrix. Five rectangular areas of this matrix are used, (see Appendix B), namely:

(i) Punch every line

(ii) Document columns in use

(iii) Character formation

(iv) Punch cycle make up

(v) Sentinel formation

3.6.3 Plugboard Links

Forty-nine links are required on the plugboard, the links and their purposes are listed below:

(i) A fixed link between 1D and 1C will cause every line of the document to be punched. In this case it is normal to use neither line numbers nor number ends.

(ii) A fixed link between 1D and 1E will cause only lines containing information to be punched.

(iii) Every column specified in the area from 2B-13E must be connected by a fixed link to the corresponding hole specifying 'on' or that specifying 'off'. This specifies the columns to be read.

(iv) In the area 1F-18J every bit of every character must either be connected by a fixed link to the corresponding 'inhibit' hole or to any hole specifying an information or line number bit. Every column specified as live (by links in area 2B-13E) must be connected to an information bit for punching.

(v) A fixed link must be inserted between 19F-19J, 21F-21H and the corresponding hole in row 20. This link specifies the number of characters to be punched for each line of information read from the document. The number of characters includes the row number and the 'number end' character if these are to be punched.

(vi) 22G must be connected by a fixed link to 22F if a 'number end' character is to be punched after the information from each row of the document, with the exception of the last. If 'number end' characters are not required 22G must be connected to 22H.

(vii) The area 1K-12N specifies how the single character to be perforated in the sentinel for each row on the sentinel form is to be routed to the punch. Each of the bits in the character is represented in each of the rows 2, 5, 8 and 11. The routing is affected by making four connections only, one for each bit. This is done by making a connection between the hole representing the document column to be used and the nearest hole representing the bit to be punched if that column contains a mark.

It is permissible to use either permanent or variable plugboards. When the variable type is being assembled, fixed links must be used wherever possible and flexible links used only when connections are to be made between holes which are not adjacent to each other along a row or column.

3.7 Control and Operation

The collecting hoppers are adjusted to take the correct size of document. Due to the $\frac{1}{4}$" tolerance in the brake unit, variation of width of documents within a batch is limited to $\frac{1}{2}$".

The two ten-position rotary switches on the control panel are set to the number of rows to be read from each document, the maximum being 99.

The ready lamp on the control panel should be the only lamp lit when reading commences. It should be noted that the power alarm remains alight for 30 seconds after the power is switched on. Documents are fed by hand singly, face up and with the top edge towards the reading head onto a set of inclined rollers which keep the document aligned while moving it under the reading heads. After it has been read the document is engaged by a set of rollers which transport it into the accept or reject hopper according to the setting of a flap on the conveyor.

If the document is halted during reading due to a miscount or misread alarm then the eject key is pressed which transfers the document to the reject hopper and initiates an 'eject document' cycle on the paper tape.

Sentinels are read from specially filled in documents. The sentinel key must be in the Up position while this is being done. In the Down position the sentinel key allows documents to be read while the 'tape low' alarm is functioning.

Reading must not under any circumstances be attempted if an engineers control alarm is lit.

The 'fan' and 'no tape' alarms cause the document being read to be rejected and an eject cycle to be punched on the paper tape.

3.8 Automatic Column and Line Counter Selection (an Optional Extra)

Under normal conditions, documents containing different numbers of columns cannot be put through the Document Reader in the same batch due to the wiring of the plugboard. However, if on the plugboard 21C is linked to 21D, an automatic condition is set up whereby all types of documents can be read, with the following proviso. Three lines at the head of each form are required to set up the selection for each individual form (Appendix A) as follows:

Line 1: Line Count

A series of short horizontal lines positioned to give, in binary decimal form, the number of rows to be read.

Line 2: Column Check

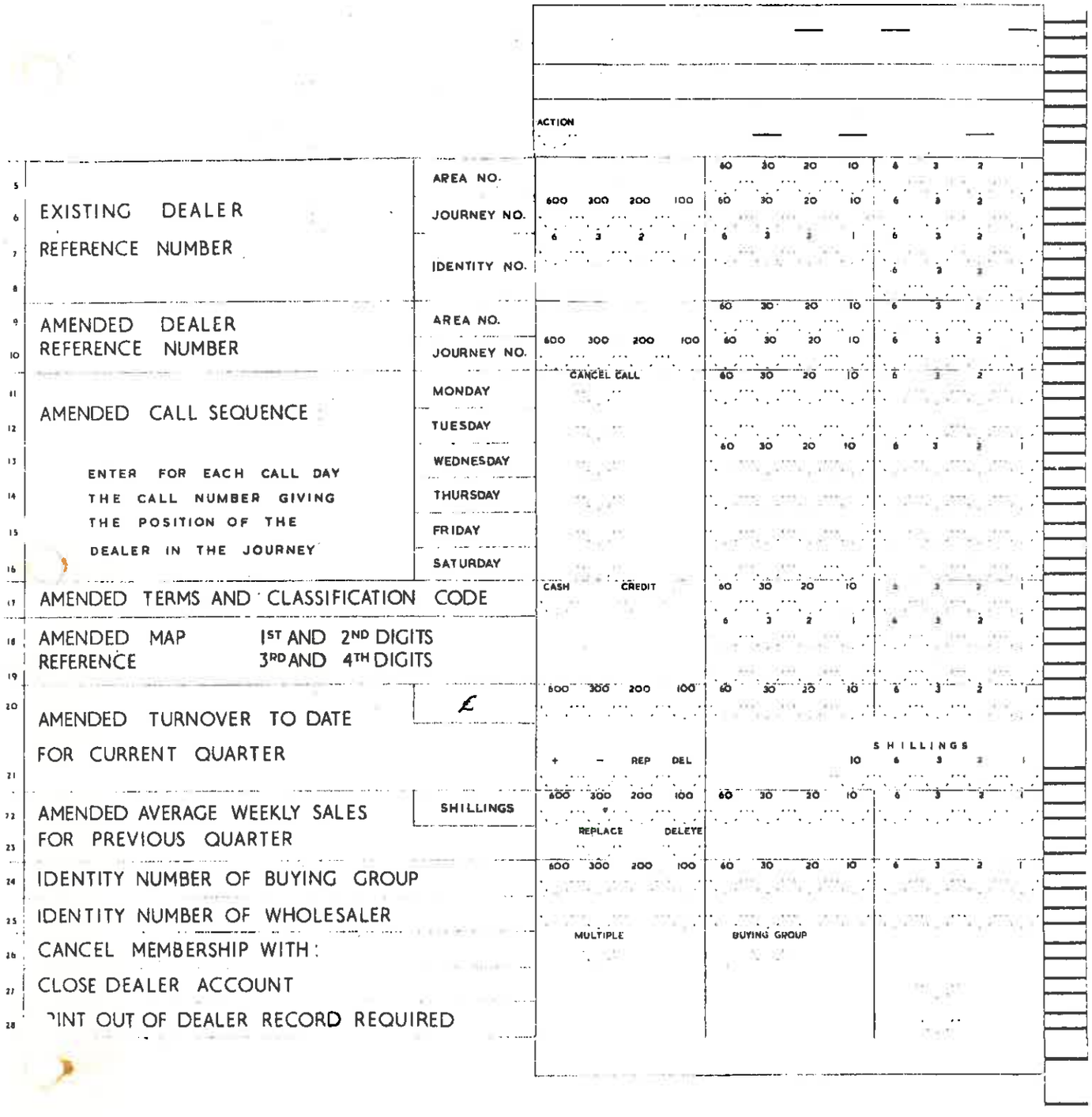
A continuous horizontal line corresponding to the number of read heads on the reader checks that all the heads are active.

Line 3: Column Select

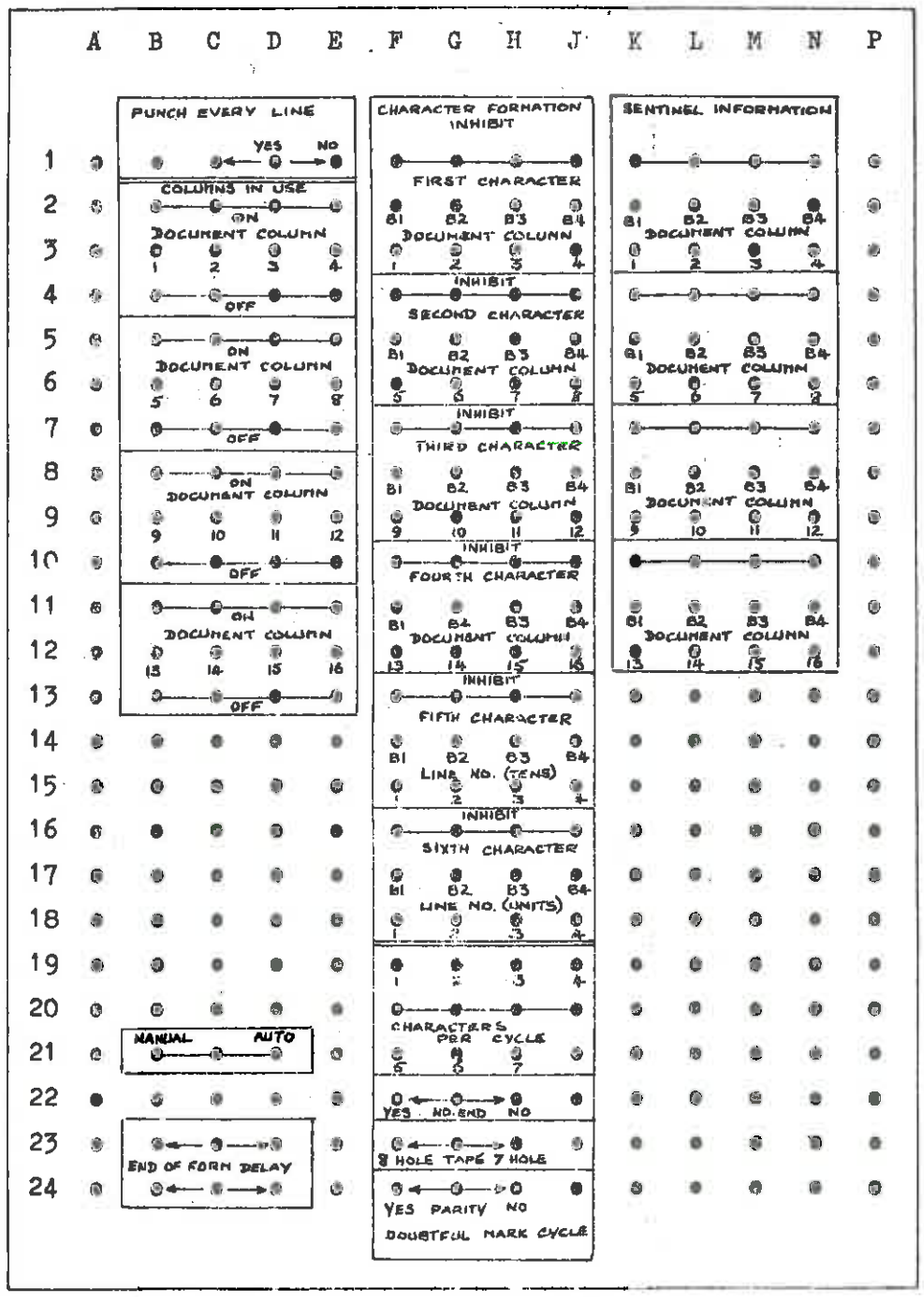
A continuous or broken horizontal line indicates that columns under this line only are to be read.

When the automatic condition is not required, 21C is linked to 21B to give the manual condition, and the documents are read according to the plugboard.

BAKERY SALES RECORDS AMENDED OUTLET DETAILS – NUMERIC

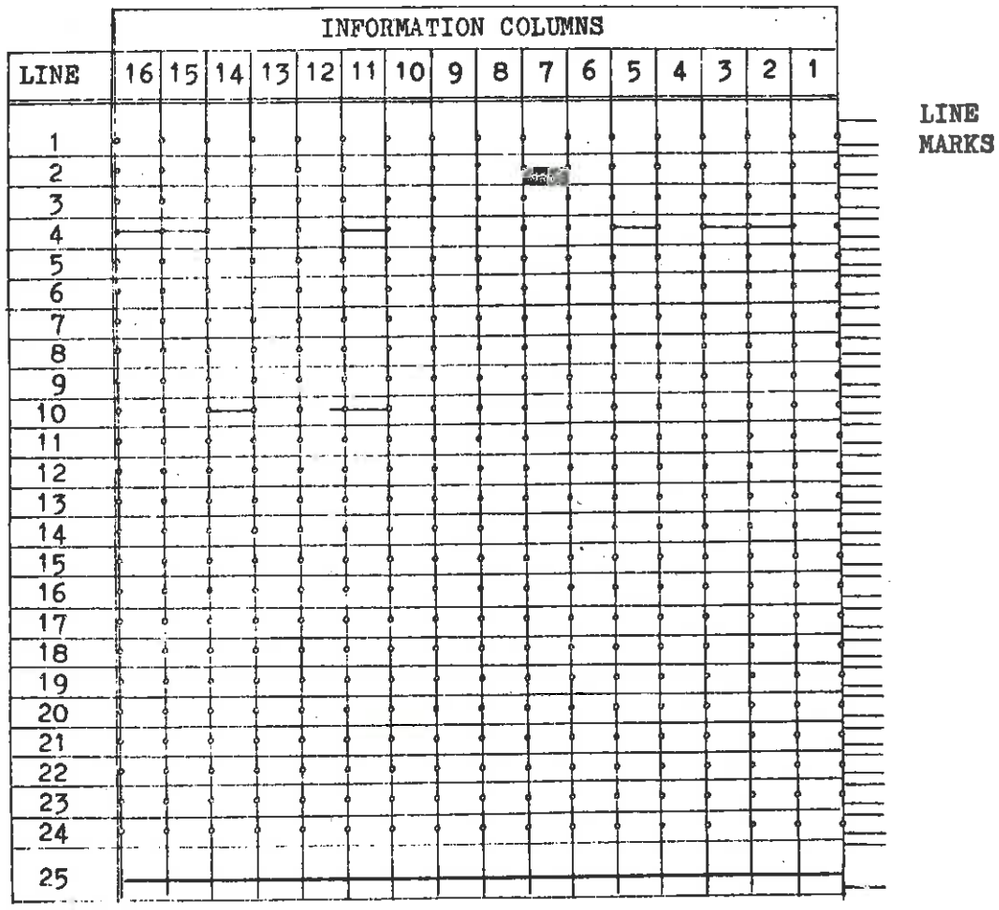


APPENDIX B : <u>DOCUMENT READER PLUGBOARD LAYOUT (Front)</u>



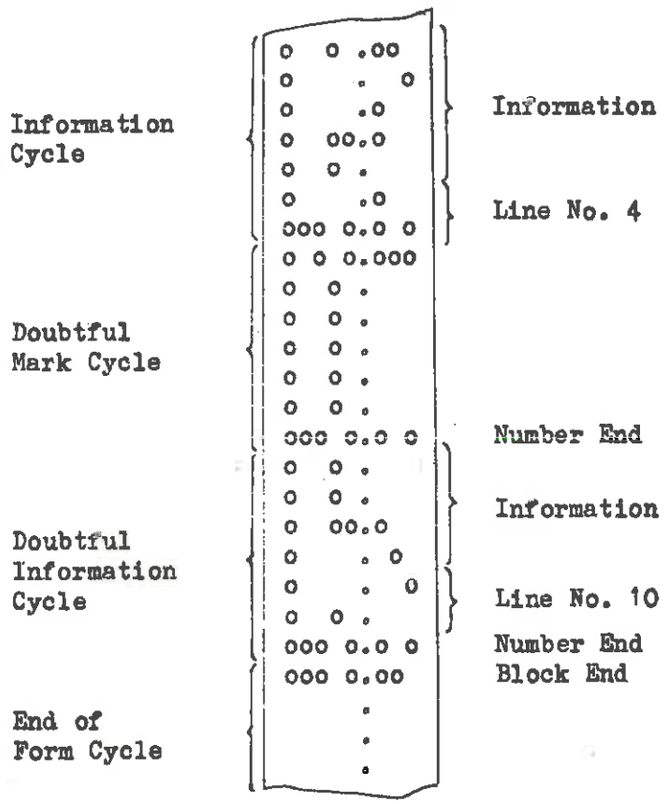
APPENDIX C : EXAMPLE OF COMPLETED FORM WITH CORRESPONDING PUNCHED TAPE

COMPLETED FORM

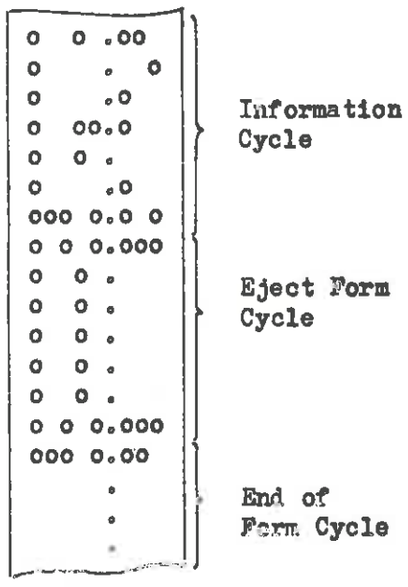


Erased mark on line 2, column 7.
Doubtful mark on line 10, column 12.
Good marks on line 4, columns 2,3,5,11,15,16, and on line 10, columns 11 and 14.
Line 25 checks reading on all columns.

TAPE CORRESPONDING TO FORM ON PREVIOUS PAGE



CASE WHERE END OF FORM WRONGLY DETECTED LINE 6



4. THE CARD COLLATOR

4.1 General

The Collator can be used to merge (collate) two packs of cards to check the numerical sequence of a pack or to remove cards from a pack.

The Collator is composed essentially of two feeding hoppers and four sorting boxes for the reception of collated and selected cards. The machine can deal with 80 or 38 column cards but not both. External controls consist of a single panel detachable plugboard, and start and stop keys.

4.2 Facilities of the Collator

There are two feed hoppers on the Collator, the Primary and the Secondary. Cards placed in the Primary Feed, so called because cards from this feed are instructed to move first and therefore reach the sorting boxes first, pass through three card positions before arriving at the sorting boxes. After leaving the feed the Primary cards move up to but not beyond the Sequence Brushes. The next move is over the Sequence Brushes to an intermediate non-reading position. The cards are then moved over the Primary Brushes to the Primary Eject position and thence into their hopper.

Cards leaving the Secondary Feed move up to but not beyond the Secondary Brushes. The next move is over the Secondary Brushes and thence into their hopper.

It follows therefore that cards from the Primary Feed can be sensed twice whereas Secondary Feed cards only once.

The Collator contains a 16-column control unit, the first card of the Primary pack setting up the initial reading in it on passing over the Primary Brushes. Any cards being sensed by either the Primary Sequence or Secondary Brushes are automatically compared with the control unit value.

The facilities allow the Collator to perform the following jobs:

4.2.1 Merging

The plugboard is made up so that up to 16 columns on the Primary pack cards may be read, and up to 16 columns on the Secondary pack cards read also. The two packs to be merged are then placed face down in the two hoppers. On starting the machine, the first Primary card that is fed in sets up its value on the control unit. As the Primary cards are fed in so the control unit is stepped on correspondingly until a card at the Secondary Brush Sensing position is found to equal the value on the control unit. This Secondary card is then merged in behind the Primary card that set up the value in the control unit.

4.2.2 Sequence Checking

As the cards in the Primary Feed pass over two sensing positions, it is possible to check that these cards are in sequence. Cards passing over the Primary Sensing Brushes set up their value in the control unit which in turn is compared with the value of the card passing over the Sequence Brushes. If the value of this second card is less than the control unit value an error condition is set. This can be indicated to the Operator by:

(a) Causing a marked card to be inserted from the Secondary hopper;

(b) causing the error card to go into a different hopper;

(c) stopping the machine and lighting the alarm lamp.

These conditions are set up by special plugboard links.

4.2.3 Card Pulling

The plugboard can be made up so that when two packs are being fed through the Collator, when an identical card is sensed at the Primary and Secondary Sensing Stations, the Secondary card is rejected.

4.2.4 Card Separating

To separate cards of a particular designation from a pack of multi-designated cards a special, or Pilot, card is made up. This Pilot card has only the one required designation punched in it, and is fed into the Collator on the front of the pack. It then sets up the control unit with this value and all successive cards are compared. The plugboard has been made up so that on detecting the required designation the Collator places the card in a separate hopper.

4.3 The Plugboard

For the description of the plugboard and making up of the plugboard for the above tasks, see the manufacturers manual.

4.4 Speed of the Collator

The Collator operates at 240 cards per minute, increasing to 480 cards per minute when both feeds are being used.

5. THE CARD SORTER

5.1 General

The Card Sorter is designed to sort cards according to the desgnation punched in a selected sorting column. It will sort 80-column cards at the rate of 600 per minute. The sorter is composed essentially of a feed hopper and 13 sort hoppers.

5.2 Principles of Sorting

Cards are placed face down in the feed hopper and the column they are to be sorted on is selected using the Column Selection handle. This places the read head in line with the required column. As the cards are fed through, the read head senses a hole punched in the column and causes the card to drop in the hopper corresponding to the particular designation. If the column does not have a hole punched in it, then the card goes into the reject hopper. By selecting any of the 'ignore row' keys, when the read head senses a hole in one of the rows to be ignored, it rejects the cards. If a column contains more than one hole the card is sorted on the first hole sensed at the read station.