

Oxford University Computing Laboratory

Computer Manuals

The 1401/1440
Simulators

4085

SIMULATORS

IBM 1401/1440 Simulators

Description of SPAN System.

1900

4085(3)
368

19000

TRAC series

19000

TRAC series

19000

TRAC series

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The 1401/1440 Simulators

1401/1440 SIMULATORS

19000

TRAC series

1900 SERIES

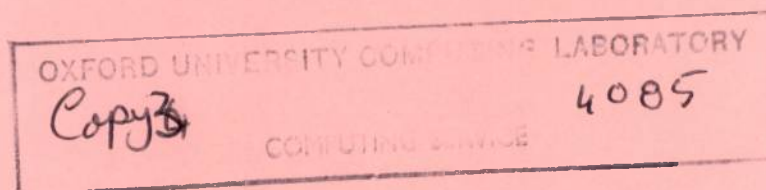
ICL

THE 1401/1440 SIMULATORS

Second Edition March 1968

Amendment List 1

- 1 Remove and destroy contents pages iii and iv. Insert new contents pages iii and iv.
- 2 Remove and destroy pages 1 and 2. Insert new pages 1 and 2.
- 3 Remove and destroy pages 5 to 18. Insert new pages 5 to 18.
- 4 Remove and destroy pages 25 to 28. Insert new pages 25 to 28.
- 5 Remove and destroy pages 37 to 45. Insert new pages 37 to 45.
- 6 Insert new pages 47 to 57 after page 45.
- 7 Update amendment record and file this list at the back of the manual.



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4085(3) 3-70

1900 SERIES

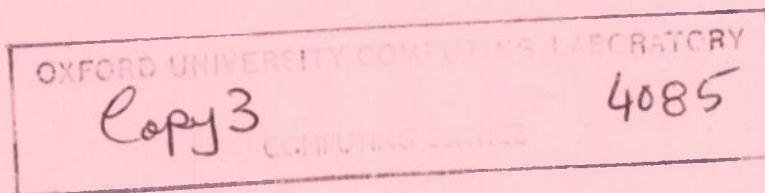
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THE 1401/1440 SIMULATORS

Second Edition March 1968

**Amendment List 2
incorporating User Notices The 1401/1440 Simulators (1) to (8)**

- 1 Remove and destroy pages 5 to 8. Insert new pages 5 to 8.
- 2 Remove and destroy pages 21 to 23. Insert new pages 21 to 23.
- 3 Remove and destroy pages 27 to 32. Insert new pages 27 to 32.
- 4 Remove and destroy page 35. Insert new page 35.
- 5 Remove and destroy pages 47/48. Insert new pages 47/48.
- 6 Destroy User Notices 1 to 8.
- 7 Update the amendment record and file this list at the back of the manual.



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1401/1440 SIMULATOR

The Mark 11 issue of the simulator is now available on application to the Software Library. The generation number of the tape is 11. This issue will, in accordance with standard ICL practice, be automatically sent to users who hold the previous issue. Distribution is expected to begin shortly and users not receiving it within fourteen days of the publication date of this notice should inform

The Registry,
Issue Branch,
International Computers Limited,
30/31 Friar Street,
Reading, RG1 1JP,
Berkshire.

Software errors corrected

The errors reported in the following Software Notices have been corrected in the Mark 11 version:

SPAN 14/27, Item 33
1900 /SIMULATORS/2, Items 3, 4 and 5
1900 /SIMULATORS/3, Items 6, 7 and 8

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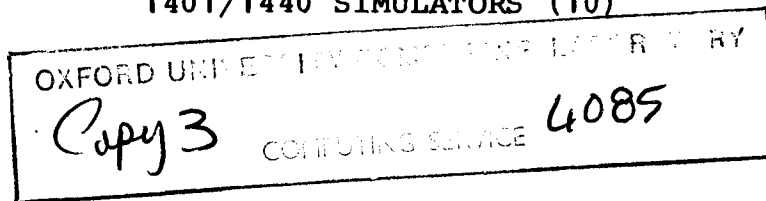
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1401/1440 SIMULATORS (10)



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1401/1440 SIMULATOR

The Mark 12 issue of the Simulator will shortly be available on application to the Software library. The generation number of the tape is 12.

This issue will, in accordance with standard ICL practice, be automatically sent to users who hold the previous issue. Distribution is expected to begin shortly and users not receiving it within fourteen days of the publication date of this notice should inform

The Registry,
Software Distribution Department,
International Computers Limited,
30/31 Friar Street,
Reading, RG1 1JP
Berkshire.

Software errors corrected

The error reported in Software notice 1900/Simulators/4, item 9 has been corrected in this version.

Amendment incorporated

The two new keys included in the Mark 12 issue of the Simulator, allow a wider range of line printers to be used. The choice of key depends on the availability of print channels 6 and 7 on the line printer.

1401/1440 Simulator manual

The following alterations to the manual should be noted before attempting to use the Mark 12 issue:

Page 2

Add 2404 and 2405 to list of line printers available.

Page 7

Exception condition 3 should now read: If there are not 24 parameter cards

Page 14

The description of the 1403/1443 carriage control loop should now read as follows:

Carriage control loop

1403/1443 CONTROL LOOP

The simulator uses a standardised 1900 control loop and a table describing the original 1403/1443 control loop to effect the required paper movements.

If 1900 LP print channels 6 and 7 are available the channels of the 1900 control loop should be punched as follows:

Channel Punching

- | | |
|---|---|
| 1 | Punched to correspond to the position of the 1st line on a form |
| 2 | Punched in the same line as a channel 1 punch and thereafter in each sixth succeeding line. |
| 3 | Punched in the line immediately succeeding every channel 2 punch |
| 4 | Punched in the line immediately succeeding every channel 3 punch |
| 5 | Punched in the line immediately succeeding every channel 4 punch |
| 6 | Punched in the line immediately succeeding every channel 5 punch |
| 7 | Punched in the line immediately succeeding every channel 6 punch |
| 8 | No punching |

The length of the loop is at the discretion of the user - within the limitations of the 1900 printer being used - provided that the diagonal pattern in channels 2 to 7 is repeated an integral number of times.

If 1900 LP print channels 6 and 7 are not available the channels of the 1900 control loop should be punched as follows:

Channel Punching

- | | |
|---|---|
| 1 | Punched to correspond to the position of the 1st line on a form |
| 2 | Punched in the same line as a channel 1 punch and thereafter in each fourth succeeding line |
| 3 | Punched in the line immediately succeeding every channel 2 punch |
| 4 | Punched in the line immediately succeeding every channel 3 punch |
| 5 | Punched in the line immediately succeeding every channel 4 punch |
| 6 | No punching |
| 7 | No punching |
| 8 | No punching |

The length of the loop is at the discretion of the user - within the limitations of the 1900 pointer being used - provided that the diagonal pattern in channel 2 to 5 is repeated an integral number of times.

ORIGINAL 1403/1443 CONTROL LOOP

The image of the original 1403/1443 control loop should be punched into table cards as described in Appendix 5 and fed to the simulator as described in Loading 1401/1440 programs from cards, page 10.

Page 21

Paragraph 2, line 4 should now read: This process should produce exactly 24 cards;

Page 23

Insert two new keys between 0210002 and 03000001

- | | |
|---|--|
| # | 1401/1440 1900 LP PRINT CHANNELS 6 AND 7 ARE AVAILABLE
02200001 |
| # | 1401/1440 1900 LP PRINT CHANNELS 6 AND 7 ARE NOT
AVAILABLE 02200002 |

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1401/1440 SIMULATOR MANUAL

Appendix 5

#XGVL VALIDATE 1403/1440 CARRIAGE CONTROL LOOP TABLE

The following paragraph should appear immediately after the DESCRIPTION paragraph:

"When the document to be printed is longer than 11", parameter 0180001 should be specified to the SPAN Editor program: when the document length is 11" or less, parameter 0180002 should be specified (see Appendix 2).

The first sentence of the paragraph following the heading FIELDS 3 TO 6 AND FIELDS 1 TO 6 IN SUBSEQUENT CARDS should now read:

"Each field represents the punching of the twelve channels of one line of the 1401/1443 paper tape loop, with a 1 punched where there was a hole (otherwise leave blank)."

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1401/1440 SIMULATORS (12)

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CARD READERS

This notice extends the list of 1900 card readers that may be used with the Simulator.

Amendments to 1401/1440 Simulators Manual

Page 2, lines 37-38. Amend to read:

1402 Reader/Punch	2101, 2104, 2105, 2106 with Decoder
1442 Reader/Punch	G or 2102 with Decoder E or 1911,
	1912 with Card Image feature.
	(The Card Image Feature is an optional extra on 2101 and 2104.)

Page 10, line 3. Amend to read:

For 1911, 1912, 2102 and 2104 readings using card image feature.

Page 10, line 7. Amend to read:

For 2101, 2104, 2105, 2106, 2102 readers using decoder G or E mode.

Page 10, lines -2 and -1. Amend to read:

The 1900 card reader should be set up so that the appropriate Decoder or Card Image is available.

Page 11, line 9. Amend to read:

4. As in loading 1401/1440 Programs from cards, steps 4 and 5.

Page 13, lines 1 and 2. Amend to read:

With any card reader with the decoder feature, the code button must be set to CODE 2 when 1401/1440 cards are being read. For reading cards other than 1401/1440 it should be set to CODE 1.

Page 13, Exception conditions 1, line 1. Amend to read:

1. Invalid 1401/1440 punchings with 1911, 1912, 2101, 2104 readers using card image mode.

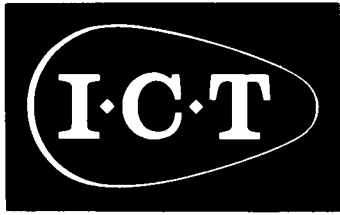
Page 13, Exception conditions 2, line 1. Amend to read:

Invalid 1401/1440 punchings with a card reader using the Decoder E or G mode.

Page 20, line -1. Amend to read:

The feature can only be simulated with a card reader that has card image.

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The 1401/1440 Simulators

Technical Publication 4085

© *International Computers and Tabulators Limited 1967*

First Edition January 1967 (4014A)

Second Edition March 1968

*Issued by Technical Publications Service
International Computers and Tabulators Limited
Head Office: I.C.T. House, Putney, London S.W.15
and printed in Great Britain by
Printing and Stationery Department
Letchworth, Hertfordshire*

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Chapter 1 Introduction

This manual describes the SPAN system, which is used to simulate the IBM 1401/1440 computers on machines in the I.C.T. 1900 series. It is assumed that the reader has some knowledge of the operation of the IBM 1401/1440 and an understanding of the I.C.T. 1900 series.

The SPAN system consists of a simulator program (#XG14), an editor program (#XGSE), which enables the user to create a simulator for his specific requirements, and a number of ancillary service routines.

Program #XG14 is an interpretive program designed to run 1401/1440 object programs as if they were in the 1401/1440 computers. Its efficiency depends on the instruction mix in the 1401/1440 program being simulated. Input/output limited 1401/1440 programs may be executed faster by the simulator than the 1401/1440, whereas computation limited 1401/1440 programs may be run slower. In general, job throughput times for commercial programs will be as fast under the simulator as on the 1401/1440.

METHOD

The complete 1401/1440 core store is held in a single area of the 1900 store. Each seven-bit 1401/1440 character is held in a 12-bit half word of the 1900 store. The most significant six bits containing octal 77 (the 'word mark character') or 0 represent the presence or absence of a word mark indicator; the least significant six bits, (the data character) represent the data bits of the 1401/1440 character. Parity checking is done by the 1900 processor, and the 1401/1440 parity bit is therefore ignored.

The simulator functions by analysing each 1401/1440 instruction in turn. The type of 1401/1440 instruction is determined, simulated address registers are set, and control is passed to the appropriate routine, which simulates the actual operation. Upon completion of the operation, control returns to the interpreter for examination of the next instruction.

The simulated 1401/1440 I address, A address, and B address registers are stored in binary, and their contents updated within the basic control. Chaining, determined by instruction length, bypasses setting the address registers. The 1401/1440 index registers are left in character form, and are converted to binary for addition into the simulated address registers.

Throughout these operations, checks corresponding exactly to those of the 1401/1440 hardware are made for address, format, and process errors, so that the 1401/1440 instructions are performed correctly.

INPUT/OUTPUT CONTROL

Each of the following peripheral devices on the 1401/1440 is simulated on an equivalent device on the 1900:

- Console
- Line Printer
- Card Reader/Punch
- Magnetic Tape
- Disc Storage

In general, input/output transfers take place through buffers located outside the simulated 1401/1440 core area. The physical transfer of data on the 1401/1440 is thus simulated by an internal transfer between the 1401/1440 core area and a buffer. Only when a data block exceeds the buffer size does the transfer take place directly to or from the simulated 1401/1440 core area. During internal transfers of data, character conversion processes are automatically carried out.

Wherever possible, physical 1900 transfers take place simultaneously with processing, thus taking advantage of the increased power of the 1900 series.

Apart from the actual loading of the various devices with cards, paper and magnetic tape reels and E.D.S., all physical actions are under control of the simulator.

Whenever the 1401/1440 program requires data to be input or output via a slow peripheral, magnetic tape or E.D.S. the internal transfer to or from a buffer takes place immediately. It is therefore not possible to simulate programs that modify an input or output area after a peripheral transfer has been initiated, counting on a delay before the transfer starts.

Simulation of the 1401/1440 console is carried out by messages on the 1900 console typewriter. Each 1401/1440 operation has an equivalent 1900 message or number of messages. The original 1401/1440 operating instructions should be rewritten as 1900 console operation messages as described in Chapter 3. The operator should consider the program as a 1900 program.

1401/1440 - 1900 CONFIGURATIONS

A description of the configuration of the 1401/1440 to be simulated is used to select those parts of the SPAN system needed. An editor program provided for this purpose automatically creates the required version of the simulator when given a description of the user's 1401/1440 and certain features of his 1900. This ensures that the minimum of core store is used to hold the simulator program.

The basic simulator requires 4,000 words and:

A 1401/1440 with s characters of core store needs $s/2$ words. (e.g. 12,000 characters of store occupy 6,000 words).

Simulation of the Multiply/Divide special feature requires 285 words.

Simulation of 1401/1440 magnetic tape operations requires 3,150 words. (Reading 1401/1440 and Read/Write SPAN tapes only - see Note.)

Simulation of 1401/1440 disc operations requires $1,500 + 265n$ words, where n = number of disc drives.

Simulation of the Direct Seek special feature requires 80 words.

Simulation of the Scan Disc special feature requires 100 words.

Simulation of the Advanced Programming special feature (indexing and functions H, P and Q) requires 130 words.

Simulation of the Sterling Arithmetic special feature requires 390 words.

Simulation of the Expanded Sterling Edit special feature requires 260 words.

Simulation of the Sterling Conversion special feature requires 270 words.

Note: Add $s/2$ words if reading/writing 1401/1440 tapes only. Add $(s/2 + 200)$ words if reading/writing SPAN and 1401/1440 tapes.

Peripheral devices simulated and their 1900 equivalents, are as follows.

1401/1440	1900	
1402 Reader/Punch	1911, 1912, 2101 or 2104 Card Reader with Card Image Feature	
1442 Reader/Punch	or 2102 Card Reader (with Decoder - E)	
1402 Reader/Punch	1921, 1920/2 or 1922/1 Card Punch or	
1442 Reader/Punch	2151 Card Punch	
1403 Model 1 Printer	1933/2 Printer	
1443 Printer	1933/3 Printer	
	1932/2 Printer	
	1931/2 Printer	
	2401/2 Printer	
	2402/2 Printer	
1403 Model 2 Printer	1933/3 Printer	
729 Model II Magnetic Tape	{ 1971 Magnetic Tape	
729 Model IV Magnetic Tape		1972 Magnetic Tape
729 Model V Magnetic Tape		1973 Magnetic Tape
729 Model VI Magnetic Tape		1974 Magnetic Tape
7330 Magnetic Tape		
7335 Magnetic Tape		

1311 Disc Storage

2801 E.D.S.

2802 E.D.S.

The Print Storage feature, Numerical Print feature and combination Write/Read/Punch instructions are simulated. Special print character sets require an identical set on the 1900 print barrel.

The following special features are provided by the simulator at the user's option.

Advanced Programming Feature

Indexing

Store A address

Store B address

Move to Record Mark or Group Mark/Word Mark.

Multiply

Divide

Expanded Print Edit

Branch on Sense switches B to G

End of Reel

Tape Error

High-Low-Equal Compare

Printer Busy

Carriage Busy

Sterling Features

Sterling Arithmetic and Coding Control

Sterling Conversion

Sterling Edit

Expanded Sterling Edit

SIMULATED MAGNETIC TAPE FILES

The simulator can read even parity magnetic tape files written by the 1401/1440 at 200, 556 or 800 b.p.i. on IBM 729 Model II, IV, V or VI, IBM 7330 or IBM 7335 decks. This should enable the user to avoid any initial conversion problems.

The simulator can read and write tape in one of two modes and formats:

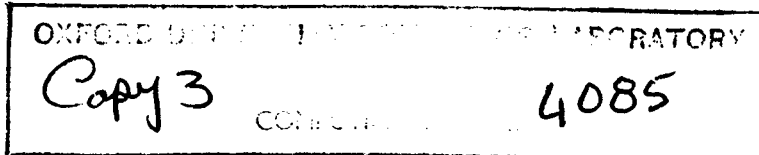
- 1 Even parity mode, standard 1401/1440 format.
- 2 Odd parity mode, special SPAN format.

Tapes written in 2 can only be read back into the 1900 through the simulator and not into the 1401/1440. However, processing of SPAN tapes gives a considerably faster transfer between buffer and the simulated store, and is recommended for all circumstances unless the output is to be read by a 1401/1440.

SIMULATED E.D.S. FILES

The 1900 cannot read from or write to IBM 1311 disc packs on 2801 or 2802 disc transports, so all IBM disc files have to be transferred to I.C.T. disc packs. Each I.C.T. disc must be prepared by running under the program #XGSA before it is used as a simulated 1311 disc for the first time. By using an IBM utility program to copy data from an IBM disc to tape or cards, and then simulating the corresponding IBM utility program to put tape or cards to disc, data can be transferred from an IBM disc to an I.C.T. disc.

Chapter 2 The programs in the SPAN system



THE SPAN SYSTEM TAPE

The SPAN system consists of the following PLAN 3 source programs held on a single reel of magnetic tape, which will be referred to as the SPAN system tape.

- #XGSE { SPAN Editor
SPAN Library of simulation routines from which #XG14 is created.
- #XGVP Validate SPAN print conversion table
- #XGVL Validate SPAN 1403/1443 carriage control loop table
- #XGVT Validate SPAN magnetic tape configuration table
- #XGWL Write SPAN labels to magnetic tape
- #XGSA Write sector addresses and mode to disc

SPAN Editor

This program is used to select those parts of the SPAN Library of simulation routines which are required for a particular 1401/1440 installation. The process of editing must be carried out before simulation can be performed, but in general need be done only once for any given 1401/1440 installation.

The editor operates by examining a description of the 1401/1440 configuration presented in the form of parameter cards, and it creates a magnetic tape with the various simulation routines needed, still in PLAN 3.

This magnetic tape is then compiled to produce the version of #XG14 required by the user.

SPAN library of simulation routines

This part of the SPAN system contains a library of simulation routines required for all of the 1401/1440 hardware features described in 1401/1440 - 1900 Configurations on page 2.

Validate SPAN print conversion table

The SPAN system allows the user to select a set of graphics from the 1900 series print barrel to represent the graphics on the 1403/1443 print chain. This is achieved by creating a character conversion table which the simulator uses to convert from internal 1401/1440 characters to 1900 series graphics. #XGVP accepts the parameter cards describing the conversion table and validates their contents (see Appendix 5).

Validate SPAN 1403/1443 carriage control loop table

The user is required to describe each 12-channel 1403/1443 carriage control loop on parameter cards, and #XGVL should be used to validate the contents of the cards (see Appendix 5).

Validate SPAN magnetic tape configuration table

In order to optimise the physical transfers of data to and from magnetic tape, the SPAN system requires a description of the user's 1900 magnetic tape configuration. This description is presented in the form of parameter cards as described in Magnetic Tape Configuration Table, page 9 and #XGVT validates the contents of the cards (see Appendix 5).

If the user's 1900 has only one tape control, then he should ignore all references to this program and to the SPAN Magnetic Tape Configuration Table.

Write SPAN labels to magnetic tape

The SPAN system requires that all magnetic tapes, other than original IBM 1401/1440 tapes, should have special SPAN labels. Program #XGWL will write SPAN labels to 1900 tapes as required by the simulator (see Appendix 5).

Write sector addresses and mode to disc

Program #XGSA will set up 1900 discs for use as required by the simulator, by giving them sector addresses and mode (see Appendix 5).

THE SPAN EDITOR

Compile SPAN Editor

The user must first compile the SPAN Editor program using the PLAN compiler #XPLV.

The input for this compilation run consists of the SPAN system tape and two parameter cards punched as follows:

Card	Columns	Contents
1	1 to 14	IN(SPAN14LIBRY
	15	Blank
	16	(
	17 to 19	Mark number of simulator with leading zeros
	20 to 21))
	22 to 80	Blank
2	1 to 4	PEND
	5 to 80	Blank

The resulting object program must now be used to edit the SPAN system tape.

Input 1401/1440 information

The editing process requires information about both the user's 1900 and 1401/1440 configurations. This is created by filling in the form *Parameters for SPAN Editor* in Appendix 2 and punching the appropriate lines on 80-column cards.

The user should mark with a cross (x) on the left of this form each line that contains a statement correctly describing some feature of his 1900 or 1401/1440 configuration. For example if the user's 1401 had magnetic tape, one of the lines containing a statement beginning:

1401 HAD MAGNETIC TAPE

should be marked whereas the line containing the statement

1401 DID NOT HAVE MAGNETIC TAPE

should be unmarked.

The marked lines should be punched, and these cards, in the order of the lines on the form, make up the parameters for the editing process. Certain lines have preprinted crosses against them; these should always be punched. Only the data in columns 1 to 15 and 73 to 80 is significant to the Editor. The alpha text is for clarity only.

Edit SPAN system tape

The next step is to edit the SPAN system tape to produce, on another magnetic tape in PLAN, a version of the simulation system tailored to the user's particular requirements.

The operating instructions for this run are as follows:

- 1 Load the Editor program (#XGSE, priority 80, 3,968 words) into store.

- 2 Mount the SPAN system tape (file name SPAN14LIBRY) without a write permit ring.
- 3 Load a scratch tape with a write permit ring to receive the output from the editing process.
- 4 Place the parameter cards, prepared as in Input 1401/1440 Information on page 6, in the card reader.
- 5 Activate the program by typing

GO #XGSE 20

The program will first open the output tape, read the parameter cards, and write to the output tape. It will then open the input tape and copy information from it onto the output tape.

When the process is complete, the program will type

END JOB OK

delete itself and request Executive to load #XPLV.

Exception conditions

- 1 If the first parameter card does not contain SPAN1 in columns 1 to 5 and LIBRY in columns 7 to 11, the message

FIRST CARD INCORRECT

will be typed and the program will delete itself. The card should be corrected and the program rerun.

- 2 If errors are detected in the remaining parameter cards, an error listing headed

INPUT CARDS ERROR LISTING

is produced, and after all of the cards have been read the program deletes itself and types

ERRORS IN CARDS

The cards should be corrected and the program rerun. Invalid conditions detected are as follows:

- (a) If a non-numeric character is detected in columns 73 to 80 of any parameter card, the line

NON-NUMERIC GROUP/ALTERNATIVE xxxxxxxx

is printed, where xxxxxxxx gives the contents of columns 73 to 80 of the offending card.

- (b) If, for any card except the first and last, column 1 does not contain # and columns 2 to 15 are not blank, the message

COLUMNS 1 TO 15 INCORRECT xxxxxxxx

will be printed, where xxxxxxxx gives the contents of columns 73 to 80 of the offending card.

- (c) If columns 73 and 77 of cards other than the first and last do not both contain zero, the message

COL 73 & COL 77 ARE NOT BOTH ZERO FOR xxxxxxxx

will be printed, where xxxxxxxx gives the contents of columns 73 to 80 of the offending card.

- (d) If a parameter card has in columns 73 to 76, a number that appeared in columns 73 to 76 of a previous card, the message

GROUP xxxx ALREADY CHOSEN, SO ALTERNATIVE yyyy BYPASSED

will be printed, where xxxx gives the contents of columns 73 to 76 and yyyy columns 77 to 80 of the offending card.

This will occur if an unmarked line on the *Parameters for SPAN Editor* form has been punched or if the user has marked lines containing contradictory statements.

- 3 If there are not 23 parameter cards, the program will delete itself and type

INCORRECT NO OF VALID CARDS

The user has failed to select one, and only one, option that correctly describes either his 1900 or his 1401/1440 configuration.

4 If errors are detected on the input tape, an error listing headed

INPUT TAPE ERROR LISTING

is produced, and after the whole tape has been read the program deletes itself and types

INVALID INPUT TAPE

If the user does not know the reason for the error(s) he should obtain a new SPAN system tape and re-run the program.

Invalid conditions detected are as follows:

(a) If a non-numeric group or alternative number is detected the line

NON-NUMERIC GROUP /ALTERNATIVE .XXXXXXXX

is printed, where .XXXXXXXX gives the group and alternative number of the offending record.

(b) If the first character of either the group or the alternative number is non-zero (unless both are set to 9999) the message

COL 73 & COL 77 ARE NOT BOTH ZERO FOR .XXXXXXXX

will be printed, where .XXXXXXXX gives the group and alternative number of the offending record.

5 If some of the parameter cards are punched in columns 73 to 80 with numbers not shown on the form, an error listing headed

SECTIONS NOT FOUND ON INPUT TAPE

will be printed. Under this heading will appear one or more lines with the format

GROUP .XXXX ALTERNATIVE .YYYY

where .XXXX and .YYYY give the contents of columns 73 to 76 and 77 to 80 respectively of the offending card.

After printing this listing, the program will delete itself and type

UNBALANCED. DUMP AND END

The user should correct the parameter cards and rerun the job.

6 The following three messages may also be typed and the program suspended:

(a) **PARITY ERRORS. DUMP AND END.**

(b) **LONG BLOCKS. DUMP AND END.**

(c) **UNKNOWN CONDITION. DUMP AND END.**

If any of these occur the user should obtain a new SPAN system tape and re-run the program.

Produce final simulator tape

Finally the tape produced by the SPAN Editor should be compiled using #XPLV and two parameter cards punched as follows:

Card	Columns	Contents
1	1 to 13	IN(EDITEDSPAN
	14 to 15	Blank
	16)
	17 to 80	Blank
2	1 to 4	PEND
	5 to 80	Blank

The object program tape will contain #XG14 (or #XG11, #XG12 or #XG13 depending on the #XGSE parameter used - see Appendix 1), which is used to effect simulation of the user's 1401/1440 and the ancillary programs.

Chapter 3 Operating the simulator

CARD DECK STRUCTURE

The order in which the various types of card are submitted to the simulator is as follows:

- Print Conversion Table (Optional)
- 1403/1443 Carriage Control Loop Table (Optional)
- Magnetic Tape Configuration Table (Optional)
- * End of Tables Card
- 1401/1440 Program
- 1401/1440 Data
- End of File Cards
- 1401/1440 Program and so on
- * This card is compulsory if there are any tables preceding it, otherwise it must not be present.

Print conversion table

This table links each 1401/1440 character with an associated printer graphic. When the simulator is initially loaded, it contains one of the standard versions, Tables A and H, as set out in Appendix 1. The table can only be changed by supplying a new version which is punched in the format described in Appendix 5 and then placed at the head of the input deck before loading. Having been changed, it will remain changed in the simulator until a new table is submitted.

1403/1443 carriage control loop table

This table describes the 1403/1443 Carriage Control Loop which was used with the program being simulated when it was run on the 1401/1440; its format on punched cards is described in Appendix 5.

If the version of the image currently held by the simulator describes the appropriate loop, then these cards need not be present. On initial loading, the simulator contains a standard version of this image which represents a 66-line 1403/1443 control loop with channel 1 punched in line 1 and channel 12 punched in line 64 or for 18-inch documents, a 108 line loop with channel 12 punched in line 106.

Magnetic tape configuration table

This table describes the distribution of controls amongst the magnetic tape units attached to the user's 1900. The description is used by the simulator in order to optimise transfers to and from magnetic tape. The format on cards is described in Appendix 5.

If the 1900 magnetic tape units all share a single control, these cards need not be present. If the 1900 magnetic tape units share more than one control and these cards are not present, simulation will be less efficient. These cards need be present only with the first 1401/1440 program to be simulated after the simulator has been loaded into the 1900 store.

End of tables card

This card must be present if, and only if, one or more table change cards are present. It indicates to the simulator that no more table change cards remain to be loaded. It contains four asterisks in columns 1 to 4 and the remainder is blank.

End of file cards

The operator should place two end of file cards behind the last card of the 1401/1440 data pack. These cards should have the following format:

For 1911, 1912, 2101 and 2104 readers

Columns	Contents
1 and 2	All rows punched
3 to 80	Irrelevant

For 2102 reader

Columns	Contents
1 to 4	****
5 to 80	Irrelevant

LOADING PROCEDURE

Initializing the simulator

Load the simulator (#XG14) into the 1900 store in the normal manner from SPAN run tape (see SPAN Editor, on page 6).

At this point the SPAN run tape may be dismounted.

When this operation is complete, type

GO #XG14 29

The simulator will set up various internal switches and then suspend and type a message prefixed by SR.

This is in fact a simulated Start Reset – see Appendix 3, Option 16 – but is being used here simply to initialize the simulator.

Loading 1401/1440 programs from cards

- 1 Place the card deck in the reader.
- 2 If any table cards are present, type

ON #XG14 19

GO #XG14 29

The simulator will read up to the end of tables card, and make appropriate modifications to itself.

If a Print Conversion Table is present, the message

PRI

will be typed. If a 1403/1443 Carriage Control Loop Image is present, the message

LOOP

is typed. If a Magnetic Tape Configuration Description is present, the message

TAPE

is typed. When the end of tables card has been read, the simulator will suspend itself and type

COMPLETE

- 3 Mount on the printer, if not already present, the 1900 Carriage Control Loop (see page 14, 1403/1443 Carriage Control Loop).
- 4 At this point various switches, such as the simulated sense switches, sterling switches, disc write-address key switch and the I/O check stop switch could be set ON or OFF (see Appendix 3).
- 5 If a 2102 reader is being used it should be set up to use code 2. The loading of the 1401/1440 program can then be initiated by typing the messages

ON #XG14 22

GO #XG14 25

Loading 1401/1440 programs from magnetic tape

- 1 The deck structure in this case should be as illustrated in Card Deck Structure, page 9, but without the 1401/1440 program cards.
- 2 If any table cards are present, then action as on page 10, Loading 1401/1440 Programs from Cards, step 2.
- 3 As in Loading 1401/1440 Programs from Cards, step 3.
- 4 As in Loading 1401/1440 Programs from Cards, step 4.
- 5 Mount the 1401/1440 PLT on an available deck and allocate it as unit 1 (see page 15, Facilities Available).
- 6 The loading of the 1401/1440 program can then be initiated by typing the messages

ON #XG14 19 22

GO #XG14 25

CONSOLE OPERATION

The simulator is controlled through the console typewriter. In this way a complete record of the console actions is created. A list of the 1401/1440 console facilities and their simulated equivalents is given in Appendix 3.

The simulator transfers control to the typewriter when:

- 1 responding to some operator action
- 2 a 1401/1440 program halt is encountered
- 3 an exception is detected in the 1401/1440 program.

Operator input to the simulator is achieved through the use of the bits of the monitor word, ALTERing the contents of words 10, 11 and 14 and GOing at entry points 20 to 29.

The standard 1900 entry points give access to the following facilities.

Entry	Facility
29	Start Reset (Appendix 3; Option 16) Table Load (See Loading Procedure page 10.)
28	Alter Registers (Appendix 3; Option 12)
27	Alter Storage (Appendix 3; Option 11)
26	Display Storage (Appendix 3; Options 9, 10)
25	Load 1401/1440 Programs (Appendix 3; Options 19, 20) Move Paper to Head of Form (See Line Printer page 14)
24	Unload/Rewind/Backspace Magnetic Tape (See Magnetic Tape page 15)
23	Sterling Switches (Appendix 3; Options 25 to 28)
22	Alter disc write-address key (See E.D.S. - Facilities Available page 17) Close E.D.S. files (See E.D.S. - Facilities Available page 17) Alter disc mode checking switch (see E.D.S. - Facilities Available page 17)
21	Start (Appendix 3; Option 15)
20	Reserved for Maintenance

I/O DEVICES - MANUAL OPERATIONS

The following sections describe the operating procedures for the input/output devices in some detail. This section serves to stress that, apart from the card punch, the simulator must be informed of any significant manual alteration in the state of the input/output devices. Specifically the following rules *must* be observed.

Card reader

Whenever the card reader is reloaded after it has been run out manually, the operator must type
ON #XG14 22

Line printer

Whenever paper is to be lined up to head of form, the operator must first type
ON #XG14 20
GO #XG14 25

The simulator will type HALTED: COMPLETE. The operator can then line up the paper.

Magnetic tape

Whenever a reel (on 1401/1440 unit n) is to be unloaded, the operator must type
AL #XG14 14 n
GO #XG14 24

The simulator will unload the tape and release it and then type HALTED: COMPLETE.

Whenever a reel (on 1401/1440 unit n) is to be rewound, the operator must type
ON #XG14 19
AL #XG14 14 n
GO #XG14 24

The simulator will rewind the tape and then type HALTED: COMPLETE.

Exchangeable Disc Store

No simulated discs must be on-line at the start of a program.

When a disc is requested by the message LOAD DRIVE n , the disc pack which is allocated to the drive n according to the operating instructions must be put on-line and the operator must type GO #XG14.

Whenever all the discs used by the program are to be unloaded the operator must type
ON #XG14 9
GO #XG14 22

Whenever a particular disc n is to be unloaded during the program the operator must type
ON #XG14 1 n
GO #XG14 22

where n refers to the 1401/1440 drive number.

A program must not be deleted without first unloading all the discs it uses.

CARD READER

Card codes

Cards should be punched in standard 1401/1440 code (see Appendix 1), with the exception that the character ? (plus zero) may be represented by either $\bar{1}2$, 2, 8, or $\bar{1}2,0$. (Note that the 1401/1440 $\bar{1}2$ overpunch is equivalent to the 1900 $\bar{1}0$ overpunch.)

With the 2102 card reader the code button *must* be set to CODE 2 when 1401/1440 cards are being read. At other times it should be set to CODE 1.

Stacker select

This 1401/1440 facility is not simulated. Stacker select instructions in the 1401/1440 program are effectively ignored.

Priming the reader

Whenever the card reader is reloaded after it has been run out manually, the operator must type

ON #XG14 22

If this is not done, the simulator will process information already present in its card read buffers before physically reading the first card.

End of file condition

If the 1402/1442 Reader/Punch end of file indicator is to be simulated, the operator must place behind the last card of the pack at least two special end of file cards as described in End of File Card, page 10.

Exception conditions

1 Invalid 1401/1440 punchings with 1911, 1912, 2101 and 2104 readers.

If an invalid punching is detected in a column of the card currently being read by the 1401/1440 program, the character octal 20 is substituted. Further action depends upon the state of the I/O Check Stop switch.

(a) I/O Check Stop Switch OFF

This 1401/1440 switch state is simulated by having bit 8 of the simulator's monitor word set OFF.

If an invalid punching is detected, the simulated 1401/1440 card reader error indicator is set ON and the remainder of the card is checked. Simulation does not stop.

(b) I/O Check Stop Switch ON

(i.e. simulator's monitor word bit 8 set ON).

If an invalid punching is detected, the simulator suspends itself and types the Standard Halt Line (see Appendix 4) prefixed by CR. The value of B final displayed gives the location of the invalid punching, e.g. if B final is 00037 then column 37 is in error.

When simulation stops, the error card is the last but one in the stacker. The operator should run out the reader (more cards may be waiting in the track on some readers), repunch the offending card, and replace it and the following cards in the input hopper. Then reprime the reader and type

ON #XG14 22

GO #XG14 21

after which the repunched card will be read again and simulation continued.

Note: If the operator merely types

GO #XG14 21

when a card reader error is indicated, the card in error will be ignored.

2 Invalid 1401/1440 punchings with a 2102 card reader.

Since the 2102 reader translates any punching into some internal code, invalid punchings cannot be detected.

3 If a card wreck or jam occurs, normal 1900 operating procedures should be followed.

4 In a 1440 system if the groupmark-workmark is missing from the end of the read area, the simulator suspends itself and types the Standard Halt Line (see Appendix 4) prefixed by R0. The fault in the 1440 program must be corrected.

CARD PUNCH

Card codes

1920/2, 1921, 1922/1 AND 2151 PUNCHES.

Cards are punched in standard 1401/1440 code (see Appendix 1) with the exception that the character ? (plus zero) is punched as $\overline{12}$, 2, 8 instead of $\overline{12}$, 0. The punching $\overline{12}$, 2, 8 will be read back by the simulator as the internal 1401/1440 character ?.

Stacker select

This 1401/1440 feature is not simulated. Stacker select instructions in the 1401/1440 program are effectively ignored.

Card wreck/jam

Normal 1900 operating procedures should be followed.

LINE PRINTER

Print chain

In place of the 1403/1443 print chain the simulator uses the 1900 print barrel and a conversion table.

The 1900 graphics used by the simulator to represent each 1401/1440 character are normally given by one of Tables A and H in Appendix 1. The user must select one of these tables to be assembled as an integral part of his simulator during the #XGSE Editor run.

However, if these tables are unsatisfactory or if the user had more than one chain for use with his 1403/1443, he is at liberty to modify the contents of the simulator's conversion table. This can be done at simulation time through the use of the table load facility (see 2 of Loading 1401/1440 Programs from Cards, page 10) and a Print Conversion table punched on cards (see Print Conversion Table, page 9).

1403/1443 carriage control loop

The simulator uses a standardised 1900 control loop and a table describing the original 1403/1443 control loop to effect the required paper movements.

The channels of the 1900 control loop should be punched as follows:

Channel	Punching
1	Punched to correspond to the position of the first line on a form.
2	Punched in the same line as a channel 1 punch and thereafter in each sixth succeeding line.
3	Punched in the line immediately succeeding every channel 2 punch.
4	Punched in the line immediately succeeding every channel 3 punch.
5	Punched in the line immediately succeeding every channel 4 punch.
6	Punched in the line immediately succeeding every channel 5 punch.
7	Punched in the line immediately succeeding every channel 6 punch.
8	No punching.

The length of the loop is at the discretion of the user – within the limitations of the 1900 printer being used – *provided that diagonal pattern in channels 2 to 7 is repeated an integral number of times.*

The image of the original 1403/1443 control loop should be punched into table cards as described in Appendix 5 and fed to the simulator as described in Loading 1401/1440 Programs from Cards, page 10.

Move to head of form

If the operator wishes to move the paper to the head of form position, he must first type

ON #XG14 20

GO #XG14 25

The simulator will type HALTED: COMPLETE. The operator can then line up the paper.

Exception conditions

For 1440 simulation, if the groupmark-wordmark is missing from the end of the print area, the simulator suspends itself and types the Standard Halt Line (see Appendix 4) prefixed by LP. The error in the 1440 program must be corrected.

MAGNETIC TAPE

1401/1440 magnetic tapes

The simulator can read and write even parity magnetic tapes at 200, 556 or 800 b.p.i. which are compatible with IBM 7330, IBM 7335 or IBM 729 II, IV, V, or VI decks.

1900 series magnetic tapes

The simulator can read and write simulated 1401/1440 magnetic tape files on odd parity 1900 reels, at 200, 556, or 800 b.p.i.

All reels on which the simulator is to write must have as the first two blocks special SPAN labels written by the program #XGWL (see Appendix 5). The user is recommended to write SPAN labels on a group of 1900 reels and then to reserve these for use with the simulator.

If an attempt is made to read from a 1900 series tape that does not have a SPAN label, the simulator will assume that it is a tape which was written on the 1401/1440. It is certain that the label checking procedures in the 1401/1440 program will then reject the tape.

Operating

Apart from the actual mounting and dismounting of reels, it must be an *absolute* rule that all accesses to magnetic tapes must be made through the facilities provided by the simulator. If, for example, the operator unloads and replaces a reel manually, the simulator will assume that no reel or position change has taken place.

Facilities available

The following table lists the operating facilities available with magnetic tape.

1401/1440 operation	1900 equivalent	1900 action
1 Mount a reel of magnetic tape, to be read or written on the 1900, in the special SPAN format and allocate it as unit n ($n = 1,2,3,4,5,6$)	Mount the reel of an available deck with the geographical address A , then type GIVE #XG14 A n	Executive will access the selected deck whenever the simulator addresses deck n .
2 Mount a reel of magnetic tape, either written on the 1401/1440, or to be written in 1401/1440 format, and allocate it as unit n ($n = 1,2,3,4,5,6$)	Mount the reel on an available deck with the geographical address, say, A , then type GIVE #XG14 A n M where M is a number calculated as follows $M = r + s$ where $r = \left. \begin{array}{l} 0 \ 200 \\ 16 \ 556 \\ 32 \ 800 \end{array} \right\} \begin{array}{l} \text{tape density} \\ \text{in characters} \\ \text{per inch} \end{array}$ $s = \left. \begin{array}{l} 0 \ 0.75 \\ 8 \ 0.56 \end{array} \right\} \begin{array}{l} \text{gap length} \\ \text{in inches} \end{array}$	Executive will access the selected deck whenever the simulator addresses deck n .

1401/1440 operation	1900 equivalent	1900 action
3 Unload a tape on unit n ($n = 1,2,3,4,5,6$)	ALTER #XG14 14 n GO #XG14 24	The reel on simulated 1401/1440 magnetic tape unit n is unloaded and released by the simulator which then suspends itself and types COMPLETE
4 Rewind the tape on unit n ($n = 1,2,3,4,5,6$)	ON #XG14 19 ALTER #XG14 14 n GO #XG14 24	The reel on simulated 1401/1440 magnetic tape unit n is rewound by the simulator which then suspends itself and types COMPLETE
5 Backspace the tape on unit n ($n = 1,2,3,4,5,6$)	ON #XG14 20 ALTER #XG14 14 n GO #XG14 24	The reel on simulated 1401/1440 magnetic tape unit n is backspaced one 1401/1440 block by the simulator which then suspends itself and types COMPLETE
6 Backspace the tape on unit n again ($n = 1,2,3,4,5,6$)	Immediately after the operation described in (5) above the operator may type ON #XG14 20 GO #XG14 to cause a further backspace, and so on.	

Note: 1440 configurations have a maximum of two tape units.

EXCHANGEABLE DISC STORE

All discs to be used by the simulator must be called SIM1400DISC and have generation number 9.

The program #XGSA must be used to write sector addresses and mode switches to every disc before it is first used by the simulator.

One IBM 1311 cylinder is simulated on one I.C.T. 2801 or 2802 cylinder.

Executive requires some cylinders of an I.C.T. disc, and this means that on a 2801 with 100 cylinders, not all the 100 cylinders of a 1311 can be simulated. Cylinders 0 to $n-1$ of the 1311 are simulated, where n is the number of cylinders available for use on the 2801. It is up to the user to ensure that neither the program #XGSA nor the programs to be simulated use the cylinders n to 99.

On a 2802 with 200 cylinders all 100 cylinders of the 1311 can be simulated.

The mode check switch should be set to "normal" for all programs except the IBM Sort 5 Generative program and the object programs Sort 51, 52, 53 and 54 when it should be set to "inhibit".

Operating

At the start of a simulated program, disc cartridges may be mounted, but they must not be put on-line.

All loading and unloading of disc cartridges and the setting of the simulated write-address key and mode check switches must be performed via the console typewriter and the simulator.

Facilities available

The following table lists the operating facilities available with E.D.S.

1401/1440 operation	1900 equivalent	1900 action
1 Mount disc <i>x</i> on drive <i>n</i>	Mount simulated disc <i>x</i> but leave it off-line until the message LOAD DRIVE <i>n</i> is typed. Put simulated disc <i>x</i> on-line and type GO #XG14	The disc is opened and the message PACK <i>m</i> OPENED AS DRIVE <i>n</i> is typed, where <i>m</i> is the cartridge serial number. Executive will access the selected disc whenever the simulator addresses drive <i>n</i> .
2 Unload disc <i>x</i> from drive <i>n</i>	ON #XG14 1 <i>n</i> GO #XG14 22	The disc is closed and the message DRIVE <i>n</i> CLOSED is typed. The simulator can no longer access the disc. The simulator halts and types COMPLETE.
3 Unload all discs	ON #XG14 9 GO #XG14 22	All discs opened by the program are closed and for each one, the message DRIVE <i>n</i> CLOSED is typed. The simulator halts and types COMPLETE.
4 Turn the write-address key switch on (i.e. track operations are to be performed in the current program)	ON #XG14 19 GO #XG14 22	Message WRITE-ADDRESS SWITCH ON is typed. Simulator halts.
5 Turn the write-address key switch off (i.e. track operations are no longer to be performed in the current program)	ON #XG14 20 GO #XG14 22	Message WRITE-ADDRESS SWITCH OFF is typed. Simulator halts.
6 Set a switch to inhibit mode checking for Sort 5	ON# XG14 17 GO# XG14 22	Message MODE CHECKS SUSPENDED is typed. Simulator halts.
7 Reset the switch to ensure normal mode checking after Sort 5	ON# XG14 18 GO# XG14 22	Message MODE CHECKS RESUMED is typed. Simulator halts.

Exception conditions

- 1 If the disc called for by the message LOAD DRIVE *n* cannot be opened, the message OPEN DISC FAILURE - CODE *m* is typed and the simulator halts.

Code *m* = 1 - File not in system
Put correct disc on-line and

GO #XG14

Any other code - Code as for reply word of the open instruction. Take action accordingly.

- 2 The message DISC ADDRESS OUT OF RANGE *nnnnnmmm* where *nnnnn* = sector address and *mmm* = sector count is typed if a disc transfer outside the range of the defined file is attempted.

This would happen when trying to simulate the whole of a 1311 disc on a 2801. Either a 2802 should be used instead of the 2801 or the 1401/1440 program should be amended to avoid using the 1311 cylinders which weren't simulated.

- 3 DISC ERROR – CODE 3 is typed when an unclearable parity error occurs during an attempted disc transfer.
- 4 DRIVE *n* NOT CLOSED AS GENERATION 9 is typed if that file did not close with generation number 9. Whilst being addressed, a file has as generation number the drive number with which it is being addressed. When the above message occurs, the program will not have been adversely affected; but because the generation number of the file concerned did not revert to 9, that file cannot be re-opened by the simulator.
- 5 If the program goes illegal after attempting via the console typewriter to close a disc which has not been opened by the program, the operating procedure should be repeated with the correct drive number.
- 6 All non-numeric characters in sector addresses to be written under the write disc track sector instruction are transferred as zero.
- 7 Irregular numeric addressing schemes will only work under certain circumstances and any timing advantages of them will be lost in simulation.
- 8 The disc track record feature is not simulated.

Appendix 1 1401/1440-1900 code equivalents

The following table gives a complete list of equivalent 1401/1440 and 1900 codes.

The 1900 Typed Code column gives the graphics used to represent 1401/1440 characters in typed console messages, e.g. display of storage contents. In certain cases one character is represented by two typed digits, e.g. § is typed as 74.

The 1900 Store Print Code column gives the graphics used to represent 1401/1440 characters in printed displays of the contents of the simulated 1401/1440 store.

1401/ 1440 Octal	1401/ 1440 Defined	1401/ 1440 Print Chain A	1401/ 1440 Print Chain H	1401/ 1440 Card Code	1900 Print Table A	1900 Print Table H	1900 Card Code	1900 Typed Code	1900 Store Print Code
00	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK
01	1	1	1	1	1	1	1	1	1
02	2	2	2	2	2	2	2	2	2
03	3	3	3	3	3	3	3	3	3
04	4	4	4	4	4	4	4	4	4
05	5	5	5	5	5	5	5	5	5
06	6	6	6	6	6	6	6	6	6
07	7	7	7	7	7	7	7	7	7
10	8	8	8	8	8	8	8	8	8
11	9	9	9	9	9	9	9	9	9
12	0	0	0	0	0	0	0	0	0
13	#	#	=	8,3	#	=	8,3	#	#
14	@	@	'	8,4	@	'	8,4	@	@
15	:	BLANK	BLANK	8,5	BLANK	BLANK	8,5	:	:
16	>	BLANK	BLANK	8,6	BLANK	BLANK	8,6	>	>
17	√ tape mark	BLANK	BLANK	8,7	BLANK	BLANK	8,7	[[
20	C	≠	≠	NOTE 1	+	+	NOTE 1	76	↑
21	/	/	/	0,1	/	/	0,1	/	/
22	S	S	S	0,2	S	S	0,2	S	S
23	T	T	T	0,3	T	T	0,3	T	T
24	U	U	U	0,4	U	U	0,4	U	U
25	V	V	V	0,5	V	V	0,5	V	V
26	W	W	W	0,6	W	W	0,6	W	W
27	X	X	X	0,7	X	X	0,7	X	X
30	Y	Y	Y	0,8	Y	Y	0,8	Y	Y
31	Z	Z	Z	0,9	Z	Z	0,9	Z	Z
32	≠ record mark	≠	≠	0,8,2	+	+	0,8,2	£	£
33	'	,	,	0,8,3	,	,	0,8,3	'	'
34	%	%	(	0,8,4	%	(	0,8,4	%	%
35	= word separator	BLANK	BLANK	0,8,5	BLANK	BLANK	0,8,5	=	=
36	,	BLANK	BLANK	0,8,6	BLANK	BLANK	0,8,6	,	,
37	" tape segment mark	BLANK	BLANK	0,8,7	BLANK	BLANK	0,8,7	"	"
40	-	-	-	11	-	-	11	-	-

1401/ 1440 Octal	1401/ 1440 Defined	1401/ 1440 Print Chain A	1401/ 1440 Print Chain H	1401/ 1440 Card Code	1900 Print Table A	1900 Print Table H	1900 Card Code	1900 Typed Code	1900 Store Print Code
41	J	J	J	11,1	J	J	11,1	J	J
42	K	K	K	11,2	K	K	11,2	K	K
43	L	L	L	11,3	L	L	11,3	L	L
44	M	M	M	11,4	M	M	11,4	M	M
45	N	N	N	11,5	N	N	11,5	N	N
46	O	O	O	11,6	O	O	11,6	O	O
47	P	P	P	11,7	P	P	11,7	P	P
50	Q	Q	Q	11,8	Q	Q	11,8	Q	Q
51	R	R	R	11,9	R	R	11,9	R	R
52	!	-	-	11,0	-	-	11,0	!	!
53	\$	\$	\$	11,8,3	\$	\$	11,8,3	74	\$
54	*	*	*	11,8,4	*	*	11,8,4	*	*
55	)	BLANK	BLANK	11,8,5	BLANK	BLANK	11,8,5))
56	;	BLANK	BLANK	11,8,6	BLANK	BLANK	11,8,6	;	;
57	Δ delta	BLANK	BLANK	11,8,7	BLANK	BLANK	11,8,7	77	←
60	&	&	+	12	&	+	10	&	&
61	A	A	A	12,1	A	A	10,1	A	A
62	B	B	B	12,2	B	B	10,2	B	B
63	C	C	C	12,3	C	C	10,3	C	C
64	D	D	D	12,4	D	D	10,4	D	D
65	E	E	E	12,5	E	E	10,5	E	E
66	F	F	F	12,6	F	F	10,6	F	F
67	G	G	G	12,7	G	G	10,7	G	G
70	H	H	H	12,8	H	H	10,8	H	H
71	I	I	I	12,9	I	I	10,9	I	I
72	?	&	&	12,0	&	&	10,8,2	?	?
73	.	.	.	12,8,3	.	.	10,8,3	.	.
74	□	□	)	12,8,4	[	)	10,8,4	75]
75	(	BLANK	BLANK	12,8,5	BLANK	BLANK	10,8,5	((
76	<	BLANK	BLANK	12,8,6	BLANK	BLANK	10,8,6	<	<
77	≠ group mark	BLANK	BLANK	12,8,7	BLANK	BLANK	10,8,7	+	+

Notes:

- 1 This character cannot be punched on 1401/1440 cards.
- 2 The 1401/MLP feature can be simulated. If so, an 8 and 9 punched in the same column of a card will both be ignored. This is achieved by selecting the option on the line with 00100003 in columns 73 to 80 when specifying the parameters for the SPAN Editor (see page 22). The feature can not be simulated with the 2102 Card Reader.

Appendix 2 Parameters for SPAN Editor

The following form should be used to create parameters for the SPAN Editor program (see Input 1401/1440 Information, page 6).

The user should mark, in the column provided for that purpose, only those lines that contain statements correctly describing either his 1900 or his 1401/1440 configuration or some desired feature of the simulator. These lines, together with those lines marked with a preprinted cross (x), should then be punched into 80-column cards. This process should produce exactly 23 cards; if it does not, the user has either marked contradictory statements or has failed to mark some relevant statement.

Notes:

- 1 Advanced Programming Feature includes indexing and the instructions with operation code H, P and Q.
- 2 Print Conversion Tables A and H are detailed in Appendix 1. If neither Table A nor H is satisfactory, one of them *must* be selected, and any necessary changes made at simulation time by using print conversion table change cards.
- 3 The user can select a simulator that:
 - (a) can simulate any 1401 magnetic tape operations using SPAN tapes (see 1900 Series Magnetic Tapes, page 15) but cannot write tapes in 1401 format, by selecting the line containing 00300001 in columns 73 to 80, *or*
 - (b) cannot simulate 1401 magnetic tape operations, by selecting the line containing 00300002 in columns 73 to 80, *or*
 - (c) can simulate any 1401 magnetic tape operations using SPAN tapes (1900 series Magnetic Tapes, page 15) or 1401 tapes (1401/1440 Magnetic Tapes, page 15), by selecting the line containing 00300003 in columns 73 to 80, *or*
 - (d) can simulate any 1401 magnetic tape operations by using 1401 tapes (1401/1440 Magnetic Tapes, page 15) but cannot use SPAN tapes (1900 Series Magnetic Tapes, page 15), by selecting the line containing 00300004 in columns 73 to 80.

Similar options for 1440 magnetic tape can be chosen by punching 00300005 to 00300008 in columns 73 to 80.

- 4 The name of the user's simulator can be chosen from one of four names. This is helpful when producing different versions.

1900 SERIES PLAN CODING SHEET				TITLE	SEGMENT
				PROGRAMMER	DATE
LABEL	OPERATION	ACC.	OPERAND	PROG. IDENT.	SEQUENCE
1	6 7	12 13 15 16	20 24 28 32 36 40 44 48 52 56 60	72 73 75 76	80
X	SPAN 14 LIBRY				
			1401, 1900 CARD READER HAS DECODER E FEATURE	001	00001
			1401, 1900 CARD READER HAS CARD IMAGE FEATURE	001	00002
			1401, 1900 HAS CARD IMAGE WITH MPL FEATURE	001	00003
			1440, 1900 CARD READER HAS DECODER E FEATURE	001	00004
			1440, 1900 CARD READER HAS CARD IMAGE FEATURE	001	00005
			1401/1440 HAD ONLY 4K OF STORE	002	00001
			1401/1440 HAD ONLY 8K OF STORE	002	00002
			1401/1440 HAD ONLY 12K OF STORE	002	00003
			1401/1440 HAD 16K OF STORE	002	00004
			1401 HAD MAG TAPE REQUIRE TO READ 1401 TAPES, R/W SPAN	003	00001
			1401 DID NOT HAVE MAGNETIC TAPE	003	00002
			1401 HAD MAG: TAPE, REQUIRE TO R/W SPAN AND 1401 TAPES	003	00003
			1401 HAD MAG: TAPE, DO NOT REQUIRE SPAN TAPES	003	00004
			1440 HAD MAG TAPE REQUIRE TO READ 1440 TAPES, R/W SPAN	003	00005
			1440 DID NOT HAVE MAGNETIC TAPE	003	00006
			1440 HAD MAG: TAPE, REQUIRE TO R/W SPAN AND 1440 TAPES	003	00007
			1440 HAD MAG: TAPE, DO NOT REQUIRE SPAN TAPES	003	00008
			1401/1440 HAD ADVANCED PROGRAMMING FEATURE	004	00001
			1401/1440 DID NOT HAVE ADVANCED PROGRAMMING FEATURE	004	00002
			1401 HAD READ PUNCH RELEASE FEATURE	005	00001
			1401 DID NOT HAVE READ PUNCH RELEASE FEATURE	005	00002
			1440 HAD 1442 READER/PUNCH	005	00003
			1440 HAD 1442 READER	005	00004
			1441/1440 HAD MODIFY ADDRESS	006	00001
			1401/1440 DID NOT HAVE MODIFY ADDRESS	006	00002
			1401/1440 HAD DECIMAL MULTIPLY/DIVIDE ONLY	007	00001
			1401/1440 DID NOT HAVE MULTIPLY/DIVIDE	007	00002
			1401 HAD DECIMAL AND STERLING MULTIPLY/DIVIDE	007	00003
			1401/1440 HAD HIGH/LOW/EQUAL COMPARE	008	00001
			1401 DID NOT HAVE HIGH/LOW/EQUAL COMPARE	008	00002
			1441/1440 HAD SENSE SWITCHES B TO G	009	00001
			1401/1440 DID NOT HAVE SENSE SWITCHES B TO G	009	00002
			1401 HAD STERLING ARITHMETIC	010	00001
			1401/1440 DID NOT HAVE STERLING ARITHMETIC	010	00002
			1401/1440 HAD EXPANDED PRINT EDIT WITHOUT STERLING	011	00001
			1401 HAD EXPANDED STERLING EDIT	011	00002
			1401/1440 DID NOT HAVE EXPANDED EDIT OR STERLING EDIT	011	00003
			1401 HAD STERLING EDIT BUT NOT EXPANDED EDIT	011	00004
			1401/1440, 1900 HAS NO CARD PUNCH	012	00001
			1401, 1900 HAS CARD PUNCH	012	00002
			1440 HAD 1442 READER/PUNCH, 1900 HAS CARD PUNCH	012	00003
			1440 HAD 1444 PUNCH, 1900 HAS CARD PUNCH	012	00004
			1401 HAD DISC	013	00001
			1440 HAD DISC	013	00002
			1401 HAD NO DISC HAD TAPE	013	00003
			1401 HAD NO DISC NO TAPE	013	00004
			1440 HAD NO DISC	013	00005
			1401 HAD 100 POSITION PRINTER	014	00001
			1401 HAD 132 POSN PRINTER, NO PRINT STORAGE	014	00002
			1401 HAD 132 POSN PRINTER WITH PRINT STORAGE	014	00003
			1401 HAD 132 POSN, NO PRINT STORAGE, PRINT ONLY 120 POSN	014	00004
			1401 HAD 132 POSN, WITH PRINT STORAGE, PRINT ONLY 120 POSN	014	00005
			1440 HAD 1443 PRINTER WITH 120 POSITIONS NO PRINT STORAGE	014	00006

1900 SERIES PLAN CODING SHEET			TITLE PROGRAMMER		SEGMENT DATE																		
LABEL	OPERATION	ACC.	OPERAND												PROG. IDENT.	SEQUENCE							
1	6	7	12	13	15	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	73	75	80
#							1440	H.R.D.	1443	PRINTER WITH 144	POSITIONS	NO	PRINT STORAGE								01400007		
#							1440	H.R.D.	1403	PRINTER WITH 152	POSITIONS										01400008		
#							1440	H.R.D.	1443	PRINTER WITH 120	POSITIONS -	PRINT STORAGE									01400009		
#							1440	H.R.D.	1443	PRINTER WITH 144	POSITIONS -	PRINT STORAGE									01400010		
#							1401/1440	H.R.D.	NO	DISCS											01500001		
#							1401/1440	H.R.D.	1	DISC	SEE NOTE	BELOW									01500002		
#							1401/1440	H.R.D.	2	DISCS	SEE NOTE	BELOW									01500003		
#							1401/1440	H.R.D.	3	DISCS	SEE NOTE	BELOW									01500004		
#							1401/1440	H.R.D.	4	DISCS	SEE NOTE	BELOW									01500005		
#							1401/1440	H.R.D.	5	DISCS											01500006		
#							1401/1440	H.R.D.	DISC	WITH DIRECT	SEEK FEATURE										01700001		
#							1401/1440	H.R.D.	DISC	WITHOUT DIRECT	SEEK FEATURE										01700002		
#							1401/1440	DID	NOT	HAVE	DISC										01700003		
#								MAXIMUM	DOCUMENT	LENGTH	IS	18	INCHES								01800001		
#								MAXIMUM	DOCUMENT	LENGTH	IS	11	INCHES								01800002		
#							1401/1440	HAD	SCAN	DISC	FEATURE										01900001		
#							1401/1440	DID	NOT	HAVE	SCAN	DISC	FEATURE								01900002		
#								USER	REQUIRES	PRINT	CONVERSION	TABLE	A -SEE	APPENDIX	1						02000001		
#								USER	REQUIRES	PRINT	CONVERSION	TABLE	B -SEE	APPENDIX	1						02000002		
#							1401/1440	HAD	BRANCH	IF	BIT	EQUAL	FEATURE								02100001		
#							1401/1440	DID	NOT	HAVE	BRANCH	IF	BIT	EQUAL	FEATURE						02100002		
#								THE	SIMULATOR	SHOULD	BE	NAMED	XG11								03000001		
#								THE	SIMULATOR	SHOULD	BE	NAMED	XG12								03000002		
#								THE	SIMULATOR	SHOULD	BE	NAMED	XG13								03000003		
#								THE	SIMULATOR	SHOULD	BE	NAMED	XG14								03000004		
x	END																						

Note: If discs are being used and there is spare core available to the simulator, the user may choose an option stating that he has more disc drives than he actually has, for this may increase the speed of disc operations.

The maximum number of possible drives is five, but there is no advantage in stating a number more than twice the actual number.



Appendix 3 1401/1440 console functions and their simulated equivalents

In the table that follows, certain abbreviations are used:

- 1 **x** represents a 1401/1440 storage address in decimal form, from 1 to 5 digits in length.
- 2 **XYX** represents a 1401/1440 character.

X = 0 if no word mark is required
 1 if a word mark is required

YY is the 1401/1440 octal representation of the character (see Appendix 1). Thus, for example, the 1401/1440 characters A and Z would be represented, respectively, by 161 and 031.

- 3 **STANDARD HALT LINE** is a message typed by the simulator
 - (a) in response to some operator action, *or*
 - (b) on detection of a 1401/1440 halt instruction, *or*
 - (c) on detection of an error condition in the 1401/1440 program.

This message has a prefix identifying its source and gives, in general, the contents of the I, A and B address registers and the state of the sense switches and certain other indicators. A detailed description of the Standard Halt Line is given in Appendix 4.

If the simulator detects any error in a message input by the operator, for example an attempt to display location 6000 on a 4000 character simulated machine, the message

OP ERROR

is typed out.

- 4 Monitor word bits 19 and 20 are always left set OFF by any operating facility that employs them.

1401/1440		1900	
Switch	Function	Action	Effect
1 I register Key/ Light	Display I register	Not needed	The contents of the simulated I register are displayed at every halt.
2 A register Key/ Light	Display A register	Not needed	The contents of the simulated A register are displayed at every halt.
3 B register Key/ Light	Display B register	Not needed	The contents of the simulated B register are displayed at every halt.
4 Manual address dial	Set address needed for mode switch reference	Not needed	Addresses are an integral part of appropriate type-ins.
5 Run	Execute mode		Initiated by Start (below) or Card Load (below) or Tape Load (below)
6 I/EX	Stepped execution	Not simulated	
7 Single cycle	Stepped execution	Not simulated	
8 Single cycle (non-process)	Stepped execution	Not simulated	

Switch	Function	Action	Effect	
9	Character display	Display	<p>Either AL #XG14 10 x GO #XG14 26</p> <p>or</p> <p>ON #XG14 19 AL #XG14 10 x GO #XG14 26</p>	<p>A line is typed giving the address (x) input, the contents of the location addressed and the four succeeding locations. Where a character has a word mark it is preceded by an @ symbol. Thus, for example, <u>ABCDE</u> in locations 301 to 305 would be shown as 00301 A @B C @DE. The full list of 1900 graphics used to represent 1401/1440 characters in such a message is given in Appendix 1.</p> <p>During this operation the address in word 10 is incremented by 5 so that by typing GO #XG14 immediately after the simulator has displayed the requested locations, the operator can display the next five locations, and so on.</p> <p>Two lines are printed: the first giving the contents of the location addressed and the succeeding 99 locations, the second showing a + under each character that has a word mark.</p> <p>The simulator then suspends and types COMPLETE. During this operation the contents of word 10 are incremented by 100 so that by typing ON #XG14 19 GO #XG14 immediately after the message the operator can then display the next 100 locations, and so on. The 1900 graphics used to represent 1401/1440 characters in this printout are given in Appendix 1.</p>
10	Storage printout	Display	<p>ON #XG14 20 GO #XG14 26</p> <p>The current contents of the simulated 1401/1440 store are printed out 100 characters at a time. Each set of 100 characters is displayed on a line immediately followed by a further line containing a + under each character with a word mark. When the operation is complete, the simulator suspends and types</p> <p style="text-align: center;">COMPLETE</p> <p>The 1900 graphics used in this printout to represent 1401/1440 characters are given in Appendix 1.</p>	

Switch	Function	Action	Effect
11 Alter storage	Enter characters into storage	<p>Either</p> <p>AL #XG14 10 x AL #XG14 11 * XYY GO #XG14 27</p> <p>or</p> <p>ON #XG14 19 AL #XG14 11 * XYY GO #XG14 27</p>	<p>The simulator inserts the character represented by <i>XYX</i> into location <i>x</i> then suspends and types a line giving <i>x</i>, and the original and new contents of that location; (see page 25 for key to abbreviations). Where either character has a word mark it will be preceded by an @ in the message typed. For example if location 3274 contained <u>A</u>, and then G was inserted, the simulation would type</p> <p style="text-align: center;">03274 @A G</p> <p>The 1900 graphics used to represent 1401/1440 characters are given in Appendix 1. During this operation the address in word 10 is incremented by 1.</p> <p>Fills the whole of the simulated store with the character represented by <i>XYX</i> then suspends and types</p> <p style="text-align: center;">COMPLETE</p>
12 Alter (address register)	Enter storage address into an address register	<p>For I register</p> <p>AL #XG14 10 x GO #XG14 28</p> <p>For A register</p> <p>ON #XG14 19 AL #XG14 10 x GO #XG14 28</p> <p>For B register</p> <p>ON #XG14 20 AL #XG14 10 x GO #XG14 28</p>	<p>Enters the address <i>x</i> into the appropriate address register and then suspends and types the Standard Halt Line prefixed AR.</p>
13 Storage scan	Display	See character display (above)	
14 Address stop	Stop 1401/1440 execution at a given address	Not simulated	
15 Start	Initiate execution	GO #XG14 21	Simulation proceeds with the instruction currently addressed by the simulated I address register.
16 Start reset	Clear latches etc. preparatory to running the next 1401/1440 program	GO #XG14 29	The simulator will set OFF: the card read error latch, the arithmetic overflow latch, the magnetic tape end of reel latch, and the carriage control channels 9 and 12 latches. Additionally various switches are set up within the simulator. It will then suspend and type the Standard Halt Line prefixed by SR.

Switch	Function	Action	Effect
17 Stop	Stop 1401/1440 execution	SU #XG14 AL #XG14 32 *03600037 GO #XG14	Simulation stops on completion of the current 1401/1440 instruction and the Standard Halt Line, prefixed by SD, is typed. Note 1: If the operator action to take place does <i>not</i> include typing a GO at message, then SU #XG14 is sufficient. Note 2: This facility is limited to programs which are not using the line printer. Word 32, which is set with a branch to word 31 during use of Stop, may be overwritten by the printing routine.
17a Trace	Trace 1401/1400 instructions	AL #XG14 32 *03600037 ON #XG14 0 GO #XG14	Simulation is stopped as in 17 above, or by a simulated 1400 halt. On typing GO, simulation will continue with a trace of each 1400 instruction simulated. Note: This facility is limited to programs which are not using the line printer. Word 32, which is set with a branch to word 31 during use of Trace, may be overwritten by the printing routine.
18 Check reset	Reset after process error	Not simulated – not needed	
19 Card load	Initiate loading of a 1401/1440 card program	GO #XG14 25	Clears 1401/1440 card read area, sets word mark on location 1, sets I address register to 1, then reads a card and begins simulating.
20 Tape load	Initiate loading of a 1401/1440 program from magnetic tape	ON #XG14 19 GO #XG14 25	Reads a block in load mode from tape unit 1 into location 1, stopping on the inter-block gap; sets the I address register to 1 then begins simulating.
21 Tape select	Select tape unit	Not simulated – not needed	
22 Backspace	Backspace tape	ON #XG14 20 AL #XG14 14 <i>n</i> GO #XG14 24	Backspaces the reel on simulated 1401/1440 magnetic tape unit <i>n</i> (<i>n</i> = 1, ...,6) one block then suspends and types COMPLETE. The backspace operation can be repeated by typing: ON #XG14 20 GO #XG14
23 I/O check stop	Stop on I/O error	To set it ON ON #XG14 8 To set it OFF OFF #XG14 8	The setting of this switch affects only card reading.

1401/1440		1900	
Switch	Function	Action	Effect
24 Sense switches	Handswitches	Set one ON ON #XG14 <i>i</i> Set one OFF OFF #XG14 <i>i</i> where <i>i</i> = 1 to 7 for A to G respectively.	The simulator uses monitor word 30, bits 1 to 7 to represent the 1401/1440 sense switches A to G.
25 Set codes to IBM shillings and pence		ON #XG14 19 20 GO #XG14 23	Suspends and types SHILLINGS CODE IBM PENCE CODE IBM
26 Set codes to IBM, pence and SCS (BSI) shillings		ON #XG14 20 GO #XG14 23	Suspends and types SHILLINGS CODE SCS PENCE CODE IBM
27 Set codes to SCS (BSI) shillings and pence		GO #XG14 23	Suspends and types SHILLINGS CODE SCS PENCE CODE SCS
28 Set codes to SCS (BSI) pence and IBM shillings		ON #XG14 19 GO #XG14 23	Suspends and types SHILLINGS CODE IBM PENCE CODE SCS
29 Disc write-address key	Allows disc track operations to be performed.	To set on ON #XG14 19 GO #XG14 22 To set off ON #XG14 20 GO #XG14 22	Suspends and types WRITE- ADDRESS SWITCH ON Suspends and types WRITE- ADDRESS SWITCH OFF

Appendix 4 Messages output by the simulator

STANDARD HALT LINES

The majority of messages output by the simulator will be Standard Halt Lines. These have the format

PP IIII O AAAAA BBBB SSSSSSSSSSSSS

- P is some prefix identifying the reason for the message (a complete list is given on page 33).
- I is normally the current value of the simulated I address register. For illegal conditions in the 1401/1440 program (see table at the end of this appendix) it is the address of the operation code of the instruction giving rise to the condition.
- O is the operation code of the instruction at the address given by I.
- A is the current value of the simulated A address register. (For illegal conditions in the 1401/1440 program it is rubbish.)
- B is the current value of the simulated B address register. (For illegal conditions in the 1401/1440 program it is rubbish.)
- S gives the current state of up to 14 simulated 1401/1440 latches. If any of these latches is set OFF, nothing is typed for it.

The following symbols will be typed to indicate those latches which are set ON.

- A Sense switch A is set ON
 - B Sense switch B is set ON
 - C Sense switch C is set ON
 - D Sense switch D is set ON
 - E Sense switch E is set ON
 - F Sense switch F is set ON
 - G Sense switch G is set ON
 - I I/O check stop switch is set ON
 - L End of card file latch is set ON
 - R Card read error latch is set ON (This cannot occur if I is typed.)
 - V Arithmetic overflow latch is set ON
 - > High compare latch is set ON
 - < Low compare latch is set ON
 - = Equal compare latch is set ON
- (Occur only if High/Low/Equal feature being simulated.)
- U Unequal compare latch is set ON (Occurs only if High/Low/Equal feature not being simulated.)

Whenever a Standard Halt Line is typed out, the last card presented to the 1401/1440 program is the last but two in the stacker, except for prefix CR when it is the last but one (see Card Reader page 12).

CHANGE PAPER

The simulator will suspend itself and type

CHANGE PAPER

if it detects paper low immediately before the first line of a document is to be printed.

The operator should put a new supply of paper in the printer lining it up exactly as it was when the simulator halted and then type

GO #XG14

Note: No GO at entries can be used between the typing out of CHANGE PAPER and the typing in of GO #XG14.

| GIVE UNIT *n*

If the 1401/1440 program addresses 1401/1440 magnetic tape unit *n* (*n* = 1,2,3,4,5,6) and this unit has not been allocated, the simulator will suspend itself and type

| GIVE UNIT *n*

The operator should mount the required reel on an available deck, allocate that deck as unit *n* with a GIVE directive (see Magnetic Tape Facilities Available, page 15) and then type

GO #XG14

LOAD DRIVE *n*

When a disc is required by a program for the first time, the simulator will suspend itself and type LOAD DRIVE *n*.

The operator should put on-line the disc cartridge required on that drive number (this should be identified in the operating instructions) and then type

GO #XG14

Then the simulator will type

PACK *mmmmmm* OPENED AS DRIVE *n*

where *mmmmmm* is the I.C.T. disc cartridge serial number.

SEQ. IDEN. NO * *

During the loading of table change cards (see page 10, 1401/1440 Programs from Cards, step 2) each table is checked for correct sequence. If any card is out of order, the simulator suspends itself and types SEQ. The operator should reorder the cards, refeed the table that is in error and type

ON #XG14 19

GO #XG14 29

Similarly if the identity code on any card of a table is not identical to the code on card 0001 of that table, the simulator will suspend itself and type IDEN. The operator should correct the cards, refeed the table that is in error and type

ON #XG14 19

GO #XG14 29

If any table contains too many data fields, the simulator will suspend itself and type NO**. The table should be corrected and action taken as for SEQ and IDEN. (The Print Conversion table should have exactly 64 fields, the 1403 Carriage Control Loop table not more than 144, and the Magnetic Tape Configuration table not more than 30, excluding the final blank field. In each case a field containing **** should terminate the data fields.)

PRI, LOOP, TAPE

As the simulator loads table change cards (see page 10, 1401/1441 Programs from Cards, step 2) it identifies the tables being modified by typing out

PRI when the first card of the Print Conversion table is read

LOOP when the first card of a 1403/1443 Carriage Control Loop table is read

TAPE when the first card of a Magnetic Tape Configuration table is read.

The simulator does not stop when it types these messages.

COMPLETE

The simulator will suspend and type the message **COMPLETE** to indicate that some action initiated by the operator has been successfully completed.

OP ERROR

If the operator misuses any of the facilities available, the simulator will suspend and type

OP ERROR

The operator should repeat the operation, correctly.

GO IF UNIT *n* 1401 TAPE

The reel mounted on the deck **GIVE *n*** as unit *n* does not have a SPAN label (as written by program #XGWL).

If it is an original 1401/1440 file or a reel to be written in 1401/1440 format, the operator should type

GO #XG14

to continue simulation.

If it is not a 1401/1440 format file, the operator should replace it with the correct reel then type

ON #XG14 19

GO #XG14

to continue simulation.

OTHER MESSAGES

Any other message will arise as a direct result of operator actions, e.g. display of contents of storage locations.

STANDARD HALT LINE CHECK LIST

The condition giving rise to the type-out of a Standard Halt Line is identified by a two-character prefix. The following tables list the possible values of this prefix and describe the condition associated with each value.

The first table lists those conditions that can be expected in normal running. If the operator types

GO #XG14 21

after any of these messages, simulation will continue at the instruction at the displayed I address.

Normal running

Prefix	Cause and contents
AR	The operator has just altered the contents of the I, A, or B address register.
CR	An invalid punching has been detected in the card which is <i>last but one</i> in the output stacker of the card reader. B final in the message gives the number of the offending column.
SD	The operator has caused simulation to be suspended on the completion of the previous 1401/1440 instruction.
SR	The operator has just used the Start Reset facility.
H	The simulator is currently simulating a 1401/1440 Halt instruction with the format : or : d or : AAA d or : AAA BBB or : AAA BBB d
HB	The simulator is currently simulating a 1401/1440 Halt instruction with the format : AAA

If a condition that cannot be simulated arises in the 1401/1440 program, a Standard Halt Line with a prefix E? is typed out. ? is a code whose value depends upon the condition encountered and is given in the table below. In these messages, the I address indicates the location of the operation code of the instruction that cannot be simulated.

The following procedure should be adopted. The operator should provide a 1401/1440 core print for analysis by the maintenance programmer by typing

```
ON #XG14 20
GO #XG14 26
```

The 1401/1440 core will be printed and the simulator will suspend itself and type

```
COMPLETE
```

The program may be continued at 1401/1440 location *n* (except for error code E) by typing

```
AL #XG14 10 n
GO #XG14 28
GO #XG14 21
```

For code E, simulation can be continued only by typing GO #XG14 21, in which case the simulator will ignore the long block indicator.

Exception conditions

Prefix	Cause
E1	The operation code of the current 1401/1440 instruction is either invalid or has no word mark.
E2	The A address of the current 1401/1440 instruction is invalid.
E3	The A field of the current 1401/1440 instruction ran off the 1401/1440 store.
E4	The B address of the current 1401/1440 instruction is invalid.
E5	The B field of the current 1401/1440 instruction ran off the 1401/1440 store.
E6	The current 1401/1440 instruction has an invalid format. (If the instruction is a Control Carriage, the d character may specify a channel not punched.)
EA	The current instruction has an indexed address. The result of adding together the address and the contents of the index register is invalid.

Prefix	Cause
EB	The current 1401 instruction is a Move Characters and Edit (with Sterling Feature) instruction. The B field is not long enough to allow the pence and shillings positions to be transferred from the A field.
EC	The current 1401 instruction is a Move Characters and Edit (with Sterling Feature) instruction and the shillings code switch is set to IBM code. A shillings position in the A field has zones on it.
ED	The current 1401/1440 instruction is a Move Characters and Edit (with the Expanded Print Edit Feature but without the Sterling Feature). The B field specifies both the Float \$ and the decimal control options.
EE	The simulator is currently reading from a SPAN tape, that is a 1401/1440 tape file written by a simulated program in the special SPAN format. The physical block which has just entered storage is larger than the simulator's buffer.
EG	Attempting to write 1401 or 1440 tape when not possible (see keys 00300001 and 00300005).
EH	The current 1401/1440 instruction is a Multiply and the B field is too short.
EI	The current instruction is a Sterling Conversion (Multiply) and there are two sterling markers in the multiplier.
EJ	The current instruction is a Sterling Conversion (Multiply) and either the pence position or the shillings position (SCS coding only) contains an invalid character.
DC	There is an error in the disc control field of the current instruction.
DK	The write-address key is not on or the sector count is not 20 for the current track operation.
LP	The current 1440 instruction is a print and the groupmark-workmark is missing from the print area.
RO	The current 1440 instruction is a card-read and the groupmark-wordmark is missing from the read area.



Appendix 5 Ancillary programs

USING THE ANCILLARY PROGRAMS

The five programs briefly described in Validate SPAN Print Conversion Table, page 5, to Write Sector Addresses and Mode to Disc, page 6, are in general only required once for any given installation. It is important that they are correctly operated in order to produce the optimum results from the SPAN system.

The first three of these programs validate information on table change cards punched in the following standard format:

Field number	Start column	End column	Meaning
Field 1	1	12	These 12-digit fields are used to hold table entries
Field 2	13	24	
Field 3	25	36	
Field 4	37	48	
Field 5	49	60	
Field 6	61	72	
Field 7	73	75	Identification Code
Field 8	76	76	Designation
Field 9	77	80	Sequence Number

The rules governing the contents of fields 7 to 9 are common to all table change parameters, and are as follows.

Field 7 - Identification code

This is a user defined code that may consist of any 1900 characters and is unique for each group of cards holding a table, irrespective of the type (print conversion, carriage control loop or magnetic tape configuration) to which the group belongs. Each card within a group must contain the identification code, so that cards of a particular table can be identified.

Field 8 - Designation

This field determines the type of table change card thus:

	Designation
Print Conversion Table	1
Carriage Control Loop Table	2
Magnetic Tape Configuration Table	3

Field 9 - Sequence number

This field contains the sequence number of the card within the group, starting at 0001. Leading zeros are punched.

Fields 1 to 6 - Table entries

The contents of these fields vary depending upon the type of table. They are described in the following three sections. Table entries run consecutively through fields 1 to 6 of each card and continue in field 1 of the next card.

#XGVP VALIDATE PRINT CONVERSION TABLE

Description

In place of the 1403/1443 print chain the simulator uses the 1900 print barrel and a conversion table. The 1900 graphics used by the simulator to represent each 1401/1440 character are normally given by one of the tables A and H in Appendix 1.

The user can change the contents of the conversion table at run time by supplying the simulator with other versions of the Print Conversion table, each held on cards punched as below.

This program is designed to help the user to validate the cards.

Input

The six least significant columns of each 12-column data field are used to hold the six bits of a 1900 character; a 1 bit represented by a 1 punch, a 0 bit by a blank.

Field 1 of card 1 should contain the 1900 character giving the 1900 printer graphic to be associated with the 1401/1440 character octal 00. Field 2 of card 1 should similarly define the 1900 graphic to be used for the 1401/1440 character octal 01, and so on to field 4 of card 11, which should define the 1900 graphic to be used for the 1401/1440 character octal 77. Field 5 of card 11 should have four asterisks punched in columns 49 to 52.

Any number of versions of the Print Conversion table – each starting with the sequence number 0001 – may be validated in one run. The last such table should be followed by a card with four asterisks punched into columns 1 to 4. This card is *not* part of any table, it is present merely to indicate the termination of the data to be validated.

Operating

- 1 FIND #XGVP from the SPAN run tape (priority 80, 1,088 words of storage).
- 2 Place the table cards in the reader.
- 3 Type GO #XGVP 20 to activate the program, which will then read cards and print.

When the last card has been read the program will delete itself and type

END OF JOB

Output

The program processes one version of the table at a time.

First the contents of each card are listed in an edited form.

Next the 1900 graphic represented by each field is printed against the octal form of the 1401/1440 character with which that field is associated, e.g.

```
00
01      1
02      2
-----
61      A
62      B
-----
77      +
```

Exception conditions

Seven different error conditions in the cards are detected and for each one a message is printed underneath the display of the contents of the card, or in the list of printer graphics.

- 1 **INCORRECT DIGIT IN COLUMN 76**
Column 76 does not contain 1.
- 2 **COLUMNS 73 - 75 DO NOT MATCH**
The identity code on this card does not correspond with the code on card 0001.
- 3 **INCORRECT SEQUENCE IN COLUMNS 77 - 80**
This card is not sequenced correctly.

If any one of fields 1 to 6 (with the exception of field 5 of the eleventh card) contains either

- (a) a punching in the six most significant columns, *or*
- (b) a punching other than blank or 1 in the six least significant columns,

then no error is flagged. However in the table giving 1401/1440 octals and equivalent 1900 graphics, the message NOT INPUT will replace the 1900 graphic.

The program assumes that it is processing the last card of one version of the table when it detects asterisks in the first four columns of a data field. If this condition arises when less than 64 fields have been input, the missing graphics will be replaced by the message NOT INPUT in the printed table. If more than 64 fields have been input, the additional fields will be ignored and the printed table will be followed by the message TOO MANY FIELDS.

#XGVL VALIDATE 1403/1443 CARRIAGE CONTROL LOOP TABLE

Description

The 12-channel carriage control loop on the 1403/1443 printer is simulated by a standardized 8-channel 1900 series control loop and an image of 1403/1443 loop. Each image is punched into cards in the manner described below. This program validates the contents of these cards. Several carriage control loop images may be validated in one run.

Input

FIELD 1 (FIRST CARD ONLY)

This must contain the binary representation of the number of lines in the loop (maximum 144) with a 1 bit punched as a 1, and a 0 bit left blank.

FIELD 2 (FIRST CARD ONLY)

This must contain a repetition of field 1.

FIELDS 3 TO 6 AND FIELDS 1 TO 6 IN SUBSEQUENT CARDS

Each field represents the punching of the twelve channels of one line of the 1403/1443 paper tape loop, with a 1 punched where there was a hole. Channel 12 is on the left, and channel 1 on the right in each field. The first field corresponds to the first line on the loop, and so on, until all lines have been punched.

The first line of the loop (field 3, card 1) should correspond to the first line of the document.

The last line of the loop must be followed by four asterisks punched into the first four columns of the next field of the card. If the card is full, the asterisks are punched in columns 1 to 4 of the next card.

Each new image must begin with sequence number 0001.

In addition, a special last card, with asterisks in columns 1 to 4, should be placed behind the last image. (This card is *not* part of any table, and is present merely to indicate the end of the data to be validated.)

Operating

- 1 **FIND #XGVL** from the SPAN run tape (priority 80, 1,088 words of storage).

- 2 Place the table cards in the reader.
- 3 Type GO #XGVL 20 to activate the program, which will then read cards and print.

When the special last card has been read the program will delete itself and type END JOB.

Output

Each carriage control loop image is displayed in a form similar to that in which it would appear on a document planning chart. The lines of a loop are printed on successive lines of the page, a zero indicating a punching, a dot indicating no punching. Sequence number and identification code are shown against the first line from each card.

Exception conditions

The following error codes may be flagged against the first line for a card

SEQU. The card is out of sequence.

DESIG. Columns 76 does not contain 2.

IDENT. Columns 73 to 75 do not contain the code that appeared in card 1 of this image.

If the numbers given in field 1 and field 2 do not agree with one another *and* with the actual number of lines described then the message

LINE COUNT INCORRECT X Y

will appear below the printed image of the loop where X and Y are the decimal values of the numbers in field 1 and field 2 of card 1 respectively.

If the actual number of lines exceeds 144, the message

TOO MANY LINES IN LOOP

will appear below the printed image of the loop.

#XGVT VALIDATE SPAN MAGNETIC TAPE CONFIGURATION TABLE

Description

The simulator may be made more efficient in its organisation of transfers to and from magnetic tape by supplying it with a description, on cards, of the distribution of controls amongst the magnetic tape units attached to the user's 1900. The group of units attached to one control is referred to below as a cluster.

Input

This program is intended to help the user to validate the cards, which should be punched as follows:

Each 12-column field is used to hold the binary geographical address of one magnetic tape unit; a 1 bit represented by a 1 punching and a 0 bit by a blank. Starting in field 1 of card 1 the data fields should be punched in their least significant positions with the binary geographical addresses of the magnetic tape units attached to the first control. Immediately succeeding these should appear the units attached to the second control, and so on. The fields containing the first unit for each control should have a 1 punched in the most significant column.

The two fields following the last cluster should contain, respectively, all blanks and four asterisks in the most significant columns. In addition, the last card of the table should be followed by a card with asterisks punched in columns 1 to 4. (This card is *not* part of the table but merely indicates the end of the data to be validated.)

Up to five clusters and 30 magnetic tape units may be described. The simulator will assume that any units that are not included in the table share an additional control.

Operating

- 1 FIND #XGVT from the SPAN run tape (priority 80, 1,344 words of storage).
- 2 Place the table cards in the reader.
- 3 Type GO #XGVT 20 to activate the program, which will then read cards and print.

When the last card has been read the program will suspend itself and type

END OF JOB. OK.

Output

The program first lists the table cards and then prints two columns showing the decimal geographical addresses of the units in each cluster.

When the first card of the table is read, the message

ALL MESSAGES FROM HERE FOR GROUP *xxxx*

is typed, where *xxxx* gives the contents of columns 73 to 76 of the card. This message serves to identify the group of cards to which any subsequent typed error messages refer.

Following the listing of the contents of the group of cards, the message

TOTAL NO OF CARDS READ FOR THIS GROUP *n*

is printed, where *n* is a count of the number of cards in the group.

Exception conditions

- 1 If the first card of the table does not have a 3 punched in column 76, the message
COL 76 NOT 3
is typed. Subsequent cards should be checked for a 3 in column 76 if this condition occurs.
- 2 If the first card does not have a 1 punched in column 1 (to indicate the start of the first cluster) the message
FIRST CARD DOES NOT HAVE 1 IN 1ST COL.
is typed. The 1 is thereafter assumed to have been present.
- 3 If any of the data fields contains a punching other than blank or 1 in one of its eleven least significant columns the message
INVAL CHARACTER ON CARD *xxxx*
will be typed, where *xxxx* is the sequence number from columns 77 to 80 of the offending card. The punching is assumed thereafter to have been a 1.
- 4 If any card is out of order, the message
CARD NO *xxxx* OUT OF SEQUENCE
will be typed, where *xxxx* is the sequence number from columns 77 to 80 of the offending card.
- 5 If any data field contains a punching other than blank or 1 in its most significant column, the message
INVAL CHAR ON CARD *nnnn* IN FLDS 1ST POS
will be typed, where *nnnn* is the sequence number from columns 77 to 80 of the offending card. Treating the punching as a 1 will cause this field to become the first of a cluster.
- 6 If any card in a group does not have the same code in columns 73 to 75 as the first card of the group, or if that card does not have in column 76 either 3 or the same code as column 76 of the first card, then it will be ignored and the message
CARD HAVING *xxxx* AS GROUP NO IGNORED
will be typed, where *xxxx* is the contents of columns 73 to 76.
- 7 If any field on a card is blank apart from a 1 punch in its most significant column, the message
ON CARD *nnnn* 1ST COL OF FLD = 1, REST BLNK

is typed, where *nnnn* is the sequence number. If the succeeding field contains asterisks, then the field in error is assumed to be blank and therefore to be the last entry in the table. If, however, the succeeding field does not contain asterisks, the field will be treated as absolute unit zero of a new cluster.

- 8 If a blank field is found that is not followed by a field containing asterisks, it is treated as the last entry in the table and the message

ON CARD NNNN NO **** AFTER BLANK FIELD

will be typed out, where NNNN is the sequence number from columns 77 to 80 of the offending card.

- 9 If the first card of a group does not have sequence number 0001, then 0001 is assumed and the message

FIRST CARD, SEQUENCE NO NOT 0001

is typed out.

- 10 If four asterisks are encountered after a field containing a unit number (i.e. the blank field preceding the asterisks is missing), the message

TAPE NUMBER FIELD FOLLOWED BY ****

is typed out and the asterisks are treated as the end of the table.

Printouts

If more than 30 unit numbers are described by a group of cards, then the following line will be printed immediately below the listing of the cards

TOTAL OF MAG TAPE NOS AFTER FIRST 30 xxxx

where xxxx is a count of the number of units in excess of 30. The additional units will be ignored by subsequent processing.

If more than five clusters are described by a group of cards, then the following line will be printed out immediately before the line giving the number of cards in the group:

TOTAL OF MAG TAPE NOS AFTER 5 CLUSTERS xxxx

where xxxx gives a count of the number of unit numbers encountered after the fifth cluster. The additional units will be ignored but the word

REST

will be printed at the end of the *Cluster number* column of the table display after the first 30 unit numbers have been listed. The remaining unit numbers will be ignored.

#XGWL WRITE SPAN LABELS TO MAGNETIC TAPE

Description

This program will write to magnetic tapes in odd parity the special SPAN labels required by the simulator. The user is recommended to allocate a number of 1900 reels to the simulator, and to label them using #XGWL.

Input

The tapes to be labelled must belong to one of three classes.

- 1 Unused new tapes
- 2 Non-standard tapes
- 3 Standard 1900 tapes with purge dates exceeded.

Tapes of class 1 or 2 will not be checked before the new label is written, so care should be exercised whilst operating this program.

Operating

- 1 FIND #XGWL from the SPAN run tape (priority 50, 768 words of storage).
- 2 Mount the tapes to be labelled onto available decks and GIVE them to #XGWL as units 1, 2, ..., n .
- 3 If all tapes are new or non-standard, set the Monitor Word to the binary value of the reel serial number required on the first tape. The reel serial number will be incremented by 1 for successive tapes, e.g

AL #XGWL 30 *71077

- 4 Type GO #XGWL 20 to activate the program. Each tape will be labelled and released and the message

- n -

followed on the next line by the 36 characters of the SPAN label (with the tape serial number in octal) will be typed for each tape, where n is the unit allocated by the operator to the deck holding that tape. Finally the program will suspend and type

END OF JOB

Output

The tapes will each have four blocks written to them. The first and second are identical and have a format similar to the first nine words of a standard 1900 header label.

- | | |
|----------------------|---|
| First Word | - SPAN |
| Second Word | - Tape serial number |
| Third to Fifth Words | - SPANDATATAPE |
| Sixth Word | - Reel sequence number = 1 |
| Seventh Word | - File generation number = 0 |
| Eighth Word | - Retention period = 0 |
| Ninth Word | - Date written as today's date in binary. |

The third and fourth blocks will be standard 1401/1440 80-character header labels containing the (1401/1440) characters

1HDR 1234512345-001 SPAN TAPE 66001-0000

in the first 40 positions and 1401/1440 blanks in the remainder.

Exception conditions

If the tapes being labelled are specified by the operator as having standard 1900 header labels, the program will

- 1 Check that the first block on each tape contains the 1900 characters HDDR in its first word. If it does not, messages of the form

KEEP - n -

followed by the first 36 characters of the block (the tape serial number in octal) will be typed, where n is unit allocated by the operator to the deck holding that tape. The tape will be unloaded without having anything written to it.

- 2 Check that the purge date on every reel is exceeded. If any is not, then the same action is taken as in 1 above.

#XGSA WRITE SECTOR ADDRESSES AND MODE SWITCHES TO DISC

Description

This program writes sector addresses and mode switches to a disc before it is used for the first time as a simulated 1311 disc.

Input

- 1 The disc must have a file allocated using the File Allocator program # XJEC with the parameters as follows:

Function identifier	1
File identity	SIM1400DISC
Generation	9
Retention period	As required by user
Integrity code	1
Bucket size	2
Number of file areas	1
Program/data file indicator	E
Starting cylinder	see Note
Ending cylinder	see Note
Starting block	0
Ending block	79

Note: The file should be described to cover all cylinders on the disc not required by Executive, to a maximum of 100. For further information on # XJEC, see the Library Specification Manual, Part 4, E. D. S. chapter.

- 2 Input cards are as follows

Columns 1 to 6	nnnnnn	1st sector address to be written
Columns 7 and 8		Not used
Columns 9 to 14	nnnnnn	Last sector address to be written
Columns 15 to 19		Not used
Column 20	-	Move mode
	0	Load mode
Columns 21 to 80		Not used

One card is required for each area to be written in a particular mode. The whole range of sector addresses, from $0n0000$ to $0m9999$ (where $n=0, 2, 4, 6$ or 8 and $m=n+1$) should be defined (if all cylinders are simulated - otherwise the last sector address should be calculated by the user from the number of cylinders available, using the fact that one 1311 cylinder is represented on one 2801 or 2802 cylinder).

These cards should be followed by an end of file card as follows

Columns 1 to 4	****
Columns 5 to 80	Not used

Operating

- 1 FIND # XGSA from the SPAN run tape (priority 50, 1,024 words of storage).
- 2 Mount the disc.
- 3 Place the parameter cards in the reader.
- 4 Type GO# XGSA 20 to activate the program.

The sector addresses and mode switches will be written on the disc and the message

nnnnnn nnnnnn - MOVE
LOAD will be typed, when each area has been successfully completed.

- 5 The program suspends and types

END JOB OK

Output

A disc with sector addresses and mode switches written on it as described on the console typewriter.

Exception conditions

- 1 If a card with invalid data is read, the message

INVALID DATA-CARD - IGNORED

nnnnnn nnnnnn - MODE

is typed. The card should be corrected and rerun.

- 2 If a disc transfer error occurs, the message

WRITE DISK ERROR

is typed.

Abandon job and try again.

- 3 If the message DISK NOT FOUND is typed, make sure that the disc is on-line and type GO #XGSA
If the error persists abandon job and check that the disc is correctly file allocated.

Appendix 6 Conversion subroutines

There are two subroutines on the MLT in the STST block, one of which (NAFO) will convert tapes in SPAN 14 or 1401/1440 tape format to 1900 MTH format, and the other (NAN14) will convert tapes in 1900 MTH format to SPAN 14 format.

A #LIB directive must be inserted in the program using these subroutines, naming STST, S-RS subroutine groups to be searched in that order. (See the ICL 1900 Series *PLAN Reference Manual* for further details.)

The specifications of the subroutines are given in the following pages.

Title

Translate magnetic tapes in SPAN14 or 1400 format to 1900 MTH format.

Description

The subroutine reads a block from tape, converts all characters to their 1900 octal equivalent and presents one record at a time to the user who may redistribute it as required and return it to the subroutine. The subroutine will batch the records as specified by the user and write them in 1900 MTH format to the output tape using the MTH package.

Input parameters

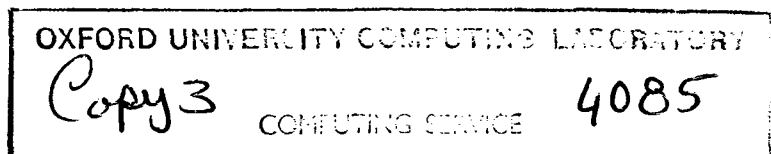
The subroutine requires one input parameter which can be on card or paper tape. On the first entry to the subroutine the appropriate peripheral is allocated, the parameter is then read and the peripheral released. The format of paper tape must be the same as for cards, including *all* spaces, except that a newline character must follow character 72.

The format is as follows.

<i>Column or character</i>	<i>Punching</i>
1 to 28	Spaces
29 to 40	File name to be included in the header label of the output file.
41	Space
42 to 44	Reel number to be included in the header label of first output reel - must be zero filled and ≤ 511 .
45	Space
46 to 52	Generation number to be included in the header label of the output file - must be zero filled and ≤ 8388607 .
53	Space
54 to 56	Retention period in days to be included in the header label of the output file - must be zero filled and ≤ 999 .
57 to 61	Spaces
62 to 64	Maximum length in words of the output records - must be zero filled and ≤ 512 .
65	Space
66 to 68	Maximum length in words of the output blocks - must be zero filled and ≤ 512 .
69	Space
70 to 72	Maximum number of records in the output blocks - must be zero filled and ≤ 256 .
73 to 80	Spaces unless parameter is on paper tape when character 73 must be a newline character.

The calling sequence must be

```
CALL 1 NAFO
LDN 3 SYMBOL1
LDN 3 SYMBOL2
LDN 3 SYMBOL3
```



where **SYMBOL1** is the address of the first word of the record area (in LOWER VARIABLE) for output from the subroutine to the user.

Word 0 of the area will contain the number of characters following this word that comprise the 1400 record.

Word 1 onwards will contain the record with characters left justified and any spare characters at the right hand end of the last word containing part of the record will be zero filled. These spare characters are not included in the count in word 0. When the record is presented to the user the characters will already have been translated to their 1900 octal equivalent (the record mark, if present on the 1400 tape, is also transferred, having been translated to octal 24).

When a tape mark is detected on the input tape word 0 is set to 1 and word 1 will contain the total number of blocks read from the input tape including label blocks but excluding tape marks.

SYMBOL2 is the address of the first word of the record area (in LOWER VARIABLE) for input from the user to the subroutine.

Word 0 of this area must contain the size in words of the record. If this has been set to zero by the user the record will be ignored.

Word 1 onwards will contain the record as distributed for output by the user.

SYMBOL3 has three uses and is the address of a word which contains

- (a) On initial entry to the subroutine
 - zero if the parameter is on card
 - non-zero if the parameter is on paper tape.
- (b) On subsequent entries to the subroutine
 - 0 for normal batching of the record.
 - 1 if the current record is to be the first record in a new batch.
 - 2 if the current record is to be the last record in a batch.
 - 3 if user has detected end of reel on the input tape.
 - 4 if user has detected end of file on the input tape.

Note: When SYMBOL3 is set to 3 or 4 by the user no record is written out so that the first word of the area defined under SYMBOL2 is immaterial.

- (c) On return from the subroutine
 - 0 if the record being presented to the user is not the first one in a 1400 block.
 - 2 if the record being presented to the user is the first one in a 1400 block.

Note: When a tape mark is read the contents of SYMBOL3 will be indeterminate.

Note: **SYMBOL1** and **SYMBOL2** must refer to an area big enough to contain the largest input and output record possible, respectively.

Results

Every record on the input tape, after having been converted from 1400 octal to 1900 octal, (and for this purpose labels are counted as records and this may influence the size of the area defined for

SYMBOL1) is presented to the user for redistributing, such as converting certain fields to binary, before being written to the output tape. It is up to the user, if he wishes, to do his own label checking and also to ensure that the first word of the area defined in SYMBOL2 is set to the number of words in the record.

If the user wishes to update the record where it is and not move it to the output area he can do this by specifying SYMBOL1 = SYMBOL2. If end of reel is reached on the output file then the subroutine will automatically close the current output tape and open a continuation reel.

If the user detects end of reel on the input tape he must indicate this by setting SYMBOL3 appropriately. The subroutine will close the current input reel and halt to allow the operator to mount the next reel, and type the appropriate GIVE message.

If the user detects end of file on the input tape he must indicate this by setting SYMBOL3 appropriately. The subroutine will then close the current input reel, write an end of file trailer label to the output tape, close the output tape and halt.

Entry point

NAFO

Link Accumulator

X1

Program return location

CALL +4

Accumulators used

X0, X1, X2, X3, X4, X5, X6, X7

Operating instructions

If the tape being converted is in SPAN format then, before entering the subroutine, the operator must type

```
ON #NAME 0
GI #NAME XX 0
```

where #NAME is the name of the program incorporating this subroutine and XX is the deck number on which the input tape is mounted. (The output tape is dynamically allocated.) If the tape being converted is in 1400 tape format then, before entering the subroutine, the operator must type

```
GI #NAME XX 0 M
```

where #NAME is the name of the program incorporating this subroutine, XX is the deck number on which the input tape is mounted, and $M = r + s$.

where $r = 0$ if tape density is 200 b.p.i.
 $= 16$ if tape density is 556 b.p.i.
 $= 32$ if tape density is 800 b.p.i.

and $s = 0$ if gap size is 0.75 inches
 $= 8$ if gap size is 0.56 inches

Program halts

MT The input tape has not been GIVen. Type the appropriate GIVE message and
GO #NAME

CR No card reader is available to the program. Make one available and type
GO# NAME

TR No paper tape reader is available to the program. Make one available and type

GO # NAME

E1 Bit 0 of Monitor Word 30 has been set ON, but the first two blocks of the input tape do not contain SPAN in the first word. To restart, the operator must type

GI # NAME XX 0
GO # NAME

where XX is the deck number of the correct input tape. The new tape will then be checked for two SPAN labels.

E5 There is an error in the parameter and any one of the following will cause this halt.

- 1 A field is out of range
- 2 A numeric field contains a non-numeric character
- 3 Maximum record length is specified as greater than maximum block length.

To restart, correct the parameter, place it in the appropriate reading device and type

GO # NAME

The parameter will be re-read and re-checked.

E6 A record that is longer than specified in the parameter has been presented for output to the output tape. To ignore this record type

GO # NAME

E7 There is an error in the MTH package.

E8 A read error has occurred on the input tape. There is no restart and the job must be re-run.

E9 A long block (greater than 16,800 characters for 1400 tapes or greater than 16,744 for SPAN tapes including word marks) has been detected on the input tape. If the input tape is in 1400 format type

GO # NAME

to ignore the remainder of the block.

If the input tape is in SPAN format there is no restart from this halt and if the operator types

GO # NAME

the results will be unpredictable.

H1 User has detected end of reel on the input tape. To continue with the next reel the operator must type the appropriate Give message (see Operating Instructions), that is

GI # NAME XX 0 (M)
and GO # NAME

HH End of run halt.

Character conversion

1400 characters will be translated to their corresponding 1900 characters where possible. Where symbols do not match the following conversion will be made.

1400	1900
✓	[
∅	↑
≠	£
Δ	←
☐]
✚	+

- Notes: 1 Data written to tape in Load Mode will be read back in by the subroutine with word separator symbols before each character which had a word mark and presented to the user in this form (the word separator symbol will be converted to 1900 octal 15).
- 2 If the tape being translated is a 1400 tape care must be taken that Executive does not try to read the tape before it is Given to the conversion program because the 1400 tape is written in even parity and this would cause the deck to fail. If this is likely to happen it may be overcome in one of two ways.
- (a) By setting the mode of the deck on which the 1400 tape is mounted to the appropriate mode as soon as it is mounted.
 - (b) By leaving the 1400 tape deck off-line until the message HALTED MT occurs.
- 3 The format of the input data blocks is assumed to be
- (a) For unblocked records the record may or may not terminate with a record mark. If present it will be presented to the user (as octal 24) together with the rest of the record and included in the characters in record count.
 - (b) For blocked records all records are assumed to end with a record mark. For variable length blocked records the block length in the first four positions of the 1400 block will be presented to the user together with the first record in every block. The user can determine whether a record is the first one in a block by the setting of SYMBOL3.

Store space used

	Number of Words
Lower Common Library Locations	-
Lower Variable	21
Lower Preset	101
Literals	1
Program	297
Upper Preset	-
Upper Variable	4717

Library subroutines called

CDECBIN F

The subroutine uses the following SD macros

SDDEF
SDWR
SDCLB
SDEND

Title

Translate magnetic tapes in 1900 MTH format to SPAN 14 format.

Description

The subroutine reads a block from tape using the MTH package. If desired it will present one record at a time to the user who may redistribute it as required and return it to the subroutine. The subroutine will translate the records to their 1400 octal equivalent, batch them as specified by the user and write them in SPAN 14 format to the output tape.

Input parameters

The subroutine requires one input parameter which can be on card or paper tape. On the first entry to the subroutine the appropriate peripheral is allocated, the parameter is then read and the peripheral released. The format for paper tape must be the same as for cards, including *all* spaces, except that a newline character must follow character 54.

The format is as follows.

<i>Column or character</i>	<i>Punching</i>
1 to 12	Input file name.
13	Space
14 to 16	Reel number of first input reel - must be zero filled.
17	Space
18 to 24	Generation number of input file - must be zero filled and ≤ 8388607 .
25 to 27	Spaces
28	Output file beginning label indicator. Punch the number of beginning labels required (maximum 7).
29 to 31	Spaces
32	Output file ending label indicator Punch the number of ending labels required (maximum 7).
33 to 36	Spaces
37 to 40	Maximum length in characters of output records - including word marks, if present, and the record mark although this will not be written to the output tape for unbatched records. The length must be zero filled and ≤ 8372 .
41 to 43	Spaces
44 to 48	Maximum length in characters of the output blocks - including word marks, if present, record marks and the four character block length count for variable length batched records, if this is required. The length must be zero filled and ≤ 09999 for variable length batched records if the block length count is required or ≤ 16744 for fixed length, unbatched variable length or batched variable length records if the block length count is not required.
49	Space
50 to 52	Maximum number of records in the output blocks - must be zero filled and ≤ 999 .

*Column or character**Punching*

53	Space
54	Block length count indicator. 0 = no block length count in first four characters of every data block 1 = block length count will be inserted in first four characters of every data block.
55 to 80	Spaces unless parameter is on paper tape when character 55 must be a newline character.

The CALLing sequence must be

```
CALL 1 NAN14
LDN 3 SYMBOL1
LDN 3 SYMBOL2
LDN 3 SYMBOL3
```

where SYMBOL1 is the address of the first word of the record area (in LOWER VARIABLE) for output from the subroutine to the user.

Word 0 of this area will contain the size in words of the record including this word.

Word 1 onwards will contain the record.

When the record is presented to the user the characters will be in 1900 octal.

The subroutine will set word 0 of this area to zero when the first beginning tape label is about to be written to the output tape if the user has specified he wants a beginning tape label or labels.

The user must set up in the area defined under SYMBOL2 the label or labels he wishes to be written to the output tape. The characters must be in 1900 octal and each label must terminate with a record mark, although the record mark will not be written to the output tape. The second label, if present, must start in the first character after the record mark terminating the first label and so on.

The subroutine will translate the label(s) to 1400 octal and write it (them) to the output tape.

The subroutine will set word 0 of this area negative when the first ending tape label is about to be written to the output tape if the user has specified he wants an ending tape label or labels. The next seven digits from word 1.0 to word 2.2 will contain the block count in decimal. X0 will be set to zero if the label about to be written is an end of file label or to one if an end of reel label. The user must set up in the area defined under SYMBOL2 the label or labels he wishes to be written to the output tape in the same way as for beginning tape labels (see above). Before the subroutine exits to the user a tape mark will have been written to the output tape and another will be written after the last label.

SYMBOL2 is the address of the first word of the record area (in LOWER VARIABLE) for input from the user to the subroutine. The record must be in 1900 octal, must start in the first character position of word 0 and must terminate with a record mark (1900 octal 24). If the user does not wish the current record to be written to the output tape he should put a record mark character in the first character position of word 0. If the user has specified single record blocks on the parameter the record mark will not be written to the output tape. See SYMBOL1 for special use of this area if beginning or ending tape labels are required - this may influence the size of the area defined by SYMBOL2.

SYMBOL3 has two uses and is the address of a word which contains

- (a) On initial entry to the subroutine
 - zero if the parameter is on card
 - non-zero if the parameter is on paper tape.
- (b) On subsequent entries to the subroutine (bit 0 of Monitor Word 30 OFF - see Results)
 - 0 for normal batching of the record
 - 1 if the current record is to be the first record in a new batch
 - 2 if the current record is to be the last record in a batch

Note: If bit 0 of Monitor Word 30 is ON (see Results), normal batching is assumed throughout the run.

Note: SYMBOL1 and SYMBOL2 must refer to an area big enough to contain the largest input and output record possible, respectively.

Results

The user has two options when using this subroutine depending on the setting of bit 0 of Monitor Word 30.

- 1 Bit 0 OFF. Every record on the input tape is presented to the user for redistributing, such as converting certain fields to decimal, before being written to the output tape. It is the user's responsibility to see that every record is terminated with a record mark (1900 octal 24).

If the user wishes to update the record where it is and not move it to the output area he can do this by specifying SYMBOL2 = SYMBOL1+1.

- 2 Bit 0 ON. No records on the input tape will be presented to the user and the subroutine will read the input records, translate them to 1400 octal and batch them onto the output tape as specified in the parameter. If this option is being used the records on the input tape must terminate with a record mark (1900 octal 24) and SYMBOL2 = SYMBOL1+1.

If end of reel is detected on either the input or output tape then the subroutine will automatically close the current reel and open a continuation reel although for an output tape, if either beginning or ending tape labels are required, control will be passed to the user to formulate his own labels.

If end of file is detected on the input tape the subroutine will close the current input reel, pass control to the user to obtain the ending label(s) if required, and close the output tape and halt.

Entry point

NAN14

Link Accumulator

X1

Program return location

CALL+4

Accumulators used

X0, X1, X2, X3, X4, X5, X6, X7

Operating instructions

Before entering the subroutine the first reel of the input file and a 1900 Scratch tape must be mounted. Both tapes are dynamically allocated.

Bit 0 of Monitor Word 30 must be set as required (see Results). The subroutine also uses bit 1 for its own internal working, so it must not be used by the program calling this subroutine.

Program halts

- CR No card reader is available to the program. Make one available and type
GO # NAME
- TR No paper tape reader is available to the program. Make one available and type
GO # NAME
- E2 A block has been found on the input tape which is greater than 512 words. If the operator types:
GO # NAME
the remainder of the block will be ignored.
- E5 There is an error in the parameter and any one of the following will cause this halt.
- 1 A field is out of range
 - 2 A numeric field contains a non-numeric character
 - 3 Maximum record length is specified as greater than maximum block length.
- To restart, correct the parameter, place it in the appropriate reading device and type
GO # NAME
The parameter will be re-read and re-checked.
- E6 A record has been presented for output to the output tape which is longer than specified in the parameter. This may be caused by the user not putting a record mark at the end of the record. To ignore this record type
GO # NAME
- E7 There is an error in the MTH package.
- E8 A read error has occurred on the input tape or a write error on the output tape. There is no restart and the job must be re-run.
- E9 A user or non-standard sentinel has been detected on the input tape. Although this implies that the input tape is in incorrect format, typing
GO # NAME
will cause the subroutine to ignore the sentinel.
- HH End of run halt.

Character conversion

1900 characters will be translated to their corresponding 1400 characters where possible. Where symbols do not match the following conversion will be made.

1900	1400
[✓
↑	∅
£	≠
←	Δ
]	∩
+	≠

Note: If the user wishes to write the output tape in Load Mode he must put a word separator symbol (1900 octal 15) before each character which is to have a word mark.

Store space used

	Number of Words
Lower Common Library Locations	-
Lower Variable	19
Lower Preset	105
Literals	-
Program	361
Upper Preset	-
Upper Variable	4718

Library subroutines called

CDECBINF

CBINDECSL

The subroutine uses the following SD macros

SDDEF

SDRD

