Oxford University Computing Laboratory

Computer Manuals

4119

SPAN System

Simulates ICL 1500 computer onto ICL 1900 Series

1900

ICL International Computers Limited

User notice

MANUAL (~~NOTICE NO.~~)

18/3/70

4119 1500 SIMULATOR (6)

File one copy of this notice with each of the manuals indicated.

1500 SIMULATOR

The Mark 6 issue of the Simulator is now available on application to the Registry, Software Distribution. The generation number of the tape is 6.

This issue will, in accordance with standard ICL practice, automatically be sent to users who hold the previous issue. Distribution is expected to begin shortly and users not receiving it within fourteen days of the application 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 errors notified in Software Notice SPAN 15/3, SPAN 15/4 and 1900/Simulators/1 have been corrected in this version.

FORM 1/230/45(3.69)

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User notice

MANUAL (NOTICE NO.) 5/8/70

4119 1500 SIMULATOR (7)

File one copy of this notice with each of the manuals indicated.

SUBSTITUTED SORT

Reference page 12, lines 6, 7 and 8

Once the combined simulator/1500 PLT has been allocated to the program as unit 0 (immediately following input of the message FI #XG15) it must remain mounted on the same tape deck until simulation is completed. No attempt must be made to TAke or GIve this tape deck.

Reference page 14, lines 14 and 15

If the first tape of the First Work Tape Set has not been GIven to the program, a 1900 Series scratch tape will be requested.

FORM 1/230/45(3.69)

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User notice

Simulators

MANUAL (NOTICE NO.) 4/8/71

4119 1500 SIMULATOR (8)

File one copy of this notice with each of the manuals indicated.

CARD READERS

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

Amendments to the manual

Page 2, line 15. This line should read:

1523 Reader 1911,1912,2101,2102,2104,2105,2106

FORM 1/230/45(3.69)

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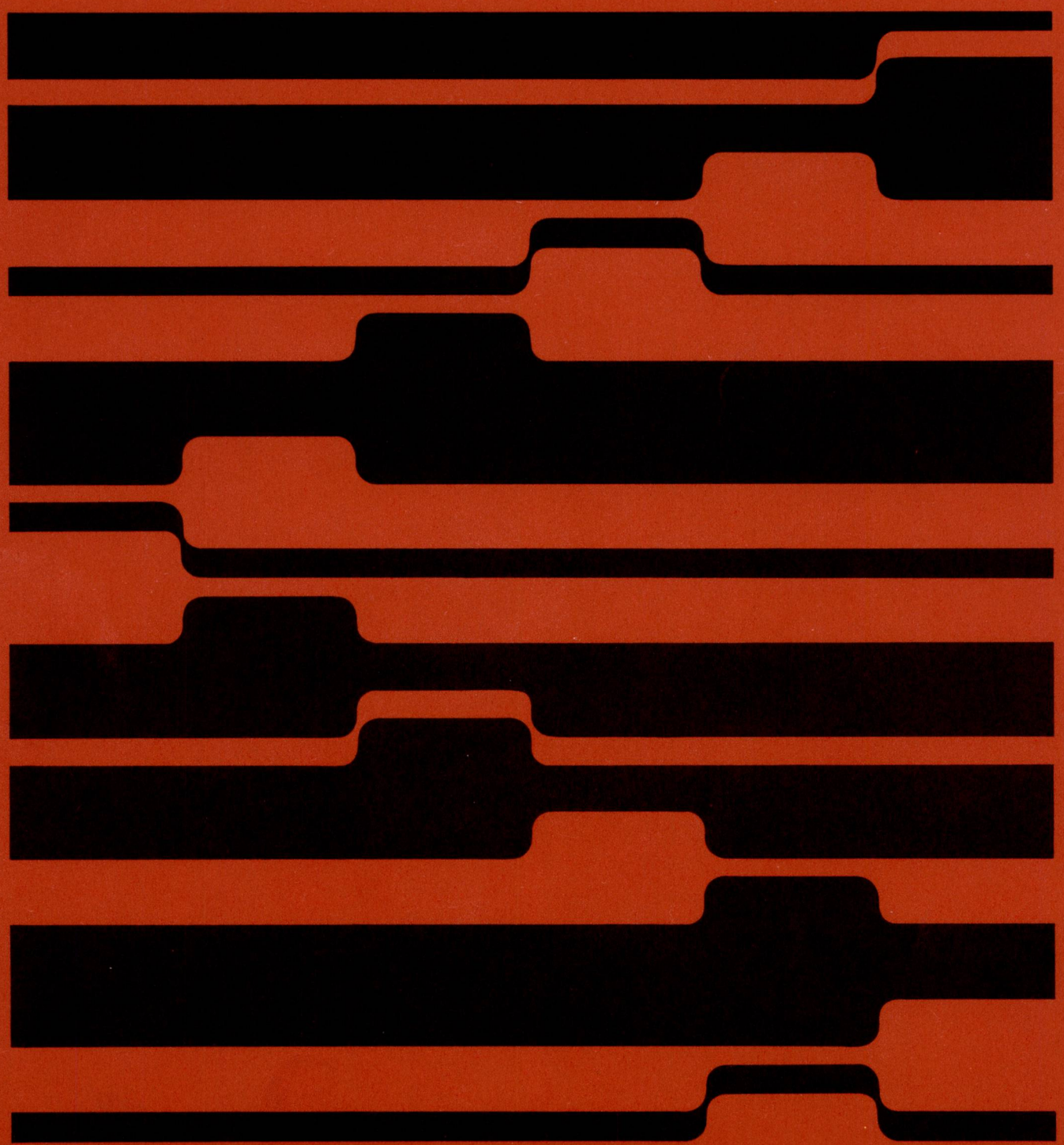
ICL 1500 Simulator

1900 Series



ICL 1500 Simulator

1900 Series

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Contents

Chapter 1 Introduction

This manual describes the SPAN system which is used to simulate the ICL 1500 computer on machines in the ICL 1900 series. It is assumed that the reader has a good knowledge of both the ICL 1500 and the ICL 1900 series.

The SPAN system consists of a simulator program (#XG15) and a number of ancillary service routines.

#XG15 is an interpretive program designed to run 1500 object programs as if they were in the 1500 computer. Its efficiency depends upon the instruction mix in the 1500 program being simulated. Input/Output limited 1500 programs may be executed faster under the simulator than on the 1500, whereas computation limited programs will run slower. In general, job throughput times for commercial programs will be as fast under the simulator as on the 1500.

METHOD

The complete 1500 store is held in a single area of the 1900 store. Each six-bit 1500 character is held in one 1900 six-bit character. Parity checking is done by the 1900 processor and the 1500 parity bit is therefore ignored.

The simulator analyzes each 1500 instruction in turn. The type of 1500 instruction is determined, simulated address registers are set, and control is passed to an appropriate execution routine which simulates the actual operation. Upon completion of the operation, control returns to the interpreter for examination of the next instruction.

The simulated 1500 P, A, B, S and T registers are stored in binary form and their contents are updated within the basic control in the same way as in a 1500.

Throughout these operations, checks corresponding to those of the 1500 hardware are made for address, format and process errors, so that the 1500 instructions are performed correctly.

INPUT/OUTPUT CONTROL

Each peripheral device on the 1500 is simulated on an equivalent device on the 1900. These are:

Line Printer

Card Reader

Card Punch

Magnetic Tape

Console operations and displays are simulated by operator input and simulator output messages on the console typewriter.

Input/Output transfers take place via buffers located outside the simulated 1500 core area. The physical transfer of data on the 1500 is thus simulated by an internal transfer of data between the 1500 core area and a buffer. During internal transfers of data, character conversion processes are automatically carried out.

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

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

Whenever the 1500 program requires data to be input or output via a slow peripheral or magnetic tape the internal transfer takes place immediately. It is therefore not possible to simulate programs which modify any input or output area after a peripheral transfer has been initiated, depending upon a delay before the transfer starts.

SORT SUBSTITUTION

Simulation of the Read Reverse facility, available with all magnetic tapes on the 1500, is inefficient, and because of this direct simulation of the 1500 sort routines can be slow. However where a sorting run does not involve the use of the Own Coding facility or non-standard labels the user can elect to have a 1900 read-forward polyphase sort substituted, automatically, for the original 1500 sort (see Chapter 4). A special tape containing both the Sort Substitution version of the simulator and the simulated 1500 P.L.T. must be produced if this facility is to be used (see Appendix 5).

1500/1900 CONFIGURATIONS

The basic simulator (for a 1500 with a 20K character store) occupies 10,000 words.

If the user wishes to simulate 1500 magnetic tape operations a further 3,000 words are required.

If the user requests the inclusion of the Sort Substitution facility in the simulator a further 1,000 words are required.

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

1500	*1900*
1523 Reader	1911, 1912, 2101, 2102 or 2104
1534 Punch	1920/2, 1921 or 2151
1533 Printer	1933/2, 1933/3, 1932/2, 1931/2, 2401/2 or 2402/2
1535 Printer	1933/3
1580 Magnetic Tape	1971 Magnetic Tape
1581 Magnetic Tape	1972 Magnetic Tape
1582 Magnetic Tape	1973 Magnetic Tape
1583 Magnetic Tape	1974 Magnetic Tape

The simulator does not cater for 1500 configurations with two card readers or two line printers.

The standard 1500 barrel contains the graphics 10, 11, ¼, ½, ¾ and ÷, which do not appear on the 1900 print barrel. The following procedure will be adopted by the simulator:

10 and 11 — Each of these will be printed in two position: the units digit in the original position and the tens digit one position to the left. This may necessitate modification to the 1500 program being simulated.

¼, ½, ¾ and ÷ — 1900 graphics from the set ", !, $, ?, ← and # will be substituted for these graphics as defined by the user.

SIMULATED MAGNETIC TAPE FILES

For reasons of efficiency, all tapes read and written by the simulator are in odd parity and in a special format.

The simulator can accept original 1500 program and data tape files only after they have been processed on a 1500 by the 1500/1900 File Conversion program #XG99 using a 1585 tape deck (see Appendix 5). If the Sort Substitution facility is to be used, 1500 Program Library Tapes must be further processed by the 1900 program #XG21 after being converted by the 1500/1900 File Conversion program #XG99.

Chapter 2 The programs in the SPAN system

THE SPAN SYSTEM TAPE

The SPAN system consists of the 1500 program 1500/1900 File Conversion (#XG99) and 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 from which #XG15 is created.
#XG20	Write SPAN Labels to Magnetic Tape
#XGVT	Validate SPAN Magnetic Tape Configuration Table.
#XG21	Create Combined SPAN/1500 P.L.T.

SPAN Editor – #XGSE

This program is used to select the version of the simulator required. The process of editing must be carried out before simulation can be performed, but in general it need be done only once for any given 1500 installation.

The Editor operates by examining user-supplied parameter cards and creating a magnetic tape with the various required simulation routines in PLAN 3 format. The magnetic tape is then compiled to produce the version of #XG15 required by the user.

SPAN library

This part of the SPAN system contains a library of simulation routines from which the user is able to select various options.

Validate SPAN magnetic tape configuration table—#XGVT

In order to optimize the physical transfer 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 and the program #XGVT validates their contents (see Appendix 5).

Write SPAN labels to magnetic tape—#XG20

The SPAN system requires that all magnetic tapes should have special SPAN labels. Original 1500 files, which have been processed by the 1500/1900 File Conversion program, conform to this requirement. #XG20 should be used to label any other tapes to be used with the simulator (see Appendix 5).

Create combined SPAN/1500 P.L.T.—#XG21

The user's 1500 P.L.T. must be specially processed by this program if the Sort Substitution facility is to be used (see Appendix 5).

THE SPAN EDITOR—#XGSE

Compiling #XGSE

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	*Column*	*Contents*
1	1 to 14	IN (SPAN15LIBRY
	15	Blank
	16	(
	17 to 19	Mark number of simulator with leading zeros
	20 to 21	))
	22 to 80	Blank

Card	*Column*	*Contents*
2	1 to 4	PEND
	5 to 80	Blank

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

Parameters for #XGSE

The editing process requires information about the user's requirements. This is created by filling in the form 'Parameters for SPAN Editor' (shown 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 which contains a statement correctly describing a feature desired of the simulator.

The marked lines should be punched on cards, and these cards, in the order of the lines on the form, make up the parameters for the editing process. (Certain lines have pre-printed crosses against them; these should always be punched.) Only data in columns 1 to 15 and 73 to 80 is significant to the Editor, the alpha text in columns 16 to 72 is for clarity only.

Operating instructions

The next step is to edit the SPAN system tape to produce on a further 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 SPAN15LIBRY) 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 described above, 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 on 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 ask Executive to load #XPLV.

Exception conditions

1 If the first parameter card does not contain SPAN15LIBRY in columns 1 to 11, the message

FIRST CARD INCORRECT

will be typed and the program will delete itself. The card should be corrected and the program re-run.

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

INPUT CARDS ERROR LISTING

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

ERRORS IN CARDS

The cards should be corrected and the program re-run.

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 had in columns 73 to 76 a number which 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 gives 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 the number of parameter cards is not correct, the program will delete itself and type

INCORRECT NO OF VALID CARDS

The user has failed to select one, and only one, option from each of the facilities presented.

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 respectively the contents of columns 73 to 76 and 77 to 80 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 re-run 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.

Batch compilation of SPAN program tape

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

Card	*Column*	*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 #XG15 (or #XG16, #XG17 or #XG18 depending on the #XGSE parameter used–see Appendix 1) 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:

Magnetic Tape Configuration Table: Optional

* End of Table Card

1500 Card Loader Bootstrap

1500 Program

1500 Data

1500 Program

etc.

* This card is compulsory if Magnetic Tape Configuration Table cards are present, otherwise it must not be present.

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 optimize 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 they are not present simulation will be less efficient. The cards need only be present with the first 1500 program which is to be simulated after the simulator has been loaded into the 1900 store.

End of table card

This card must be present if, and only if, Magnetic Tape Configuration Table cards are present. It contains four asterisks in columns 1 to 4, the remainder being blank, and must follow the last table card.

LOADING PROCEDURE

Initializing the simulator

Load the simulator (#XG15) into the 1900 store in the normal manner from the SPAN program tape (see SPAN Editor, on page 3). When this operation is complete type

ON #XG15 20

GO #XG15 29

The simulator will set up various internal switches and then suspend and type the message HALTED:–IN

Notes

1 If the Sort Substitution facility is not to be used the SPAN program tape may be dismounted at this point since no further reference will be made to it.

2 If the Sort Substitution facility is being used the SPAN program tape is a special version, see Appendix 5, containing both the 1900 binary overlay simulator program and the simulated 1500 P.L.T. This must remain mounted throughout simulation.

Loading 1500 programs from cards

1 Place the card deck in the reader, and if the 1900 card reader does not have binary image feature type

ON #XG15 18

2 If any Magnetic Tape Configuration Table cards are present type

ON #XG15 19

GO #XG15 29

The simulator will read up to the End of Table card and make appropriate modifications to itself. The message TAPE is typed and then the simulator suspends itself and types COMPLETE.

3 Mount on the printer, if not already present, the 1900 carriage control loop associated with this 1500 program (see CARRIAGE CONTROL LOOP on page 11).

4 The loading of the 1500 program can then be initiated by typing the message

GO #XG15 21

The simulator will simulate the loading of the card bootstrap.

5 For subsequent programs, loading will either be effected by the current 1500 program branching into the card loader or can be initiated from the console if simulation has stopped, by typing

AL #XG15 14 2601 (See Appendix 3, Section 4)

GO #XG15 24

The simulated P register will be set to 0260 and the simulator will suspend itself and type a standard halt line (see Appendix 4, Section 1) prefixed AR.

The 1500 program can now be started by typing

GO #XG15 22

Loading 1500 programs by search insertion from magnetic tape

1 As LOADING 1500 PROGRAMS FROM CARDS, step 1, except that in this case the 1500 card loader bootstrap would be replaced by Search Insertion parameters (LOAD, EXECUTE, STOP).

2 As LOADING 1500 PROGRAMS FROM CARDS, step 2.

3 As LOADING 1500 PROGRAMS FROM CARDS, step 3.

4 The loading of the 1500 program can then be initiated by typing the message

ON #XG15 19

GO #XG15 21

5 The simulator halts with the typed message:

PUT PLT NO IN WRD 14

The operator should then type:

AL #XG15 14 *MM

GO #XG15

where MM is the two digit octal representation of the 1500 unit number on which the P.L.T. is mounted.

6 Simulation will then start with the loading and operating of the Insertion Bootstrap in Search mode.

Loading 1500 programs by automatic insertion from magnetic tape

1 As LOADING 1500 PROGRAMS FROM CARDS, step 1, except that in this case no parameter or bootstrap cards precede the first 1500 program.

2 As LOADING 1500 PROGRAMS FROM CARDS, step 2.

3 As LOADING 1500 PROGRAMS FROM CARDS, step 3.

4 The loading of the 1500 program can then be initiated by typing the message

ON #XG15 20

GO #XG15 21

5 As LOADING 1500 PROGRAMS BY SEARCH INSERTION FROM MAGNETIC TAPE, step 5.

6 Simulation will then start with the loading and operating of the Insertion Bootstrap in Automatic mode.

The loading procedures for card loading and also for both tape insertion routines have been modified so that it is not necessary for the operator to simulate the switching ON and OFF of the WTAB switch. The simulated WTAB switch is set ON and OFF at the appropriate time and the halt at which the operator would normally expect to set WTAB OFF is displayed but the simulator does not halt. This modification considerably streamlines program loading procedure whilst at the same time giving complete security.

CONSOLE OPERATION

The simulator is controlled through the console typewriter. In this way a complete record of the console operations is created. A list of the 1500 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 1500 program halt is encountered,

3 an exception condition is detected in the 1500 program.

Operator input to the simulator is achieved through use of the bits of the monitor word, ALTERing the contents of words 10, 11 and 14 to 17 and GOing at entry points 20 to 29. The standard 1900 entry points give access to the following facilities.

Entry Point	*Facility*
29	Initiate Simulator–see INITIALIZING THE SIMULATOR on page 7 Table load–see LOADING 1500 PROGRAMS FROM CARDS, step 2, on page 8 General Reset–see Appendix 3 Section 1 Sort Restart–see RESTARTING THE SORTING AND POSTSORT PHASES, Section (e) on page 19.
28	'Obey' a given 1500 instruction–see Appendix 3, Section 9.
27	Display Switches–see Appendix 3, Section 8 Alter Switches–see Appendix 3, Section 6.
26	Display Storage–see Appendix 3, Section 7.
25	Alter Storage–see Appendix 3, Section 5.
24	Alter Registers–see Appendix 3, Section 4.
23	Unload Magnetic Tape–see Appendix 3, Section 10 Rewind Magnetic Tape–see Appendix 3, Section 11.
22	Start–see Appendix 3, Section 2.
21	1500 Bootstrap loader facilities–see pages 7 and 8.
20	Reserved.

I/O DEVICES–MANUAL OPERATIONS

The following sections describe in some detail the operating procedures for the I/O devices. This section serves to stress that for the card reader and magnetic tape the simulator must be informed of any significant manual alteration in the state of the device. 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 #XG15 22

Magnetic tape

Whenever a reel (on 1500 unit n) is to be unloaded the operator must type

AL #XG15 14 *n*

GO #XG15 23

where n is the octal equivalent of the 1500 deck address in 1500 code i.e. deck A = octal 21.

Whenever a reel (on 1500 unit n) is to be rewound the operator must type

ON #XG15 19

AL #XG15 14 *n*

GO #XG15 23

where n is the octal equivalent of the 1500 deck address in 1500 code i.e. deck A = octal 21.

The simulator will rewind or unload the tape as appropriate and then type

HALTED: COMPLETE

CARD READER

Card codes

Cards should be punched in standard 1500 code (see Appendix 1) with the exception that the 1500 character $\overline{10}$ may be represented either by the card code $\overline{10}$, 0 or by $\overline{10}$, 8, 7, if the 1900 card reader has binary image feature. If the 1900 card reader does not have binary image feature the 1500 character $\overline{10}$ can only be represented by $\overline{10}$, 7, 8 because the card reader cannot distinguish between a $\overline{10}$ and $\overline{10}$, 0 punching, so, either the user must change any $\overline{10}$, 0 punching to $\overline{10}$, 7, 8, or, change his program to accept $\overline{10}$, 0 being read as & instead of the 1500 character $\overline{10}$. On output, the character $\overline{10}$ will always be punched as $\overline{10}$, 7, 8.

Priming the reader

On initial set-up, and whenever the card reader has been reloaded after it has been run out manually, the operator should type

ON #XG15 22

If this is not done the simulator will present to the 1500 program whatever information is already in its card read buffers, and an error is certain to occur.

Invalid card codes

If an invalid 1500 card code is detected then simulation will be suspended and a Standard Halt Line prefixed CR (see Appendix 4) will be typed. The card in error will be the last but two in the stacker. The operator should correct the error card then refeed it and any subsequent cards. Simulation should then be restarted by typing

ON #XG15 22

GO #XG15 22

If the operator does not wish to correct the card or to run out the reader then simulation can be restarted by typing

GO #XG15 22

In this case the error card will be ignored.

Card wreck/jam

Normal 1900 operating procedures should be followed.

CARD PUNCH

Card codes

Cards are punched in standard 1500 code except that the 1500 character octal 37 will be punched as the code $\overline{10}$,

8, 7 (not as $\overline{10}$, 0).

Card wreck/jam/error
Normal 1900 operating procedures should be followed.

LINE PRINTER

Graphics
In place of the 1500 print barrel the simulator uses the 1900 print barrel and a conversion table.

The 1900 graphics used by the simulator to represent each 1500 character are identical to those used by the 1500 except for:

(a) the characters ¼, ½, ¾ and ÷

The user may assign any one of the graphics, ", !, $, ?, ← and # to each of the above during the Editor run (see THE SPAN EDITOR on page 3).

(b) 10 and 11 which are dealt with as described in 1500/1900 CONFIGURATIONS on page 2.

Carriage control loop
Channels 2 and 3 of the 1900 carriage control loop should be punched to represent respectively the vertical tabulation and top of form punchings in the 1500 loop. At least one additional punching should be made in channel 1 in the top of form position to allow the 1900 operator to line up the paper initially. The number of rows in the loop can be any convenient multiple of the number of lines on the 1500 document.

During simulation, the paper low indicator will be tested after every 1500 page change instruction. If it is set, the simulator will suspend and type

CHANGE PAPER

The operator should then reload the printer and type

GO #XG15

and simulation will continue.

MAGNETIC TAPE

Data tapes
Original 1500 files must be processed by the 1500/1900 File Conversion program (see Appendix 5) before they can be used.

All other tapes must be specially labelled by the program #XG20 (see Appendix 5) before the simulator will write to them.

Program library tapes
All original 1500 Program Library Tapes must be processed by the 1500/1900 File Conversion program (see Appendix 5) before they can be used by the simulator.

If the Sort Substitution facility is to be used then the simulated P.L.T. produced by the 1500/1900 File Conversion program must be reprocessed by the Create Combined SPAN/1500 P.L.T. program #XG21 (see Appendix 5).

Operating
Apart from the actual mounting and dismounting of reels it must be an *absolute* rule that all accesses to magnetic tape 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, and an error is certain to occur.

Facilities available
The 1500 unit numbers are represented in the 1900 operating facilities as follows:

1500	1	2	3	4	5	6	A	B	C	D	E	F	J	N
1900	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Note: The use of either L or P as the N character of a tape instruction is treated as illegal. Moreover, if either of these characters is present in the sort tape table when a substituted sort is entered, an error will be indicated (see ERROR MESSAGES on page 15).

If the Substituted Sort version of the simulator is being used the above equivalence table does not apply to the combined SPAN/1500 P.L.T., which is always considered as 1900 unit 0. This is because it contains a 1900 binary overlay program.

The following table lists the magnetic tape operating facilities available with the simulator:

1500 Operation		*1900 Equivalent*	*1900 Action*
1	Mount a reel on 1500 unit *n*	Mount the reel on an available deck, with geographical address A, then type GIVE #XG15 A *m* where *m* is the 1900 equivalent of *n*, from the previous table.	Executive will access the selected deck whenever the simulated program addresses deck *n*
2	Unload the reel on 1500 unit *n*	AL #XG15 14 *n** GO #XG15 23	The reel on 1500 magnetic tape unit *n* is unloaded and released by the simulator which then suspends itself and types COMPLETE.
3	Rewind the reel on 1500 unit *n*	ON #XG15 19 AL #XG15 14 *n** GO #XG15 23	The reel on 1500 magnetic tape unit *n* is rewound by the simulator which then suspends itself and types COMPLETE and bit 19 is set OFF.

* *n* is the octal equivalent of the 1500 deck address in 1500 code

i.e. deck A = octal 21
deck B = octal 22
etc.

Chapter 4 Substituted sort

Simulation of the Read Reverse facility, available with all magnetic tape systems on the 1500, is inefficient. Because of this, direct simulation of 1500 sorts can be slow. However, where a sorting run does not involve the use of the Own Coding facility or Non-Standard Label Processing the user may employ a version of the simulator which will automatically substitute a 1900 read forward polyphase sort for the original 1500 sort (see Appendix 2).

If this version of the simulator is used then the following limitations also apply:

1 The simulated 1500 P.L.T. containing the original 1500 sort must be processed by the program Create Combined SPAN/1500 P.L.T. (see Appendix 5) and the output from this run used as the simulator run-time program tape.

2 No record may be greater than 2044 characters in length, including the terminal E/I.

3 No key may start later than in the 1000th position of a record.

4 The input file must conform to the standards described in the 1500 Systems Standard Manual.

5 No attempt must be made by any of the programs being simulated to write to the 1500 P.L.T.

OUTLINE METHOD

At the point in the 1500 program where the first instruction of the 1500 sort is encountered, simulation is interrupted and the Substituted Sort section of the simulator is entered. This first reads and validates the 1500 sort parameter cards.

Next the data to be sorted is read, processed and written to the first work tape of the First 1500 Work Tape Set, in standard 1900 M.T.H. format. The other work tapes are given 1900 scratch labels.

The 1900 sort (a modified version of the polyphase sort #XSMC) is overlayed from the combined SPAN/1500 P.L.T. Directed by a converted version of the original 1500 parameters it is used to sort the data from the first tape of the First 1500 Work Tape Set onto one of the other work tapes. The sorted output is then written back in SPAN format onto the first tape of the First 1500 Work Tape Set. The remaining work tapes are given SPAN labels and the simulator is reinstated. The simulated store is exactly as it would be after the standard exit from the 1500 sort program, and normal simulation is resumed.

Restart facilities are provided during the operation of the sort and the conversion of the sorted output to SPAN format.

They are described in RESTARTING THE SORTING AND POSTSORT PHASES on page 19.

PARAMETER CARDS

At the point in the 1500 program when the first instruction of a Substituted Sort is obeyed the 1500 sort parameters must be the first cards in the reader. These cards should be in the format described in the ICL 1500 Tape Sort and Tape Merge Manual with the following exceptions in the punching of the Way card:

In addition to the information described in the Sort/Merge manual the Way card should contain in

Columns 75, 76 Blanks if the sorted output file is to have no labels or E/Fs.

00 if the sorted output file is to have opening E/Fs but no labels,

01 if the sorted output file is to have opening E/Fs and ending labels but no beginning labels.

10 if the sorted output file is to have beginning labels but no ending labels,

11 if the sorted output file is to have ending and beginning labels.

Column 77	Blank if the sort work tapes have no opening E/Fs or beginning labels,
	0 if the sort work tapes have opening E/Fs but no beginning labels,
	1 if the sort work tapes have beginning labels.
Column 78	Blank if no printing is required,
	1 if the user requires printouts similar to those provided by the 1500 sorts.
Columns 79, 80	As 75, 76 but for the input files.

MESSAGES ON CONSOLE TYPEWRITER DURING NORMAL RUNNING

ENTERING SUBSTITUTED SORT
This message is typed when the simulator detects the first instruction of a 1500 sort for which a 1900 sort is to be substituted.

Between the typing of this and the next message (see PRESORT PHASE below):

1 The 1500 parameter cards are read and validated,

2 The 1500 tape table contents are validated,

3 The first tape of the First Work Tape Set is label checked– if labels were specified on the Way card– and certain information is written to it.

PRESORT PHASE
This message is typed when the simulator has completed the operations outlined in the previous section.

Between the typing of this and the next message (see 1900 SORT below):

1 The data to be sorted is processed and written in 1900 M.T.H. format to the first tape of the First Work Tape Set. This tape is then rewound.

2 The remaining work tapes are label checked, if labels were specified, given 1900 scratch labels and then rewound.

1900 SORT
This message is typed when the 1900 sort routine is entered. Between the typing of this and the next message, the data to be sorted will be read and distributed to a number of work tapes.

The tape input to the sort will then be released and the sort will type the following message:

REMOVE INPUT REEL FROM UNIT XX
XX indicates the geographical address of the unit on which the input reel was mounted.

The sort will then request a 1900 scratch tape.

The operator should dismount the input reel and replace it by a 1900 scratch tape with a write permit ring. He should then type

GO #XG15

to continue and sort.

When data has been sorted the tapes used by the sort will be released and the sort will then type the following message

END OF SORT, FINAL O/P REEL ON UNIT YY
YY will indicate the geographical address on which the output reel is mounted.

The sort will then transfer control to a further section of the simulator which will type the following message:

POSTSORT PHASE
After typing this message the simulator will request the tape dismounted previously (a tape labelled SPAN15TOXSMC). The operator should dismount one of the 1900 scratch tapes released by the sort and replace it by the requested tape

with a write permit ring. Simulation will continue.

The simulator will reopen the sorted output from the 1900 sort and a number of 1900 scratch tapes. The sorted data will be read and re-written in simulated 1500 format.

The simulated 1500 will then be set up as if at the end of a simulated 1500 sort, the messages

SORT O/P REEL 1 ON DCK XX

and

NORMAL SIMULATION
will be typed (where XX is the deck number on which the final sorted output in simulated 1500 format is mounted) and normal simulation will be resumed.

ABNORMAL CONDITIONS

Multi-reel input

During the presort phase, the simulator will type the following message after each input reel has been opened (except for the final reel):

MOUNT NEXT REEL

The operator should then mount the next reel without a write permit ring on any available deck with geographical address A. When the input reel is exhausted the simulator will suspend itself and type

NEXT REEL ON UNIT *nn*

This message indicates to the operator the program unit number which he must assign to deck A, on which is mounted the next reel awaiting processing. He should then type

GI #XG15 A *nn*

GO #XG15

and the presort phase will continue.

Multi-reel output

During the processing described under 1900 SORT the simulator may type a message of the form

FIRST O/P REEL ON UNIT *nn* FULL

The sort will then request a 1900 scratch tape.

The sorted output data occupies more than one output reel. The operator should dismount the reel on geographical address *nn* and replace it by a 1900 scratch tape with a write permit ring.

NOTE: During the processing described under POSTSORT PHASE the simulator will ask Executive to open in reel number order the reels of the file containing the sorted data.

ERROR CONDITIONS

Error messages

During the processes described under ENTERING SUBSTITUTED SORT a number of errors may be detected. The messages typed by the simulator and the errors giving rise to the messages are given below.

1	HALTED:–L1	The 1500 tape unit number in location 0837 is invalid.
2	HALTED:–L2	The first 1500 sort parameter card read is not a Way card, or the format of the Way card is incorrect.
3	HALTED:–L3	One of the 1500 sort parameter cards was an Own Code card. If the sort about to be obeyed includes own coding then simulation must be abandoned since this is not permitted.
4	HALTED:–L4	One of the 1500 sort parameter cards is duplicated (e.g. two Way cards have been read).

5 HALTED:–L5 A card has been read which is not a 1500 sort parameter card.

6 HALTED:–L6 One of the input file label parameter cards has a file number which is not in the range 0 to 9.

7 HALTED:–L7 The 1500 sort parameter cards did not contain one of the following:

a Max Input card

a Max Output card

a Key card.

8 HALTED:–L8 A 1500 tape unit number in 0835 or 0836 is invalid.

9 HALTED:–L9 One of the unit numbers for the tapes of the First Work Tape Set is invalid.

10 HALTED:–LA One of the unit numbers for the tapes of the Second Work Tape Set is invalid.

11 HALTED:–LB The 1500 P.L.T. (unit number in location 0200) is duplicated with either the last tape of the Second Work Tape Set or with one of the tapes of the First Work Tape Set.

12 HALTED:–LC The first input station (unit number in 0835) is duplicated with either the last tape of the Second Work Tape Set or with one of the tapes of the First Work Tape Set.

13 HALTED:–LD The second input station (unit number in 0836) is duplicated with either the last tape of the Second Work Tape Set or with one of the tapes of the First Work Tape Set.

14 HALTED:–LE One of the 1500 tape unit numbers in either the First or the Second Work Tape Set is duplicated.

15 HALTED:–LF The Max Input card is incorrect.

16 HALTED:–LG The Max Output card is incorrect.

17 HALTED:–LH The Key card is incorrect

18 HALTED:–LI The Descending Key card is incorrect.

19 HALTED:–LJ The label options specified on the Way card contradict the label parameter cards.

20 HALTED:–LK The Order of Compare card is incorrect.

21 U *nn* NOT USEABLE

The tape mounted on 1900 unit *nn* is invalid. One of the following is missing:

(a) The special SPAN labels–see DATA TAPES on page 11.

(b) A valid purgeable 1500 label (if labels were specified for this tape on the Way card).

(c) A valid opening E/F (if an opening E/F was specified for this tape on the Way card).

The simulator unloads the tape before typing this message. The operator should replace the offending tape by a 1900 scratch tape with a write permit ring and then type

GI #XG15 XX *nn*

GO #XG15

where XX is the deck number on which the scratch tape has been mounted and *nn* is the unit number in the error message.

Recovery from error conditions 1 to 20 above

All the error conditions arising above, with the exception of number 21, are due to programmer error, and can only be corrected immediately if the programmer is in attendance, or if the operator has a first class knowledge of the 1500 sort program.

If an immediate correction can be made, the following general procedure should be followed:

1 Errors 2 to 7 and 15 to 20.

The card reader should be run out, the error in the parameter card(s) corrected, and *all* the 1500 sort parameters should be refed. The operator should then type

GO #XG15 22

and simulation will continue.

2 Errors 1 and 8 to 14

The card reader should be run out. The operator should then use the storage display and alteration facilities described in Appendix 3 to correct the location(s) in the simulated 1500 store which are in error. *All* the sort parameters should be refed and the operator should type

GO #XG15 22

and simulation will continue.

The user should note that under conditions 1 and 2 it is not necessary for the operator to type

ON #XG15 22

because although the card reader will be reprimed the simulator sets bit 22 ON by program and thus the manual operation is superfluous.

3 If the correction cannot be applied immediately and other programs are to be simulated, the sort program should be reloaded later using search or automatic insertion as convenient.

During the processes described under PRESORT PHASE on page 14 various error conditions are detected. The messages typed by the simulator, the errors detected and the operator action required are listed below:

1 NON-SPAN TAPE

One of the sort work tapes does not have a SPAN label–see DATA TAPES on page 11. The simulator unloads the tape and types the above message but does not stop. The operator should dismount the reel which has been unloaded and replace it by a 1900 scratch tape with a write permit ring.

2 CAN'T USE TAPE

One of the sort work tapes does not have either

(a) a valid purgeable 1500 label–if labels were specified on the Way card, or

(b) an opening E/F–if this was specified.

The simulator unloads the offending tape and types the above message but does not stop. The operator should dismount the reel which has been unloaded and replace it by a 1900 scratch tape with a write permit ring.

3 END LABEL CHECK

The end label check on the current input tape has failed. The operator can either restart simulation at some point prior to the sort, or, by typing

GO #XG15

the error can be ignored.

4 NON-SPAN TAPE *nn*

The input tape on 1900 unit *nn* does not have a SPAN label–see DATA TAPES on page 11. The simulator unloads the tape and types the above message but does not stop.

5 INVALID TAPE UNIT *nn*

The input tape on 1900 unit *nn* does not have a valid 1500 beginning label. The simulator unloads the tape and types the above message but does not stop.

6 WRONG TAPE IS ON *nn*

The input tape on 1900 unit *nn* is not one of the files specified on the label parameter cards or is a correct reel which has been presented out of order. The simulator unloads the tape and types the above message but

does not stop.

7 BAD BLOCK ON UNIT *nn*

The simulator has detected one of the following conditions in a 1500 input block from the reel which it is currently processing on 1900 unit *nn*:

(a) The 1500 block is a 1900 tape mark.

(b) The 1500 block is not in correct SPAN format.

(c) Ending labels specified as present on the Way card but no label found on input tape.

(d) A single character block has been read on the input tape which is neither an EF nor an ED.

The operator may either type

GO #XG15

to cause the simulator to ignore the error condition and read the next input block, or he may type:

AL #XG15 6 0

GO #XG15

to force the offending reel to be closed as if the end of the data on it had been detected.

8 BAD FORMAT UNIT *nn*

The simulator has detected one of the following conditions in a 1500 input block from the reel which it is currently processing on 1900 unit *nn*:

(a) The current 1500 record contains either a 1500 octal 17 or 77.

(b) The 1500 record is not long enough to contain the specified keys.

(c) The 1500 block or current 1500 record is longer than the specified maximum.

(d) The 1500 block is not terminated by EI EF (batched records) or by EI (unbatched records).

To ignore the error condition or to close the offending reel proceed as described under 7 above .

9 ETW OR PARITY ON UNIT *nn*

The simulator has detected either ETW or unclearable parity errors on the output reel on 1900 unit *nn*. If the operator types

GO #XG15

the conditions will be ignored. Otherwise he should restart simulation at some point prior to the sort.

INTERRUPTING THE SORTING

During the processing described under REMOVE INPUT REEL FROM UNIT XX on page 14, the 1900 sort may be interrupted in order that it may be restarted later. To perform an interruption the operator should type

GO #XG15 26

All the tapes being used by the sort will be closed and the tape which was last being written will be left with a 1900 scratch label, all the others having a one day retention period. The message

RUN POSTPONED

will be typed and the simulator will delete itself.

The operator should unload and preserve all the tapes being used by the sort, except the one mounted on geographical address XX, where XX is taken from the last occurrence of the message

WRITING XX

which will have been displayed from time to time during the sort.

If any simulated 1500 files were mounted which were not being used by the sort, the operator should unload them, note on them the 1900 program unit number which the simulator was using to address them, and then preserve them.

Similarly, he should note the state of the cards in the card reader and preserve them together with any line printer output.

RESTARTING THE SORTING AND POSTSORT PHASES

After an interruption as described in previous section, or a hardware failure occurring during either the SORT (page 14) or the POSTSORT phase (page 14), the restart procedure is as follows:

(a) The combined SPAN/1500 P.L.T. is mounted.

(b) The preserved tapes which were being used by the sort are mounted with write permit rings.

(c) If the restart is due to an incident during the processing described under REMOVE INPUT REEL FROM UNIT XX, a 1900 scratch tape with a write permit ring should be mounted.

(d) The data in other peripherals is replaced as it was before the interruption.

(e) The operator types

FI #XG15

ON #XG15 19 20

If the restart is due to a hardware failure during the POSTSORT phase, bit switch 21 is also set ON

If the 1900 card reader does not have binary image feature, bit switch 18 is also set ON.

GO #XG15 29

The simulator will reset the sort phase and, if all the files originally mounted were being used by the sort, the sorting phase will be resumed. However, if other simulated 1500 files are required, simulation will be suspended and a message of the form

MOUNT TAPE ON *nn*

will be typed. The operator should mount on the deck with geographical address A the simulated 1500 file which was originally mounted on 1900 program unit number *nn*, and then type

GI #XG15 A *nn*

GO #XG15

to continue simulation. This process will be repeated until the last file has been accepted, after which the sorting phase will be resumed.

No check is made on files loaded in this way so the operator must be extremely careful when using this restart procedure.

Appendix 1 Table of 1500/1900 code equivalents

The '1900 Typed Code' column in the following table gives the 1900 graphics which are used to represent 1500 characters in messages typed by the simulator. Certain 1500 characters (e.g. blank) are represented by two graphics.

1500 Octal	1500 Char Defined as	1500 Card Code	1900 Card Code	1900 Typed Code	1500 Graphics	1900 Graphics	1500 Octal	1500 Char Defined as	1500 Card Code	1900 Card Code	1900 Typed Code	1500 Graphics	1900 Graphics
00	0	0	0	0	0	0	40	–	$\overline{11}$	$\overline{11}$	–	–	–
01	1	1	1	1	1	1	41	J	$\overline{11}$,1	$\overline{11}$,1	J	J	J
02	2	2	2	2	2	2	42	K	$\overline{11}$,2	$\overline{11}$,2	K	K	K
03	3	3	3	3	3	3	43	L	$\overline{11}$,3	$\overline{11}$,3	L	L	L
04	4	4	4	4	4	4	44	M	$\overline{11}$,4	$\overline{11}$,4	M	M	M
05	5	5	5	5	5	5	45	N	$\overline{11}$,5	$\overline{11}$,5	N	N	N
06	6	6	6	6	6	6	46	O	$\overline{11}$,6	$\overline{11}$,6	O	O	O
07	7	7	7	7	7	7	47	P	$\overline{11}$,7	$\overline{11}$,7	P	P	P
10	8	8	8	8	8	8	50	Q	$\overline{11}$,8	$\overline{11}$,8	Q	Q	Q
11	9	9	9	9	9	9	51	R	$\overline{11}$,9	$\overline{11}$,9	R	R	R
12	BLANK	BLANK	BLANK	]	]	]	52	E/I	$\overline{11}$,8,2	$\overline{11}$,8,2	[	[	[
13	¼	8,3	8,3	#	¼	NOTE 2	53	£	$\overline{11}$,8,3	$\overline{11}$,8,3	£	£	£
14	@	8,4	8,4	@	@	@	54	*	$\overline{11}$,8,4	$\overline{11}$,8,4	*	*	*
15	(	8,5	8,5	(	(	(	55	E/D	$\overline{11}$,8,5	$\overline{11}$,8,5	$	¾	NOTE 2
16	)	8,6	8,6	)	)	)	56	E/F	$\overline{11}$,8,6	$\overline{11}$,8,6	<	<	<
17	BLANK	NOTE 1	8,7	BLANK	BLANK	BLANK	57	$\overline{11}$	NOTE 1	11,8,7	!	$\overline{11}$	NOTE 3
20	&	$\overline{10}$	$\overline{10}$	&	&	&	60	½	$\overline{11}$,0	$\overline{11}$,0	"	½	NOTE 2
21	A	$\overline{10}$,1	$\overline{10}$,1	A	A	A	61	/	0,1	0,1	/	/	/
22	B	$\overline{10}$,2	$\overline{10}$,2	B	B	B	62	S	0,2	0,2	S	S	S
23	C	$\overline{10}$,3	$\overline{10}$,3	C	C	C	63	T	0,3	0,3	T	T	T
24	D	$\overline{10}$,4	$\overline{10}$,4	D	D	D	64	U	0,4	0,4	U	U	U
25	E	$\overline{10}$,5	$\overline{10}$,5	E	E	E	65	V	0,5	0,5	V	V	V
26	F	$\overline{10}$,6	$\overline{10}$,6	F	F	F	66	W	0,6	0,6	W	W	W
27	G	$\overline{10}$,7	$\overline{10}$,7	G	G	G	67	X	0,7	0,7	X	X	X
30	H	$\overline{10}$,8	$\overline{10}$,8	H	H	H	70	Y	0,8	0,8	Y	Y	Y
31	I	$\overline{10}$,9	$\overline{10}$,9	I	I	I	71	Z	0,9	0,9	Z	Z	Z
32	+	$\overline{10}$,8,2	$\overline{10}$,8,2	+	+	+	72	E/B	0,8,2	0,8,2	?	÷	NOTE 2
33	.(Period)	$\overline{10}$,8,3	$\overline{10}$,8,3	.(Period)	.(Period)	.(Period)	73	,(Comma)	0,8,3	0,8,3	,(Comma)	,(Comma)	,(Comma)
34	;	$\overline{10}$,8,4	$\overline{10}$,8,4	;	;	;	74	%	0,8,4	0,8,4	74	%	%
35	:	$\overline{10}$,8,5	$\overline{10}$,8,5	:	:	:	75	● ISS	0,8,5	0,8,5	75	↑	↑
36	'(Apos.)	$\overline{10}$,8,6	$\overline{10}$,8,6	'(Apos.)	'(Apos.)	'(Apos.)	76	=	0,8,6	0,8,6	76	=	=
37	$\overline{10}$	$\overline{10}$,0 (SEE NOTE 4)	$\overline{10}$,8,7	←	$\overline{10}$	NOTE 3	77	>	NOTE 1	0,8,7	77	>	>

Note 1: The characters with the octal configurations 17, 57 and 77 cannot be input via the card reader on the 1500.

Note 2: The user may elect to represent each of the 1500 graphics ¼, ½, ¾ and ÷ by any one of the 1900 graphics ", !, $, ?, ← and # (see SPAN Editor parameters, Appendix 2).

Note 3: The 1500 graphics $\overline{10}$ and $\overline{11}$ are each displayed as two graphics by the simulator. The units graphic (0 or 1 respectively) is printed in the position originally occupied by the $\overline{10}$ (or $\overline{11}$), the tens graphic (1) is printed in the position immediately to the left of the units.

Note 4: The character with the octal configuration 37 is represented on input via the 1500 reader by the card code $\overline{10}$, 0 but is punched out by the 1500 as $\overline{10}$, 8, 7. The simulator will accept either $\overline{10}$, 0. or $\overline{10}$, 8, 7 as input if the 1900 card reader has binary image feature or only $\overline{10}$, 8, 7 if the 1900 card reader does not have binary image feature. The character will always be punched out as $\overline{10}$, 7, 8.

Appendix 2 Parameters for SPAN Editor

The form on page 26 should be used to create parameters for the SPAN Editor program–see page 3.

The user should mark, to the left of column 1, only those lines which contain statements correctly describing his 1500 or some desired feature of the simulator. These lines, together with the two lines marked with a preprinted cross (x), should be punched into 80 column cards. This process should produce exactly ten cards. If it does not the user has failed to select one, and only one, option from each of the choices presented to him.

	1 15	16 72	73 80
X	SPAN15LIBRY		
	#	1500 DID NOT HAVE MAGNETIC TAPE	00100001
	#	1500 HAD MAGNETIC TAPE, NO SORTS TO BE SUBSTITUTED	00100002
	#	1500 HAD MAGNETIC TAPE, SOME SORTS TO BE SUBSTITUTED	00100003
	#	PRINT 1/4 AS "	00200001
	#	PRINT 1/4 AS !	00200002
	#	PRINT 1/4 AS $	00200003
	#	PRINT 1/4 AS ?	00200004
	#	PRINT 1/4 AS ←	00200005
	#	PRINT 1/4 AS #	00200006
	#	PRINT 1/2 AS "	00300001
	#	PRINT 1/2 AS !	00300002
	#	PRINT 1/2 AS $	00300003
	#	PRINT 1/2 AS ?	00300004
	#	PRINT 1/2 AS ←	00300005
	#	PRINT 1/2 AS #	00300006
	#	PRINT 3/4 AS "	00400001
	#	PRINT 3/4 AS !	00400002
	#	PRINT 3/4 AS $	00400003
	#	PRINT 3/4 AS ?	00400004
	#	PRINT 3/4 AS ←	00400005
	#	PRINT 3/4 AS #	00400006
	#	PRINT DIVIDE SYMBOL AS "	00500001
	#	PRINT DIVIDE SYMBOL AS !	00500002
	#	PRINT DIVIDE SYMBOL AS $	00500003
	#	PRINT DIVIDE SYMBOL AS ?	00500004
	#	PRINT DIVIDE SYMBOL AS ←	00500005
	#	PRINT DIVIDE SYMBOL AS #	00500006
	#	1500 HAD 120 POSITION PRINTER	00600001
	#	1500 HAD 160 POSITION PRINTER	00600002
	#	SIMULATOR IS TO BE CALLED XG15	00700001
	#	SIMULATOR IS TO BE CALLED XG16	00700002
	#	SIMULATOR IS TO BE CALLED XG17	00700003
	#	SIMULATOR IS TO BE CALLED XG18	00700004
	#	1500 HAD CARD PUNCH	00800001
	#	1500 DID NOT HAVE CARD PUNCH	00800002
X	# END		

Appendix 3 Facilities available on the simulated 1500 console

A Standard Halt Line is a message typed by the simulator

1 in response to some operator action,

2 on detection of a 1500 halt instruction, or

3 on detection of an error condition in the 1500 program.

This message has a prefix identifying its cause and gives, in general, the contents of the P, A, B, S and T registers and the state of certain 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 20,000, the message

OP ERROR

is typed out.

The 1900 console operation corresponding to each 1500 console operation is shown in the table below et seq.

1500 Operation		*1500 Effect*	*1900 Operation*	*1900 Effect*
1	General Reset	Clear registers switches etc.	GO #XG15 29	Clears P, A, B, S and T registers. Sets PRI's to PRZ. Sets Arithmetic overflow OFF. Sets E/F and E/D Normal and Simultaneous latches OFF. Sets all ETW latches off. Initializes the simulator's buffers. Displays the message GENERAL RESET, then suspends itself and types a message giving the state of the BCT, INT, WTAB and SMDI switches.
2	Start	Begin execution	GO #XG15 22	Simulation begins at the 1500 instruction currently addressed by the P register.
3	Stop	Stop execution	either SU #XG15	If simulation is to be stopped to allow some operator action *not* involving the typing of a GO at message (other than GO #XG15)
			or SU #XG15 AL #XG15 32 *03600037 GO #XG15	If simulation is to be stopped on completion of the current 1500 instruction to allow some operator action involving the typing of a GO at message. The simulator will suspend itself and type a Standard Halt Line prefixed ST.

1500 Operation		*1500 Effect*	*1900 Operation*	*1900 Effect*
				Note: Use of this facility is limited to programs that 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.
3a	Trace	Trace 1500 instructions	AL #XG15 32 *03600037 ON #XG15 0 GO #XG15	Simulation is stopped as in 3 above, or by a simulated 1500 halt. On typing GO, simulation will continue with a trace of each 1500 instruction simulated. Note: Use of this facility is limited to programs that 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.
4	Alter Registers	Enter an address into address register P, A, B, S or T	AL #XG15 14 XY GO #XG15 24 where Y is 1, 2, 3, 4, or 5 for P, A, B, S and T respectively and X is a 1500 decimal storage address from 1 to 5 digits in length.	The simulator will alter the appropriate simulated register and will then suspend itself and type a Standard Halt Line prefixed AR.
5	Alter Storage	Enter characters into storage	AL #XG15 14 XY AL #XG15 15 *$I_1I_2I_3I_4$ AL #XG15 16 *$I_5I_6I_7I_8$ GO #XG15 25 where Y is a single digit (from 1 to 8) giving a count of the number of characters to be stored; X is the decimal address of the leftmost location in the 1500 store at which the characters are to be stored and I_1 ..... I_8 are 1500 characters each represented by its *two-digit* octal equivalent (see Appendix 1). Clearly if less than five characters are input it will not be necessary to alter word 16. For example if only 3 characters are to be altered then the operator need only type AL #XG15 15 *$I_1I_2I_3$ GO #XG15 25	The simulator will store the characters as required and will then suspend itself and type out two messages thus: XXXXX $J_1J_2J_3J_4J_5J_6J_7J_8$ XXXXX $I_1I_2I_3I_4I_5I_6I_7I_8$ where X is the address input, the J_i are the 1500 characters originally occupying the altered locations and the Ij are the characters which have just replaced them. (The Ji and Ij are represented as indicated in the '1900 Typed Code' column of the code tables in Appendix 1).

1500 Operation		*1500 Effect*	*1900 Operation*	*1900 Effect*
6	Alter Switches	Alter the setting of the console switches; BCT, WTAB and SMDI.	AL #XG15 14 *AB GO #XG15 27 Where A is zero (or 1) if the switch is to be set OFF/ON and B is 1, 2 or 3 to indicate either the BCT, the WTAB or the SMDI switch, respectively.	The simulator will alter the state of the specified switch appropriately and will then suspend itself and type two messages of the form: BCT ??? INT ??? WTAB ??? SMDI ??? (where ??? will be either OFF or ON to indicate the state of the switch named immediately on the left). The first message will show the previous switch settings and the second will show the new setting.
		Alter the setting of the INT console switch	To set it ON: ON #XG15 1 To set it OFF: OFF #XG15 1	The simulator will test bit 1 of the monitor word to determine the state of the simulated INT switch.
7	Display	Display on the console the contents of the specified storage location	AL #XG15 14 A GO #XG15 26 Where A is the decimal address, up to five digits, of the leftmost location of the area to be displayed	The simulator suspends itself and types a message of the form AAAAA $I_1I_2I_3$ ..... I_9I_{10} where AAAAA is the address input to word 14 and I_1 to I_{10} are the 1500 characters stored in locations A to A +9 The 1500 characters are represented as indicated in the '1900 Typed Code' column of Appendix 1. During this operation the address in word 14 is incremented by ten and typing GO #XG15 would cause the next ten locations to be displayed.
8	Display Switches	Back lights in certain console switches indicate their OFF/ON states.	ON #XG15 19 GO #XG15 27	The simulator unsets monitor word bit 19 then suspends itself and types a message of the same form as that shown in operation 6

1500 Operation		*1500 Effect*	*1900 Operation*	*1900 Effect*
9	(a)	To obey an instruction via the console and then continue at the instruction addressed by the P register.	AL #XG15 14 *$I_1 I_2 I_3 I_4$ AL #XG15 15 *$I_5 I_6 I_7 I_8$ AL #XG15 16 *$I_9 I_{10}$ GO #XG15 28 where the Ii are the 1500 characters of the instruction to be obeyed, each represented by its *two-digit* octal equivalent.	The simulator will simulate the instruction described and will then continue simulation with the instruction addressed by the current value of the P register.
	(b)	To obey an instruction via the console and then halt.	ON #XG15 19 and then as in 9(a) above.	The simulator will unset monitor word bit 19 and will then simulate the instruction described. Finally it will suspend itself and type a Standard Halt Line prefixed OP (the P register value given in this line will be false). If the operator then types GO #XG15 22 simulation will be continued with the instruction addressed by the current *true* value of the P register. If the operator wishes to start the program at a different address he should set P following the procedure in 4 above and then type GO #XG15 22. Note: I_1 may not be octal 51 since the simulator will not allow a Repeat instruction to be obeyed using this facility.
10		Unload the reel on 1500 magnetic tape unit *n*	AL #XG15 14 *n** GO #XG15 23	The simulator will unload the specified reel. It will then suspend itself and type COMPLETE
11		Rewind the reel on 1500 magnetic tape unit *n*	ON #XG15 19 AL #XG15 14 *n** GO #XG15 23	The simulator will rewind the specified reel. It will then suspend itself and type COMPLETE. Monitor word bit 19 will be set OFF.

**n* is the octal equivalent of the 1500 deck address in 1500 code,

i.e. deck A = octal 21
deck B = octal 22
etc.

Appendix 4 Messages output by the simulator

1 STANDARD HALT LINES

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

PP IIIII O N AAAAA BBBBB SSSSS TTTTT Z V

P is a prefix identifying the reason for the message and a complete list is given on page 34.

I is normally the current value of the simulated P register (when the message is output in response to the use of certain operating facilities it is rubbish–see Appendix 3).

O is the operation code of the instruction at the address given by 'I-10'.

N is the N character of the instruction at the address given by 'I-10'.

A is the current value of the simulated A register. (For illegal conditions in the 1500 program it is rubbish). If the value is not a valid storage address then asterisks are typed.

B is as A but for the simulated B register.

S is as A but for the simulated S register.

T is as A but for the simulated T register.

Z represents the state of the simulated Previous Result Indicators. A P/N/Z will be typed for PRP/PRN/PRZ respectively.

V represents the state of the simulated Arithmetic Overflow Indicator. If the indicator is set ON, a V will be typed, otherwise nothing will be typed.

Whenever the Standard Halt Line is typed the last card presented to the 1500 program is the *last but two* in the stacker.

2 COMPLETE

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

3 OP ERROR

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

OP ERROR

The operator should repeat the operation correctly.

4 PUT PLT NO IN WRD 14

If the operator loads the 1500 program using the Search Insertion or the Automatic Insertion bootstrap facilities (see page 8) the simulator will suspend itself and type the message

PUT PLT NO IN WRD 14

The operator should type

AL #XG15 14 **nn*

GO #XG15

where *nn* is the two-digit octal representation of the 1500 unit number on which the 1500 P.L.T. is mounted.

5 CHANGE PAPER

If the user has punched the eighth channel of the 1900 carriage control loop the simulator will suspend

itself and type:

CHANGE PAPER

if it detects the Paper Low condition.

The operator should follow the procedures described under CARRIAGE CONTROL LOOP on page 11.

6 CIG MTU *nn*

If the simulator detects, while reading the simulated 1500 file on 1900 magnetic tape unit *nn*, a 1500 block less than three characters in length which is not a single character E/F or E/D then it suspends itself and types

CIG MTU *nn*

Typing GO #XG15 will cause the invalid block to be ignored.

7 ALLOCATE MTU *nn*

The operator has neglected to give one of the tapes required by the 1500 program. He should mount the missing tape and then type

GI #XG15 A *nn*

GO #XG15

where A is the geographical address of the deck on which the tape is mounted and *nn* is the 1900 unit number which the simulator has indicated in the ALLOCATE message and which it will use to reference geographical deck A.

NOTE: The relationship between *nn* and the 1500 tape unit number is given by the table in FACILITIES AVAILABLE on page 11.

8 NOT SPAN MTU *nn*

The reel mounted on 1900 unit *nn* does not have the special SPAN labels written by the 1500/1900 File Conversion program or the Write SPAN Labels to Magnetic Tape program (Appendix 5). The operator should unload the offending reel, replace it with a valid reel and then type

GI #XG15 A *nn*

GO #XG15

where *nn* is the unit number displayed in the message and A is the geographical address of the deck on which the reel is mounted.

9 SEQU, IDEN, NO **

During the loading of Magnetic Tape Configuration Table cards (see LOADING 1500 PROGRAMS FROM CARDS step 2, on page 7), the cards are checked.

If any card is not correctly sequenced the simulator will suspend itself and type

SEQU

Similarly if the identity code on any card is not identical to the code in card 0001 of the table or if column 76 does not contain a 3 the simulator will suspend itself and type

IDEN

If the table contains too many data fields the simulator will suspend itself and type

NO**

In each of the above cases the operator should obtain a correct card pack, refeed it and type

ON #XG15 19

GO #XG15 29

to continue.

10 TAPE
During the loading of Magnetic Tape Configuration Table cards (see LOADING 1500 PROGRAMS FROM CARDS step 2, on page 7) the simulator will display the message

TAPE

but will not stop.

11 ENTERING SUBSTITUTED SORT
See Chapter 4, Substituted Sort.

12 U *nn* NOT USEABLE
See Chapter 4, Substituted Sort.

13 HALTED:– L?
Where ? is some error code, see Chapter 4, Substituted Sort.

14 PRESORT PHASE
See Chapter 4, Substituted Sort.

15 NON-SPAN TAPE *nn*
See Chapter 4, Substituted Sort.

16 CAN'T USE TAPE
See Chapter 4, Substituted Sort.

17 NEXT REEL ON UNIT *nn*
See Chapter 4, Substituted Sort.

18 END LABEL CHECK
See Chapter 4, Substituted Sort.

19 INVALID TAPE UNIT *nn*
See Chapter 4, Substituted Sort.

20 WRONG TAPE IS ON *nn*
See Chapter 4, Substituted Sort.

21 MOUNT NEXT REEL
See Chapter 4, Substituted Sort.

22 BAD BLOCK ON UNIT *nn*
See Chapter 4, Substituted Sort.

23 BAD FORMAT UNIT *nn*
See Chapter 4, Substituted Sort.

24 ETW OR PARITY ON UNIT *nn*
See Chapter 4, Substituted Sort.

25 1900 SORT
See Chapter 4, Substituted Sort.

26 REMOVE INPUT REEL FROM UNIT *nn*
See Chapter 4, Substituted Sort.

27 FIRST O/P REEL ON UNIT *nn* FULL
See Chapter 4, Substituted Sort.

28 END OF SORT, FINAL O/P REEL ON UNIT *nn*
See Chapter 4, Substituted Sort.

29 POST SORT PHASE
See Chapter 4, Substituted Sort.

30 WRITING *nn*
See Chapter 4, Substituted Sort.

31 RUN POSTPONED
See Chapter 4, Substituted Sort.

32 MOUNT TAPE ON *nn*
See Chapter 4, Substituted Sort.

33 SORT O/P REEL 1 ON DCK XX
See Chapter 4, Substituted Sort.

34 NORMAL SIMULATION
See Chapter 4, Substituted Sort.

Any other message will arise as a direct result of operator actions, e.g. display 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 possible values of this prefix and describe the condition associated with each value.

The first table lists those conditions which can be expected in normal running:

Standard halt lines – normal running

Prefix	*Cause and Contents*
ST	The operator has used the formal stop facility (see Appendix 3).
AR	The operator has used the Alter Registers facility (see Appendix 3).
OP	The operator has obeyed a 1500 instruction on the console (see Appendix 3). The P register value displayed is rubbish.
H	The simulator is currently simulating a 1500 Halt instruction.
CR	The simulator has discovered an invalid 1500 punching code in the card which is last but two in the stacker (see INVALID CARD CODES on page 10).

If a condition which cannot be simulated arises in the 1500 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:

Standard halt lines – error conditions

Prefix	*Error Condition and Contents*
E1	The OP code of the current instruction is invalid.
E2	The N character of the current instruction is invalid.
E3	The A address of the current instruction is invalid.
E4	The B address of the current instruction is invalid.
E5	The current instruction has given rise to an invalid storage address.
E6	The current instruction has addressed locations either in the Arithmetic Tables area, if the simulated WTAB switch is OFF or beyond location 1999.
E7	The current instruction is a Tally. The tally count is not in the range 00 to 99.
E8	The current instruction is a single character Add or Subtract. Either the A or the B field contains an invalid character.
E9	The current instruction is an Add or Subtract. The A field contains an invalid character.

Prefix	*Error Condition and Contents*
EA	The current instruction is an Add or Subtract. The result has overflowed beyond the first overflow position.
EB	The current instruction is an Add or Subtract. The B field contains an invalid character.
EC	The current instruction is a print. The first position of the line contains a 10 or an 11 (see 1500/1900 CONFIGURATIONS on page 2).
ED	The 1500 program has just obeyed a repeatable instruction in a Repeat cycle. Simulation cannot continue because the address of the start of the repeat loop – held in locations 222 to 225 – is not a valid storage address.
ER	The current instruction is attempting to read reverse a magnetic tape reel beyond B.T.C.
BT	The simulator was last entered by a GO at 21 message. The first 1500 halt encountered does not have the A address 8009.

If the operator types

```
GO #XG15 22
```

after any of the above messages, simulation will contine with the instruction following the one giving rise to the error condition.

Appendix 5 Ancillary programs

1500/1900 FILE CONVERSION PROGRAM

Description
This is a 1500 program which reads 1500 magnetic tape reels (data or program files), processes them and rewrites them via a 1585 industry compatible deck in a format suitable for use with the 1500 simulator on the 1900 series.

Input
The input to this program consists of one or more 1500 magnetic tape reels, each of which must conform to the following rules:

1 The information on each reel *must* terminate with a single-character E/D block.

2 No reel may contain a block greater than 15,900 characters in length.

3 No reel may contain the character octal 77.

Parameter cards

```
LOAD__XG99
EXECUTE__JN08350835J↑08360836V102190260
EXECUTE__V102191010
EXECUTE__V102193000
STOP
```

The N character of the instruction filling location 0835 is the unit number on which the input reel is mounted.

Operating instructions
The program requires a 20K core store.

1 Place the 1500/1900 File Conversion P.L.T. on a deck.

2 Place the first input reel on deck N.

3 Place a 1900 scratch tape with a write permit ring on the 1585 deck. This should be a full length reel.

4 Place the parameters in the card reader

5 Set the 1585 deck address switch to ISS and to the highest recording density available with the 1900 configuration on which simulation is to take place.

6 Perform a Search Insertion from the 1500/1900 File Conversion P.L.T.

When the program is activated it will copy and re-format the data from the input reels.

At the end of each input reel (except the last) the program will halt with

N = 1, A = 4444, B = 0001, P = 3020

If the next reel to be converted is the last, the operator should set INTerrupt ON and, if necessary, manually insert the deck number in location 0835. He should then hit START. If the last reel is being processed, the final halt is via the Standard Exit 0770.

Output
For each input reel the program will print the contents of the first block on the reel—up to a maximum of 100 characters. It will then check the label on the 1900 scratch tape reel and print the serial number of that reel. The data from the input reel will then be copied and re-formatted onto the 1900 reel. When the terminating E/D on the input reel has been copied the input and out-put reels will be rewound and the message

END OF TAPE

printed.

Exception conditions

1 Halts

(a) N = 4, A = 9999, B = 0001, P = 3540

The 1900 reel on the 1585 deck is not a scratch tape. To continue, replace the offending reel by a 1900 scratch tape with a write permit ring and hit START.

(b) N = 4, A = 9999, B = 0002, P = 3580

The first block on the current input reel is a single character E/D. To continue replace it with a new input reel and hit START.

2 Printed messages

(a) If a block on an input reel is found to be greater than 15,900 characters in length then a message is printed indicating the position of the block on the input tape, the block is ignored and file conversion continues with the next block.

(b) If a block on an input reel is found to contain the character octal 77, then a message is printed indicating the position of the block on the input reel and file conversion continues with the next block. In this case the output reel should not be used with the simulator since it will be incorrectly formatted.

#XG20 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 #XG20.

Input

The tape to be labelled must belong to one of three classes:

1 Unused 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 instructions

1 FIND #XG20 from the SPAN run tape (priority 80, 768 words of storage).

2 Mount the tapes to be labelled onto available decks and GIVE them to #XG20 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 one for successive tapes.

4 Type GO #XG20 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 = 999
Ninth Word	– Date written as today's date in binary.

The third block will be a standard 1500 29-character header label containing the (1500) characters.

EB_SPANDATA_001_010166_010166EI

The fourth block will contain an EF.

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 the 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. For any reel whose purge date is not exceeded the same action is taken as in 1.

#XG21 CREATE COMBINED SPAN/1500 P.L.T.

Description

This program creates a special simulator program tape which contains both 1900 binary program and a simulated 1500 P.L.T. This special tape must be used in place of the original simulated 1500 P.L.T. when running 1500 programs with a version of the simulator which contains the Sort Substitution facility (see SORT SUBSTITUTION on page 2, THE SPAN EDITOR on page 3, and Appendix 2).

Every 1500 P.L.T. to be used by this version of the simulator must be processed in this way whether it contains sorts or not.

Input

Input to this program consists of:

1 The Sort Substitution version of the simulator in binary overlay program form on a magnetic tape.

This tape is produced by

(a) using the Editor (see THE SPAN EDITOR on page 3) to create in PLAN the version of the simulator employing the Sort Substitution facility,

(b) compiling the PLAN program using #XPLV (page 6) to produce the program in semi-compiled form,

(c) mounting the magnetic tape containing the semi-compiled program and a scratch tape and typing

FI #XG15 #TAPE

which causes the program to be written to the scratch tape in binary form.

2 A simulated 1500 P.L.T.

This may be produced either by

(a) using the 1500/1900 File Conversion program to convert an existing original 1500 P.L.T.,

or

(b) using an existing version of the simulator to simulate a 1500 program which creates the 1500 P.L.T. (e.g. by simulating a tape assembly).

3 Parameter cards

Each sort program on the 1500 P.L.T. for which a 1900 polyphase sort is to be substituted at run time must be described by a parameter card. Each card should be punched in 1900 card code and have the format:

Columns	*Contents*
1	#
2	Blank
3 to 32	The program name assigned to the sort in the 1500 program title block.
33 to 80	Ignored

4 End Card

The last parameter card should be followed by an End card, that is, a card punched with END in columns 1 to 3.

This card must be present even if no other parameter cards are required.

Operating instructions

1 FIND #XG21 from the SPAN run tape (priority 80, 2496 words of storage).

2 Mount the simulator binary program tape (see 1 above) and GIVE it to #XG21 as unit 1.

3 Mount the simulated 1500 P.L.T. (see 2 above) and GIVE it to #XG21 as unit 2.

4 Mount a 1900 scratch tape with a write permit ring and GIVE it to #XG21 as unit 3.

5 Place the parameter cards and End card (see 3 and 4 above) in the card reader.

6 Type GO #XG21 20 to activate the program.

When the two input tapes–modified according to the information on the parameter cards– have been merged onto the output tape the program will suspend itself and type

END OF RUN.

Output

The simulator binary program is first copied onto the output tape. The parameter cards are then read, listed, converted to 1500 internal code and stored in tables. Next the simulated 1500 P.L.T. is copied to the output tape but additionally where a program title block matches one of the parameter cards the following 1500 sort is specially 'marked' whilst being copied. (This 'marking' allows the simulator to recognize, at run time, that a sort is being obeyed.) The program prints a message giving the name of the sort and indicating that it has been 'marked' in this way.

Exception conditions

If a parameter card names a program which is either

1 not on the 1500 P.L.T., or

2 appears on the 1500 P.L.T. more than once,

the condition is noted on the line printer.

#XGVT VALIDATE SPAN MAGNETIC TAPE CONFIGURATION TABLE

Description

The simulator may be made more efficient in its organization 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.

It is most important to validate any Magnetic Tape Configuration Table cards before loading them into the simulator

because any format or punching errors can cause serious difficulties.

Input

1 Table Cards

Field No.	*Start Column*	*End Column*	*Meaning*
1	1	12	These 12-digit fields are used to hold table entries
2	13	24	
3	25	36	
4	37	48	
5	49	60	
6	61	72	
7	73	75	
8	76	76	
9	77	80	

Fields 1 to 6

Each 12-column data field is used to hold the binary geographical address of one magnetic tape unit; a one bit represented by a 1 punching and a zero 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 all have a 1 punched in the most significant column.

The two fields following the last cluster should contain, respectively, all blanks and then four asterisks in the most significant columns.

Field 7 Identification Code

This is a user defined code which may consist of any 1900 characters. Each card within the table must contain the same identification code, which may of course be all blanks.

Field 8 Designation

Each card must contain a 3 in this column

Field 9 Sequence Number

This should start at 0001 on the first card and be incremented by one for each succeeding card of the table. The field should be zero filled. The data fields (1 to 6) are considered to run continuously through field 6 of one card to field 1 of the next.

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

2 Last Card

This card has asterisks punched in columns 1 to 4.

Operating instructions

1 FIND #XGVT from the SPAN run tape (priority 80, 1344 words of storage).

2 Place the table cards and last card 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 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 are 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 which 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

1 If more than 30 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.

2 If more than five clusters are described by a group of cards, 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.

Appendix 6 Conversion subroutines

There are two subroutines on the MLT in the STST block, one of which (NAFI) will convert tapes in SPAN15 format to 1900 MTH format, and the other (NAN15) will convert tapes in 1900 MTH format to SPAN15 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 SPAN15 format to 1900 MTH format.

Description
The subroutine reads a block from tape, converts all characters to their 1900 octal equivalent. 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 batch 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.

Column or character	*Punching*
1 to 3	Spaces
4	Input file beginning label indicator 0 = no label 1 = standard label 2 = non-standard label
5 to 7	Spaces
8	Input file ending label indicator 0 = no label 1 = standard label 2 = non-standard label
9 to 12	Spaces
13 to 20	Input file name, if standard label, otherwise spaces
21	Space
22 to 24	Reel number of first input reel, if standard label, otherwise spaces
25 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 the first output reel – must be zero filled and $\leqslant 511$
45	Space
46 to 52	Generation number to be included in the header label of the output file – must be zero filled and $\leqslant 8388607$
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 $\leqslant 999$
57 to 61	Spaces
62 to 64	Maximum length in words of the output records – must be zero filled and $\leqslant 512$

Column or character	*Punching*
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    NAFI
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 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.

When the record is presented to the user the characters will already have been translated to their 1900 octal equivalent (the EI character at the end of the record is also transferred, having been translated to octal 73).

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 the 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 (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.

(c) On return from the subroutine (bit 0 of Monitor Word 30 OFF)

0 if the record being presented to the user is not the last one in a 1500 block.

2 if the record being presented to the user is the last one in a 1500 block.

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, after having been converted from 1500 octal to 1900 octal, is presented to the user for redistributing, such as converting certain fields to binary, before being written to the output tape.

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. It is the user's responsibility to ensure that when the record is returned to the subroutine the record count word in the first word of the area defined in SYMBOL2 is altered if he has changed the record length.

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 1900 octal and batch them onto the output tape as specified in the parameter until the end of file is reached on the input tape. As the user will not be moving the record from the user input area to the user output area SYMBOL1 must be set equal to SYMBOL2.

If the end of reel is reached on the output tape then the subroutine will automatically close the current output tape and open a continuation reel.

If the subroutine detects end of reel on the input tape the subroutine will close the current input reel and halt and will then either carry on with a continuation reel or write an end of file trailer label to the output tape, close the output tape and halt with end of run halt depending upon the operator action taken (see Program Halt, H1).

If the subroutine detects end of file on the input tape the subroutine will close the current input reel, write an end of file trailer label to the output tape, close the output tape and halt.

Entry point
NAFI

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 operator must type

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.)

Bit 0 of Monitor Word 30 must be set as required (see Results).

Program halts
MT The input tape has not been GIven. The operator must type

GI #NAME XX 0

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 The input beginning tape labels are not of the correct format and any one of the following will cause this halt.

1 The first two blocks on the tape do not contain SPAN in the first word

2 The file name is incorrect, if standard beginning label specified

3 The reel number is incorrect, if standard beginning label specified

4 The beginning tape label, if specified as standard, is less than 29 characters in length

5 The EF block (either the first 1500 block if no label specified, or the block following the 1500 label) is either not an EF character or not a single character block.

If this halt occurred owing to a parameter error the program must be restarted,however if it has occurred because the wrong tape was mounted 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 correct format.

E2 A block on the input tape has been found which contains more than 10,764 1500 characters. If the operator types

GO #NAME

the subroutine will close the input and output tapes after writing an end of file trailer label on the output tape. The subroutine will then halt with end of run halt.

E3 A record has been found that does not terminate with an EI character or characters are present after the EF character at the end of a batched block of records.

If the operator types

GO #NAME

the subroutine will do the same as described under halt E2.

E4 The input ending tape labels are not of the correct format and any one of the following will cause this halt.

1. A non-numeric character in the block count, if standard ending label specified.
2. Incorrect block count, if standard ending label specified.
3. The end of tape label is not followed by a single character block.

If the operator types

GO #NAME

the subroutine will do the same as described under halt E2.

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. To ignore this record type

GO #NAME

E7 There is an error in the MTH package

H1 The subroutine has detected end of reel on the input tape. At this point the user has two options.

1. Type

   GI #NAME XX 0

   GO#NAME

   to open a continuation reel and continue the run where XX is the deck number of the continuation reel.

2. Type

   GO #NAME

   to write an end of file trailer label to the output tape, close the output tape and terminate the run with the end of run halt.

HH End of run halt.

Character conversion

1500 characters will be translated to their corresponding 1900 characters where possible. Where symbols do not match the following conversion will be made.

1500	*1900*
¼	#
½	"
¾	$
÷	?
$\overline{10}$	←
$\overline{11}$	!

Notes:

1 The input tape must conform to 1500 Magnetic Tape Standards except that the beginning and ending labels may be specified as non-standard.

2 When the subroutine is to be run with bit 0 of Monitor Word 30 ON, the following is all that is required in the way of a program to convert a tape.

```
#PROGRAM                NAME50
#LOWER
                        USIN(XXX)
#LOWER
PARAM                   Z
#PROGRAM
#ENTRY                  0
        CALL    1       NAFI
        LDN     3       USIN
        LDN     3       USIN
        LDN     3       PARAM
#END
#FINISH
```

where XXX is the maximum length in words of the records and Z is zero for a card parameter or non-zero for a paper tape parameter.

The operating instructions of this program would be

```
LO      #NAME
ON      #NAME 0
```

```
GI      #NAME XX 0
GO      #NAME 20
```

where XX is the deck number of the input tape.

Store space used

	Number of Words
Lower Common Library Locations	–
Lower Variable	21
Lower Preset	86
Literals	1
Program	363
Upper Preset	–
Upper Variable	3216

Library subroutines called

CDECBINF

The subroutine uses the following SD macros

SDDEF
SDWR
SDCLB
SDEND

Title
Translate magnetic tapes in 1900 MTH format to SPAN 15 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 1500 octal equivalent, batch them as specified by the user and write them in SPAN 15 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 of paper tape must be the same as for cards, including *all* spaces, except that a newline character must follow character 52.

The format is as follows.

Column or character	*Punching*
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 0 = no label required 1 = label required
29 to 31	Spaces
32	Output file ending label indicator 0 = no label required 1 = label required
33 to 35	Spaces
36 to 40	Maximum length in characters of the output records – including the terminating EI character. The length must be zero filled and ⩽ 10,764.
41 to 43	Spaces
44 to 48	Maximum length in characters of the output blocks – including the terminating EF character if the records are to be batched. The length must be zero filled and ⩽ 10,764.
49	Space
50 to 52	Maximum number of records in the output blocks – must be zero filled and ⩽ 999.
53 to 80	Spaces unless parameter is on paper tape when character 53 must be a newline character.

The CALLing sequence must be

```
CALL    1    NAN15
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 a beginning tape label is about to be written to the output tape if the user has specified he wants a beginning tape label. The user must set up in the area defined under SYMBOL2 the label he wishes to be written to the output tape. The characters must be in 1900 octal and the label must terminate with an EI character (1900 octal 73). The subroutine will translate the label to 1500 octal and write it to the output tape followed by an EF.

The subroutine will set word 0 of this area to -1 when an ending tape label is about to be written to the output tape if the user has specified he wants an ending tape label. The next ten characters from word 1.0 to word 3.1 will contain EB xxxxxxxEI where xxxxxxx is the block count in decimal. If the user requires an ending label of this form he must re-enter the subroutine with SYMBOL2 = SYMBOL1 + 1. If the user requires any other ending label format he must set up in the area defined under SYMBOL2 the label he wishes to be written to the output tape. The characters must be in 1900 octal and the label must terminate with an EI character (1900 octal 73). The subroutine will translate the label to 1500 octal and write it to the tape. The subroutine will automatically write the correct EF and ED blocks.

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 an EI character (1900 octal 73). If the user does not wish the current record to be written to the output tape he should put an EI character in the first character position of word 0. 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 an EI character (1900 octal 73).

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 1500 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 an EI character (1900 octal

73), 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 if required, and close the output tape and halt.

Entry point
NAN15

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 for an unbatched output tape or equal to or greater than maximum block length for a batched output tape.

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 an EI character 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 1500 characters where possible. Where symbols do not match the following conversion will be made.

1900	*1500*
#	¼
"	½
$	¾
?	÷
←	$\overline{10}$
!	$\overline{11}$

Note: When the subroutine is to be run with bit 0 of Monitor Word 30 ON, the following is all that is required in the way of a program to convert a tape, providing the output will be single reel and standard 29 character beginning and standard 10 character ending labels are required.

```
#PROGRAM                    NAME50
#LOWER
                            USIN (XXX)
#LOWER
PARAM                       Z
BTL                         29H?] IIIIIII] RRR] DDDDDD] PPPPPP[
#PROGRAM
#ENTRY                      0
START     CALL    1         NAN15
          LDN     3         USIN
          LDN     3         USIN + 1
          LDN     3         PARAM
          LDX     3         USIN
          BNZ     3         START
          LDN     6         BTL
          LDN     7         USIN + 1
          MOVE    6         8
          BRN               START
#END
#FINISH
```

where IIIIIII is the file identification in 1900 octal
RRR is the reel number in decimal
DDDDDD is the date written in the form MMDDYY
PPPPPP is the purge date in the form MMDDYY
XXX is the maximum length in words of the records

and Z is zero for a card parameter or non-zero for a paper tape parameter.

For multi-reel output it will be necessary for the user to update the reel number in the beginning tape label.

If no beginning or ending tape labels are required lines 6 and 13 to 18 of the above coding can be omitted.

The operating instructions of the program would be

```
LO    #NAME
ON    #NAME 0
GO    #NAME 20
```

Store space used

	Number of Words
Lower Common Library Locations	–
Lower Variable	18
Lower Preset	114
Literals	–
Program	318
Upper Preset	–
Upper Variable	3216

Library subroutines called

CDECBINF

CBINDECSL

The subroutine uses the following SD macros

SDDEF

SDRD

AMENDMENT RECORD

List Number	*Item Numbers*
1	1 *to* 6
	to
	to
	to
	to
	to
	to
	to
	to
	to
	to
	to
	to
	to
	to
	to
	to
	to
	to
	to

Should any additions or amendments to this Manual be necessary, they will be issued in the form of Amendment Lists.
When such changes have been incorporated, an appropriate entry should be made in the table on the left and the pink instruction sheet(s) should be filed behind this page.

1900 SERIES

ICL

1500 SIMULATOR

Second Edition August 1968

Amendment List 1
incorporating User Notices 1500 Simulator (1) to (5).

1 Remove and destroy pages 3 to 6. Insert new pages 3 to 6.

2 Remove and destroy pages 25 to 30. Insert new pages 25 to 30.

3 Remove and destroy pages 39/40. Insert new pages 39/40.

4 Remove and destroy page 45. Insert new page 45.

5 Destroy User Notices 1 to 5.

6 Update the amendment record and file this list at the back of the manual.

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