

ELLIOTT

903

Volume 3: OPERATING INSTRUCTIONS
Part 1: BASIC EQUIPMENT
Section 3: TELEPRINTER

Contents

	Page
Chapter 1: INTRODUCTION AND OPERATING INSTRUCTIONS	
1.1 Introduction	1
1.2 Brief Physical Description	1
1.3 Operator's Controls	1
1.3.1 Operational Controls	2
1.3.2 Character Keys	3
1.4 Operating Procedure	5
1.4.1 Loading the Ribbon	5
1.4.2 Loading Paper Form	6
1.4.3 Loading Paper Tape	6
1.4.4 Operating the Equipment	7
1.5 Materials Required for Operation	8
1.5.1 Paper Form	8
1.5.2 Ribbon	9
1.5.3 Paper Tape	9

SEE ISSUE 2A

Page

Chapter 2: OPERATOR'S MAINTENANCE

2.1	Introduction	10
2.2	Materials Required	10
2.3	Maintenance	10
2.4	Test Program	11
2.5	Computer Records	11

Chapter 3: OPERATOR'S TEST PROGRAMS

3.1	Introduction	12
3.2	Method of Use	12
3.2.1	903(a) System	12
3.2.2	903(c) System	12
3.2.3	Output Pattern	13
3.2.4	Input Keys	14
3.2.5	Input a Line	14
3.2.6	Echo Check	15
3.2.7	Tape Reader and Punch Test	15
3.3	Abbreviated Test Procedure	15

END-OF-TEXT FIGURES

Fig.

Overall View and Keyboard	1
Ribbon Threading	2
Paper Form Threading and View of Detent Pawl	3
Tape Punch	4
Output Pattern	5
Input Pattern	6

SEE ISSUE 2A

Page

Chapter 2: OPERATOR'S MAINTENANCE

2.1	Introduction	10
2.2	Materials Required	10
2.3	Maintenance	10
2.4	Test Program	11
2.5	Computer Records	11

Chapter 3: OPERATOR'S TEST PROGRAMS

3.1	Introduction	12
3.2	Method of Use	12
3.2.1	903(a) System	12
3.2.2	903(c) System	12
3.2.3	Output Pattern	13
3.2.4	Input Keys	14
3.2.5	Input a Line	14
3.2.6	Echo Check	15
3.2.7	Tape Reader and Punch Test	15
3.3	Abbreviated Test Procedure	15

END-OF-TEXT FIGURES

Fig.

Overall View and Keyboard	1
Ribbon Threading	2
Paper Form Threading and View of Detent Pawl	3
Tape Punch	4
Output Pattern	5
Input Pattern	6

	Page
Chapter 2: OPERATOR'S MAINTENANCE	
2.1 Introduction	10
2.2 Materials Required	10
2.3 Maintenance	10
2.4 Test Program	11
2.5 Computer Records	11
Chapter 3: OPERATOR'S TEST PROGRAMS	
3.1 Introduction	12
3.2 Method of Use	12
3.2.1 903(a) System	12
3.2.2 903(c) System	12
3.2.3 Output Pattern	13
3.2.4 Input Keys	14
3.2.5 Input a Line	14
3.2.6 Echo Check	15
3.2.7 Tape Reader and Punch Test	15
3.3 Abbreviated Test Procedure	15
Appendix 1:	SECOND TELEPRINTER FACILITY
	END-OF-TEXT FIGURES
	Fig.
Overall View and Keyboard	1
Ribbon Threading	2
Paper Form Threading and View of Detent Pawl	3
Tape Punch	4
Output Pattern	5
Input Pattern	6

AMENDMENT SHEET

Page	Issue	Reference	Amendment
9	2	After last line	"In addition to WATERLOW A1 and ASCOM tapes, PREMIER C has been found to give satisfactory operation in the reading and punching equipment. It does, however, produce more fluff, necessitating more frequent cleaning of the equipment. PREMIER C is available from: Percy Boyden & Co. Ltd., 5, Commerce Way, Wadden, CROYDON, Surrey."

Chapter I: INTRODUCTION AND OPERATING INSTRUCTIONS

1.1 Introduction

The teleprinter (Figure 1) is mounted on its own stand and incorporates a 10 character-per-second paper tape reader (the printer reader) and a 10 character-per-second paper tape punch (the printer punch).

The teleprinter should only be used on-line as a control device for inputting or outputting information to or from the 903 central processor; the control switches, mounted on the reader and punch mechanisms adjacent to the keyboard, should only be used in the LINE position (see Para. 1.3).

The teleprinter is able to produce more than 64 different codes although it is limited to this number of printing characters. (The codes are given in Volume 1, Section 1.2.6.). The possibility of input and output messages overprinting each other is remote; it is avoided by arranging for a new line sequence to precede the output of a message.

The operator is responsible for the following duties:-

- (1) Carrying out regular maintenance as detailed in Chapter 2.
- (2) Ensuring that adequate supplies of ribbon, paper form and paper tape are available.
- (3) Loading the ribbon, paper form and tape as detailed in Para. 1.4.
- (4) Running the test program as detailed in Chapter 3.
- (5) Storage of all tapes.

1.2 Brief Physical Description

The printer reader and printer punch form part of the teleprinter but are physically separate units mounted immediately to the left of it. The reader is situated adjacent to the teleprinter character keys and the punch is situated behind the reader, adjacent to the platen.

1.3 Operator's Controls

The teleprinter controls may be divided into two categories:-

(1) Operational Controls

These controls allow the operation of the teleprinter to be controlled by the user.

(2) Character keys.

These are situated on the keyboard and their use causes the appropriate codes to be sent to the buffer.

1.3.1 Operational Controls

LINE/OFF/LOCAL Switch

This is a three-position switch mounted on the front of the teleprinter. It should always be set to LINE when the teleprinter is in use and in this position the teleprinter is connected to the controller.

In the LOCAL position the keyboard is connected solely to the reader and punch (i.e. the teleprinter is off-line). In the OFF position the teleprinter is switched off.

A red lamp, mounted to the right of this switch, lights when power is applied to the teleprinter (when fitted).

Reader Single-Shot Button

This is an unlabelled black push-button mounted on the right-hand side of the teleprinter keyboard. Each depression of the button causes the tape in the reader to advance by one sprocket hole.

ON and OFF Buttons

These two push-buttons are situated above the punch which is switched on by depressing the ON button. Codes punched are copies of those sent to the printing mechanism, either from the central processor or from the keyboard via the controller, irrespective of whether the parity is correct. The punch is switched off by depressing the OFF button.

REL (release) Button

The release button is mounted to the left of the OFF button and is provided to enable tape jammed in the punch to be freed by releasing the sprockets.

B.SP (backspace) Button

The backspace push-button is mounted to the left of the ON button. Each depression of the button backspaces the tape by one sprocket hole. No more than two backspaces should be performed consecutively as the tape is otherwise liable to become unreadable.

START/STOP/FREE Switch

This is a three-position toggle switch situated below the reader. The reader is started by setting the switch to START; normally, however, it is only set to START when the DEMAND lamp on the 903 control panel is lit. The reader stops when the switch is set to the STOP position, while in the FREE position tape may be moved freely in both directions.

The logic treats information entered via the reader as if it originated from the keyboard.

Alarm

This is a small switch fitted to the printer reader. When all the tape runs out of the reader, the reader stops.

1.3.2 Character Keys

Print Keys

If any one of the 42 character keys is depressed, the code for the character marked on it is sent to the buffer and the character is printed. Some of the keys are also used to provide shift characters. These are produced by depressing the SHIFT key and, whilst holding it down, depressing the required character key.

RETURN (carriage return) and LINE FEED Keys

These two keys enable the mechanism to be positioned ready to start printing at the beginning of a new line. They should be depressed in the order RETURN followed by LINE FEED. The appropriate code is then sent to the buffer.

Space Bar

The space bar is a control situated below the character keys. When depressed the space code is sent to the buffer.

SHIFT Keys

A SHIFT key is situated at each end of the keyboard. Shift characters are inscribed on the upper half of some of the character keys and when a SHIFT key is depressed together with one of these keys, the shift character is typed.

Keys which do not have shift characters are locked when a shift key is depressed.

CTRL (control) Key

The control key is situated on the left-hand side of the keyboard. When used with certain other keys it enables codes in the range

0-31 to be punched (see Volume 1, Section 1.2.6., Appendix 1, Table 1). The effect of the key is to delete bit 7 and modify bit 8 in order to retain even parity. The code produced by the control key does not cause a character to be printed although it is reproduced by the punch.

In certain cases it is necessary to depress both the shift and control keys; e.g. to produce a code with the value 30, it is necessary to depress the shift key, the control key and, while holding them down, the N key. Keys which do not have control characters are locked when the control key is depressed.

DELETE Key

In order to delete a character which has been punched on tape when working off-line, the tape should be backspaced until the required character is obtained and then the DELETE key should be depressed. The delete code, which is ignored by most input programs, is punched in place of the character to be erased. The DELETE key has no practical use when working on-line.

REPT (repeat) Key

Depressing the repeat key together with one of the print keys causes the appropriate character to be printed and punched continuously until either key is released.

RUN OUT Key

When this key is held down the tape runs through the punch. Sprocket holes only are punched and a stream of zero characters is sent to the buffer.

TAB Key

When this key is operated, with the control key held depressed, the tabulation code is sent to the buffer. Although this has no effect on the teleprinter, whose printing mechanism lacks a tabulation facility, the code will be reproduced and will be effective on tape reading equipment which has this facility.

Although TAB is inscribed on the upper half of the I key it is a control and not a shift character.

HALT Key

When this key is operated, with the control key held depressed, the halt code is sent to the buffer. This code has no effect on the reader, which can only be stopped manually, but is used to end program tapes.

Although HALT is inscribed on the upper half of the T key it is a control and not a shift character.

1.4 Operating Procedure

Before the equipment can be operated, it must first be switched on, and then loaded with ribbon, paper form and paper tape.

1.4.1 Loading the Ribbon (Figure 2)

- (1) Raise the cover over the ribbon and paper form mechanism and pull both ribbon spools off their spindles.
- (2) Engage the hook that is on the end of the ribbon in the hub of the empty spool. If the ribbon is not fitted with a hook, secure it by piercing the end of the ribbon with the arrow fitted in the hub.
- (3) Wind a few turns on to the empty spool.
- (4) Ensure that the reversing eyelet is wound upon the spool.
- (5) Replace the spools on their spindles in such a manner that the ribbon feeds to the rear from the right-hand side of the spool situated on the right.
- (6) Rotate the left-hand spool until the driving spool pin locates the appropriate hole on the spool.
- (7) Thread the ribbon around the right-hand vertical post and through the slot in the reverse arm.
- (8) Thread it through the right-hand slot of the ribbon guide and out via the left-hand slot.
- (9) Pull the ribbon forwards and thread it through the slot in the left-hand reverse arm and around the adjacent vertical post.
- (10) If there is any slack in the ribbon either of the spools may be rotated to take this up. Lower the cover over the ribbon and paper form mechanism. Typing can take place if the paper is loaded.

1.4.2 Loading Paper Form (Figure 3)

- (1) Raise the cover over the ribbon and paper form mechanism.
- (2) Remove the empty roll of paper together with the spindle.
- (3) Insert the spindle into the new roll and ensure that the paper is centralised on it.
- (4) Insert the roll of paper into its recess and ensure that the spindle rests in the slots provided. The paper should unroll from the bottom.
- (5) Fold the leading edge of the paper backwards and crease it in order to present a smooth edge for threading.
- (6) Unroll the paper and push it forwards so that it moves over the paper straightener and then downwards under the platen.
- (7) Release the tension of the pressure roller by moving the pressure lever forward.
- (8) Push the paper as far forwards as it will go.
- (9) Re-apply tension to the pressure roller and advance the paper (by turning the platen knob clockwise) until its leading edge is resting on the paper deflector guide.
- (10) Release the tension on the pressure roller and straighten the paper.
- (11) Re-apply tension to the pressure roller, and lower the cover over the ribbon and paper form mechanism.

The paper is now ready for printing.

1.4.3 Loading Paper Tape (Figure 4)

- (1) Remove the tape punch cover and place a reel of eight-hole tape on the spindle provided on the punch mechanism.
- (2) Insert it in the paper recess, so that the ends of the spindle rest in the slots provided. (The paper should feed from the top of the reel.)

- (3) Lift the lever which releases the panel on which the push-button controls are mounted.
- (4) Engage the tape in the tape guide assembly between the roller and the punch block, and push it through until it emerges at the other end.
- (5) Replace the control panel and punch cover.
- (6) Press the ON button on the punch and RUN OUT on the teleprinter. The tape should be pushed forward by the rollers onto the punch block and sprocket holes, with blanks on each side of the holes, should be punched.
- (7) If the RUN OUT button and any character key are depressed at the same time, the codes for that character should be printed and punched continuously until the character key is released.

1.4.4 Operating the Equipment

The teleprinter unit enables the operator to control the running of a program by sending information to, and receiving information from, the central processor. Information may be sent to the processor via the keyboard on the teleprinter or by means of the printer reader. This information is always printed on the teleprinter and may also be produced on tape by means of the printer punch. All characters input are automatically re-output and consequently printed and possibly punched.

The keyboard layout of the teleprinter is very similar to that of a typewriter and most of the controls have similar functions. In order to input information into the central processor the LINE/OFF/LOCAL switch must be set to LINE and the SELECT INPUT switch on the 903 control panel set to TELEPRINTER. As soon as the DEMAND lamp lights the first character key may be depressed; additional keys may be depressed until the DEMAND lamp stays extinguished. (If a character key is depressed whilst the DEMAND lamp is extinguished, the character read in to the buffer from the keyboard is liable to be overwritten by an output character from the processor.)

As long as the buffer was previously empty, the information will be read into it and will also be printed on the teleprinter. On receipt of a Demand signal, the information will be transferred to the central processor, so leaving the buffer empty ready for the next character.

Data can be read from the printer reader when the DEMAND lamp lights. (On the 903(c) system (see Para. 3.2.2.), data can be read from either the printer reader or a paper tape equipment reader depending upon the position of the SELECT INPUT switch.) The printer reader should be loaded with tape and, when the DEMAND lamp lights, the START/STOP/FREE switch set to START. Tape will be fed continuously and the information read to the central processor will also be printed on the teleprinter. If the central processor fails to accept a character before the following character is read, the tape will continue to move through the printer reader but no characters will be printed or sent to the computer. The printer reader should be stopped, by returning the switch to the STOP position, and the tape reset to the first character missed. The switch should then be set to START again.

On the 903(a) system (see Para. 3.2.1.), information from the central processor is always output to the teleprinter but may also be produced on tape. On the 903(c) system information can be output to either a paper tape equipment punch or the teleprinter depending upon the position of the SELECT OUTPUT switch on the 903 control panel, and the interface signals from the processor. Where an output is required from the printer punch it should first be loaded with blank tape (Para. 1.4.3.) and then the punch ON button should be depressed. Punching can now take place and any data typed on the teleprinter keyboard is reproduced. The punch is switched off by depressing the OFF button.

1.5 Materials Required for Operation

1.5.1 Paper Form

The paper form is supplied either in the form of rolls or listing forms and is normally 21.5 cm (8.5 in) wide. The maximum size possible is 26.7 cm (10.5 in). When supplied in the form of rolls the maximum outer diameter of the roll is 12.8 cm (5 in); the inner diameter is 2.5 cm (1 in).

Suppliers are:-

Waterlow Automation Services Ltd.,
P. O. Box 10,
Dunstable,
Beds.

or

Percy Boyden and Co. Ltd.,
5, Commerce Way,
WADDON,
Croydon,
Surrey.

1.5.2 Ribbon

The ribbon is supplied in black only; its part number is 7835-B.

The supplier is:-

Westrex Co. Ltd.,
152, Coles Green Road,
London, N.W.2.

1.5.3 Paper Tape

Two types are available:

Type	WATERLOW A1	ASCOM
Length (nominal)	304.8 m (1000 ft.)	
Width	2.5 cm (1 in) for 8 channel working	
Colours	White, Light Blue, Dark Blue, Green, Pink, Red, Yellow and Salmon	White, Light Blue, Dark Blue, Green, Pink and Yellow
Overprinting	Two types, giving 24 possible codings.	Available at extra cost

Waterlow A1 paper tape is available from

Waterlow Automation Services Ltd.,
P.O. Box 10,
DUNSTABLE,
Beds.

Ascom paper tape is available from two suppliers:

Rolco Papers Ltd.,
11-16, Leigh Hunt Street,
London, S.E.1.

Thames Paper Supplies Ltd.,
13-21, Curtain Road,
London, E.C.2.

See attached Amendment Sheet for further information on tape supplies.

Chapter 2: OPERATOR'S MAINTENANCE

2.1 Introduction

The operator is responsible only for the routine maintenance of the equipment and should not attempt to remove or adjust any part of the equipment unless so instructed in this chapter.

2.2 Materials Required

The following items are required for the maintenance detailed in this chapter.

- (1) Camel hair brush. Catalogue No. 5416
- (2) Suction cleaner
- (3) Test program X50.

2.3 Maintenance

Every morning, before switching on, the operator should carry out the following cleaning and maintenance procedure:-

- (1) Clean the tape storage bin, supplied with the 903(c) system, with a suction cleaner (see Para. 3.2.2.).
- (2) Empty the chad box.
- (3) Ensure that the ribbon is in good condition and replace if necessary (Para. 1.4.1.).
- (4) Check that the ribbon reversing mechanism is working.
- (5) Clean out the punch mechanism with the suction cleaner and/or camel hair brush. (Operating experience may show that this should be carried out more frequently than daily).
- (6) Check that the platen is held rigid, yet free to rotate when the detent pawl is released (Figure 3).
- (7) Clean the outside cover with a camel hair brush; a liquid cleaner must NOT be used.

2.4 Test Program

The test program X50 checks the operation of the teleprinter, printer reader and printer punch and must be run daily after the other maintenance has been completed. The procedure is detailed in Chapter 3.

2.5 Computer Records

Entries should be made in the Computer log book to record the following events:-

- (1) Times of fault occurrences.
- (2) Nature and suspected location of fault.

Chapter 3: OPERATOR'S TEST PROGRAMS

3.1 Introduction

This chapter describes the test program X50 that should be run daily by the operator to test the teleprinter. The program, comprising five separate phases, should be run after the maintenance procedure detailed in Chapter 2 has been followed and before the equipment is used. The operator should ensure that sufficient copies of the master tape supplied are available for this purpose. The master tape itself should never be used.

Although the program checks the output and input modes, it is not intended to be a diagnostic program so far as the operator is concerned. If any of the tests fail and the repair of the fault is not within the scope of the operator's duties, the maintenance engineer should be informed.

3.2 Method of Use

3.2.1 903(a) System (central processor, 8K core store, teleprinter and control unit)

- (1) Set the Mode switch on the control unit to OPERATE.
- (2) Set the Address keys to 8181 (111111110101).
- (3) Set the SELECT INPUT and SELECT OUTPUT switches on the control panel to AUTO.
- (4) Depress the ON button on the control unit.
- (5) Depress the RESET button.
- (6) Load the program tape into the printer reader (Para. 1.4.3.).
- (7) Depress the JUMP button and wait for the DEMAND lamp to light.
- (8) Set the START/STOP/FREE switch to START; the tape will be read in.
- (9) Set up the Address keys for entry to the required phase and depress the JUMP button again.

3.2.2 903(c) System (central processor, 8K core store, tape reader, tape punch, teleprinter and control unit)

On the 903(c) system, the paper tape equipment reader will normally be used to input data punched on tape, rather than the printer reader.

- (1) Set the Mode switch on the control unit to OPERATE.
- (2) Set the Address keys to 8181 (111111110101).
- (3) Set the SELECT INPUT and SELECT OUTPUT switches on the control panel to AUTO.
- (4) Depress the ON button on the control unit.
- (5) Depress the RESET button.
- (6) Load the program tape into the reader with the last blank character under the read head.
- (7) Depress the READ button.
- (8) Depress the JUMP button; the tape will be read in.
- (9) Set up the Address keys for entry to the required phase and depress the JUMP button again.

NOTE: Each phase has a separate entry point as shown in Table 1; the operator may carry out the tests in any order.

Table 1: PHASES 1 TO 5 ENTRY POINTS

Phase	Test	Address Key Setting	Entry Point
1	Output Pattern	0000000010101	21
2	Input Keys	0000000010110	22
3	Input a Line	0000000010111	23
4	Echo Check	0000000011000	24
5	Tape Reader & Punch Test	0000000011001	25

3.2.3 Output Pattern

A series of patterns, each comprising 82 lines of type (see Figure 5), is printed and should be checked by the operator for errors. Each line of the pattern begins with a full stop to provide a visual check (by running an eye down the page) that the type head returns correctly for each line. The pattern output comprises the tests shown in Table 2.

It should be noted that the line numbers given in Figure 5 are for convenience only; they are not, in fact, printed by the teleprinter.

Table 2: TELEPRINTER TESTS

LINE No.	TEST
1	Title
2, 3	Spacing, complete repertoire
4	Typehead
5	Pinhead traverse
6, 7	Circular aggregate motion
8	Vertical motion
9 to 12	Extremes of circular motion
13	Reversal
14	Clutch
15, 16	Spacing
17	Alphabet with varying delay between each character
18 to 81	Shifting character set
82	End title

For greater ease of reading there is an extra RETURN, LINE FEED and full stop between each of the lines 1 to 15.

3.2.4 Input Keys

The operator should depress all the keys on the keyboard in the order indicated in Figure 6. The program checks that the correct characters are sent to the processor. If an error occurs the message

ERR

is output on the teleprinter and the program returns to the beginning of the phase. The operator should type the characters again.

3.2.5 Input a Line

The operator should depress keys in any order until either a semicolon (;) is typed or 70 characters (one line of type) are printed. When either occurs, the characters typed are output again on the teleprinter; the lines of type should be compared visually for errors.

3.2.6 Echo Check

The operator should type a character, which is then immediately output again on the teleprinter. Another character should then be typed in and this is again output. The operator should continue this process for as many characters as he wishes, in each case ensuring that the 'echo' character is identical to the preceding one.

3.2.7 Tape Reader and Punch Test

The operator should produce a punched tape of the output pattern shown in Figure 5. This is achieved by loading the printer punch with blank tape, depressing the ON button and running phase 1.

The leading blanks of the tape so produced should be loaded into the printer reader without tearing it off at the punch. The three-position toggle switch should be set to START and the tape will be read in and checked against a stored table. Whilst the tape is being read in, the information is output to both the teleprinter and the punch. The tape being punched can be fed into the printer reader at the end of the pattern so forming a continuous reader, punch and teleprinter test.

If an error occurs (i.e. a character received from the reader differs from that expected), then

ERR
X
Y

is output on the teleprinter and the program stops. In this message X is the eight-bit binary pattern of the correct character, whilst Y is the eight-bit binary pattern of the character received.

An error may be due to either an incorrect character having been punched, or to the printer reader misreading a character. The operator should therefore examine the relevant portion of tape and compare it visually with a specimen tape in order to determine which error occurred.

If no error conditions occur, the program will continue until the printer reader detects the end of the tape.

3.3 Abbreviated Test Procedure

The tests are given above in full; however, due to considerations of the time involved in carrying out the complete procedure, it will probably be preferable to limit the tests in the following way:-

Phase 1	Output Pattern	-	Examine just the first 20 lines of type.
Phase 2	Input Keys	-	Carry out the test in full.
Phase 3	Input a Line	-	Omit
Phase 4	Echo Check	-	Omit

Phase 5 Tape Reader and - Read punched tape of just the
Punch Test first 10 lines of type. (This
should be done whilst phase 1
is being run.)
Continue phase 5 test as
indicated in Para. 3.2.7.

The extent to which the tests are limited (or omitted) must be left to the operator's discretion.

Phase 3 and 4 should be carried out by the Maintenance Engineer as, and when, required.

Appendix 1: SECOND TELEPRINTER FACILITY

General Description

A second identical teleprinter may also be used on a 903 System (see Appendix 5, Section 1.2.6 in Volume 1 of this Manual). In this case, the controller and the power supplies for this teleprinter will be housed in a separate standard 900 desk which also houses an Interface Unit. With a double system, both teleprinters will be connected to the Central Processor via the Interface Unit.

Controls, Operation and Maintenance

The controls, operation and maintenance of the second teleprinter are identical to that of the teleprinter described in Chapters 1 and 2. A control panel (for the second teleprinter) is mounted on the top front edge of the desk housing the external controller for this teleprinter. This control panel is identical in appearance and function to the computer control panel mounted on the computer desk (see Section 3.1.2 Figure 1) but its controls and indicators refer only to the second teleprinter and/or second paper tape station if fitted.

Daily Test Program

The daily test program X50A checks the operation of a second teleprinter connected to an external controller in the manner described above. The program is exactly the same as the one for the teleprinter connected to the controller built into the 903 computer desk, with only the addresses changed. Hence the description of test program X50 in Chapter 3 should be referred to for this test.

The program is issued as a sumchecked binary tape and adequate copies should be made for emergencies.