ELLIOTT 903

Volume   3:   OPERATING INSTRUCTIONS

Part   1:   BASIC EQUIPMENT

Section   1:   CENTRAL PROCESSOR

Contents

END-OF-TEXT FIGURES

Chapter   1:   OPERATING INSTRUCTIONS.

1.1   INTRODUCTION.

The Elliott 903 computer is a general purpose machine which operates in the parallel mode on 18 bit words. The central processor, main store, paper tape and teleprinter controller and power supplies for each are built in 19" rack mounting modules and housed in one standard desk. Extra store, when supplied, is contained in a separate desk.

Three basic configurations of the 903 are offered and these are:-

903A, 903B, 903C.

Figure 1 of this section shows a pictorial view of a 903B system. Figure 2 shows a detailed front view of the Control Unit. Details of the items of equipment for each of the basic systems are listed in paragraph 1.3 of this chapter. Where applicable it is envisaged that the teleprinter will stand on the right-hand side of the processor desk (when viewed from front) but this may vary according to customer requirements and installation details.

1.2   OPERATOR'S DUTIES.

In addition to operating a system the operator is responsible for some routine maintenance which is scheduled below.

The duties of the operator are as follows:-

(a)	Operating Equipment.	See paragraph 1.5
(b)	Cleaning.	See Chapter 2
(c)	Maintenance.	
(d)	Use of routine test programs.	See Chapter 3

1. 3   TABLE OF BASIC SYSTEMS.

CATALOGUE NO.	EQUIPMENT NAME	INCLUDES
	ITEMS COMMON TO 903A, 903B, 903C	
DPA1	Central Processor with 8192 word store	Desk, Central Processor, 8192 word store; fans and mains filters
DPA51	Control Unit (Free Standing)	Control Unit with plinth; 2 inter-connecting cables (Control Unit to computer)
	903A ONLY	
DPA241	Teleprinter (with stand)	Teleprinter and associated logic; connecting cables (2 off)
DPA211	Teleprinter Controller	
	903B ONLY	
DPA231	Paper Tape Punch	Tape Punch and associated logic; connecting cables (2 off)
DPA221	Paper Tape Reader	Tape Reader and associated logic; connecting cables (2 off)
DPA211	Paper Tape Controller	
	903C ONLY	
DPA221	Paper Tape Reader	Tape Reader and associated logic; connecting cables (2 off)
DPA231	Paper Tape Punch	Tape Punch and associated logic; connecting cables (2 off)
DPA241	Teleprinter with stand	Teleprinter and associated logic; connecting cables (2 off)
DPA211	Teleprinter and Paper Tape Controller	

1.4 OPERATOR'S CONTROLS.

(1)   Computer Mode Switch.

This is a 3-position Yale-lock switch.   The working modes generated by this switch are AUTO, OPERATE and TEST.

The computer mode switch determines which switches of the control unit shall be ~~operable~~ effective.

(a)   Test Mode

All switches ~~operable~~ effective.

(b)   Operate Mode

As for (a) except that Enter, Obey, Cycle Stop, Order Stop, Cycle Repeat, Modifier (B) and F keys become ineffective.

(c)   Auto Mode

As for (b) except that Stop, Restart and the Program Interrupt switches become ineffective.

✱

(2)   Off Switch.

This is a spring-loaded push-switch with an inset red lamp.   The computer is off when the lamp is lit but the mains supply is available.

When the switch is depressed the computer supplies are switched off sequentially.

(3)   On Switch.

This is a spring-loaded push-switch containing a green lamp.   Depression of this switch brings on the computer supplies sequentially and the lamp lights when all supplies reach the correct level. The computer will jump to the program trigger location (8177) in Auto mode or provide a Reset condition if in Operate or Test mode when switched on.

(4)   Reset Switch.

This is a spring-loaded push-switch containing a red lamp.   When depressed, the computer is Reset and all registers are cleared.

✱ NOTE: The interrupt mode switches should normally be set to the mid position. If they are put in the TRACE position, interrupt will be generated.

(5)   Stop Switch.

This is a spring-loaded push-switch containing an orange lamp.   When this switch is depressed, the lamp lights and the computer stops at the finish of the current instruction.

(6)   Restart Switch.

This is a spring-loaded push-switch.   If the computer has stopped, depression of this switch restarts the computer and causes the stop lamp to go out.

(7)   Jump Switch.

This is a spring-loaded push-switch.   When depressed, the computer will obey the instruction contained in the store location specified by the N (address) keys of the Word Generator.

(8)   N (address keys of Word Generator)

These are two position lever keys.   The thirteen N-keys of the Word Generator, when depressed, generate the appropriate store address bits.   The decimal value of the store address selected is the sum of the numbers which label each of the depressed keys.

(9)   Interrupt/Level Switches.

There are three push-switches on the Control Unit, each of which contains two lamps.   The Interrupt lamps (in the top half of each switch) are red, and the Level lamps (in the bottom half of each switch) are green.   The program priority level is marked on each switch (e. g. LEVEL 1 corresponds to highest program priority and is active when the lamp is lit). The action of these switches is governed by 3 lever-key switches (see item 10 of this paragraph).   When an Interrupt key is depressed the inset Interrupt lamp will light to indicate that an interrupt demand has been made at the level corresponding to that marked on the switch.   The Level lamp of that switch may not light immediately however, since this lamp only indicates the current program level.   Note that all levels of interrupt may be demanded simultaneously but only one program level can be operative at any one time.

(10)   There are three 3-position lever-keys on the Control Unit immediately to the right of the Interrupt/Level switches.   These switches modify the effect of the Interrupt/Level switches.   The switches are numbered 1, 2 and 3 to correspond with program levels 1, 2 and 3.   The Trace position of these keys causes a continuous interrupt demand to be made at the level selected.   In the mid. (on-line) position these switches inhibit manual interrupts.   In the down (manual) position these switches inhibit peripheral interrupts.

(11)   Volume Control.

This is a rotary potentiometer mounted on the Control Unit front panel. It is used to adjust the level of sound, produced by the loudspeaker which provides indication of the computer's performance when obeying a program.

(12)   The 9 remaining lever-keys which are listed below are of use to engineers and are described in detail in Volume 4.

(a)   Cycle Stop/Normal/Order Stop.

(b)   Cycle Repeat

(c)   Enter

(d)   Obey

(e)   F (function) keys.   There are 4 of these.

(f)   The B (address modifier) key.

1. 5   OPERATING PROCEDURE.

Although it is possible to operate the 903 computer in either the Auto or Operate mode, it is expected that the Auto mode will normally be used for on-line real-time working such as process control when it is required only to switch the computer on and off. The third possible mode of working is the Test mode. This is an engineer's facility and is described in Volume 4.

The following text outlines the effect of operating the machine in Auto and Operate modes.

1. 5. 1   Auto Mode Operation.

Ensure that the mains supplies to the Punch, Reader and/or Teleprinter are switched on.

Determine that the mains is available, indicated by the Off lamp being lit. Depress the On button. When the On lamp is lit, the computer becomes operative and jumps automatically to the program trigger location (8177).

The result of this action will depend on the program which was stored initially and the type of system being operated.

Program descriptions are contained in Volume 2 and program operating instructions in Part 3. 2.

1.5.2   Operate Mode Operation.

Switch on the computer as already described in paragraph 1.4.1., and note that the Reset lamp and the Interrupt/Level 1 lamps light.   The paper tape station supplies will be sequenced on automatically.

Input via tape reader is carried out as follows:-

*(a)   Load the tape into the reader (see section 3.1.2).

*(b)   Depress Read button and note that the Read lamp is extinguished.

(c)   Set up the N (address) keys to the program entry location (Volume 2 gives details of program entry points).   If the tape is to be input under Initial Instructions the address keys must be set to 8181.

(d)   Depress the Jump button whereupon the tape will be read in.

Once the computer has entered and started obeying a program and if no further operator intervention is required, the mode switch on the control unit may be turned to Auto.   This can be used as a protective measure to minimise the number of effective controls on the Control Unit.

1.5.3   Program Failure.

If a program contains a false instruction, such as addressing a non-existent peripheral, the effect is undefined.

If the program is halted and computation ceases (generally indicated by the lack of output from the loudspeaker), it is necessary to depress the Reset key which will clear the main and auxiliary accumulators.   The failing program should be checked for errors before attempting to continue operating.

* Refer to section 3.1.3 for input via a teleprinter.

Chapter   2:   OPERATOR'S MAINTENANCE

2. 1   INTRODUCTION.

The operator is required to perform routine maintenance, as scheduled in this chapter, as well as operating the system. Any necessary maintenance which is not covered in the following text should not be attempted by the operator, but left to a maintenance engineer.

2. 2   MATERIALS REQUIRED.

(1)   Lint-free cloth. (Cat. No. 6241).

(2)   Materials for paper tape equipment maintenance are listed in section 3. 1. 2.

2. 3   DAILY MAINTENANCE.

Before commencing a day's operation of the machine, it is desirable to

(1)   Dust off the computer desk top, especially between punch, reader and paper tape bin with a lint-free cloth.

(2)   Dust the control unit lamps and switches with the lint-free cloth.

(3)   Clean and check paper tape equipment as detailed in section 3. 1. 2., and the teleprinter as detailed in section 3. 1. 3.
If the computer fails to switch on check that the Off lamp on the Control Unit is lit. If it is not, then ensure that the computer is plugged into a live wall socket. Should the Off lamp still fail to light then call a computer maintenance engineer.
At the beginning of each day or when the computer is suspected of malfunctioning the daily test programs, which are supplied should be used. These test programs are described in Chapter 3 of this section.

Chapter   3:   DAILY TEST PROGRAMS

3. 1   INTRODUCTION.

There are 3 daily test programs in the 903 software library which test the processor and store.   The test programs concerning paper tape equipment are mentioned in section 3. 1. 2.

The processor and store test programs are

(1)   Test program X. 2. (Store test 1).   This program performs a chequerboard test pattern for an 8192 word store.

(2)   Test program X. 3. (Function test).   This program tests each of the computer functions from 0 to 15 and B-modification.

(3)   Test program X. 4. (Store test 2).   This program tests store selection circuits and verifies that data is retained in the store when the supplies to the computer are disconnected and then reconnected.   Where it is possible, preserve master tapes from the software library and use copies.

3. 2   METHOD OF USE.

3. 2. 1   Test program X. 2.

(1)   Set the computer Mode switch to Operate.

(2)   Set N (address) keys to 8181.

(3)   Load tape in reader and depress Read button.

(4)   Depress Jump button.

Part of the tape will be read in (i . e. to the start of the blank characters in the middle of the tape).

The program is self-triggered, and writes a chequerboard pattern from location 2 to location 8043, tests this pattern and complements each location in turn.   If the pattern is correct, the inverse pattern is written and tested.   If no error occurs at this stage, a character will be read from the tape.   The program repeats itself until the first non-blank character is read whereupon the second part of the program tape will be read in to the computer.   This part is also self-triggering and produces a legible output on the paper tape punch of a successful test. This output is

903, STORE TEST 1 O. K.

3. 2. 2   Test Program X. 3.

    (1)   Set the computer Mode switch to Operate.

    (2)   Set the N (address) keys to 8181.

    (3)   Load the tape in the reader and depress
        the Read button.

    (4)   Depress the Jump button.

The first part of the tape will be read in and after a short pause, during which it clears the store, the next section of tape will be read in.

    (5)   Set the N (address) keys to ~~7008~~ and
        depress the Jump button again.

The program now cycles each function 150 times, at the end of which it inputs a character from the tape reader. If the character is blank, the function test is repeated until the first non-blank character is read, at which point the output on the paper tape punch given is:-

"FUNCTION TEST O. K. "

The test may be stopped manually at any point by the depression of the Stop button and recommenced by depression of the Restart button, but stopping the test destroys the legible output

"FUNCTION TEST O. K. "

3. 2. 3   Test Program X. 4.

    (1)   Set the computer Mode switch to Operate.

    (2)   Set the N (address) keys to 8181.

    (3)   Load the tape in the reader and depress
        the Read button.

    (4)   Depress the Jump button whence the
        tape is read in.

    (5)   Set N (address) keys to 8000, and depress
        the Jump button again.

The checking routine is then followed. When the routine is finished, the first parameter section of tape is entered (See Note 1). The reader inputs a character and if this is a blank the checking routine is repeated until a non-blank character is read, whereupon a legible output on

the paper tape punch of

"STORE 2 O. K. " is given.

To test the retention of data in the store

(6)   Switch computer off.

(7)   Set the N (address) keys to 8009.

(8)   Switch the computer on.

(9)   Depress the Read button, then the Jump
button.

The checking routine is followed as before and the
second parameter section of tape is entered.

NOTE 1

The parameter sections are lengths of blank tape with
a non-blank character at their ends.   The number of
blank characters which will be read, determines the
number of times the test is cycled.   These parameter
sections will be on the tape following the program
section.

3. 3   ERROR INDICATIONS FROM TEST PROGRAMS.

3. 3. 1   Test Program X. 2. Errors.

When an error is detected the computer will
punch ten characters.   The first will be an erase character (11, 111, 111)
which serves to mark the start of the group.   The following three groups of
three are:-

(1)   Characters 2, 3 and 4 represent the address
(in binary) of the first of the storage pair,
one of which has failed.

(2)   Characters 5, 6 and 7 represent the
contents (in binary) of the first of these
locations.

(3)   Characters 8, 9 and 10 represent the
contents (in binary) of the second of these
locations.

Since three 8 bit characters comprise 24 bits, of which only 18 are significant, then the first 6 bits of the first character in each group of three will be meaningless.

3. 3. 2   Test Program X. 3. Errors.

When an error is detected during a test cycle, the program will output 1 of 57 characters continuously.   The following table lists each of these characters and the failing function they represent:-

X. 3. ERROR INDICATIONS

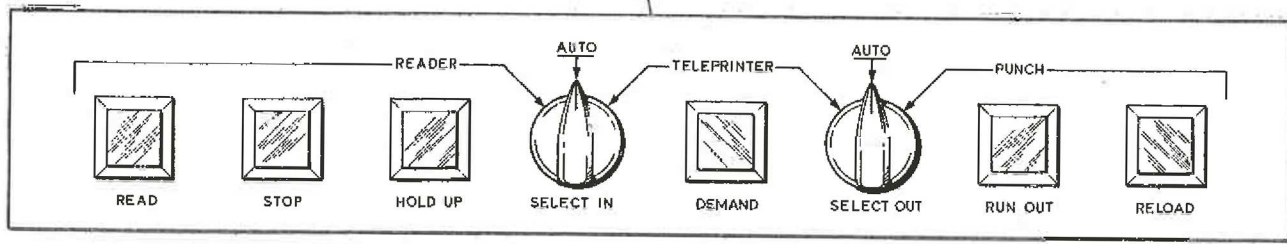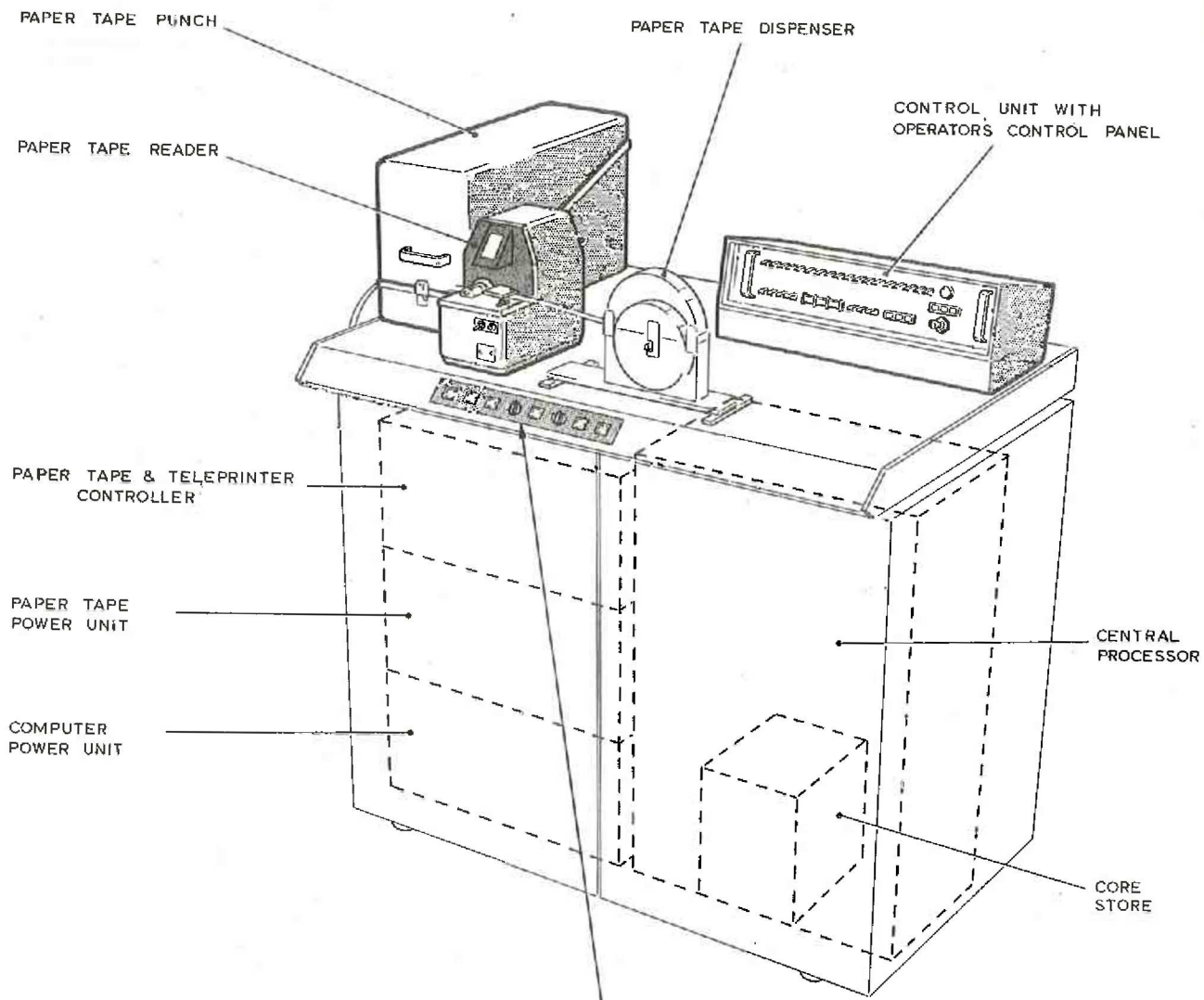NOTE Q = Auxiliary Accumulator

A = Main Accumulator

Error Character	Function Failing
00000. 001	4
00000. 010	5
00000. 011	7 a
00000. 100	7 b
00000. 101	9 a
00000. 110	9 b
00000. 111	1 a
00001. 000	1 b
00001. 001	1 c
00001. 010	1 d
00001. 011	1 e
00001. 100	1 f
00001. 101	1 g
00001. 110	2 a
00001. 111	2 b
00010. 000	2 c
00010. 001	2 d
00010. 010	6 a
00010. 011	6 b

Error Character	Function Failing
00010.100	6 c
00010.101	6 d
00010.110	10
00010.111	0
00011.000	11
00011.001	3
00011.010	14 a
00011.011	14 b - A. wrong
00011.100	14 b - Q. wrong
00011.101	14 c
00011.110	14 c - A. wrong
00011.111	14 d - Q. wrong
00100.000	14 e - A. wrong
00100.001	14 e - Q. wrong
00100.010	14 f - Q. wrong
00100.011	14 g - Q. wrong
00100.100	14 h - Q. wrong
00100.101	14 i - Q. wrong
00100.110	14 j - A. wrong
00100.111	14 k - Q. wrong
00100.000	14 l - Q. wrong
00101.101	14 m- Q. wrong
00101.010	14 n - Q. wrong
00101.011	14 o - Q. wrong
00101.100	14 p - A. wrong
00101.101	14 q - Q. wrong
00101.110	14 q - A. wrong
00101.110	14 q - A. wrong
00101.111	12 a - Q. wrong
00110.000	12 a - A. wrong

| Error Character	Function Failing
00110.001	12 b - Q. wrong
00110.010	12 b - A. wrong
00110.011	13 a - Q. wrong
00110.100	13 a - A. wrong
00110.101	13 b - Q. wrong
00110.110	13 b - A. wrong
00110.111	13 c - A. wrong
00111.000	13 d - A. wrong
00111.001	B-modification

3.3.3   Test Program X.4. Errors.

When an error is detected during a test cycle, two 8-bit characters are output. The first character represents the 8 least significant bits of the failing store address and the 5 least significant bits of the second character represent the 5 most significant bits of the failing store address. The remaining three bits of the second character are always ones.

PAPER TAPE PUNCH

PAPER TAPE DISPENSER

CONTROL UNIT WITH
OPERATORS CONTROL PANEL

PAPER TAPE READER

PAPER TAPE & TELEPRINTER
CONTROLLER

PAPER TAPE
POWER UNIT

CENTRAL
PROCESSOR

COMPUTER
POWER UNIT

CORE
STORE

READER — AUTO — TELEPRINTER — AUTO — PUNCH

READ   STOP   HOLD UP   SELECT IN   DEMAND   SELECT OUT   RUN OUT   RELOAD

PAPER TAPE & TELEPRINTER CONTROL PANEL

THIS IS THE DESK UNIT FROM THE FRONT AND
SHOWS THE INTERNAL STORAGE OF EQUIPMENT
AS WELL AS THE LAYOUT OF EQUIPMENT BUILT
INTO DESK TOP

OVERALL   VIEW
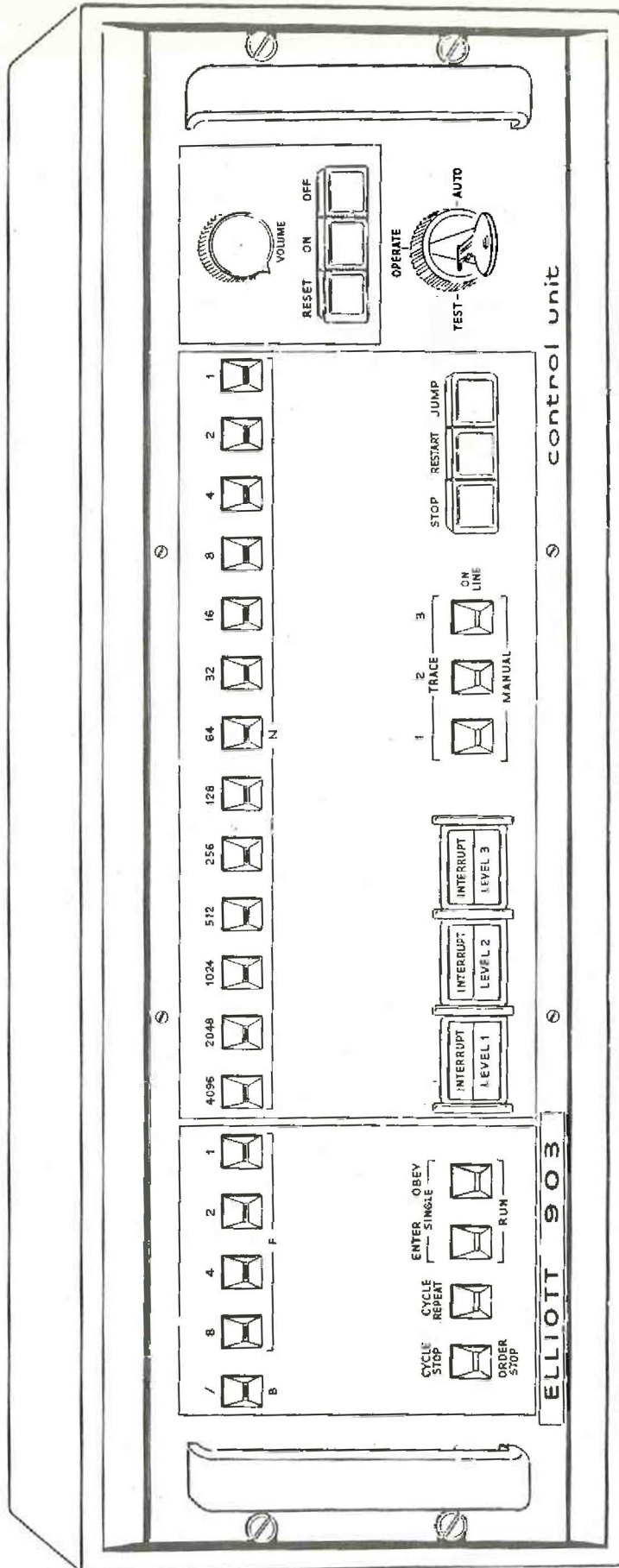
Figure 1 (ISSUE 2)

903 Control Unit

Figure 2

(Issue 2)