

	Page
3.4 Patterns..	12
3.5 Modes	13
3.6 Errors	13
3.6.1 Writing and Reading Phase	14
3.7 Error Summary	16
3.7.1 Writing Phase	16
3.7.2 Reading Phase	16
3.7.3 Relocation	16
3.7.4 Output	17
3.8 Entry Points	18

Appendix 1: INSTRUCTIONS FOR USE OF XTM72 AS A DAILY
TEST PROGRAM

END-OF-TEXT FIGURES

	Figure
Controller	1
General view of Handler Cabinet showing four Handlers and tape deck mechanism	2

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Chapter 1: GENERAL INFORMATION

1.1 Introduction

The 9 Kc/s Magnetic Tape System provides for the 900 computer, a large backing store which can be written into or read from at high speed. Data not required in the computer store during the whole of a program can be written onto tape and extracted at specified points in the program. Standard sections which may be less frequently used but permanently required, can be written onto tape and stored away indefinitely (see Paragraph 2.3.2).

The system consists of a remote controller connected by a single cable to up to four tape handlers. A handler is designed to move half inch wide tape at 45 inches per second, when either reading or writing. Packing density is 200 characters per inch on seven tracks, giving a data transfer rate of 9000 characters per second. Maximum tape length is approximately 2400 feet when using ten inch reels.

1.2 Controller and Handlers

1.2.1 Controller

1.2.1.1 General Description

The controller is housed in a standard 900 desk (Figure 1), and the interconnecting cable supplied allows it to be placed up to 25 feet away from the handlers. Connection to the central processor is via two cables approximately 25 feet in length.

The controller desk contains the following units:-

1. Operator Control Panel.
2. Engineer Control Panel
3. Mains Filter
4. Controller Logic
5. Power Supplies.

A separate mains supply via one input cable supplies power to the controller.

1.2.1.2 Operator Control Panel

The controls which are shown in Figure 2, are described in the following table:-

Control	Effect	Lamp lit when	Notes
POWER ON: green lamp in press button	Pressing the POWER ON button when the OFF lamp is lit will switch the controller on. The OFF lamp is extinguished	power is available	Switching on of the controller is independent of both the computer and the handlers.
POWER OFF: red lamp in press button	Pressing the POWER OFF button when the ON lamp is lit will switch the controller off. The ON lamp is extinguished.	mains is available when controller is off.	Switching off of the controller is independent of both the computer and the handlers.
RESET: white press button	Pressing the button will reset the controller to an initial state.	-	The Status Word bits are reset.
SELECTED: yellow lamp	-	controller is addressed by central processor	Lamp lit indefinitely if wrong instruction sequence is given.

1.2.2 Handlers

1.2.2.1 General Description

The handlers, which share a single electronics unit and power supply, are all housed in one cabinet (Figure 2). The cabinet may be fitted with 1, 2, 3 or 4 handlers, including the necessary amount of filler panels.

Each handler supplied consists of the following sub-units, which are fitted together to form one compact unit:-

1. Tape Deck Mechanism
2. Operator Control Panel
3. Engineer Control Panel

4. Read/Write Head Stack
5. Erase Head
6. Beginning and End of Tape Photosense Heads
7. Individual Pre-amplifiers.

Power for the handlers is supplied via one input cable from a mains socket. There is no remote power on/off facility as every handler fitted has its own POWER ON/OFF switch.

Each handler is allocated a predetermined number 0, 1, 2 and 3, to specify its location in the system.

1.2.2.2 Operator Control Panel

The controls which are identical for each handler, are shown in Figure 1, and described in the following tables:-

Control	Effect	Lamp lit when	Notes
POWER ON/OFF: green lamp in press button	Initially, pressing this button once switches on the handler. Pressing the button a second time switches off the handler.	power is available for the handler.	Switching on any handler also switches on the power required for the shared electronics unit.
FILE PROTECT INDICATOR: yellow lamp	-	no file reel is mounted, or if a file reel is mounted which does not have a write permit ring fitted.	Writing cannot occur on the handler when this lamp is lit.
REMOTE INDICATOR: green lamp in press button	Pressing this button when the LOCAL lamp is lit will cause the handler to enter the Remote state.	the handler is in Remote.	The lamp in the LOCAL INDICATOR is extinguished.

Control	Effect	Lamp lit when	Notes
LOCAL INDICATOR: red lamp in press button	Pressing this button when the REMOTE lamp is lit will cause the handler to enter the MANUAL state. The REMOTE lamp will be extinguished. The tape will stop.	the handler is in Manual.	When power is first switched on the handler is automatically set to the Manual state. If the handler is not available due to a tape drive or servo fault the handler will be in the Manual state but the light in the LOCAL INDICATOR will be extinguished.
SELECT INDICATOR: white lamp	-	a handler has been selected by program.	A handler may only be selected if it is in the Remote state. Only one handler at a time may be selected.
FORWARD: grey biased press button	This control operates only in the Manual state. Pressing the button will make the tape move forward.	-	The tape may be stopped by either detecting the LOAD POINT, the END-OF-TAPE marker, or by pressing the RESET button. The LOAD POINT and END-OF-TAPE marker are reflective strips positioned just after the beginning and just before the end of the tape respectively.
REVERSE: grey biased press button	This control operates only in the Manual state. Pressing the button will make the tape move in reverse.	-	The tape may be stopped by detecting the LOAD POINT, the END-OF-TAPE marker, or by pressing the RESET button.

Control	Effect	Lamp lit when	Notes
REWIND: grey biased press button	This control operates only in the Manual state. Pressing the button will make the tape move in reverse at rewind speed.	-	The tape is normally stopped by detecting the LOAD POINT. In case of an emergency the tape may be stopped by pressing the RESET button.
RESET: grey biased press button	Pressing this button stops the tape in both Manual and Remote states.	-	The handler will be automatically set to the Manual state if it was in the Remote state initially.

1.3 Operating Procedure

1.3.1 Power Switching Precautions

A handler must not be switched on or off while another handler is obeying a computer instruction, as this may corrupt the tape at the point where it was involved in that instruction.

In the event of a mains power failure, no damage will result to either the tape or system equipment, but the tape will be corrupted at the point where a write or erase operation may have been in progress at the time. The operator should ensure that the MAINS supply is not accidentally disconnected while programs are run.

1.3.2 Tape Loading

The tape should be loaded in the following manner - see Figure 2 for guidance.

1. Initially, power to the handler selected must be switched on in order to release the tape reel brakes.
2. Lift open the handler access door.
3. Pull the operating rod of the REEL BRAKE switch outwards. This switches off the vacuum.

4. Slip the file reel onto the reel retainer spindle and while holding it firmly against the turntable surface, turn the retainer knob clockwise to the mechanical stop. Check that the file reel is now locked in position.
5. Pass the tape around the supply servo tachometer spindle.
6. Pass the tape across the supply vacuum chamber, between the loop retaining plate and the mouth of the chamber.
7. Pass the tape across the tape cleaner cartridge, the read/write head and around the capstan.
8. Pass the tape across the take-up vacuum chamber between the loop retaining plate and the mouth of the chamber.
9. Pass the tape around the take-up servo tachometer spindle and attach it to the fixed take-up reel. Wind at least three turns of tape onto the take-up reel.
10. Close the handler access door, thus resetting the REEL BRAKE switch and turning on the vacuum. If the access door is desired open, the REEL BRAKE switch may also be reset by hand by pressing it inwards.
11. Press the FORWARD button on the selected handler. The reel servos will now allow the formation of stabilised loops in the vacuum chambers. If the FORWARD button is kept depressed for about half a second, the tape will move forward to the LOAD POINT where it is made to stop by means of a reflective marker attached to the tape. This marker is positioned approximately 15 feet after the beginning of the tape. If the handler is now put into the Remote state by pressing the REMOTE button, the tape will come under program control.
12. It should be noted that the handler access door also actuates an INTERLOCK switch, and a handler will stop if the access door is opened during operation. To operate the handler with the access door open, the INTERLOCK switch must be pulled outwards. To return to normal operation, close the access door.

NOTE: A tape may be loaded with or without a Write Permit ring fitted on the file reel. The Write Permit ring is a removable plastic ring fitted in a groove in the file reel and its presence actuates a switch which permits writing to occur. To prevent writing from occurring on a tape, this ring must be removed.

1.3.3 Tape Unloading and Switching Off

With the handler in Manual and the tape stopped at the LOAD POINT, lift open the handler access door and pull out the operating rod of the REEL BRAKE switch - if the tape is not at the LOAD POINT, press the REWIND button and wait until the tape stops at the LOAD POINT. Manually wind the File Reel anti-clockwise until all the tape is taken up by the File Reel. Firmly hold the File Reel and turn the retainer knob anti-clockwise until the File Reel is freed from the reel retainer spindle. Remove the File Reel and store it as necessary (see Paragraph 2.3.2). If the handler is not required for further use, close the access door and press the POWER ON/OFF button only when the other handlers are not obeying computer instructions, (see Paragraph 1.3.1.)

To unload a tape from a handler which is in Remote, first press the LOCAL INDICATOR button associated with the handler. Next, press the appropriate REWIND button, wait until the tape stops at the LOAD POINT and proceed as described above.

1.3.3.1 Unloading Precautions

If for some reason a handler has been switched off, it must first be switched on to release the tape reel brakes and allow the use of the manual controls, before a tape can be unloaded.

To avoid damaging the tape, the File Reel should only be removed from the tape deck when all the tape has been rewound. It is possible that with the tape at the LOAD POINT pressing the REVERSE or REWIND button will cause all the tape to be taken up by the File Reel but this is not recommended, as there is a tendency for the tape end to become frayed.

Chapter 2: EQUIPMENT 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 unless so instructed in this chapter.

2.2 Materials Required

The following items, which must always be kept in adequate supply, are required for the maintenance of the equipment.

1. Clean lint-free cloth (Catalogue No. 6241)
2. Cotton Buds (Catalogue No. 15162)
3. Denatured Alcohol
4. Ampex Head Cleaner (Catalogue No. 15158)
(Ampex No. 087-007)

Obtainable from:-

Ampex Electronics Ltd.,
Reading,
Berkshire,
ENGLAND.

2.3 Maintenance Procedure

2.3.1 Cleaning the Handler Mechanism

The following must be carried out by the operator after every eight hours of equipment use.

1. Use a cloth or cotton bud moistened with Ampex head cleaner to wipe off any oxide or dirt that may have accumulated on or around the head stacks, head gate flap and tape cleaner cartridge. Metal objects should never be used close to the head stacks for cleaning purposes due to the risk of scratching the valuable surfaces.
2. Use a cloth moistened with alcohol to clean off all traces of oxide and dirt from the capstan surface by means of a dabbing action. The capstan may be rotated for easy access.

3. Clean the vacuum chambers and glass covers, first removing the plastic overlay plate which is held in place by two screws. The vacuum chamber glass covers can now be removed by carefully easing them away from the retaining clips. Clean the interiors of both chambers with a cloth moistened in alcohol. Particular care should be taken to remove any oxide or dirt from the loop sensor and loop windows.
4. Before replacing the glass covers, clean the rotary guide at each vacuum chamber exit and the tachometer pulley at the entrance to each chamber. A cloth or cotton bud moistened with alcohol should be used. The parts may be rotated by hand to ensure thorough cleaning, particular attention being paid to these portions of the guides contacted by the edge of the tape. In the case of spring loaded guides, the lower ceramic guide flange may be depressed slightly on its spring for cleaning.
5. Clean and replace the vacuum chamber glass covers. Clean and refit the plastic overlay plate. In both cases a cloth or cotton bud moistened with alcohol should be used.
6. Clean the active surface of the photosense head using a DRY cloth or cotton bud.
7. The tape deck of each handler cabinet should be kept free of dust and dirt particles. The plastic window of the tape access door should be cleaned with a soft cloth (to avoid scratching) moistened with alcohol.

2.3.2 Storage and Use of Magnetic Tape

Magnetic tape should normally be stored inside their containers in the same environmental conditions as the computer room, i.e. between 10 °C to 30 °C temperature and 20% - 95% relative humidity without condensation. This is for periods of less than a year.

For storage periods of more than a year, the temperature and relative humidity must be held between 20 °C to 25 °C and 45% to 55% without condensation respectively. In this case, the operator must ensure that unused tape be rewound at least once a year.

Newly acquired tape must be acclimatised for at least four hours before use. When ordering extra reels of tape, the length (1200 or 2400 ft), quantity required and Catalogue Number (DPA 923) must be quoted.

2.4 Maintenance Precautions

The following precautions should be observed in the course of maintenance:-

1. Many industrial solvents may dissolve the head lamination adhesive, therefore only Ampex Head Cleaner should be used in the head area.
2. Many industrial solvents may mark the perspex window of the access door and the plastic overlay plate. Use only the recommended cleaning fluid for these parts.
3. Ampex Head Cleaner must not be used to clean rubber parts as it will damage the rubber.
4. Cleaning agents should not be allowed to contact tape and it must be ensured that all cleaned parts are completely dry before loading the tape.
5. Cleaning agents should not be allowed to penetrate into bearings so care should be taken to avoid spillage.
6. It is recommended that all cabinets be generally kept free from fluff and dust especially the cooling vent grills on the handler cabinet. Failure to keep the vents clear could result in overheating and subsequent damage. As an added precaution, the handler cabinet should not be positioned within ten feet of any paper tape, line printer or card equipment. Airflow through the installation should take paper dust from such equipment away from the tape system.

On completing the maintenance procedure, the operator should run the Daily Test Program described in Chapter 3 to ensure that the system is in working order.

Chapter 3: DAILY TEST PROGRAM XTM72

3.1 General Description

The Test Program XTM72 provides a general engineering and mechanism test for the 9 Kc/s Magnetic Tape System. Until a permanent program is available, refer to Appendix 1 when using XTM72 as a daily test.

The program is supplied in the form of a sumchecked binary tape and is input under Initial Instructions (see Section 1.2.3 in Volume 1 of this Manual). Copies should be made and stored for emergencies. Control is effected by typing the appropriate entry points on the Control Teleprinter which also outputs all error messages.

3.2 Write and Read a Block Sequence

Initially the program will select each handler which is available, and on each of these handlers will perform the following operations:-

1. The program will write 16 blocks of data, the shortest of these will be of 4 words, and each block will be increased by 64 words until a block of 964 words is written.
2. The blocks written will then be read by the tape performing the following operations:-

BACK, READ
BACK, BACK, READ
BACK, BACK, READ
ETC.

until all blocks written have been read. The blocks will then be read in a forward direction until the last block written has been read.

3. The program then returns to the write cycle, and the operation will be repeated. The program will perform this cycle 10 times on each handler, but an option is available whereby the operator may specify the number of times this operation is to be performed. If it is desired to continue to the End of Tape the operator should specify a large number of cycles, e.g. 2000, the extra cycles will not be obeyed after End of Tape is detected.

3.3 Operator Options

By selection of different entry points the operator may alter the initial program parameters, which are given in the table below. The parameter names displayed by this option are given in the left-hand column, the purpose of the parameter in the centre column, and the Initial program value in the right-hand column.

Parameter		Purpose	Initial Value
RE-READS	=	Number of re-reads to be attempted on a block of data.	4
RE-WRITE	=	Number of attempts to write a block of data.	3
FIND	=	Number of attempts to locate a block.	6
CYCLES	=	Number of cycles to be made of the write, back, read, sequence.	10
PATTN	=	Number of pattern to be selection (see Paragraph 3.4 below).	1

To change any of the above the operator must select entry point 26, the parameter names in the left-hand column will then be output, and after each the operator must type the new value, terminated by a fullstop.

If the character / is typed, the old parameter will be left unchanged. If any character other than / . or a numerical character is typed, the same parameter name will be re-output.

3.4 Patterns

The following patterns may be requested by the operator:-

Pattern Number (Typed by Operator)	Selected Pattern
1	RANDOM
2	ALL ONES
* 3	ALL ZEROS

Pattern Number (Typed by Operator)	Selected Pattern
4	SHIFTING ONES
* 5	BINARY COUNT

(Initially pattern number 1 is selected unless changed by the operator)

* Zero characters should not be used in even parity.

3.5 Mode

There are four modes of operation, and an entry point will be provided for each (see Paragraph 3.8 below). The four options available are as follows:-

Mode	Entry Point
ODD PARITY, BLOCK TRANSFER	22
ODD PARITY, WRITE/READ A WORD	23
EVEN PARITY, BLOCK TRANSFER	24
EVEN PARITY, WRITE/READ A WORD	25

The operator will select one of these to start the test.

3.6 Errors

There are three basic modes controlling error output, and an entry point is provided for each of these. The entry points have the following effect:-

Mode	Entry Point
OUTPUT ALL ERRORS	27
OUTPUT ALL ERRORS AND WAIT RE-ENTRY AT 9	28
SUPPRESS ALL ERROR OUTPUT	29

Initially the program will output all errors, but error messages will only be output after the program has made a specified number of attempts to recover from the error. (The initial values may be found under Paragraph 3.3 above).

If, during the running of the program an error summary is required the operator should generate an Interrupt on Level 3. An entry point is also provided to enable the operator to extract the same information on completion of a program run.

Details of this output may be found in Paragraph 3.7, Error Summary.

3.6.1 Writing and Reading Phase

3.6.1.1 Writing Phase

The following errors may be displayed during the writing phase:-

```
WR    ERR
HR <X> BLCK <Y>
```

The above may be followed by one or more of the following messages:-

```
PRTY <n>          (Parity)
MDT  <n>          (Missed Data Transfer)
ZCH  <n>          (Zero Character)
```

Where <n> is the number of times each error occurred in attempting to write the block.

3.6.1.2 Reading Phase

If the program is unable to locate the desired block, and has failed after repeated attempts, the following error message will be output:-

```
HR  <X>
LST <X> FND <Y>
```

If the block is correctly located, but the program is unable to read it without exceeding the specified number of attempts, the following error output will be displayed:-

```
RD    ERR
HR  <X> BLCK <Y>
ST  <STATUS IN BINARY>
```


The above may be followed by one or more of the following messages:-

PRTY <n>	(Parity)
MDT <n>	(Missed Data Transfer)
LRCD <n>	(Long Record)
SRCD <n>	(Short Record)
2CH <n>	(Zero Character)

The data read by the program will then be examined in store, and compared with the data which was written.

If the data fails to compare the following output will be displayed:-

```
HR <X> WD <Z>  
EX <EXPECTED WORD IN BINARY>  
RD <FIRST WORD IN ERROR IN BINARY>
```

If the program is in the "wait after error" mode the message

```
WAITING
```

will be output before the program enters a dynamic stop.

In the "wait after error" mode the operator may select an entry point which will "dump" the pattern written and the pattern read onto paper tape. When the "dump" is complete the program will enter a dynamic stop.

If the program is in the "wait after error" mode, and fails to read a block of data after the specified number of attempts, the program will output an error message and stop. If the operator requires to make further attempts at this block he should re-enter the program at location 31. This will then make the specified number of attempts to read the block again.

If at any stage a handler is put into manual, or is not available, e.g. writing is not permitted, the following message will be output, and the next handler selected:-

```
ABANDON HR <X>  
ST <STATUS IN BINARY>
```

3.7 Error Summary

The operator may request an error summary by the following methods:-

If, during the running of the program an error summary is required, a manual Interrupt should be generated on Level 3.

If a run has been abandoned the error to that stage of the program may be requested by the use of entry point 24. (See Para. 3.8 below).

The error summary will consist of the following information:-

3.7.1 Writing Phase

1. Number of re-writes.
2. Number of temporary errors in writing.
3. Number of permanent errors in writing.
4. Ratio of permanent errors/number of words.
5. Ratio of temporary errors/number of words.

3.7.2 Reading Phase

1. Number of re-reads.
2. Number of temporary errors in reading.
3. Number of permanent errors in reading.
4. Ratio of permanent errors/number of words.
5. Ratio of temporary errors/number of words.

3.7.3 Relocation

1. Number of temporary losses of position.
2. Number of attempts to locate the block.
3. Number of total losses of position.

3.7.4 Output

The above error information will be output in the following format:-

```
ERR SUMMARY HR <X>
WR PHASE
REWRITES <n>
TEMP. ERR <m>
PERM. ERR <o>
TEMP. ERR RATIO <m> / <w> x 10000
PERM. ERR RATIO <o> / <w> x 10000
RD PHASE
REREADS <p>
TEMP. ERR <q>
PERM. ERR <r>
TEMP. ERR RATIO <q> / <w> x 10000
PERM. ERR RATIO <r> / <w> x 10000
LOSS OF POSITION
PERM. <s>
TEMP. <t>
RECOV. <u>
```

Where <w> is the number of words written or read.

The Read and Write phase error ratios are cumulative, all other error counts are cleared after each request for an error summary.

The error summary will be followed by the number of cycles, completed with each handler.

```
HR CYCLES = <n>
```

3.8 Entry Points

Entry Point	Result of Entry
21	Open Multiplexer and stop.
22	Odd parity, Block Transfer and start test.
23	Odd parity, Read/Write a word and start test.
24	Even parity, Block Transfer and start test.
25	Even parity, Read/Write a word and start test.
26	Change parameters, (see Paragraph 3.3 above).
27	Set "output all errors" Flag and stop.
28	Set "wait after errors" Flag and stop.
29	Set "suppress errors output" Flag and stop.
30	Dump of Written and Read data areas.
31	Restart reading block.
32	Output error summary entry point.
9	Restart after an error wait.

Appendix 1: INSTRUCTIONS FOR USE OF XTM72 AS A DAILY TEST PROGRAM

1.1 General

This Appendix is intended as a guide to enable XTM72 to be used by an operator as a provisional daily test.

The program will test the device in both Odd and Even Parity, Block Transfer and Write/Read a Word mode.

The data Patterns used will be Random and Shifting Ones.

1.2 Method of Use

The operator will input XTM72 under Initial Instructions.

If a multiplexer is fitted enter first at 21 then:-

1. Enter at 27, and press the RESET button.
2. Enter at 26, Teleprinter output Follows, and the operator must type the character shown:-

Output	Operator types
RE-READS	/
RE-WRITE	/
FIND	/
CYCLES	1.
PATTN	4.

3. Enter at 23

The tapes will then obey one cycle of Shifting Ones, in Odd Parity and in the Write/Read a Word mode. When one cycle has been completed on every handler, press the RESET button.

4. Enter at 32 to output an Error Summary.
5. Enter at 26, Teleprinter output Follows, and the operator must type the characters shown:-

Output	Operator Types
RE-READS	/
RE-WRITE	/
FIND	/
CYCLES	/
PATTN	1.

6. Enter at 24

The tapes will then obey a cycle of Random data and Even Parity in Block Transfer mode. When one cycle has been completed on every handler, press the RESET button.

7. Enter at 32 to output an Error Summary.

8. Enter at 26, Teleprinter output Follows, and the operator must type the characters shown:-

Output	Operator Types
RE-READS	/
RE-WRITE	/
FIND	/
CYCLES	10.
PATTN	/

9. Enter at 22

When the tapes have completed one cycle on every handler, press the RESET button.

10. Enter at 32 to output an Error Summary.

11. Steps 2 to 7 inclusive may be omitted if the operator does not desire to test Write/Read a Word or Even Parity.

