

**REVISIONS**

SYM	DESCRIPTION	BY	DATE	APPROVED
A	PILOT RELEASE PER CR/O 0900	TD	12/83	—
A1	CR/O 1067	EB	1-26-84	EB
A2	PRODUCTION RELEASE CR/O 1579	EB	7/19/84	Tom

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<b>NOTES UNLESS SPECIFIED</b>  1 TOLERANCES .XX                    ANGULAR .XXX                  0°30' 2 REMOVE ALL BURRS 3 BREAK ALL SHARP EDGES .010 APPROX. 4 MACH SURFACES 125/ OR BETTER ✓ 5 DIM ARE IN INCHES 6 ( ) DIM ARE IN MILLIMETERS	DRAWN                  JB                  12/83	MODEL NO.                  9050B	
	CHECK <i>JB</i> 12-20-83		TITLE  CARTRIDGE TAPE DRIVE, ENHANCED BASIC, PRODUCT DESCRIPTION (9050B)
	APPR <i>G.H. TOCF</i> 12-21-83		
	RELEASE <i>EB</i> 1/11/84		
<h1>ARCHIVE</h1>			
MATERIAL:	SIZE                  DWG NO.                  REV. <b>A</b> 20500-001                  A2		
FINISH:	SCALE                  DO NOT SCALE DWG                  SHEET 1 OF 2		

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## FIGURES

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## 1.0 SCOPE

The Basic SIDEWINDER Tape Cartridge Drive described in this specification is a compact magnetic tape drive specifically designed for fixed-disk memory back-up applications. The drive is designed to record at 10,000 frpi. Capacity specifications assume (1) the use of a (0,2) run length limited code which records one byte (8 bits) in 10 flux transition positions, (2) an interblock postamble, gap and preamble of 15 bytes or less and (3) streaming (continuous) tape motion.

MODEL	SPEED	CAPACITY	PART NUMBER
9050B	90 ips	45/60 Mbytes	80172-001

Run length limited codes (d,k) are recording codes in which flux transitions are separated by at least "d" zeroes but by no more than "k" zeroes.

## 2.0 REFERENCE DOCUMENTS

ANSI X3B5/83-71  
ANSI X3B5/83-72

## 3.0 GENERAL DESCRIPTION

### 3.1 BASIC DRIVE

The SIDEWINDER drive has a basic main frame (Figure 5) on which are mounted the magnetic recording head, capstan drive motor, tape hole sensors, "cartridge in place" and "safe" sensing switches. The drive electronics is packaged on two printed circuit boards, one mounted above and one mounted below the installed tape cartridge. Overall dimensions and mounting points for the drive are shown in Figure 4.

### 3.2 STORAGE MEDIA

Archive Intelligent Tape Drives use the Archive MODEL 09C 8000 BPI Data Cartridge or DC600A as the storage media. The MODEL 09C (Archive part number 20121-001) is a 450 feet long 1/4" wide tape cartridge that is described by ANSI standard X3B5/83-71 and qualified for 8000 BPI operation by Archive. The DC600A (Archive part number 20464-001) is a 600 foot long 1/4" wide tape cartridge described by ANSI standard X3B5/83-72.

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4.0

PERFORMANCE FEATURES

The SIDEWINDER drives are designed for optimum performance in fixed disk back-up applications and as a result embody the following features:

- o 45/60 megabytes of formatted mass storage at low cost for small systems users.
- o Advanced streaming technology heads provide cost effective high density recording:
  1. 28000 bpi (10,000 frpi)
  2. read after write
  3. AC erase
- o Stepper motor positioning offers:
  1. Fast access to track position
  2. Mechanical simplicity and precise positioning
  3. Potential for expanded capacity with same basic device
- o Short forward/reverse tape motion eliminates start friction during head positioning.
- o Industry standard 8" flexible disk DC power voltages.
  1. Simplifies integration into floppy disk based systems.
  2. +24 and +5 VDC power allows for use of available power supplies.
- o Addressability for up to four drives on a single bus including a SELECTED return signal.
- o SELECTED LED indicator light shows when not to remove cartridge.
- o Tape speed controlled by means of a digital, no adjustment capstan servo.
- o Tape position codes (2 bits) allow controller to deal with levels rather than tape hole pulses (see 7.7).
- o EOT/BOT stop control prevents tape from running off reels.
- o Simple mechanical mounting
  1. Use of 8" floppy disk mount or Sidewinder standard mount simplifies integraton and reduces costs.
  2. Light weight (only 2.1 pounds) reduces cost of installation.

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- o Glass reinforced polycarbonate main frame
  1. Light weight
  2. Low cost
  3. Excellent thermal expansion characteristics
  
- o Designed for high volume production
  1. Quality can be maintained at large production levels.
  2. Allows for upward flexibility of production volumes.

5.0 OPERATIONAL SPECIFICATION

5.1 DATA HANDLING

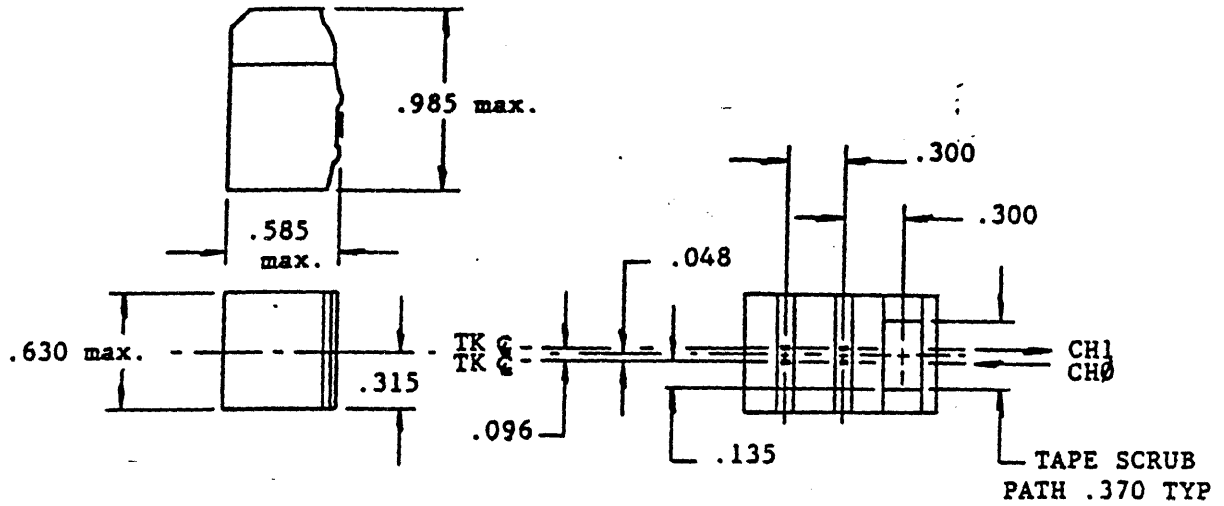
Capacity, Unformatted	48.6 Mbytes (450 foot) 64.8 Mbytes (600 foot)
Capacity, Formatted and Streaming	45 Mbytes (450 foot) 60 Mbytes (600 foot)
Number of Recording Tracks	4
Transfer Rate	90 Kbytes/sec (900 Kfrps) at 90 ips
Recording form	9 track "serpentine"
Recording code	Customer selectable subject to constraints of 7.8 and 7.9
Head Type	Read after write with separate erase bar

Write transfer rate tolerances are controller dependent (see 7.8). Read transfer rate tolerances add +/-10% to account for maximum tape speed variations.

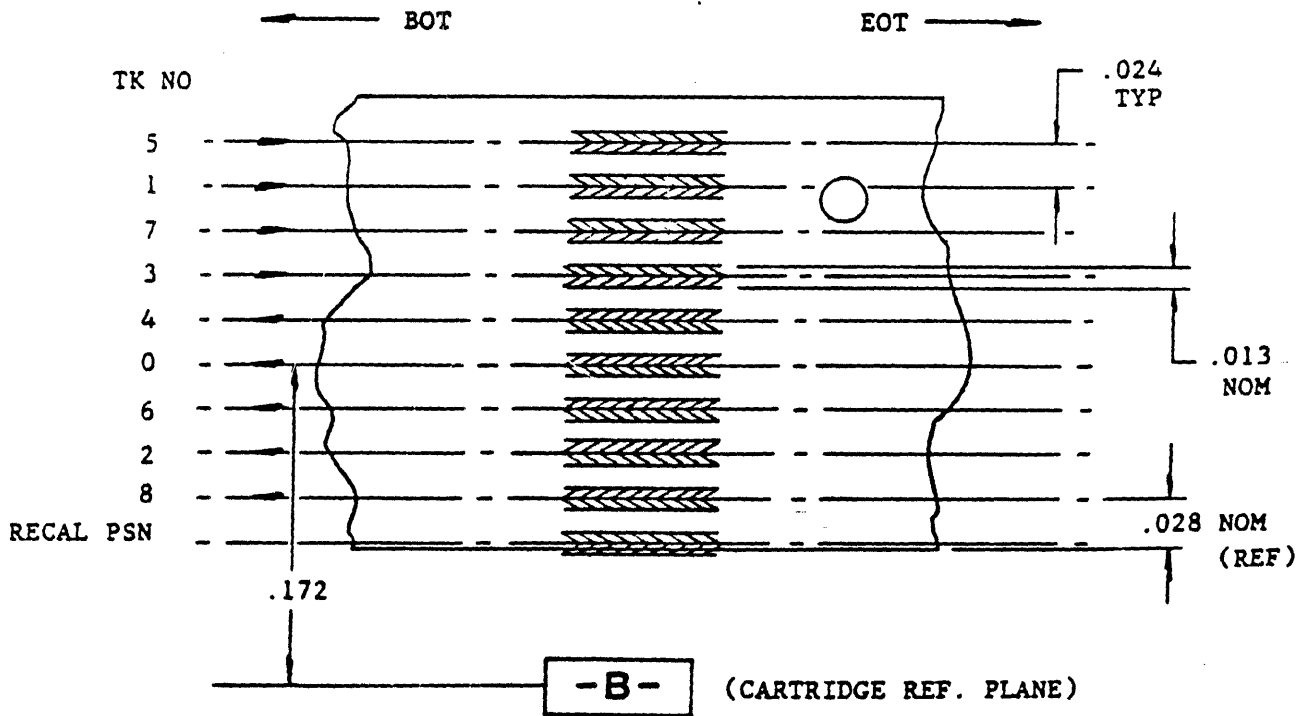
"Serpentine" refers to the technique of recording logically adjacent tracks in opposite directions, even numbered tracks in a forward direction and odd numbered tracks in a reverse direction. Tracks are recorded serially one at a time. This technique eliminates the need of rewinding the tape to read or write the next track of data. The erase bar is full width and is gated with the low order track select bit TK0- allowing erasing of the tape when track 0 or track 2, etc. is selected. See Figure 1 for recording head characteristics, Figure 2 for recording track layout and Figure 3 for tape cartridge characteristics.

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HEAD DETAIL  
 FIGURE 1  
 SCALE: 1:1



TRACK DETAIL  
 FIGURE 2

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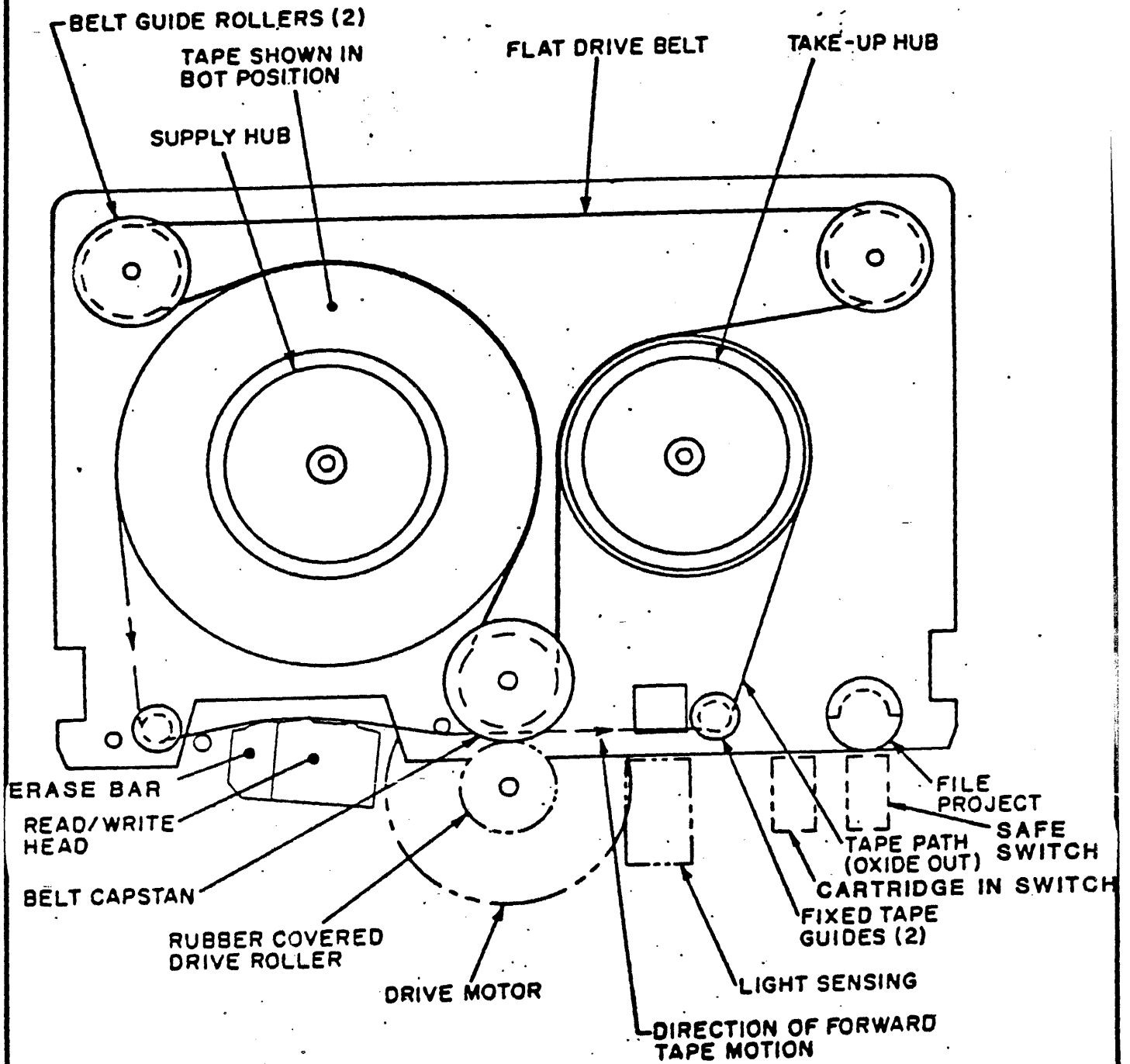


Fig. 3  
Cartridge Diagram

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## 5.2 DATA RELIABILITY

Soft error rate                    Not more than 1 in  $1E8$  bits  
 Hard error rate                    Not more than 1 in  $1E10$  bits

A soft error is one that can be recovered in 16 or less retries. A hard error is one that cannot be recovered in 16 or less retries. Tape dropouts with signal amplitudes less than 35% of nominal are excluded from error rate tests. Archive data encoding and data recovery electronics are used in error rate tests. The Archive 8000 BPI datacartridges is required to achieve these error rates.

(the term  $E = X10$  raised to the power of the number following)

## 5.3 TAPE MOTION

Speed, Read/Write                    90 ips  
 Speed, High Speed                    N/A  
 Speed Variation, Read/Write  
   Short term                            +/-7%  
   Long term                            +/-3%  
 Speed Variation, High Speed  
   Short term                            N/A  
   Long term                            N/A  
 Start/Stop Time                      300 ms max.

Speed Variation is the tape speed variation of the loaded cartridge. Long term variations are measured over a distance in excess of 180 inches of tape.

## 5.4 POWER REQUIREMENTS

DC Voltage	+24 Volts	+5 Volts
Tolerance including max ripple of	+/-10% 500 millivolts	+/-5% 100 millivolts
Current		
standby	0.1 amps nom	1.0 amps max
operational	0.8 amps nom 1.6 amps max	1.0 amps max
tape start surge	2.5 amps max for up to 300 millisecc (may be longer for defective cartridge)	N/A
power on surge	thru 1250 UF max capacitance	thru 50 UF max capacitance
Voltage rise time	N/A	50 msec max, else RST-
Power sequence	turn on 24 VDC before 5 VDC, else use RST-	N/A

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Power Dissipation  
 30 Watts typical  
 50 Watts maximum

The DC Power Connector (J2) is an AMP P/N 1-480426-0. The mating connector (P2) requires an AMP P/N 10480424-0 and uses AMP P/N 60619-1 female contacts. The power connections are as follows:

Pin 1	+24VDC
Pin 2	+24VRET
Pin 3	+5VRET
Pin 4	+5VDC

Pins 2 and 3 are connected together at the drive.

## 5.5 PHYSICAL CHARACTERISTICS

### 5.5.1 DIMENSIONS

	Basic Unit	With 8" Floppy Mount
DEPTH	6.00 +/- .02 in 152.4 +/- .51 mm	14.00 +/- .01 in 336.6 +/- .25 mm
WIDTH	7.75 +/- .02 in 196.9 +/- .51 mm	8.55 +/- .01 in 217.2 +/- .25 mm
HEIGHT	4.5 +0, -.2 in 114.3 +0, -5.1 mm	4.5 +0, -.2 in 114.3 +0, -5.1 mm
WEIGHT	2.1 +/- .1 lb 0.95 +/- .05 kg	3 +/- .1 lb 1.36 +/- .05 kg


### 5.5.2 MOUNTING

Physical mounting of the SIDEWINDER BASIC Drive is achieved either with the Archive standard 1/4" cartridge tape drive mounting (see Figure 4 for mounting hole locations), or an optional 8" floppy disk mount.

The drive is tested for alignment in the horizontal plane and also in the vertical plane with the head below the motor. It is recommended that the units be mounted only in one or other of these orientations.

If the drive is mounted for operation in a dirty environment, positive measures should be taken to ensure that contaminants do not enter the drive.

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The basic SIDEWINDER Drive can be optionally supplied with a front panel. There is no rear panel. All connections are made directly to the printed wiring board via ribbon cable (I/O) and AMP (power) type connectors.

5.5.3 CARTRIDGE LOADING AND UNLOADING

The cartridge is loaded by pushing it to a hard stop through the loading aperture. There is only one orientation of the cartridge which allows it to be loaded.

The cartridge is unloaded by pulling it from the drive.

5.6 MEAN TIME BETWEEN FAILURES

The Mean Time Between Failures (MTBF) shall be greater than 3500 hours. This time includes all power on and operational time but excludes any maintenance periods. The operational versus power on time is assumed to be 30%.


5.7 CLEANING

The recording head should be cleaned after the first 2 hours of tape movement of a new cartridge and thereafter after every 8 hours of tape movement with a lintless cotton swab coated with isopropyl alcohol or IBM Tape Cleaner.

5.8 MEAN TIME TO REPAIR

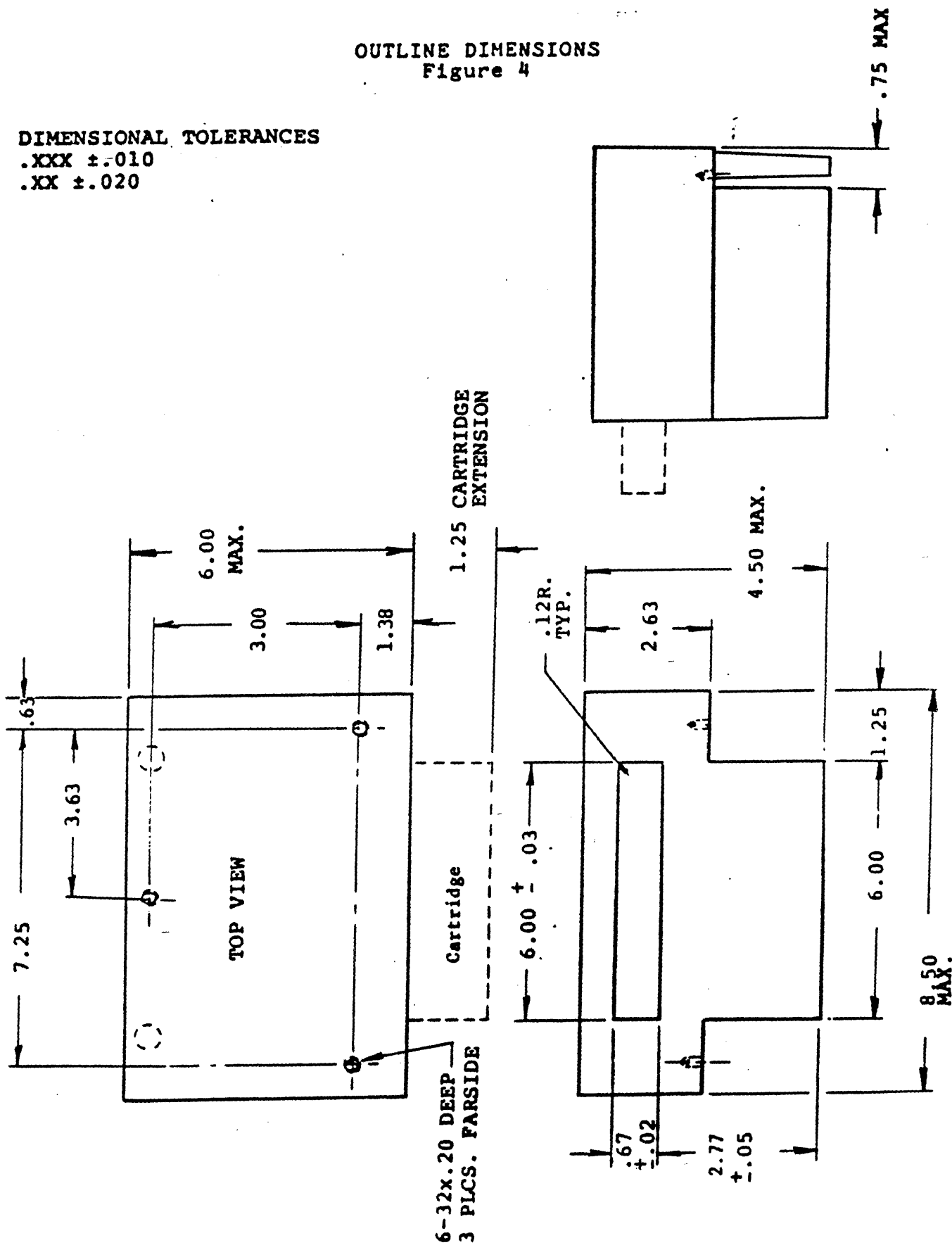
The Mean Time to Repair (MTTR) is the average time required by an Archive Field Engineer (or equivalent) to diagnose and repair a defective Archive Intelligent Cartridge Tape Drive by replacement of any of three major electronic or any of three major mechanical assemblies and shall be less than 0.5 hours over the design life of the product.

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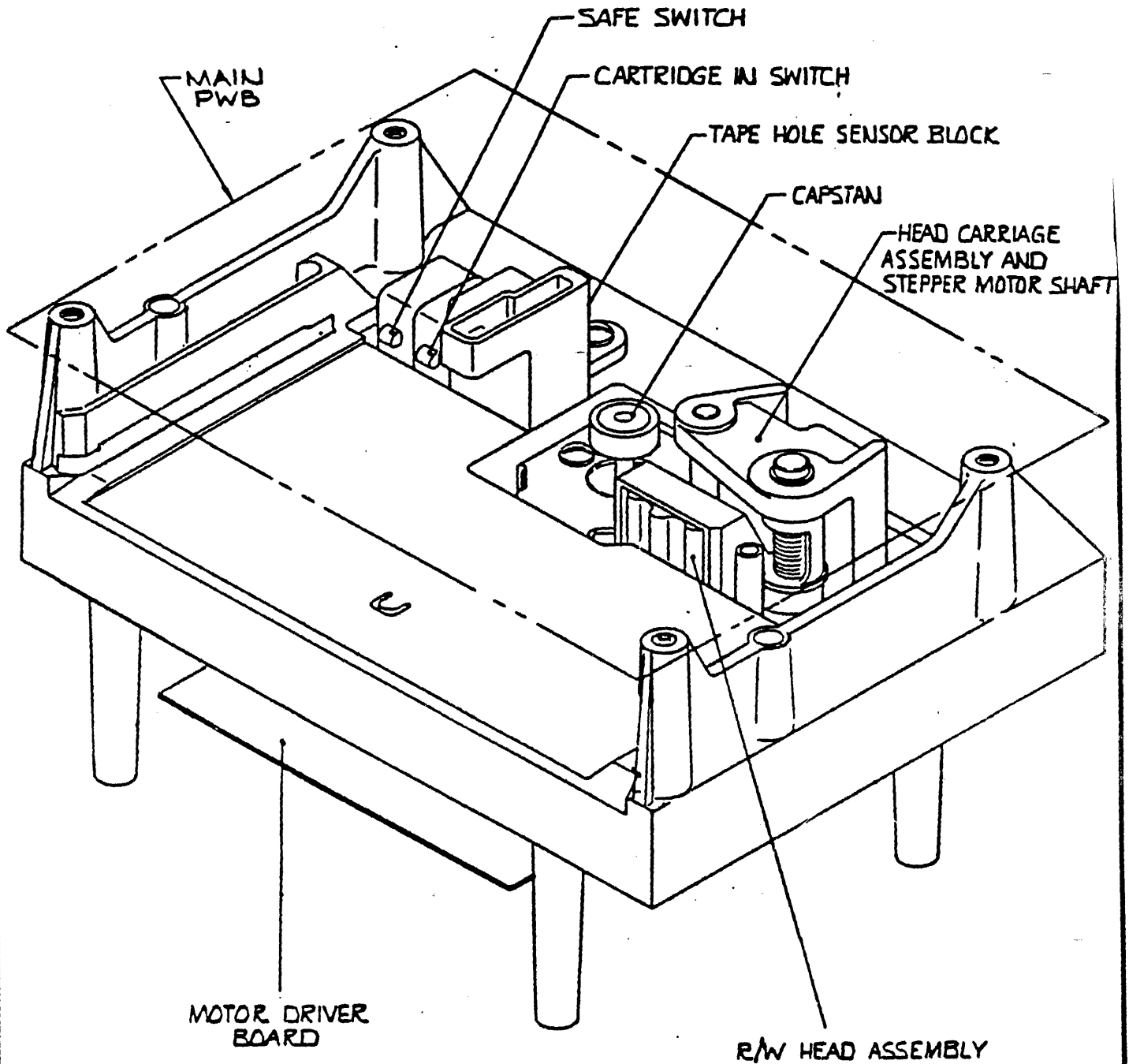
OUTLINE DIMENSIONS  
Figure 4

**DIMENSIONAL TOLERANCES**  
 .XXX ±.010  
 .XX ±.020



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DRIVE MAINFRAME

FIGURE 5

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## 6.0 ENVIRONMENTAL CHARACTERISTICS

### 6.1 TEMPERATURE

Equipment Operational +5 to +45°C  
Equipment Non-Operational -30 to +60°C

### 6.2 RELATIVE HUMIDITY

Equipment Operational 20 to 80% non-condensing  
\* Maximum wet bulb temperature 26°C

Equipment Non-Operational 0 to 99% non-condensing

### 6.3 THERMAL GRADIENT

Equipment Operational 1.0 degree C/min

### 6.4 ALTITUDE

Equipment Operational -200 ft to 15,000 ft  
Equipment Non-Operational -200 ft to 50,000 ft

### 6.5 AMBIENT CONDITIONS

Free air flow is required to prevent the drive ambient temperature from rising above 45 degrees C (113 degrees F) under operating conditions. Otherwise force cooling to achieve the operating temperature requirements should be supplied.

### 6.6 SHOCK

Equipment Operational 2.5 g max., 1/2 sine wave,  
11 msec duration on axis

Equipment Non-Operational 25 g max., 1/2 sine wave,  
Cartridge and Front 11 msec duration on any axis  
Panel Installed

Equipment Non-Operational 50 g max., 1/2 sine wave,  
Cartridge and Front 11 msec duration  
Panel Not Installed on any axis

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## 6.7 VIBRATION

Equipment Operational      0.005 inch max peak-to-peak displacement 0 to 63 Hz, 1 g max acceleration 63 to 500 Hz

Equipment Non-Operational    0.1 inch max peak-to-peak displacement 0 to 17 Hz, 1.5 g max acceleration 17 to 500 Hz

## 7.0 INTERFACE DESCRIPTION

### 7.1 INTERFACE SIGNAL LEVELS

All signals to the Host shall be standard TTL levels as follows:

FALSE, Logic 0 (high) = 2.4 to 5.25 VDC  
TRUE, Logic 1 (low) = 0 to 0.55 VDC

All signals to the Drive shall be standard TTL levels as follows:

FALSE, Logic 0 (high) = 2.0 to 5.25 VDC  
TRUE, Logic 1 (low) = 0 to 0.8 VDC

Voltages shall be measured at the drive connector and the cable length shall not exceed 10 meters.


### 7.2 SIGNAL TERMINATIONS

The Standard termination is 180 ohms to +4.3VDC and 390 ohms to GND. Resistance tolerance is +/-10%. For controller at one end of the bus, all signal lines to controller shall be terminated both at the controller and the last drive; signal lines to drives may be terminated only at the last drive if active pull up drivers (74S240) or (equiv) are used; otherwise terminators at both ends are required. For controller in the middle of the bus, all signal lines shall be terminated at the drives on each end of the bus. (see 7.6)

### 7.3 SIGNAL LOADING

Signal sources from the drive are capable of driving two (2) terminations and one TTL load (1.6 ma). Signals from the controller to the drives are loaded by no more than one TTL load at each drive (4 TTL loads max.) plus required terminations. The controller shall not load the signals from the drive with more than one terminator and one TTL load.

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#### 7.4 INPUT/OUTPUT SIGNAL CONNECTOR

The signal connector on the drive is a 50 conductor edge connector. Mating connector 3M type, 3415-0001 or equivalent may be used.

#### 7.5 I/O PIN ASSIGNMENTS AND SIGNAL DESCRIPTION

PIN#	NAME	TO	DESCRIPTION
02	GO-	D	Go Control for Capstan Servo
04	REV-	D	Direction Control for Capstan Servo
06	TR3-	D	Track Select Bit 3
08	TR2-	D	Track Select Bit 2
10	TR1-	D	Track Select Bit 1
12	TR0-	D	Track Select Bit 0
14	RST-	D	Reset
16	DS3-	D	Drive 3 Select Control
18	DS2-	D	Drive 2 Select Control
20	DS1-	D	Drive 1 Select Control
22	DS0-	D	Drive 0 Select Control
24	HC-	H	High Write Current for DC600 Tape
26	RDP-	H	Read Pulse Output - a pulse per flux transition
28	UTH-	H	Upper Tape Position Code
30	LTH-	H	Lower Tape Position Code
32	SLD-	H	Selected Response from Selected Drive
34	CIN-	H	Cartridge In Place
36	USF-	H	Unsafe - Cartridge Safe Plug is in "unsafe" position (i.e. writing is enabled)
38	TCH-	H	Capstan Tachometer Pulses - each pulse equals 145 +/-3% mils of tape movement
40	WDA-	D	Write Data Signal
42	WDA+	D	Inverse Write Data Signal
44	THR-	D	Threshold - Invokes a 35% qualifying amplitude sequence for the read signal off tape
46	RES	D	Reserved
48	WEN-	D	Write Enable Control
50	EEN-	D	Erase Enable Control

All odd pins are signal returns, are connected to signal GND at the drive and should be connected to signal GND at the Host.

#### 7.6 DRIVE ADDRESSING AND TERMINATIONS

Drive addressing is user programmable by means of the 14 pin shunt in location 2B of the upper drive electronics PWB as shown in Figure 6.

Locations 1A and 3A contain 14 pin 220/330 ohm resistor network DIPS and must be present only in the last Drive or Drives on the Bus as shown in Figure 7.

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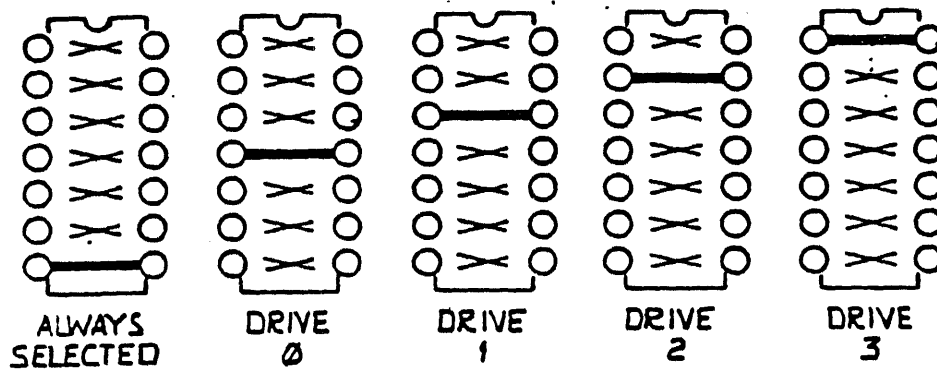
A

SCALE

DO NOT SCALE DWG

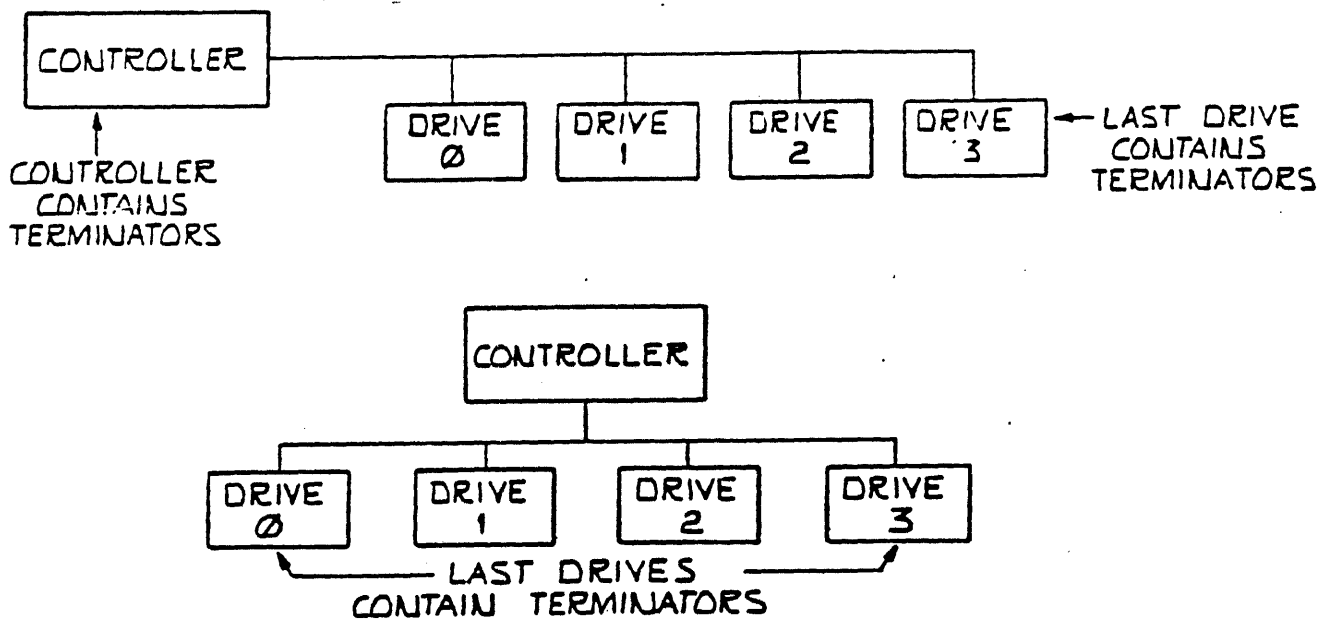
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DRIVE ADDRESSING

FIGURE 6



TERMINATIONS

FIGURE 7

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## 7.7 CONTROLS IMPLEMENTATION AND TIMING

The Drive Control Block Diagram is shown in Figure 8. On power up or assertion of a 13 microsecond or longer pulse on the RST- input signal line, the LSI CONTROL DEVICE performs a 3 second power up initialization and recalibration of the stepper motor positioner to the recalibrate reference position (one track position below track 2, see Fig. 2).

Host control signals SLD, TK1, 2 or 3, REV and GO along with drive tape hole and cartridge in place signals are then scanned at 1.7 msec intervals. When found by the scan, control functions are performed in the following priority:

1. Track position
2. Tape hole responses
3. Motion control.

Host control signals are scanned at the above rates except while the LSI CONTROL DEVICE is performing any of the following:

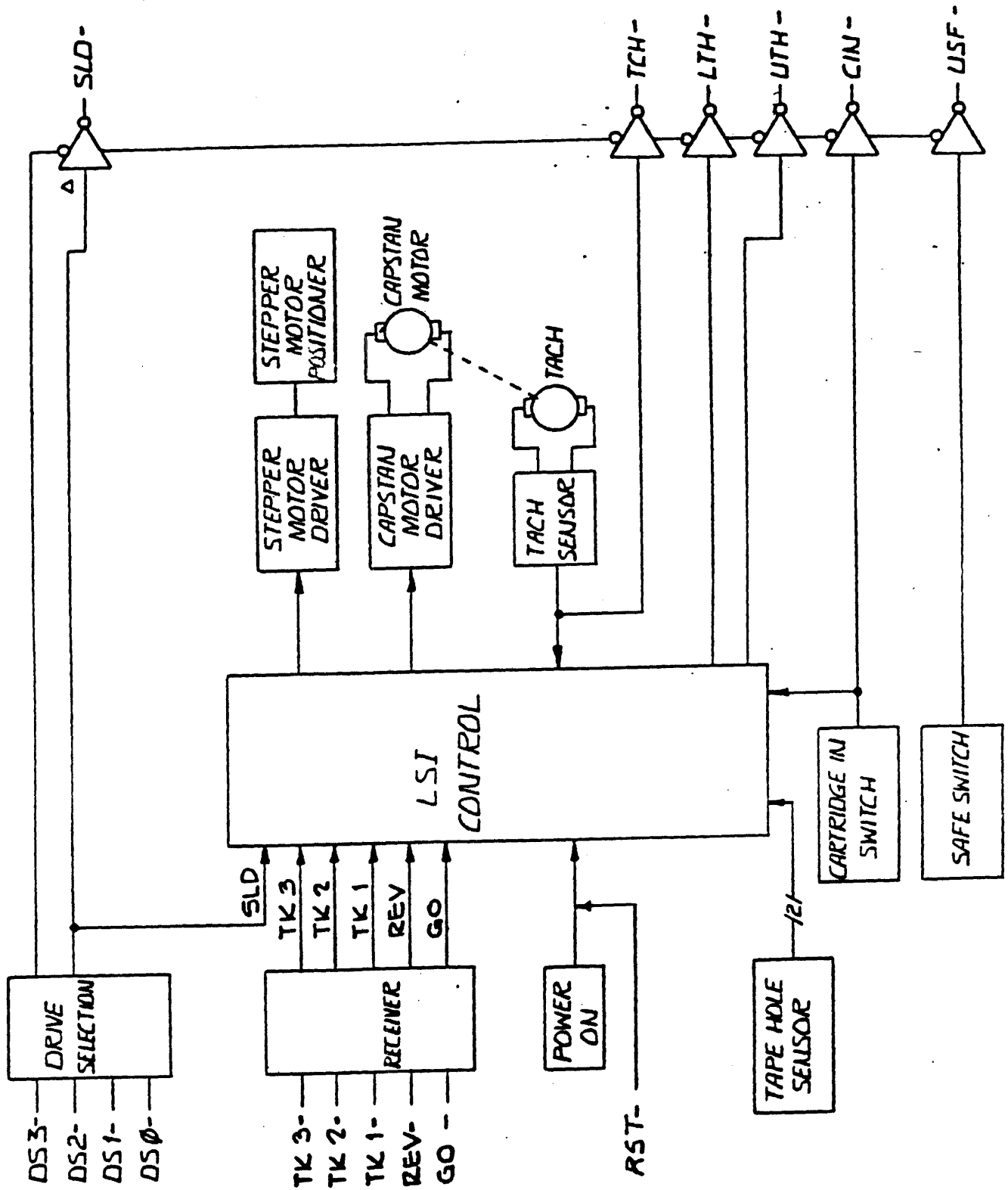
1. Track positioning (500 msec/track)
2. Tape start (300 msec max)
3. Tape stop (300 msec max)

Host control signals are not responded to unless SLD is asserted for the drive. De-assertion of SLD causes a tape stop sequence to occur. When found by the scan, a change in state of TK1, 2 or 3 causes a track position sequence to be performed to locate the recording head on the required track. Typical tape motion timing is shown in Figure 9. Assertion of GO, when found by the scan, causes a tape start sequence in the direction specified by the state of REV. It is permissible to change the state of TK1, 2 or 3 and REV while GO is asserted. Changing the state of TK1, 2 or 3 while GO is asserted causes a stop sequence followed by a track position sequence and a start sequence if GO is still asserted. Changing the state of REV always causes a stop sequence followed by a start sequence in the opposite direction if GO is left active. Removal of the cartridge causes a stop sequence to occur. Insertion of the cartridge causes tape motion functions to be performed. Start sequences include protection against over dissipation of the capstan motor due to stall caused by a defective cartridge by limiting the motor duty cycle to 50 msec on, 1 second off when stalled.

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		SCALE	DO NOT SCALE DWG	SHEET 18 OF 17

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CONTROL BLOCK DIAGRAM

FIGURE 8

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SIZE

DWG. NO.

A

20500-001

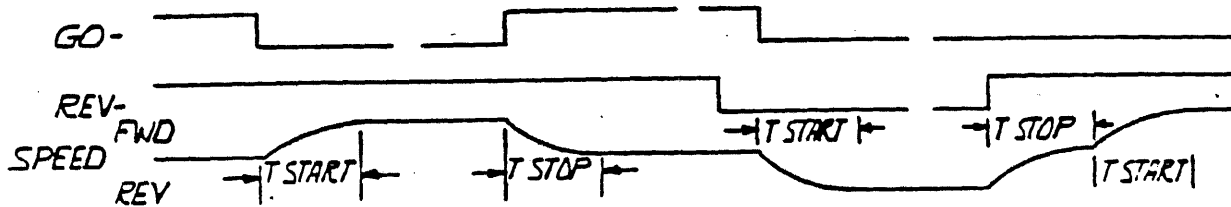
REV

A

SCALE

DO NOT SCALE DWG

SHEET 13 OF 29



T START      300 MSEC MAX  
 T STOP      300 MSEC MAX

MOTION CONTROL TIMING

FIGURE 9

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		SCALE	DO NOT SCALE DWG	SHEET 20 OF 22

Tape position code signals (UTH, LTH) are generated by the LSI CONTROL DEVICE and are defined as follows (see Figure 10):

UTH	LTH	Description
1	1	Beginning of tape position - BOT holes nearest recording area just right of tape hole sensor
0	1	End of tape position - EOT hole nearest recording area just left of tape hole sensor
1	0	Warning zone - between BOT tape holes and Load Point Hole or between Early Warning hole and EOT tape hole
0	0	Recording zone - between Load Point hole and Early Warning hole providing that a beginning of tape position or end of tape position has occurred since the last cartridge insertion (CIN), otherwise this code means "tape position unknown".

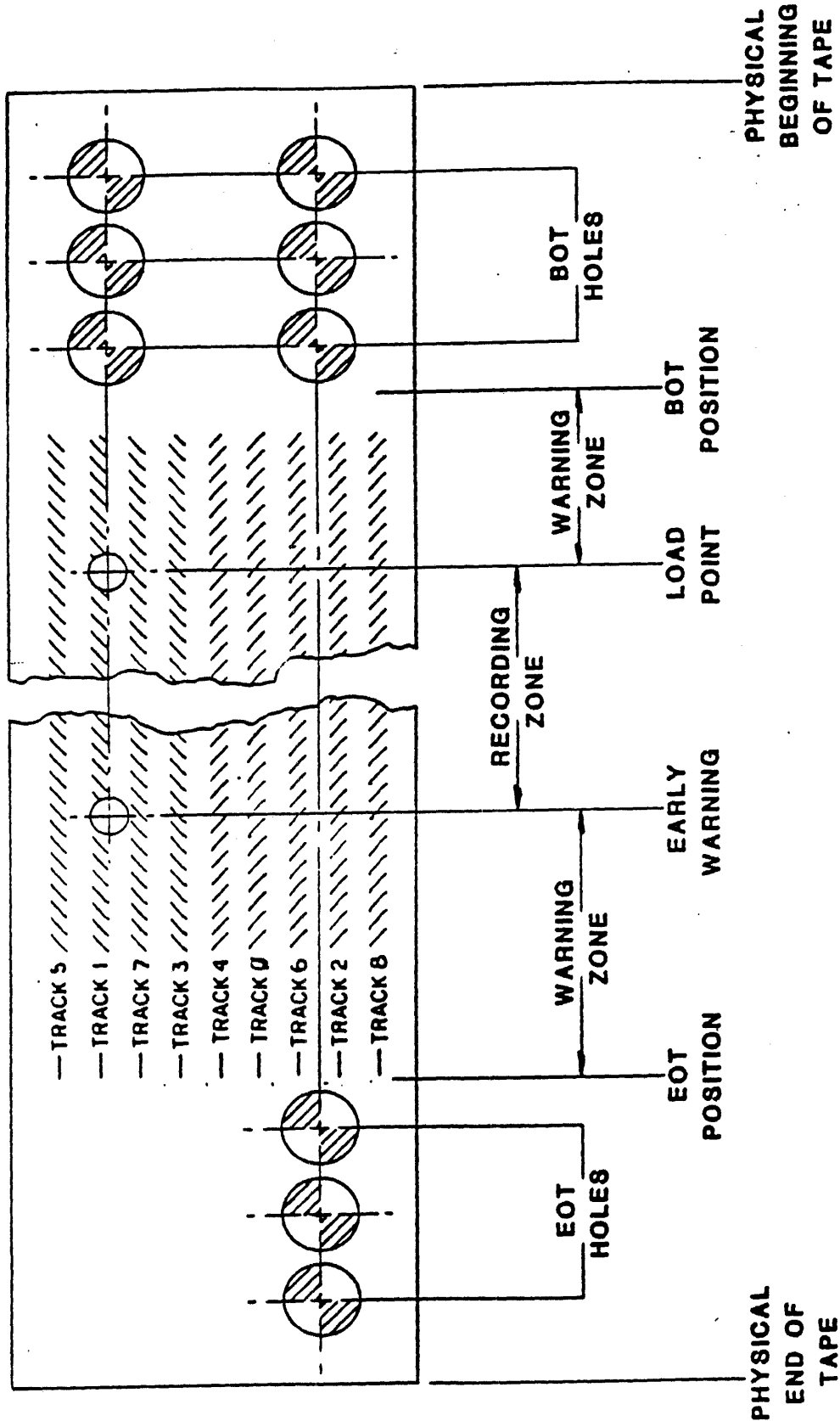
When a cartridge insertion occurs, the position of the tape within the cartridge is unknown until the tape has been moved to BOT or EOT. It is therefore appropriate for the Host to cause a move to one or the other in order to place the tape at a known position. The host can cause the tape to move to the beginning of tape by asserting REV and GO. When the BOT holes are seen by the LSI CONTROL DEVICE, UTH and LTH are both asserted (beginning of tape position code), a tape stop sequence occurs, the host control lines are scanned for FWD (inverse of REV) and GO, and if not found the tape is moved forward until the BOT holes are again seen and then immediately stopped. UTH and LTH will continue to be asserted as long as the Host commands reverse or no tape movement. When FWD and GO are found by the scan, the LSI CONTROL DEVICE asserts the Warning Zone indication prior to initializing the tape start sequence. When the Load Point hole is seen by the LSI CONTROL DEVICE, Recording Zone is asserted. As forward motion continues, the Early Warning hole crosses the sensors and Warning Zone is asserted. When the EOT hole is seen by the LSI CONTROL DEVICE, end of tape position code is asserted, a tape stop sequence occurs, the host control lines scanned for REV and GO and if not found the tape is moved reverse until the EOT hole is again seen and then immediately stopped. End of tape position code will continue to be asserted as long as the Host commands forward or no tape movement. When REV and GO are asserted, the LSI CONTROL DEVICE asserts the Warning Zone indication prior to initializing the tape start sequence. Further events in the reverse direction are analogous to the description of forward events.

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		SCALE	DO NOT SCALE DWG	SHEET 2 OF 2

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← "FORWARD" DIRECTION OF TAPE TRAVEL (OXIDE SIDE OF TAPE SHOWN)



LATCHED TAPE HOLE AND TAPE POSITION HOLE RELATIONSHIPS

FIGURE 10

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TITLE

SIZE

A

DWG. NO.

20500-001

REV

A2

SCALE

DO NOT SCALE DWG

SHEET 22 OF 29

## 7.8 WRITE AND ERASE CHANNELS

The SIDEWINDER write and erase drivers are shown in Figure 11. When enabled (i.e. drive selected and WEN asserted), the write drivers supply current to the selected write head. When WDA+ is false and WDA- is true, positive current is supplied and when WDA+ is true and WDA- is false, negative current is supplied. The other two combinations of WDA+ and WDA- are disallowed when writing is enabled. Head selection is controlled by the low order track bit TK0. Head 0 is connected to the write voltage WRV (selected) when TR0- is false. Head 1 is connected to WRV (selected) when TR0- is true. The write driver can drive current disconnected when the SAFE switch is open or during power up and down of the +5VDC. For full protection of written tapes during power up and down, the host must not activate WEN- or EEN-. The erase head is also connected to WRV when TK0- is false. The erase driver is enabled when the drive is selected and EEN- is asserted. The 3.58MHZ AC erase signal is internally generated by the drive.

The SIDEWINDER write and read channels are designed for high density digital recording and as a consequence low density recording is disallowed. When writing is enabled, data transitions must occur only at intervals of 1.11, 2.22, or 3.33 usec +/-1%. The recording code used must comply with these requirements.

The HC- interface line is used to increase the write current so as to optimize the writing of DC600 tapes. If the incorrect write current is used for either type of data cartridge, then data reliability cannot be guaranteed. The 600 foot cartridge can be distinguished from the 450 foot cartridge by the length of the warning zone from BOT to load point. The distance is 36 inches (400 msec at 90 ips) for the 450 foot cartridge and 48 inches (530 msec at 90 ips) for the 600 foot cartridge.

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TITLE

SIZE

DWG. NO.

REV

A

20500-001

A

SCALE

DO NOT SCALE DWG

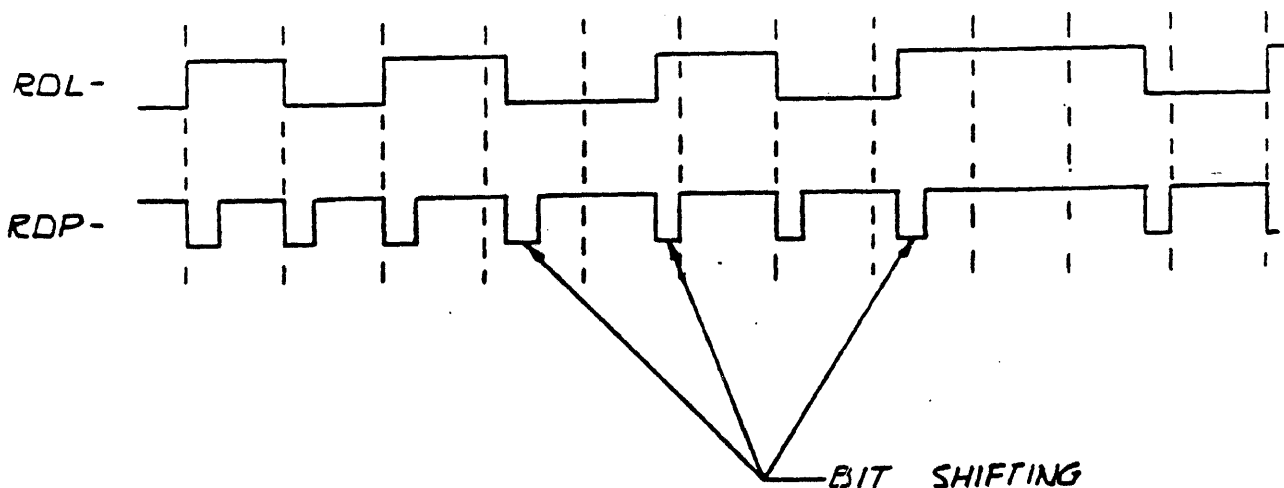
SHEET 23 OF 23

## 7.9 READ CHANNEL

The SIDEWINDER read channel is shown in Figure 13. Selection of the read head is controlled by  $TK\theta^-$ . Read head 0 is selected when  $TK\theta^-$  is false while Read head 1 is selected when  $TK\theta^-$  is true. For READ only operations the signal from the selected read head is amplified, differentiated and filtered, amplified again, and converted to logic level by a comparator and limiter. Transitions of duration less than half a data transition period are removed by the time domain filter from the read level signal ( $RDL^-$ ). The read level signal ( $RDL^-$ ) resembles write data ( $WDA^-$ ) and read pulses ( $RDP^-$ ) are generated at each transition of  $RDL^-$  as shown in Figure 12. For READ-AFTER-WRITE operations, a 35% of nominal signal amplitude threshold is invoked to eliminate marginal recording areas from the magnetic media.

The controller designer should allow bit shifts (deviations of read level transitions) of up to  $\pm 0.41$  usec for tape recording areas in which the signal amplitude is not less than 35% of nominal. Peak shifts of up to  $\pm 1/2$  a data transition period and greater may occur in recording areas in which the signal amplitude is less than 35% of nominal.

SIDEWINDER read channels are not designed to read data from a track in the opposite direction to which it was recorded.



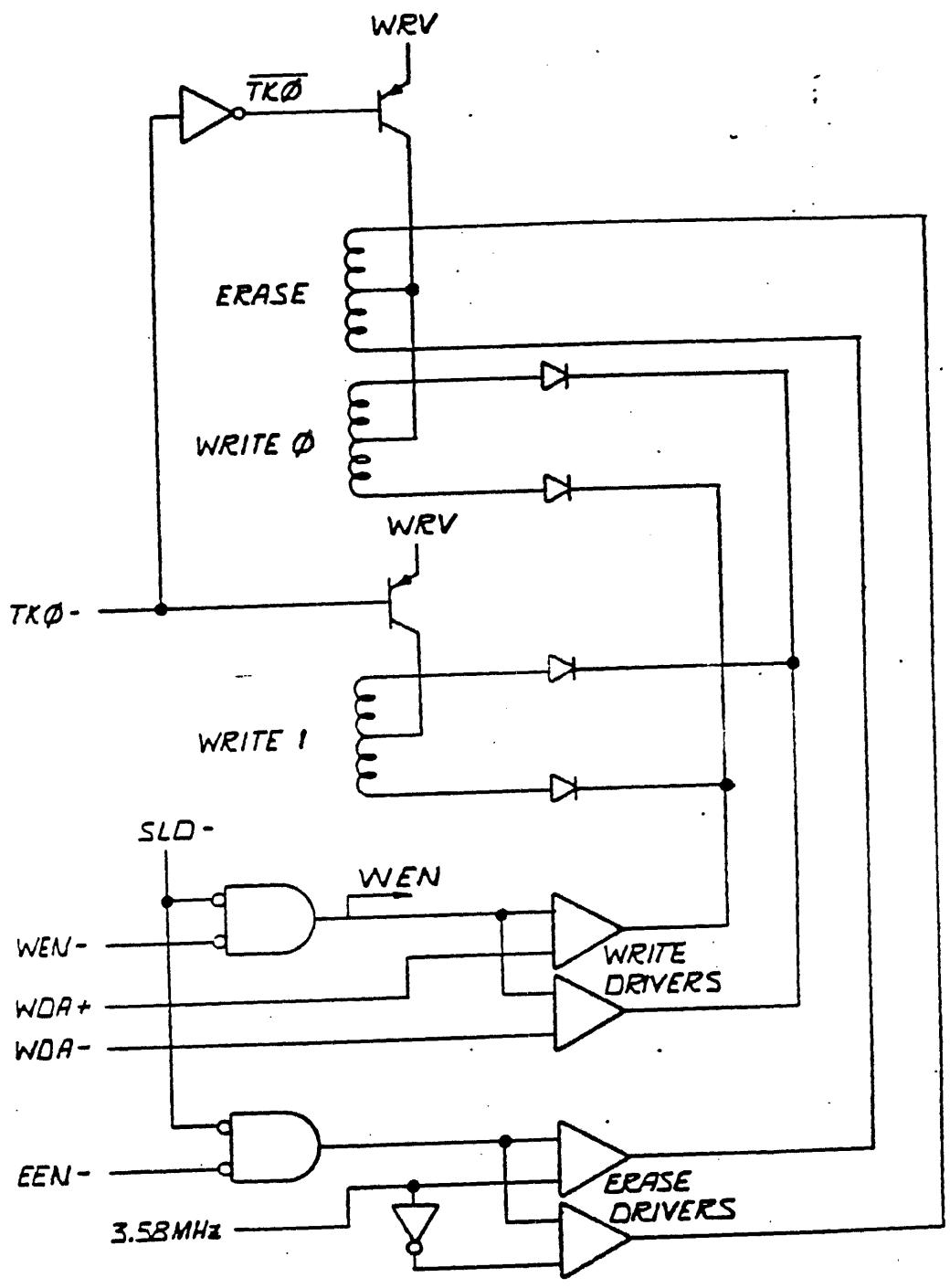
READ SIGNALS  
FIGURE 12

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		A	20500-001	A2
		SCALE	DO NOT SCALE DWG	SHEET 24 OF 29



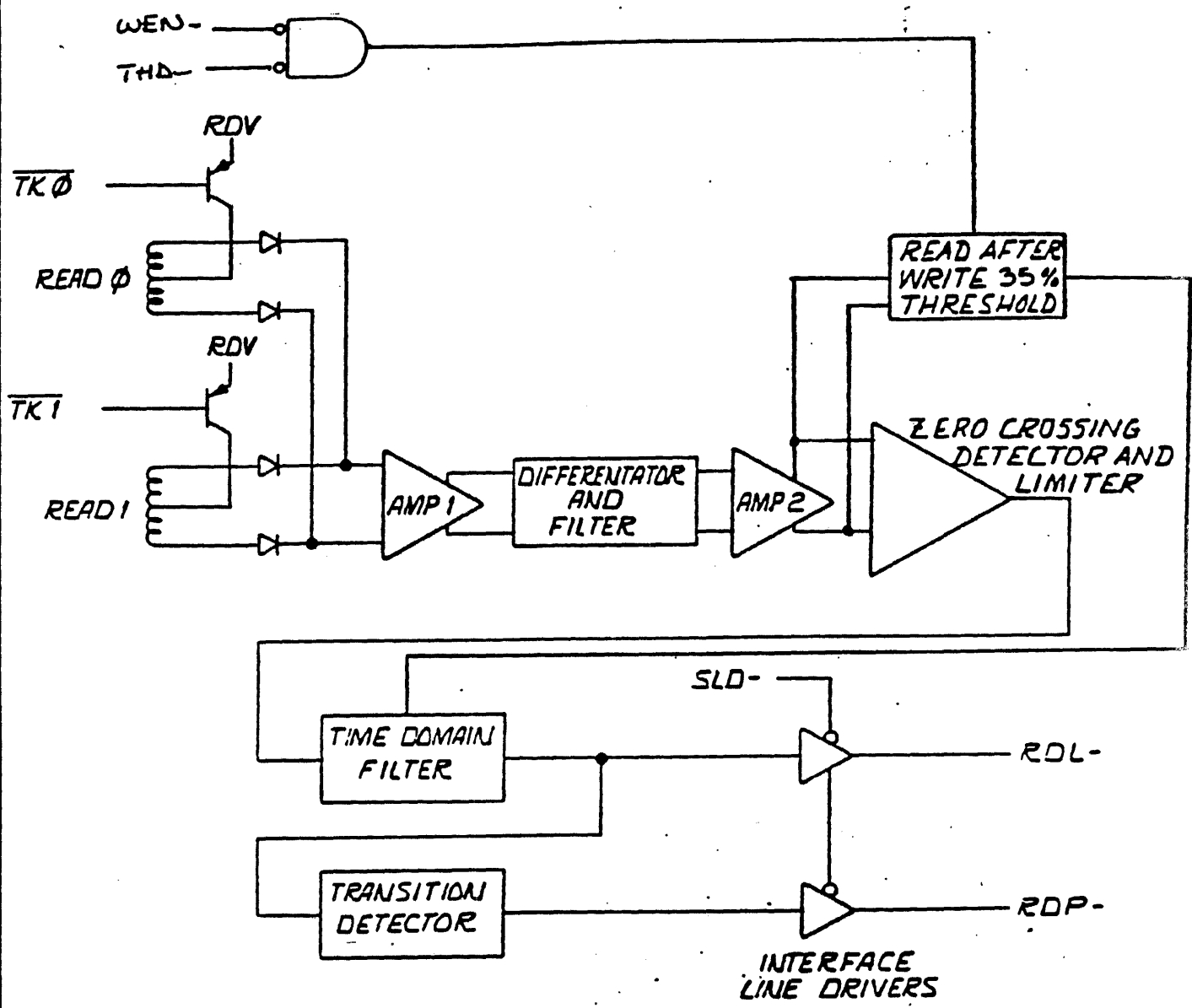
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WRITE AND ERASE DRIVERS

FIGURE 11

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		A	20500-001	AC
SCALE		DO NOT SCALE DWG		SHEET 25 OF 25



**READ CHANNEL**  
**FIGURE 13**

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		SCALE	DO NOT SCALE DWG	SHEET 26 OF 27

## 8.0 APPLICATION NOTES

It is assumed that the controller designer is familiar and has a working knowledge of high density self-clocking codes, phase lock loops, organizing of data into blocks, CRC codes, etc.. These application notes address only those items requiring special attention due to unique properties of the SIDEWINDER, the cartridge tape, and the serpentine recording form.

### 8.1 VCO AND PHASE LOCK LOOP

A voltage controlled oscillator and phase lock loop is a requirement for synthesizing an adequate read clock which tracks tape ISV (instantaneous speed variation) and allows reliable recovery of high density data. Further, a 3rd order (minimum) wide band phase lock loop filter is required to allow the synthesized read clock to track ISV frequencies which have been observed as high as 20 KHz. The high frequency ISV components are caused by longitudinal shock (sound) waves propagating between tape reels which are caused by "tape snap", a result of tension equalization between adjacent outside layers of tape occurring when tension differential forces exceed friction forces.

### 8.2 RETENSION

Tension between reels of the cartridge tape is required to maintain proper tape head contact for reliable recording. Tape tension in the cartridge tape is achieved by differential tension between the tape reels, i.e. the take up reel is maintained at a higher tension than the supply reel by the iso-elastic band. Since the tape must be run both forward and backward, a reel is always being unwound at less tension than it was wound. Should "tape slip" occur, tape tension required for good head media contact may be lost which results in data errors.

Cartridge tape manufacturers recommend a retension pass to correct this problem. A retension pass consists of continuous forward tape motion beginning at BOT and ending at EOT followed by continuous reverse tape motion from EOT to BOT. The controller designer should provide a means by which the user can cause a retension pass when necessary. A retension pass requires 2 minutes.

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		A	20500-001	A
		SCALE	DO NOT SCALE DWG	SHEET 27 OF 27

### 8.3 ERASE PASS

An erase pass on the cartridge tape is useful for removing all previously written data so that no matter how little of track 0 may be written, there will be no data beyond that which was most recently written. An erase pass requires 2 minutes.

### 8.4 OVERWRITE

The SIDEWINDER is not designed to overwrite previously written data, it is designed to write only on tapes erased by the SIDEWINDER erase head. The controller designer should make it impossible for the user to cause an overwrite situation to occur.

### 8.5 REPOSITIONING THE TAPE

Historically tape drives have been designed to start and stop within interblock gaps which separate data blocks to allow blocks to be identified by a block count. Block identification is essential for rewrites of blocks inadvertently written in dropout regions of the tape, for repositioning the tape during read retries, and for resumption of a read or write operation after a tape stop. The SIDEWINDER's long start/stop time and the requirement of very short gaps between records to achieve high capacity are both inconsistent with block counting. Therefore blocks must be identified with an address field which will allow the host (controller) to identify blocks. A 16 bit (2 byte) field is recommended for this purpose which will allow the controller to identify a block which is as much as +32,767 or -32,768 blocks away from present position. Approximately 20,000 256-byte blocks can be written on one track. A 2 byte address field will allow unique identification of each of these blocks. Tape repositioning can then consist of stop, back up behind the desired block and then run in the original direction. If the read head is still not behind the desired block, the process may be repeated.

When repositioning to the last block written to resume a halted write operation, the controller designer should keep in mind that the write head is 0.300 inches ahead of the read head and that this amount of recording length will be lost each time streaming operation is halted.

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		A	20500-001	A
		SCALE	DO NOT SCALEDWG	SHEET 28 OF 29

## 8.6 READ AFTER WRITE CHECK

The elimination of hard errors is the goal of both the controller designer and the drive designer as well as the user. In order to avoid hard errors, user data must not be recorded in marginal recording areas of the cartridge tape. Marginal recording areas of the cartridge tape are normally found by the controller by means of the read after write check whereby those blocks found to be in error by the read after write check are rewritten in different recording areas. The effectiveness of this technique is much enhanced when more stringent recording requirements are placed on the read after write check so that margin is gained for subsequent read operations. The penalty for more stringent read after write recording requirements is that more blocks will be rewritten than otherwise would be. However, a few tens of rewrites on a tape containing tens of thousands of blocks is a small sacrifice to obtain a cartridge tape which, with proper care, may have no hard error throughout its useful life.

More stringent read after write recording requirements are provided by the 35% threshold capability of the drive (Section 7.9 and Figure 13). Additional margin may be obtained in the controller by use of a "75% window" centered on the expected data transition position. Data transitions occurring outside the window during the read after write check are not used thereby causing a read after write error and subsequent rewrite of the block. For read only operations, a full 100% window should be used. This technique is used in the ARCHIVE Intelligent Drive.

## 8.7 Compatibility with 9020 and 3020

Model 09C Cartridge tapes written on 9020I or 3020I Drives are readable on the 9045I. Data cannot be appended to such tapes by the 9045I. Nor can tapes written by the 9045I be read reliably by the 9020I or 3020I. Compatibility of the 9045B applies to applications in the Archive Intelligent Drives.

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TITLE

SIZE

A

DWG. NO.

20500-001

REV

A2

SCALE

DO NOT SCALE DWG

SHEET 29 OF 29

# Tape Cartridge

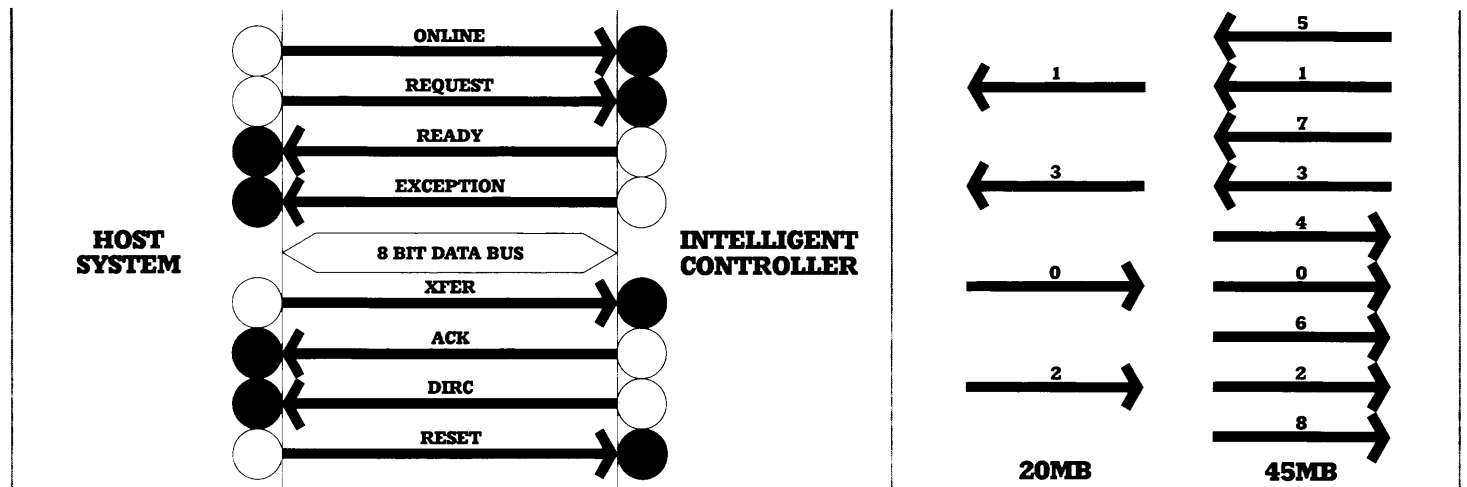
The tape cartridge plays a very important role in the overall data reliability of the 1/4-inch streaming tape drive.

Standard 1/4-inch cartridges offer a unique combination of low media costs, high capacities, adequate transfer rates, compact size and virtually foolproof operation, and they are available in a variety of tape capacities. Industry-standard 4-inch by 6-inch cartridges with 450-feet of tape can store up to 45 MB of data in a streaming format. With the 600-foot cartridge, capacities of 60 MB are possible.

The SIDEWINDER and SCORPION tape cartridge eliminates the problem of dust, stray fingerprints and creases which can destroy data. The written tape is entirely enclosed inside the cartridge when removed from the drive. Contamination is virtually eliminated. Qualified tape cartridges are available through Archive Corporation.



## Simplified QIC-II Interface



**20MB and 45MB Track Formats:** Both serpentine formats are provided by use of a dual read/write head in conjunction with stepper-motor positioning. Efficient data block format achieves 97% utilization of tape. The track layout enables reading tapes written on a 20MB Side-winder by the 45MB Super Sidewinder.

# Specification Summary

## Scorpion

## Sidewinder

	5320	5920	5945	3020	9020	9045
<b>Data Handling</b>						
Transfer Rate	30 Kbytes/Sec.	90 Kbytes/Sec.	90 Kbytes/Sec.	30 Kbytes/Sec.	90 Kbytes/Sec.	90 Kbytes/Sec.
Capacity:						
Unformatted	21.6MB	21.6MB	48.6MB	21.6MB	21.6MB	48.6MB
Formatted	20MB	20MB	45MB	20MB	20MB	45MB
Recording Tracks/Format	4 Track Serpentine	4 Track Serpentine	9 Track Serpentine	4 Track Serpentine	4 Track Serpentine	9 Track Serpentine
Recording Code	(0,2) Run Length Limited	(0,2) Run Length Limited	(0,2) Run Length Limited	(0,2) Run Length Limited	(0,2) Run Length Limited	(0,2) Run Length Limited
Head Format	Read while write with separate erase	Read while write with separate erase	Read while write with separate erase	Read while write with separate erase	Read while write with separate erase	Read while write with separate erase
Recording Density	8,000 BPI	8,000 BPI	8,000 BPI	8,000 BPI	8,000 BPI	8,000 BPI
Tape Speed	30 IPS	90 IPS	90 IPS	30 IPS	90 IPS	90 IPS
Flux Density	10,000 FRPI	10,000 FRPI	10,000 FRPI	10,000 FRPI	10,000 FRPI	10,000 FRPI
<b>Data Reliability</b>						
Recoverable Error Rate	No more than 1 in 10 <sup>8</sup> bits	No more than 1 in 10 <sup>8</sup> bits	No more than 1 in 10 <sup>8</sup> bits	No more than 1 in 10 <sup>8</sup> bits	No more than 1 in 10 <sup>8</sup> bits	No more than 1 in 10 <sup>8</sup> bits
Non-recoverable Error Rate	No more than 1 in 10 <sup>10</sup> bits	No more than 1 in 10 <sup>10</sup> bits	No more than 1 in 10 <sup>10</sup> bits	No more than 1 in 10 <sup>10</sup> bits	No more than 1 in 10 <sup>10</sup> bits	No more than 1 in 10 <sup>10</sup> bits
<b>Device Reliability</b>						
MTBF	> 5,000 hours	> 5,000 hours	> 5,000 hours	> 5000 hours	> 5000 hours	> 5000 hours
MTTR	< 30 minutes	< 30 minutes	< 30 minutes	< 30 minutes	< 30 minutes	< 30 minutes
<b>Environmental</b>						
Operation Temperature	+5 to +45°C (+41° to +113°F)	+5 to +45°C (+41° to +113°F)	+5 to +45°C (+41° to +113°F)	+5 to +45°C (+41° to +113°F)	+5 to +45°C (+41° to +113°F)	+5 to +45°C (+41° to +113°F)
Storage Temperature	-30° to +60°C (-22° to +140°F)	-30° to +60°C (-22° to +140°F)	-30° to +60°C (-22° to +140°F)	-30° to +60°C (-22° to +140°F)	-30° to +60°C (-22° to +140°F)	-30° to +60°C (-22° to +140°F)
Relative Humidity (Non-condensing)	20 to 80%	20 to 80%	20 to 80%	20 to 80%	20 to 80%	20 to 80%
Maximum Wet Bulb Temperature	26°C	26°C	26°C	26°C	26°C	26°C
Altitude	-1000 to +15,000 ft.	-1000 to +15,000 ft.	-1000 to +15,000 ft.	-1000 to +15,000 ft.	-1000 to +15,000 ft.	-1000 to +15,000 ft.
<b>Tape Motion</b>						
Speed (Not Selectable):						
Read/Write	30 IPS	90 IPS	90 IPS	30 IPS	90 IPS	90 IPS
Rewind	90 IPS	90 IPS	90 IPS	90 IPS	90 IPS	90 IPS
Speed Variation (with loaded cartridge):						
Short Term	±7%	±7%	±7%	±7%	±7%	±7%
Long Term	±3%	±3%	±3%	±3%	±3%	±3%
Start/Stop Time	100 mSec.	300 mSec.	300 mSec.	100 mSec.	300 mSec.	300 mSec.
<b>Power</b>						
Requirement	+12V ±5% 1.1A nom. 3.7A max.	+12V ±5% 1.3A nom. 3.7A max.	+12V ±5% 1.3A nom. 3.7A max.	+24V ±10% 0.8A nom.	+24V ±10% 0.8A nom.	+24V ±10% 0.8A nom.
Basic Unit	+5V ±5% C 1A max.	+5V ±5% C 1A max.	+5V ±5% C 1A max.	+5V ±5% C 1A max.	+5V ±5% C 1A max.	+5V ±5% C 1A max.
Intelligent Unit	+5V ±5% C 3.3A max.	+5V ±5% C 3.3A max.	+5V ±5% C 3.3A max.	+5V ±5% C 3.5A max.	+5V ±5% C 3.5A max.	+5V ±5% C 3.5A max.
<b>Power Dissipation (Calculated)</b>						
Typical:						
Basic	17 Watts	20 Watts	20 Watts	30 Watts	30 Watts	30 Watts
Intelligent	25 Watts	28 Watts	28 Watts	35 Watts	35 Watts	35 Watts
Maximum:						
Basic	23 Watts	27.5 Watts	27.5 Watts	50 Watts	50 Watts	50 Watts
Intelligent	36 Watts	40 Watts	40 Watts	60 Watts	60 Watts	60 Watts
<b>Physical Dimensions (Nominal)</b>						
Height (inches/cm)	1.625/4.126 (B) 3.25/8.252 (I)	1.625/4.126 (B) 3.25/8.252 (I)	1.625/4.126 (B) 3.25/8.252 (I)	(Intelligent Unit) 4.5/11.4	(Intelligent Unit) 4.5/11.4	(Intelligent Unit) 4.5/11.4
Width (inches/cm)	5.75/14.605	5.75/14.605	5.75/14.605	8.55/21.7	8.55/21.7	8.55/21.7
Depth (inches/cm)	8.0/20.32	8.0/20.32	8.0/20.32	10.0/25.4	10.0/25.4	10.0/25.4
Weight (pounds/kg)	3.0/1.36 (B) 4.0/1.82 (I)	3.0/1.36 (B) 4.0/1.82 (I)	3.0/1.36 (B) 4.0/1.82 (I)	3.5/1.5	3.5/1.5	3.5/1.5
Dimensions are exclusive of face plate.						
<b>Media</b>						
	ANSI Standard X3.55—1977 450 ft. 600 ft.	ANSI Standard X3.55—1977 450 ft. 600 ft.	ANSI Standard X3.55—1977 450 ft. 600 ft.	ANSI Standard X3.55—1977 450 ft.	ANSI Standard X3.55—1977 450 ft.	ANSI Standard X3.55—1977 450 ft. 600 ft.