Diablo Systems Incorporated

Series 30 Disk Drives

Models 31, 33, 33F

Product Description

PREFACE

The purpose of this manual is to provide the prospective user of a Diablo Series 30 Disk Drive with the units various characteristics, capabilities and specifications.

Comments on this manual or its use are invited.

"Diablo" is a trademark of Diablo Systems, Inc.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

GENERAL DESCRIPTION AND SPECIFICATIONS

Figure 1-1   SERIES 30 DISK DRIVES

1.1   INTRODUCTION

The Diablo Series 30 Disk Drives are compact, lightweight, random access storage devices. Their utilitarian design and field proven reliability make them well suited for use in small computer systems, data aquisition systems, terminals, and other storage applications.

The Series 30 Drives include Models 31, 33F and 33. Model 31 is the basic version, and the major subject of of Series 30 publications. It features operator exchangeable Type 2315 Single Disk Cartridges. Model 33F is identical to the Model 31 except that its disk cartridge is "locked in" and requires a technician to change the cartridge. The 33F's front panel door is eliminated along with the associated interlock circuitry. The front panel LOAD/RUN switch and the LOAD, READY, and CHECK indicator lights are also eliminated in the Model 33F. The Model 33 consists of one each Model 31 and Model 33F.

1.2   GENERAL SPECIFICATIONS

1.2.1   Disk Format
The recording disk is a 14" aluminum plate which has been precision ground for flat and parallel surfaces. Its two surfaces are then coated with a 50-250 microinch thick layer of gamma-ferric oxide magnetic recording material and precision burnished to a flatness on the order of 30 microinches. These carefully prepared surfaces allow recording heads to "fly" in close proximity to them (within 70 microinches) without physical contact, which in turn allows extremely dense recording techniques. The disk is then mounted on a spindle and rotated at a constant speed.

The Diablo read/write (recording) head consists of two sets of coils and associated pole pieces arranged at right angles to each other and mounted on a circular ceramic head shoe. The design of this shoe utilizes the "boundary layer" of air associated with the rapidly moving disk surface to keep it from actual contact with the surface, even under mild spring pressure from its support arm.

Figure 1-2 illustrates the shoe, and shows the two "bleed" holes which control the pressure of the entrapped air, and thus the height at which the shoe will "fly". It should be noted that disk surface cleanliness is an absolute must since the 70 microinches flying height is less than the thickness of a fingerprint.
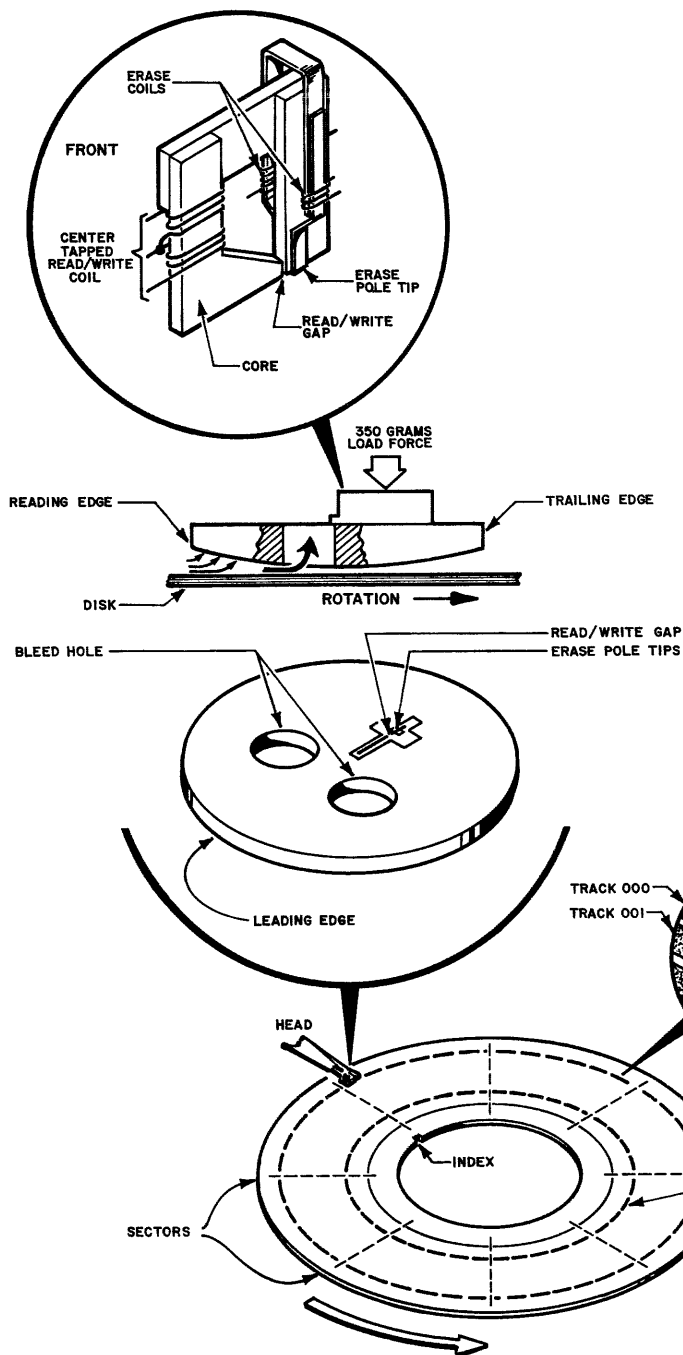
Figure 1-2 DIABLO READ/WRITE HEADS AND RECORDING TECHNIQUES

Data is recorded in concentric rings on each disk surface by positioning the heads accurately over the desired ring or "track" area. As data is recorded, dc current is passed through the erase coils to "trim" or dc erase a narrow band on each side of the recorded track, to provide a "dead" band between recorded tracks. Each disk side provides room for up to 203 recording tracks (200 normally used with 3 spares). Corresponding upper and lower tracks on the same disk are referred to as one "cylinder". The tracks are approximately 0.010" apart center to center, with an erased band approximately 0.003" wide in between to prevent cross-talk.

Each disk is provided with a metal ring containing an indexing slot and up to 24 "sector" slots (presently available are sector rings with 8, 12, 16, 20, or 24 slots, with 8 the standard. A 32 sector ring is available as a special option). These slots are detected electronically, and used to first "align" the disk with its addressing circuitry, and then to divide the recording tracks into segments, or sectors. Data may then be identified by its track and sector address for accurate retrieval.

Figure 1-3 illustrates the track-sector concept. Diablo disk drives utilize the double frequency method for recording data on the disks. In the double frequency recording method, a flux transistion (or polarity change) is recorded for each input pulse. Clock pulses are used to record transistions on the disk at regular intervals. The period of time between these transistions is referred to as a "bit cell". An additional pulse or transistion within the bit cell is a bit "1". A bit cell without the additional pulse or transistion is designated a bit "0".

Figure 1-4 illustrates the arrangement of a typical double frequency recording sequence for recording data in one sector of one track on one side of the disk.

The read/write heads are mounted on movable arms so they may be positioned over the rotating disk surfaces in their "flying" condition, one on each side of the disk. The larger read/write pole pieces are aligned circumferentially with the disk, while the smaller erase pole pieces straddle the larger and are aligned radially with the disk.

1.2.2 Power Requirements

Voltages: +15 VDC ±5% @ 8A Peak 4A Average
−15 VDC ±5% @ 8A Peak 4A Average
Power: Less than 100 watts

The Diablo Model 215 Power Supply was designed to supply power to Series 30 units.
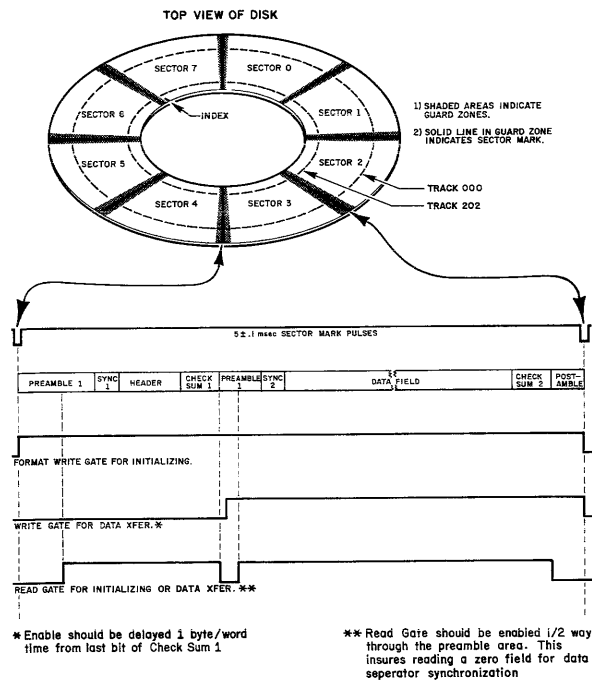
Figure 1-3 TYPICAL TRACK-SECTOR FORMAT
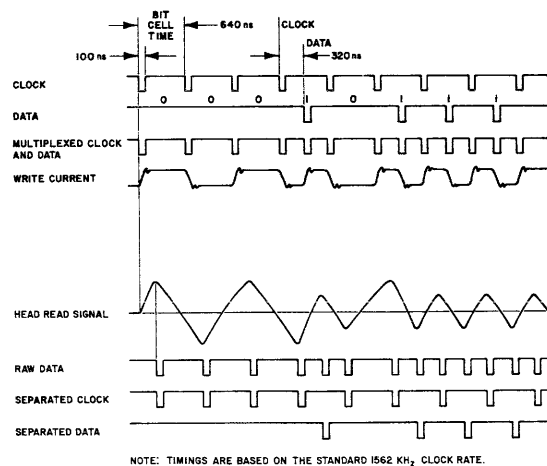
Figure 1-4 DOUBLE FREQUENCY RECORDING

1.2.3 Physical Characteristics

Width - 17½ inches
(19 inches with rack mount flanges)
Depth - 22-7/8 inches
(25¾ inches with connectors)
Height - 6½ inches (table model)
Weight - 43 pounds

1.2.4 Environmental Considerations

Temperature - 60-90°F ambient, to ensure cartridge interchangeability
Relative Humidity - 20-80% with no condensation

1.2.5 Features

The Series 30 Disk Drives offer several features which enhance their use by OEM customers.

Compatibility - Series 30 Drives are designed to be compatible with systems designed for other equipment.

Daisy-Chain Operation - Series 30 Drives may be operated in daisy-chain fashion with up to four units per chain. They may also be intermixed with Series 20 and Series 40 Drives in chains of up to 4 units.

Options - Several options are offered with the Series 30, to enhance its utilization in special situations. These are discussed in Section 6, and include interconnecting cables and terminators.

1.3 PERFORMANCE SPECIFICATIONS

Table 1-1 lists the performance specifications for the standard and high-density Series 30 Disk Drives:

TABLE 1-1
PERFORMANCE SPECIFICATIONS
SERIES 30 DISK DRIVES

Operating Characteristics

Recording Disk:	IBM Type 2315 or equivalent
Rotation (Spindle) Speed:	1500 RPM ± 1%
Type of Recording:	Double Frequency

Access Times

Average Latency	20 milliseconds
Head Positioning	
Track to adjacent track	15 milliseconds
Full move across disk	135 milliseconds
Average	70 milliseconds

Capacity	Standard	Hi-Density
Bit Density (innermost track)	1100 bits/inch	2200 bits/inch
Track Density	100 tracks/inch	100 tracks/inch
Track Width	0.0051 inch	0.007 inch
Track Spacing	0.010 inch	0.010 inch
Bit Transfer Rate	781 KHz	1562 KHz
Bits per Cartridge (Drive)	12,000,000	24,000,000
Bits per Cylinder	60,000	120,000
Bits per Track	30,000	60,000
Cylinders per Cartridge	203	203
Tracks per Cartridge	406	406
Sectors per Track	8 (std) to 24	8 (std) to 24
Sectors per Cartridge	3248 (std) to 9744	3248 to 9744
Bits per Sector — Standard	3750	7500

1.4 UL & CSA APPROVAL

Diablo Series 30 Disk Drives are approved devices under both UL and CSA requirements. The approval file numbers are listed here for your reference:

UL No. E48862 (Santa Clara, Ca.)
CSA No. LR2196-155C

SECTION 2

INSTALLATION AND OPERATION

2.1 INSTALLATION

A Series 30 Disk Drive may be used as a table top unit, or mounted in a standard 19" rack. When the table top option is selected, the unit is fitted with a flangless front panel assembly and rubber feet. When the unit is to be rack mounted, two more optional front panel assemblies are available, along with rack slides. Figure 2-1 illustrates the three optional front panel assemblies, while Figure 1-1 shows the units with rack slide rails installed.

A
FLANGLESS
(TABLE TOP)

B
FLANGED
(EXTENDED FRONT)
24" DEEP CABINETS

C
FLANGED
(FLUSH FRONT)
30" DEEP CABINETS
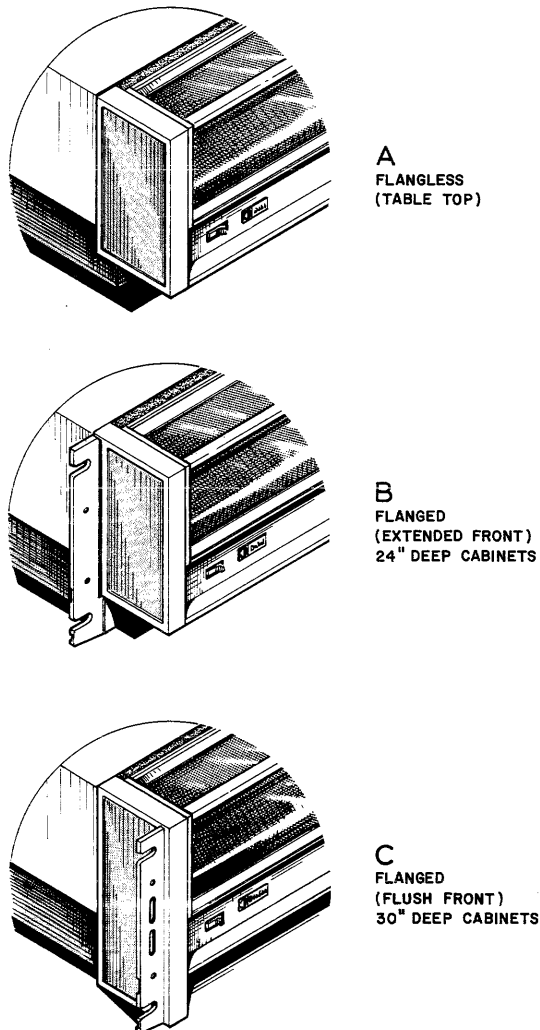
Figure 2-1   FRONT PANEL OPTIONS

The unit should always be supported on slide rails when mounted in a rack cabinet. In addition, even though the flangless front panel option can be accommodated in a rack mount installation as suggested in Figure 1-1, Diablo recommends the use of the appropriate flanged front panel assembly for securing the unit to the rack. See Section 6.

Figure 2-2 illustrates Series 30 rack mounting, and provides dimensional requirements. Diablo slide rails allow the unit to be pulled out from the rack cabient far enough to remove the top cover and raise the electronics assembly for service without disconnecting the interconnecting cables attached to the rear panel.

Figure 2-3 shows the Series 30 electronics assembly raised up to its service position.

2.2 INTERCONNECTING CABLES

2.2.1 Connector Parts

A standard Series 30 Disk Drive has two interface (Input/Output) and one power connector on its rear panel, as shown in Figure 2-4. The two interface I/O connectors are connected in parallel, pin for pin by the unit's mother PCB. Of these, connector P2 has pin (M) contacts, while connector P5 has socket (F) contacts. Table 2-1 lists the connector parts required for cable ends to mate with these rear panel I/O connectors.

TABLE 2-1

CABLE CONNECTOR PARTS DESCRIPTION

Power Cable Connector

1. Plug	— Winchester MRAC 14SJTCH
	Diablo P/N 10534-10
2. Contacts (socket)	— Winchester 100-1014S
	Diablo P/N 10525-11

Interface (I/O Connector (Socket, left hand)

1. Plug	— Winchester MRAC 42PJTDH
	Diablo P/N 10523-11
2. Contacts (pin)	— Winchester 1024P
	Diablo P/N 10525-12

Interface (I/O) Connector (Pin, right hand)

1. Plug	— Winchester MRAC 42SJTDH
	Diablo P/N 10523-10
2. Contacts (socket)	— Winchester 1024S
	Diablo P/N 10523-13

Figure 2-2   SERIES 30 RACK MOUNT (FLUSH MOUNT OPTION SHOWN)

Figure 2-3   ELECTRONICS ASSEMBLY
IN SERVICE POSITION

Figure 2-4   SERIES 30 REAR PANEL
INTERFACE CONNECTORS

2.2.2 Connector Pin Assignments

Table 2-2 lists the pin assignments for both Power and I/O connectors.

TABLE 2-2

POWER AND INTERFACE CONNECTOR PIN ASSIGNMENTS

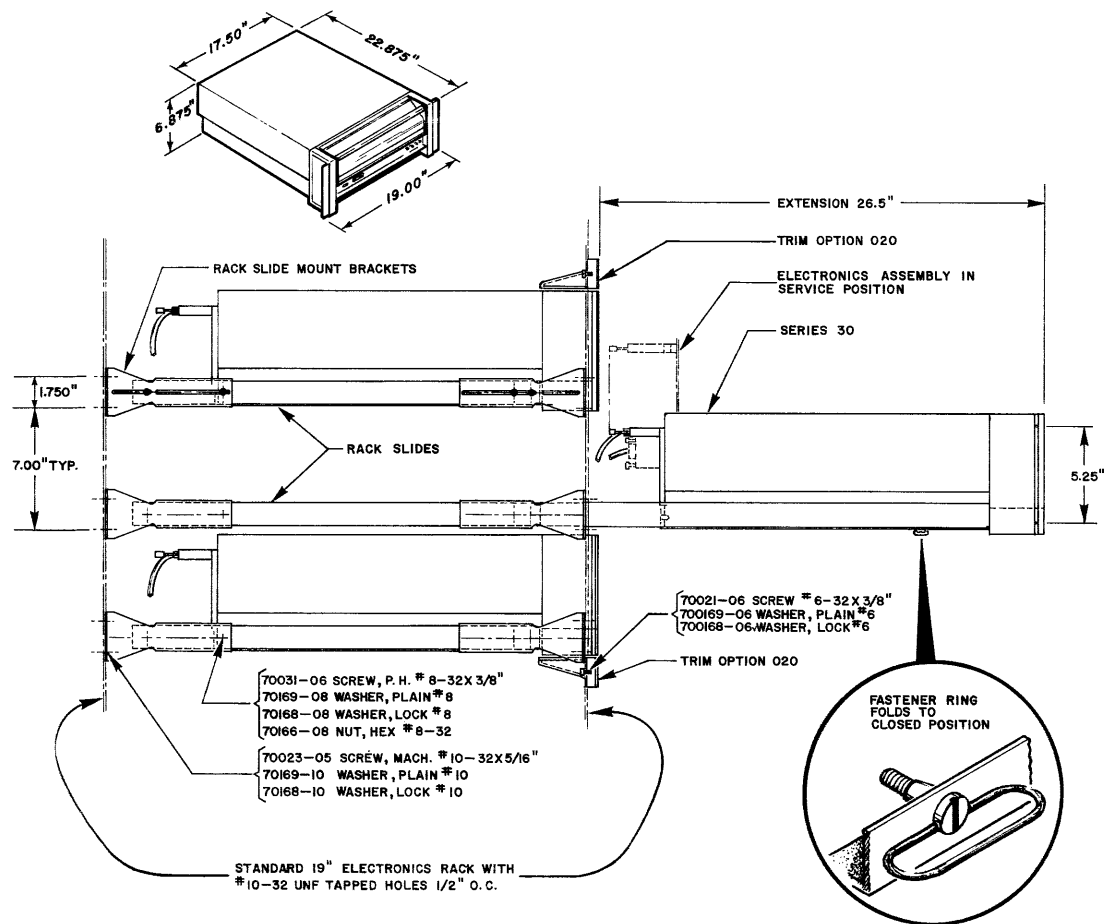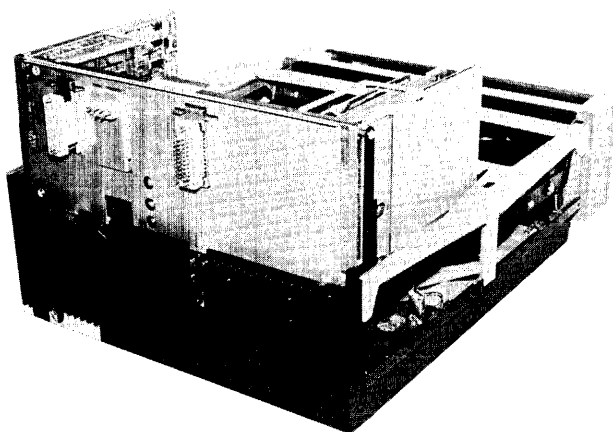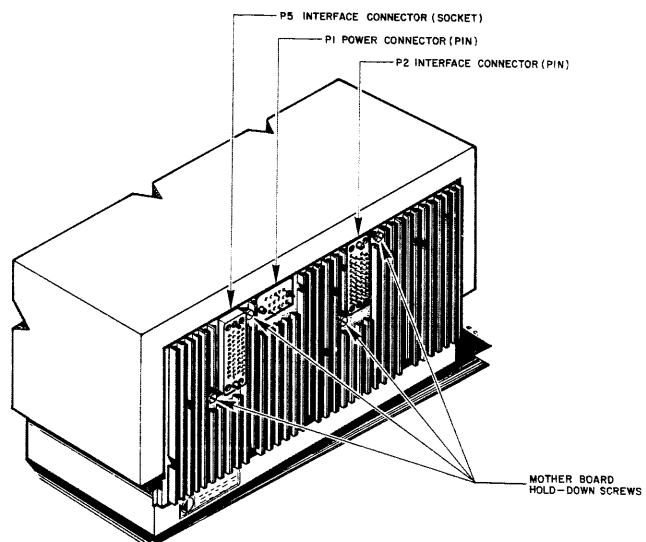| Signal Function	Pin
POWER CONNECTOR PIN ASSIGNMENTS	
+ 15V High Current.	K
+ 15V Low Current.	H
− 15V High Current.	R
− 15V Low Current.	P
Ground Return	C
INTERFACE CONNECTOR PIN ASSIGNMENTS	
Track Address - bit 1	LL
- bit 2	N
- bit 4	RR
- bit 8	J
- bit 16	X
- bit 32	FF
- bit 64	T
- bit 128	BB
Restore	VV
Strobe	SS
Head Select	AA
Write Gate	EE
Write Data & Clock	B
*Write Protect Input	H
*Write Protect Status Indication	P
*Erase Gate.	K
File Ready	U
Ready to Seek, Read, or Write	F
Address Acknowledge	NN
*Logical Address Interlock.	XX
Seek Incomplete	TT
Sector Mark	W
Index Mark.	Y
Sector Address - bit 1	CC
- bit 2	JJ
- bit 4	KK
- bit 8	MM
- bit 16	UU
*Pseudo Sector Mark.	S
Write Check	HH
Read Clock	A
Read Data	C
Read Gate	E
Select Line - Unit 1	L
- Unit 2	R
- Unit 3	V
- Unit 4	Z
*High Density Indication	M
**Daisy Chain Cable Terminator, +5V	PP
Ground	D
Ground	DD
Ground	WW

*Related to optional features

**Pin (PP) supplies +5 volts to the cable terminator network

2.2.3 Cable Recommendations

2.2.3.1 Power Input Cable

A Series 30 Disk Drive requires power input of ±15 Vdc ±5% @ 8A peak (4A average) from an external source. Diablo's Model 215 Power Supply was designed for use with the Series 30 Drive. One Model 215 Power Supply, along with a Diablo No. 11188 5' Power Cable (see Section 6.3) will supply all the power needs for two Series 30 Disk Drives.

Should the user elect to provide power to the Series 30 from another source, the following parameters should be observed:

1) Maximum Cable length without special considerations = 5'
2) Wire size for power circuits = 16 AWG, ground return = 15 AWG braid
3) Separate circuits should be provided for the high and low current inputs, to avoid common impedance problems
4) For cables over 5' in length, a 30,000 uFd 50V buffer capacitor should be included on each end of each power conductor, located within 2½' of the end.

2.2.3.2 Input/Output (I/O) Cable

Two types of cable may be considered for use with the Series 30. One is the conventional round cable consisting of twisted pairs of wires for each signal, with a PVC jacket. The other type is a PVC flat cable with a flexible ground plane.

Round Cable

For those applications where, in spite of the drawbacks, a round cable is preferred, the type recommended is made of twisted pairs insulated with head sealed overlapped MI-LENE tapes. Physical characteristics of round cables are:

Number of twisted pairs	50
Wire size	28 AWG (7/36)
Nominal OD of insulated wire	.023"
Nominal OD of PVC jacket	.370"
Underwriters' Laboratory rating	Style No. 2384

The characteristic wave impedance of one single twisted pair is approximately 85 Ohms. If all ground leads of the twisted pairs are grounded on both ends, the wave impedance is reduced to 75 Ohms. If the twisted pairs are jacketed by an overall braided shield, the wave impedance drops to approximately 45 Ohms, resulting in excessive current from the drive circuits. Individually shielded twisted pair cable is not recommended.

Flat Cable

Because of the uniform transfer characteristics and production efficiency, a flat cable type is recommended. The The characteristic wave impedance is 80 Ohms, with the shield plane grounded on both ends. The physical characteristics of the type of flat cable recommended by Diablo is as follows:

Number of conductors	50
Wire size	30 AWG solid
Shield	Flexible ground plane
Insulation	PVC

Cable Lengths

Diablo offers a wide selection of prepared transistion cables for use with Series 30 Drives. These will be found listed and described in the Diablo Sales Literature, in the Diablo Series 30 Disk Drive Parts Catalog, Publication No. 81504 and in Section 6.3 of this manual. In planning an installation, the designer should keep in mind that the TOTAL cable run in any daisy chain configuration should NOT exceed 30 feet.

2.2.3.3   Terminating Resistors

The signal lines carrying pulses transmitted by any disk drive will cause reflection on both ends of the cable if the cable is not properly terminated.
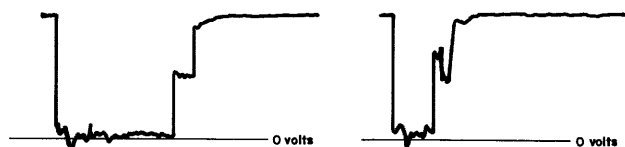

Figure 2-5   WAVESHAPES

Figure 2-5 shows two waveshapes taken on the terminated end of a cable when the other end was left unterminated. The negative going leading edge is not affected significantly, and can be used as an input to logic circuits if properly handled. The trailing edge, however, is determined by the time duration of the pulse, and the length of the cable. Those lines carrying signals of short duration should always be terminated on both ends. No satisfactory system performance can be achieved, even with relatively short cable lengths, if the signal lines are not properly terminated on both ends.
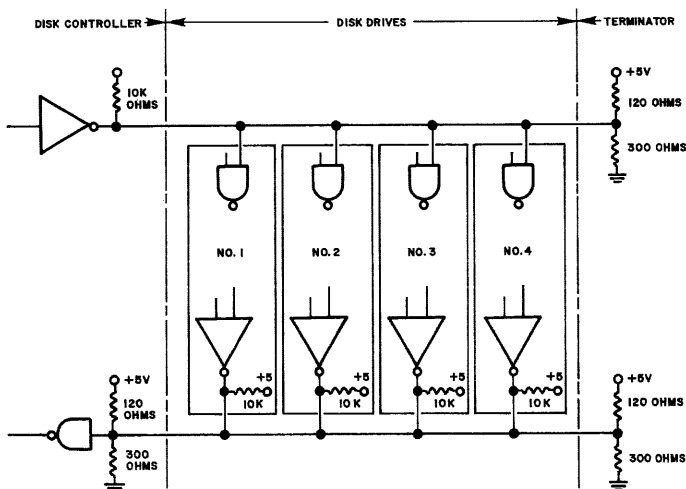

Figure 2-6   TYPICAL TERMINATION CIRCUITS

A typical circuit for termination of the cables is shown in Figure 2-6. Diablo offers a selection of terminators designed for use with the Series 30 Drives. These are also listed in sales literature, in the Series 30 Parts Catalog, and in Section 6.3 of this manual.

2.3   OPERATING

2.3.1   Controls and Indicators
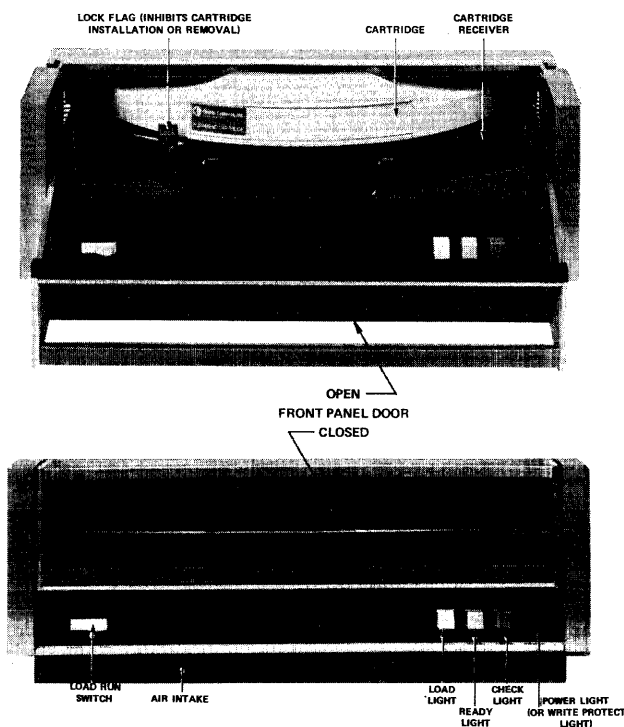
Figure 2-7 MODEL 31 CONTROLS AND INDICATORS

The Model 31 Disk Drive, as shown in Figure 2-7, has one control switch, four indicator lights, and an interlock ("lock") flag. Table 2-3 describes the function of each.

The control switch, three of the indicators, and the lock flag are all omitted in the Model 33F.

2.3.2   Operating the Model 31

The control switch is labelled "LOAD/RUN". In the LOAD position, application of power will light the LOAD light, lower the lock flag, and unlatch the front panel door. In this condition, the door may be opened and the disk cartridge inserted or removed. Opening the door disengages the cartridge disk from the drive spindle's magnetic clamp and lifts it clear for removal. Closing the door, with a cartridge inserted, lowers the disk into place properly aligned for operation, and allows the magnetic clamp to "lock" it into place.

Moving the LOAD/RUN switch to its RUN position latches

the door closed, raises the lock flag, and initiates the startup sequence. When the spindle and disk are at proper operating speed, and the machine is ready for operation, the READY light comes on.

Switching the LOAD/RUN switch from RUN to LOAD extinguishes the READY light, and initiates the load sequence. The heads retract, and the spindle slows to a stop under dynamic braking. When the heads are fully retracted and the spindle has stopped, the door is unlatched, the lock flag is lowered, and the LOAD light comes on indicating that it is safe to open the door and remove or insert a cartridge.

2.3.3 Operating the Model 33F

The front panel door of the Model 33F is locked shut by the top cover. The spindle and disk rotate anytime power is applied to the drive, and the disk cartridge can be removed or replaced only by a technician. the POWER indicator is the only front panel device seen on this model.

back to RUN. This light also indicates a a low voltage condition.

Power
A. red signal light that indicates the presence or absence of power. The light glows when operating power is present.

OPTIONAL

Protect
(Located in power light position)
A red backlighted momentary contact pushbutton switch that is on those disk drives that are equipped with the Write Protect option. See Section 6.3

TABLE 2-3

FRONT PANEL
SWITCH AND INDICATORS

Panel Name	Function
Load/Run	A two position rocker type switch that provides a means for starting and stopping disk rotation. Cartridges may be removed and inserted when the Load light is on and the switch is in the LOAD position. With a cartridge inserted, switching to the RUN position starts disk rotation and brings the disk up to its normal operating speed in about 50 sec. If the switch is moved to the LOAD position, the disk decelerates to a stop in about 10 seconds, after which the Load light is turned on, the door interlock releases, and the door can be opened.
Load	A white signal light which indicates that the spindle is not rotating, and that cartridges can be loaded, or unloaded. The light goes off whenever the LOAD/RUN switch is set to the RUN position.
Lock Flag	Lowers to allow cartridge removal when heads have been retracted and spindle is not moving.
Ready	A yellow light which indicates that the drive has completed its start-up cycle. The light comes on when the disk is rotating at its correct speed. The light remains on throughout a seek, read or write operation. The light extinguishes as soon as the LOAD/RUN switch is set in the LOAD position.
Check	An orange signal light which indicates that due to some abnormal condition, the Model 31 may be incapable of writing. The light is reset by moving the LOAD/RUN switch to LOAD position and then

INTERFACE INFORMATION

3.1 GENERAL

Up to four disk drives may be connected in parallel with each other to one controller. These drives may be all Model 31's, all Model 33F's, a mixture of Models 31 and 33F, or Series 30's combined with Series 20 Drives. Note that two Model 33's would fulfill the four unit limit. Connecting two or more drives to one controller is referred to as a "daisy chain" installation. The final drive in any system will have an open I/O connector. This last connector must have a terminator installed to properly terminate each line, as was discussed in Section 2. Diablo Series 20 and Series 30 Disk Drives are signal compatable and are directly combinable in a daisy chain system with suitable transition cabling.

3.2 POWER REQUIREMENTS

The Series 30 Disk Drives do not include power supplies or power controls. All unit power supply and control must be provided externally by the using system. As discussed earlier, the Series 30 Drive requires ±15 Vdc ± 5% at 4 Amperes average current drain, with an instantaneous peak demand of up to 8 Amperes. Diablo's Model 215 Power Supply will support two Series 30 Disk Drives.

[CAUTION]

Connection to the rear panel power connector must not be made or broken while power is on, to avoid damage to the drive.

3.3 INPUT/OUTPUT CONSIDERATIONS

Definition of the Standard input and output interface lines are given in the following paragraphs. Signal polarity is 0 volt nominal for LO ("true") and +5 volts nominal for HI ("false").

3.4 STANDARD INPUT LINES

TRACK ADDRESS — Eight lines which accept an 8-bit binary absolute track address. These signal lines are strobed with the strobe signal to perform a seek operation. The track address lines should be held true no longer than five microseconds after the trailing edge of the strobe signal.

RESTORE — One line which accepts a signal calling for "head positioner restore". After executing this command, the heads are located over track "0", the Address Register is set to address "0", and an Address Acknowledge signal is issued. (A logical address interlock pulse will be issued if an address greater than 202 is set on the track address line.) The Restore signal must be settled prior to the leading edge of the Track Address Strobe signal, and held for no longer than five microseconds after the trailing edge of the Strobe signal.

STROBE — This signal is used for sampling the Track Address and Restore lines. The leading edge of the Strobe should appear only after the appropriate signals have fully settled. The Strobe must be held until either the "Address Acknowledge" signal or the "Logical Address Interlock" signal is issued by the Disk Drive. This may be as soon as 22.5 microseconds or as late as 47.5 microseconds after the leading edge of the Strobe. When the Address Acknowledge or the Logical Address Interlock are issued, the Strobe signal must be removed within 5 microseconds.

HEAD SELECT — One line which allows the selection of one of the two heads for reading or writing. The signal on this line must be held for the entire duration of a read or write operation. Polarity: 0 volt nominal (LO) selects upper head, +5 volts nominal (HI) slects lower head.

WRITE GATE — One line which turns on write current and erase current simultaneously in the head which has been selected. This signal must be applied at least 2 microseconds prior to writing the first flux transition, and held for the entire duration of the write and erase operation.

WRITE DATA & CLOCK — One line which accepts multiplexed data and clock pulses for double frequency or phase encoding type recording, one complete pulse for each recorded flux reversal. Pulses must have a minimum width of 100 nanoseconds. Leading edge must have a transition time of not more than 50 nanoseconds. This line is held at nominal +5 volts when not writing.

READ GATE — One line which enables the Read Clock and Read Data output lines. Read Gate must be held at nominal 0 volts during the desired read option.

SELECT LINES — In order to perform the selection of one particular unit in a system where more than one drive is used, four Select Lines and a corresponding internal jumper are accomodated. These lines select and activate the input/output lines of the jumpered unit either in a Daisy Chain or a party line system configuration.   See Section 6.3 for Optional Input lines.

3.5 STANDARD OUTPUT LINES

FILE READY — A 0 volt level (LO) on this line indicated that the disk drive is in the following condition:

1. Drive supplied with proper power.
2. Loaded with a disk cartridge.
3. LOAD/RUN switch in RUN position.
4. Disk Start-up cycle is completed.
5. Write Check flip/flop is reset.

READY TO SEEK, READ, OR WRITE — (Ready to S/R/W). A 0 volt level (LO) on this line indicates that the disk drive is in the File Ready condition (see above) and it is not in the process of executing a seek operation. Following a seek command to a valid address (other than the present address) or a Restore command, the Ready to S/R/W line goes "false" in no less than 2.5 microseconds after detecting the leading edge of the Strobe signal. The return of the Ready to S/R/W line to the "true" state indicates that the seek (or Restore) operation has been completed, the Read/Write heads are fully settled and the machine is ready to accept a Read, Write, or another Seek operation.

ADDRESS ACKNOWLEDGE — This signal line notifies the controller that a command to move the heads to a specified address has been accepted, and that execution of the command has commenced. An Address Acknowledge signal is issued in a minimum of 22.5 μsec. after the Strobe signal even if there is no change from the previous address. The Address Acknowledge signal is a pulse with a minimum width of 2.5 microseconds and a maximum width of 7.5 microseconds. The Address Acknowledge signal will not be issued if a command to move to a track position greater than 202 is received. In this case, execution is suppressed, and a Logical Address Interlock signal is issued on a different line (see below). The Address lines, as well as the Strobe signal, must be held until either the Address Acknowledge or the Logical Address Interlock signal is issued by the disk drive.

LOGICAL ADDRESS INTERLOCK — A pulse on this line indicates that a command to move the heads to a track address greater than 202 has been received, and the command is therefore not executable. The seek command is suppressed. The Strobe signal must be removed within 5 microseconds after receipt of this signal. The Logical Address Interlock signal has the same timing relationship as the Address Acknowledge signal.

SEEK INCOMPLETE — A 0 volt level (LO) on this line indicates that, due to some malfunction, a seek operation was not completed. This signal level will be maintained until a Restore command (see above) is received and executed by the disk drive.

SECTOR MARKS — This line supplies one 0 volt nominal (LO) 5 microsecond pulse for each of the sector slots as they pass by the sector transducer. The leading edge should be used as reference. The "unusual" slot, which serves as the marker for the sector, is suppressed on this line and fed to a separate line called Index Marks (see below).

INDEX MARKS — This line supplies one 0 volt nominal (LO) 5 microsecond pulse per disk revolution to provide sector identification. The leading edge of this pulse follows

the leading edge of the last sector pulse by a nominal 610 microseconds and signifies that the next Sector Mark following this pulse is the Sector Mark for the first sector.

PSEUDO SECTOR MARKS — Rotational speed of the spindle is servo controlled by counting the number of transitions provided by a crystal oscillator between Index Marks. This provides an extremely accurate speed control which is independent of line voltage or frequency fluctuations. The pseudo Sector Mark line carries these 2000 ±1% square wave clock pulses to the interface. These pulses may be used to format the disk into the desired number of pseudo sectors.

WRITE CHECK — A 0 volt level (LO) on this line indicates that one or more of the below listed conditions are present within the Series 30 Disk Drive.

1. Write Current without a true Write Gate line.
2. Write Gate line true without Write Current.
3. Write and Select of both heads.
4. Erase Current without a true Erase Gate line.
5. Erase Gate line true without Erase Current.

When Write Check is set true by one of the above listed conditions, execution of all external commands is suppressed. To reset Write Check, on the Model 31, the operator must move the Load/Run switch to the Load position and then return it to the Run position, the Model 33F must have its power removed and then applied.

The Write Check line is also used to notify the controller that the supplied voltage to the Series 30 has dropped to less than a nominal 13.5 volts. If this occurs during a Write operation, it may be desirable to re-write the affected record. Reset is not required when Write Check is caused by voltage fluctuation.

READ CLOCK — This line supplies pulses that represent clock signals which have been separated from the data signals during reading. Pulse width is nominally 100 nanoseconds with a minimum of 50 nanoseconds and a maximum of 150 nanoseconds. The leading negative going edge must be used for reference.

READ DATA — This line feeds out pulses that represent data signals which have been separated from clock signals during reading. Pulse width is nominally 100 nanoseconds with a minimum of 50 nanoseconds and a maximum of 150 nanoseconds. The leading negative going edge must be used for reference.

HIGH DENSITY INDICATION — A 0 volt level (LO) on this line indicates that the disk drive has the high density option installed. In a standard density disk drive this line is floating.

SECTOR ADDRESS — Five output lines which define, in binary encoded form, the sector under the Read/Write head. This address is derived from a five bit binary sector counter. This counter is advanced by the leading edge of each sector mark and is reset to zero by the leading edge of the sector mark following the index mark. The status of

the Sector Address Counter can be unambiguously evaluated if the readout occurs at the trailing edge of the Sector Mark signal. See Section 6.3 for Optional Output lines.

3.6 INTERFACE TIMING CONSIDERATIONS

3.6.1 Read Amplifier Recovery

A read amplifier recovery period of 50 μsec is required after a change in head selection or after a write operation.

3.6.2 Timing

Figures 3-1, 3-2, and 3-3 illustrate typical timing relationships. These figures contain numerous notations and should be carefully reviewed.
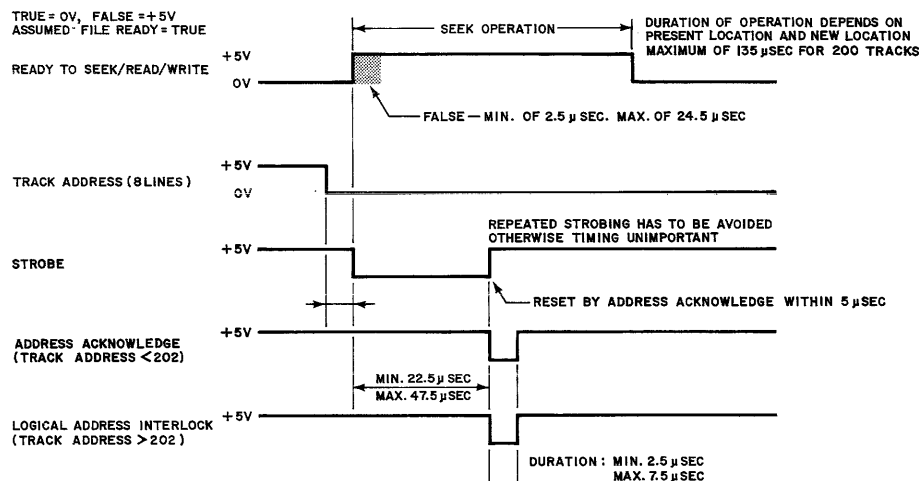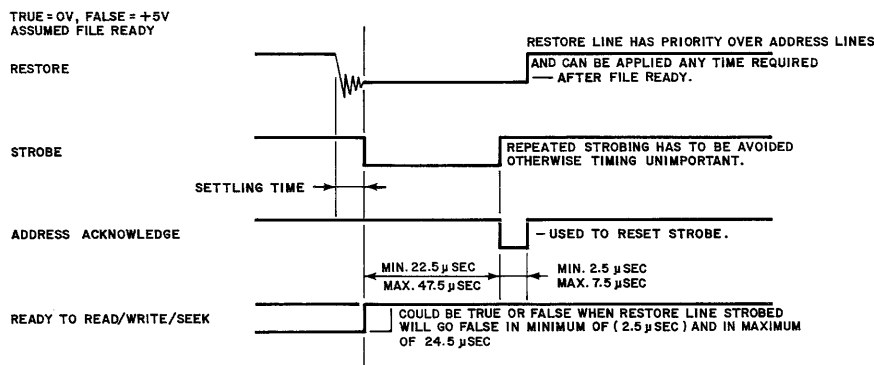

Figure 3-1 TYPICAL SEEK OPERATION
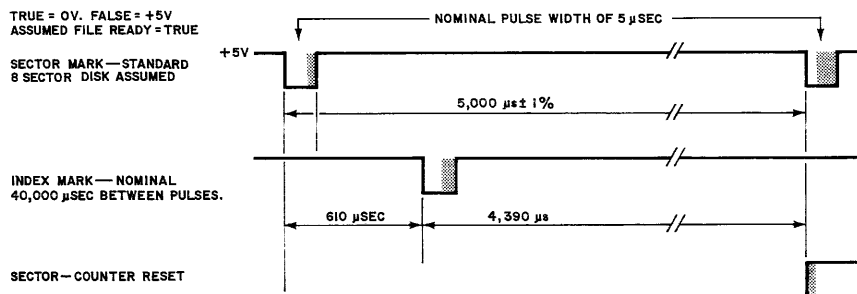

Figure 3-2 TYPICAL RESTORE OPERATION

Figure 3-3 SECTOR AND INDEX MARK TIMING RELATIONSHIP

3.6.3 Data Record Format

Since each system's requirement is likely to have significantly different requirements, the example given below is to be regarded as merely a suggested method of determining data format. The factors considered in this example, which effect the amount of time available for writing data between Sector Marks, are based on inner track and are the minimum amount of time to be considered.

1. Physical location of Erase and Write coils. The time difference between these coils at the standard density is 65 μsec, at high density it is 25 μsec. When these coils are activated and deactivated at the same time, there is a nominal gap of unerased data and a glich on the disk surface that must be considered.

2. Location of the Sector Mark slots on the disk hub. The relative placement of these slots from disk to disk will affect the amount of time available. Cartridge manufacturers specify this variance at $\pm 0° 12'$ or ± 22.5 microseconds.

3. Alignment of Sector Transducer in relationship to each head. There will be up to a ± 5 microsecond variance in this alignment from disk drive to disk drive.

4. Sector jitter and C.E. cartridge variance may be as much as ± 10 microseconds.

5. Preamble used for synchronizing the data and clock separation circuits and for providing needed time intervals. The preamble considered in this example consists of all zero bits followed by a single one bit. The preamble must be started when the write gate is set true and must allow a minimum of 6 microseconds of preamble to be read (for synchronizing the separation circuits) prior to the single one bit.

6. Speed variation. Only the overspeed tolerance, which shortens the amount of available time is considered.

   Note: All check characters that are used to insure fidelity of data are considered as part of the data record.

3.6.4 Computation of Data Record

1. Physical location of Erase & Wire coils = 65 μsec*

2. Location of Sector Mark slots = 45 μsec

3. Alignment of Sector Transducer = 10 μsec

4. Sector jitter and C.E. cartridge variance = 20 μsec

5. Preamble for synchronizing = 6 μsec

6. Speed variation = 1%

7. Nominal time per revolution = 40,000 μsec

8. Nominal time per sector = 40,000 μsec/n
   (Where n = number of sectors)

Minimum time per sector = (40,000/n - 0.99) - (65+45+10+20+6)

Where (0.99) = Allowance for 1% speed variation
    65 = Erase and Write coil*
    45 = Sector location
    10 = Sector alignment
    20 = Sector jitter
    6 = Preample sync

Example (for n = 8 sector): (4950) − 146 = 4804 μsec**

The actual maximum data length is equal to the next smaller whole number of computer words that will fit within 4804 μsec at the disk recording bit rate.

At the 781 KHz rate, the maximum number of bits is 4804 μsec/1.280 μsec = 3753, which would be 3753/12 = 312 twelve bit words; or 3753/8 = 469 eight bit words. Where 1.280 ηsec = one bit cell at 781 KHz.

The bit cell duration for the 720 KHz, 1562 KHz, and the 1440 KHz is 1.389 μsec, 640 ηsec and 694 ηsec.

3.6.5 Write Operation

With the calculation given above, a typical Write operation would proceed as follows (see Figure 3.4).

1. Detection of the Sector Mark indicating the beginning of the desired sector to be written.

2. Wait 65 μsec, then enable Write Gate and Erase Gate, thereby turning on current in the Write and Tunnel Erase heads.

3. Commence writing of the preamble, a continuous stream of zeros followed by a single one, for 61 μsec. The next recorded bit will be the first bit of data record.

4. Write the data record, comprising no more than the computed maximum number of data bits, including check character. (In this example the maximum number of bits = 3753).

5. After writing the last bit of the data record, continue writing zeros until 65 μsec after the next Sector Mark. At that time turn off the Write Gate, Erase Gate, and stream of zeros.
   Note: The entire surface of the disk that will be read must be recorded.

3.6.6 Read Operation

When the data format has been written as above, a typical Read operation would proceed as follows (see Figure 3-4).

---

*25 microseconds with the high density option

**With high density this time is 4844 because of the difference in the erase coil placement.
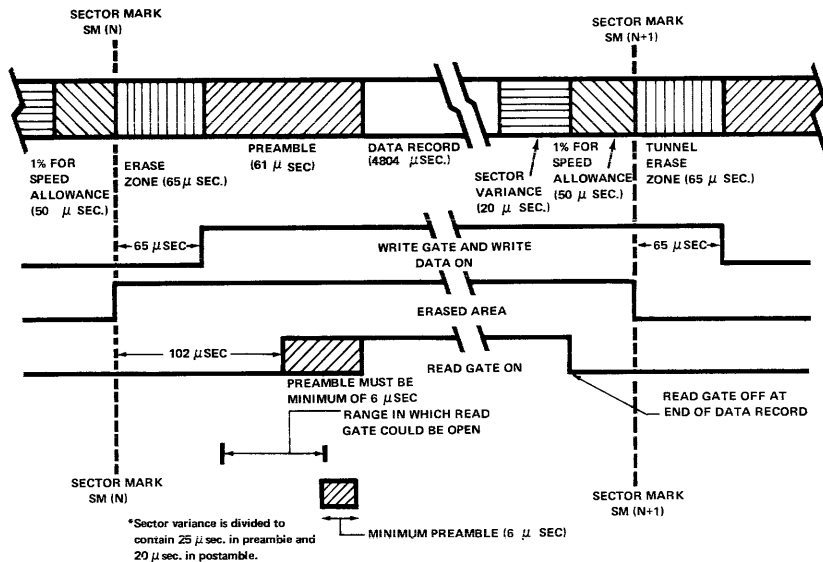
Figure 3-4 DATA FORMAT

SUMMARY:

1. Preamble consist of all zeros concluded by a single one.
2. Write and Erase Gate turned on together - 65 μsec after SM(N), (25 μsec with high density).
3. Start writing preamble concurrent with Write and Erase Gate.
4. Continue writing zeros until 65 μsec SM(N+1); then turn off Write and Erase Gates (25 μsec with H.D.)
5. Read Gate open 102 μsec after SM(N).

[CAUTION]

After a head select or the termination of a write operation, allow 50 μsec for read amplifier recovery; this may be wholly or partly overlapped with other delays.

1. Detection of Sector Mark indicating the beginning of the desired sector to be read.
2. Wait 102 μsec, then enable Read Gate, thereby reading the zeros from the preamble and synchronizing the separation circuits.
3. If at least 6 μsec of zeros followed by a single one bit is detected, then the preamble has been properly read and the next bit is the first data record bit.

4. Disable Read Gate after reading the last bit of the Data Record.

3.7 DRIVE CAPABILITY OF OUTPUT LINES

Read Clock, Read Data, Sector Mark and Index Mark lines are driven as shown in Figure 3-5. All other output lines are driven by the circuit shown in Figure 3-6.
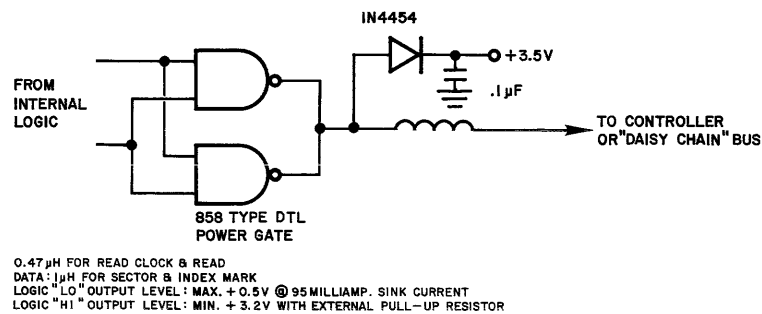

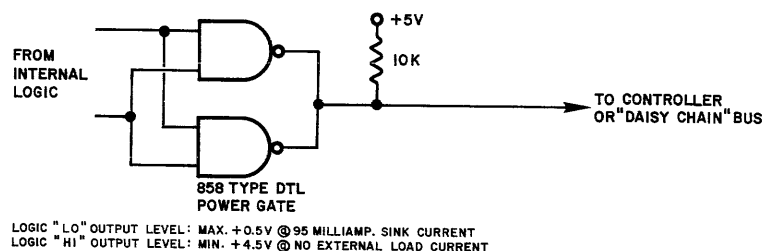**Figure 3-5 OUTPUT DRIVER CIRCUIT OF READ CLOCK, READ DATA, SECTOR MARK AND INDEX MARK LINES**

Figure 3-6 OUTPUT DRIVER CIRCUIT

3.8 INPUT GATES

The Series 30 disk drives use a 380 type NOR gate as the input circuit. This integrated circuit is from the Utilogic family and because of its circuit structure has a higher input threshold in the "low" logic state than most commercially available DTL of TTL circuits. This assures a higher noise margin on all input lines. In addition, the 380 input circuit loads the signal transmission lines with significantly less input current, causing a lesser amount of local reflections on the line in a "Daisy Chain" configuration.

The input of the 380 circuit has to be "pulled-up" in the "High" logic state. For this reason it cannot be driven by an open collector driver stage without collector resistance. This collector resistance is installed by terminating the the last Series 30 on the buss.

Figure 3-7 shows the input circuit used in the Series 30.

INPUT CIRCUIT "DAISY CHAIN" VERSION
LOGIC "LO" INPUT THRESHOLD: MIN. +1.4V ; NO CURRENT LOAD
LOGIC "HI" INPUT THRESHOLD: MAX. +2.7V; 180 MICROAMP. MAX. CURRENT LOAD (PULL—UP)
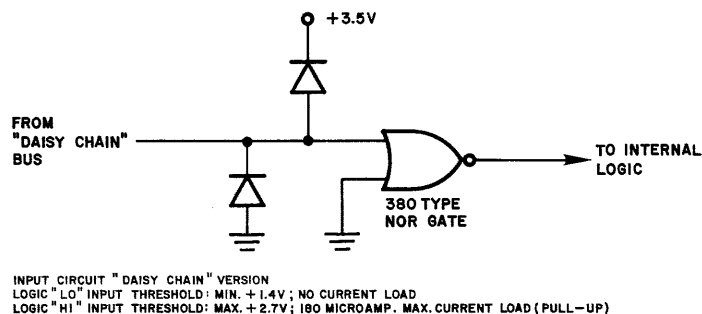
Figure 3-7   STANDARD INPUT CIRCUIT

PRINCIPLES OF OPERATION

4.1 GENERAL PRINCIPLES OF THE DISK DRIVE

The Series 30 Disk Drive consists of those functional units illustrated in the block diagram of Figure 4-1. Together, they spin the magnetic disk at 1500 RPM ±1%, precisely align the heads over track locations, and perform data writing and reading functions. Each major functional part is described in more detail in the following paragraphs. Note that in the descriptions, reference is made to a 100 KHz crystal clock oscillator, or a submultiple of its frequency. This oscillator is used as a reference signal in the disk drive.

Figure 4-1 SIMPLIFIED BLOCK DIAGRAM OF DISK DRIVE

4.2 READ/WRITE HEADS

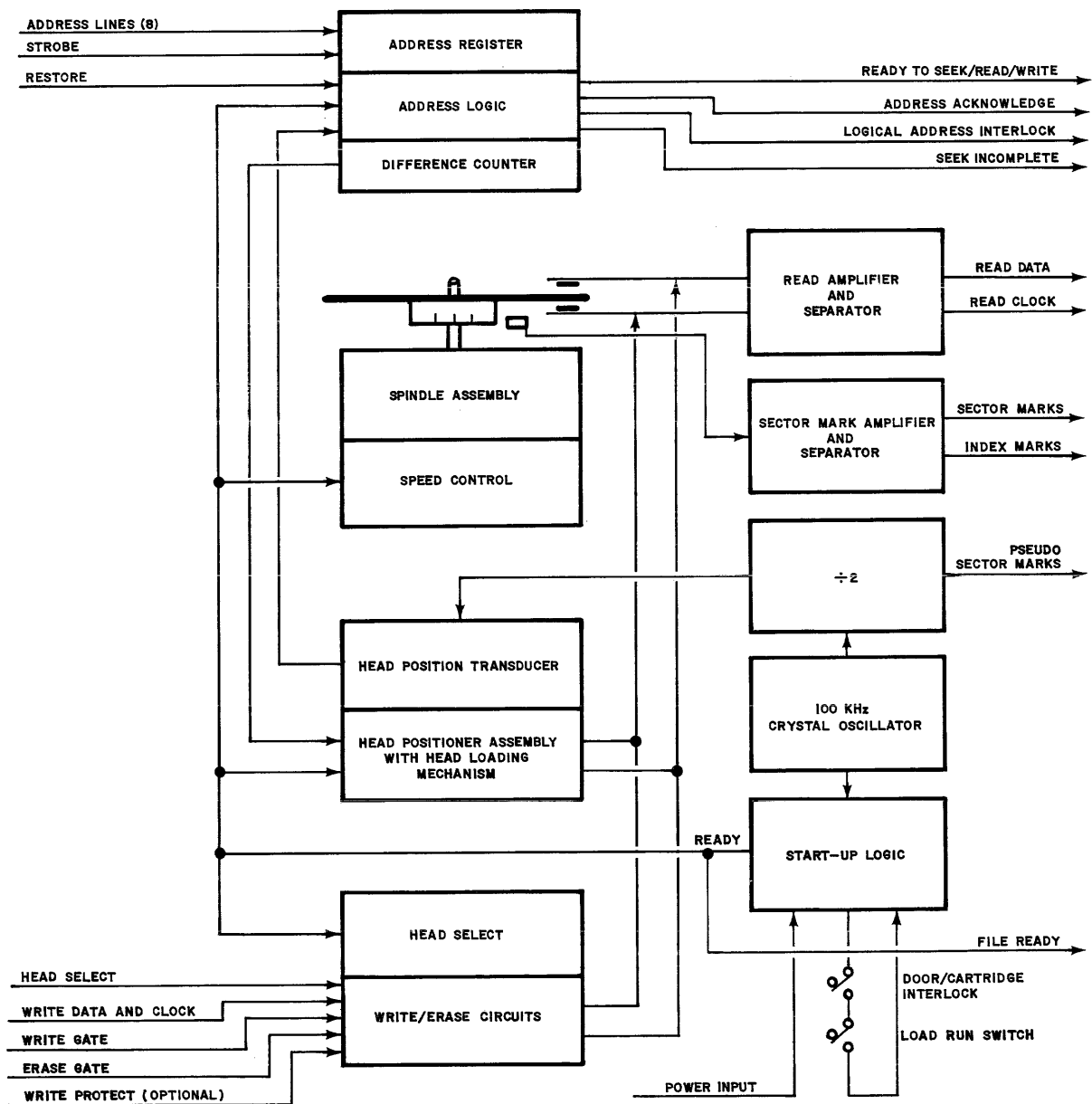The two read/write heads will read or write data on the disk by means of standard electromagnetic recording technique. One head functions on the top surface of the disk and the other on the bottom surface. The heads are physically laid out as shown in Figure 4-2. Each read/write head consists of three separate precisely mounted head coils: one performs the reading or writing function, whereas the other two erase to limit the physical width of data tracks on the disk surfaces.
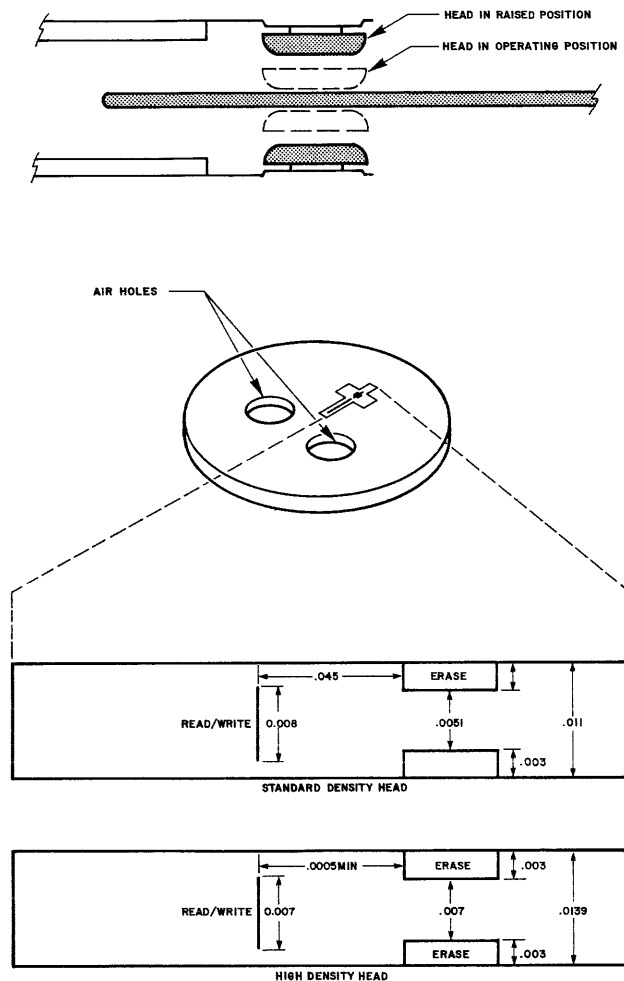

Figure 4-2 DIAGRAM OF READ/WRITE HEAD LAYOUT

In their operating position, the heads fly approximately 120 microinches, or 3 microns off the surfaces of the standard density disk; the heads fly closer to the surface on the high density model. The heads are mounted on two arms that move from the periphery of the disk towards its center locating the heads laterally along the disk surfaces to position over any of the 203 cylinders. The heads are lowered (loaded) to their flying positions by a solenoid operated mechanism and are maintained there by spring pressure. Initial loading of the heads is controlled by the Start-up Logic and takes place when the disk is rotating at approximately 1800 RPM to assure the presence of stable boundary layers of air between the heads and disk surfaces.

(See Start-up Logic paragraph 4-8). The heads are unloaded when the Load/Run switch is switched from Run to Load; if power fails; or if disk rotation should drop below 1464 RPM.

The read/write circuits perform the amplification and signal conditioning necessary for the translation between interface data signal voltages and head currents. The upper or lower head is selected by the "Head Select" interface line.

In a write operation, a single input line delivers multiplexed clock and data pulses; one complete pulse corresponding to each flux transition. The write circuits, activated by the Write Gate, will allow current to pass through the write head and write one flux transition for each pulse. The erase heads, activated by the Erase Gate (normally tied to the Write Gate) will trim the written track to 0.005 inch (0.007 with high density option).

In a read operation, head current pulses generated by passage of flux transitions beneath the heads are of alternating sign. The read circuits amplify, shape, and separate these pulses into distinct Clock and Data pulse streams before delivering them to the interface lines. Data pulse separation is accomplished by a read data and clock separation circuit, based upon flip-flop logic. The format of each data record, controlled by the using systems, includes a preamble. This preamble established sync for the data and clock separation circuit.

4.3 WRITE CHECK

Certain conditions, if they occur, are likely to result in faulty or invalid data being recorded on the disk. Many of these conditions are monitored within the Series 30 and if they should occur, the Write Check interface line is made true and the Check indicator lamp on the Model 31 is turned on. A Write Check condition will occur is the supplied voltage drops below the specified 5% or if certain Write or Erase current faults are present.

A Write or Erase fault will be present and the Write Check condition set if write or erase current is flowing when the corresponding gate interface line is false. The Check condition will also be set if write or erase current is not flowing when the corresponding gate interface line is true. The other Write Check condition is a multiple head selection when the Write or Erase Gate interface line is true.

The Write Check condition caused by a voltage variation will last only for the duration of the faulty voltage; whereas the Write or Erase will set an internal latch that is reset by the operator placing the Load/Run switch in the Load position and then back to Run.

4.4 SPINDLE SPEED CONTROL

The spindle assembly performs the task of holding and spinning the disk. The disk is held to the spindle assembly by a magnetic ring. The spindle dc servo motor, enclosed within the housing, operates under the control of the master 100 KHz crystal clock. Start-up Logic (paragraph 4-8) controls the spindle motor during start-up.

Spindle speed is electronically controlled. An electronic counter, basically, counts one half of the 100 KHz oscillator pulses between Index Marks. The exact time period that it takes the disk to complete one full revolution should be 40 milliseconds. If the disk rotates slowly, more than 40 ms will pass between Index Marks and a greater number of pulses will be counted, indicating an under-speed condition. An overspeed condition will cause fewer pulses to be counted between Index Marks. Given the pulse count, the speed control circuit determines whether during the next full rotation the spindle motor is to be speeded up or slowed down. The motor input is correspondingly switched to a high level current source or to a low level current source — for the entire duration of the next revolution. The high level source will accelerate the spindle motor, whereas the low level source will allow the motor to decelerate. Thus, the motor may be slightly accelerating or decelerating about its nominal speed. The speed variation is maintained within ±1%. A decrease in speed to 1464 RPM will cause the heads to unload and loss of the File Ready condition. The heads will be reloaded when nominal speed has been regained.

4.5 INDEX AND SECTOR MARK CIRCUITS

The Index and Sector Mark circuits supply timing pulses, related to the rotational position of the disk, to internal circuits and also to the interface. Internally, the Index Mark is delivered to the spindle speed control circuits (described in paragraph 4.4) once per revolution. The Index Mark and Sector Marks are delivered to the system controller on two separate interface lines.

The Index and Sector Mark circuits develop their timing pulses by sensing physical slots in the hub of the 2315 type disk cartridges. The physical slots are sensed by a transducer, called the Sector Mark Transducer. Near one of the sector slots is a unique slot, labeled Index Mark slot, which orginates a pulse to identify a complete rotation of the disk.

The equally spaced Sector Marks are normally used by the operating system to format tracks on the disk surface into sectors and the Index Mark is used to establish the beginning of a track. There is a special circuit in the disk drive that separates the Index Mark from the Sector Marks, because as they are supplied by the Sector Mark Transducer, they are indistinguishable.

Pseudo Sector Marks are also available at the interface. These Pseudo Sector Marks are generated by utilizing alternate pulses of the 100 KHz crystal oscillator. These pulses are used to control the spindle speed (paragraph 4.4), and may also be utilized to generate sector formats.

4.6 ADDRESS ARITHMETIC AND TRACK SELECTION LOGIC

The address arithmetic and track selection logic receives a binary 8-bit cylinder address from the controller and supplies decoded head positioning information to the head positioning servo circuit.

To derive head positioning information, an address register and two counters are employed. The address register stores the track address at which the heads are presently located (existing address). The new address is held on the interface lines and is subtracted from the existing address by the first counter. The difference is then entered into the second counter. Contents of the second counter, called the difference counter, are then decoded and used to indicate the direction in which the heads are to be moved and the speed at which they are to move.

As the heads move, each track centerline is detected by the position transducer output. The difference counter is incremented at each of these centerline detections. A predetermined value in the difference counter indicates that the heads are in position at the new track address. As the difference counter increments, it also changes velocity instructions, such that the head motion is rapid at the beginning and slower as the correct track is approached. An absence of head movement when the difference counter is not at its pre-determined value indicates a Seek Incomplete, which is fed to the interface.

When the difference counter is loaded, the address register accepts the new address from the interface lines and the old address is destroyed. The storage of the new address triggers the Address Acknowledge signal.

If a Track Address cannot be executed, because it is greater than 202, a Logic Address Interlock is generated and no head motion takes place.

When a Restore command is present, it takes precedence over Track Address input and causes the heads to withdraw to track 0.

4.7 HEAD POSITIONING

Positioning of the head carriage is accomplished by the head positioner assembly under the control of a dual mode velocity and position servo circuit. The head positioner assembly is illustrated in Figure 5-4. The velocity and position servo circuit applies voltage of proper polarity and magnitude to the dc servo motor contained within the head positioner assembly.

Any head movement is detected by the head positioner transducer and introduced to the servo circuits. This feedback will hold the carriage at the correct location. During an address seek operation the speed of the head carriage is controlled at one of four different speeds. The speed used will depend on the amount of movement required. The movement required is determined by the difference counter.

4.8 START-UP LOGIC

The Start-up Logic performs two basic functions; it controls operation of the equipment, including the head operation, during the start-up cycle, and it also controls the operation of various interlocks used to protect data and equipment.

During the start-up cycle this logic causes the spindle motor to overspeed. This overspeed purges the interior of the cartridge by causing an above-normal air flow through it and brings about temperature equilibrium. The initial loading (lowering) of the heads, takes place when the disk is rotating at the overspeed condition; this is to assure the presence of stable boundary layers of air between the heads and disk surface. The heads will be retracted when the Load/Run switch is changed to Load, if power should fail, or if disk rotation should drop below 1464 RPM. The File Ready lamp and interface line will become true when the spindle speed has slowed back to nominal, if Write Check is false.

The interlocks and safety devices controlled by the Start-up Logic minimize the possibility of accidental data loss, in routine operation or emergency shut-down. The interlocks comprise: the door lock, with its LOCK flag, the cartridge-in-place mircoswitch, and the head retracted switch.

The Start-up Logic also generates an internal head restore command as a part of every start-up cycle to bring the heads over track 0. This occurs when power is first applied to the disk drive, at any time the Load/Run switch is changed (when a cartridge is loaded), or after a voltage error condition.

4.9 DAISY CHAIN

The Daisy Chain feature, by means of select lines, allows for the selection of one particular unit in a system where more than one drive is used. All interface lines of a unit are inactive until that unit is selected. Up to four direct Select lines are accommodated.

A Sector Address Counter is included within the Series 30. This is a five stage binary counter which is advanced by the leading edge of each Sector Marks. The leading edge of the Sector Mark following the Index Mark resets the counter on each revolution of the disk. The state of each counter stage is made available on the I/O connector.

SECTION 5

MAINTENANCE

5.1 GENERAL INFORMATION

The Series 30 is designed to reduce preventive maintenance and repair procedures. This conservative design has virtually eliminated mechanical wear. The design has also resulted in the removal of all potentionmeters, belts, pulleys and other mechanisms normally requiring field adjustment. All components are used well below their design limits. Spindle speed and head position are controlled electrically with the minimum amount of mechanical hardware.

5.2 MAINTENANCE PHILOSOPHY

When machine replacement is not practical the field maintenance philosophy is on-line diagnosis; off-line repair; off-line checkout and adjustment; thus on-line verification of performance. The machine is taken off-line disconnecting the power and signal cables. The machine is placed on-line by connecting the power and signal cable.

[CAUTION]

Do not drop power by removing the power cable. Shut off power at the controlling system. All power must be removed before either cable is disconnected.

5.3 FIELD TESTER AND DISK CARTRIDGE

Diablo offers two exercisers. One has the control switches necessary to perform basic Seek and Restore operations. The second exerciser can perform Seek, Restore, Read/Write and Data Checking functions.

The standard C.E. pack contains two pre-recorded tracks on each side of the disk. Track 100 is an eccentric track, containing 1100 bits per inch. A part of track 100 is written inward from centerline and a part is written outward from centerline. Read/Write head alignment is accomplished when equal amplitudes are present from this eccentric track signal when read by the tunnel erase heads at the standard density. With high density track 105 is used and read by the Read/Write Coils.

The Index Mark is adjusted by use of track 095, which is positioned so a time delay of 30 ±5 μsec exist between the Index Mark and the first bit. Track 100 is used for sector alignment with the high density C.E. pack. The standard C.E. pack is modified to accommodate the high density option.

[CAUTION]

Do not allow writing on the bank of tracks from 90 to 110 to insure protection of the pre-recorded tracks.

5.4 SERVO RELEASE SWITCH

The electronic detenting of the Series 30 holds the head carriage. Do not attempt to move the head location when power is applied until the servo release switch, located at the top right section of the motherboard, is depressed.

5.5 MOTHERBOARD

Raise the motherboard to the servicing position (see Figure 5-1), after releasing its four holding screws, by using the handle in the center of the board. Make sure the board is locked into its servicing position, by using the hand operated linkage, before releasing the handle. These precautions should also be used to lower the board into its normal operating position. Do not leave the holding screws loose.

5.6 PREVENTIVE MAINTENANCE PHILOSOPHY

The objective of maintenance is to provide maximum utilization of the machine with minimum unavailable time. Unless a preventive maintenance operation increases machine availability it is unnecessary. The semi-annual preventive maintenance session on the Series 30 is comprised of visual inspection and cleaning. Do not alter any adjustment on equipment that is performing at a satisfactory level.

Preventive maintenance procedures, when operating in a normal office environment on a one-shift basis, are to be performed at 1000 operating hour intervals, an abnormally dirty environment or a high incident of cartridge loading may dictate preventive maintenance. Table 5-1 indicates the area that should receive preventice maintenance and the action to be performed.
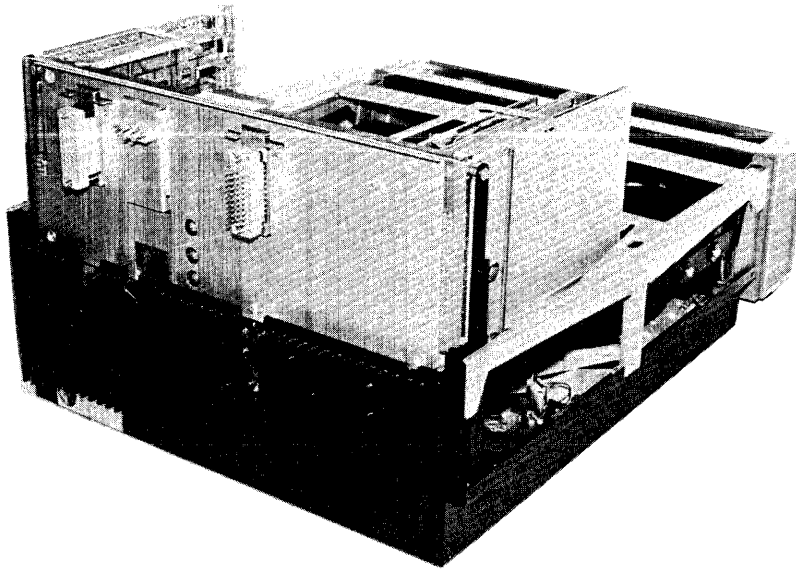
Figure 5-1   DISK DRIVE WITH ELECTRONICS ASSEMBLY SHOWN RAISED IN THE SERVICING POSITION

TABLE 5-1

PREVENTIVE MAINTENANCE ACTION
6 month interval

AREA	ACTION
Read/Write Heads	Clean and inspect for scratches and build-up of oxide
Carriage Rail	Clean and inspect. Apply two drops of oil on each of the 2 wicks only if dry.
Spindle Assembly	Clean and inspect the magnetic ring. Magnetic particles may be removed using adhesive tape.
Base Plate and Covers	Clean and inspect for loose hardware.
Air Filter	Replace

5.7   PREVENTIVE MAINTENANCE PROCEDURES

HEAD CLEANING — Clean heads with 91% isoprophyl alcohol (or equivalent) using a lint free wiper to remove any alcohol residue. Complete removal of contamination, including fingerprints, is mandatory.

AIR FILTER REPLACEMENT — To replace the air filter, disconnect all cables from the disk drive and turn the entire unit upside down for convenience of access.
1.   See Figure 5-2.
2.   Loosen the two filter screws and lift out filter element.

3.   Install a new element (Diablo Part No. 15170), making sure that its orientation agrees with the air flow direction arrow shown on the filter element.
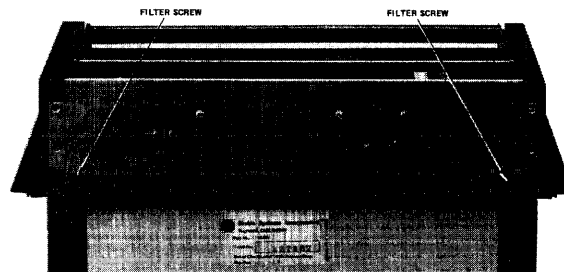4.   Tighten the filter screws.

Figure 5-2   AIR FILTER REPLACEMENT

5.8   TROUBLESHOOTING

The following simplified procedures are to be used to determine whether the Series 30 is malfunctioning or whether the malfunction is actually being caused by some other reason. During the warrantly period additional troubleshooting or repair should not be performed on the disk drive. Diablo should be contacted for servicing assistance, instructions, or for return of the equipment to the factory. If any additional maintenance is to be done, a Maintenance Manual must be obtained from Diablo.

When an operating difficulty is encountered check the software in the controlling system, the cartridge, and the operating system control inputs to the Series 30, verify that all cable connections are made properly. If difficulty

has not been isolated remove power to the equipment and disconnect the input/output signal cable. Then turn on equipment power.

Load a cartridge into the disk drive and bring it up to speed. At this time, either the READY or CHECK lights should be on and the corresponding output signal on the rear panel interface connector will be true if the unit is selected.

CHECK light on indicates low voltage, or trouble in the Write circuitry.

READY light on indicates that a cartridge is properly loaded, that the speed is correct and that the heads are loaded.

Neither light on after about 50 seconds indicates power or internal difficulty; Diablo Field Service Department should be contacted.

5.9 SPARE PARTS

When a customer has a trained service force maintaining a system configuration, the return of the Series 30 to Diablo for maintenance may be judged impractical. In this, or similar situations, the customers service force should be supported with spare machines or spare parts.

The following three lists of spare parts represent the three levels of recommended spare parts for supporting the Series 30.

List 1. Preventive Maintenance Kit — These items should be available to each person servicing the Series 30 on a scheduled basis. It contains all the material needed for normal scheduled maintenance.
1. 91% isoprophyl alcohol
2. Lint free wipers
3. Syringe oiler
4. Touch-up paint
5. Air filter

List 2. Corrective Maintenance Items — This listing contains all the sub-assemblies, tools and test equipment that would be required to effectively repair the Series 30 in almost 100% of the instances.
1. One of each pluggable circuit card
2. Diablo exerciser
3. One C.E. disk cartridge (standard or high density)
4. One upper and one lower Read/Write head
5. One Head Cable
6. Card retainers - left and right
7. Power transistors
   a) MJE2955
   b) MJE3055
   c) MPSU01
   d) MPSU51
8. Lamps
9. Extender board
10. Oscilloscope
11. Tools

a) Long blade screwdriver
b) Phillips screwdriver
c) Track "0" deflection tools
d) Torque wrench set

List 3. Parts Support Location — This is the highest level of spare parts that is recommended by Diablo Field Service Department. This level of spare parts would be appropriate for the self sufficient customer who has a large number of disk drives.
1. Additional preventive maintenance items
2. Additional corrective maintenance items
3. Spindle assembly
4. Head Positioner assembly
5. Motherboard and heatsink assembly
6. Cartridge receiver assembly
7. Door lock assembly

5.10 LOCATIONS

This section contains descriptions and illustrations of components within the Series 30. These illustrations serve as an aid in accomplishing maintenance operations.

Baseplate Assembly A rigid aluminum casting, around which the entire drive is structured. The baseplate itself rests on three resilient shock mounts and provides mounting for the spindle assembly head positioner assembly, cartridge handling components, and the sector transducer.

Spindle/Blower Assembly (Figure 5-3) Consists of a dc servo motor; a plate that holds the cartridge by means of a magnetic ring; and an impeller used for forcing filtered air into the disk cartridge.
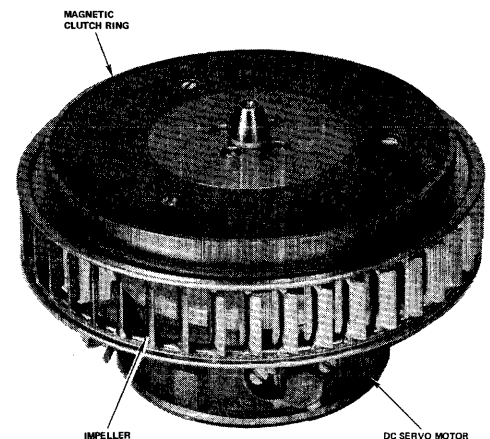

Figure 5-3   SPINDLE BLOWER ASSEMBLY

Head Positioner Assembly (Figure 5-4) Consists of a head carriage sub-assembly that holds the heads, a head position transducer that provides feedback to the servo circuits, and a head loading mechanism that lowers or retracts the heads from their operational position. Motion is imparted to the head carriage by a built-in dc servo motor, via a rack and pinion.
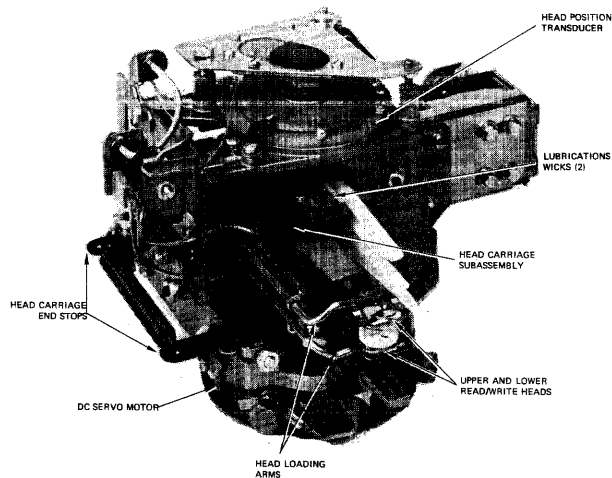
Figure 5-4 HEAD POSITIONER ASSEMBLY (FRONT VIEW)

Door and Cartridge Receiver Assembly (Figure 5-5) The The front assembly includes the cartridge access door, control panel and the cartridge removal interlock components. The cartridge access door constitutes a single sub-assembly with a linkage to the cartridge receiver that raises the cartridge off of the spindle assembly when the door is opened.

Cartridge Handling Components (Figure 5-5) Includes the cartridge receiver, a cartridge sense microswitch, the cartridge door opening mechanism, and two pins on which the cartridge aligns when inserted.

Air Filtering Components (Figure 5-2) Includes the filter, impeller (mounted on spindle), and scroll case through which the air travels from the filter to the cartridge.

Electronics Assembly (Figure 5-5) A heatsink extends across the width of the equipment enclosure and, together with the motherboard, constitutes the entire back part of the equipment. On the inside face of the heatsink panel are power transistor circuits. Parallel and adjacent to the heatsink is a motherboard to which all circuit card connectors and also the external cable connectors are attached. There are six pluggable circuit cards and space is provided for four additional cards. The entire motherboard and pluggable circuits cards can be raised for maintenance access.
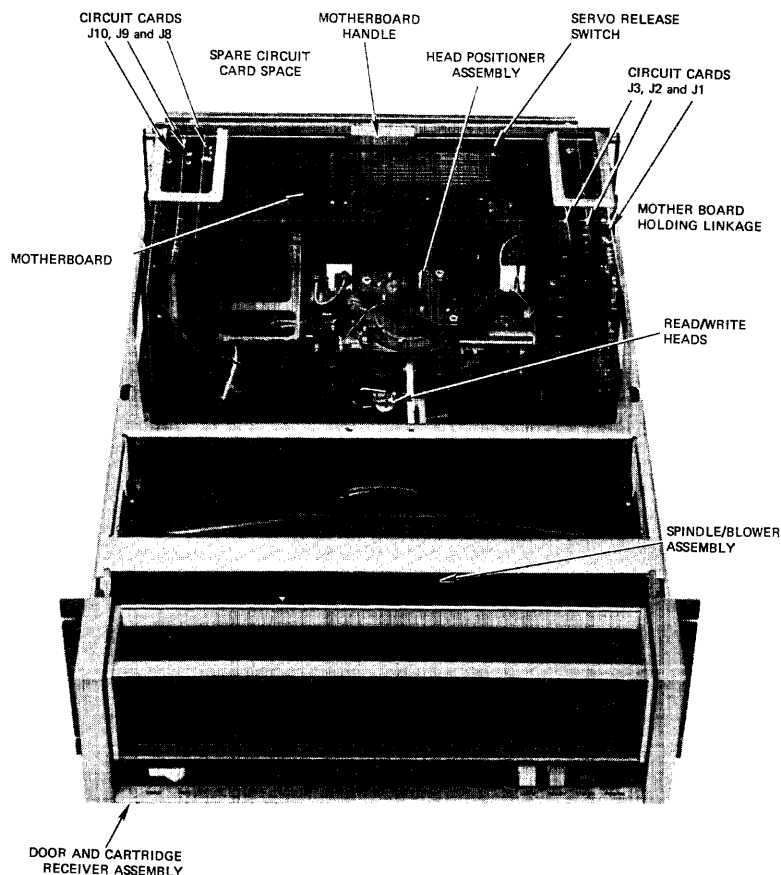

Figure 5-5 INTERNAL COMPONENTS OF THE DISK DRIVE

SECTION 6

OPTIONS

6.1 GENERAL INFORMATION

The following paragraphs first outline the standard Series 30 Disk Drive, and then describe several major options which may be included during manufacture or added later. Table 6-1 at the end lists all currently available options.

Any questions regarding options should be taken up with your Diablo Sales Representative.

6.2 THE STANDARD SERIES 30 DISK DRIVE

The standard, or basic Series 30 Disk Drive includes mechanisms and circuitry to produce all data, control, and status functions with TTL or DTL compatible logic signals in standard density format (1100 BPI) housed in a standard cabinet.

6.3 OPTIONS

6.3.1 Mounting Options
Series 30 Disk Drives may be used as desk top units, or mounted in a 19" rack cabinet. When mounted in a rack cabinet, the disk drive should be supported on slide rails and be equipped with a front panel assembly that attaches to the rack cabinet. Diablo supplies slide rails, mounting brackets, and hardware with units ordered with the extended or flush mount option (No. 15376-01 LH Slide, -02 RH Slide/ No. 15558 Rail-to-Rack Mounting Brackets/ and No. 15691-01 Hardware Kit).

Diablo slide rails allow the disk drive to be pulled out from the rack cabinet far enough to raise the electronics assembly, with the rear panel cable connectors attached, to an elevated service position. The user must specify the physical mounting configuration at the time of ordering. Refer to Figure 2-1.

1) OPTION 017 — Flangeless front mount. This configuration does not have the mounting flanges used to fasten the drive into a cabinet. This configuration is considered a desk top model, even though it may be mounted on slide rails and installed in a rack cabinet.

2) OPTION 018 — Flush Mount. The front of the Series 30 is fastened flush with the front of the cabinet with this configuration. This option requires a cabient at least 30" deep, and may require a trim piece (OPTION 020) at the top and bottom of the installation.

3) OPTION 019 — Extended Mount. This configuration will fit into a 24" deep cabinet. The front of

the Series 30 will extend 3¼" from the front of the cabinet.

6.3.2 Density and Sector Options

The user must specify the required density at the time of ordering. The data separation circuits and, possibly, other assemblies are affected by the density ordered.

1) OPTION 001 — 1020BPI and 720 KHz
2) OPTION 002 — 1100BPI and 781 KHz (Standard Density)
3) OPTION 003 — 2040BPI and 1440 KHz
4) OPTION 004 — 2200BPI and 1562 KHz (High Density)

The user may also select various sector configurations.

5) OPTION 025 — Standard Density 8 Sector
6) OPTION 026 — High Density 8 Sector
7) OPTION 039 — Standard Density 12 Sector
8) OPTION 041 — High Density 12 Sector
9) OPTION 052 — High Density 16 Sector
10) OPTION 040 — Standard Density 24 Sector
11) OPTION 042 — High Density 24 Sector
12) OPTION 054 — 32 Sector

6.3.3 Input Line Options

1) OPTION 008 — ERASE GATE. One line normally tied internally to the Write Gate which turns on the Erase Current. With the Erase Gate Option, this line is brought out separately. There is no built-in delay of Erase Current.

2) OPTION 005 — WRITE PROTECT INPUT. The Write Protect option prevents writing by inhibiting Write Current. Write Protect is set when power is applied or when the LOAD/RUN switch is activated. It may also be set by this Write Protect input line with a 0 volt nominal signal with a minimum duration of 350 nsec. Write Protect is reset by the operator depressing the PROTECT switch.

6.3.4 Output Line Options

1) OPTION 005 — WRITE PROTECT STATUS. A 0 volt nominal level indicates that the drive's write capability is inhibited. The operator can change the status manually by depressing the momentary action PROTECT switch on the front panel. This reestablishes the drive's write capability.

2) OPTION 046 (−)⎫ ATTENTION LINE.
    OPTION 047 (+)⎭
    Four standard interface lines are reassigned with this option. These lines are:

Attention Unit No. 1 Pin H
    was Write Protect Input
Attention Unit No. 2 Pin M
    was High Density Indication
Attention Unit No. 3 Pin S
    was Pseudo Sector Marks
Attention Unit No. 4 Pin xx
    was Logical Address Interlock

An internal attention jumper plug is added in each drive. This jumper plug connects that drive to one of these four Attention lines. The Attention line number and the Select line number must correspond.

The Attention line signal is a logical combination of internal disk drive signals and serves the purpose of informing the controller when a disk drive becomes ready, completes a seek operation, fails to complete a seek operation, or accepts a cylinder address.

With Attention line negative (Option No. 046), the Attention line is at a nominal 0 volts in the not ready state, and goes to +5 volts when the disk drive reaches the Ready status. The Attention line will go to 0 volts at the start of a seek operation, and will return to +5 volts at the completion of the seek. This occurs when the read/write heads are settled over the new cylinder, or upon detection of a Seek incomplete condition. In the event of a seek to the present cylinder address, the Attention line presents a pulse coincident with the Address Acknowledge pulse. In the event of a illegal cylinder address, the Address Acknowledge pulse is presented to the Attention line; the Seek Incomplete line is also set true with an illegal address and must be reset by a restore operation.

With Attention line positive (Option No. 047), the Attention line is at +5 volts in the not ready state, and goes to 0 volts when the disk drive reaches status. The output level of the Attention is in the opposite polarity, but operates exactly as explained in the above description of Option No. 046.

3)   OPTION 048 — INTERRUPT. With this option the File Ready, Ready to Seek/Read or Write, and Seek Incomplete are not conditioned by the Select line. Therefore they present their status to the interface at all times. This option may require special cabling not provided by Diablo except by quotation.

TABLE 6-1

SERIES 30 OPTIONS

OPTION	DESCRIPTION
001	720 KHz - 1020BPI - IBM Compatible
002	781 KHz - 1100BPI - Diablo Standard
003	1440 KHz - 2040BPI - Option
004	1562 KHz - 2200BPI - Option
005	Write Protect
008	Erase Gate (Not tied to Write Gate)
013	Paint - Orange with Diablo Logo
014	Paint - Orange without logo
015	Unpainted without logo
017	Flangeless Mount (table top trim)
018	Flush Mount
019	Extended Front
020	Upper Trim for Flush Mount
020	Lower Trim for Flush Mount
023	Drive Tester with Read/Write Data
024	Extender Board Assembly
025	Standard Density - 8 Sector
026	High Density - 8 Sector
027	Standard Density Alignment Pack
029	Dual Unit Power Supply
030	High Density Alignment Pack
032	Power Supply Cable
033-05'	Receptacle Connectors on 5' flat cable (female)
033-07'	Receptacle Connectors on 7' flat cable (female)
034-05'	Pin Connectors on 5' flat cable (male)
034-07'	Pin connectors on 7' flat cable (male)
035	Receptacle terminator with resistors (female)
036	Pin terminator with resistors (male)
037	Receptacle terminator without resistors (female)
038	Pin terminator without resistors (male)
039	Standard Density - 12 Sector
040	Standard Density - 24 Sector
041	High Density - 12 Sector
042	High Density - 24 Sector
043	Option 023 using external power
044	Rack Mounting for Power Supply
045	Paint - Black without logo
046	Attention Line Negative
047	Attention Line Positive
048	Interrupt Option
050	DTC Card FPC Interdata Controller
051	Standard Density - 16 Sector
052	High Density - 16 Sector
053-05'	M/F Cable 5'
053-07'	M/F Cable 7'
054	32 Sector
056	Cable Assembly (Interdata Controller)
057	Terminator (no erase gate) Female with resistors
058	Terminator (no erase gate) Male with resistors
060	Paint - Grey/Green without logo
061	Paint - Blue without logo
062	Grained without logo
063	Paint - White White (Varian)
064	Attention line with logical address interlock (Varian)
065	Cartridge Closing Bail Assembly