Helios II

Model 2 (Part No. 300000)

Model 4 (Part No. 304000)

Disk Memory System Manual

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PREFACE

As a convenience feature for the user, this three-ring binder is an "easel" binder. The cover is hinged across the front and back as well as down the binding. You may find it helpful to stand up the binder in its easel position for two-handed operations when reference to the manual is necessary at the same time, as in the assembly sections, or troubleshooting.

TO USE THIS FEATURE: (Refer to illustration below)

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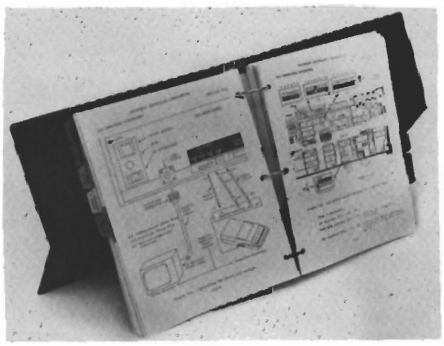
2. Set the manual up on the table, with the bottom of the pages down against the table, and the top inclining away from you. (It is supported from falling by the portion of the binder you have bent back.)



IMPORTANT NOTE

The first part of this manual you should read is at the very end: the Updates section. Integrate this information into your manual before you begin.

The reader is invited to participate in the evolution of this manual. Please send your comments or suggestions for improvements to Processor Technology.

In Memoriam

This book is dedicated in grateful memory of Noel Leffler, a fine engineer and good person who is largely responsible for this book, but who died before his Helios II project was completed.

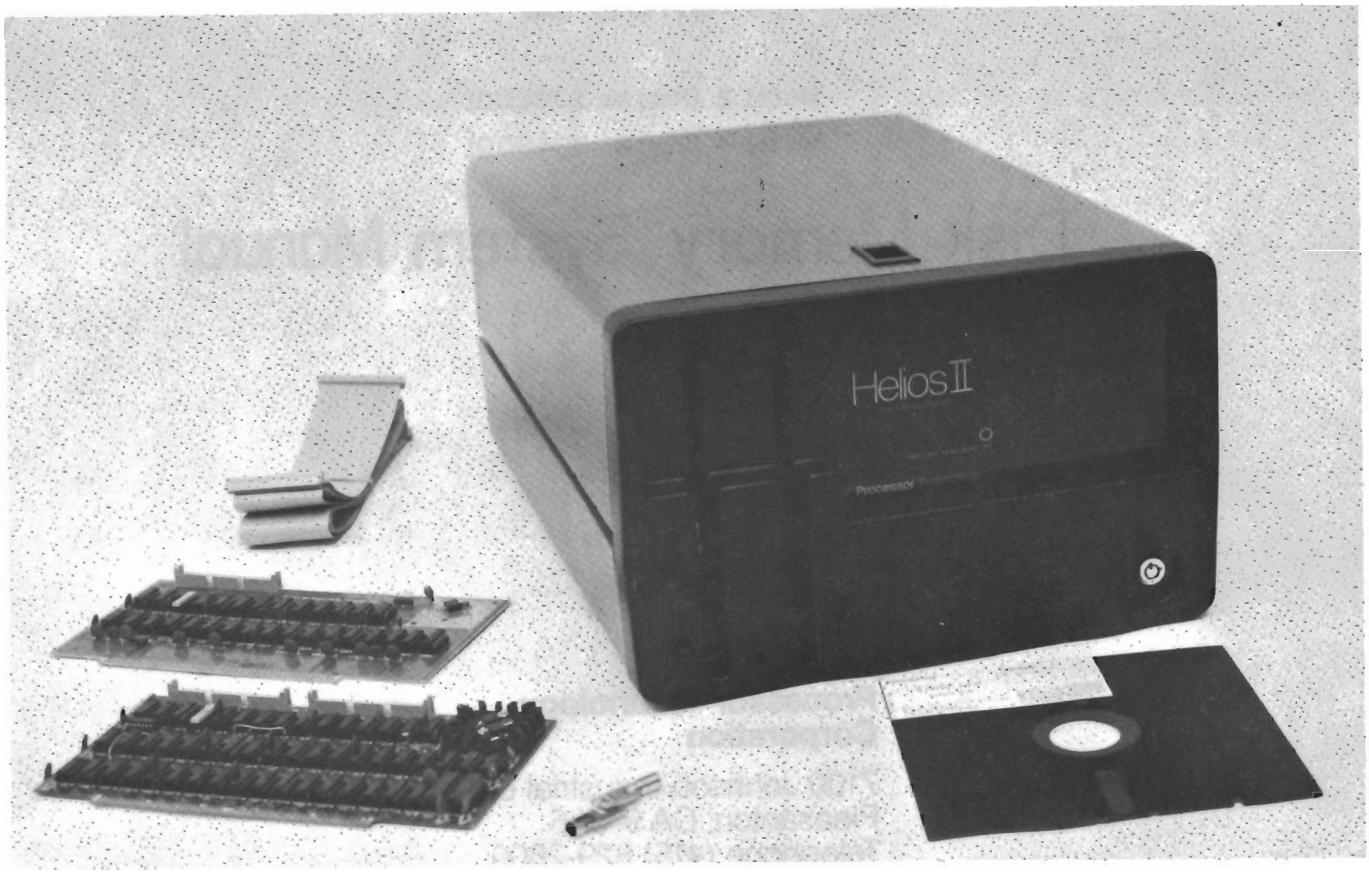


Fig. Ø Helios II System: Diskette Drive Cabinet, Controller and Formatter PCBs and Diskette containing PTDOS

CONTENTS OUTLINE

Detailed contents precede each section.

SOFTWARE MANUAL: PTDOS User's Guide

NOTE

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ABBREVIATIONS

±	Plus or minus
A	Ampere; Automatic; Address
AC	Alternating current
ACI	Audio Cassette Interface
ADDR DSBL	Address Disable
A/R	As received
Assy	Assembly
Aux	Auxiliary
AWG	American Wire Gage
BC	Bit Counter
BCTC	Bit Counter transmission complete
Bin	Binary
BO	Bootload
Br.	Bridge
BTU	British Thermal Unit
BUSTR	Bus Strobe
C	Celsius (centigrade); Capacitor
CC	Construction Counter
CC DSBL	Command/Control Disable
Cer	Ceramic
CF	Carbon film
CI	Command Interpreter
Cm	Centimeter
CNTR	Counter
Comm	Commoning
Conn	Connector
CPSI	Clock Pulse Serial Input
CPSO	Clock Pulse Serial Output
CPU	Central Processing Unit
CR	Carriage Return
CRC	Cyclic Redundancy Check
CRC ERR	CRC Error
CUTS	Computer Users Tape System
CWE	Check Write Enable Signal on formatter, CRC gen.
D	Display
DC	Direct Current
DI	Data Input
DIO	Diode
DIP	Dual-In-Line Package
DMA	Direct Memory Access
DNSYNC	Name of a FF on the controller
DO	Data Output
DO DSBL	Data Out Disable
DOS	Disk Operating System
Drv	Drive
DS	Data Serial
EMI	electromagnetic interference
EO	Enable Output (Fifo signal)
EX-OR	exclusive OR
F	Fahrenheit
Fab	Fabrication
FF	Flipflop
FIFO	First-In, First-Out (LSI Buffer)
FIFOPL	FIFO Parallel Load
FIFO QS	Fifo Serial Output
Fig	Figure
ft	feet
FW	Flat Washer
g	gravity (unit of measure)
GND	Ground
Hex	hexidecimal
HN	hex nut

HRR	Hold Request Resynchronized
Hz	Hertz (cycle)
IC	Integrated Circuit
ID	Identifier
IESA	Input Enable Serial, A
IESB	INPUT Enable Serial, B
Insul.	Insulated
Inv	Inverter
I/O	Input/Output
IRF	Input Register Full
ITLW	Internal Tooth Lock Washer
J	Jack
JK	Inputs to a JK Flipflop
K	kilobyte
Kg.	kilogram
kHz	kilohertz
LED	Light Emitting Diode
LS	Low Power Schottky
mA	milliampere
µf	microfarad
max.	maximum
MOS	Metal Oxide Semiconductor
MPX	multiplexer
MR	Master Reset (Fifo signal)
µs	microsecond
ms	millisecond
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
N	number
NA	Not Applicable; National Semiconductor
NET	network
No.	number
NPN	Negative, Positive, Negative
ns	nanosecond
Ω	ohm
OD	outside diameter
OESA	Output Enable Serial, A (Fifo signal)
OESB	Output Enable Serial, B (fifo signal)
ORE	Output Register Empty
P	Plug; Processor
PC	Punctuation Counter
PCB	Printed Circuit Board
PCHI	Signal on formatter
PCL	Punctuation Counter L
PCQ	Punctuation Counter Output
PCX	Punctuation Counter X
PDBIN	Processor Data Bus In
PHLDA	Processor Hold Acknowledge
PHLDAR	Delayed PHLDA
PHMS	Phillips Head Machine Screw
PINTE	Processor Interrupt Enable (S-100 signal)
PL	Parallel Load
Plex	plexiglas
POC	Power On Clear
PRDY	Processor Ready
PT	Processor Technology
PTDOS	Processor Technology Disk Operating System
PWAIT	Processor Wait (S-100 signal)
PWR	Processor Write
Pwr	power

Q	transistor; Output of a JK flipflop
R	Resistor
RAM	Random Access Memory
RCLOCK	Read Clock
RDATA	Read Data
Recpt.	receptacle
Rect.	Rectifier
Reg.	regulator
REV	revision
RH	Relative Humidity
RMC	Read missing clock
RND	Round
rpm	revolutions per minute
RSECT	Sector Reset
RQST	Request
R/W	Read or Write
S	Seek; Status
S-100	name of Intel standard 100-pin bus interface
SREADY	Status Ready
SS	solid strand
sec.	second
SHLTA	Status Halt Acknowledge
SINP	Status Input
SINTA	Status Interrupt Acknowledge
Sldr	solder
SM1	Status Machine Cycle 1
SMEMR	Status Memory Read (S-100 signal)
SOUT	Status Output
SWO	Status Write Out (S-100) Signal
SYNC	Synchronization
Tant	tantalum
TC	Transmission Complete
TCSI	Transmission Complete Serial Input
TOP	Transfer Out Parallel (Fifo Signal)
TOS	Transfer Out Serial (Fifo Signal)
TP	Test Point
TR	transfer
TRANS COMM	transfer command
TTS	Transfer to Stock, FIFO signal
U	Integrated Circuit
UFO	Unidentified Flying Object
UUT	Unit Under Test
ϕ2	Phase 2 (Signal on Controller)
V	Volt(s)
VAC	Volts AC
VCC	+5 V (Fifo pin)
VDC	Volts DC
VDM	Video Display Module
VOM	volt/ohm meter
XCVR	transceiver
XEQ	Execute
XRDY	External Ready

CONTENTS

SECTION 1 INTRODUCTION

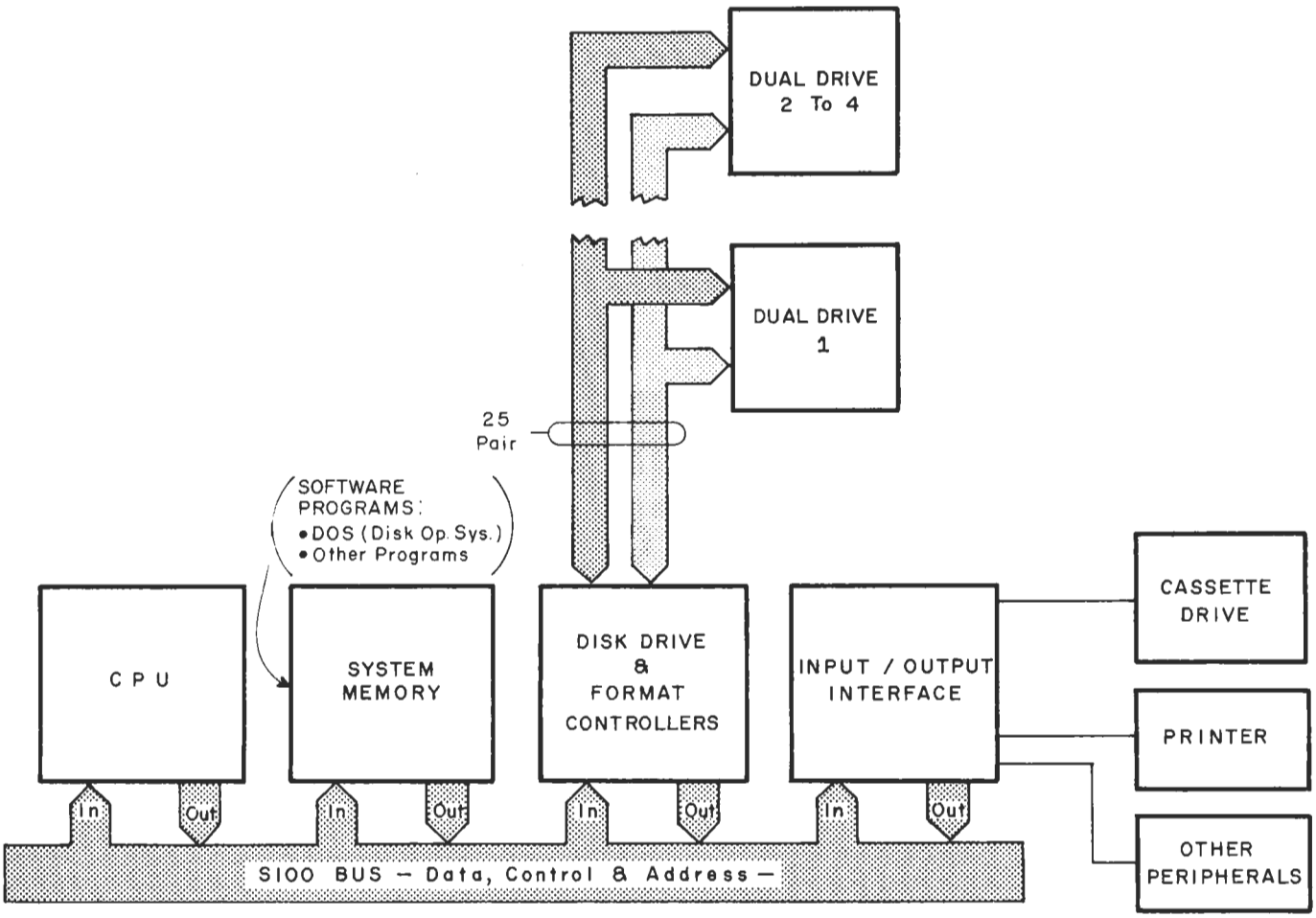

Fig. 1-1 Helios II System, Generalized Block Diagram

SECTION 1 INTRODUCTION

1.0 SCOPE OF THIS MANUAL

This manual is an operating and light maintenance reference for Helios II floppy disk memory system in its various configurations. The binder containing this manual also contains the system software manual, PTDOS User's Manual.

For detailed drive assembly troubleshooting, and replacement procedures for authorized dealers, refer to Helios II Service Manual.

1.1 GENERAL DESCRIPTION OF THE Helios II SYSTEM

(Refer to Fig. 1-1, Helios II System, Generalized Block Diagram.)

The Helios II is a dual floppy disk drive system designed as a mass data storage for host microcomputers using the S-100 bus. The disk drive unit is a firm-sectored type, which uses an optical sector and indexing system. The diskette required is a standard 32+1 hole diskette. System storage capacity is approximately 768,768 bytes per dual drive (two diskettes). The controller in the system is capable of interfacing up to four dual drives in two cabinets. Access time is approximately 173 ms typical. DMA (Direct Memory Access) transfer rate is approximately .66 megabyte per second. A sixteen byte fifo buffers the drive and computer.

1.2 PHYSICAL CONFIGURATION (Refer to Fig. 3-4, Diskette Drive Cabinet, Inside View.)

A. Model 2

The Helios II Model 2 consists of one dual drive unit, in its own air cooled cabinet, a controller PCB and formatter PCB which plug into the backplane of the S-100 bus, a power supply and cabling. (Refer to the frontispiece "Helios II System ...") The formatter is virtually part of the controller. The formatter PCB does not have to be plugged into the backplane. A Model 2 can be upgraded to a Model 4.

B. Model 4

The Helios Model 4 consists of two dual drive units in a cabinet the same size as the Model 2. It differs from the Model 2 in that it has two fans, a higher capacity power supply, and a larger indicator display. It uses the same controller and formatter PCBs.

Two Model 4s can be daisy-chained in an 8-diskette-unit system which can be accommodated by standard controller and formatter PCBs and PTDOS software.

1.3 OPERATING SYSTEM and TEST/DIAGNOSTIC PROGRAMS

A disk operating system called PTDOS (Processor Technology Disk Operating System) is provided on a diskette. A test program is also provided on cassette.

1.4 DESCRIPTION OF DISKETTE DRIVE ASSEMBLY

(Refer to Item 7, Fig. 8-2, Cabinet Assembly, Model 2, Exploded.)

The Helios II diskette drive assembly (commonly referred to hereafter as "drive assembly") is installed in the Helios II cabinet as a separate subassembly without DC power or cabling of its own. Signal and power are provided from interconnections from other subassemblies in the system.

The Helios II diskette drive is designed to provide a means of low-cost, random-access data storage. This is accomplished through the recording of data on, and the retrieval of data from two separate rotating magnetic surfaces, as represented by two separate diskette cartridge assemblies (commonly called diskettes).

Means for easy acceptance, rotation, and quick independent removal of each diskette is provided by spindles which are linked to and derive their rotational motion from an electrical drive motor.

The diskette drive consists of: selectable read/write/erase electronics; common positioning control electronics; a common head positioning actuator; a common Track ØØ sensor; a common spindle drive mechanism; two read/write/erase heads; two head loading actuators; two separate index sensors.

1.4.1 DISKETTE ACCESS

Data is transferred to or from each diskette through its separate read/write/erase head.

Each read/write/erase head is assembled on a carriage which is located on the common head positioning actuator. The read/write/erase head is in direct contact with the diskette media surface. The head employs a single read/write gap followed by tunnel erase elements to provide erased areas between data tracks. Thus, normal track position tolerances between media and drives will not degrade the signal-to-noise ratio, and the diskette interchangeability is enhanced.

1.4.2 ELECTRONICS

A. Sufficient control electronics are employed to provide minimal data access time at optimal data transfer rates within compatibility requirements.

   The electronics perform the following functions:

1. Interpret and generate control signals.
2. Move the read/write/erase heads to the selected track.
3. Load the heads and read or write data.
4. Drive the spindle motor.

B. The electronics are packaged on printed circuit boards containing the following circuits:

1. Head positioning actuator driver.
2. Head load actuator drivers.
3. Read/write/erase amplifier and transition detector.
4. Index detection.
5. Track position and data safety sensing.
6. Spindle motor driver.

1.5 DISKETTE (Refer to Section 2, for specifications.)

The diskette is a cartridge that consists of a flexible magnetic disk enclosed in a plastic jacket. The disk is free to rotate within the jacket. Access and sector/index holes for the read/write/erase head and for data timing are provided. There are 32 sector holes and one index hole. Data is recorded only on one side of the diskette at the present time. The Helios II has provisions for the addition of another index photosense assembly to accommodate recording on both sides of the diskette. Reading and writing are done with the head in contact with the disk.

The diskette is provided with an envelope and container to protect the diskette when not in use. Detailed handling instructions are described in Section 4, Operating Instructions.

1.5.1 DISKETTE INTERCHANGEABILITY

Each diskette drive in conjunction with the controller transfers data to and from the diskette in such fashion that diskettes are fully "write/read" interchangeable within any other Helios II diskette drive system. (See Section 4.3.3, Diskette Compatibility with Other Systems.)

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SECTION 2 SPECIFICATIONS

CONTENTS (Continued)

SECTION 2 SPECIFICATIONS

2.0 INTRODUCTION

These specifications are divided into four subsections:

1. System (the cabinet and the PCBs installed in the host computer and cabling).
2. The PCBs excluding those in the drive assembly.
3. The diskette drive assembly.
4. The diskette.

All specifications pertain to a Model 2 (one dual drive) unless noted otherwise.

2.1 SYSTEM SPECIFICATIONS

2.1.1 PHYSICAL

A. Net Shipping Weight: 24.04 Kg. (53 lbs.)

B. Cooling: Forced air with passive mechanical filter.

C. Dimensions (cabinet) Height: 23.47 cm (9.24")
Width: 35.59 cm (14.01")
Length: 50:72 cm (19.97")

2.1.2 ENVIRONMENTAL

A. Temperature and Humidity

1. Operating

a. Range: 10 to 38°C (50 to 100°F)

b. Max. gradient: 36°C (20°F) per hour.

c. Relative Humidity: 8 to 80%.

d. Max. Wet Bulb Temperature: 25°C (78°F).

2. Storage (Non-operating)

a. Range: -29 to +49°C (-20 to +120°F).

b. Max. gradient: 36°C (20°F) per hour.

c. Relative Humidity: 8 to 80%.

d. Max. Wet Bulb Temperature: 29°C (85°F).

B. Ambient Air: Clean, dust and particle free air, cool with 50% humidity. No corrosive gases in the air. No colloids such as tobacco smoke.

C. Other: (See 2.3.3, Diskette Drive Assembly.)

2.1.3 POWER REQUIREMENTS (Cabinet with contained components, excluding PCBs in host computer.)

117 VAC, 8A Max; 5.0 nominal running

OR: 230 V, 50 Hz

Average Power Consumption: 30 watts

2.2 PCBs

The following PCBs are components of the system outside of the diskette drive assembly:

1. Controller
2. Formatter
3. Indicator Panel
4. Regulator

A. IC Technology

TTL and low power Schottky TTL.

B. Power Requirements

PCB	Voltage	Current (Typical)
Controller	+8 VDC (typical) +7.25 VDC (min.)	1600 mA
Formatter	+8 VDC unregulated +7.25 V (min.)	600 mA
Regulator	+8 VDC unregulated (min.); -8 V 60 Hz (min.); 24 V 60 Hz (min.)	
Indicator	+5 VDC	175 mA

C. Connectors

J2 of formatter PCB (jack which mates with P2): consists of a female shell: Molex Part No. 22-01-2015 and three pins, Molex Part No. 09-50-01114. (P2 is not supplied; see Section 3.5, Optional DC Power for Formatter PCB.)

2.3 DRIVE ASSEMBLY (Removed from cabinet and system)

2.3.1 DIMENSIONS

Height: 21.84 cm (8.6")
Width: 11.18 cm (4.4")
Depth: 38.1 cm (15.0") overall from mounting surface
Weight (shipping): 11.34 Kg. (25 lbs. max.)
Weight (installed): 9.07 Kg. (20 lbs. max.)

2.3.2 MULTIPLE-DRIVE OPTION

The multiple-drive option provides for the operation from one controller and two power supplies of up to four dual diskette drives (8 drive units) in close physical proximity to each other. All diskette drives in this system configuration use the same printed circuit boards. However, the line-terminating resistors on the diskette drive electronics printed circuit board (Data and Interface PCB) and indicator panel PCBs and are removed from all but the drive farthest from the controller, and the proper drive selector module is inserted in each drive. (Refer to Section 4.2.2, Drive Configuration.)

2.3.3 ENVIRONMENTAL REQUIREMENTS:

The diskette drive and diskette should be in the same environment and subject to the same environmental conditions (especially temperature and humidity) for at least one hour prior to operation, as normal recommended operating procedure.

A. Temperature, Relative Humidity, Maximum Wet Bulb

(See Section 2.1.2, System Environmental.)

B. Magnetic Fields

1. Operating

The ambient stray magnetic field in the region of the head should not exceed 15 Gauss.

2. Storage

The ambient stray magnetic field in the region of the diskette should not exceed 50 oerstads.

C. Altitude

1. Equipment Operational

Sea level to 10,000 feet.

2. Equipment Non-operational

Sea level to 35,000 feet.

D. Shock and Vibration

The equipment should not suffer damage nor fail to perform as specified after having been subjected to the following shock and vibration under non-operational conditions:

1. Shock

Internal bracing is allowed if needed to meet this requirement. Eighteen (18) impact shocks of 5 g's (±10%) consisting of three shocks in opposite directions along each of three mutually perpendicular axes. Each shock impulse shall be a half sine wave with a time duration of 11 (±1) ms.

2. Vibration

Internal bracing is allowed, if needed, to meet this requirement. 1.5 g's (±10%) for the 5 to 55 (Hz) range for four hours on each axis with a 20-minute frequency scan.

E. Cleanliness

The Helios II diskette drive assembly is designed for use in commercial and industrial environments. However, no air filters or forced-air systems are provided within the diskette drive itself. Therefore, it should be kept in the Helios cabinet. If it must be removed from the cabinet for maintenance, and operated, optimum performance can be expected when used in a computer room environment with the resultant air cleanliness found in such a location. Dust and other airborne contaminants are a major threat to the operating life of the media and drive recording and positioning systems. (Refer to Section 6, Maintenance.)

2.3.4 ELECTRICAL SPECIFICATIONS

A. DC Power

The following DC power is required per dual diskette drive:

+5V DC = 5%	1.7 A nominal running. 2.2 A maximum running.
+8V DC Unregulated (Limits: 7.0 to 10.0V)	1.2 A nominal running. 2.0 A maximum running.
-5V DC = 10%	0.15 A nominal. 0.20 A maximum.
+24V DC + 10%	1.0 A nominal when seeking. 0.2 A nominal when not seeking. 1.2 A maximum seeking with 3.0 A. maximum peak surges for up to 10 ms at start of seek.

B. Logic Levels

Interface line logic levels are as follows:

Negative level = 0.0V to ±0.5V.
Positive level = ±2.5V to ±5.5V or open circuit.
I/O signals are negative when selected (True).

2.3.5 FUNCTIONAL SPECIFICATIONS

A. Diskette Loading Controls

Diskette loading and unloading is under manual operator control. Loading and unloading mechanisms within the drive provide the following features:

1. Positive diskette registration when loaded.
2. Visible, partial ejection of the diskette when unloading.
3. Minimum possibility of diskette damage due to loading/unloading.

4. Easy diskette loading and unloading.
5. Unloading initiated manually or by remote control line (remote on designated options only).

B. Diskette Rotational Speed Control

1. Spindle Drive System

A direct-coupled DC spindle motor servoed to follow a reference frequency comprises the diskette spindle drive system. Spindle power is applied by inserting one or both diskettes into the diskette drive.

2. Motor Speed Regulation

a. Average Diskette Rotational Speed: 360 ±7 rpm

b. Instantaneous Speed Variation: ±5 rpm

3. Motor Start Time

The diskette drive comes up to speed and attains operational status with 1 second after the application of drive DC or diskette insertion.

C. Head Loading

1. Head Engage Time

The head engage time is less than 40 ms.

2. Head Contact Force

The head-to-disk contact force is 13 grams nominal, as established by testing and vendor recommendations.

D. Head Positioning

1. Head Positioning Times

Track-to-track, including settling time: 10 ms max.

Inside-to-outside track, including settling: 100 ms max.

2. Rotational Latency

Average rotational latency: 83.3 ms.

3. Head Positioning Error Rate

The head positioning error rate is less than one positioning error per 10^6 seek executions.

E. Data Recording

1. Recording Mode

Data is represented on the diskette by 8-bit bytes.

2. Recording Format

Firm-sectored type, formatted by PTDOS (Refer to Section 7, Theory of Operation.)

3. Recording Density

Data is recorded at a nominal density of 6536 (±4%) flux changes per inch for an all 1's pattern on the innermost track, and 3672 (±4%) flux changes per inch for an all 1's pattern on the outermost track.

4. Recording Capacity

Unformatted data capacity is 3.1 megabits per diskette and 41 kilobits per track, single-side recording. Seventy-seven (77) tracks are available.

5. Write Data Transfer Rate

The write data bit rate is determined by the controller. The nominal bit rate is 250 kilobits per second. To insure that the recording density and read data bit rate are held within the specified limits, the write data bit rate shall not vary more than ±0.3% from nominal.

6. Read Data Transfer Rate

The read data bit rate is determined by the recording density and the rotational speed of the diskette being read. The nominal bit rate is 250 kilobits per second. Due to variations between diskette drives and controllers, this bit rate may vary as much as ±17% on an instantaneous basis (including pulse crowding effects).

7. Recoverable Read Error Rate

A recoverable read error is defined to be a read error corrected by no more than three attempts to read the record in error. The recoverable read error rate is less than one error per 10^9 bits read. All error rates are quoted for reading and writing on the same machine without removal and re-insertion of the diskette. All error rate tests are to be performed with a new (unused) diskette.

8. Non-recoverable Read Error Rate

A non-recoverable read error is defined to be a read error which cannot be corrected after three attempts to read the record in error. The non-recoverable read error rate is less than one error per 10^{12} bits read. Errors caused by the diskette (i.e., due to surface flaws, etc.) shall not be included in the computation of the non-recoverable read error rate.

F. Data Addressing at Track Locations

The diskette drive is designed to locate data at the 77 defined tracks on the initialized surface of a diskette. Recorded tracks after tunnel erasure are 0.012" on 0.021" centers. The 77 tracks are numbered from ØØ for the outermost track to 76 for the innermost track. Track centerline is defined by the formula:

centerline radius = 2.029" + (76-N)/48"
±(tolerance)"

where N is the physical track number.

G. MTBF, MTTR: (See Section 6, Maintenance.)

2.3.6 SAFETY REQUIREMENTS

A. Interlocks

An interlock indicating that a diskette has been properly mounted in the diskette drive is provided for each individual unit within the dual drive. This interlock inhibits operation of the spindle motor and generation of the Ready interface signal when diskettes are not properly mounted in the diskette drive.

B. Heat Dissipation

Nominal heat dissipation for the all-DC-power diskette drive is 109 BTU per hour. Average operating power is 28 watts.

2.3.7 INTERFACE CONNECTORS

Within the configuration of a diskette system, all diskette drives are connected to the controller through a signal connector, either directly or by cabling routed in parallel to other diskette drives. Power is supplied to each diskette drive through a separate power connector.

A. Signal Interface

(For names and descriptions of signals, see Section 7, Theory of Operation.)

The signal connector of the first diskette drive in a diskette system is connected directly to the controller through a 50-conductor flat cable, or through a cable consisting of twenty-five twisted wire pairs. The signal connectors of subsequent diskette drives are connected in parallel with the signal connector of the first diskette drive through similar cables.

All signal lines should have a maximum length of 20 feet, and shall use a wire diameter equivalent to AWG #30 or larger.

B. Power and Interface Pin Connections

(See Section 7, Theory of Operation.)

C. DC Power to Diskette Drives

All DC power lines shall have lengths and wire diameters consistent with meeting the power regulation requirements of the diskette drive, as specified in Paragraph 2.3.4.

Eight lines are used to transmit DC power from the power supply through a separate power connector for each drive. One line pair (high and ground) is used for +5 VDC, one for +5 VDC unregulated, one for +24 VDC, and one for -5 VDC. In addition, a separate single line is available to connect drive and power supply chassis grounds.

Five-foot lengths of #18 AWG wire are normally acceptable for use as DC power lines between the drive and typical power sources.

2.3.8 INTERFACE REQUIREMENTS

A. Power-on Sequence

DC power levels may be applied in any sequence to the diskette drive without causing damage to the drive unit.

B. Power-off Sequence

Power levels may be removed in any sequence from the diskette drive without causing damage to the drive.

C. Data Access and Transfer

The timing inter-relationship during head positioning, head selection, and data transfer satisfies the following criteria and remains within the tolerances specified below:

1. Diskette spindle speed: 360 ±12 rpm.
2. Maximum head positioning time for an adjacent rack seek: 10 ms.
3. Maximum head positioning time for a 76-track seek: 100 ms.
4. Average rotational latency: 83.3 ms.
5. Maximum motor start time: 1 sec.
6. Radial dimensions of recording tracks: 3.612" for track ØØ, 2.029" for track 76.
7. Separation between the read/write gap and the trailing erase gap: 0.035 ± 0.002".
8. Index pulse interval time: 166.7 ± 3.3 ms.
9. Read data cell time: 4.0 µs ± 4%.
10. Write clock pulse to write data pulse: 2.0 µs ± 0.3%.
11. Width of Read, Separated Data, and Separated Clock pulses: 200 ns ± 20%.
12. Write data frequency: 249.7 kHz ± 0.3%.
13. Head load time: 40 ms maximum.
14. Erase gate turn-on: 210 ± 8 µs after leading edge of Write Gate (internal drive timing).

15. Erase gate turn-off: 518 ± 10 µs after trailing edge of Write Gate (internal drive timing).

16. Maximum rise and fall time of interface pulses: 25 ns.

17. Phase-locked oscillator acquisition (lock-up) requirement is 4 bytes of all zeroes data.

18. Separated clock contains only those clocks that were written on the diskette.

19. Write current amplitude automatically switched by internal drive logic between Tracks 43 and 44.

20. Restore is a low-speed head positioning operation to Track ØØ. Completion of the Restore command is indicated by a negative level on the Seek Complete interface line.

21. Track position incrementing of the Track Difference Buffer Register in the drive is initiated by the positive-going (trailing) edge of the internal track detent pulse.

22. The Direction Select line shall be stable for a minimum of 100 ns prior to the leading edge of the Step pulse(s).

23. The entire pulse train on the Step line representative of a multi-track address change (one pulse per track) must be transmitted in less than 2.0 ms, at pulse recurrent frequencies of up to 500 kHz.

2.4 DISKETTE (For care and handling of diskettes, see Section 4.3.)

2.4.1 PHYSICAL

A. Type

Compatible to Dysan Part No. 101, having 32 sector holes and one index hole. Compatible diskettes are manufactured by Maxell.

B. Wearlife

200 hours of use on one track.

C. Dimensions

Inner Disk:	19.8 cm diameter (7.8")
Protective Jacket:	20.32 cm square (8")
Index Holes:	.025 cm (.01")

2.4.2 ENVIRONMENTAL

A. Temperature and Humidity

1. Operating

(See System Environmental, 2.1.2.)

2. Storage (Non-operating)

a. Range: 4°C to 53°C (40°F to 127°F).

b. Relative Humidity: 8% to 80%.

c. Max. Wet Bulb Temperature: 29°C (85°F).

3. Transportation

(Diskette in its envelope and in a protective box)

Range: -40°C to 53°C (-40 to 127°F).

Relative Humidity: 8 to 80%.

B. Ambient Air

Clean, dust and particle free air, cool with 50% humidity. No corrosive gases in the air. No colloids such as tobacco smoke.

CONTENTS

SECTION 3 UNPACKING AND ASSEMBLY TIPS

SECTION 3 UNPACKING AND ASSEMBLY TIPS

3.0 INTRODUCTION

This section contains information you may need from time to time for making hardware modifications and updates to your Helios. It includes PCB and IC handling, soldered and PCB modifying tips.

Instructions for hardware changes are in the form of Change Notices which are contained in Section 10, Updates. From time to time additional Change Notices may be sent to you.

Also, in this section are instructions for re-assembling the Helios II after special cleaning procedures in Section 6, Maintenance.

3.1 UNPACKING

1. Choose a clear, clean, flat area to unpack.

2. Inspect for shipping damage. If damage is detected, contact the carrier and Processor Technology immediately.

3. Do not pull the cardboard dummy diskettes out of the diskette slots. Wait until you have read Section 4, Operating Instructions. The cardboard must be ejected by the drive when AC power is applied.

4. Check the contents of the shipment against the following list and the packing list. If an item is missing, notify Processor Technology.

   a. Helios II cabinet(s) with 2 keys.
   b. Controller PCB.
   c. Formatter PCB.
   d. Cable Assembly, Controller/Formatter.
   e. Cable Assembly, Controller/Cabinet(s).
   f. Helios II Disk Memory System Manual (this Manual).
   g. PTDOS User's Guide software manual
      (in this binder, behind the white cardboard divider).
   h. Diskette, containing PTDOS.
   i. Diskette, blank.
   j. Cassette, Disk System Test.

NOTE: If you have purchased a computer system containing one or more Helios II cabinets, compare the contents of the shipment package(s) against the packing list instead of the above list.

There should also be an accessories price list and a warranty card in the binder of the manual.

5. Fill out the warranty card and mail it to Processor Technology.

6. When you are unpacked, go to Section 4, Operating Instructions.

3.2 ASSEMBLY TIPS

3.2.1 PRINTED CIRCUIT BOARDS

A. ORIENTATION OF PCBs
(Refer to the PCB Assembly drawings in Section 8, Drawings.)

Orient the PCB with the component side up, lying flat on the work bench, so that the printed matter on the component side is in normal reading position. The printed matter is called the legend. The legend contains the silkscreened component layout lines and the component identification words and numbers. The components are soldered in place over their respective outlines. There may or may not be traces on the component side in addition to the components. This side of the PCB is referred to as the "component side" or the "legend side."

The opposite surface of a PCB has trace circuits etched on it and is called the "trace side," or "circuit side," or "solder side." It is characterized by a lack of components and by the points of the component lead wires protruding above its surface (when assembled).

B. IDENTIFYING REVISION LEVELS OF ASSEMBLIES

1. Assembly Number

This number is marked on the component side of the PCB, either silkscreened as part of the legend or etched as part of the conductor pattern if a legend is not used. Example: "ASSY 123456 REV..." The revision level is marked separately and is not part of the silkscreen or etching. "Assembly" means the board is assembled with components to a certain configuration. The same schematic may be used for different assemblies or revision levels.

2. PC Number

This number (with Rev. letter) is etched on the solder side (trace side) of the PCB. Example: "PC 123456 REV X." This PC number gives the part number and revision level of the bare board.

3.2.2 DIP SOCKETS

There are two sizes: 14 and 16-pin. The correct size is indicated by the size of the legend on the component side of the PCB.

A. Orientation of DIP Sockets

Orient each socket with its end notch or #1 end matching the colored dot on the legend. The pin #1 end is indicated by the lower right-hand corner being filled in on an angle. Occasionally, the #1 pin end of a socket is indicated instead by a notch in the side of the socket. (See Figure 3-1, DIP Sockets.)

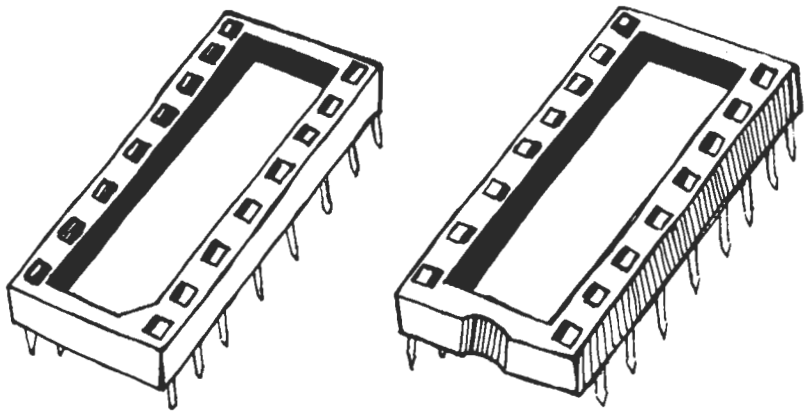


Figure 3-1, DIP Sockets

B. DIP Socket Installation Tip

1. Insert socket pins into the mounting pads at the appropriate location.
2. While pressing the socket in place to ensure that is is fully seated, on back (solder) side of board, bend pins at opposite corners of socket (e.g., pins 1 and 9 on a 16-pin socket) outward until they are at a 45° angle to the board surface. This secures the socket until it is soldered.
3. Repeat this procedure with each socket until all are secured to the board.
4. Solder the unbent pins on the trace side.
5. Straighten the bent pins and solder. Do not solder bent pins since that may cause solder bridges.

3.2.3 INTEGRATED CIRCUITS

> CAUTION
>
> Installing and Removing Integrated Circuits*
>
> NEVER install or remove integrated circuits when power is applied to the Helios II. To do so can damage the ICs.

*There are no MOS ICs on Helios PCBs.

A. ORIENTATION OF ICs AND SOCKETS

Orient the IC so that the number one pin is in the lower right hand corner. The pin number one position is indicated by a dot or small hole embossed into the lower right hand corner or by a notch molded into the IC on the lower edge when the IC is properly oriented. The assembly drawing and the legend both show the notch in the lower edge of the IC and a dot on the PCB in front of the outline of the IC socket. (See Figure 3-2, "Integrated Circuits.")

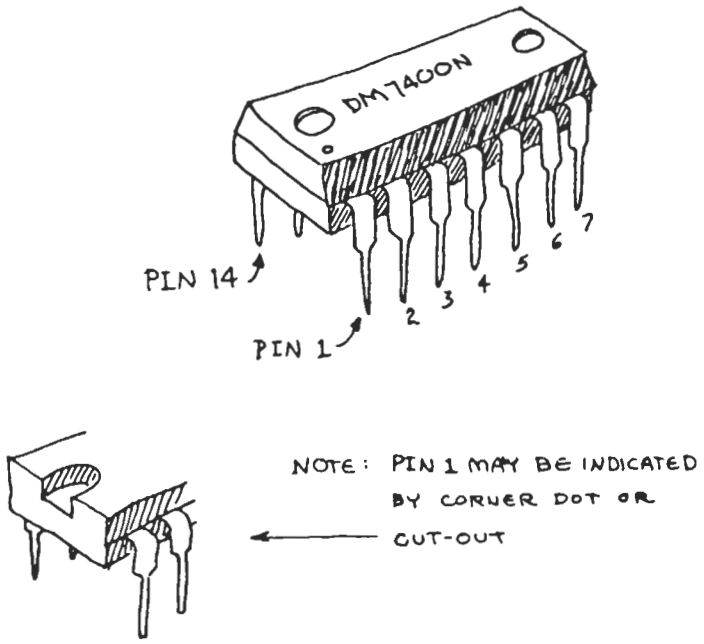


Figure 3-2, Integrated Circuits

B. LOADING ICs

Many DIP devices have their leads spread so that they may not be inserted directly into their sockets. They must be "walked in" using the following procedure.

Insert the pins from one row only into the socket until they barely engage. Push the device using both hands with even pressure to bend this first row of pins until the second row of pins lines up with the holes in the socket, then push the second row of pins into the socket. After all ICs are inserted, examine each to make sure that no pins are bent out or under. Careful examination might prevent hours of unnecessary troubleshooting later.

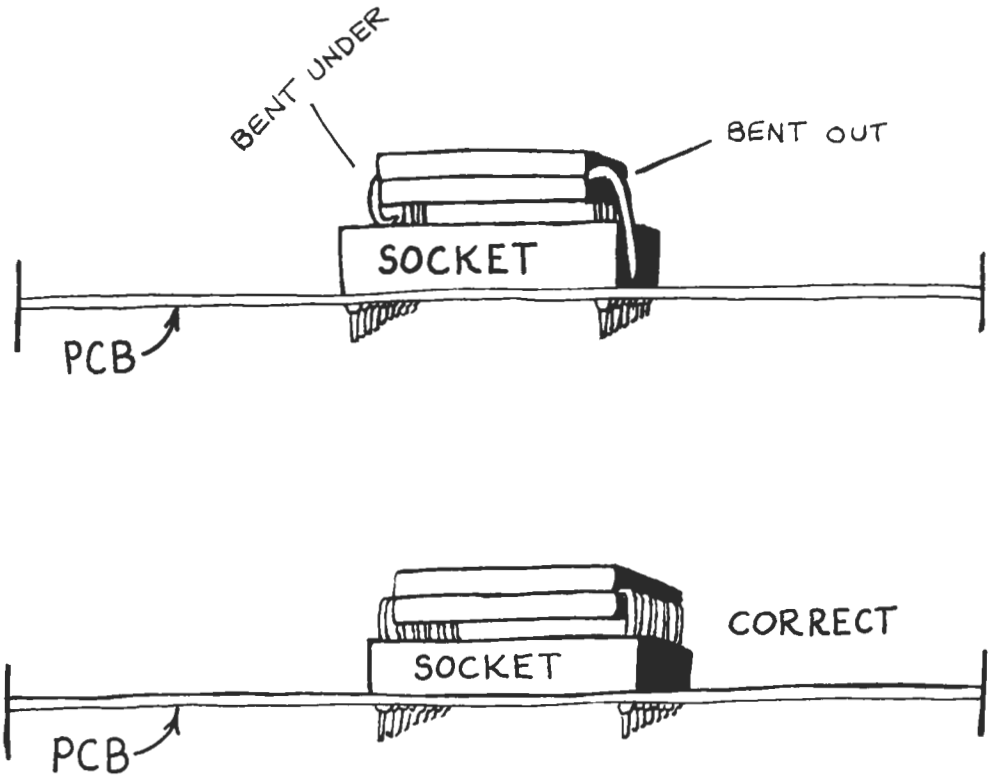


Figure 3-3, Checking IC Pins

3.2.4 SOLDERING

1. Use a low-wattage iron with a small screwdriver pointed tip, 25 watts maximum on the formatter, controller, and indicator panel PCBs. A higher wattage may be used on the regulator board.

   Larger irons run the risk of burning the printed-circuit board. Don't try to use a soldering gun, they are too hot.

2. To make a good solder joint the iron must be clean. Keep a damp piece of sponge by the iron and wipe the tip on it before using it and after each use.

3. Use only 60-40 rosin-core solder. NEVER use acid-core solder or externally applied fluxes. Use the smallest diameter solder you can get.

4. To solder, wipe the tip, apply a light coating of new solder to it, and apply the tip to both parts of the joint, that is, both the component lead and the printed-circuit pad. Apply the solder against the lead and pad being heated, but not directly to the tip of the iron. Thus, when the solder melts the rest of the joint will be hot enough for the solder to "take," (i.e., form a capillary film).

5. Always heat both parts that are to be soldered, preferably at their junction. Use a very light touch. Pressing the

tip of the iron too hard on pad or trace can cause the pad or trace to lift off the board and permanently damage the board.

6. Apply solder for a second or two, then remove the solder and keep the iron tip on the joint. The rosin will bubble out. Allow about three or four bubbles, but don't keep the tip applied for more than ten seconds.

7. Solder neatly and as quickly as possible. Wipe residual flux off the soldering iron with a damp sponge.

8. Solder Bridges

   Solder should follow the contours of the original joint. A blob or lump may well be a solder bridge, where enough solder has been built upon one conductor to overflow and "take" on the adjacent conductor. This causes a short circuit. Due to capillary action, these solder bridges look very neat, but they are a constant source of trouble when boards of a high trace density are being soldered.

   The Helios II uses circuit boards with plated-through holes. Solder flow through to the component (front) side of the board can produce solder bridges. After soldering each group of components, clean the soldered parts immediately and then check for such bridges.

   A few minutes of careful inspection at this time may prevent damage to components and hours of troubleshooting later. The best time to inspect for solder bridges is immediately after soldering; otherwise, time will be wasted going back to find the soldered areas with the possibility of overlooking or forgetting them.

   To remove solder bridges, it is best to use a vacuum "solder puller" if one is available. If not, the bridge can be reheated with the iron and the excess solder "pulled" with the tip along the printed circuit traces until the lump of solder becomes thin enough to break the bridge. Braid-type solder remover, which causes the solder to "wick up" away from the joint when applied to melted solder, may also be used.

9. The Helios II circuit boards have integral solder masks (lacquer coating); masks shield selected areas on the boards and minimize the chances of creating solder bridges during assembly. Do not put masking tape over the traces. When the masking tape is removed, it can tear off the solder mask.

SOLDER CLEANING INSTRUCTIONS

A. Select the following materials:

   a. Solder flux remover (kester).

   b. Flux (Acid) Brush (Cut off bristles of a tooth brush to 3/8 inch to make a cleaning brush).

   c. Paper towels (small Kimwipes are recommended).

B. Put flux remover on the area to be cleaned and scrub the area with the cleaning brush.

C. Put the paper towel over the scrubbed area.

D. Brush the back side of the paper towel.

E. Lift off paper towel and discard.

3.3 MODIFYING PCBs

3.3.1 TOOLS AND MATERIALS REQUIRED

1. Exacto knife.
2. Soldering iron and solder.
3. #24 insulated, solid jumper wire.
4. Magnifying glass.

3.3.2 LOCATING IC PINS

1. Orient the PCB as in section 3.2.1, Orientation of PCBs.
2. Put your finger on pin-1 of the device called for in the instructions; for example, U23-14 (IC 23, pin-14).
3. Keeping your finger at the place, flip the PCB over by twisting your wrist horizontally so that the trace side faces up and the Rev level of the board is in normal reading position.
4. Note to which pin lead or pad your finger is pointing at on the other side of the PCB. Pin-1 on the trace side is square; other pin pads are round.
5. Count the pins clockwise to arrive at the pin called for by the instructions. (The pins are counted counterclockwise on the legend side.)

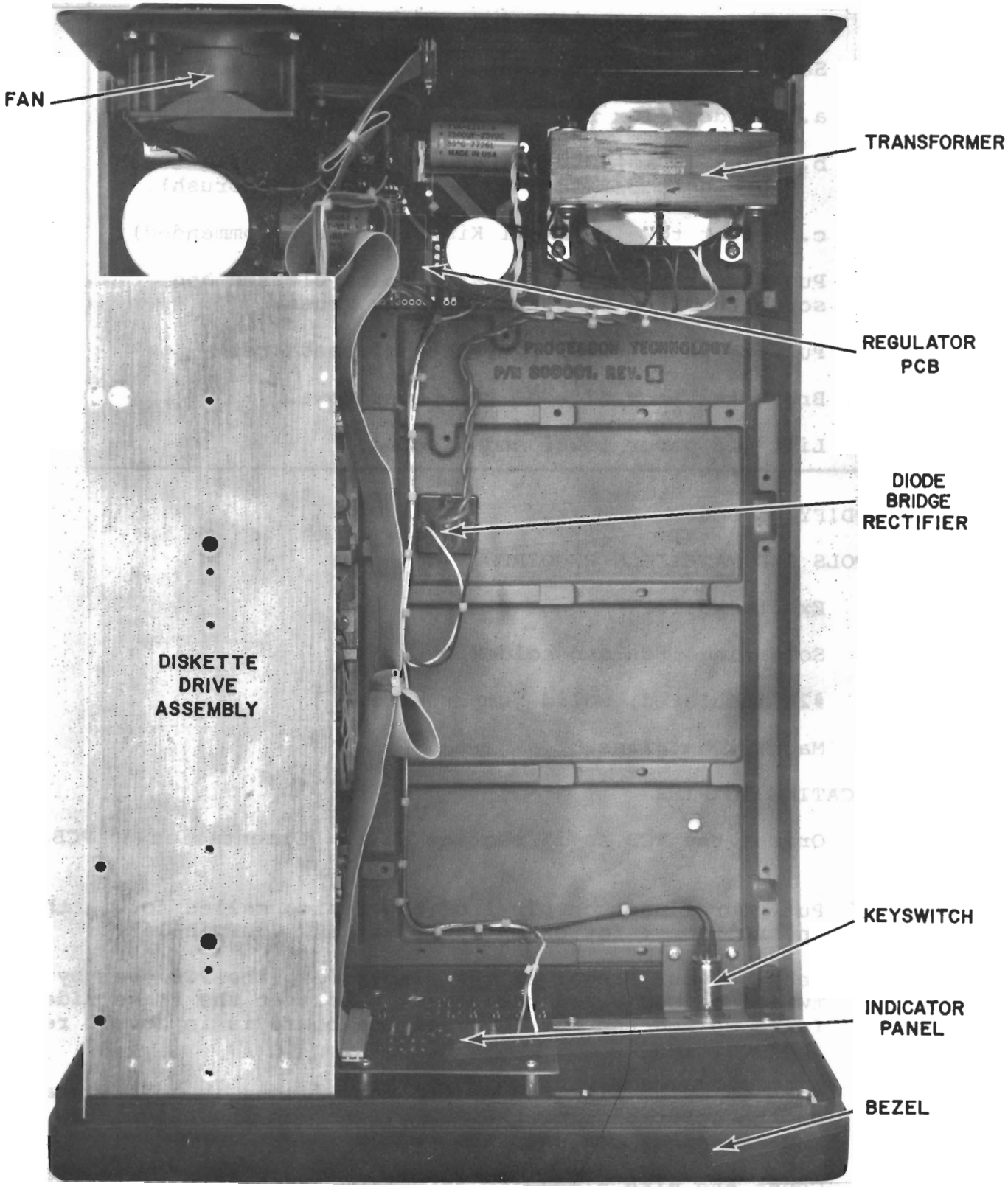


Figure 3-4 Helios II Diskette Drive Cabinet, Inside Top View

3.3.3 TO CUT A TRACE

1. Make two cuts between 1/32 and 1/16 inch apart.
2. Lift up the trace between the cuts with an exacto knife. (Sometimes space will not permit this.)
3. Inspect with a magnifying glass to be sure all copper has been removed.

> **NOTE**
>
> All trace cuts are to be made on the trace side of the PCB unless otherwise specified.

3.3.4 TO INSTALL A SOLDER BRIDGE

To solder a solder bridge onto a trace, first scrape off the solder mask so that the solder will adhere.

3.3.5 CHECK AFTER MODS

1. After you have soldered a connection, clean and inspect for solder bridges.
2. Check the modifications made by reversing the procedure in "Locating IC Pins;" that is, orient the PCB with the trace side up (where the mods are usually made); then put your finger on the connection; count the pin number, flip the PCB over and verify the device designation.

3.4 RE-INSTALLING THE DISKETTE DRIVE ASSEMBLY

(Refer to the exploded views of the cabinet, base, and bezel assemblies, Figures 8-2, 8-3, and 8-4, respectively.)

1. Choose a clean and uncluttered area to install the drive assembly. Optical and mechanical systems within the disk drive unit are particularly susceptible to dust and dirt accumulating especially when the top cover is removed; the working area should be thoroughly cleaned and kept clean while the drive is being installed.

> **CAUTION**
>
> Avoid handling the drive unit by its inner components; pick it up by its outer chassis only. Alignment of these components is critical. Do not touch them unnecessarily with the hand or tools. This is especially the case with the positioner mechanism.

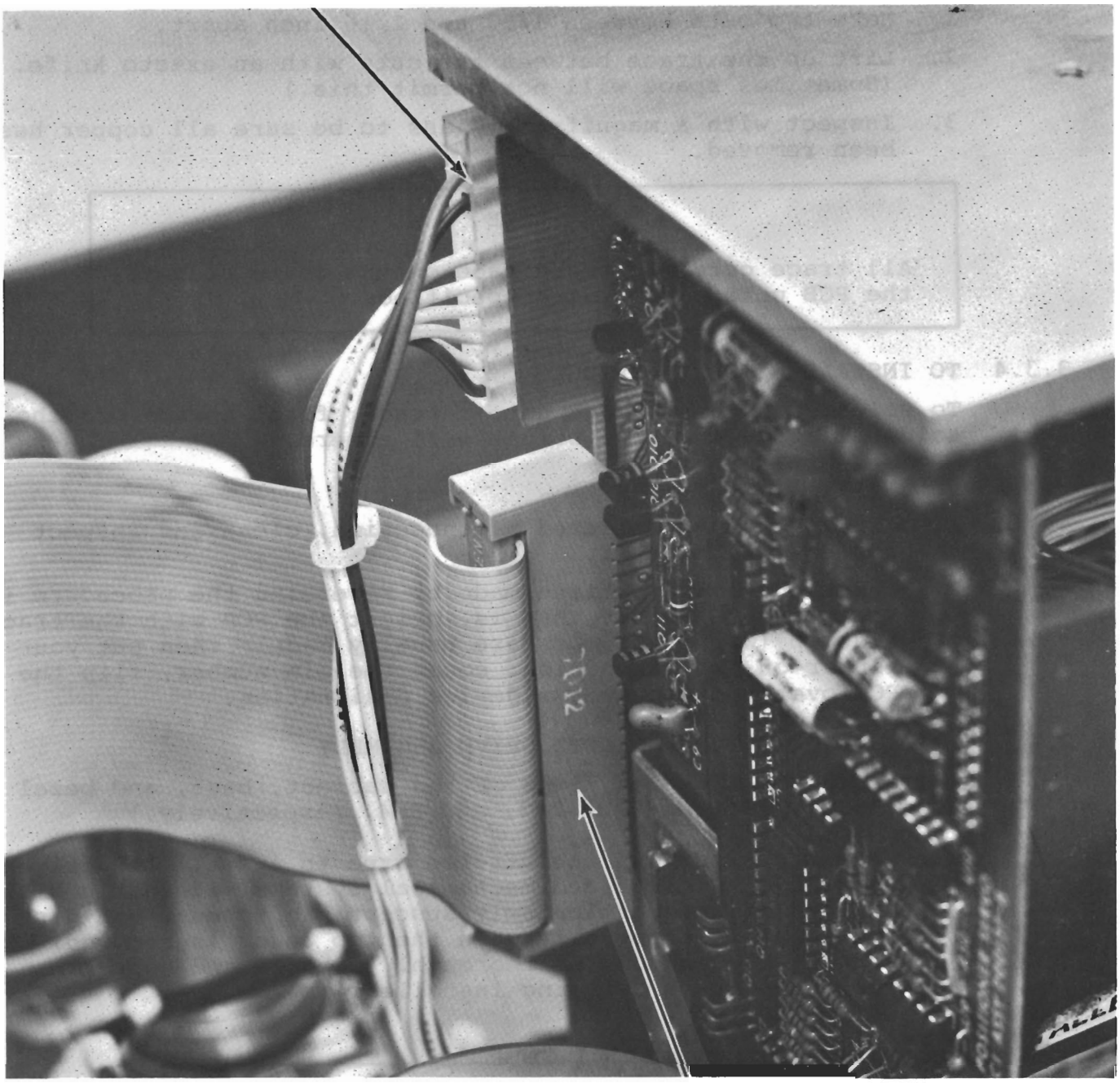


Fig. 3-5. Disk Drive DC Power and Signal Connectors

2. Select the Helios II bezel assembly and install the disk drive to bezel using two 8-32 x 1 inch cap screws. Do not tighten at this time.

3. Reinstall the pushbutton switches on the bezel as follows:

   a. Insert switch into hole provided on bezel.

   b. Attach and tighten the internal tooth lockwashers and hexnuts over the stems of the switches.

   c. Push-back-on the pushbutton covers.

4. Mount the drive assembly to the base assembly using four 8 x 32 x 5/8 inch screws, four #8 internal lockwashers; tighten the screws

5. Make sure the #8 cap screws (step 2) are still untightened at this time.

6. Attaching Bezel to Base

   (Refer to Fig. 8-2, Cabinet Assembly, Exploded.)

   a. Install three 6-32 x 7/16 inch screws and three #6 internal lockwashers from the bottom of the base into the bezel.

   b. Install one 6-32 x 1/2 inch screw and one internal lockwasher on the keyswitch side of the bezel into the base.

   c. Now tighten the two #8 cap screws which attach the bezel assembly to the drive assembly (installed in step 2).

7. Ensure that all screws are tight.

8. Connect the 10-pin plug connector from the power supply wiring harness to J3 of the rear of the disk drive unit. One of the pins is removed from J3 and a polarizing plug is inserted in the mating plug hole so that 10-pin plug connector can go on only one way. (See Fig. 3-5, Diskette Drive DC Power and Signal Connectors.)

9. Connect the flat 50-conductor signal cable (Signal/Indicator Panel Cable Assembly) from the indicator panel PCB to the disk drive at P1. P1 is an edge connector on the PCB* protruding its short edge at the rear of the drive assembly. The pin-1 end of the plug connector (indicated by the colored stripe on the pin-1 edge of the cable) goes on at the bottom of the mating PCB edge connector P1. Pin-2 is designated on the PCB legend at this end and pin-50 on the opposite end. (See Fig. 3-5, Disk Drive DC Power and Signal Connectors.)

*Data and Interface PCB.

10. Install the top cover on the drive cabinet. Using three 6 x 32 x 1/4 inch screws, attach the rear panel to the cover.

3.5 OPTIONAL DC POWER FOR FORMATTER PCB

The formatter PCB receives only DC power through the S-100 edge-connector. Instead of plugging the formatter into a S-100 backplane connector, when the connector would otherwise be useful, power may be supplied through P2. The connector, J2, which mates with P2 is specified in Section 2, Specifications.* It is not supplied in Helios II system.

To supply power through P2:

1. Apply +8 volts on pin 3 (center pin).

2. Ground on pins 1 and/or 5.

*Since the voltages are arranged symmetrically around the center pin, the plug is non-polarized. The jack which mates with P2 may be oriented either way.

CONTENTS

SECTION 4 OPERATING INSTRUCTIONS

SECTION 4 OPERATING INSTRUCTIONS

4.0 INTRODUCTION

The Helios II should not be loaded with the PTDOS program until the Disk System Test in Section 5, "Testing and Trouble-shooting" is performed; however, this entire section should be read before performing the tests in Section 5.

This section builds up to the actual operating instructions rather than jumping into them. The operator must be adequately prepared with information and understand the relative importance of the elements in the system. For example, the care and handling of the diskette is critical in a floppy disk system. Special terminology used in this system must be defined. The sequence of steps is often as important as the steps themselves. Please read each section in the sequence given. Of course, when you become familiar with the content, the sections can be referenced as needed.

These instructions are aimed primarily at the operation of the system hardware with some references to disk operating system. Instructions for the software are in the PTDOS User's Guide, also contained in this binder.

4.1 SYSTEM REQUIREMENTS

1. Helios II tested as per Section 5, Testing and Trouble-shooting.
2. Host computer (S-100 bus compatible), preferably a Sol-20.*
3. 16 kilobytes of RAM memory (minimum) configured as follows:

   4K: ØØØØH to 3FFFH

   12K: 9ØØØH to BFFFH
4. Video monitor or black and white TV converted for video input. (For TV conversion instructions, see Sol Systems Manual, Appendices, or VDM-1 Video Display Module Assembly and Test Instructions (PTC).
5. PTDOS program on diskette; a blank diskette.
6. Disk System Test (cassette).
7. BOOTLOAD program in either of three forms:
   a. P.T. BOOTLOAD Personality Module.
   b. BOOTLOAD as recorded on the front of the Disk System Test cassette (item 6 above). This requires a Sol or a host computer with CUTS interface and CUTER monitor.
   c. BOOTLOAD listing. (Refer to PTDOS User's Guide, Section 8, Appendix B, "Getting Started with PTDOS.")
8. Helios II Disk Memory System Manual, including the PTDOS User's Guide.

*This section is oriented primarily with the assumption that the Helios is associated with a Processor Technology Sol system.

4.2 TERMINOLOGY, NUMBERING, AND CONFIGURATION

The terms used in this manual in relation to the drive configurations are illustrated in Figure 4-2 "Helios System Terminology."

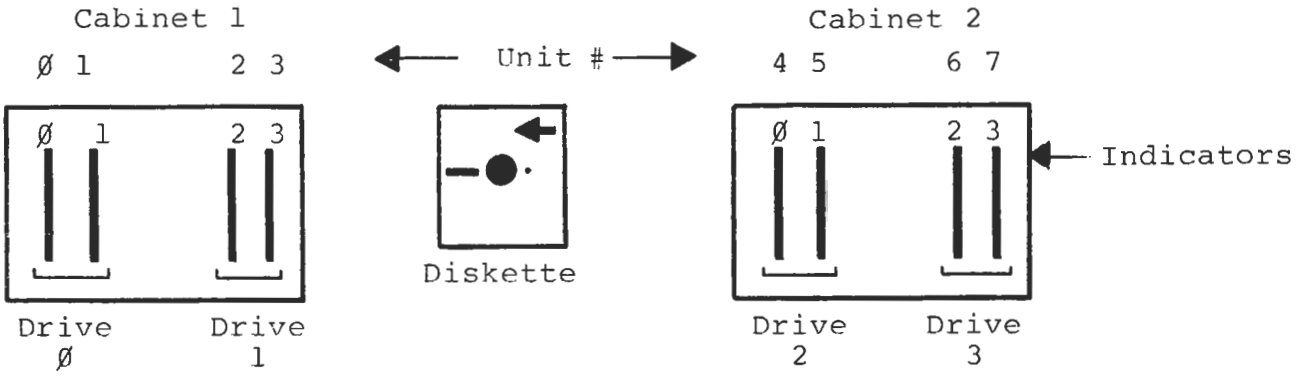


Figure 4-2 Helios System Terminology

(Model 2 contains only drive Ø, units Ø and 1. See 4.2.2 , Multi-Drive System Configuration.)

4.2.1 HELIOS TERMS (Refer to Fig. 4-2)

CABINET	The enclosure containing one or two dual drives.
DRIVE	The dual drive assembly; containing 2 slots to accept diskettes.
UNIT	The individual diskette slot with its accompanying drive mechanism, numbered by counting all the slots in the system (from Ø up to 7 inclusive).
SELECTED UNIT	The unit in the system selected by the PTDOS and indicated by the light on one of the indicator panels in the system (Ø up to 7 inclusive).
INDICATED UNIT	The individual diskette slot numbered by counting only the slots within a given cabinet. (Ø up to 3 inclusive).
DISKETTE	The floppy disk recording medium.

4.2.2 MULTI-DRIVE SYSTEM CONFIGURATION

A. Placement of Terminator Resistors

Four dual diskette drives can be operated with signal connectors in parallel on one signal cable (daisy chain). In a multi-drive system, the terminator resistor pack, which can occupy U1 on the drive Data and Interface PCB, must be installed only in the drive farthest electrically from the controller. All the other drives must have U1 vacant.

Similarly, resistors R12 through R15 on the indicator panel PCB must be installed only in the drive cabinet further electrically from the controller and must be removed from the board in the cabinet closer to the controller.

B. Selector DIP (Refer to Fig. 8-15, Selector DIPS ...)

The Helios system is capable of accommodating up to 8 units, as shown in Figure 4-2. Model 2 contains two units only. In systems containing more than two units, each pair of units must be able to identify itself to PTDOS as being units Ø-1, 2-3, 4-5, or 6-7.

On the large PCB on the right side of each drive (Data and Interface PCB) is a DIP socket, U11, which can receive a DIP device called a Selector. The Selector performs the unit identification function. If you are using the Model 2 alone, it is recommended that you do install the Selector if supplied with the unit (even though it will be non-functional), as a means of safe-keeping it. If Selector Ø-1 is not installed, the drive will respond to calls from the software to any unit, Ø through 7. If you add additional drives, install Selector Ø-1 in the left-hand drive (drive Ø of cabinet 1). Make sure the pin 1 designation on the Selector is aligned with the pin 1 designation on the socket U11, as with an ordinary IC.

Additional Selectors designated 2-3, 4-5, and 6-7 are available. If a second drive is added in the same cabinet, install a Selector 2-3 in it. The left-hand drive in a second cabinet should receive Selector 4-5 whether or not the first cabinet has a second drive identified 2-3. The right-hand drive in a second cabinet should receive Selector 6-7. This arrangement of unit identification is shown in Figure 4-2, "Helios System Terminology."

Refer to 7.12.2, E, Parallel Operation and Unit Selection for more information.

4.3 CARE AND USE OF DISKETTES

> NOTE:
>
> Use only Dysan diskettes (Dysan Part No. 101) or an approved equivalent such as Maxell. This diskette must have 32 sector holes (plus one index hole), which are visible through the small hole near the spindle hole.

4.3.1 PRELIMINARY HANDLING TIPS

The floppy disk diskette is a precision component and must be handled with reasonable care to avoid damage or accidental erasure. Proper care will assure longer life and greater reliability. The main concerns are dirt, foreign matter, mechanical damage, magnetic fields, and heat.

1. Store the diskette in its protective envelope at all times when not in use. Store in a vertical position. Store in a cool, dry place, out of direct sunlight. Do not leave it in a car or near sources of heat.

2. Do not bend or crease the diskette. Handle carefully, and never touch the area inside the rectangular window, or the magnetic surface containing the tracks inside the circular window. Fingerprints can destroy data and prevent the diskette from being written on.

3. Insert and remove the diskette from the drive carefully and gently.

4. Protect the area of the diskette which is exposed on both sides, through the area of the window, from contact with hands or other objects. A small crease from a fingernail or sharp object can render the diskette useless.

5. Avoid exposure to magnetic fields from magnets, transformers, etc. Avoid contact with all ferrous metals. Common tools, such as screwdrivers, often have megnetized tips which can erase valuable information stored on the diskette.

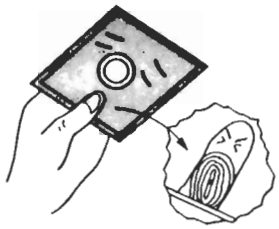
..3.2 LOADING AND UNLOADING THE DISKETTE

> CAUTION
>
> Do not execute the procedures in this section using a recorded diskette. You may practice using a blank diskette. This section is primarily for you to remember when you get to the operating instructions, Section 4.7.

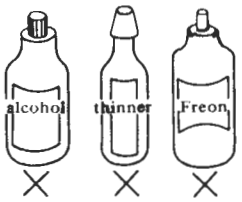
FLOPPY DISK HANDLING AND STORAGE

Handling precautions to protect against possible failure

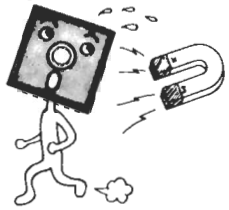
1. Do not touch the disk surface. Easily contaminated, and causes errors.



2. Do not use solutions: alcohol, thinner, Freon, to clean the disk.

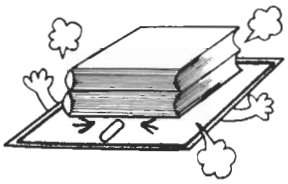


3. Do not use magnets or magnetized objects near the disk.
Data can be lost from a disk when exposed to a magnetic field.

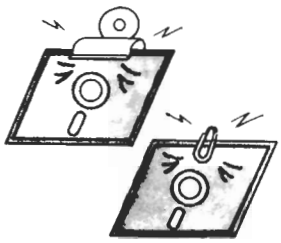


4. Do not bend or fold the disk.

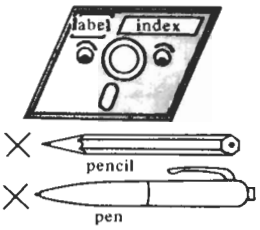
5. Do not place heavy objects on the disk.



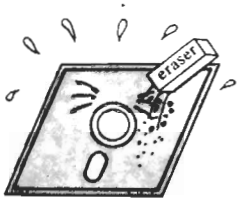
6. Do not use rubber bands or paper clips on the disk.



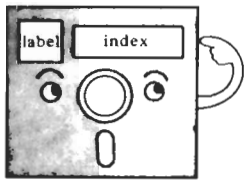
7. Do not write on a disk label with a pencil or a ball-point pen.
Use a fiber-tip.



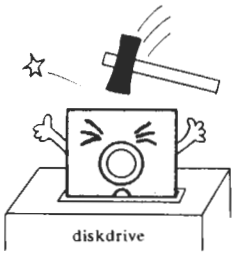
8. Do not use erasers.



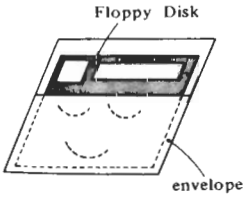
9. Put I. D. labels in a right place, never use them in layers.



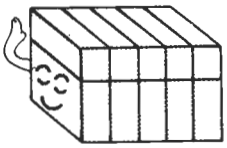
10. Insert carefully, by grasping upper edge and placing it into the drive.



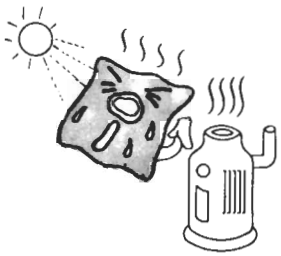
11. Keep disk in its envelope.



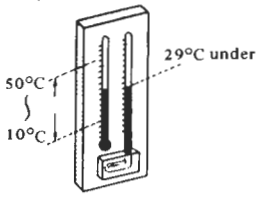
12. Store disk not for immediate use in their box, and set it up.



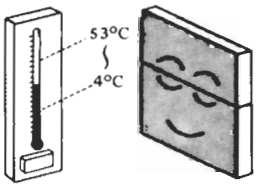
13. Do not expose the disk to excessive heat or sunlight.



14. Operating environment
10°C to 50°C (50°F to 122°F)
20% to 80% RH
less than 29°C (Wet bulb temperature)



15. Storage environment
4°C to 53°C (40°F to 127°F)
8% to 80% RH



16. Transportation
During transportation the disk shall be in its envelope, and in a protective box.
Temperature: −40°C to 53°C (−40°F to 127°F)
Relative humidity: 8% to 90% RH

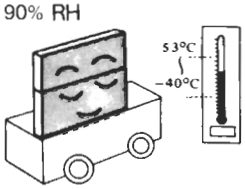


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Fig. 4-3 Floppy Disk Handling And Storage

DISKETTE CAUTIONS

A. Do not attempt to insert a diskette with the power to the drive turned OFF. Acceptance of the diskette by the drive is motorized.

B. Do not turn the drive power OFF with a diskette in the slot. Eject the diskette(s) before power-down.

C. Do not turn the computer power OFF with a diskette still in a slot. Eject the diskettes before computer power-down.

D. Do not try to pull out the diskette manually with the power to the drive turned off. The ejection of the diskette is motorized.

E. Do not run the drive with one diskette in and one ejected. Fully remove the ejected diskette. Otherwise, the revolving hub for the ejected unit may wear into the ejected or partially removed diskette.

1. The diskette should be approximately the same temperature as the drive while operating. If the diskette has been exposed to temperatures outside the recommended operating conditions given in Section 2, keep it at room temperature for about five minutes before inserting it in the drive.

2. Grasp the diskette on its edge opposite the notched edge (opposite the rectangular window with the rounded edges.) (Refer to Fig. 4-4, Diskette Orientation for Loading.)

3. Hold the diskette vertically on edge so that the label is in the upper right corner (on the left side of the diskette). The large notch should be in the bottom 1/4 of the diskette.

4. The direction of insertion into the diskette aperture is forward from the notched edge.

   Insert the diskette gently into the appropriate slot, until the front edge is flush with the face of the slot. There should be no resistance to the insertion. A sensing device in the drive will automatically close the carrier when the diskette is properly positioned. The drive will grab the diskette and spin it.

   If the diskette is inserted in the wrong orientation, it will cause no damage, but no data can be read or written on the diskette; if PTDOS is loaded, it will report, on the system output device, the error message: "Drive not Ready."

   The heads for both units read or write on the side of the diskette opposite the side with the label. Only this side is tested and initialized by the diskette manufacturer at the present time.

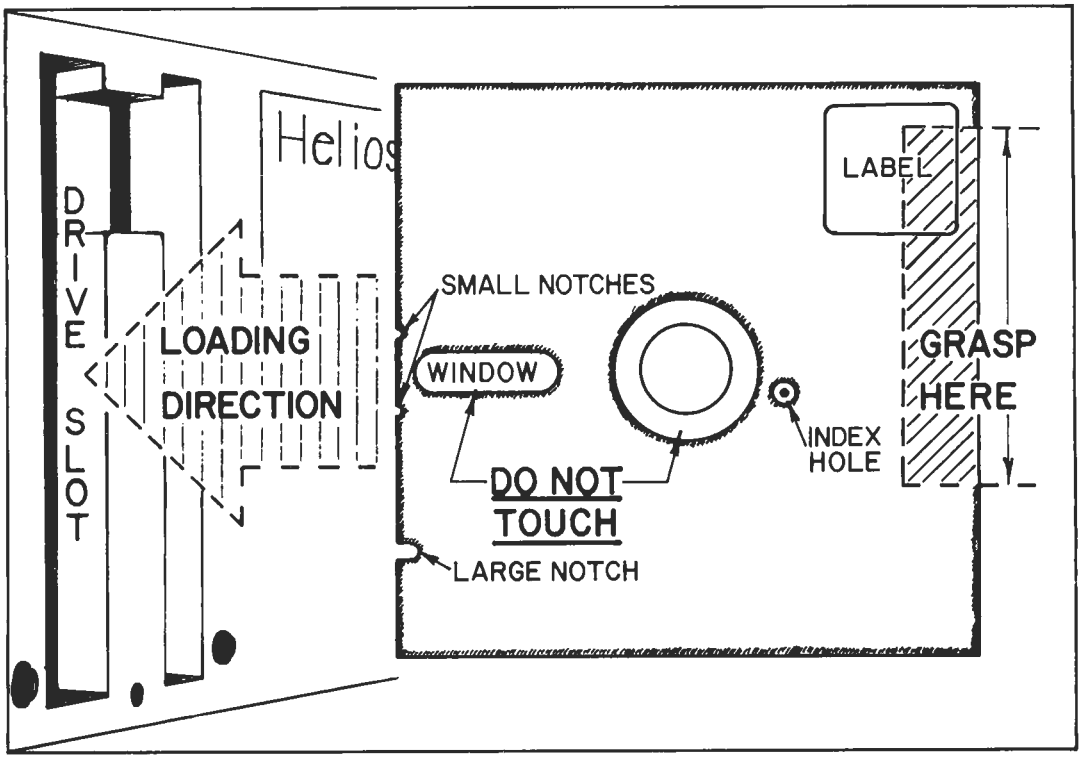

Fig. 4-4 Diskette Orientation for Loading

5. To eject diskette, apply power to the drive, and press the EJECT button next to the slot in which you have inserted the diskette. The diskette should eject automatically to where it can be easily removed from the drive. If the adjoining unit is revolving with a loaded diskette, remove the ejected diskette completely to avoid abrasion.

6. When you leave your Helios idling with power on for more than a few minutes, eject the diskette to save wear and tear on the diskette and the spindle and drive motor. This will also conserve energy.

4.3.3 WRITE PROTECTION

> CAUTION
>
> Helios II diskettes that have data written on them are not protected from being overwritten by the protect label. See explanation in the following paragraph.

The edge of the diskette, diagonally opposite the label, has an oval notch. In some floppy disk systems the diskettes are normally protected from being written upon unless this notch is covered over with a protect label. In the Helios system, the

diskettes are always unprotected mechanically but are protected by program control. Diskettes can be written on whether or not the notch is covered.

4.3.4 DISKETTE COMPATIBILITY WITH OTHER SYSTEMS

Diskettes containing data written by your Helios II may be used in any other Helios II system. Blank diskettes may be used in other floppy disk systems but written diskettes will not be compatible in format with other systems.

4.4 SETUP AND INSTALLATION

1. Assure that the ambient temperature is between 50° and 100°F (10°C to 38°C); room temperature (77°F, 25°C) is recommended.

2. Situate the disk drive unit in the working area so that there is easy access for inserting and removing diskettes.

3. Make sure the fan opening, on the rear panel, is unobstructed, allowing adequate air flow.

4. Assure that the power ON/OFF switches for both the Helios cabinet(s) and the host computer are OFF.

5. Locate a S-100 slot in the computer for the controller PCB. The slot should be located so that the formatter PCB can be plugged into an adjacent or nearby slot and connected with the flat signal cable, and so that the controller PCB can be connected via a flat signal cable to the disk drive. (Refer to Fig. 8-1, System Assembly, Interconnect Diagram.)

   Because of the heat dissipated by the controller PCB and because of the cable connections involved, the top slot (in the Sol) is recommended for the controller PCB and the second slot for the formatter PCB. (Cable connections are described in the following section.)

   Insert the formatter in the second slot (in the Sol) and the controller PCB in the top slot. This will allow for the interconnecting cable to lie flat in the space between the top PCB and the Sol cover.

> CAUTION
>
> Do NOT position the controller and formatter PCBs so that their connecting signal cable must be wedged between two PCBs. This may cause the signal cable to be punctured by the component leads and may also cause the boards to bow outward unless the cable is creased in a particular spot. For proper cable orientation, refer to Fig. 8-1, System Assembly, Interconnect Diagram.

NOTE

The formatter PCB receives only DC power from the S-100 backplane. DC power can also be supplied to the formatter PCB through its 5-pin P2. The formatter PCB, therefore, does not have to be plugged into the computer backplane to function in the Helios II system. Instructions for supplying DC power to the formatter PCB are paragraph 3.5, "Optional DC Power for the Formatter PCB."

4.4.1 CONNECTING THE CABLES

(Refer to Fig. 8-1, System Assembly, Interconnect Diagram.)

CAUTION

Take care to observe the correct polarity of the mating connectors. Triangular arrowheads are molded on matching ends of the connectors to indicate the polarity.

In addition to the arrowhead polarity indicators, there are two other aids in matching the polarity of the connectors. The pin numbers are molded (embossed) along their respective pin jacks on the face of the cable connectors. A colored stripe along one edge of the flat signal cable indicates the pin-1 signal line.

NOTE

The connectors on the ends of the signal cables are designed to mate with the connectors on the formatter and controller PCBs only one way. This is accomplished by the fact that Pin 15 of the P3 jacks on both PCBs are removed. Pin-31 of P2 on the controller PCB and J5 of the drive cabinet are also removed. Tiny polarizing plugs are inserted in the mating female connectors at the corresponding pin numbers.

1. Assure that the controller and formatter PCBs are positioned according to subsection 4.4, "Setup and Installation."

2. Select the controller/formatter interconnect cable (a flat signal cable about 10 inches long.)

   a. Orient the cable lengthwise (left to right) so that the colored stripe is up or away from you.

   b. Connect the left-hand connector to P3 of the formatter PCB, observing the proper pin polarity. The cable should be extending out from P3 (away from the computer). The color stripe should be on the side of the connector which is opposite the heatsink (to the right of the PCB looking from the rear of the Sol.) See Fig. 8-1, System Assembly, Interconnect Diagram.)

3. Observing the same pin polarity, connect the other end of the cable to P3 of the controller PCB, which is recommended to be placed above the formatter PCB.

4. Select from the kit the controller/cabinet signal cable (a flat 50-pin signal cable about 5 ft. long). Plug one end of this cable onto P2 of the controller PCB and the other end onto J5 on the rear panel of the drive cabinet.

5. Assure that both PCBs are securely plugged into the backplane.

6. Fold the loop of the controller/formatter cable down flat on top the controller PCB.

7. Replace the computer's cover.

8. Assure that the AC linecord is plugged into the 3-pin receptacle at the lower right-hand corner of the rear panel of the Helios cabinet.

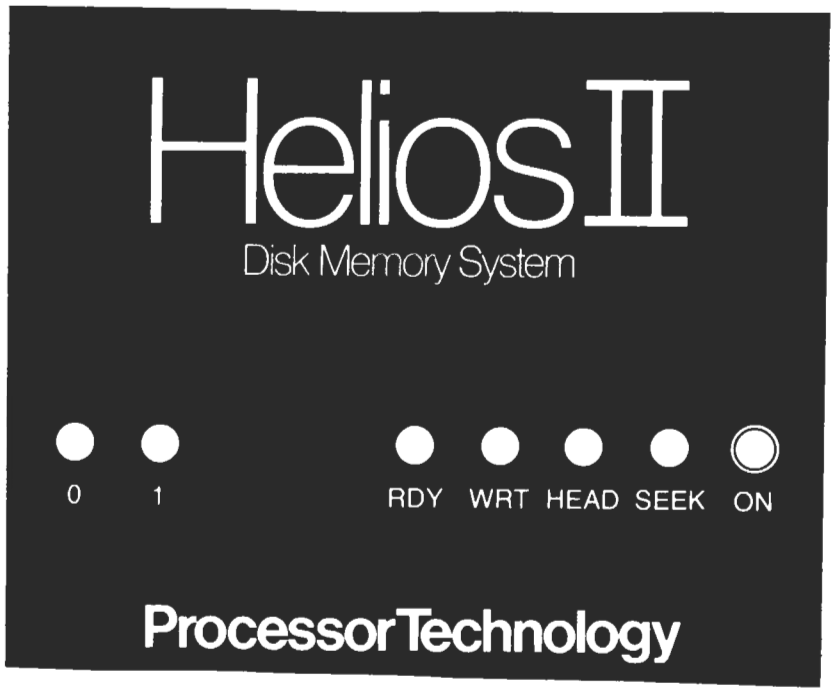

Fig. 4-5 Helios II Indicator Panel, Model 2

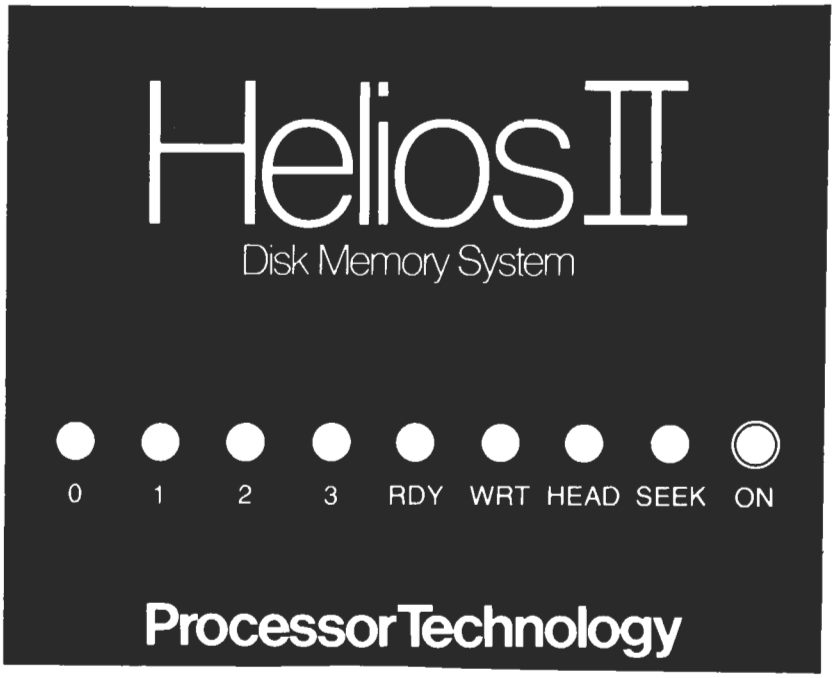

Fig. 4-6 Helios II Indicator Panel, Model 4

4.5 INDICATORS (Refer to Fig. 4-5 and 4-6, Helios II Indicator Panels and Fig. 4-2, Helios System Terminology.)

In the Helios II, Model 2, there are 7 indicator lights on the front panel. They consist of small round windows back-lighted by LED's (Light Emitting Diodes).

LEGEND	POSITION	DESCRIPTION
ON	Far right (Both Models)	The ON LED glows when AC power is applied to the drive and the power key switch is ON.
Ø	Far left (Both Models)	The Ø (zero) LED glows to indicate that the left-hand unit of the left-hand dual drive is selected by the system.
1	Second from left (Both Models)	The 1 (one) LED glows to indicate that the right-hand unit of the left-hand dual drive is selected by the system. Note: the system selects only one unit at a time. Normally unit Ø is ON when the system is initialized. If the system by mistake selects a unit not in your configuration, no indicator will light.
2	Third from left (Model 4)	The 2 LED glows to indicate that the left-hand unit of the right-hand dual drive is selected by the system.
3	Fourth from left (Model 4)	The 3 LED glows to indicate that the right-hand unit of the right-hand dual drive is selected by the system.

ACTION INDICATORS

READY	Fifth from right	The selected unit is ready and its drive is rotating at speed. The diskette is positioned properly.
WRITE	Fourth from right	The system is writing on the diskette.
HEAD	Third from right	The selected head is loaded.
SEEK	Second from right	(SEEK COMPLETE) When the light is OFF, the selected unit is seeking the track requested by the system. When light is ON, the selected unit is on the last track requested.

4.6 CONTROLS

> CAUTION
>
> The Controls sections is to familiarize you with the controls only. For operating instructions, refer to subsection 4.7, "Operating Instructions."

The operator controls the Helios II system primarily through the console keyboard. See the PTDOS User's Manual, in this binder, for keyboard commands. The controls on the front panel of the disk drive cabinet are: key switch and two eject buttons for each dual drive.

KEY SWITCH (Refer to Fig. 4-1 "Helios II Front Panel.")

The key switch locks the AC power to the drive either ON or OFF. Its purpose is to protect the drive from unwanted access by locking the AC power OFF or to preserve power by locking the AC power ON. The key can be removed in either position. Two keys are provided for the lock.

KEY POSITION	FUNCTION
ON	To lock the drive power ON, turn the key clockwise and remove key.
OFF	To lock the drive power OFF, turn the key counterclockwise and remove key.

EJECT BUTTONS

To eject a diskette, hold the appropriate eject button in momentarily, with the power ON.

4.7 OPERATING INSTRUCTIONS

> CAUTION
>
> These instructions assume your Helios II is tested according to Section 5, "Testing and Troubleshooting." The PTDOS program can be erased from the diskette by an untested system. As soon as you have qualified your system according to Section 5 and you are familiar with the system, use the DISKCOPY command to produce a backup diskette, in case the PTDOS program is accidentally erased.

1. Assure the cables are connected as described in subsection 4.4.1, "Connecting the Cables."

2. Turn on AC power to the computer.

3. Turn on AC power to the disk drive using the keyswitch.

4. Initialize the computer operating system (OS). The OS prompt character should appear to indicate the OS is ready.

5. Insert a diskette containing PTDOS in unit Ø. (See instructions in subsection 4.3, "Care and Use of Diskettes."

6. If your computer is a Sol equipped with the BOOTLOAD Personality module (a Helios II accessory), load the PTDOS from the diskette by typing: BO (from SOLOS Command Mode)

   Press: RETURN

> Bootload is a short program which bootstraps a longer bootload program off the diskette. The longer bootload in turn loads the PTDOS itself and transfers control to it. The PTDOS is loaded into RAM in the computer. For the listing and additional information, refer to PTDOS User's Guide, Section 8, Appendix B, "Getting Started with PTDOS."

7. If your computer is other than a Sol, load and execute the program BOOTLOAD from the cassette containing the Disk System Test. Bootload is on the front part of the tape.

   Both BOOTLOAD and the Disk System Test are in CUTS format which requires the CUTS interface module with the CUTER operating system.

8. When PTDOS has been successfully loaded, it presents "PTDOS" on the output device, with the current version number, release date, and other system information. On a second line it presents an asterisk as the prompt character: *

   When presented, the prompt character indicates that the Command Interpreter (CI) program within PTDOS is waiting for a command.

> CAUTION
>
> Do not procede further without completely assimilating PTDOS User's Guide, Section 8, Appendix B, "Getting Started with PTDOS."

NOTES