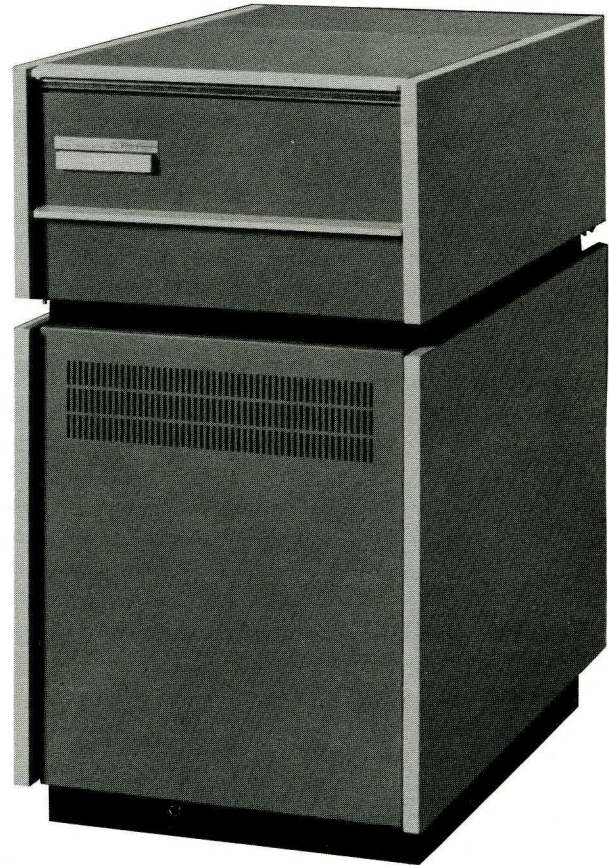


# CONTROL DATA® 9427H CARTRIDGE DISK DRIVE

Designed for Original Equipment Manufacturers (OEM)

APR 27 1979

  
CONTROL  
DATA



The Control Data 9427H Cartridge Disk Drive is a medium-capacity, random-access storage device that records and reads information on a cartridge and fixed disk. The basic 9427H unit consists of a rack-mountable deck assembly that includes a spindle and drive motor, head-positioning mechanism, logic chassis, power supply and air-filtration system. Read/recovery circuits operate with or without missing clock patterns such as those found in variable-sector formats. This unit also

features absolute (direct) addressing to position heads to the desired track. A closed-loop, proportional-servo system performs head positioning. The carriage is driven by a voice-coil linear actuator which provides rapid data accessing.

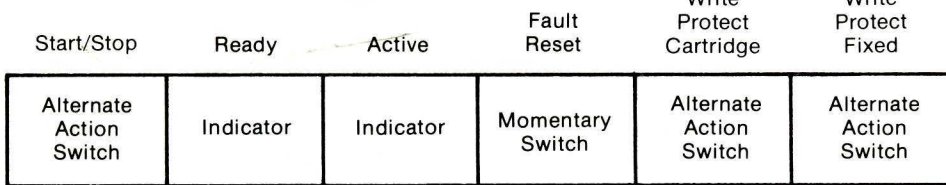
The 9427H uses the CDC® 9848 Cartridge Disk or equivalent (IBM 5440). The basic 9427H has  $50 \times 10^6$  bits of cartridge capacity and  $50 \times 10^6$  bits of fixed-media capacity.

## Features

- Twelve megabyte standard, unformatted capacity (optional 6 and 3 megabyte capacities)
- Less than 35 millisecond random-access time
- Write protect
- Independent blower motor
- Variable interface
- Rack- or cabinet-mount options
- Self-contained, integral, universal 50 or 60 Hz, 100 to 250 V ac power supply
- Wide voltage tolerance (-15 to +10 percent) allows operation during power brownouts
- MTBF exceeds 4000 hours



## Operator Control Panel



### Start/Stop (switch)

This switch energizes the spindle motor and initiates the first seek operation. Depressing this alternate-action switch at any time after the start cycle is initiated causes the disk drive to cycle down. The indicator remains illuminated until disk rotation has stopped.

### Ready (indicator)

Illuminates when the drive unit is up to speed, heads are loaded and the unit is ready for use. This indicator is extinguished when a fault condition exists, or an emergency retract or stop operation is performed.

### Active (indicator)

Becomes illuminated when the drive unit is actively engaged in any mode, such as: direct (forward or reverse) seek, return to zero seek, read, write or erase.

### Fault Reset (indicator and switch)

Indicator becomes illuminated when any fault exists, with the exception of a line power failure. The unit is reset by the Fault Reset switch if a momentary, non-damaging fault has occurred. Depressing this switch clears the fault logic and extinguishes the indicator. However, a persistent fault condition will not permit a reset.

### Write Protect, Cartridge (indicator and switch)

This alternate-action switch remains slightly depressed and is illuminated when on. In the on state, cartridge data-write and erase operations are inhibited.

### Write Protect, Fixed (indicator and switch)

An alternate-action switch that remains slightly depressed and is illuminated when on. In the on state, fixed-disk data-write and -erase operations are inhibited.

## Functional Description

The Model 9427H base unit consists of 6 megabytes of top-load, removable-cartridge capacity and 6 megabytes of fixed capacity. A speed of 2400 (optional 1500) revolutions per minute enables the 9427H to operate at a 2.50 megahertz (optional 1.56 mega-

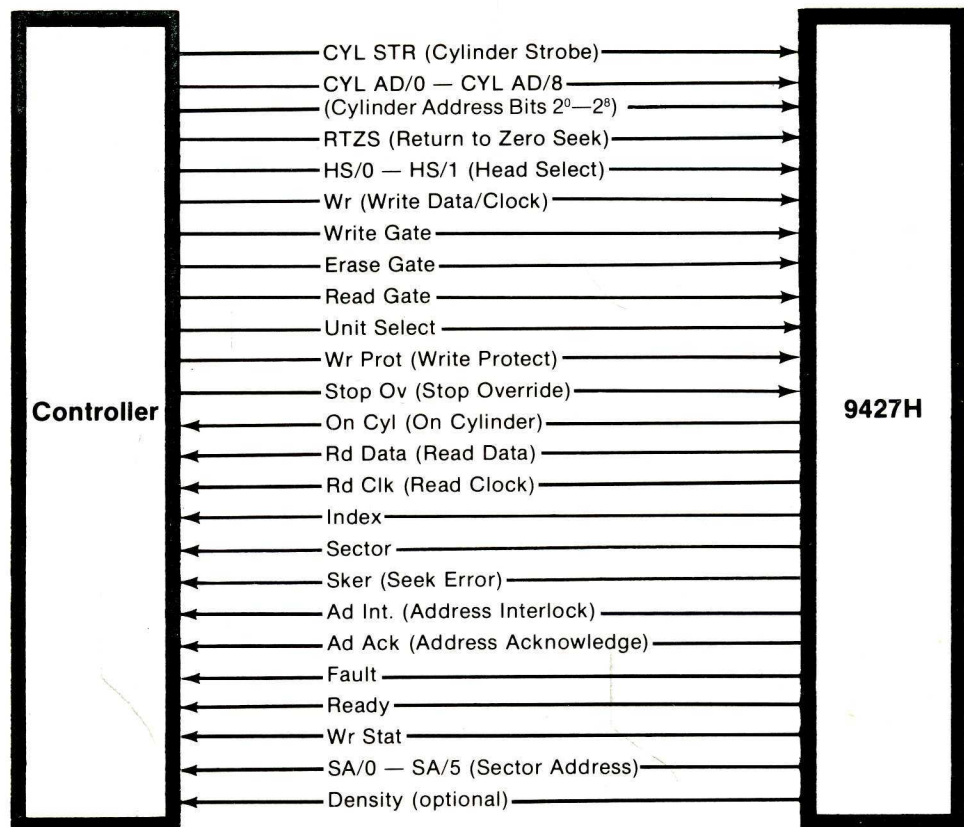
hertz) data rate. Head positioning is performed via a field-proven, closed-loop servo system, with both acceleration and velocity feedback.

Data recovery circuitry operates with either soft-sectoring formats (missing clock), such as those found in variable sector formats, or hard sectoring formats to a maximum of 72 sectors. This device is capable of operation in either a star or daisy-chain configuration.

## Electronics

Standard logic building blocks feature commercially available, low-power CMOS semiconductor technology. This technology includes many innovations that enhance circuit performance and reliability, reducing overall cost of ownership.

## 9427H Interface



Each printed-circuit board is an easily replaceable functional module, designed for simplified maintenance and troubleshooting.

The 9427H is a modularly constructed device consisting of a base deck assembly, spindle, AC drive motor, AC blower system, voice-coil positioner, analog and digital circuit boards within an interface card cage, integral power supply, air-filtration system and cartridge receiver assembly. Overall construction is designed for ease of maintenance.

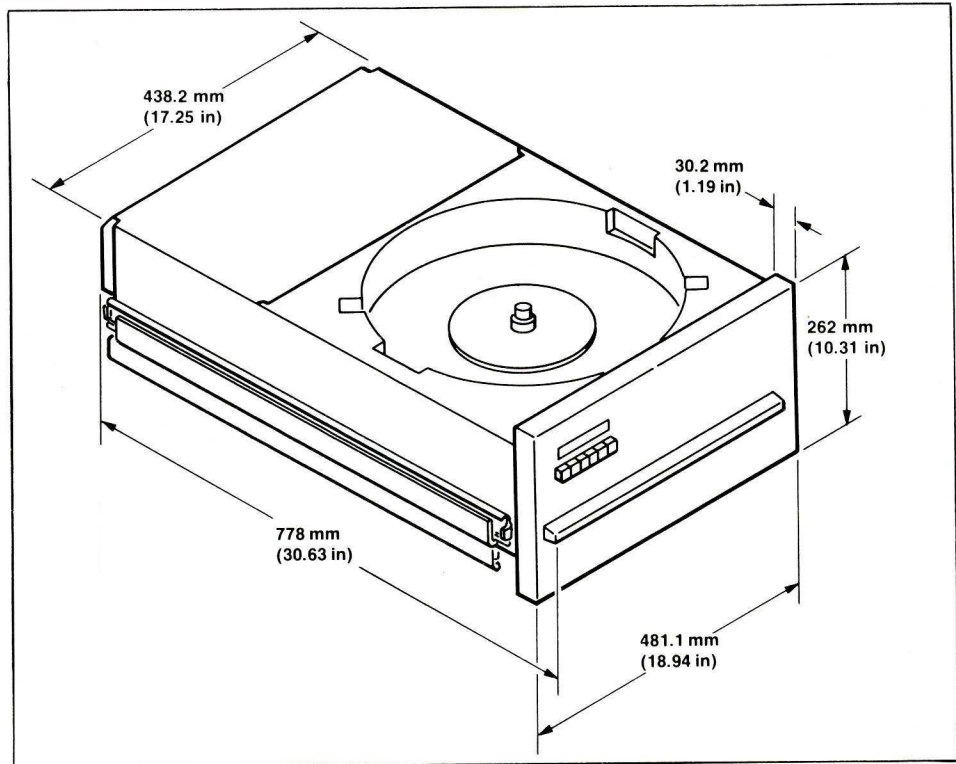
#### Standard Features

- Rack mounting (with slides)
- Twelve-megabyte, unformatted, on-line storage
- 60- or 50-hertz, 100 to 250 volt AC power supply
- Multiple (hard) or soft sectors
- Sector addressing
- 200 tracks per inch
- Write protection (cartridge and/or fixed disk)
- Daisy chain interface
- Variable interface
- 2400 revolution-per-minute spindle speed
- Stradle-erase heads

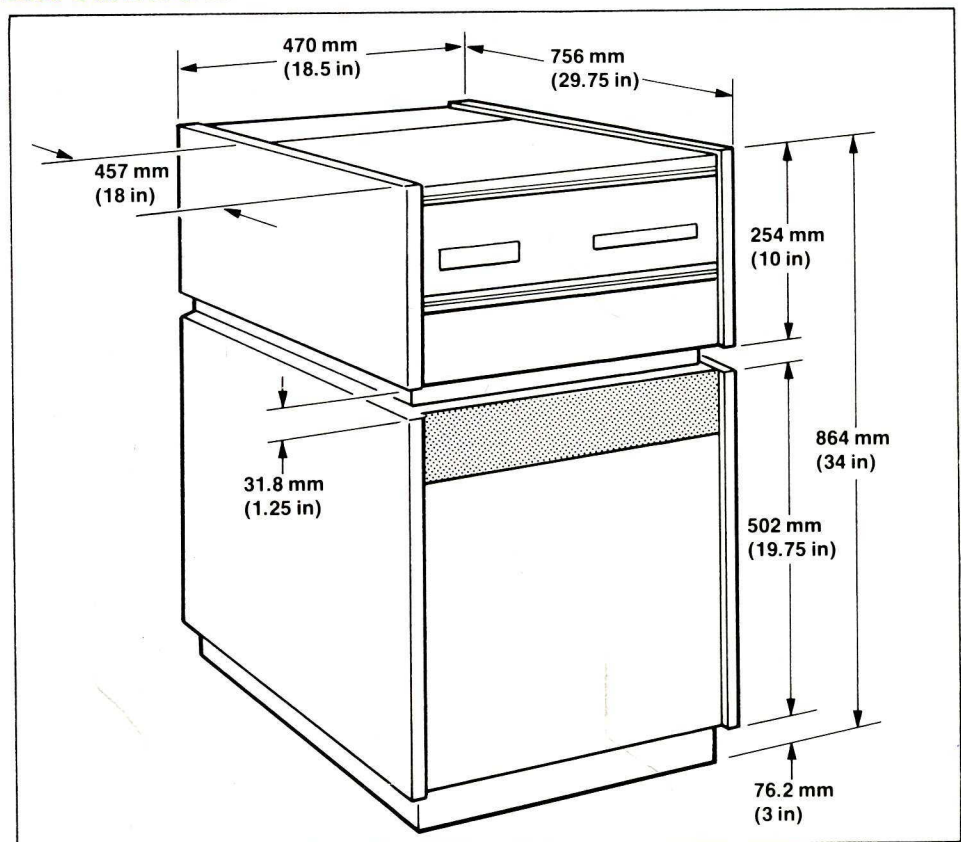
#### Options

- Cabinet mounting
- 100 tracks per inch
- 1500 revolution-per-minute spindle motor
- Pre-erase heads
- Elco, Winchester, AMP I/O cable connector
- Dynamic brake
- Variable (hard) sectoring, 1 to 72

#### Rack-Mounted Unit

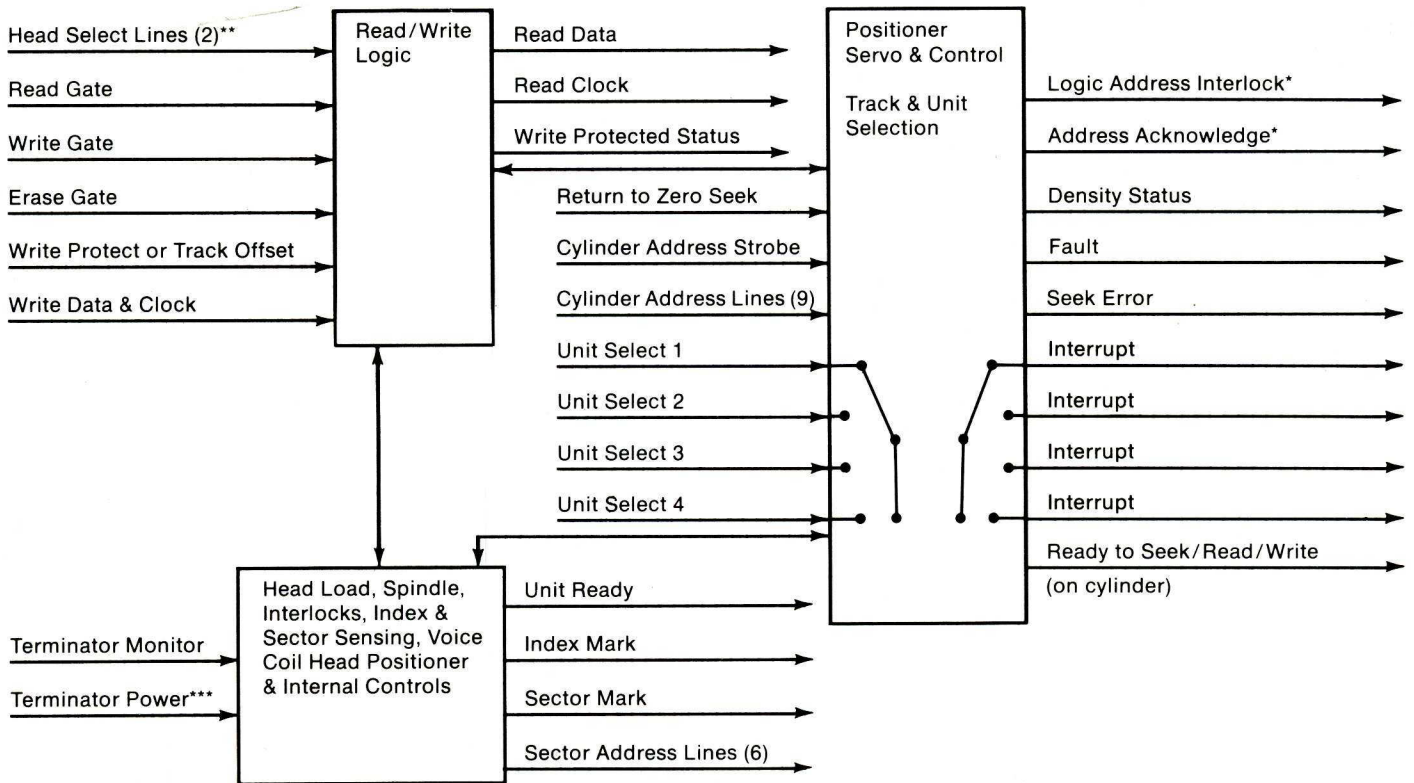


#### Base Cabinet Unit





### 9427H Simplified Functional Block Diagram



\*With the optional availability of Logical Address Interlock and Address Acknowledge interface lines using a Winchester connector, the 9427H is compatible with the Diablo 40 Series Cartridge Disk Drive. Address Interlock is not available on the ELCO connector.  
 \*\*Switches are provided to invert each of these signals to allow compatibility with any head and disk numbering scheme. \*\*\*Terminator power is supplied by the 9427H on Winchester and 3M connector options. With ELCO or AMP connections, it is optionally supplied by either the controller or the 9427H.

## Specifications

### General

Track Density	200 tracks/in or 100 tracks/in
Accessing Time	
Maximum	60 ms
Maximum Track to Track	7 ms
Average	35 ms
Spindle Speed	2400 r/min (1500 r/min optional), $\pm 2\%$ with $\pm 0.5$ Hz and + 10% to 15% mains tolerances
Latency Time	12.5 ms (at 2400 r/min) 20 ms (at 1500 r/min)

### Recording

Mode	Double frequency
Density, Nominal	1530 bits/in, outer track 2200 bits/in, inner track
Bit Rate, Nominal	2.50 MHz (1.56 MHz at 1500 r/min)
Tracks Per Cylinder	4 (2 if fixed disk removed)
Cylinders Per Unit	406 (numbered 0 through 405)
Sectors	1, 2, 3, 4, 5, 6, 8, 10, 12, 14, 15, 16, 20, 24, 25, 28, 29, 30, 32, 40, 48, 50, 56, 60, 64 hard or missing-clock soft sectoring
Units Per Controller	
I/O Channel	4 maximum, in daisy-chain configuration
Data Capacity	
Bits/Track	62,600 (nominal)
Bits/Cylinder	250,000 (nominal)
Bits/Unit	100,000,000 (nominal)
Cartridge Disk	
Number/Cartridge	1
Usable Recording	
Surfaces/Disk Cartridge	2
Disk Surface Diameter	356 mm (14 in)
Recording Diameters	Track 405 (inner), 231 mm (9.077 in) Track 0 (outer), 334 mm (13.127 in) nominal
Disk Surface Coating	Magnetic oxide
Read/Write Heads	Control Data self-loading, straddle erase standard (pre-erase available)

### Power

Input Power Source	
60 Hz Units	100 to 250 V ac in 10-volt increments (+ 10%, - 15%), 59 to 60.5 Hz, single phase
50 Hz Units	100 to 250 V ac in 10-volt increments (+ 10%, - 15%), 49 to 50.5 Hz, single phase
Current	The following chart applies at 50 or 60 Hz and nominal line voltage with actuator performing worst-case (maximum power) repeat seeks

VOLTS	100	110	120	130	140	150	160	170
AMPS	5.2	4.7	4.3	4.0	3.7	3.4	3.2	3.0
VOLTS	180	190	200	210	220	230	240	250
AMPS	2.9	2.7	2.6	2.5	2.4	2.3	2.2	2.1

**Power Factor**

8 (During spindle start, surge current is twice the above values at 5-second duration)

**Input-Output Connectors**

Two on I/O panel at rear of unit. A terminator is required if unit is the last (or only) unit connected to the controller. The terminator consists of DIP-packaged resistor networks which plug into the I/O card and can be removed.

**Environmental (operating)**

- Temperature
- Humidity
- Altitude

27°C to 32°C (50°F to 104°F)  
10% to 80% with no condensation  
0 to 3048 m (0 to 10,000 ft)  
Specifications are available for operation at extended environmental limits

**Physical Characteristics (rack-mounted unit)**

- Height:
- Width
- Depth

262 mm (10.31 in) panel  
(Mounts on 267 mm (10.5 in) centers in relay rack)  
483 mm (19 in)  
718 mm (28.25 in) behind recessed panel  
727 mm (28.63 in) behind panel  
Flat panel fits 762-mm (30-in) deep RETMA rack  
58 kg (127 lb), rack version

**Weight**

**Physical Characteristics (cabinet-mounted unit)**

- Height
- Width
- Depth
- Weight
- Air Filter

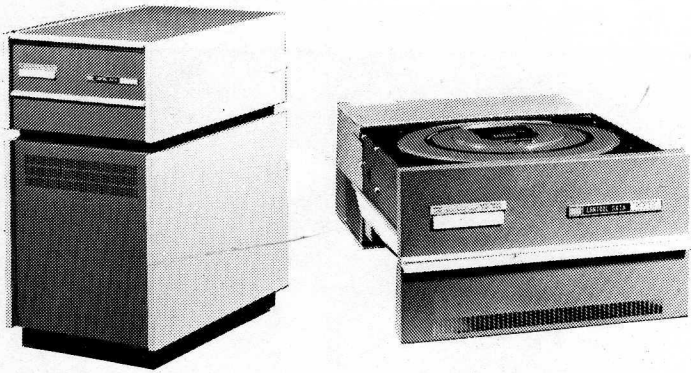
864 mm (34 in)  
470 m (18.5 in)  
756 mm (29.75 in)  
92 kg (202 lb)  
0.3 Micron (99%)

Specifications subject to change without notice

CONTROL DATA SALES OFFICES ARE LOCATED IN PRINCIPAL CITIES THROUGHOUT THE WORLD

OEM PRODUCT SALES  
BOX, 0, MINNEAPOLIS, MINNESOTA 55440  
TELEPHONE: (612) 853-3111  
TWX: 910-576-2978





# The 9427H HAWK

## A Mature Product

Beginning with product shipments in late November 1976, the 9427H Hawk reached the mature product point in its life cycle. For convenience, this is identified as blockpoint 8 on these devices. Consistent with normal product development and with the 9427H product specification, performance measurements proceed through the first three years of product life; 1st year—introduction, 2nd year—production improvements and 3rd year—mature product status.

So, for the Hawk, blockpoint 5 represented the 1st year product, blockpoint 6 was the 2nd year product and blockpoint 7 & 8 becomes the 3rd year mature product. Why two blockpoints for the mature product? For convenience of manufacture, the mature product enhancements were separated into two parts. The mechanical and electro-mechanical changes were incorporated in blockpoint 7 and the electronic enhancements in blockpoint 8.

As an aid to our customers and their field support people, to our own sales force and field engineering personnel, we have prepared the following pictorial summary of the major blockpoint changes.

Improvement in the 9427H audible noise level was accomplished in a three step manner. Blockpoint 5 units had belt-drive blower assembly (Figure 2). The blower and blower motor was coupled via a grooved pulley, V-belt and idler arrangement. Blockpoint 6 coupled the blower to the motor via pulley and belt, except that both the belts and pulleys were flat rather than V-shaped and the idler was removed (Figure 3). In blockpoint 7/8 units, the motor is coupled directly to the impeller and there is no need for belts and pulleys (Figure 4).

In some unique customer applications, a random low level static discharge spike would radiate from some inductosyn cables (Figure 5). Blockpoint 6 introduced a new cable with altered internal shielding construction. Externally, the cable has the same physical appearance, so the color is changed from black to white.

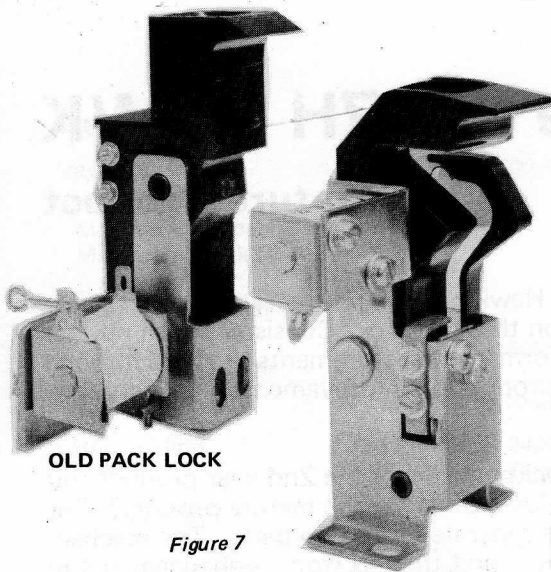
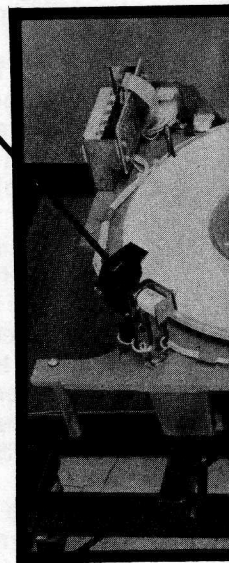
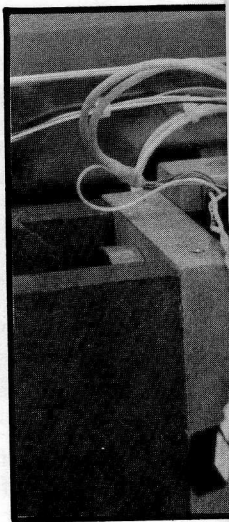
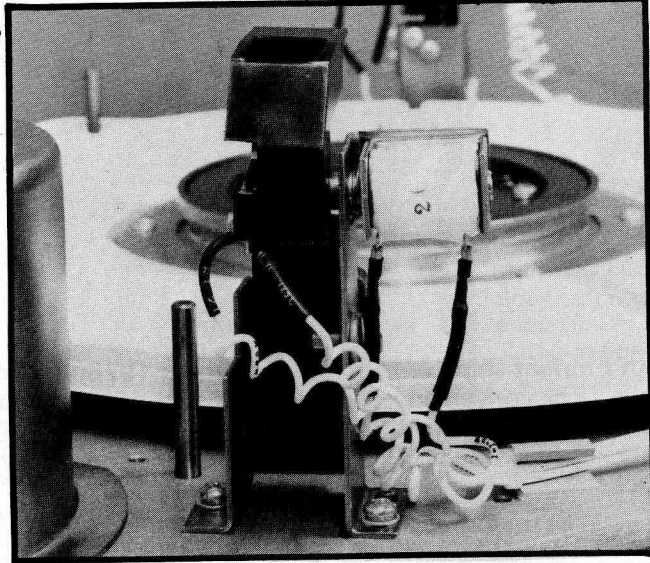
One other change of significance in blockpoint 6 was the upgrading of a 400-volt mechanical relay to a 600-volt solid state relay on the spindle drive motor assembly (Figure 6). This change can only be detected by reading the voltage rating on the relay itself.

As previously stated, blockpoint 7 was the mature product mechanical change. One major purpose was to change the mounting of the brush assemblies and pack locks from the receiver (as in blockpoints 5 & 6) to the base deck (Figures 1, 7, 8, 9). To accomplish these changes, the base deck was changed. Mounting holes were added and deleted as required and strengthening ribs were added for additional support during rough handling and transportation. The receiver (Figures 10 & 11) was redesigned to change from a cast metal to an equally strong structured foam material (Figure 12). With this change, maintenance can be accomplished, when needed, by easily removing the light weight foam receiver. The previously described direct drive blower (Figure 4) was also incorporated during blockpoint 7.

Finally, blockpoint 8 includes the electronic changes, primarily the repackaging of the various printed circuit board assemblies. The servo, sector and preamp boards were relaid out to remove various customer unique "piggy-back" boards that had been added. Functionally they are identical to previous boards, so that board interchangeability is maintained. Thermal sensing and thermal protection were added to the power supply. These changes are internal to the covered power supply (Figure 1). A small wiring harness was added connecting the sensing devices to the circuit breaker (Figure 14). The breaker was changed, but is not visibly different than the one it replaces. The power 1 and power 2 boards were relaid out to accommodate the additional circuitry and the added harness plug (Figure 13). The power supplies are total assembly interchangeable. The power boards are only interchangeable in sets and require the additional harness.

With the above enhancements, the 9427H Hawk moves into the mature product stage of its product life. The mature Hawk will give outstanding performance to its users. With its high reliability, thermal stability, ease of maintenance, and multiple fault detection capability, the 9427H is far superior to competitive devices.

NEW PACK LOCK ASSEMBLY  
Figure 8



OLD PACK LOCK

NEW PACK LOCK

Figure 7

NEW BRUSH ASSEMBLY  
Figure 9

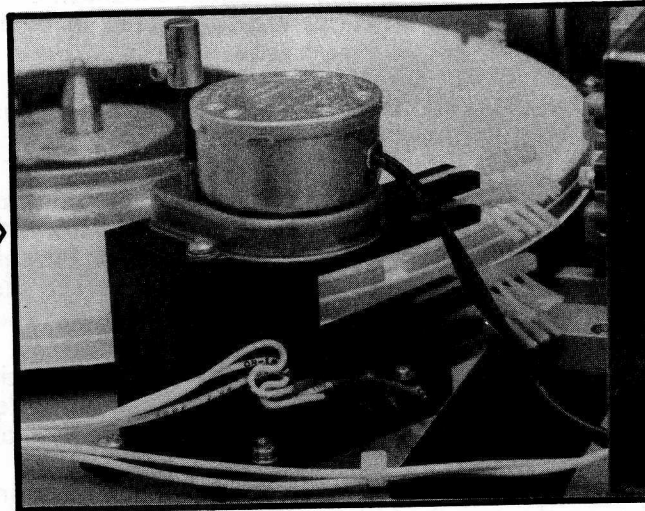
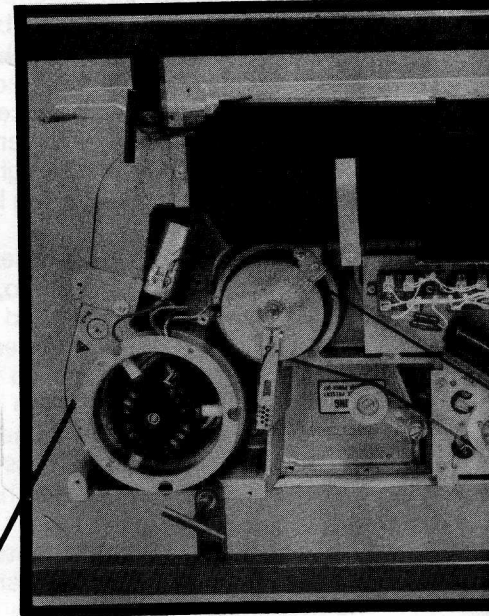
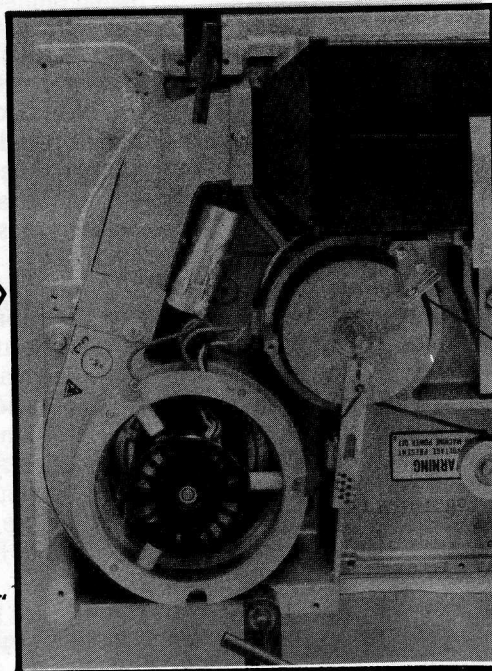


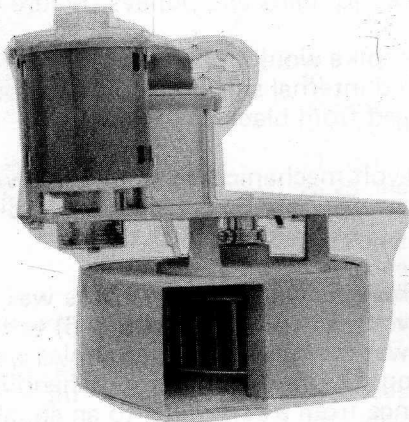
Figure 14

BOTTOM VIEW BP8 MAIN

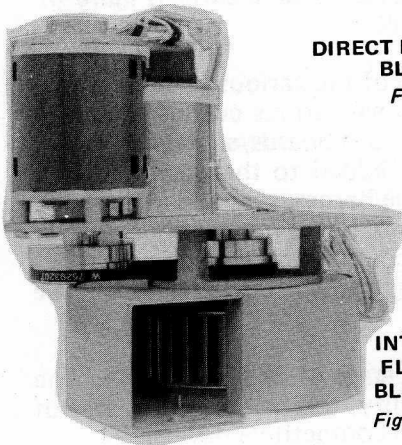
DIRECT DRIVE BLOWER  
Figure 4



OLD 'VEE BELT' BLOWER  
Figure 2



INTRUM FLAT BELT BLOWER  
Figure 3





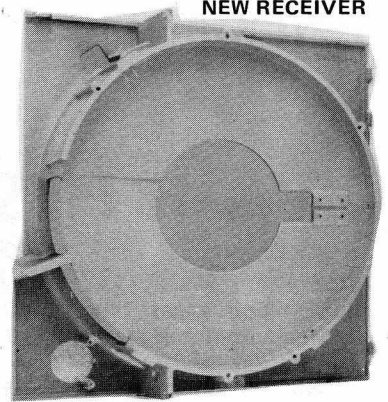
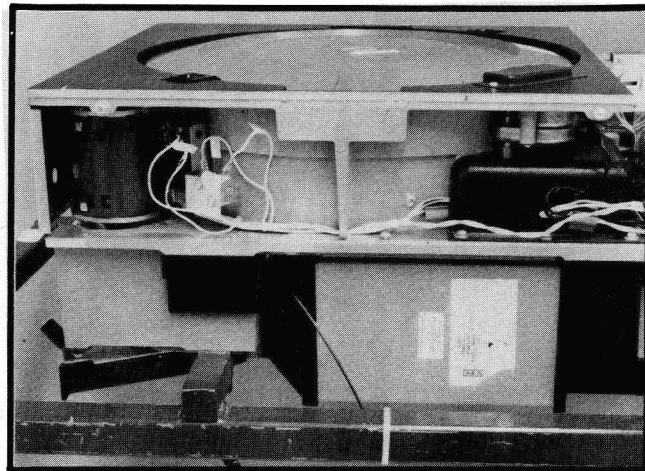
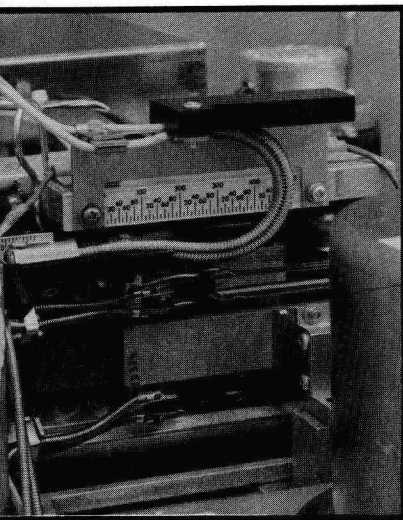
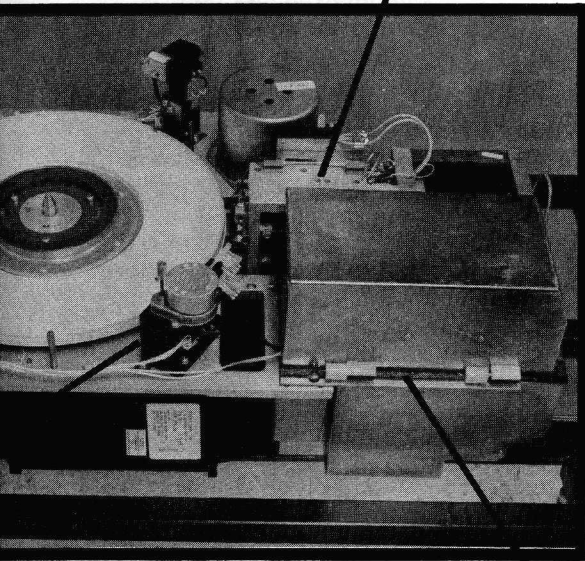
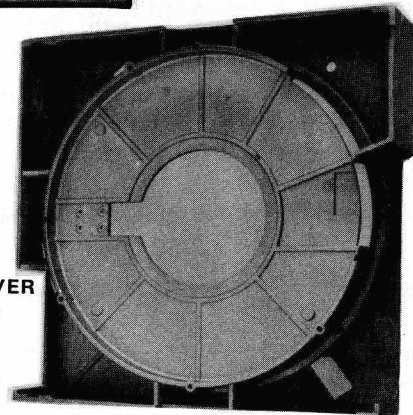


Figure 12  
NEW RECEIVER

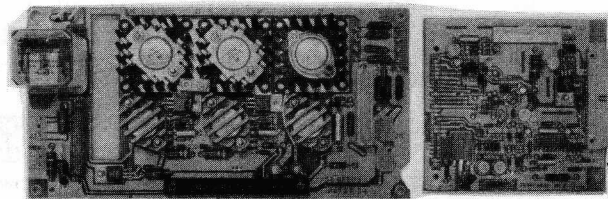


TOP VIEW BP8 MAIN ASSEMBLY  
Figure 1

OLD RECEIVER  
MOUNTED  
Figure 10

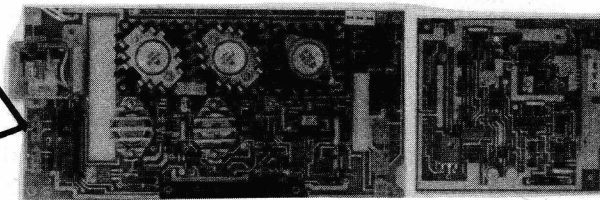


OLD RECEIVER  
Figure 11



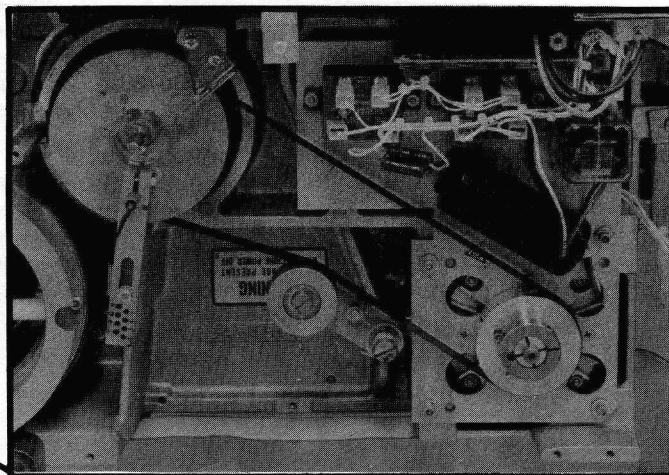
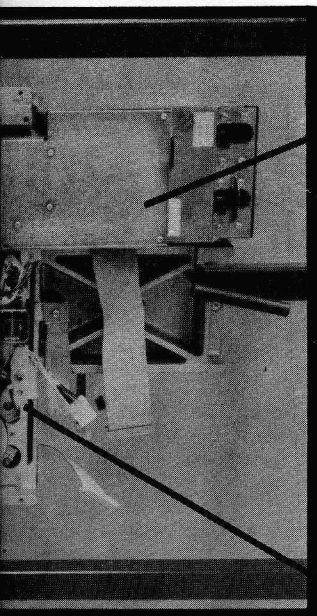
OLD POWER BOARDS

Figure 13



NEW POWER BOARDS

ASSEMBLY



SOLID STATE  
RELAY  
Figure 6

## SPECIFICATIONS

Track Density	200 TPI or 100 TPI
Accessing Time	
Maximum access time	60 ms
Maximum track to track access time	7 ms
Average access time	35 ms
Spindle Speed	2400 rpm (1500 rpm optional) (±2% with ±½ Hz and +10%-15% mains tolerances)
Latency Time	12.5 ms (at 2400 rpm) (20 ms at 1500 rpm)
Recording Mode	Double frequency
Density (nominal)	1530 bpi (outer track) 2200 bpi (inner track)
Bit rate (nominal)	2.50 MHz (1.56 MHz at 1500 rpm)
Tracks per cylinder	4 (2 if fixed disk removed)
Cylinders per unit	406 (numbered 0 through 405)
Disk surface coating	Magnetic oxide
Read/Write Heads	CDC self-loading, straddle erase standard; pre-erase available
Physical (Rack-Mounted Unit)	
Height	10.31 inch (panel) (Mounts on 10½-inch centers in relay rack)
Width	19 inch
Depth	28.25 inch behind recessed panel 28.63 inch (behind panel) Flat panel (fits 30-inch deep relay rack)
Weight	135 pounds (rack version)
Physical (Cabinet Mounted Unit)	
Height	34 inches
Width	18½ inches (18½ inches bottom)
Depth	29¾ inches
Weight	235 pounds
Air Filter	0.3 Micron 99%
Electrical	
Input power source	
60 Hz units	100-250 volts a.c. in 10-volt increments (+10%, -15%), 59-60.5 Hz, single phase
50 Hz units	100-250 volts a.c. in 10-volt increments (+10%, -15%), 49-50.5 Hz, single phase

Sectors	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15, 16, 18, 20, 24, 25, 28, 29, 30, 32, 36, 40, 48, 50, 56, 60, 64, 72 hard or missing-clock soft sectoring
Units per controller I/O channel	4 maximum, in daisy-chain configuration
Data Capacity	
Bits per track	62,500 nominal
Bits per cylinder	250,000 nominal (125,000 without fixed disk option)
Bits per unit	100,000,000 nominal (50,000,000 without fixed disk option)
Cartridge Disk	
Disk per cartridge	1
Useable recording surfaces per disk cartridge	2
Disk surface diameter	14 inches
Recording diameters	Track 405 (inner), 9.077 inches Track 0 (outer), 13.127 inches nominal
Current	The following chart holds true at 50/60 Hz and nominal line voltage with accessor doing worst-case (maximum power) repeat seeks.

VOLTS	100	110	120	130	140	150	160	170
AMPS	5.2	4.7	4.3	4.0	3.7	3.4	3.2	3.0
VOLTS	180	190	200	210	220	230	240	250
AMPS	2.9	2.7	2.6	2.5	2.4	2.3	2.2	2.1

Power factor: .8	Surge current during spindle start is twice the above values and lasts 5 seconds
Input/Output Connections	Two connectors on the I/O panel at the rear of the unit. A terminator is required if the unit is the last (or only) unit connected to the controller. The terminator consists of DIP-packaged resistor networks which plug into the I/O P.I.B. and can be removed.
Environmental (Operating)	Temperature: 60°F to 90°F Humidity: 10% to 80% (No condensation) Altitude: Zero to 7500 feet (Specifications are available for operating at extended environmental limits.)

These specifications are subject to change without notice.