CONTROL DATA 9427H Cartridge Disk Drive is a medium capacity, random-access storage device which records and reads information on a cartridge disk. The basic 9427H unit consists of a rack-mountable deck assembly which includes a spindle and drive motor, head-positioning mechanism, logic chassis, power supply and air-filtration system. The read/recovery circuit will operate with or without missing clock patterns such as those found in variable sector formats. The unit features absolute (direct) addressing to position heads to desired track.

The CDC® 9427H uses the CDC 9848 Cartridge Disk or equivalent (IBM 5440). A single disk within the cartridge stores information on two oxide-coated surfaces. Head positioning is performed by a closed-loop, proportional-servo system. The carriage is driven by a voice-coil linear actuator, which provides rapid data accessing.

The basic 9427H has a capacity of 50 x 10⁶ bits. Storage capabilities can be doubled by adding an optional fixed disk. This disk provides the same facilities as the cartridge, except that it is non-removable.

Special Features:
• 12 MB standard, optional 6 MB and 3 MB capacities unformatted
• Under 35 ms random access time
• Independent blower motor
• Rack or cabinet mount options
• Self contained, integral, universal 50/60 H, 100-250 VAC power supply.
• Extremely cool operation (less than 5° F temp. rise in the cartridge area)
• Wide voltage tolerance (±15% +10%) allows operation during power brown-outs

OPERATOR CONTROL PANEL

<table>
<thead>
<tr>
<th>Start</th>
<th>Ready</th>
<th>Active</th>
<th>Fault</th>
<th>Reset</th>
<th>Write Protect Upper</th>
<th>Write Protect Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Start Switch—When depressed, energizes the spindle drive motor and initiates the First Seek sequence provided the cartridge disk is in place, the cartridge hold downs are closed and the appropriate voltages are present.

Start Indicator—Lights when the spindle is rotating and remains lit after the Start Switch is de-energized until the spindle has stopped. The indicator also is lit when the Start Switch is in the "on" position, even if a condition exists which prevents the First Seek sequence.

Fault Reset Switch—Pressing the switch clears the Fault flip-flop in the logic chassis and extinguishes the Fault Indicator on the operator panel, providing the fault condition is no longer present. Faults which are potentially damaging to heads or media result in automatic head retraction and stopping of the spindle, and can only be cleared by stopping and re-starting the spindle with the Start switch.

Fault Reset Indicator—Lights when one or more operational faults occurs.

Write Protect Upper Switch—When depressed, prevents Write and Erase operations, thus protecting data on the cartridge disk.

Write Protect Upper Indicator—Lights when cartridge data are protected either by the controller via I/O signals or by the operator via the Write Protect Switch.

Write Protect Lower Switch—When depressed, prevents Write and Erase operations, thus protecting data on the fixed disk.
Write Protect Lower Indicator—Lights when fixed disk data are protected either by the controller via I/O signals or by the operator via the Write Protect Switch.

Ready Indicator—Lights when unit is up to speed and the heads are loaded and a first seek has been successfully completed.

Active Indicator—Lights when unit is seeking, reading or writing.

INTERFACE DATA

The 9427H interface provides flexibility in the design of new controllers, yet remains compatible with existing controllers for CDC Cartridge Disk Drives. All interface signals are defined true when at ground potential, and false when at +4 volts (nominal).

INPUT SIGNAL LINES

Cylinder Address Bits—Consist of nine lines carrying the cylinder address to the drive when the CA strobe is valid (true).

Return to Zero Seek—A 1 microsecond pulse which causes the heads to recalibrate to cylinder position 000. Optionally, this line can be a level used in conjunction with CA strobe.

Head Select—One line is used to select the cartridge or fixed disk, and another line selects the upper or lower Read/Write head of the selected disk. Optionally, either or both head select lines can be converted.

Write Data Clock—One line carries the double frequency clock and data information signals to the drive.

Write Gate—When true, the Write Gate enables a write current to pass through the write coils of the selected head.

Erase Gate—When true, the Erase Gate enables an erase current to pass through the erase coils of the selected head.

Read Gate—When true, the Read Gate enables the recorded transitions on a pack to be sensed when the head is selected. The Read Gate is also used to gate separated data and separated clock pulses to be transmitted to the controller.

Unit Select—Four lines (one per unit) are used to select a unit to be accessed. The lines must remain active during any command from the controller, except when monitoring interrupts. Optionally, the unit may be continually selected for star configuration.

Write Protect or Track Offset—This dual mode-line is enabled by a switch in the interface panel. When in the Write Protect mode, actuating this line inhibits writing and erasing. When in the Track Offset mode, activating this line causes heads to move cyclically ±800 micro inches from nominal position at a 2 Hz rate.

200 TPI Status—When true, the line indicates that unit is operating in a 200 TPI mode.

Stop Override—If the unit of interest has been started by the operator and the stop-override option has been selected, then Unit Select will maintain 9427H in a selected on-line condition until the Unit Select falls, even if the front panel start switch is reversed to an “off” position.

OUTPUT SIGNAL LINES

All output lines are gated by unit select with the exception of the Interrupt lines.

On Cylinder—When true, the line indicates that the heads have been moved to the desired location indicated by the contents of the Cylinder Address Register. At the On Cylinder time, the carriage has positioned the heads at the nominal track location and is ready for a new command sequence. Optionally the On Cylinder can also be present when a Seek Error has occurred.

Read Data—The separated Read Data is transmitted on this line, and is valid only when Read Gate is “on.” Pulse width is optionally either 100 ns or 200 ns.

Read Clock—The separated clock is transmitted to the controller using Read Clock line. This line is also only true when Read Gate is true. Pulse width is optionally either 100 ns or 200 ns.

Erase Gate—When true, the Erase Gate enables an erase current to move to the specified cylinder address within 500 ms of CA strobe. An RTYS command sent to the unit indicating a Seek Error will clear the Seek Error condition and restore the actuator to cylinder 000.

Fault—The Fault condition is true if any of the following conditions exist: multiple head selection; Read and Write Gate enabled at the same time; Read and Erase Gate enabled at the same time; Erase current and no Write Gate; Write current and no Erase Gate; Read, Write or Erase Gates are “on,” but On Cylinder is not true; departure of power supply voltages from specified values; or if the fixed disk heads are selected when no fixed disk is installed. All fault conditions except the last two are latched and are resettable by the Fault Reset switch or by RTYS.

Write Protected—When Write Protected, raising of internal Write Enable is totally inhibited. The condition is true if Write Protect line from the controller is true or if the applicable operator control panel Write Protect switch is “on.”

Unit Ready—Condition is true if cartridge is in place, disks are up to speed, heads are loaded and the unit has been selected by a controller.

Interrupt 1, 2, 3 and 4—These lines are unique to each disk drive and therefore not gated by the unit select line. Interrupt (attention), when true, indicates that either the previously initiated seek has been completed and the heads are On Cylinder, or 500 ms have elapsed since the start of the Seek and On Cylinder did not rise. Interrupt is reset by either Read or Write Gate, or by another seek
command. The Seek Error line is made true by any failure to complete a Seek. It may be reset only by an RTZS command. Sector Address—Six lines carry the address of the sector currently under the Read/Write heads. They are gated for the unit and disk which is selected.

### 9427H Simplified Functional Block Diagram

- **Read/Write Logic**
  - Read Data
  - Read Clock
  - Write Protected Status
  - Return to Zero Seek
  - Cylinder Address Strobe
  - Cylinder Address Lines (9)
- **Positioner Servo & Control**
  - Track & Unit Selection
  - Logic Address Interlock
  - Address Acknowledge
  - Density Acknowledge
  - Fault
  - Seek Error
  - Interrupt
- **Head Load, Spindle, Interlocks, Index & Sector Sensing, Voice Coil Head Positioner & Internal Controls**
  - Unit Ready
  - Index Mark
  - Sector Mark
  - Sector Address Lines (6)

*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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track Density</td>
<td>200 TPI or 100 TPI</td>
</tr>
<tr>
<td>Accessing Time</td>
<td></td>
</tr>
<tr>
<td>Maximum access time</td>
<td>60 ms</td>
</tr>
<tr>
<td>Average access time</td>
<td>35 ms</td>
</tr>
<tr>
<td>Spindles Speed</td>
<td>2400 rpm (1500 rpm optional)</td>
</tr>
<tr>
<td>(±2% with ±1/2 Hz and +10%–15% mains tolerances)</td>
<td></td>
</tr>
<tr>
<td>Latency Time</td>
<td>12.5 ms (at 2400 rpm)</td>
</tr>
<tr>
<td></td>
<td>(20 ms at 1500 rpm)</td>
</tr>
<tr>
<td>Recording Mode Density</td>
<td>Double frequency</td>
</tr>
<tr>
<td>(nominal)</td>
<td>1530 bpi (outer track)</td>
</tr>
<tr>
<td></td>
<td>2200 bpi (inner track)</td>
</tr>
<tr>
<td>Bit rate (nominal)</td>
<td>2.50 MHz (1.56 MHz at 1500 rpm)</td>
</tr>
<tr>
<td>Tracks per cylinder</td>
<td>4 (2 if fixed disk removed)</td>
</tr>
<tr>
<td>Cylinders per unit</td>
<td>406 (numbered 0 through 405)</td>
</tr>
<tr>
<td>Sectors</td>
<td>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 maximum, in daisy-chain configuration</td>
</tr>
<tr>
<td>Data Capacity Bits per track</td>
<td>62,500 nominal</td>
</tr>
<tr>
<td>Bits per cylinder</td>
<td>250,000 nominal (125,000 without fixed disk option)</td>
</tr>
<tr>
<td>Bits per unit</td>
<td>100,000,000 nominal (50,000,000 without fixed disk option)</td>
</tr>
<tr>
<td>Cartridge Disk</td>
<td>14 inches</td>
</tr>
<tr>
<td>Disk per cartridge</td>
<td>Track 405 (inner), 9.077 inches</td>
</tr>
<tr>
<td>Useable recording surfaces per disk cartridge</td>
<td>Track 0 (outer), 13.127 inches nominal</td>
</tr>
</tbody>
</table>
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 (18¼ inches bottom)
- Depth: 29¼ 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

Current - The following chart holds true at 50/60 Hz and nominal line voltage with accessor doing worst-case (maximum power) repeat seeks.

<table>
<thead>
<tr>
<th>VOLTS</th>
<th>100</th>
<th>110</th>
<th>120</th>
<th>130</th>
<th>140</th>
<th>150</th>
<th>160</th>
<th>170</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMPS</td>
<td>5.2</td>
<td>4.7</td>
<td>4.3</td>
<td>4.0</td>
<td>3.7</td>
<td>3.4</td>
<td>3.2</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Surge current during spindle start is twice the above values and lasts 5 seconds

Environmental (Operating)
- Temperature: 60°F to 90°F
- Humidity: 10% to 90% (No condensation)
- Altitude: Zero to 7500 feet
  (Specifications are available for operating at extended environmental limits.)