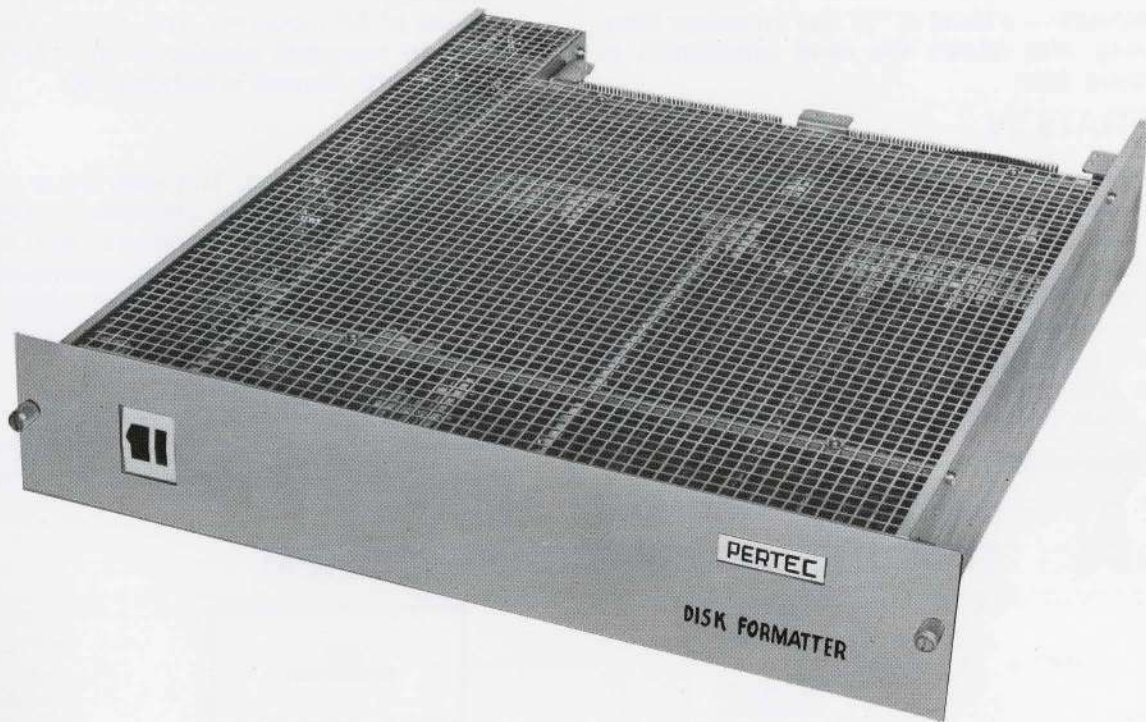


### FEATURES

- Serves up to four disk drives
- Data-scan capability
- Complete error checking
- Variable header
- Completely digital — no adjustments
- Application flexibility
- Internal power supply
- Compact — only 3½ inches high
- Low cost

JAN 8 1974



The Pertec Disk Formatter saves the cost and effort of designing and building a special formatter/controller for Pertec D3000-Series Disk Drives. The unit performs all formatter functions required to control, and transfer data to and from, up to four drives, except for a simple coupler interface to the user's processor.

The Formatter requires only 3½ inches of rack space and has internal card space to accommodate the user's coupler interface. Its low cost makes the Formatter a natural companion to a D3000-Series Disk Drive.

Disk drives may be any combination of single- or dual-disk models with the same packing density, disk speed, and sector organization. The Formatter provides comprehensive data and hardware error checking, and can be configured, using a programmable read-only memory, for virtually any application.

The high reliability and exceptional performance of Pertec's disk storage system make it ideal for use in any small- to medium-scale data or control system.

## FUNCTIONAL DESCRIPTION

When used in conjunction with D3000-Series Disk Drives, the Formatter provides all timing and control functions necessary to form a data storage and retrieval system (through a customer-furnished coupler interface). Two Formatters can be daisy-chained together, and up to four disk drives can be daisy-chained on each Formatter. A single Formatter configuration is shown in Figure 1.

### Header Format

The Disk Drive Formatter utilizes a variable-header format which consists of the following elements (see Figure 2).

- **Preamble** — a burst of "0" bits for sector tolerancing and allows the read electronics to acquire data.

## OPERATION

The Formatter can execute two disk commands which are routed directly to the selected disk drive to cause the positioner to move to the specified cylinder address; and six formatting commands. The formatting commands control transfer of data to or from the disk and can be executed in either a single- or multi-sector mode. Formatting commands may be issued while the selected disk drive is still engaged in a seek operation.

### Disk Commands

**SEEK** — causes positioner to move to the speci-

- **Sync bit** — a single "1" bit which flags the beginning of useful data.
- **Header** — two bytes which contain the cylinder, head, and sector address of the current sector. This information is compared with the expected address before data is transferred.
- **Data** — n bytes of data, written least-significant bit first. The number of bytes depends on the Formatter configuration.
- **Check** — two bytes of sum check (SCK) information for the header and data fields. When reading from disk these bytes are compared with a regenerated sum check.
- **Postamble** — a burst of "0" bits which prevents effects of bit crowding, and allows the erase head to complete erasing of the check field before write current is switched off.

fied cylinder address. The disk drive validates the address and, if the address is illegal, the positioner does not move and an error is reported to the controller. Seeks may be overlapped; that is, two or more disk drives may be seeking simultaneously, while a data transfer is taking place on another drive.

**RESTORE** — a seek to cylinder 000 which recalibrates the positioner servo electronics. Used when initializing the system or for diagnostic check.

FIGURE 1 FORMATTER IN DISK STORAGE SYSTEM

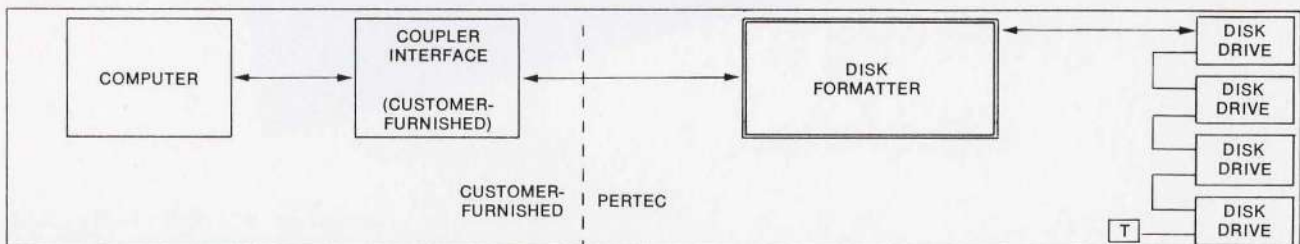
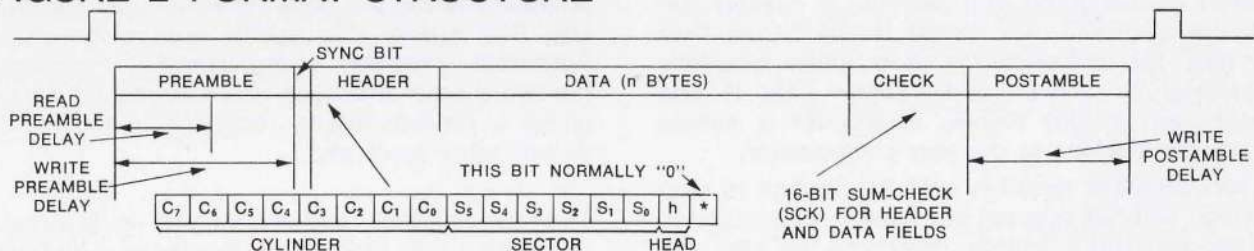


FIGURE 2 FORMAT STRUCTURE



## Formatter Commands

**READ**—causes data to be read from the selected disk.

**WRITE**—causes data to be written on the selected disk.

**VERIFY**—causes read-after-write checking, and is commonly programmed after each WRITE command. Similar to READ except that read data is not transferred to the controller and no processor time is required.

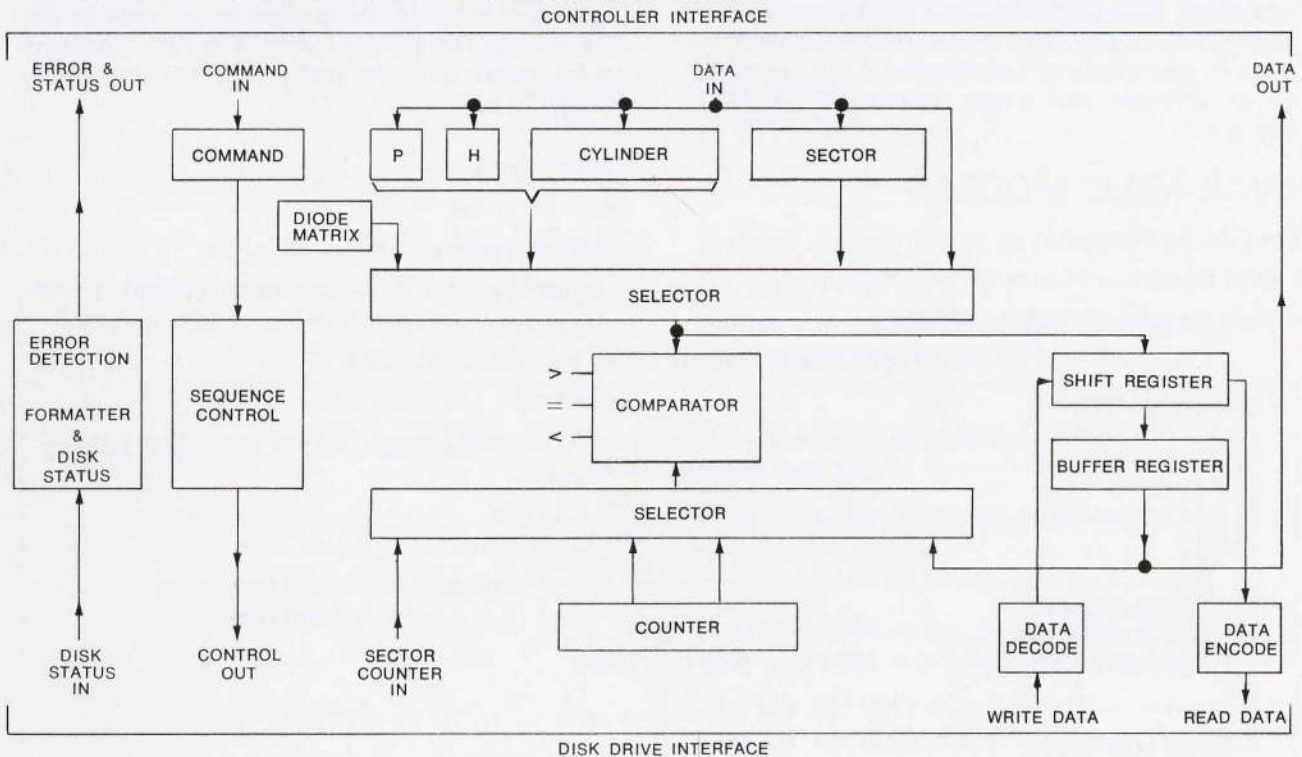
**SCAN HIGH, SCAN LOW, SCAN EQUAL**—used

to search the disk surface for a specific file or class of files. Field length may be masked so certain portions of the sector can be specified by the user's controller. The data field read from the disk is compared, byte-by-byte, with the data field received from the controller or processor.

## Error Checking

Error checking and reporting is comprehensive and includes illegal cylinder error, program error, format error, address error, and data error (SCK check).

### FIGURE 3 FORMATTER ORGANIZATION



## Logic Organization

Figure 3 shows the logic organization within the Formatter.

### Writing Data

The Formatter provides all control and timing necessary for data transfer to and from the disk. WRITE command allows data to be stored on the disk. When the command is received, the specified address is validated. An error condition is signaled if an illegal address is received. After the correct header check is made, the formatted data is sent to the disk serially to be recorded on the disk. The data transfer between the controller and the formatter is byte-serial.

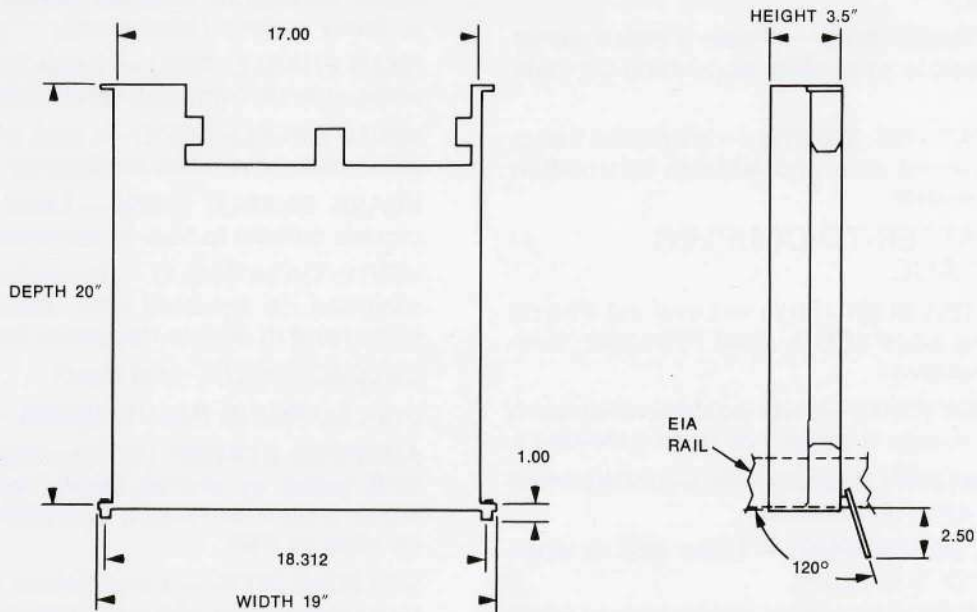
### Reading Data

Error and status signals from the active disk drive are received by the Formatter which interprets the signals and uses the information to control the disk drive, and transmits appropriate signals through the coupler to the computer.

Information from the disk drive sector counter is compared with that stored in the Formatter to obtain information for locating the data to be read. As data is read from the disk, serially, it is clocked into the shift register and transferred, in bytes, through the buffer register to the coupler.

## SPECIFICATIONS

<b>Physical</b>	
Height	3.5 inches
Depth	20.0 inches
Width	19 inches (rack mounting)
Weight	25 pounds (approx)
<b>Power Requirements</b>	
AC Voltage	Tapped transformer accommodates input voltage of 100, 110, 115, 125, 200, 210, 220, 230, 240, or 250 volts $\pm 10\%$
Frequency	48 to 400 Hz
Power	30 watts max
<b>Environment</b>	
Non-operating	
Temperature	$-45^{\circ}\text{C}$ ( $-50^{\circ}\text{F}$ ) to $+71^{\circ}\text{C}$ ( $+160^{\circ}\text{F}$ )
Altitude	0 to 50,000 feet
Shock	Normally encountered in normal shipping, installation, and service
Operating	
Temperature	$+2^{\circ}\text{C}$ ( $+35^{\circ}\text{F}$ ) to $+50^{\circ}\text{C}$ ( $+122^{\circ}\text{F}$ )
Altitude	0 to 20,000 feet
Humidity	10 to 95 percent (without condensation)
<b>Interface</b>	DTL/TTL compatible



## INTERFACE DESCRIPTION

All interface lines are low-true and have the following approximate voltage levels.

User coupler to Formatter: false = +3v, true = 0 v  
The Formatter interprets an open line as a logical false signal. Minimum pulse width is 1 microsecond, at the interface.

### 1. COUPLER-TO-FORMATTER INTERFACE

FORMATTER ADDRESS (FAD) — Level which selects either of two Formatters that can be attached to user's coupler interface.

DISK ADDRESS (DAD0, DAD1) — Levels select one of four disk drives that can be attached to the Formatter.

INITIATE COMMAND (GO) — Pulse initiates Formatter command specified by the command lines.

COMMAND LINES (WRT, VFY, SNH, SNL, HCI, MGN1, MGN2) — Pulse overlapping GO. Defines operation requested by the program.

FORMATTER ENABLE (FEN) — Level which, when false, resets Formatter logic.

LAST SECTOR (LST) — Level which, when true, identifies last sector of a data transfer.

SEEK (SKC) — Level overlapping SKS. True for a seek operation, false for a restore operation.

SEEK STROBE (SKS) — Pulse initiates either seek or restore operation, depending on state of SKC.

DATA INPUT (WC, W0-W7) — Nine lines transmit multiplexed data and address information to the Formatter.

### 2. FORMATTER-TO-COUPLER INTERFACE

FORMATTER BUSY (FBY) — Level set true on the trailing edge of GO when Formatter command is received.

DATA BUSY (DBY) — Level indicates when each sector of a data transfer has been processed.

PROGRAM ERROR (PER) — Pulse occurs when program error is detected.

FORMAT ERROR (FER) — Pulse occurs when format error is detected.

ADDRESS ERROR (AER) — Pulse occurs when address does not compare with expected address.

DATA ERROR (DER) — Pulse occurs, with a READ, VERIFY, or SCAN command, on SCK failure.

SCAN FOUND (SNF) — Pulse occurs during SCAN command if unmasked data field bits are matched. Generated for each sector of the data transfer.

INTERRUPT (INT) — Pulse indicates successful seek or restore operation, or an illegal cylinder address. Also generated if disk begins to unload due to a hardware malfunction. Interrupts computer.

WRITE STROBE (WSTR) — Pulse for each data byte transmitted to Formatter.

READ STROBE (RSTR) — Pulse for each data byte transmitted from Formatter.

DATA OUTPUT (R0-R7) — Eight lines transmit read data from Formatter to controller.

### 3. FORMATTER-TO-DISK INTERFACE

DISK SELECT (SLT0-SLT3) — Level on one of four lines selects one of up to four disk drives attached to Formatter.

PLATTER SELECT (PSLT) — Level (used on dual-disk units only) to select either upper platter (true level) or lower, fixed, platter (false level).

HEAD SELECT (HSLT) — Level selects either upper surface of selected platter (true level), or lower surface (false level).

READ ENABLE (REN) — Level, when true, enables outputs from disk drive read electronics.

WRITE ENABLE (WEN) — Level, when true, enables disk drive write electronics.

ERASE ENABLE (EEN) — Level, when true, causes current to flow in selected erase head.

WRITE DATA (WDA) — Bit-serial data to be recorded on selected disk. Data is fully encoded and in double-frequency form.

UNLOAD (UNL) — (not used).

DISK MARGINS (MGN1, MGN2) — (not used).

ADDRESS STROBE (ADS) — Pulse (which is SKS gated by enable levels) which initiates either a seek or restore operation, depending on state of RTR.

RESTORE (RTR) — Level (which is  $\overline{\text{SKC}}$  gated by enable terms) which defines seek or restore command as follows: False = SEEK, True = RESTORE.

**CYLINDER ADDRESS (CADC, CAD0-CAD7)** — Nine lines specify the required cylinder address when a SEEK command is sent.

#### 4. DISK-TO-FORMATTER INTERFACE

**READY (RDY)** — Level indicates that the selected disk drive is ready for use.

**MALFUNCTION (MLF)** — (not used).

**FILE PROTECT (FPT)** — Level indicates that selected platter is protected and cannot be written on (controlled by operator switch on disk drive).

**DUAL PLATTER (DPL)** — Level indicates the number of platters on selected disk drive. False = single platter, True = dual platter.

**DOUBLE TRACK (DTR)** — (not used).

**ILLEGAL CYLINDER (CIL)** — Level, when true, indicates that illegal cylinder address has been received.

**READ DATA STROBE (RDS)** — True-going pulse occurring with each data bit read from the disk.

**READ DATA (RDA)** — True-going pulse for each logic "1" bit read from the disk.

**INDEX PULSE (INXP)** — Pulse occurring once with each revolution of the disk, as the index slot on selected platter is detected.

**SECTOR PULSE (SECP)** — Pulse occurring with each sector slot detected during each revolution of the disk.

**DISK SEEKING (SKG0-SKG3)** — Level on any line indicates seek status of corresponding disk drive attached to the Formatter.

**SECTOR COUNTER (SEC0 - SEC5)** — Binary count which is address of sector currently under read/write heads. There are separate counters for each platter in dual-platter drives.

**DEVICE CODE (DISK, NRZ, 7TR)** — (not used).

**TERMINATOR VOLTAGE (+3.5 v)** — Two lines supply +3.5 v dc at 800 ma for line-terminating resistors in user's equipment.

#### Controller/Formatter Interface

##### Logic Levels at Interface

+3 v = high = false  
0 v = low = true

##### Logic Levels to Drivers, from Receivers

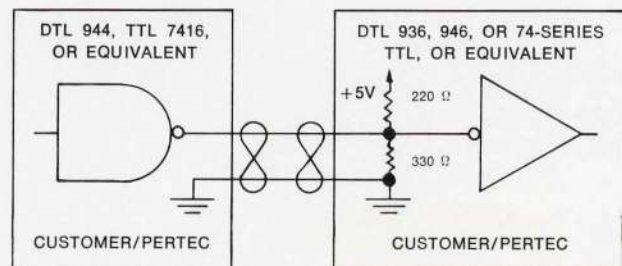
+5 v = high = true  
0 v = low = false

##### Noise Margins (25°C)

High — 450 mv  
Low — 250 mv

##### Cable Characteristics

Twisted pairs with grounded returns, maximum length 20 feet.



## NOTES

## NOTES

**PERTEC**  
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Pertec reserves the right to change specifications at any time. It is Pertec policy to improve products as new techniques and components become available.

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