PERTEC

MAGNETIC TAPE FORMATTER

FEATURES

- [ ] **Lower-cost magnetic tape systems**
- [ ] **One simple tape transport coupler for all formats**
- [ ] **Combined NRZI and phase-encoded formatting**
- [ ] **Open-ended for future expansion**
- [ ] **Master oscillator timing — no single shots**

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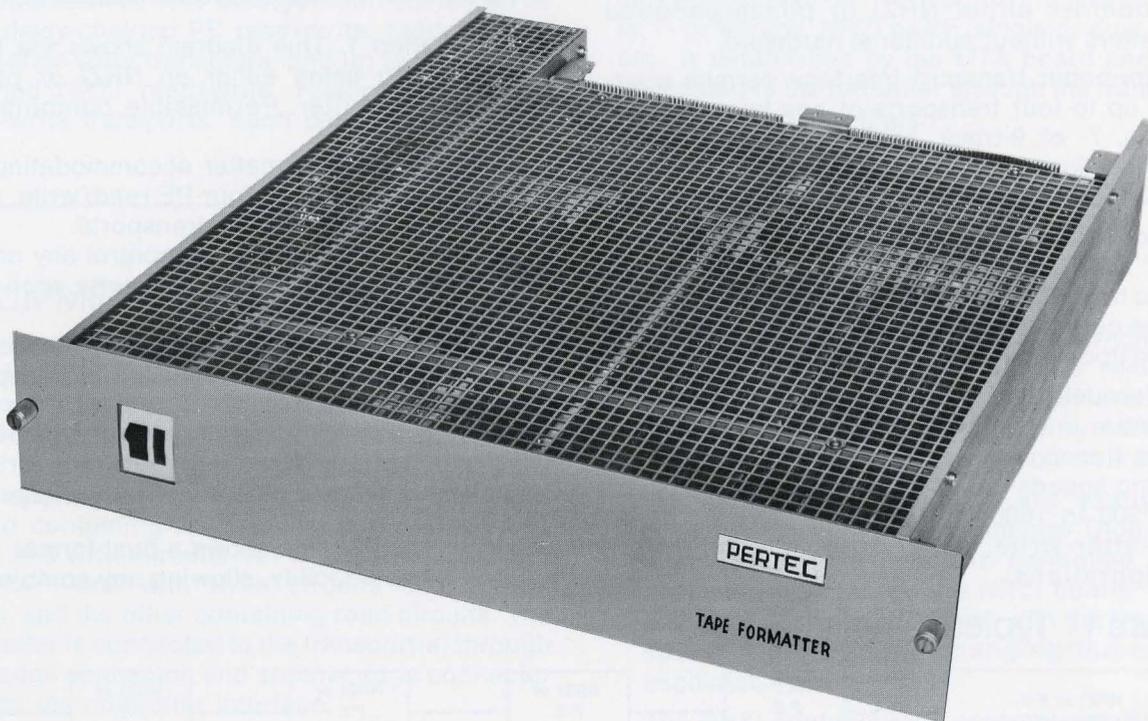
TAPE FORMATTER

LOW COST, COMPACT, HIGH PERFORMANCE FORMATTERS

Pertec's compact formatters provide exceptional flexibility, performance, and reliability in controlling the writing and reading of Pertec's NRZI and phase-encoded magnetic tape transports. The formatter's unique interface is identical for both phase-encoded and NRZI versions and are available in transfer rates compatible with transport speeds between 6.25 ips and 75 ips.

Pertec formatters offer the user greater freedom in utilizing his tape transport facility, and feature superior reliability and ease of operation. Typical applications are in:

- [ ] **Data Communications**
- [ ] **Data Terminals**
- [ ] **Data Acquisition Systems**
- [ ] **Minicomputers**
- [ ] **Key-to-Tape Systems**
- [ ] **Optical Character Recognition**
- [ ] **Computer Output Microfilm**

FUNCTIONAL DESCRIPTION

The Pertec formatter unit contains timing and control logic, and power supplies, to control all functions of tape motion and data transfer between the user's data source and Pertec's family of synchronous magnetic tape transports. Since most controller functions are automatically performed in the formatter, only a simple universal coupler is required to complete the interface. The interface is organized so that a single coupler will operate either NRZI or phase-encoded formatters without additional hardware.

The formatter transport interface permits operating up to four transports of any two standard speeds, 7- or 9-track, NRZI or phase-encoded configurations. Dual formatters include logic for both NRZI and phase-encoded formats.

The formatter logic is compatible with the exclusive "EDIT" feature which is available on all Pertec transports. Tape motion and tape positioning are carefully controlled providing "error free" record updating in critical data entry applications.

The formatters are completely compatible with the entire line of Pertec's 5000, 6000, and 7000 Series transports — a line of nearly 300 models offering speeds from 6.25 ips to 75 ips, densities from 200 to 1600 cpi, seven or nine tracks, in read-after-write, read/write, and read-only configurations.

A magnetic tape facility using these formatters is an open-ended system accommodating a wide variety of functions and recording parameters. The modular design of the formatters makes it convenient to adapt any system to meet new tape format applications.

Figure 1 diagrams the three basic formatter configurations utilizing the complete range of synchronous magnetic tape transports.

Configuration 1. This diagram shows the basic configuration using either an NRZI or phase-encoded formatter. Permissible combinations are:

- A complete PE formatter accommodating any combination of up to four PE read/write, read-only, or read-after-write transports.
- A single NRZI formatter to control any combination of up to four NRZI read/write, read-only, or read-after-write transports.
- A PE write-only formatter providing write-only control of up to four PE read/write transports.

An option is available which provides the connectors and additional dc power for either a plug-in buffer board (see Buffered Transport Data Sheet) or a plug-in customer-built coupler.

Configuration 2. This shows a dual-format, completely flexible facility, allowing any combination

Figure 1 Typical Configurations
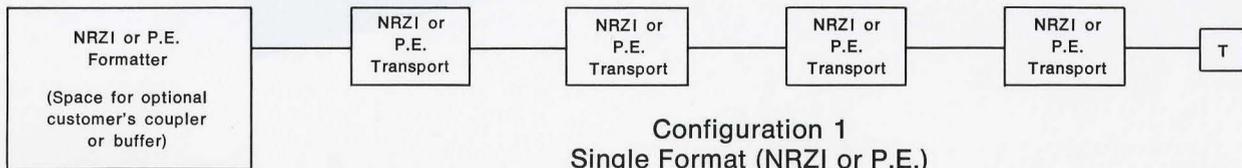
Configuration 1
Single Format (NRZI or P.E.)
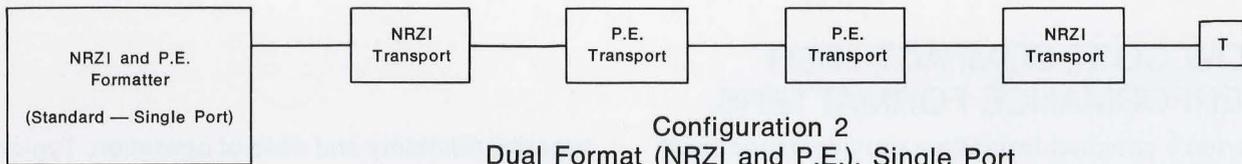
Configuration 2
Dual Format (NRZI and P.E.), Single Port
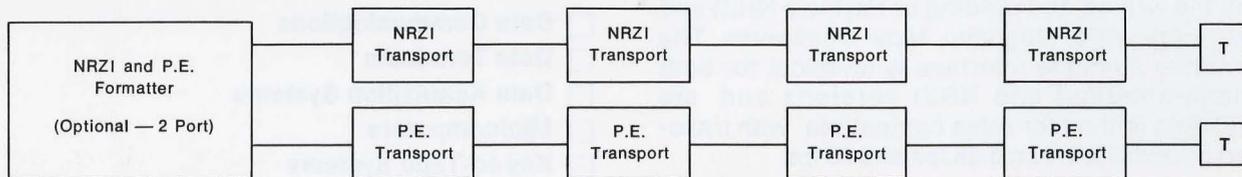
Configuration 3
Dual Format (NRZI and P.E.), Two Ports

of NRZI or PE transports to be mixed. The units can operate at any two standard speeds. NRZI transports can be either 7- or 9-track units. Permissible combinations are:

- A complete PE/NRZI formatter accommodating up to four mixed transports — read/write or read-after-write units.
- A special read-only PE/NRZI formatter providing control for up to four mixed read-only transports.

Configuration 3. This configuration serves up to four daisy-chained PE read/write, read-only, or read-after-write transports, and up to four daisy-chained NRZI read/write, read-only, or read-after-write transports. Each chain of transports is controlled through a separate port on the formatter. No MTA (Multi-Transport Adapter) is required when a single transport of each type is used. Transports in either chain may be any combination of single- or dual-stack head units with the same or dual speeds. NRZI transports may be any combination of 7-track or 9-track units.

For multi-transport operations, the Pertec MTA lets the user interconnect the transports in a daisy-chain fashion. Transport configuration; that is, 7- or 9-track, NRZI or PE, single or dual stack, etc., is established by the MTA board and communicated to the formatter through the transport/ formatter interface lines.

EQUIPMENT DESCRIPTION

The basic formatter comprises a dc power supply, slide-mounted chassis, input/output connectors, and a printed circuit back panel with connectors for two plug-in printed circuit boards.

A single-format NRZI unit uses a single NRZI board containing logic for motion control, and read and write circuits. A PE formatter uses two boards — one with write circuits and control logic, and the other containing read circuits. The formatter is connected to the transport(s) through one edge connector, and another edge connector serves the controller interface.

- **Chassis Assembly.**
  The formatter is built on a framed chassis with slides for convenient service access. Mounted in a standard 19-inch EIA rack, the unit is cooled by normal air convection.

- **Power Supply Assembly.**
  Designed for easy removal, the power supply assembly incorporates a choke regulator which reduces the overall size and power consumption. The regulator, contained on one printed circuit module, incorporates both overvoltage and current sensing to provide overall system protection.

- **NRZI Board Assembly.**
  This plug-in board contains all transport timing and motion-control logic, write data and check character generation logic, read data and check character logic, end-of-file generation and detection, and end-of-record detection

logic. Formatter logic is internally switched for read/write, read-after-write, and read-only transports through information provided by the transport interface, or adapted by means of hardwired jumpers on the circuit board.

Transport speed changes are easily programmed by Pertec's "Complete Digital Design". All critical timing is controlled by an oscillator mounted on the NRZI board. Therefore, matching the formatter with the transport speed requires only changing the plug-in oscillator module.

The NRZI printed circuit assembly is also used to provide timing and transport control for dual-format, read-only configurations.

- **Phase Encoded Write and Control Board.**
  All tape transport timing and motion-control logic, and logic for identification burst generation, preamble and postamble generation, end-of-file generation and detection, and parity generation and checking, is contained on this printed circuit assembly. Functional timing for phase-encoded write operations is similar to that of the NRZI version with speed changes handled by a plug-in oscillator module.

- **Phase-Encoded Read Board.**
  Read data discrimination, preamble and postamble detection, error detection with single-track error correction and end-of-file functions, are provided on this printed circuit assembly. Following phase synchronization, the preamble and postamble are stripped and the characters

are assembled in a four-stage deskewing register before data is output. When a single-track dropout occurs, the track is subsequently ignored and the data is automatically corrected using the odd parity concept. For ease in changing speed, the phase-encoded tracking oscillator is housed on a plug-in printed circuit card. In addition, an optional dual-speed tracking oscillator is available for reading data from multi-speed transports.

The comprehensive set of input commands gives the user maximum transport capability using minimum coupler logic. After receiving the input command, the formatter assumes the busy status until completion of the command cycle. Data timing is managed by the formatter clock and the data transfer is performed on a request basis. After completion of the command sequence, the appropriate status flags are transmitted for customer interrogation.

AVAILABLE MODELS

Table 1 lists the basic model numbers and corresponding compatible transports. All formatters are shipped with a set of input/output connectors, a formatter/transport cable, and maintenance manual.

- **Single Format, NRZI.**
  There are two models of NRZI formatters to meet most data recording applications. Data density may be 200, 556, or 800 bpi compatible with transfer rates ranging from 1.25KHz to 60KHz. Data can be either seven or nine tracks including a parity track.

  Formatter functions include tape motion control, parity generation and checking, CRC and LRC character generation and checking, File Mark generation and detection, and End of Record detection.

  When used with Pertec's 5000, 6000, or 7000 Series tape transports, the NRZI formatter performs all functions required to generate and read IBM- and ANSI-compatible magnetic tapes, in either 7- or 9-track formats.

  The NRZI formatter operates and controls selection of up to four NRZI transports. The transports may be all of the same type or any combination of 7- or 9-track, read/write, or read-after-write units, or read-only transports. A two-speed option is available to handle dual-speed transport systems. Tape speeds may range from 6.25 to 75 ips.

- **Single Format, Phase Encoded.**
  The phase-encoded (PE) formatter is available in four configurations to satisfy every PE data requirement. All models are designed for 1600-cpi operation, operate at tape speeds between 6.25 and 75 ips, and read or write a nine-bit

data character (eight data bits plus one parity bit).

PE formatter functions include ID burst generation and detection, data encoding and decoding, data deskewing, single track dropout and error correction, and tape motion control. Used with Pertec's 5000-, 6000-, and 7000-Series transports, the formatter controls generation and reading of ANSI- and IBM-compatible phase-encoded tapes.

The PE formatter operates and controls selection of up to four PE transports. As the transports of different configurations, send their read/write or read-after-write information through the interface, the formatter automatically switches internal logic to adapt to each transport. All formatters normally operate at a single speed but a two speed option may be ordered. Standard tape speeds between 6.25 and 75 ips can be selected.

- **Dual-Format, Phase-Encoded/NRZI.**
  The three models of PE/NRZI formatters provide maximum coverage for any multi-format data recording applications. No additional hardware space is required because the same chassis is used. The formatter can be initially specified as an NRZI-only system with the expandable printed circuit back panel option. Then at some later date, the phase encoded boards can be added to provide dual format capability — no wires, no extra chassis or power supply.

  The dual formatter performs all the previously mentioned single-format functions and is, of course, available in dual-speed versions. Tape speeds can be selected from the standard list ranging from 6.25 through 75 ips.

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TABLE 1

Single Format:

Model Number	Number of Tracks	Format Type	Capability	Compatible Pertec Transport
F829/7	7 and/ or 9	NRZI	Read / Write & Read Only	5X60, 6X60, 7X20, 7X30, 6811, 6812
F849/7	7 and/ or 9	NRZI	Read - After - Write	5X40, 6X40, 7X40
F609	9	P.E.	Write Only	5660, 6660, 7620
F619	9	P.E.	Read Only	6611-000
F629	9	P.E.	Read/Write	5660, 6660, 7620
F649	9	P.E.	Read - After - Write	5640, 6640, 7640

Dual Format:

Model Number	Number of Tracks	Format Type	Capability	Compatible Pertec Transport
F6181	P.E. — 9 NRZI — 7 and/or 9	PE/NRZI	Read Only	5612-850, 6612-850
F6282	P.E. — 9 NRZI — 7 and/or 9	PE/NRZI	Read/Write	5X60, 6X60, 7X20, 5660, 6660, 7620
F6484	P.E. — 9 NRZI — 7 and/or 9	PE/NRZI	Read - After - Write	5X40, 6X40, 7X40, 5640, 6640, 7640

OPTIONAL FEATURES which must be specified at the time of order are as follows:

- **Color-Coordinated Front Panel.** The formatter front panel may be painted to match the customer's color scheme. Pertec's standard color is pearl white.

- **Transport Speeds.** The transfer rates and speeds of transports used. If the system uses transports of two different speeds, both must be specified.

- **Customer Logo.**

- **Formatter Address.** Specify 0 or 1. Standard address is 0.

- **Internal/External Parity Generation.** The standard unit is wired for internal parity generation.

- **Power Supply Option.** Provides additional power for buffer board or customer's interface coupler. Includes extra connectors (not available on F6282 or F6484).

- **Blank Wire Wrap Board.** For customer-built coupler.

- **220 Vac Operation.** Normally wired for 115 Vac.

- **Dual Density.** Specify any two: 200, 556, or 800 cpi for 7-track operation.

- **MTA Compatibility.** When specifying a formatter for multi-transport operation, the read-after-write version is the standard unit.

- **Dual Port Option.** Only available on dual-format units. A single port can handle up to four transports while a dual port can handle up to eight transports (not available on F6181 models).

SPECIFICATIONS

Data Density	9-Track 1600 cpi phase-encoded and/or 800 cpi NRZI. 7-Track, 800, 556, or 200 cpi NRZI
Tape Velocity	75, 45, 37.5, 25, 22.5, 18.75, 12.5, or 6.25 ips standard (dual-speed units available)
Recording Mode	Phase-encoded or NRZI, compatible with IBM and ANSI standards
Compatible Tape Transports	Any Pertec 5000-, 6000-, or 7000-Series Transports
Electronics	7400-Series, TTL Logic with DTL interface
Power	117/230 Vac. 48 to 400 Hz, 100 Watts maximum
Environment (operating)	
Temperature	35°F to 122°F (2°C to 50°C)
Altitude	Sea Level to 20,000 feet
Humidity	10% to 95% non-condensing
Mounting	Standard EIA Rack Mount (slides provided)
Weight	25 lbs maximum
Dimensions	
Height	3.5 inches
Width	19.0 inches
Depth	20.0 inches

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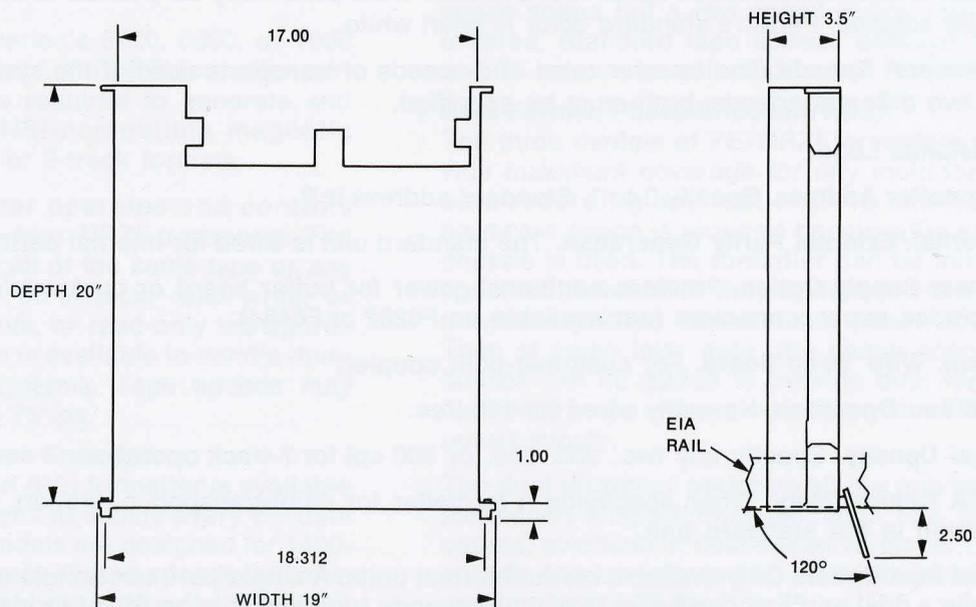
INTERFACE DESCRIPTION

1. FORMATTER CONTROL LINES

FORMATTER ADDRESS (FAD). Level, which selects one of two possible formatters.

TRANSPORT ADDRESS (TAD0, 1). Levels, which select one of four possible transports.

FORMATTER ENABLE (FEN). Level which, when true; enables the formatter.

GO. Pulse, which initiates command function required.

2. FORMATTER

COMMAND FUNCTIONS

REVERSE/FORWARD (REV). Level which, when true, selects reverse tape motion.

WRITE/READ (WRT). Level which, when true, selects write mode of operation.

WRITE FILE MARK (WFM). Level which, when true and write is true, will establish write-file-mark condition.

EDIT. Level which, when true, initiates EDIT function within formatter.

3. FORMATTER DATA INPUT

WRITE DATA LINES (WP, W0-W7). Levels which, when true, cause a "1" to be recorded.

WRITE STROBE. Pulse which, when true, indicates controller can switch data onto the lines.

LAST WORD (LWD). Level which indicates that the last character has been strobed into the formatter.

PARITY (PAR). Level which selects even or odd parity condition (NRZI 7-track only).

4. FORMATTER STATUS

FORMATTER BUSY (FBY). Level which, when true, indicates formatter is acting on a command.

DATA BUSY (DBY). Level which, when true, indicates formatter is processing data.

CHECK CHARACTER GATE (CCG). Level which, when true, indicates characters being transmitted are check characters (NRZI formatter only).

IDENTIFICATION BURST (ID). Pulses which indicate formatter is detecting an identification burst (PE formatter only).

HARD ERROR (HER). Pulse or level which is true when formatter is detecting a non-correctable error.

CORRECTED ERROR (CER). Level which, when true, indicates formatter is correcting an error (PE formatter only).

FILE MARK INDICATOR (FMK). Level which, when true, indicates the formatter has detected a file mark.

5. FORMATTER OUTPUT DATA

READ STROBE (RSTR). Pulse which, when true, indicates data on the lines can be read.

READ DATA (RP, R0-R7). Levels which, when true, indicate a "1" is being read.

6. TRANSPORT CONTROL LINES

THRESHOLD 1 & 2 (THR1, 2). Level which selects read threshold condition within selected transport.

DENSITY (DEN). Level which selects operating density in selected transport.

REWIND (REW). Pulse which commands selected transport to rewind.

OFFLINE (OFL). Pulse which commands selected transport to return to local mode.

7. TRANSPORT STATUS

READY (RDY). Level which, when true, indicates selected transport is ready to accept remote commands.

ONLINE (ONL). Level which, when true, indicates selected transport can be remotely controlled.

REWIND (RWD). Level which, when true, indicates selected transport is in rewind status.

FILE PROTECT (FPT). Level which, when true, indicates file is protected (no write enable ring on supply reel).

LOAD POINT (LPT). Level which, when true, indicates selected transport is at the load point.

END OF TAPE (EOT). Level which, when true, indicates end-of-tape marker is being detected.

MULTIPLE TRANSPORT ADAPTER STATUS

**NRZI.** Level which, when true, indicates selected transport is a NRZI unit.

7 TRACK (7-TR). Level which, when true, indicates selected transport is a 7-track unit.

SINGLE GAP HEAD (SGL). Level which, when true, indicates selected transport has a single gap head.

SPEED. Level which, when true, indicates selected transport is at low speed.

INTERFACE CHARACTERISTICS

All interface lines are low-true with logic levels of
$$+3V = \text{false}$$
$$0V = \text{true}$$

Driver input and receiver output levels are
$$+5V = \text{true}$$
$$0V = \text{false}$$

An open interface line is interpreted as false. All pulses must be at least 1 μsec wide.
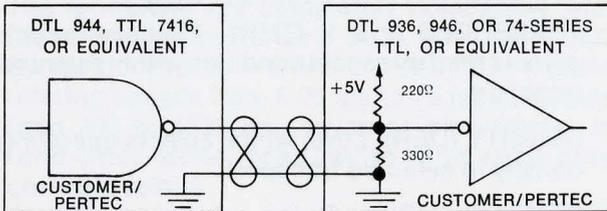
*Noise Margins in mV			
Logic	0°C	25°C	50°C
High	300	450	550
Low	450	250	200

*In excess of max crosstalk on a 40-ft. continuous unshielded cable.

Flat Cable Characteristics
The flat cable used has the following characteristics.

Wire Gauge:	No. 24 stranded
Insulation:	PVC
Impedance:	100 ohms
Capacitance:	15 picofarads/foot
Inductance:	0.20 microhenry/foot
Velocity of Propagation:	1.5 nanosec/foot
Insulation Resistance:	10^{10} ohms/foot

DTL 944, TTL 7416, OR EQUIVALENT — CUSTOMER/PERTEC

DTL 936, 946, OR 74-SERIES TTL, OR EQUIVALENT — +5V, 220Ω, 330Ω, CUSTOMER/PERTEC

NOTES

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