HIGH SPEED TAPE READERS (DX TYPE)

PDI AND PTI INTERFACE

DESCRIPTION AND PRINCIPLES OF OPERATION

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1. GENERAL

1.01 This section provides description and principles of operation for the high speed tape readers with PDI (Parallel Device Interface), and PTI (Parallel Terminal Interface) signaling. The high speed reader is an externally pulsed, magnet controlled, parallel output, perforated paper tape reader (Figure 1).

1.02 The readers recognize 5- to 8-level code holes in nonmetallic fully perforated or chadless tape which conforms to USASI Standard X3.18 1967 or equivalent. It provides a parallel electrical output corresponding to the perforated code levels in the tape on a step-by-step basis in response to command signals from an external source.

1.03 Cantilevered sensing wires are used as sensing devices with integral electrical contact surfaces providing parallel readout. Operating speeds are dependent upon the rate of external pulsing up to a maximum capability of the reader of 360 OPS (Operations Per Second).

1.04 The mechanical drive consists of torque applied continuously to the tape drive system from a motor, with torque metering to the reader through a magnetic clutch. Torque is applied to the feed wheel on a step-by-step basis through an electromagnetically controlled escapement mechanism. Two step coils are alternately energized by an electronic magnet driver in response to externally supplied clock pulses to provide for 0.1 inch steps of message tape.

1.05 Reader output is determined by presence or absence of holes in the tape. Normally closed sensing contacts are biased open by the tape over the sensing wires. A hole in the tape permits the sensing wire to spring into the hole returning the contact to its normally closed position.

1.06 These high speed readers (with PDI and PTI) are equipped with one row of tape sensing wires (code). Tape-out and tangled-tape switches are provided. The readers operate in one direction only.

1.07 The PDI circuit card provides a fully asynchronous method of signaling and contains logic circuitry to produce controlled output response from contact closures to ground and PDI input signals. This provides a 5 volt dc output voltage for a marking condition when the contacts are closed and 0 volt or ground, for a spacing condition when the contacts are open.

Prepared for American Telephone and Telegraph Company by Teletype Corporation

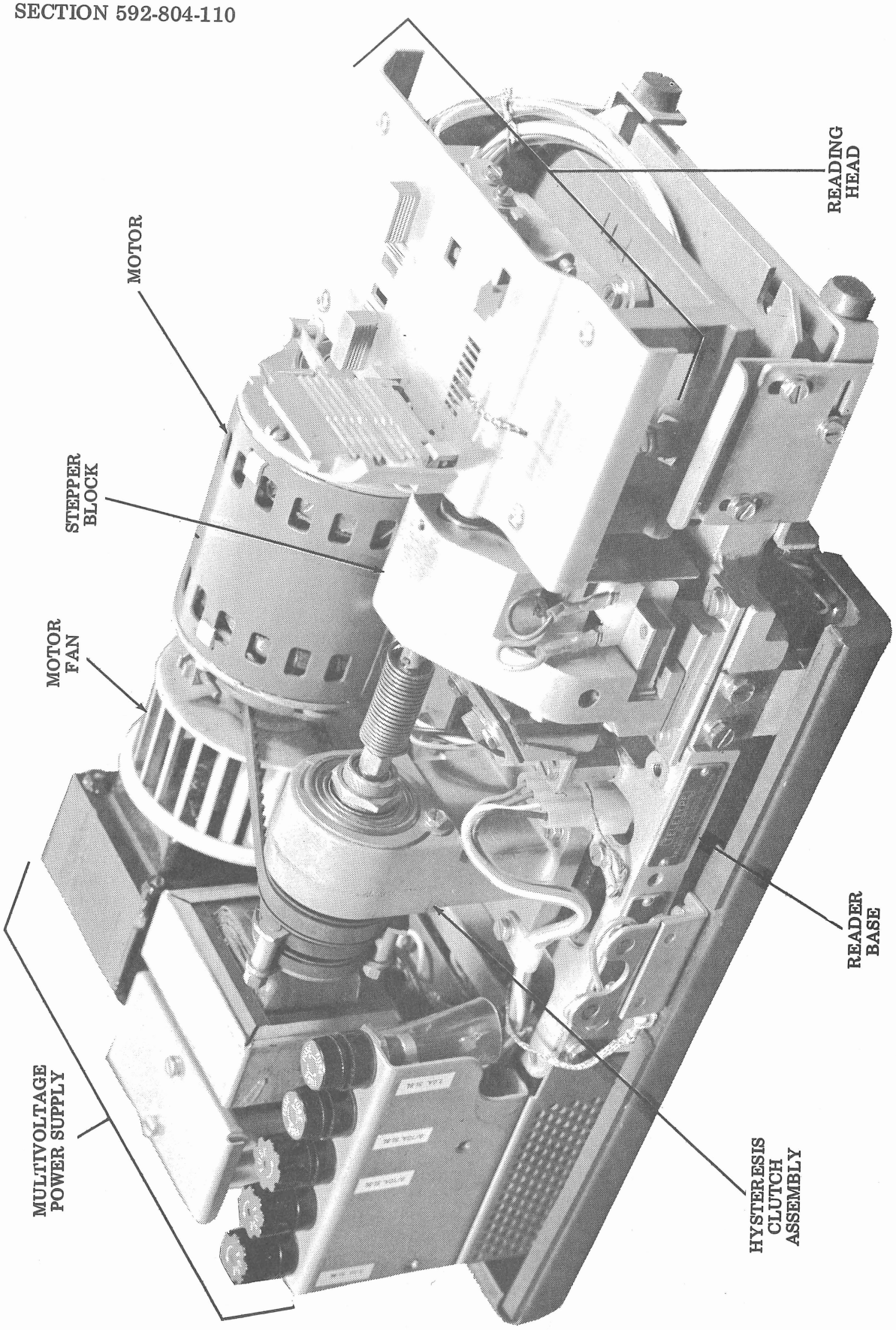

Figure 1 - High Speed Tape Reader

1.08 The PTI circuit card provides a fully isolated asynchronous method of signaling. It contains logic circuitry to produce controlled output responses from contact closures to ground and PTI input signals. This provides an output current of approximately 25 milliamperes for a spacing condition when contacts are open and zero current flow for a marking condition when contacts are closed.

1.09 The reader incorporates its own logic power supply, electronic magnet driver and control logic for the performance of all drive control in the reader. Included is the standard parallel interface scheme of message and character control together with tape motion circuitry to indicate the stepping of tape through the reading head. A motor control feature is also incorporated into the reader.

1.10 Readers are equipped with code contact sensing wires. Code contacts sense and transform perforated tape information into an electrical output.

1.11 Variable operating speeds are dependent on the external input pulsing rate up to the maximum capability of 360 OPS. Five to eight level nonmetallic fully perforated, or chadless tape conforming to recognized standards can be read by the tape reader, with a parallel electrical output corresponding to the perforated code levels in the tape.

1.12 Contact outputs for indicating tape motion, tape-out and tangled-tape conditions are also available on the reading head assembly.

1.13 The tape reader is intended to be used with high speed tape sending terminals, and other tape sending applications or it can be used as a self-contained unit (Figure 1).

2. TECHNICAL DATA

2.01 Electrical and Environmental Characteristics

(a) Power — 115 volts ac ±10%, 50 or 60 Hz, 90 watts at nominal voltage at 60 Hz.

(b) Power consumption — standby power consumption is approximately 10 watts.

(c) Heat dissipation — with reader operating on 115 volts, 60 hertz it dissipates 308 BTUs (British Thermal Units) per hour.

(d) Ambient relative humidity — normal operating efficiency can be expected at 0 to 90% humidity at an altitude of 10,000 feet.

(e) Storage temperature — minimum storage temperature is — 40 degrees to a maximum of 185 degrees Fahrenheit.

(f) Temperature ranges — this equipment is intended to be operated in a room environment within the temperature range of 40 degrees Fahrenheit to 110 degrees Fahrenheit. Serious damage to it could result if this range is exceeded. In this connection, particular caution should be exercised in using acoustical or other enclosures.

2.02 Physical Characteristics

(a) Dimensions (less covers)

(1)	Height	5-1/4 inches
(2)	Width	7-5/8 inches
(3)	Depth	14-1/8 inches

(b) Weight (less covers) . . . . 25 pounds

(c) Power cable

Purpose — supplies power (ac) for reader.
Type — 3 conductor cable with 3-pin polarized connector.
Length — 10 feet.

(d) Electrical interface

Purpose — electrical interconnection to other equipment.
Type — 50-pin connector.
Location — on rear of reader.
Mating connector — TP192014 with TP173716 terminals.

(e) Tape characteristics

Level — 5- to 8-level.
Type — fully perforated or chadless tape (including advanced feed hole).
Speed — up to and including 360 OPS.

3. DESCRIPTION

BASIC UNIT

A. Mounting

3.01 The tape reader chassis is mounted on four rubber isolated mounting feet to facilitate mounting in a cabinet or self-contained unit (Figure 1).

B. Motor Unit

3.02 This unit consists of a permanent split capacitor type induction motor with fan, pulley, timing belt, and associated mounting hardware. The run coil and start coil with series capacitor are internally strapped to provide proper motor rotation (Figure 1).

C. Hysteresis Clutch

3.03 Rotational power is supplied to the hysteresis clutch through a timing belt drive directly off the continuously operating induction motor. An average speed of 1300 rpm is produced through the constant rotation of the magnetic clutch driver. With the clutch follower coupled to the clutch driver by its permanent magnetic field, the clutch follower torque and tape transport input torque, is dependent on the adjustable air gaps between the face of the clutch driver and the clutch follower (Figure 2).

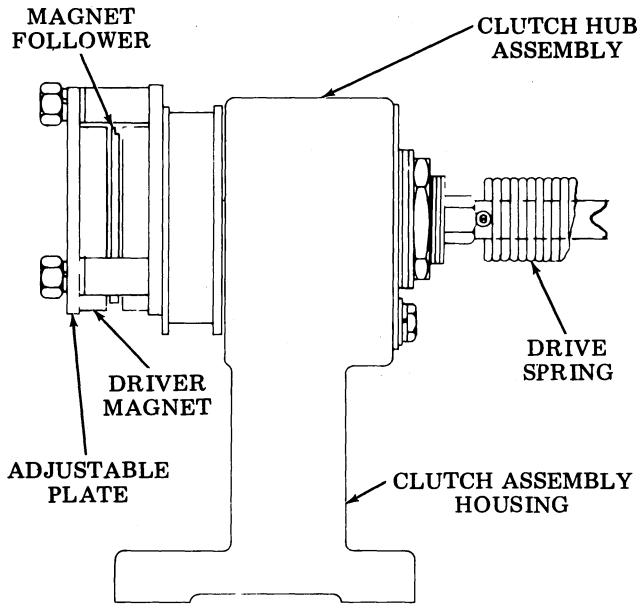

Figure 2 - Hysteresis Clutch Assembly

3.04 The smaller the air gap between the clutch follower and clutch driver magnet, the more torque input to the tape transport system. There is constant slipping between clutch driver and follower when the reader is idling.

3.05 When the unit receives a command to step, the clutch follower restores torque to the torque storage spring (escapement drive spring), compensating for the energy used in moving the tape.

D. Tape Stepper Assembly

3.06 With the reader idling, torque is applied to the escapement wheel by the intermediate escapement drive spring. Escapement wheel rotation is blocked by one side of escapement pallet (Figure 3), while the escapement pallet is held in position by an armature attached to the pallet shaft, which is attracted to the pole face of the energized magnet.

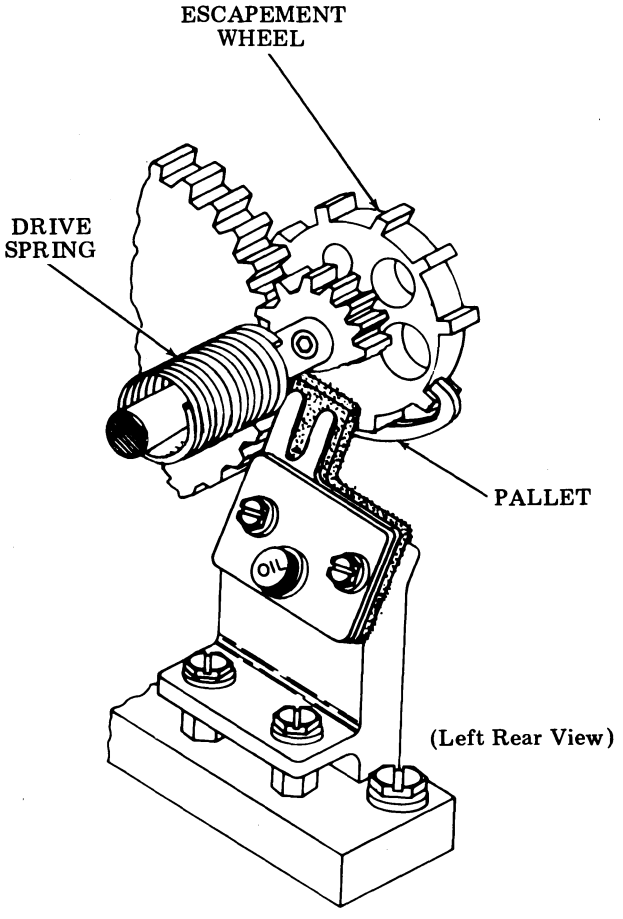

Figure 3 - Tape Stepper Assembly

3.07 A command to step is initiated by an input clock pulse into the electronic magnet driver, which removes current from the energized coil and applies current to the opposite step coil, attracting the armature to the pole face. Since the armature and pallet are rigidly attached to the same shaft, motion of the armature causes motion of the pallet releasing the escapement wheel (Figure 4).

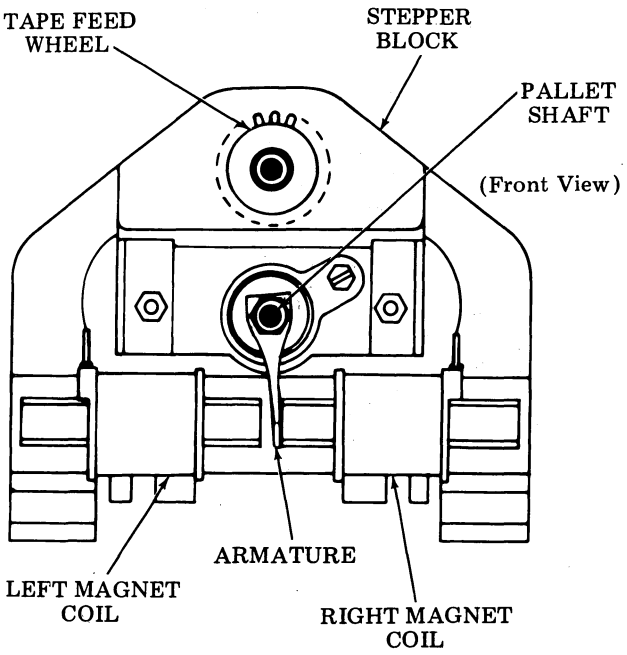

Figure 4 - Armature and Coil Assembly

3.08 Torque transferred through the escapement drive spring is converted to rotary motion on the escapement wheel, which is allowed to turn to its next position (Figures 4 and 5). Escapement wheel rotation is limited to 15 degrees and tape motion to 0.1 inch.

READING HEAD

3.09 The tape sensing wires consist of cantilevered wire springs that sense holes in the punched tape and have integral electrical contact surfaces. In the idling condition without tape in the reading head, the sensing wire contacts touch a common contact, providing a mark output, or contact closure for each sensing wire (Figure 6).

3.10 Readers with two rows of sensing wires (code and verify) will react in the same manner as explained in 3.09. Verify contacts (second row of contacts) react one step after the code contacts sense a character. Verify contacts are physically located exactly 0.1 inch behind the code contacts.

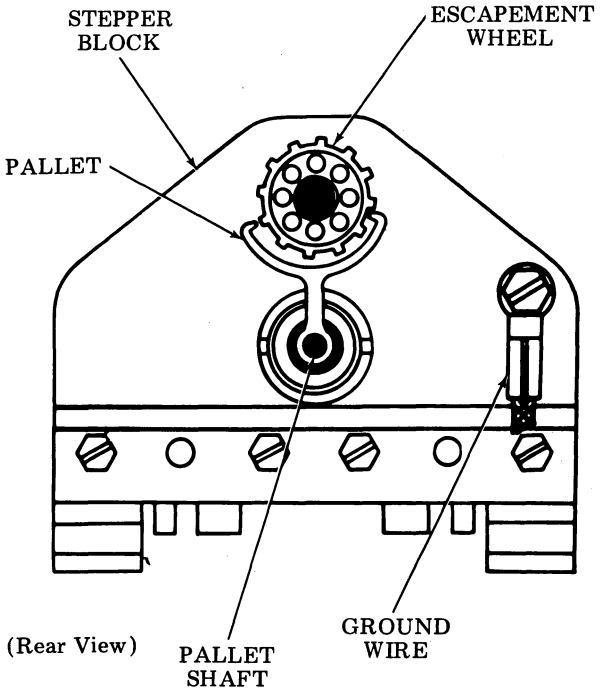

Figure 5 - Pallet Assembly

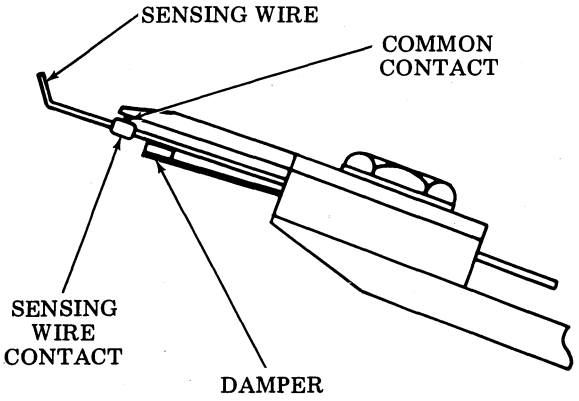

Figure 6 - Tape Sensing Wire (Without Tape in Reading Head)

3.11 Tape without code holes (feed holes only) passing over sensing wires or closing the tape lid over tape without code holes, displaces the sensing wires, opening the sensing wire contacts which provides a space output for all contacts. Tape with code holes inserted in the

reading head and the tape lid closed, provides an electrical output corresponding to the code hole pattern in the tape (Figures 7 and 8).

3.12 When inserting tape in the reading head, provide at least one inch of lead tape over the feed wheel and the first character to be read before closing the tape lid.

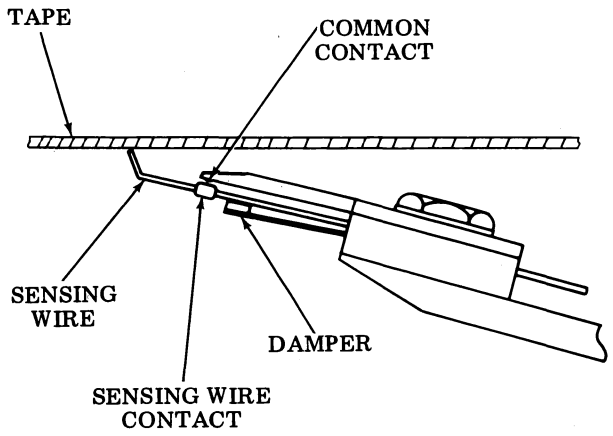

Figure 7 - Tape Sensing (Without Code Hole)

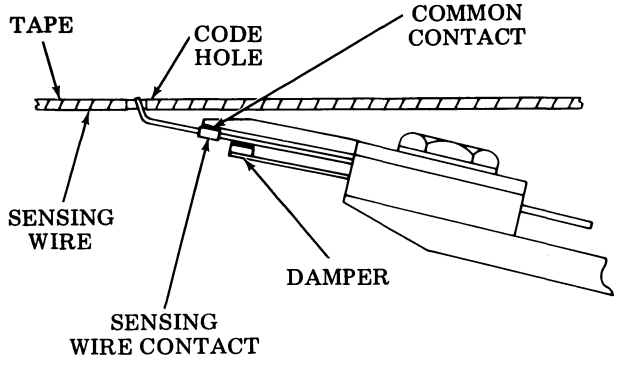

Figure 8 - Tape Sensing (With Code Hole)

3.13 The message tape determines the electrical output during the reading sequence, as the tape between adjacent characters passes over the sensing wires, all contacts are displaced to their open position producing a space output for all contacts.

3.14 As the tape continues to move through the reading head, the next character perforations permit the associated sensing wires to be released into the holes. This permits the selected sensing wires to return to their normally closed position providing a mark output.

3.15 The sensing wires should be adjusted so the wire tips are approximately in the center of the right 2/3 of the code and feed holes when the tape reaches its stop position at the end of the step cycle (Figure 9).

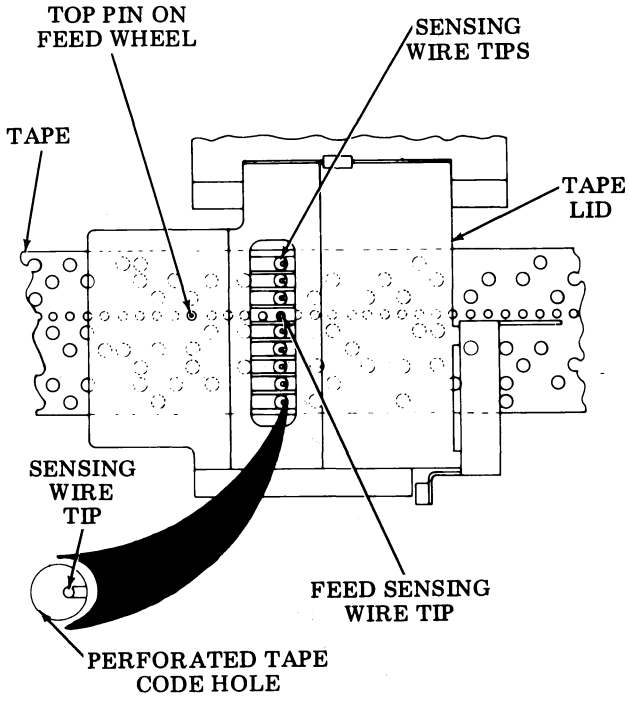

Figure 9 - Sensing Wires in Relation to Code Holes

Feed and Alarm Contacts

3.16 The feed contact provides contact closure for each feed hole as the tape advances over its position. This output is used to indicate the command to step has been obeyed and the tape has been advanced. The feed contact sensing wire is located in the code contact assembly, between number three and four sensing wires and is identical in shape as the other sensing wires.

3.17 The tangled-tape/tape-out contacts are located in the same contact pile-up (front of reader under top plate) operated by the tape-out contact bail and contact insulator which protrudes through the top plate.

3.18 With tape out of the reading head, the bail (being spring loaded) rests in its slot in the top plate. In this position (or with tape lid up) the tape-out contact is normally open and the tangled-tape contacts are normally closed (Figure 10).

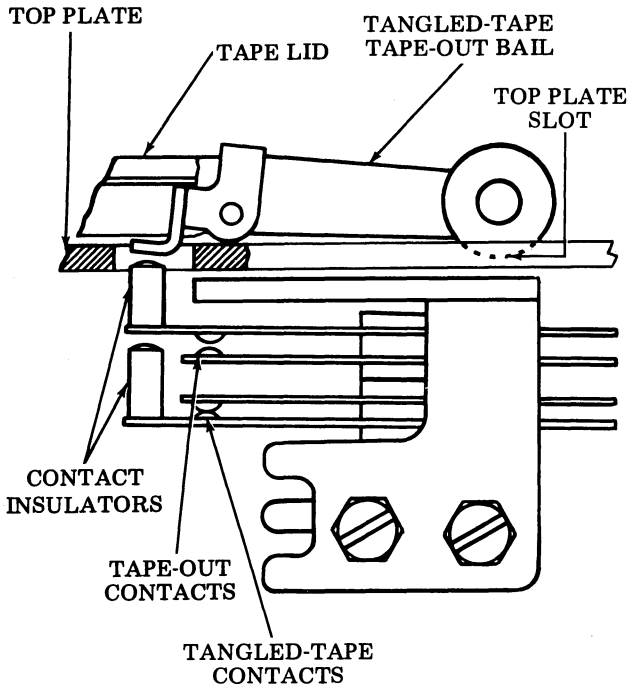

Figure 10 - Tangled-Tape/Tape-Out Contacts

3.19 When tape is placed in the reading head and tape lid closed, the bail is prevented from falling into its slot and the tape-out contacts are closed. Tangled-tape entering the reading head will raise the bail from the top plate depressing contact insulators and opening the tangled-tape contacts immediately stopping tape transmission. A minimum two inch tape trailer is required to sense tape-out and still read the last character.

3.20 Spliced tapes may be used in the reader when required. The splice (butt not overlap) thickness should not exceed 0.0075 inch, splicing tape should be applied to one side (splice up) of the tape only.

3.21 The high speed asynchronous tape motion will cause burring of the tape feed hole. A standard piece of 8-level fully perforated tape can be used reliably for a minimum of ten times in one direction.

4. PRINCIPLES OF OPERATION

CONTROL LOGIC AND INTERFACE

4.01 The internal electronics design has been tailored to the system design and as such is a fail-safe, store and forward system consisting of two types of interface signals; message control and character control leads.

MESSAGE CONTROL (PDI SIGNALING)

4.02 Message control leads provide signaling pertinent to the state of the reader.

(a) Sender Selectable (Reader Output)
Indicates reader has tape in reading head.
On — 0 volt capable of sinking 10 milliamperes.
Off — +5 volts capable of supplying 0.5 milliamperes.

(b) Send Message (Reader Input)
Corresponds to an on-off switch to the control logic.
On — 0 volt required to sink 7 milliamperes maximum.
Off — open circuit.

(c) Send Ready (Reader Output)
Indicates a send command is received, reader has stepped and a character is available in the storage buffer, no tape handling alarms are present. After the first character is loaded into the storage buffer, send ready will turn off if either send message or sender selectable turn off, or if feed detect circuit indicates the reader has failed to feed.

CHARACTER CONTROL (PDI SIGNALING)

4.03 Upon completing the required handshake signaling (sender selectable, send message, and send ready) the reader will respond to the following command and feed back a signal to the controller indicating its status.

(a) Present Next Character (Reader Input)
Command to reader to put data on data leads and step to next character.
On — 0 volt required to sink 7 milliamperes maximum.
Off — open circuit.

Note: Pulse must be left on until character available goes on.

(b) Character Available (Reader Output)
Indicates to the controller that the reader has stepped, a character is available and PNC (Present Next Character) is on.
On — 0 volt capable of sinking 10 milliamperes.
Off — +5 volts capable of supplying 0.5 milliamperes.

DATA OUTPUT (PDI AND PTI SIGNALING)

4.04 Code contacts are internally sampled and loaded into output buffer.
Mark — +5 volts capable of supplying 0.5 milliamperes.
Space — 0 volt capable of sinking 10 milliamperes.

MESSAGE CONTROL (PTI SIGNALING)

4.05 Message control leads provide signaling pertinent to the state of the reader.

(a) Sender Selectable (Reader Output)
Indicates reader has tape in reading head.
On — capable of supplying 25 milliamperes.
Off — no current flow.

(b) Send Message (Reader Input)
Corresponds to an on-off switch to the control logic.
On — sinks 25 milliamperes through optical isolator.
Off — no current flow.

(c) Send Ready (Reader Output)
Indicates a send command has been received, reader has stepped, a character is available in storage buffer, and no tape handling alarms are present. After the first character has been loaded into the storage buffer, send ready will turn off if either send message or sender selectable turn off or if feed detect circuitry indicates the reader failed to feed.
On — supply approximately 25 milliamperes.
Off — no current flow.

CHARACTER CONTROL (PTI SIGNALING)

4.06 Upon completing the required handshake signaling (sender selectable, send message, and send ready) the reader will respond to the following command and feed back a signal to the controller indicating its status.

(a) Present Next Character (Reader Input)
Command to reader to put data on data leads and step to next character.
On — required to sink approximately 25 milliamperes through optical isolator.
Off — no current flow through isolator.

Note: Pulse must be left on at least until character available goes on.

(b) Character Available (Reader Output)
Indicates to the controller that the reader has stepped, a character is available and PNC is on.
On — output transistor supplies approximately 25 milliamperes.
Off — no current flow.

For a detailed description of control circuitry, see appropriate WDP (Wiring Diagram Package).