KS-19717 TAPE PRINTER

OPERATING PROCEDURES

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CODE OR SPEC NO.	DESCRIPTION	USE
A. B. DuMont Lab Inc. Type 304 (Equivalent or other comparable scope may be used)	Oscilloscope	Not required for routine maintenance
KS-14510 L1	Multimeter, or equivalent	For performing resistance measurements
A27580	Solenoid Adjustment Tool	To adjust solenoid plunger travel

1. GENERAL

1.01 This section covers principles of operation and maintenance information for the KS-19717 L1 through L7 Tape Printers. The tape printer is initially for use on the PBX-AIOD Station Identification Frame (J1C000A) but intended for general use in the Bell System. The L1, L2, and L3 tape printers are rated "Manufacturer Discontinued" and replaced by the L4, L5, and L6, respectively.

1.02 This section is reissued to add the KS-19717 L6 and L7 tate printers and to show the L1, L2, and L3 tape printers "Manufacturer Discontinued". Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The tape printer is provided with four tapped standoffs on the underside of the unit for mounting purposes. An 18-contact circuit card provided on the unit mates with a Western Electric 906H locking-type connector for connecting the tape printer to the data and print command circuits.

1.04 The test equipment and special tools required for maintaing the KS-19717 tape printer are given in the following list:

2. DESCRIPTION

2.01 The KS-19717 L1, L2, L4, and L5 tape printers are subminiature, ribbonless, tape printers housed in a metal case with a black lusterless finish. The case is approximately 5 inches wide, 2 inches high, and 11 inches long and is designed for surface mounting. The unit is capable of printing any of 16 different characters at a speed of up to 100 words per minute (10 characters per second) in response to a four bit parallel signal input of 48 volts plus a 48 volt print command signal. The tape printer uses no standby power when idle and requires no warm-up time. It is operated by the power provided by its signal input. The KS-19717 L5 tape printer is illustrated in Fig. 1.

2.02 The KS-19717 L3, L6, and L7 (Fig. 2) tape printers differ from the printers described above in that they are capable of printing any of 64 different characters (modified ASCII code) in response to a six bit parallel signal input. The L3 tape printer can print at a speed of 10 characters

Fig. 1—KS-19717 L5 Tape Printer

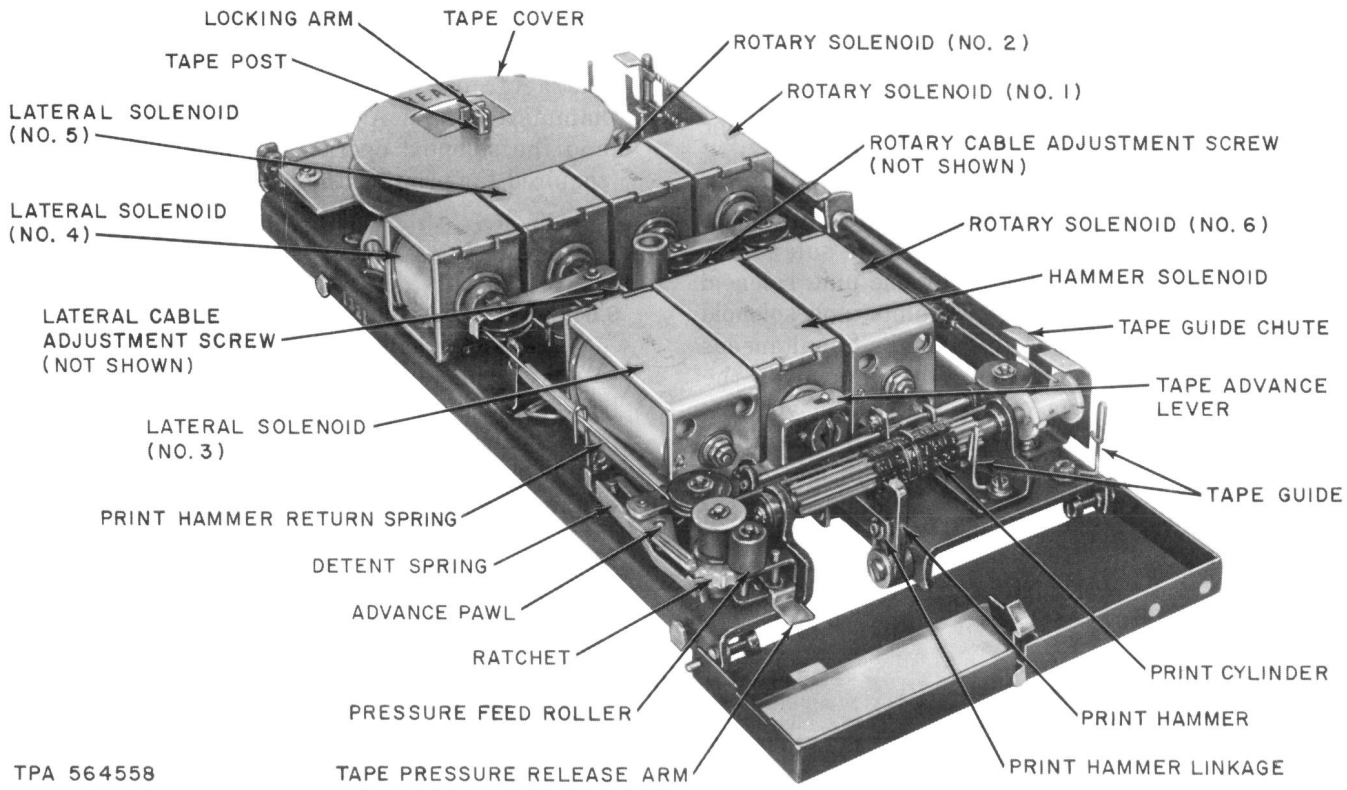


Fig. 2—KS-19717 L6 Tape Printer—Cover Removed

per second, and the L7 can print at 11 characters per second.

2.03 The characters are printed on KS-19855 L1 or KS-19717 L12 pressure responsive tape. The roll of tape has a nominal outside diameter of 3 inches, contains approximately 140 feet, and has a width of 5/16 inch. One roll of tape will provide for approximately 30 minutes of continuous operation at 100 wpm.

2.04 All new KS-19717 tape printers are equipped with a transparent front door. This door may be obtained as a modification kit for units having the metal door. The modification kit is coded:

KS-19717 L101, Front Cover Modification Kit.

3. PRINCIPLES OF OPERATION

KS-19717 L1, L2, L4, and L5 Tape Printer

3.01 The tape printer receives signals on four parallel levels. Each level is connected to a solenoid which converts the electrical impulses into mechanical motion. The motions of these four solenoids are used to move the print cylinder so the character corresponding to the input signals is positioned for printing. A print command signal applied to the hammer solenoid actuates the print hammer to imprint the selected character on the tape.

3.02 The print cylinder is equipped with eight print segments, each having eight characters or symbols. Of the eight print segments, only two segments (one set of sixteen characters and symbols) are utilized during printer operation. The remaining six print segments provide three spare sets of segments. To utilize any one of the spare sets because of wear, damaged characters, etc, the print cylinder must be manually realigned.

3.03 Print cylinder rotary positioning is accomplished in the following manner: A rotary positioning signal is applied to solenoid 4. The ***nonoperate signal*** allows the first segment or row of characters in the set to remain in horizontal alignment with the print hammer. The ***operate signal*** operates the solenoid which in turn shortens the rotary cable

to rotate the print cylinder 45 degrees bringing the second row of characters into horizontal alignment with the print hammer.

3.04 The selected character is positioned under the print hammer in the following manner: The lateral positioning signals are applied to solenoids 1, 2, and 3 to control lateral positioning of the print cylinder. Operation of solenoid 1 moves the print cylinder laterally one unit, solenoid 2 moves the print cylinder two units, and solenoid 3 moves the print cylinder four units. Simultaneous operation of more than one solenoid moves the print cylinder the sum of the units of movements for each operating solenoid. For example: Simultaneous operation of solenoids 2 and 3 will move the print cylinder six units.

3.05 The combination of concurrent lateral and rotational movement places the selected character in the print position under the print hammer. Table A lists the available characters and the solenoid operate or nonoperate conditions required for printing the characters.

3.06 The print command signal applied to the hammer solenoid actuates the print hammer to print the character. The spring actuated backstroke of the hammer operates the tape advance pawl and ratchet on the bottom of the feed wheel to advance the tape on one space for the printing of the next character.

TABLE A

PRINT CODE CHART
FOR 16 CHARACTER PRINTER

CHARACTER	SOLENOID NO. 1	2	3	4
1	X	X	O	O
2	O	X	X	X
3	X	O	O	O
4	O	X	O	X
5	O	O	O	X
6	X	O	O	X
7	X	X	X	O
8	O	X	X	O
9	X	O	X	X
∅	X	X	O	X
▭	O	O	O	O
.	O	O	X	X
(	X	X	X	X
)	X	O	X	O
—	O	O	X	O
+	O	X	O	O

Note 1: X Designates the operate (on pulse condition).

Note 2: O Designates the nonoperate (off pulse condition).

KS-19717 L3, L6, and L7 Tape Printer

3.07 The L3, L6, and L7 tape printers differ in operation from the printers covered in 3.01 through 3.06 in that they are equipped with three rotary solenoids. This permits the print cylinder to be rotated to eight positions utilizing all eight print segments. The printer receives signals on six parallel levels with each level connected to a solenoid. The combination of concurrent lateral and rotational movement places one of 64 characters under the print hammer. Table B lists the available characters and the solenoid operate or nonoperate conditions required for printing the characters.

Low Tape Alarm

3.08 The KS-19717 L2 tape printer is equipped with an L10 low tape alarm mounted at the left rear of the printer. The KS-19717 L5 and L7 printer is equipped with a low tape alarm mounted at the right rear of the printer, which is available separately as KS-19717 L11.

3.09 The KS-19717 L11 low tape alarm may be used to modify existing KS-19717 tape printers without alarms. See 030-342-801 for installing procedures. The L11 low tape alarm replaces the "Manufacturer Discontinued" L10 alarm.

4. MAINTENANCE

Replacing Tape Roll

4.01 The method of replacing the tape roll is covered in the following steps:

(1) Remove tape printer cover.

(2) Raise the locking arm on the tape post and remove the tape cover and the empty tape roll.

(3) Move the low tape alarm outward on machines so equipped.

(4) Place a new roll of tape on the spool so the tape will unwind in a clockwise direction.

(5) Thread the tape through the tape guides (also tape guide chute if provided) and between the print cylinder and print hammer as shown in Fig. 3.

(6) Move the tape pressure release arm to the right to release the pressure on the roller. Pull a few inches of tape through the space between the pressure feed roller and the tape advance roller.

(7) Release the tape pressure arm to allow the roller to press against the tape and tape advance roller.

(8) Replace the tape spool cover. Position the slot in the tape spool cover so the locking arm on the post will engage the slot when the locking arm is rotated.

(9) Rotate the locking arm into the slot in the tape spool cover.

(10) Replace the tape printer cover and fasten retaining screw.

Lubrication

4.02 ***NO LUBRICATION IS REQUIRED*** The printer is permanently lubricated during manufacture. Lubrication of solenoids or print cylinder will result in improper operation.

5. TROUBLESHOOTING

Printing Errors

5.01 In most cases the presence of trouble will be indicated by a specific print-out error. Table C lists the symptoms of the most common troubles, the probable causes, and corrective action to be taken.

Inoperative Solenoids

5.02 An inoperative solenoid will be evidenced by failure to print the character or characters normally positioned for printing by operation of the solenoid. The Print Code Chart, Table A or B can be utilized to help determine the faulty solenoid.

5.03 To determine the cause of solenoid failure:

(1) Check the mechanical functions, visually inspect the solenoid plunger and linkage for obstructions or wear, examine the solenoid wiring leads for frayed insulation or loose connections, check that the solenoid mounting screws are tight, and that the plunger stroke travel adjustment is correct. Operate solenoids manually to check for the smooth operation. If operation is not smooth, check for worn liner, etc.

TABLE B

PRINT CODE CHART FOR 64 CHARACTER PRINTER

CHARACTER	SOLENOID NO. 1	2	3	4	5	6	CHARACTER	SOLENOID NO. 1	2	3	4	5	6
▭	O	O	O	O	O	X	@	O	O	O	O	O	O
!	X	O	O	O	O	X	A	X	O	O	O	O	O
" QUOTE	O	X	O	O	O	X	B	O	X	O	O	O	O
#	X	X	O	O	O	X	C	X	X	O	O	O	O
$	O	O	X	O	O	X	D	O	O	X	O	O	O
%	X	O	X	O	O	X	E	X	O	X	O	O	O
&	O	X	X	O	O	X	F	O	X	X	O	O	O
' APOS	X	X	X	O	O	X	G	X	X	X	O	O	O
(	O	O	O	X	O	X	H	O	O	O	X	O	O
)	X	O	O	X	O	X	I	X	O	O	X	O	O
*	O	X	O	X	O	X	J	O	X	O	X	O	O
+	X	X	O	X	O	X	K	X	X	O	X	O	O
, COMMA	O	O	X	X	O	X	L	O	O	X	X	O	O
–	X	O	X	X	O	X	M	X	O	X	X	O	O
. PERIOD	O	X	X	X	O	X	N	O	X	X	X	O	O
/	X	X	X	X	O	X	O	X	X	X	X	O	O
0 NUMBER	O	O	O	O	X	X	P	O	O	O	O	X	O
1	X	O	O	O	X	X	Q	X	O	O	O	X	O
2	O	X	O	O	X	X	R	O	X	O	O	X	O
3	X	X	O	O	X	X	S	X	X	O	O	X	O
4	O	O	X	O	X	X	T	O	O	X	O	X	O
5	X	O	X	O	X	X	U	X	O	X	O	X	O
6	O	X	X	O	X	X	V	O	X	X	O	X	O
7	X	X	X	O	X	X	W	X	X	X	O	X	O
8	O	O	O	X	X	X	X	O	O	O	X	X	O
9	X	O	O	X	X	X	Y	X	O	O	X	X	O
a	O	X	O	X	X	X	Z	O	X	O	X	X	O
b	X	X	O	X	X	X	[	X	X	O	X	X	O
c	O	O	X	X	X	X	\	O	O	X	X	X	O
d	X	O	X	X	X	X	]	X	O	X	X	X	O
e	O	X	X	X	X	X	↑	O	X	X	X	X	O
f	X	X	X	X	X	X	←	X	X	X	X	X	O

Note 1: X Designates the operate (on pulse condition).

Note 2: O Designates the nonoperate (off pulse condition).

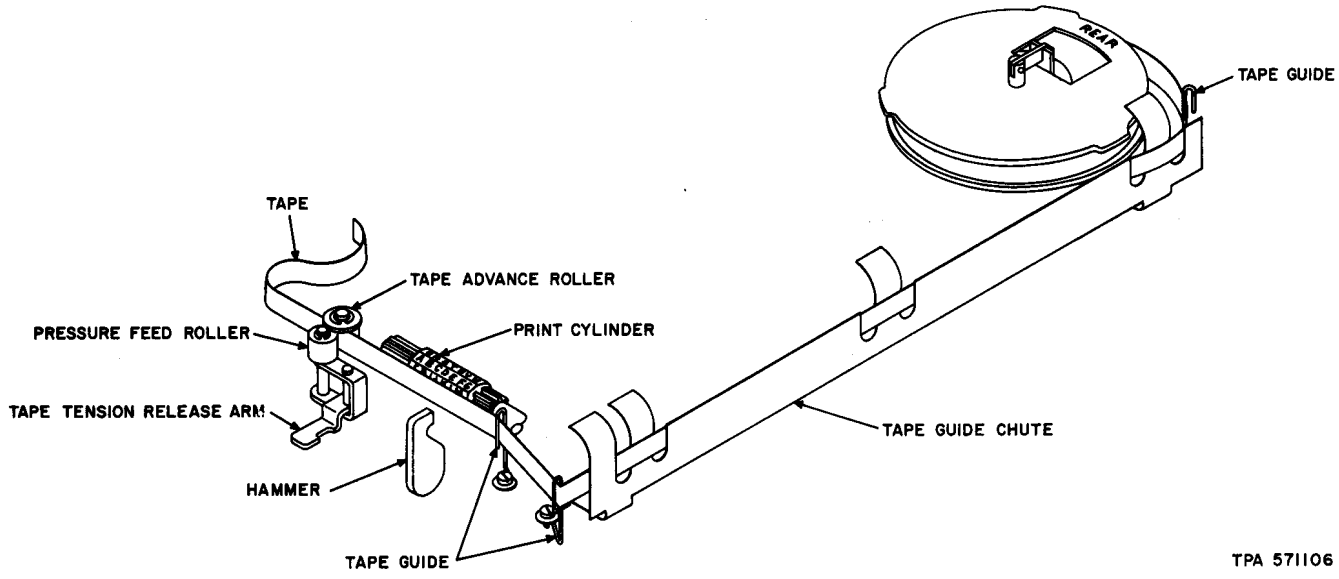


Fig. 3—Method of Threading Tape

TABLE C
TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Unevenly printed or incompletely formed character	Dirt on hammer face	Clean hammer face.
	Worn or broken type segment	Replace type segment.
	Insufficient hammer solenoid pull	Check solenoid plunger for possible dirt or metallic particles. Clean or replace plunger.
	Worn hammer operating linkage	Check linkage and replace worn parts.
	Lateral or rotary cable out of adjustment	Readjust rotary and lateral cables.
	Missing air gap washer in lateral or rotary solenoid	Remove solenoid plunger and check for presence of beryllium copper washer. Replace solenoid if washer is missing
	Rotary plunger stroke adjustment incorrect	Readjust rotary cable.
	Lateral or rotary spring tension too weak	Adjust tension or replace spring. Also check plunger stroke adjustment.
	Lateral plunger stroke adjustment incorrect	Readjust lateral cable, also check the hammer solenoid and tape advancement adjustment.

TABLE C

TROUBLESHOOTING CHART (Cont)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
Characters spaced unevenly	Hammer solenoid plunger stroke or lateral plunger stroke incorrect	Readjust plunger stroke and check the hammer solenoid and tape advancement adjustment.
	Lateral movement of print cylinder sluggish	Clean print shaft. Do ***not*** lubricate.
	Incorrect lateral solenoid adjustment	Readjust.
Garbled Message	One or more solenoids not operating properly	Refer to paragraph on inoperative solenoids.
	Shorted diodes	Refer to paragraph on inoperative solenoids.
	Shorted wiring	Refer to paragraph on inoperative solenoids.
Rotary and lateral solenoids operate, but no characters are printed	Hammer not operating	Check for current to hammer solenoid. Check for break in solenoid winding. Replace solenoid if no continuity. Check and repair hammer solenoid linkage or check print command signal.
	Shorted diode	Refer to paragraph on locating inoperative solenoids.
Tape fails to advance or does not advance smoothly	Pressure roller spring defective	Replace spring.
	Defective detent spring	Readjust or replace spring.
	Faulty advance roller and ratchet assembly	Check advance roller and replace, if defective.
	Faulty advance pawl spring or hammer return spring	Check and replace springs. (Adjust tension on hammer return spring, if necessary.)
	Incorrect hammer solenoid location or travel	Relocate or readjust hammer solenoid.

(2) Use a multimeter to check for an open coil and an open or shorted transient suppression diode (see 5.04 and 5.05). Using the resistance values given in Table D or E, refer to the schematic and wiring diagrams in Fig. 4 and 5 when making checks.

Shorted Diodes

5.04 A shorted didode can cause a failure in the operation of its associated solenoid. To determine if one or more diodes are shorted:

(1) Disconnect the tape printer from the circuit.

(2) Using the ohms scale X1 of the multimeter, connect the (+) lead from the meter to terminal 9 of the diode board and the (−) lead to terminal 12. The meter should indicate an

TABLE D

TERMINAL IDENTIFICATION FOR 16 CHARACTER PRINTER

TERMINAL	ASSIGNMENT	SOLENOID NO.	INPUT* CURRENT IN MA	RESISTANCE OHMS**
1	No. 1 Code Bit Level	1	155	310
2	No. 2 Code Bit Level	2	240	200
3	No. 3 Code Bit Level	3	229	210
4	No. 4 Code Bit Level	4	155	310
5	Spare	—	—	—
6	Spare	—	—	—
7	Print Command	Print Command	667	72
8	Spare	—	—	—
9	Solenoid Common	—	—	—
10	Reserved for Low Tape Lead	—	—	—
11	Reserved for Low Tape Lead	—	—	—
12	Diode Common	—	—	—
13	Reserved for Copy Light Lead	—	—	—
14	Spare	—	—	—
15	Spare	—	—	—
16	Spare	—	—	—
17	Spare	—	—	—
18	Chassis Ground	—	—	—

* Nominal values when operating from a 48-volt dc input.

** Nominal values specified between the designated terminal and terminal 9 at 25°C (±5) and ±5 percent of total resistance.

Note: To check solenoids, place one lead of ohmmeter on terminal 9 and other lead on terminals 1, 2, 3, 4, and 7, successively. Meter should indicate resistance as noted above.

TABLE E

TERMINAL IDENTIFICATION FOR 64 CHARACTER PRINTER

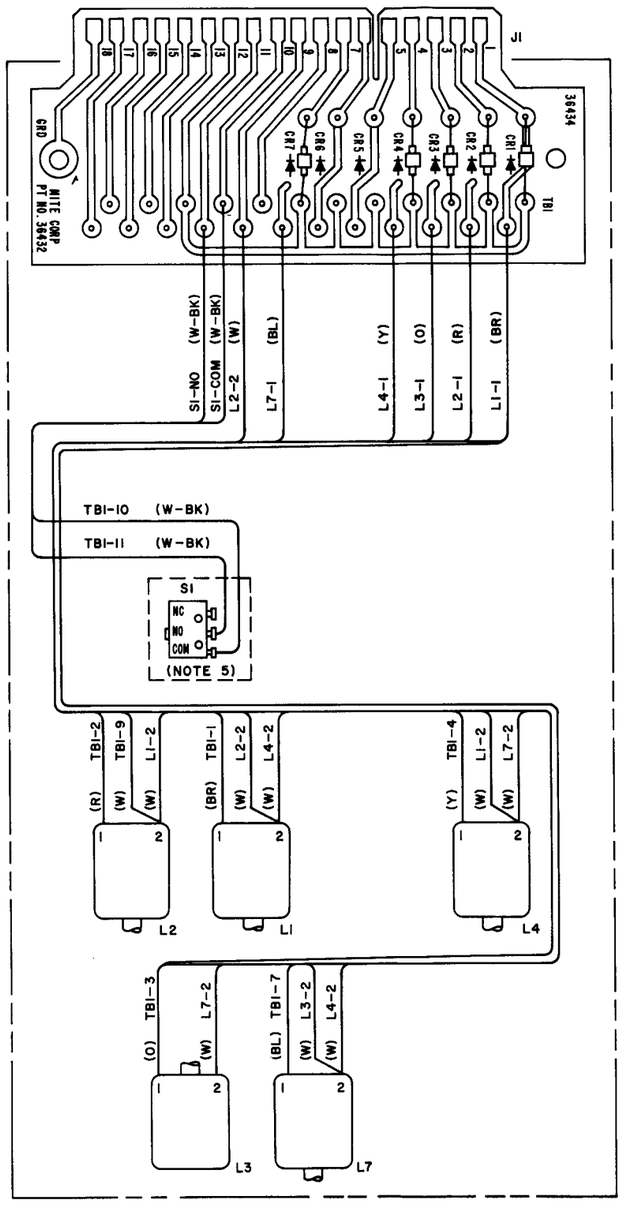
TERMINAL	ASSIGNMENT	SOLENOID NO.	INPUT* CURRENT IN MA		RESISTANCE OHMS**	
			LIST 3	LIST 6	LIST 3	LIST 6
1	No. 1 Code Bit Level	1	235	302	200	159
2	No. 2 Code Bit Level	2	152	155	310	310
3	No. 3 Code Bit Level	3	224	276	210	174
4	No. 4 Code Bit Level	4	235	302	200	159
5	No. 5 Code Bit Level	5	152	155	310	310
6	No. 6 Code Bit Level	6	224	276	210	174
7	Print Command	Print Command	653	667	72	72
8	Spare	—	—	—	—	—
9	Solenoid Common	—	—	—	—	—
10	Low Tape Lead	—	—	—	—	—
11	Low Tape Lead	—	—	—	—	—
12	Diode Common	—	—	—	—	—
13	Spare	—	—	—	—	—
14	Spare	—	—	—	—	—
15	Spare	—	—	—	—	—
16	Spare	—	—	—	—	—
17	Spare	—	—	—	—	—
18	Chassis Ground	—	—	—	—	—

* Nominal values when operating from a 48-volt dc input.

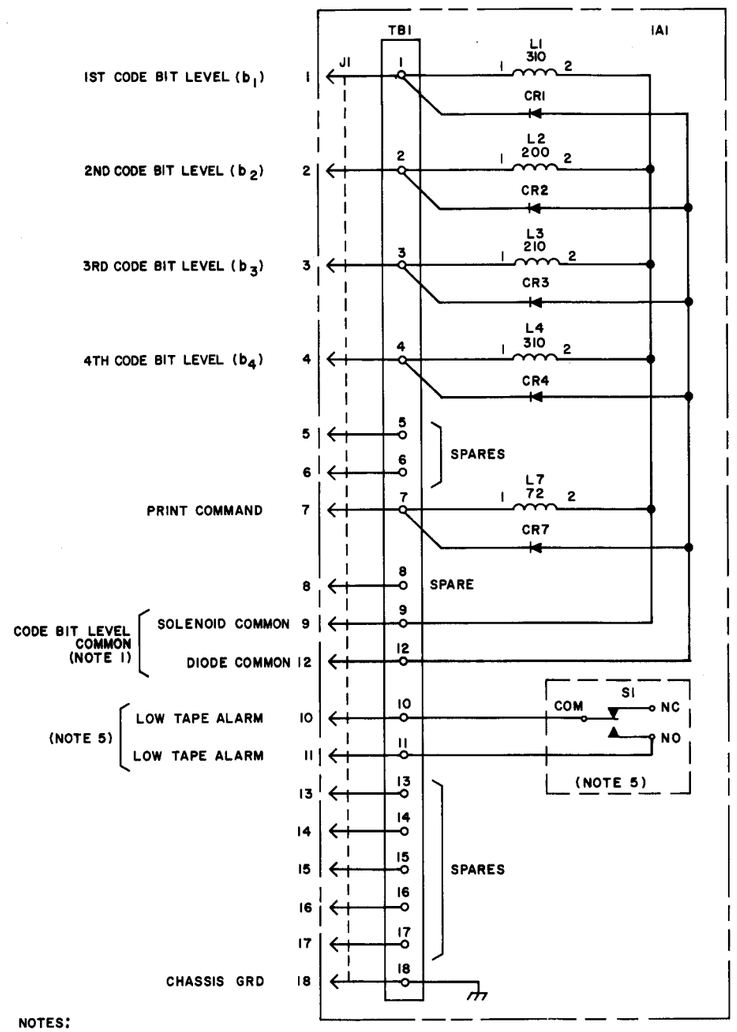
** Nominal values specified between the designated terminal and terminal 9 at 25°C (±5) and ±5 percent of total resistance.

Note: To check solenoids, place one lead of ohmmeter on terminal 9 and other lead on terminals 1 through 7 successively. Meter should indicate resistance as noted above.

WIRING DIAGRAM
(NOTE 3)



SCHEMATIC DIAGRAM

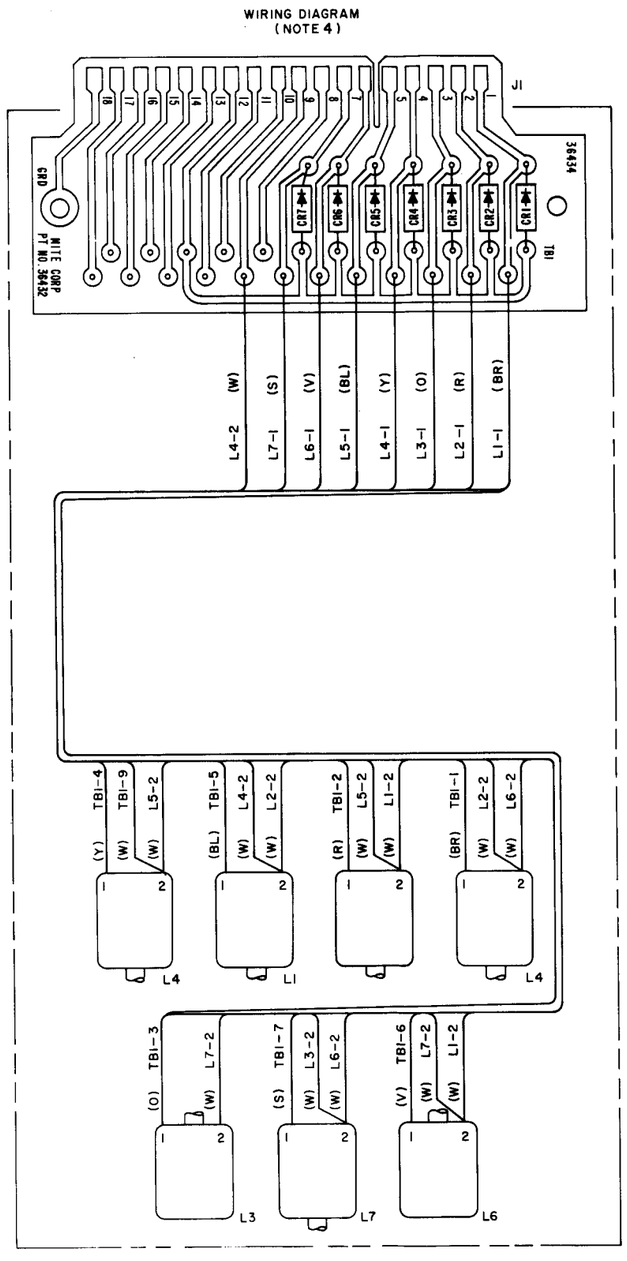


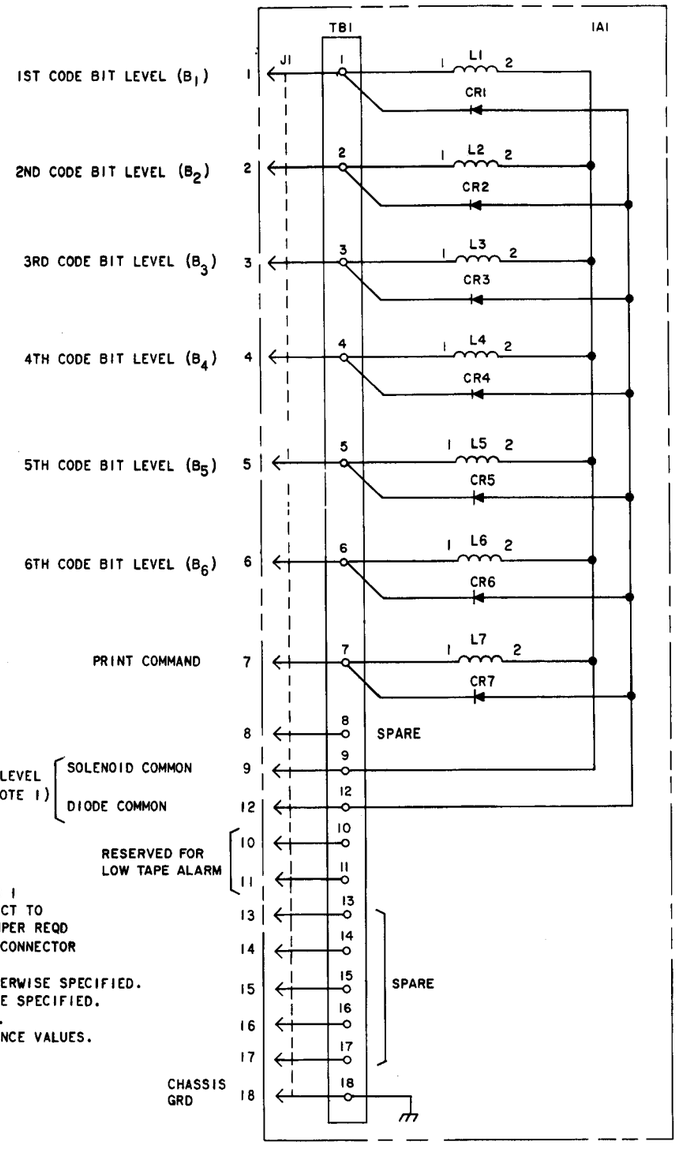
NOTES:

1. INPUT PWR: VOLTAGE LEVELS ON PINS 1,2,3,4 AND 7 ARE +48V DC WITH RESPECT TO THE CODE BIT COMMON. EXTERNAL JUMPER REQD BETWEEN PINS 9 AND 12 ON MATING CONNECTOR TO ESTABLISH DATA LINE COMMON.
2. DIODES ARE TYPE UT251 UNLESS OTHERWISE SPECIFIED.
3. ALL WIRES AWG 22 UNLESS OTHERWISE SPECIFIED.
4. SOLENOIDS ARE RATED IN OHMS ±5%.
5. SI AND ASSOCIATED WIRES ARE PART OF THE LOW TAPE ALARM WHEN THE LOW TAPE ALARM IS PROVIDED.

TPA 484183

Fig. 4—Schematic and Wiring Diagrams—16 Character Tape Printer





NOTES:
1. INPUT PWR:VOLTAGE LEVELS ON PINS 1 THROUGH 7 ARE +48V DC WITH RESPECT TO THE CODE BIT COMMON.EXTERNAL JUMPER REQD BETWEEN PINS 9 AND 12 ON MATING CONNECTOR TO ESTABLISH DATA LINE COMMON.
2. DIODES ARE TYPE UT251 UNLESS OTHERWISE SPECIFIED.
3. ALL WIRES AWG 22 UNLESS OTHERWISE SPECIFIED.
4. SOLENOIDS ARE RATED IN OHMS ±5%.
5. SEE TABLE E FOR SOLENOID RESISTANCE VALUES.

TPA 564559

Fig. 5—Schematic and Wiring Diagrams—64 Character Tape Printer

open circuit if none of the diodes are shorted. If the meter does not indicate open circuit, either the leads are reversed or one or more of the diodes are shorted. If one or more diodes are shorted, the meter will indicate 310 ohms or less depending on which diode is shorted and whether or not more than one is shorted.

(3) To locate a shorted diode, connect the (−) lead from the meter to terminal 12 and connect the (+) lead from the meter to the diode board terminals 1, 2, 3, 4, and 7, successively, until the defective diode is located, at which time the meter will indicate a short circuit. Check terminals 5 and 6 also for the L3, L6, and L7 printer.

Open Diodes

5.05 An open diode can cause faulty operation of its associated solenoid. To locate an open diode:

(1) Disconnect the tape printer from the circuit.

(2) Place a temporary jumper between terminals 9 and 12.

(3) Using the ohm scale X1 of the multimeter, connect the lead from meter terminal (−) to diode board terminal 9 or 12 and connect the lead from meter terminal (+) to diode board terminal 1. Note the resistance indicated by the meter. Reverse the meter leads and again note the resistance indicated by the meter. If the resistance is much less than the first indication, the diode connected to terminal 1 is not open. If the resistance is the same as the first indication, the diode is open. Repeat this test for diodes connected to terminals 2, 3, 4, and 7. Check terminals 5 and 6 also for the L3, L6, and L7 printer.

Checking Input Signal

5.06 If checks with the multimeter do not reveal the cause of the trouble, use an oscilloscope to check the input signal. A normal signal waveform is illustrated in Fig. 6.

Caution: Before connecting the oscilloscope to the tape printer, use a voltmeter to determine if there is a potential between terminals 9 or 12 and ground (diode board terminal 18). If there is potential, connect scope ground lead to the circuit ground instead of pins 9 and 12 on the printer.

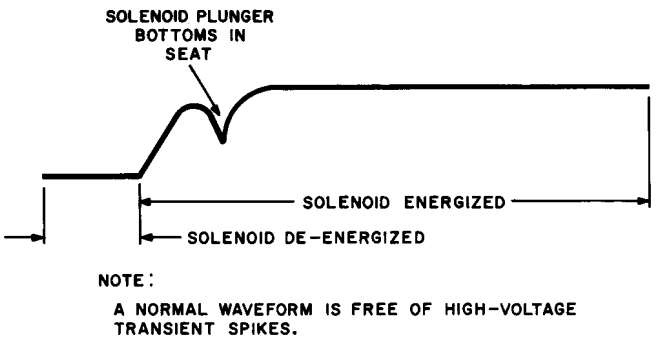
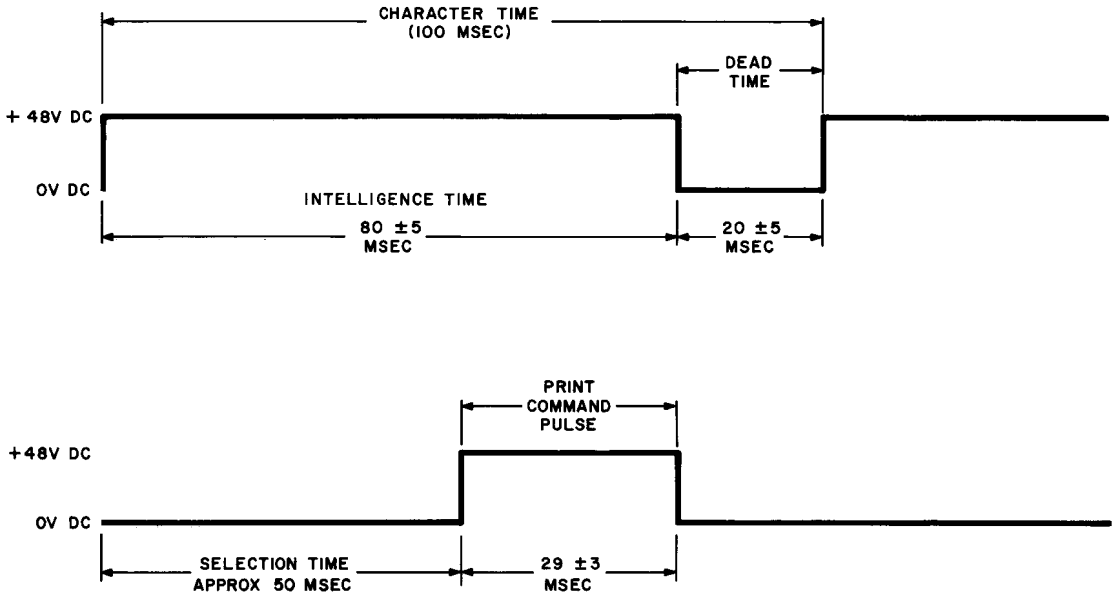


Fig. 6—Normal Signal Waveform

Connect the ground lead of the oscilloscope to circuit ground or diode board terminal 9 or 12 and connect the probe to terminals 1, 2, 3, 4, and 7 successively. Check terminals 5 and 6 also for the L3 and L6 printer. With the scope in the D.C. MODE and the probed solenoid deenergized, a zero voltage should be indicated on the scope. With a solenoid energized, 48 volts should be read.

5.07 In addition to the check in 5.06, check the print command pulse to determine that the select time relative to the beginning of an information pulse and the duration time of the pulse in milliseconds is in accordance with the pulse timing diagrams (Fig. 7 and 8). To check the print command pulse, use a dual trace scope with one channel probe attached to the information pulse being triggered and the other probe on the print command pulse. Adjust the scope to trigger on the front (or beginning) of the information pulse. Information pulse timing may be observed simply by moving the probe from the print command pulse to the information pulse lead that has the external trigger attached to it. In order to correctly observe the scope traces, it will be necessary to drive the 16 character printer with alternate combinations of the (and ▭ characters. It will be necessary to drive the 64 character printer with alternate combinations of the f and @ characters.

Note: In the event that a dual scope is unavailable, a single trace scope may be used with good approximate results (±5 milliseconds depending on the scope used). The procedure is to probe the print command pulse and synchronize the scope to the start of the information pulse. This is implemented by connecting the scopes external trigger input to the information pulse terminal. Depending upon the polarities used in the printers drive circuit, pulses may appear inverted. A polarity check should be performed on the scope to determine the off and on scope trace levels.

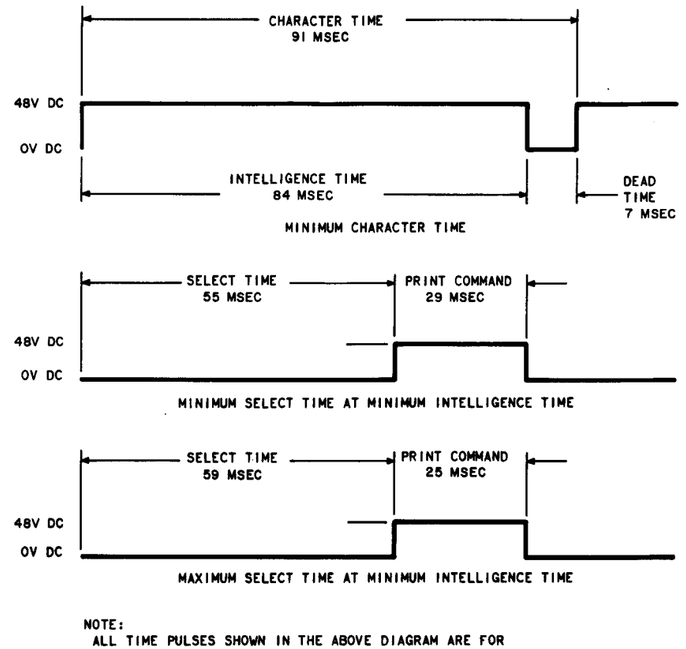


NOTE:

THIS TIMING DIAGRAM IS BASED ON THE RATE OF 100 WORDS PER MINUTE. ALL INTELLIGENCE PULSES AND THE PRINT COMMAND PULSES MUST BE SIMULTANEOUSLY SWITCHED TO THEIR OFF CONDITION DURING THE RECYCLING OR DEAD TIME PERIOD. THE SELECTION TIME SHOWN IS SECONDARY TO THE "DEAD TIME" AND "PRINT COMMAND" PULSE LENGTHS INDICATED ABOVE. UNDER CONDITIONS WHERE THE DEAD TIME IS 25 MILLISECONDS AND THE INTELLIGENCE PULSE 75 MILLISECONDS LONG, THE SELECTION TIME COULD BE A MINIMUM OF 43 MILLISECONDS. OTHER EXTREMES COULD RESULT IN A MAXIMUM SELECTION TIME OF 59 MILLISECONDS.

TPA 484179

Fig. 7—Pulse Timing Diagrams—16 Character Printer



NOTE:
ALL TIME PULSES SHOWN IN THE ABOVE DIAGRAM ARE FOR KS-19717 L6 PRINTER. TIME PULSES FOR THE L3 PRINTER ARE AS FOLLOWS:
CHARACTER TIME - 95 MILLISECONDS ± 4
INTELLIGENCE TIME - 86 MILLISECONDS ± 2
DEAD TIME - 7 MILLISECONDS ± 2
SELECTION TIME - 57 MILLISECONDS ± 2
PRINT COMMAND - 29 MILLISECONDS ± 4

TPA 564560

Fig. 8—Pulse Timing Diagram—64 Character Printer