



TECHNICAL MANUAL  
TAPE READER/PERFORATOR SYSTEM

MODELS: RAR612XBA  
RAB612XBA  
RAF612XBA



**Ex-Cell-O Corporation**

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EX-CELL-O CORPORATION

**REMEX**

1733 Alton St. • P.O. Box 11926 • Santa Ana, CA 92711

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## SECTION I

### GENERAL DESCRIPTION

#### 1.1 EQUIPMENT DESCRIPTION

This manual has been prepared to assist the user in operating, installing and maintaining the following REMEX reader/perforators: RAB612X (Figure 1-1), RAR612X (Figure 1-2), and RAF6120 (Figure 1-3). All units punch tape at 120 characters/second and read tape at up to 300 characters/second. A complete description of the model number is given in Section 1.6 and the specifications are listed in Table 1-2. Material covered in this manual is applicable to all models except as specifically noted. The operation and maintenance of the punch mechanism itself is described in a separate manual.

Incorporating its highly successful tape punch, Model RPM612X, these reader/perforator combinations provide a selection for most applications where punched tape is used. Tape is supplied from a standard 1000 foot roll (RAB612X and RAR612X) or a box of 1000 feet of fanfolded tape (RAF612X) mounted on a deck assembly above the chassis and threaded through the perforator. Punching is controlled by means of input signals which are processed and used to operate the punch at speeds up to 120 characters/second. The roll type punched tape is fed through an opening in the front panel where it is available for customer take-up. Fanfolded tape, after it is punched, is folded into a bin on the front panel.

The function of the reader is to convert the information stored in the form of punched holes into electronic signals. A plug-in circuit board provides the logic control for tape movement in either direction from external signals or the front panel switches. The outputs from the card control a step motor which drives the tape via a sprocket wheel. Data outputs are generated from the readhead which contains the photocells. As tape passes over the photocells, changes in light intensity are sensed by the photocells, amplified, and brought out to an external connector. Operation of the reader is independent of the punch so that they can both be operated at the same time if required.

Several options are available as listed in Table 1-2 including 6 or 8 track punch mechanism and selectable AC power input.

#### 1.2 EQUIPMENT SUPPLIED

Various items have been included with the tape reader/perforator system for spare parts, installation, and maintenance. These items are listed in Table 1-1.

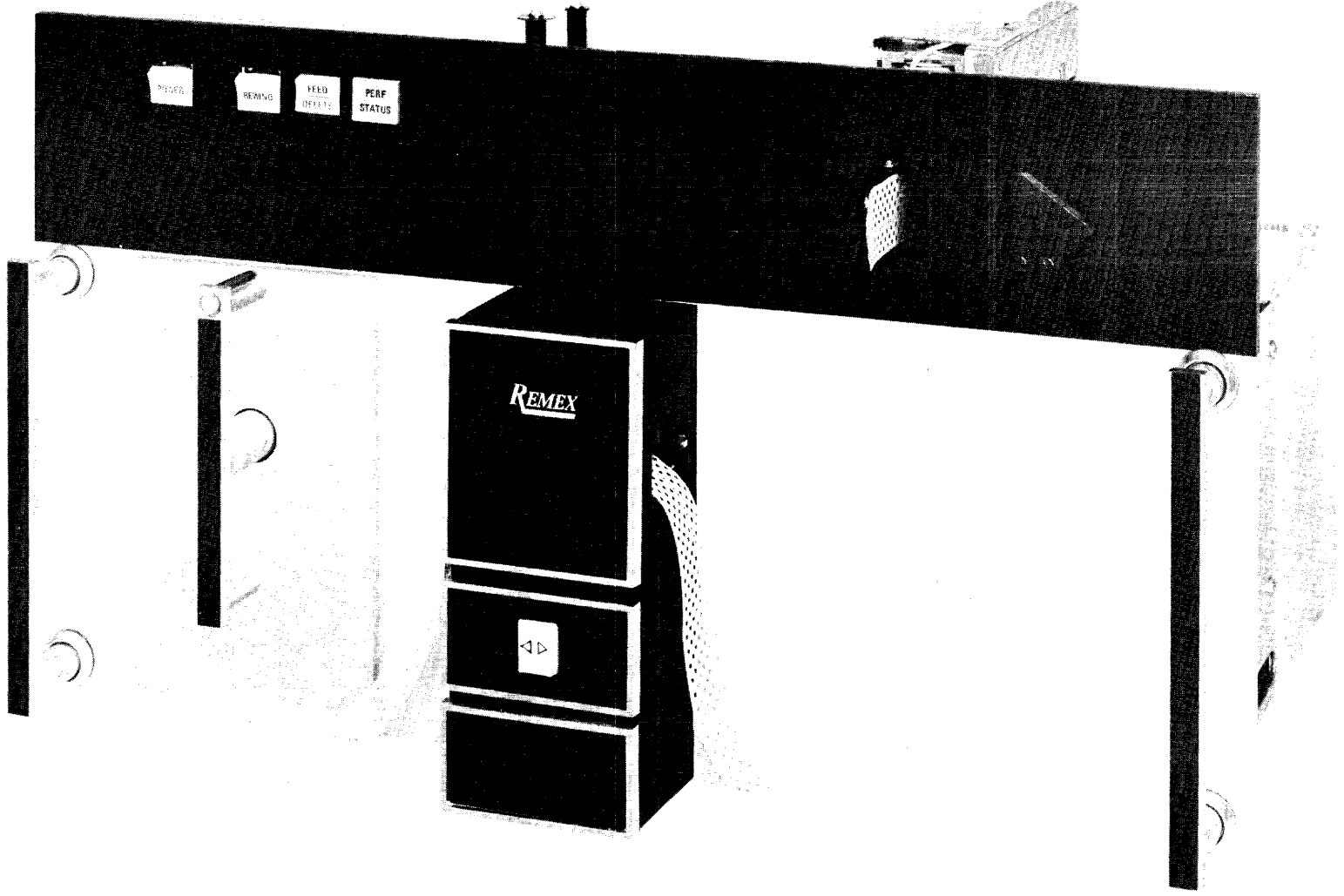


Figure 1-1. REMEX Punched Tape Reader/Perforator System, Model RAB612XBA Series.

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Figure 1-2. REMEX Punched Tape Reader/Perforator System, Model RAR612XBA Series.

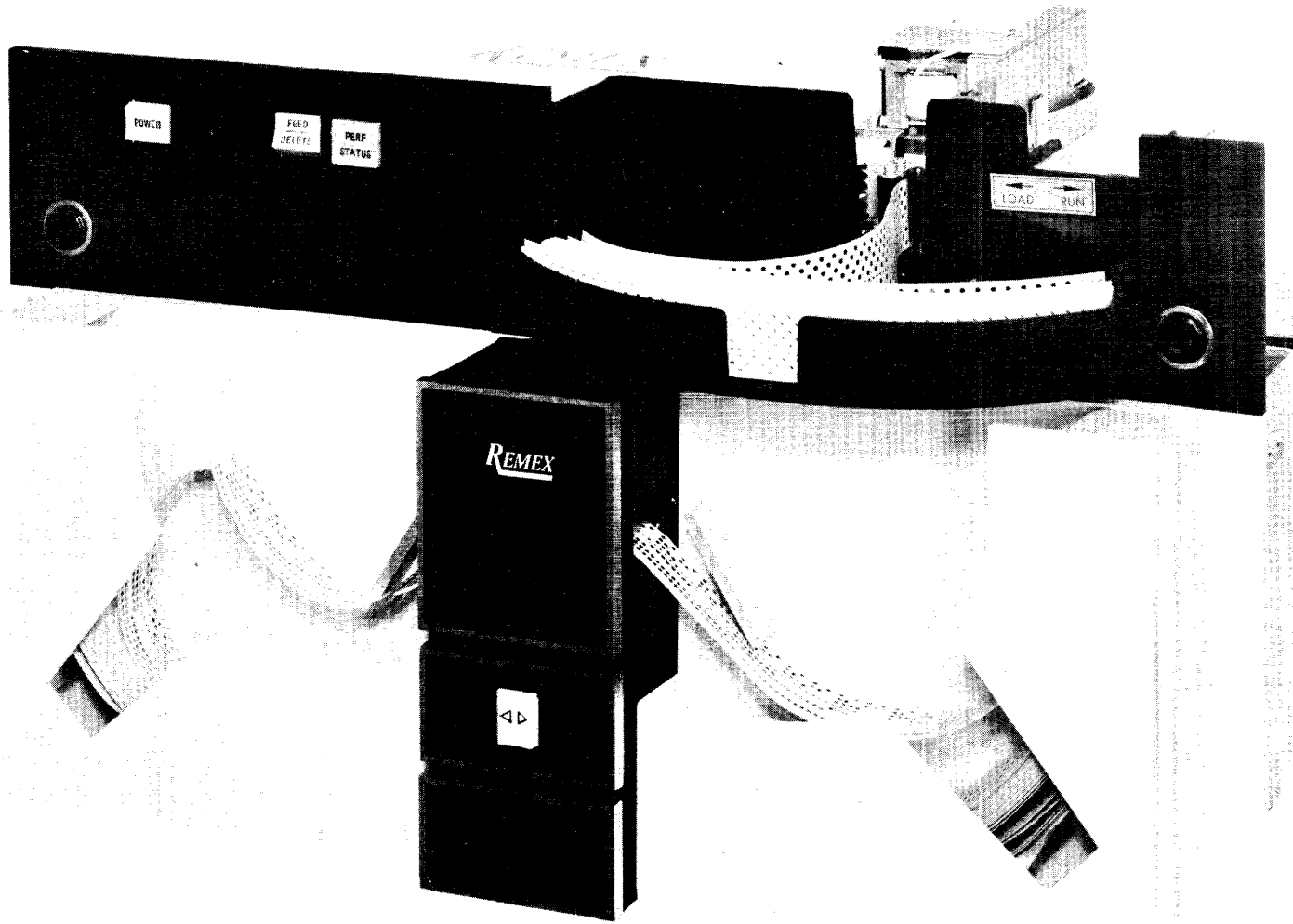


Figure 1-3. REMEX Punched Tape Reader/Perforator System, Model RAF612XBA.

Table 1-1. Equipment Supplied

Item	REMEX Part No.	RAR RAB	RAF
Brush, Right Angle	716003-104	1	1
Brush	716003-101	1	1
Connector, P1, Cannon DP-25P	706500-231	1	1
Cover, Connector	706540-144	2	2
Fuse, 4A, Slow Blow, F101 (100, 115 or 127 VAC Operation Only)	705710-128	1	1
Fuse, 2A, Slow Blow, F101 (220 to 240 VAC Operation Only)	705710-139	1	1
Fuse, 2A Perforator Driver Card, F1-F9	705725-110	3	3
Fuse, 1/4A, F1, F3, Power Supply Card	705725-102	1	1
Fuse, 4A, F2, Power Supply Card	705725-112	1	1
Fuse, 1A, F4, Power Supply Card	705725-108	1	1
Installation Drawing, Chassis Slide	112142	1	1
Instruction Drawing, Perforator Greasing Manual	112210 112670-052	1 1	1 1
Screw Lock Assembly, Set of 2 (P1)	706540-124	2	2
Tape, Roll	715200-002	1	-
Tube, Grease, 1 oz	716004-163	1	1
Tape, Fanfold	715200-001	-	1
Connector, P2, Cannon DB-25S	706510-211	1	1
Washer, #10 lock	713541-306	-	4
Screw, 10-32 x 3/4	709931-812	-	4
Striker Plate Assembly, Left	109925-1	-	1
Striker Plate Assembly, Right	109925-2	-	1
Syringe, 30 cc	716056-108	1	1

### 1.3 EQUIPMENT WARRANTY

A statement covering the warranty of this equipment is given on page iii (second page in book). It should be read and understood. All preventive maintenance procedures must be performed as outlined in Section 5.2 during the warranty period in order that the warranty remain in effect. Any questions arising concerning the warranty should be directed to the REMEX Service Department.

### 1.4 MAINTENANCE EQUIPMENT REQUIRED BUT NOT SUPPLIED

The maintenance procedures in Section 5 require equipment that is not supplied. This equipment is listed in Table 5-1.

### 1.5 SPECIFICATIONS

Listed in Table 1-2 are the characteristics and specifications of the REMEX tape reader/perforator combinations. Also see Section 1.6 for complete model number description and Figure 1-6 which indicates how the options are incorporated into the model structure. An X in a particular digit designator denotes any of the combinations given in Figure 1-6 (for that designator) can be used. Model designations using X's are frequently used throughout the manual, especially the parts list. Refer to Table 3-1 for signal descriptions.

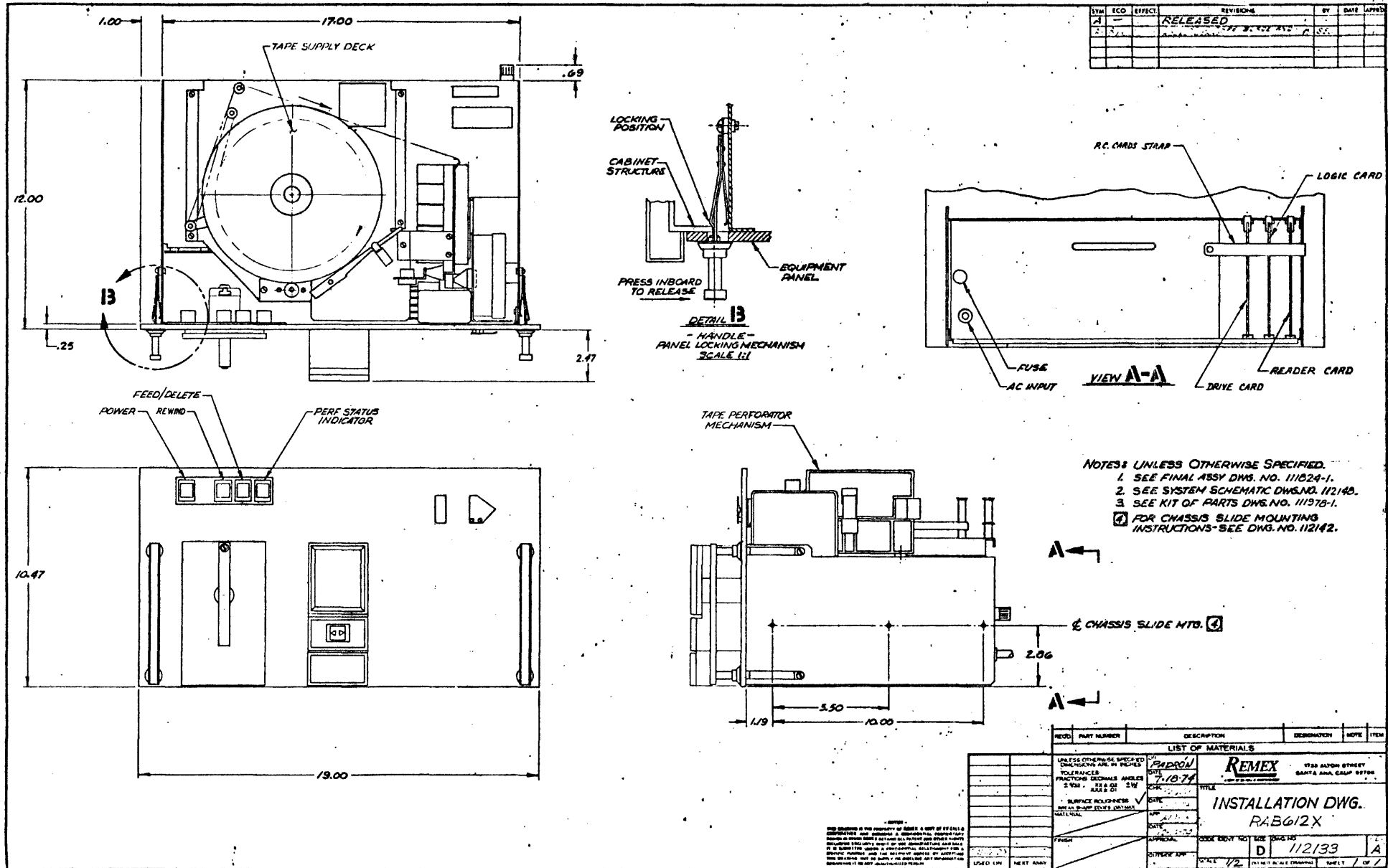


Figure 1-4. Installation Drawing, Models RAR612X and RAB612X.





## 1.6 MODEL NUMBER DESIGNATION

The REMEX model designation is used to code the basic functions, options, and configurations of a particular product line. Figure 1-6 illustrates the model code structure for the 612X series and indicates the various options. An X in a particular digit designator (as used in many parts of this manual, especially the parts list) denotes any of the combinations given in Figure 1-6 can be used.

Nonstandard (special) units use the last three numbers of the model number to denote a special unit. The difference between any special unit and the standard unit is described in an addendum at the end of the manual. Units with 000 and 901 and higher are standards and are covered in this manual without addendums.

Standard options not shown in Figure 1-6 are used in the 901 and higher numbers (standard units only) and are listed on the serial tag below the model number in the form of a series of three digit numbers depending upon the number of options used. For example, a unit with 902 in the last three digits of the model number would list two three digit numbers. Because the list of possible options is constantly changing, it is not included in the manual. Generally, this list consists of special customer requirements that do not affect the operation of the unit and includes such things as special paint, no logo, mill edge panel, etc. Table 1-3 lists those dash numbers which are applicable to all units.

Always consult the serial number tag for proper voltage and frequency to be used and for model identification. Failure to do so could result in damage to the unit. The serial tag is located on one of the rear surfaces. In all correspondence, always refer to the complete model number including the mode, the last three numbers, and the unit's serial number. Refer to the CAUTION in Section 2.4.

## 1.7 PHYSICAL DESCRIPTION

The REMEX tape reader/perforator combinations are mounted on a 10-inch panel with a height of 10 1/2 inches. Detailed dimensions are shown in Figures 1-4 and 1-5. The electronic chassis and supply deck is mounted at the rear of the unit and contains the circuit cards. The front panel contains the tape reading and transport mechanism and fanfold tanks (RAF models) which extend 2.48 inches out from the front panel. Chassis slides are also provided to give easy access to the supply deck and punch mechanism.

## 1.8 TAPE CHANNEL NUMBERING

REMEX tape reader/perforator combinations are available to punch tape of the configurations shown in Figure 1-7. The type of tape guide used in any given unit is coded in the seventh digit as part of the model number. See Figure 1-6. Note that regardless of the width of the tape or the number of tracks, the numbering of the track holes is always the same. Also see Section 1.9.

## 1.9 TAPE PREPARATION SPECIFICATIONS

Tape specifications as given in Figure 1-7, are based on the American National Standards Institute Standard X3.18-1967 (ANSI; formerly United States of America Standards Institute). A tape gauge is available from REMEX (part number 110597) so that longitudinal and perpendicular transverse spacings can be checked. To use the gauge, place the feed hole of one end of a 5-inch span in the arc until one of the cross hairs is centered in the feed hole. Read the measurement adjacent to that cross hair (plus tolerances to the right and minus tolerances to the left). A second 5-inch gauge is printed at the bottom to check longitudinal and perpendicular transverse center line spacing.

REMEX	Perforator/Reader (A)	BASIC MODEL (see Remarks)	MODEL SERIES	PUNCHING SPEED 12 IN/SEC	MECH-ANISM TYPE	BI-DIRECTIONAL	MODEL CHANGE (a)	NOT USED	Reader Input Mode	Reader Output Mode(c)	Other Circuit Options	Perf. Input Mode (b)	Perf. Out-put Mode (b)	Other Perf. Op-tions	INPUT VOLTAGE/FREQ.	SPECIAL NUMBER (d)	REMARKS
R	A	B	6	12	X	B	A	-	6	6	-	5	5	X	U	XXX	Perforator/Reader with roll supply spooling and rewinder.
R	A	R	6	12	X	B	A	-	6	6	-	5	5	X	U	XXX	Perforator/Reader with roll supply spooling only.
R	A	F	6	12	X	B	A	-	6	6	-	5	5	X	U	XXX	Perforator/Reader with fanfold supply and take-up tray.

1 = 8 Track Steel Block
2 = 8 Track Carbide Block
3 = 6 Track Steel Block with advanced feed hole
4 = 6 Track Carbide Block with advanced feed hole

5 = TTL Levels, 5V Active
6 = TTL Levels, 0V Active

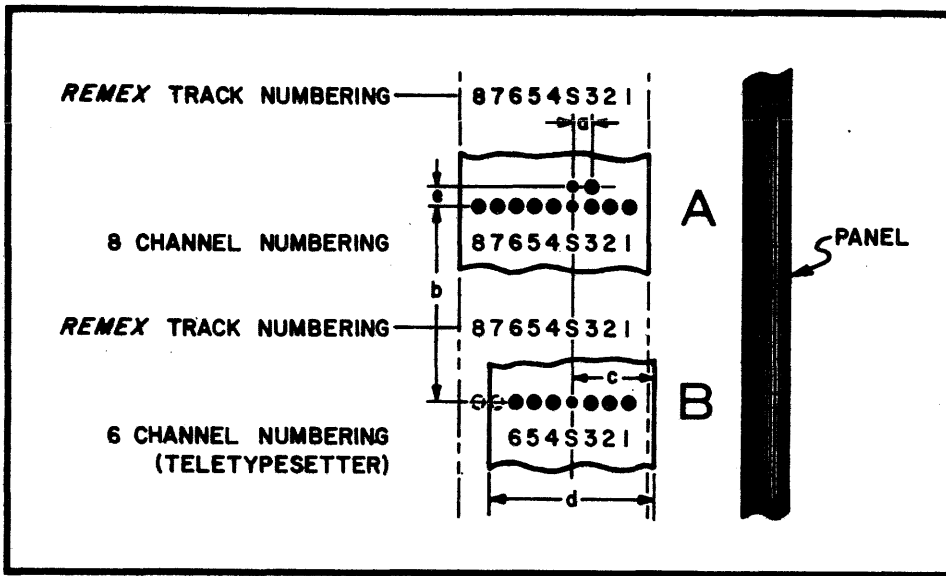
U = 100, 115, 127, 220 or 240 VAC, 47-63 Hz. Unit comes wired for 115 VAC, easy wire change for other voltages.

0	Tape Handling Error Inhibits Punch Ready Signal
1	Tape Handling Error Does Not Inhibit Punch Ready Signal

NOTES:

- (a) Letter changes with each model change, Current letter is A.
- (b) Unit is supplied with perforator mode 5 for input and output. Mode 6 is selected by grounding J1-14 for input and J1-15 for output.
- (c) Unit supplied with Reader mode 6 for output. Mode 5 output is selected by grounding J2-10.
- (d) These digits are assigned by REMEX. If the unit is standard, these are 000. 9XX is used to describe the total number (XX) of additional standard options. All other numbers are specials.

Figure 1-6. REMEX Model Number Code



MMC 371

Tape Configuration	c ±0.003	d ±0.003
A	0.392	1.000
B	0.434	0.875

In all configurations:

$$a = 0.100 \pm 0.002$$

b in any span of five inches is  $\pm 0.025$

$$e = 0.100 \pm .003$$

Data hole diameter is  $0.072 + 0.001/-0.002$

Sprocket hole diameter is  $0.046 + 0.002/-0.001$

NOTE: The 6 channel teletypesetter has the sprocket hole center line advanced by 0.013 inch with respect to the data track center line.

Figure 1-7. Tape Channel Numbering and Dimensions, Perforator and Reader.

## SECTION II

### INSTALLATION

#### 2.1 UNPACKING

Specially designed, reinforced packing cartons have been used in the shipment of the tape reader/perforator systems to provide the best possible protection during transit. Also packed with the unit in separate plastic bags and packages is the kit of parts listed in Table 1-1. A careful visual inspection of the unit should be made as soon as it is removed from the carton for any apparent damage incurred during shipping. In the event the unit has been damaged as a result of shipping, the carrier and REMEX should be notified as soon as possible. When carrying or removing the unit from the carton, it is important that it be lifted by the handles, front panel, or chassis. Never attempt to lift it by the covers, tape tanks, chassis slides or other parts which may not support the weight of the unit.

#### 2.2 SYSTEM MOUNTING

The unit contains chassis slides which mount to the cabinet wall. See Figure 1-4 or 1-5. Figure 2-3 illustrates the installation of the slides. The mounting dimensions of all slide options are the same. RAR and RAB units are secured to the cabinet by the front panel handles which are spring loaded. To release the unit, push the handles inward. RAF units use two mounting studs which snap into sockets of two release push buttons. The studs are part of two striker plates which are mounted on each side of the rack by two screws each. To release the sockets from the studs, depress the buttons. Figure 1-5 illustrates the mounting of the striker plates and chassis slide mounting hole pattern. Mounting should be in such a manner that adequate cooling is provided. The ambient temperature should not exceed the value listed in Table 1-2. It is recommended that two people be used when installing or removing the unit from the chassis slides.

#### **CAUTION**

When operating the unit, make sure it is elevated sufficiently such that the intake air flow through the fan at the bottom of the unit is not restricted. Damage to the punch will result if sufficient cooling by the fan is impeded.

#### 2.3 INITIAL ADJUSTMENTS

Each unit ~~has been~~ accurately adjusted and aligned before leaving the factory. No adjustments or calibrations are required prior to installation or use.

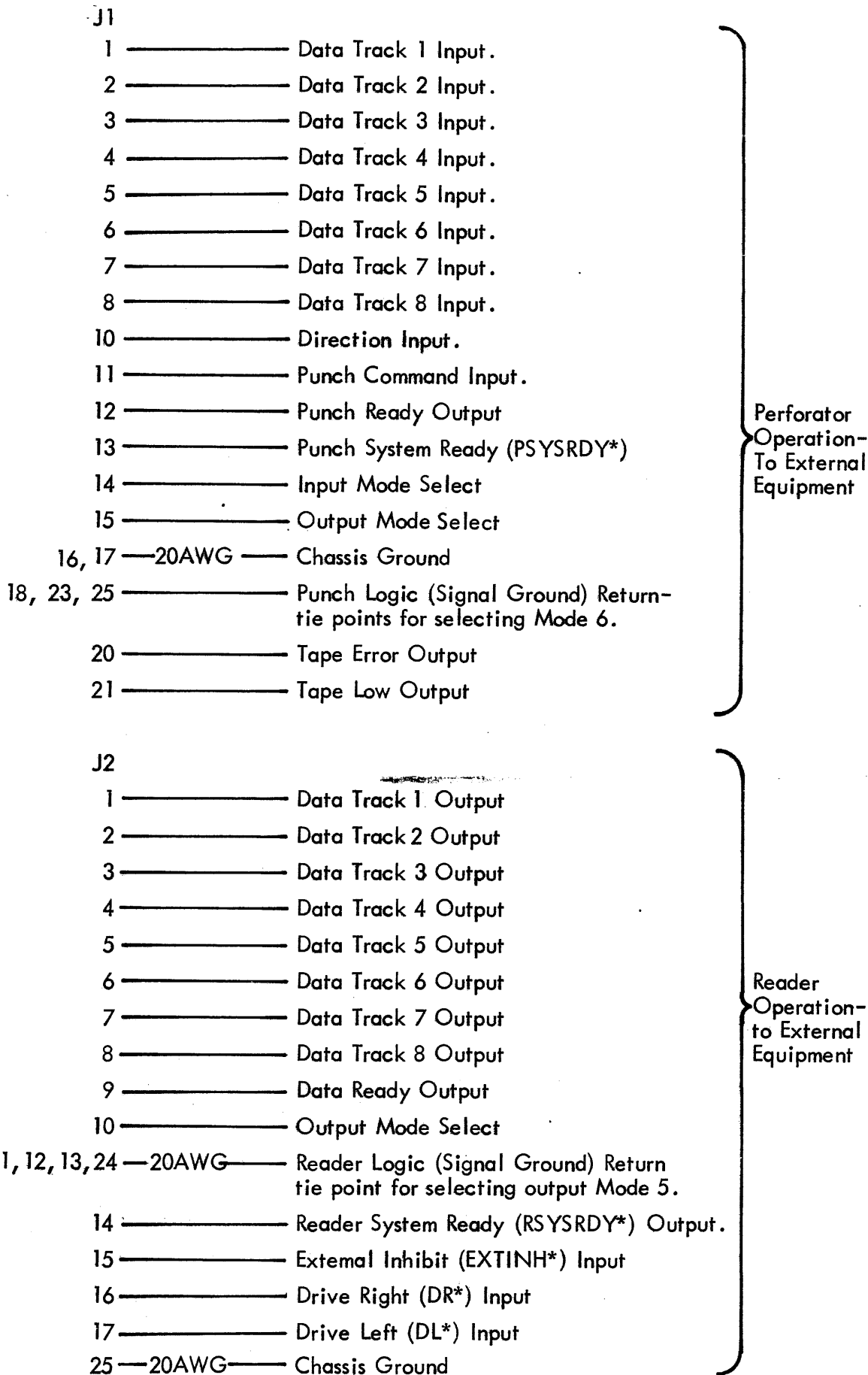


Figure 2-1. Reader/Perforator System Connections to External Equipment. See Table 3-1 for signal descriptions.

## 2.4 POWER AND SYSTEM CONNECTIONS

A.C. power is applied to the unit through a standard three-wire cord located at the rear of the unit.

### **CAUTION**

All units come wired for 115 VAC, 47-64 Hz operation. If another voltage is to be used, a wire change on the transformer must be made as described in Section 2.4.1. In addition, before operating the system, the proper fuse value (as indicated in Table 1-1) must be inserted from the kit of parts. Discard the other fuse (unless, of course, a different voltage operation is anticipated).

Refer to the serial tag for proper operating modes of the unit. See Section 1-6 and Figure 1-6 for an explanation of the model number and operating modes.

All control signals and output signals are routed through J1 for the perforator and J2 for the reader which are also located at the rear of the unit. Figure 2-1 lists the signals associated with each pin and their description is given in Table 3-1. All wire sizes are 22 AWG unless noted in Figure 2-1. The proper mating connectors for J1 and J2 have been supplied with the unit.

**NOTE:** It is recommended that the Punch Command Input line (J1-11) and Punch Logic Return (Signal Ground) line (J1-25) be a twisted pair to eliminate interference in high-noise environments.

### 2.4.1 TRANSFORMER WIRE CHANGES FOR DIFFERENT AC SUPPLY VOLTAGES

Units are supplied with a transformer which allows any of five input voltages to be used: 100, 115, 127, 220 or 240 VAC, 47-64 Hz. Unless otherwise directed by the customer, all units are wired for 115 VAC.

### **WARNING**

Disconnect the power plug before changing the transformer wire.

If it becomes necessary to use one of the other four voltages, a simple wire change is required. See schematic for power supply, Figure 8-8. To make this change it is necessary to separate the power supply assembly from the chassis. See Section 6.4. Power from the AC plug (hi-line) is routed through F101, to TB1-1, to P15-1 to S1 to P15-2 and back to TB1-5. Change the wire (white) coming from J15, pin 2 at TB1-5 (115 VAC) to TB1-4 for 100 VAC, to TB1-6 for 127 VAC, to TB1-7 for 220 VAC or to TB1-8 for 240 VAC. The white wire is the only one that requires changing. The black wire from fan M1 must remain tied to TB1-5. See Figure 5-1 for TB1 pin location.

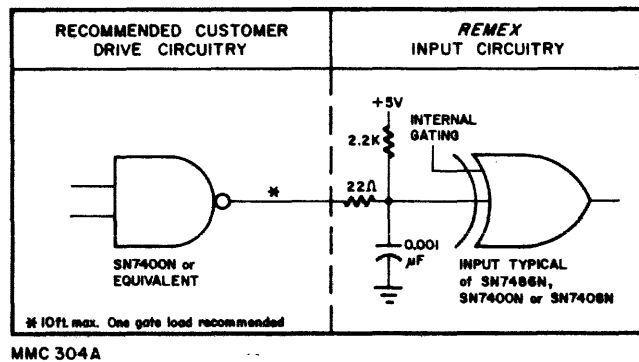
## 2.5 INTERFACE CIRCUITRY

Figure 2-2 illustrates suggested drive and output circuitry with which to interface with the REMEX circuitry as referenced in Table 3-1. Note the termination network for the output signals. This should be incorporated in the external equipment for maximum noise immunity. See Figures 3-4 and 3-5 for proper timing.

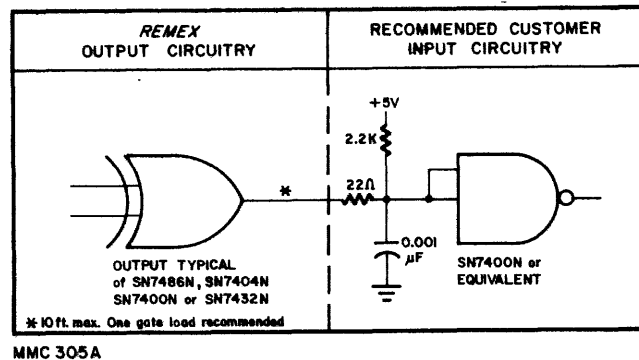
NOTES: All input and output logic signals are defined for positive logic (mode 5) i.e., inactive = 0V and active = +5 V. Therefore, signals that are 0V active (mode 6) are written with an asterisk next to the designation, e.g., Punch System Ready (PSYSRDY\*).

## 2.6 RAX6120 ADAPTER CABLE

Adapter cable 110364-1 is used when a RAX6120 has replaced a RDF/RDB/RAF/RAB 3075 a RAX6120, or is used with equipment designed for these models. By typing pin 10 to pin 11 on P2 (25 pin connector) the track outputs and the Reader Ready Output will be mode 5. Allowing pin 10 to float puts these outputs in mode 6.



CIRCUIT A

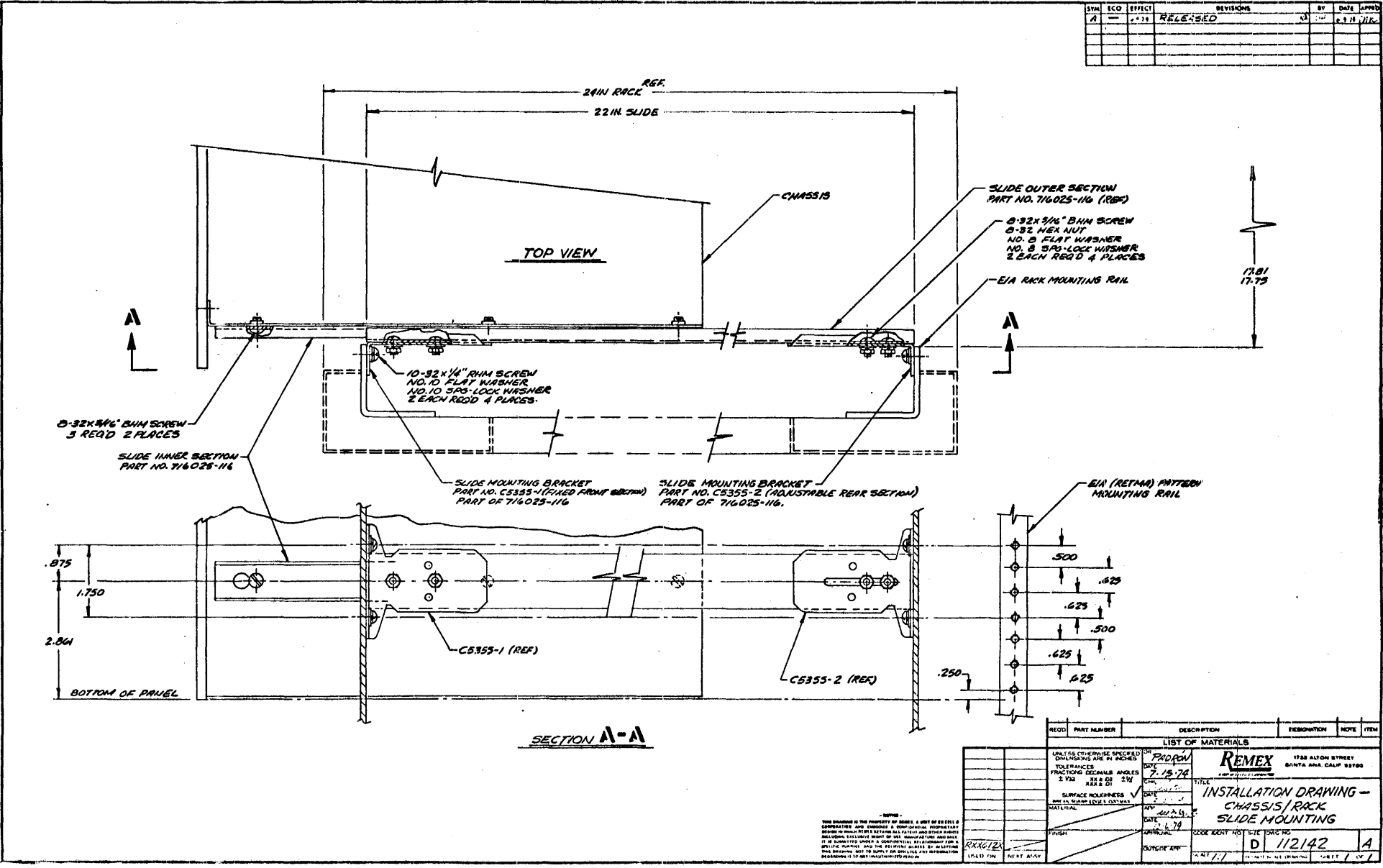


CIRCUIT B

Figure 2-2. Recommended Interface Circuitry



SYM	ECO	EFFECT	REVISIONS	BY	DATE	APPROV
A		2-72	RELEASED		2-11-72	



REQD	PART NUMBER	DESCRIPTION	QUANTITY	NOTE	ITEM
LIST OF MATERIALS					
		UNITS COVERED SPECIFIED			
		DIMENSIONS ARE IN INCHES			
		TOLERANCES			
		FRACTIONS DECIMAL ANGLES			
		2 1/2 3/4 1/2 3/8 1/4 3/16 1/8 1/16			
		SURFACE FINISHES			
		SEE DRAWING FOR DETAILS			
		MATERIAL			
		FINISH			
		APPROVAL			
		DATE			
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## SECTION III

### OPERATION

#### 3.1 INPUT-OUTPUT SIGNALS

Table 3-1 lists the input and output signals which are routed through J1 and J2. The definition and/or usage of these signals are also included in the table. Figure 3-4 shows the timing diagram for the perforator and Figure 3-5 shows the reader timing. Also see Note, Section 2.5.

#### 3.2 CONTROL FUNCTIONS

Table 3-2 lists the operating controls located on the front panel along with their descriptions and functions.

#### 3.3 OPERATING INSTRUCTIONS, PERFORATOR

The following procedures should be used when operating the perforator portion of the system. Refer to Figures 1-1 through 1-3 for location of switches. The reader and perforator portions operate independently, so either the reader or the perforator can be operated or both can be operated at the same time.

#### **CAUTION**

When operating the unit, make sure it is elevated sufficiently such that the intake air flow through the fan at the bottom of the unit is not restricted. Damage to the unit will result if sufficient cooling by the fan is impeded.

##### 3.3.1 TAPE LOADING AND THREADING, PERFORATOR

Tape is supplied from the tape deck located at the top of the unit and above the chassis and is threaded through the punch mechanism. The following procedure is recommended when loading tape:

- a. Place the POWER switch S1 in its ON position. Power is on when the POWER switch is lit.
- b. RAR and RAB Units: Place a spool of tape on the supply reel and thread it through the punch and out the opening in the front panel. Thread the tape so that the supply arm is in the approximate center of its travel. On some units the actuation of either the tape supply switch, S6, or the tape supply error switch, S7 will inhibit tape punching. The threading path is shown in Figure 3-1 and on a decal mounted adjacent to the punch.

RAF Units: Place a box of fanfolded tape on the supply deck and thread it through the punch and out the opening in the front panel. See Figure 3-2.

The threading of the tape through the punch is shown in Figure 3-3. To thread the punch, depress the punch LOAD button. This will rotate the pivot tape guide allowing access to the sprocket. Thread tape under the edge guide assembly through the punch block, over the sprocket and out through the opening in the panel. Close the pivot tape guide.

### CAUTION

When operating the unit, make sure it is elevated sufficiently such that the intake air flow through the fan at the bottom of the unit is not restricted. Damage to the unit will result if sufficient cooling by the fan is impeded.

- c. Place the FEED/DELETE switch in to the FEED position and verify that tape is advancing properly. The Punch Command line must be held in the false state while feeding with the FEED switch. On RAF units, approximately three folds of tape must be placed in the take-up tray so the tape will fold properly. Depress the FEED switch again and verify that tape is folding properly in the take-up tray.
- d. Empty the chad bin each time a new box or roll of tape is installed. This is important to prevent chad from backing up into the punch.
- e. The tape perforator portion may now be operated in one of the three modes described in Sections 3.3.2 through 3.3.4. It is recommended that the punching of fanfolded tapes be limited to 140 feet or less at one time since this is the maximum unattended storage capacity of the fanfold bin on the front panel.

### CAUTION

Whenever the punch is operated in mode 5 (especially when the punch is not connected to the normal system, i.e., bench operation), all false level inputs must be tied to OV (not open circuited). Since most inputs are internally biased to +5V, not tying them to the false (OV) condition in mode 5 could cause erratic operation. Mode 5 systems will not advance tape via the FEED/DELETE switch unless the Punch Command (J1-11) is held low. If the FEED/DELETE switch is activated while the Punch Command is at the true level, the logic will lock up and inhibit all punching. To reset this condition, turn power off and then back on.

- f. If this unit is equipped with a duplicator option, refer to Section 3.8 for operating instructions.

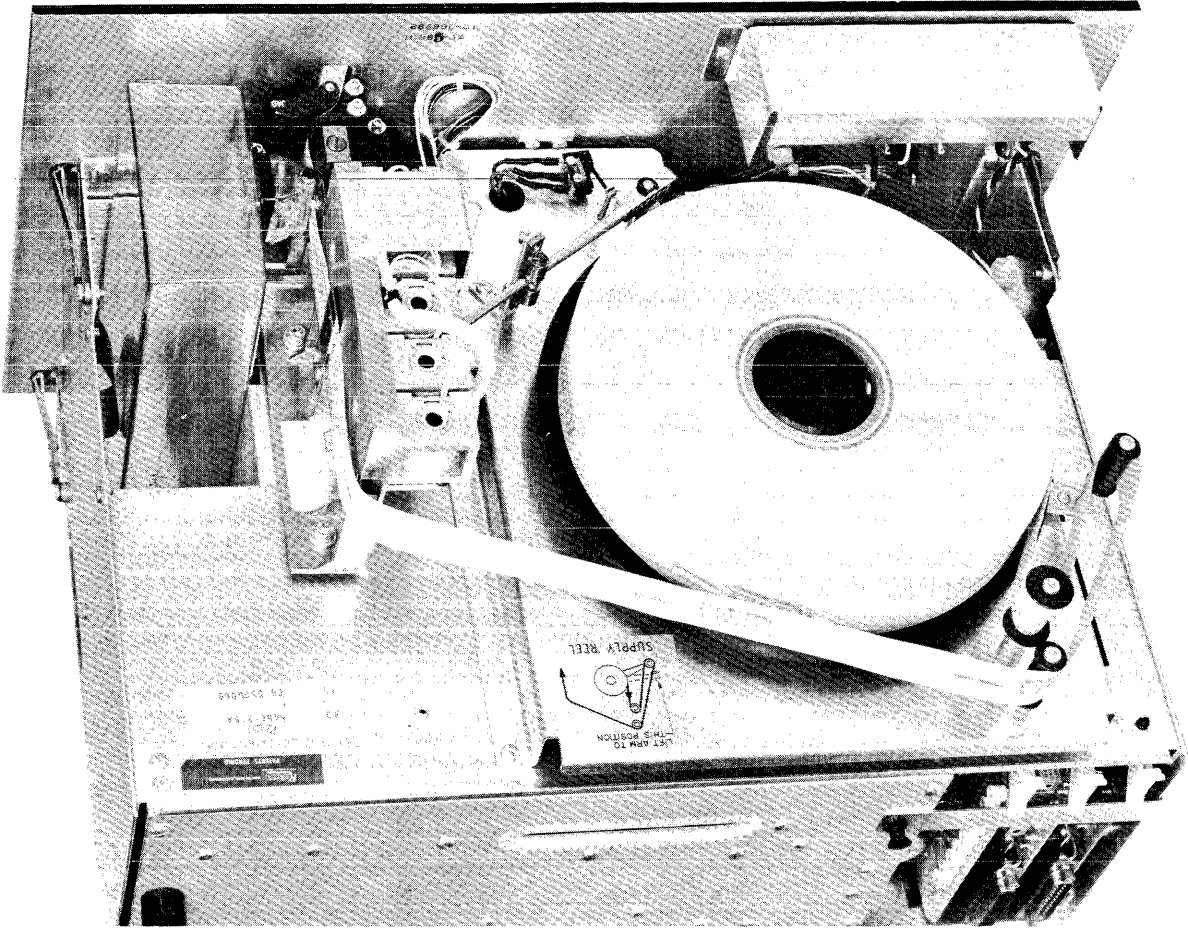


Figure 3-1. Tape Loading, Roll Type Tape

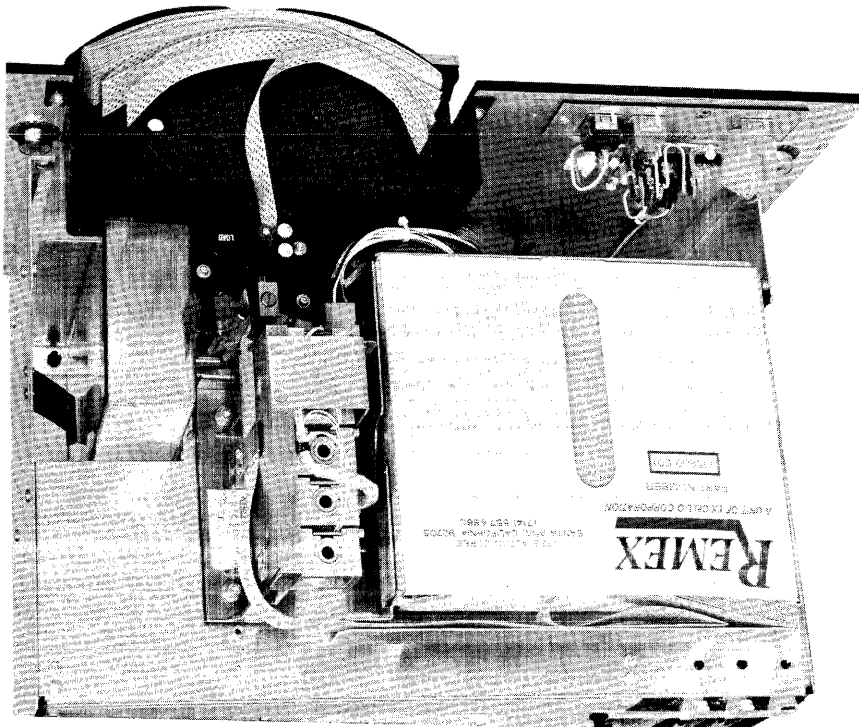


Figure 3-2. Tape Loading, Fanfolded Type Tape

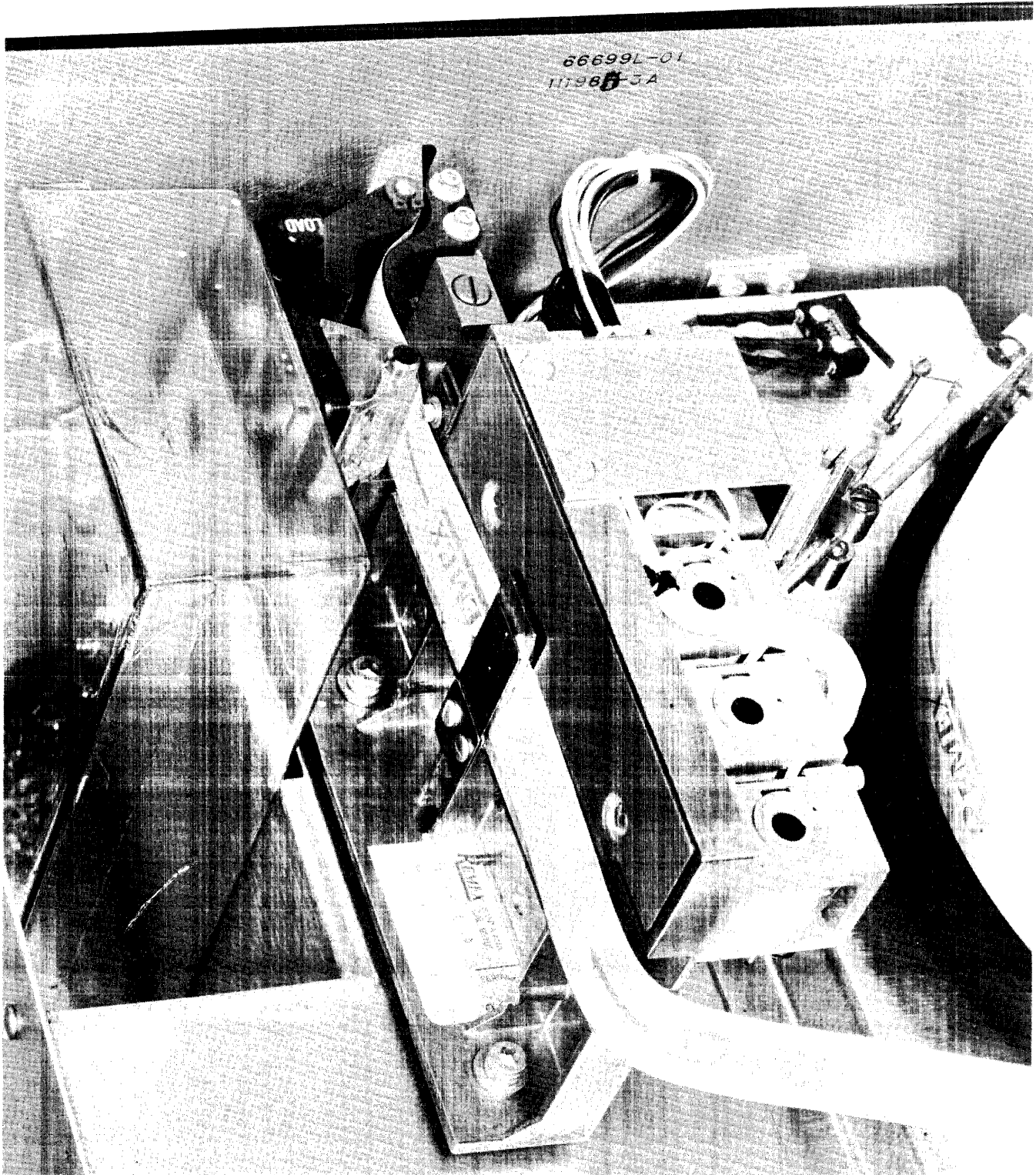


Figure 3-3. Tape Threading Through the Punch Mechanism.

Table 3-1. Interface Signal Descriptions

Connector Pin	Description	I. C. Type Interface See Figure 2-2.	Mode 5 Levels		Mode 6 Levels	
			Inactive Condition	Active Condition	Inactive Condition	Active Condition
PERFORATOR OPERATION						
J1-1 thru J1-8	Tracks 1-8 Data Input. Active condition causes a hole to be punched for that track when a true punch command is given. Data must be present at the time a punch command is initiated and must remain on the line for 2 $\mu$ sec. (min.) after the punch command input reaches the true level. Mode selected by J1-14.	A SN7486N	$0 < V < +0.4$ @4.2 mA max. (ext. sink) No Hole	+2.4 < V < +5 or open circ. Hole	+2.4 < V < +5 or open circ. No Hole	$0 < V < +0.4$ @4.2 mA max. (ext. sink) Hole
J1-10	Direction (DIR) Input. Active condition enables forward tape movement and inactive condition enables reverse tape movement as described in Operating Specifications, Modes of Operation, Table 1-2.	A SN7486N	$0 < V < +0.4$ @9.0 mA max. (ext. sink) Reverse Tape Movement	+2.4 < V < +5 or open circ. Forward Tape Movement	NOT SELECTABLE - OPERATES IN MODE 5 ONLY	
J1-11	①Punch Command (PC) Input. Active condition moves tape and initiates punching at up to 120 char/sec. as described in Operating Specifications, Modes of Operation, Table 1-2. This input line is disabled under the following conditions: 1) Punch Ready output is inactive or, 2) Tape Error output is active. Mode selected by J1-14.	A SN7486N	$0 < V < +0.4$ @4.2 mA max. (ext. sink) Tape Stopped	+2.4 < V < +5 or open circ. (transition) Tape Advances one row and punches.	+2.4 < V < +5 or open circ. Tape Stopped	$0 < V < +0.4$ @4.2 mA max. (transition; ext. sink). Tape advances one row and punches.
J1-12	Punch Ready (PRDY) Output. Active condition indicates unit is ready to accept a punch command. Output is inactive under the following conditions: 1) During advance and punch cycle (approx. 8.33 msec. following a punch command), or 2) Whenever Tape Error output (J1-20) is active. Inactive condition lags punch command by 1 $\mu$ s maximum. Mode selected by J1-15.	B SN7486N	$0 < V < +0.4$ @TTL fan-out of 10 Perforator Not Ready	+2.4 < V < +5 @TTL fan-out of 10 Perforator Ready	+2.4 < V < +5 @TTL fan-out of 10 Perforator Not Ready	$0 < V < +0.4$ @TTL fan-out of 10 Perforator Ready
J1-13	System Ready Output (SYSRDY*). Active condition indicates internal voltages have stabilized after power turn on. Inactive condition indicates power is off or internal voltages have not stabilized.	B SN7404N	NOT SELECTABLE - OPERATES IN MODE 6 ONLY		+2.4 < V < +5 or open circ. TTL fan-out of 9. Perf System Not Ready	$0 < V < +0.4$ @TTL fan-out of 10. Perf. System Ready
J1-14	Punch Input Mode Select (IMS). Selects Mode 5 or Mode 6 on both Punch Command and Punch Data Input lines.	A SN7486N	+2.4 < V < +5.0 (or open circuit) Punch Command and Data Input lines operate in Mode 5.		$0 < V < +0.4$ @16 ma. max. Punch Command and Data Input lines operate in Mode 6.	
J1-15	Punch Output Mode Select (OMS) Selects Mode 5 or Mode 6 on both Punch Ready and Tape Error Output lines.	A SN7486N	+2.4 < V < +5.0 (or open circuit) Punch Ready and Tape Error output lines operate Mode 5.		$0 < V < +0.4$ @5.0 ma. max. Punch Ready and Tape Error output lines operate in Mode 6.	
J1-16, 17	Chassis Ground. Output connection to chassis (isolated from signal ground).					
J1-20	Tape Error (TE) Output. (RAR and RAB only). Active condition indicates tape from supply is loose, broken or tight. Mode selected by J1-15. In perforator system mode XX0 (see Figure 1-8) an active signal disables Punch Command input (J1-11); does not inhibit in mode XX1.	B SN7404N	$0 < V < +0.4$ @TTL fan-out of 9 No Tape Malfunction	+2.4 < V < +5 @TTL fan-out of 9 Tape Malfunction	+2.4 < V < +5 @TTL fan-out of 9 No Tape Malfunction	$0 < V < +0.4$ @TTL fan-out of 9 Tape Malfunction

① Punch Input line and Signal Ground line (J1-25) must be a twisted pair.

Table 3-1. Interface Signal Descriptions (Continued)


Connector Pin	Description	I. C. Type Interface See Figure 2-2	Mode 5 Levels		Mode 6 Levels	
			Inactive Condition	Active Condition	Inactive Condition	Active Condition
J1-21	Tape Low (TL) Output. Active condition indicates tape supply nearly exhausted. Inactive condition indicates supply is greater than preset low tape level. For informational purposes only; does not affect operation of the system.	B SN7432N	$0 < V < +0.4$ @TTL fan-out of 9 - Tape supply above preset level.	$+2.4 < V < +5$ @TTL fan-out of 9 - Tape Low	NOT SELECTABLE - OPERATES IN MODE 5 ONLY	
J1-18, 23, 25	Signal Ground, 0V signal ground reference for all inputs and outputs (isolated from chassis ground). Tied internally to J2-11, 12, 13, 24.					
AC Plug	AC Power Input. See Input Power Specifications, Table 1-2.					
READER OPERATION			Active Condition		Inactive Condition	
J2-1 thru J2-8	Data Track Outputs. Active signal indicates data track hole and inactive condition indicates no hole condition. Mode 5 or 6, selectable (see J2-10).	B SN7486N	Mode 5: $+2.4 < V < +5$ @0.2 mA source) Hole (or Data Ready)		Mode 5: $0 < V < +0.4$ @16 mA (sink) No Hole (or Data Not Ready)	
J2-9	Data Ready Output (DATRDY). Active signal indicates data track outputs are in "on character" condition. Signal active with leading edge of feed hole and remains active until next drive signal is accepted (minimum Data Ready time is 50 $\mu$ sec). Data Ready signal is forced inactive by a load condition, external inhibit signal or out-of-tape signal. Mode 5 or 6, selectable (see J2-10).	B SN7486N	Mode 6: $0 < V < +0.4$ @16 mA (sink) Hole (or Data Ready)		Mode 6: $+2.4 < V < +5$ @0.2 mA (source) No Hole (or Data Not Ready)	
J2-10	Reader Output Mode Select. Active drive signal places data outputs and data ready output in Mode 5. Inactive signal places data outputs and data ready output in Mode 6.	A SN7486N	$0 < V < +0.4$ @16 mA max. Data Track & Data Ready signals in Mode 5.		$+2.4 < V < +5.0$ (or open circuit) Data Track & Data Ready signals in Mode 6.	
J2-11 thru J2-13, J2-24	Signal Ground (0V) to External Equipment. 0V ground reference for all inputs and outputs (isolated from chassis ground). Tied internally to J1-18, 23 and 25.					
J2-14	Reader System Ready (RSYSRDY*) Output. Active signal indicates RUN-LOAD Switch is in RUN (reader door closed) and power is on (system ready). Inactive indicates RUN-LOAD switch is in LOAD (reader door open) or if drive signal is accepted and new feed hole is not sensed within 15 ms, indicates either no tape or torn tape and serves as the out-of-tape signal (system not ready).	B SN7400N	$0 < V < +0.4$ @16 mA (sink) System Ready		$+2.4 < V < +5.0$ @0.2 mA (source) System Not Ready	
J2-15	External Inhibit (EXT INH*) Input. Active signal inhibits reader operation and causes RSYSRDY* and Data Ready signals to go inactive. Inactive signal allows reader to operate in normal manner.	A SN7408N	$0 < V < +0.4$ @16 mA (sink) Reader inhibited.		$+2.4 < V < +5.0$ (or open circuit) Reader not externally inhibited.	
J2-16	Drive Right (DR*) Input. Active signal drives tape to right in either continuous mode or asynchronous mode. See Sections 3.3.1 and 3.3.2.	A SN7400N	$0 < V < +0.4$ @ 5.0 mA max. Reader drives tape to right.		$+2.4 < V < +5.0$ (or open circuit) Reader does not drive tape to right.	
J2-17	Drive Left (DR*) Input. Same as drive right except drive to the left.	A SN7400N				
J2-25	Chassis Ground. Output connection to chassis (isolated from signal ground).					

### 3.3.2 TAPE FEED/DELETE MODE

This mode of operation allows either unit to feed tape through the punch mechanism at approximately 120 cps and punch feed holes only or an all hole delete code.

- a. Make sure tape has been threaded into the punch. See Section 3.3.1, steps a through c.
- b. Place the POWER switch in the on position.
- c. Make sure the Direction input at J1-10 is +5V or open circuit. A 0V signal at this pin will cause tape to go in the reverse direction.
- d. Place the FEED/DELETE switch into its FEED position to punch tape with feed holes only or into its DELETE position to punch tape with the all hole delete code until the desired amount of tape has been punched.

Table 3-2. Front Panel Controls

Switch	Position	Function
POWER	ON	Applies AC power to unit.
	OFF	Removes AC power from unit.
SPOOL RAB Units Only)	Momentary On	Operates manual spooler which winds tape counter-clockwise
	OFF	Removes control of spooler.
	(Momentary)	Causes reader to drive tape to the right.
	(Momentary)	Causes reader to drive tape to the left.
	OFF	Allows reader to be controlled by external signals.
READER LOAD	ON (door open)	Inhibits Reader and applies false signal to RSYSRDY* output at J2-14.
	OFF (door closed)	Allows Reader to operate and applies true signal to RSYSRDY* output at J2-14.
FEED/ DELETE	FEED (Momentary)	Causes punch to feed tape and punch feed holes only, at approximately 170 cps. Data input lines will be inhibited. (Note: The punch command line J1-11 must be held false while operating this switch.)
	DELETE (Momentary)	Same as FEED except enters an all-hole character on each line of the tape.
PERFORATOR STATUS LAMP	Illuminated	Indicates tape supply is nearly exhausted but does not affect punch system operation.



### 3.3.3 ASYNCHRONOUS FORWARD MODE

In this mode of operation, the unit will punch feed holes and data holes at up to 120 cps in the forward direction under control of input signal lines. See Figure 3-4 for proper timing.

- a. Perform Section 3.3.1, steps a through e.
- b. Check to see that the Punch Ready Output at J1, pin 12, is in the Ready state, depending upon the mode. See Table 3-1.
- c. Check J1-14 to see that the proper signal is present for the desired input mode. Check J1-15 to see that the proper signal is present for the desired output mode. See Table 3-1.
- d. Check to see that the PSYRDY\* Output at J1, pin 13, is between 0V and +0.4V.
- e. Make sure the perforator status lamp is not lighted. If it is lighted it indicates a low supply of tape.
- f. Check to see that the Tape Error Output at J1, pin 20, is in the false (No Malfunction) state, depending upon mode. See Table 3-1, J1-20.
- g. Apply a forward signal  $+2.4 < V < +5.0$  or open circuit to the Direction Input Line at J1, pin 10. Direction input must be stable for 500 nsec., min., before the punch command is given (step h). See Figure 3-4.
- h. Apply a true (hole) signal to each pin (J1, pin 1 through J1, pin 8) for the desired tracks to be punched depending upon the mode. See Table 3-1 and and Figure 3-4. Data commands must be present at the time a punch command is initiated (step i) and must remain on the line for 2 usec. (min.) after the punch command input reaches the true level.
- i. Apply the true (punch command) signal to J1, pin 11, depending upon the mode. See Table 3-1. Punching is initiated by the leading edge of the Punch Command signal which must be true for 2 usec., min., with a rise time of 1 used., max. The tape will advance one row and punch a feed hole plus those data tracks which are true (step h). The Punch Ready output will remain true for 1 usec max. after Punch Command is given.
- j. Repeat steps b through i for each line to be punched.

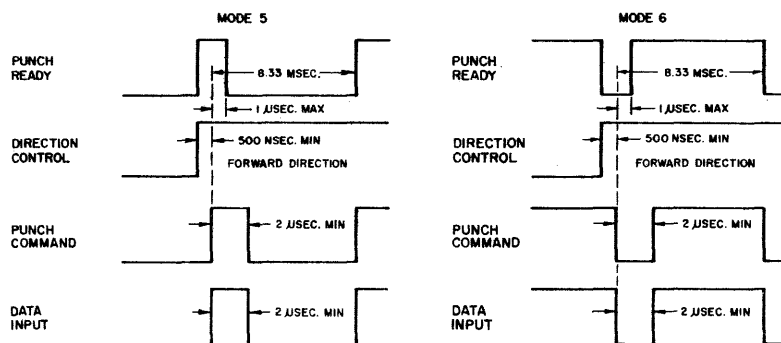


Figure 3-4. Timing Diagram, Perforator Section

### 3.3.4 ASYNCHRONOUS REVERSE MODE

In this mode of operation, the unit will move tape in the reverse direction under control of input signals up to 120 cps for 10 rows (1 inch), without punching data or feed holes.

- a. Perform Section 3.3.1, steps a through e.
- b. Check to see that the Punch Ready Output at J1, pin 12 is in the Ready state, depending upon the mode. See Table 3-1.
- c. Check J1-14 to see that the proper signal is present for the desired input mode. Check J1-15 to see that the proper signal is present for the desired output mode. See Table 3-1.
- d. Check to see that the PSYSRDY\* Output at J1, pin 13, is between 0V and +0.4V.
- e. Make sure the perforator status lamp is not lighted. If it is lighted it indicates a low supply of tape.
- f. Check to see that the Tape Error Output at J1, Pin 20, is in the false (No Malfunction) state, depending upon mode. See Table 3-1, J1-20.
- g. Apply a reverse signal between 0V and +0.4V to the Direction Input line at J1, pin 10. Direction input must be stable for 500 n sec., min., before the punch command is given (step h). See Figure 3-4.
- h. Apply the true (punch command) signal to J1, pin 11, depending upon the mode. See Table 3-1. The tape will backspace one row without punching sprocket or data.
- i. Repeat steps b through h for each line to be backspaced up to 10 lines (1 inch) maximum.

### 3.4 OPERATING INSTRUCTIONS, READER

The following procedure should be followed when reading a tape. Refer to Figures 3-5 and 3-6 during the following descriptions.

#### 3.4.1 TAPE LOADING AND THREADING, READER

Use the following procedure when loading tape into the reader:

- a. Connect J2-P2 and plug the line cord into the proper AC outlet. See Caution in Section 2.4
- b. Depress the power switch. Power is on when the switch is lit.
- c. Pull forward and down on the Door Assembly. This will raise the Upper Tape Guide allowing tape to be loaded.
- d. Check the number showing on the Tape Guide. If a two sided Tape Guide is supplied and the other width of tape is required, depress and rotate the Tape Guide Latch 180°. The Tape Guide can now be removed and then reinserted with the other guiding edge up. One sided guides, of course, do not need to be removed. The Tape Guide supplied with the unit is coded as part of the model number as indicated in Figure 1-6.

- e. Insert the tape as shown in Figure 3-6.
- f. Raise the Door Assembly up to its closed position.
- g. Make sure the RSYRDY\* output signal at J2-14 is in the true condition, i.e.,  $0 < V < +0.4$ .
- h. The reader may now be operated in either of the two modes listed in Sections 3.4.2 and 3.4.3.
- i. To unload tape, stop tape movement, lower the Door Assembly and remove the tape.
- j. To remove power, depress the POWER switch. The reader lamp will turn off.

### 3.4.2 TAPE DRIVE, ASYNCHRONOUS MODE

In this mode of operation, the reader is controlled in a line-at-a-time step mode. Each pulse input steps the tape one line. This mode is performed as follows:

- a. Perform Section 3.4.1, steps a through g.
- b. Apply the step pulse to the drive left (DL\*) line, pin 17 of J2, or the drive right (DR\*) line, pin 16 of J2 as follows. Make sure the Data Ready signal at pin 9 of J2 is in the true condition depending upon mode and that the (EXTINH)\* input signal at J2, pin 15, is false ( $+2.4 < V < +5.0$  or open circuited). See Table 3-1 and Figure 3-5.

Stop:  $+2.4 < V < 0.4 @ 5 \text{ ma.}$   
 Run:  $0 < V < +0.4 @ 5 \text{ ma.}$

The minimum pulse width for the run signal is 1 usec. Pulse to be maintained until Data Ready signal goes false (up to 100 usec., if next pulse is given coincident with Data Ready signal going true). Pulse to be removed within 50 usec. after leading edge of Data Ready signal to stop on that character.

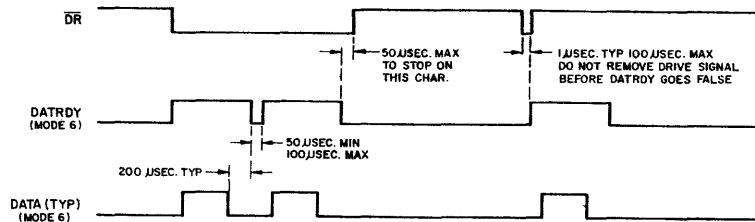


Figure 3-5. Timing Diagram for Reader

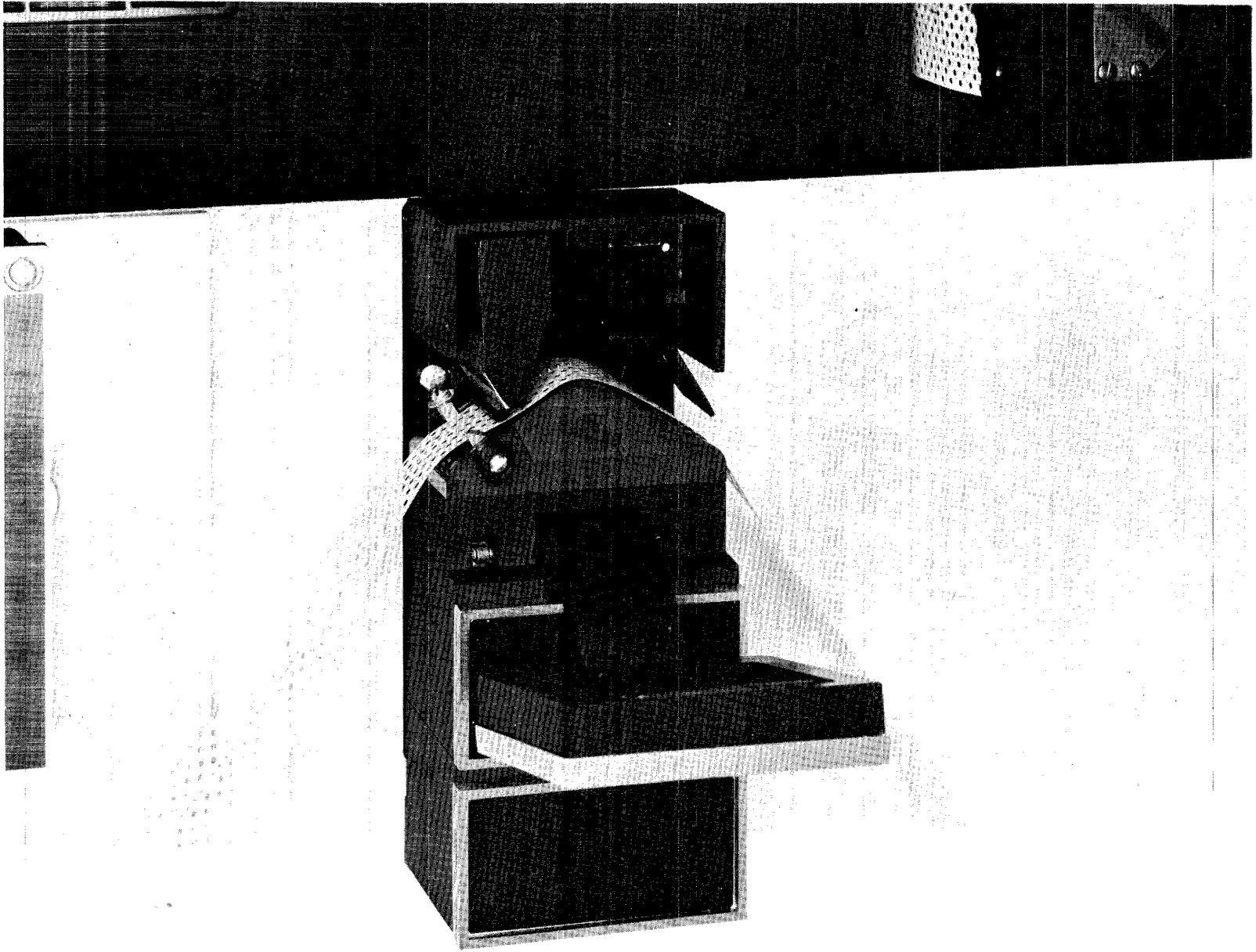


Figure 3-6. Tape Loading, Reader Section

### 3.4.3 TAPE DRIVE, CONTINUOUS MODE

In this mode of operation, the reader is controlled from an external signal as follows:

- a. Perform Section 3.4.1, steps a through g.
- b. Apply the drive left (DL\*) signal to pin 17 of J2 or the drive right (DR\*) signal to pin 16 of J2 as required. Make sure the Data Ready signal at pin 9 of J1 is in the true condition depending upon mode and that the (EXT INH)\* input signal at J2, pin 15, is false ( $+2.4 < V < +5.0$  or open circuited). See Table 3-1 and Figure 3-5.

Stop:  $+2.4 < V < +5.0$  (2.2K to +5V) or an open circuit

Run:  $0 < V < +0.4$  @ 5 ma.

Tape will be driven in excess of 300 characters/second. To stop on character, the drive signal must be removed within 50 usec after the leading edge of the Data Ready signal.

- c. Only one run signal must be present at one time. If both run signals are present, the reader will drive in the last previously commanded direction.
- d. The reader may also be driven either right or left in the continuous mode by the front panel direction switch S10. Operation of this switch in conjunction with external drive signals is not an allowed operating condition and should be avoided.

### 3.4.4 EXTERNAL INHIBIT

In this mode of operation, the reader is inhibited and the Reader System Ready (RSYSRDY\*) output (J2-14) and the Data Ready output (J2-9) are set to the false state. To place the reader in the inhibit mode apply the following signal to pin 15 of J2:

Reader Not Inhibited:  $+2.4 < V < +5.0$  (2K to 5V) or an open circuit

Reader Inhibited:  $0 < V < +0.4$  @ 5 ma.

### 3.5 TAPE RECOMMENDATIONS

Table 3-3 lists the tapes REMEX recommends for use. Basic tape specifications are given in Table 1-2.

### 3.6 OPERATIONAL MAINTENANCE

After every 6 to 8 hours of reader use, the operator should check the tape transport area of the reader for cleanliness. Dirtier environments may require more frequent cleaning of the tape transport area. This is extremely important since any dirt or foreign material covering the readhead can cause readout errors. For general cleaning, use the bristle brush supplied. Cleaning of the photocell assembly is described in Section 5.3.1.1. Make sure the tape remains clean at all times since any residue picked up by the tape can be deposited on the readhead. It has been found in certain cases that

residue picked up by the tape comes from soiled hands. It is important that care be exercised when handling tape especially in machining areas or other areas where grease, oil and sprays are present.

It is important that the chad tray alongside the punch mechanism be emptied periodically to prevent chad from backing up into the punch and creating punching errors. A good practice to follow is to empty the tray when each new roll of tape is installed. See Section 3.3.1, step f.

Table 3-3. Acceptable Tapes

REMEX has found the following tapes acceptable for use on the system.

Type	Manufacturer	Part Number
Paper, Unoiled or oiled (see note) except black carbon filled tapes	REMEX	1000 ft Roll, 715200-002 1000 ft Fanfold, 715200-001
	Paper Manufacturer's Inc.	Perfection Series
	Bemis	Paper Tape Series
	Crown Zellerbach	Paper Tape Series
	Friden	Paper Tape Series
Special Paper (roll only)	Nova Tech	Syntosil Machine Tool Tape
Special Mylar, Paper-Mylar or Polyester (roll only)	Numeridex	2000
	Arvey	RVCZ 60, RVCT 52
	Chase Foster	PMP01151

NOTE: Oiled paper tapes may be used but with more frequent punch cleaning periods. ALSO ACCEPTABLE, BUT WITH REDUCED PUNCH LIFE: Black Carbon Filled Tapes. NOT ACCEPTABLE FOR THIS PUNCH APPLICATION: Mylar-Foil, 2.6 mil, Arvey RVCP23, Numeridex #0500, all vulcanized fiber tapes, Chase Foster MFM-153515 and MFM-103515, and 3M Brand N/C Tape #401 and #301.

### 3.7 TAPE PREPARATION REQUIREMENTS

Proper tape reader operation requires that the maximum accumulated longitudinal error between feed hole centers in the punched tape be  $\pm 0.025$  inch within any span of 5 inches, as specified in the American National Standards Institute Standard X3. 18-1967 (ANSI: formerly United States of America Standards Institute). In the event a user has, because of punching problems, a number of tapes which do not conform to this specification by an amount consistently out of tolerance, the reader may be set up as in Section 5.7 using one of these tapes rather than the type specified.

A tape gauge is available from REMEX (part number 110597) so that the  $\pm 0.025$  tolerance specification can be checked. To use the gauge, place the feed hole of one end of a 5 inch span (50 characters) at the single cross hair and swing the other end of the 5 inch span in the arc until one of the cross hairs is centered in the feed hole. Read the measurement adjacent to that cross hair (plus tolerances to the right and minus tolerances to the left). A second 5 inch gauge is printed at the bottom to check both longitudinal and perpendicular transverse center line spacing. A metal tape gauge (part number 103569-4) is also available which will verify the longitudinal tolerance.

## SECTION IV

### THEORY OF OPERATION

#### 4.1 BLOCK DIAGRAM DESCRIPTION

The REMEX tape reader/perforator system performs two basic functions: (1) controls the operation of the RPM 6120 punch mechanism in response to input control signals, and (2) reads small rolls (RAB and RAR units) or fanfolded (RAF units) tapes. Each function is described below in block diagram form and illustrated in Figures 4-1 and 4-2. See also the system schematics, Figures 8-1 through 8-3. Electronic descriptions are given in Section 4.2.

##### 4.1.1 SYSTEM OVERVIEW

Figures 8-1 through 8-3 give the complete signal and card interconnection for the system. All cards and electronically active components are tied to the Master Interconnect Card, Figure 8-4, which routes the various signals. Perforator input signals are applied to J1 on the Perforator Logic card where the timing and logic occurs. The output signals from this card are then routed through the Master Interconnect card to the Perforator Driver card where they are amplified and fused. The routing then returns to the Master Interconnect card and to the punch mechanism.

Reader inputs are applied to J2 on the reader card where the control of the reader occurs. Reader motor drive signals are outputted to the Master Interconnect card which routes them to the reader. All switch operations occurring in the reader are also routed through the Master Interconnect card to the Reader Driver card.

##### 4.1.2 TAPE PERFORATION CONTROL

P.C. Card 111821 (schematic 111822) and 111831 (schematic 111832) are used to operate the punch mechanism by controlling (1) the logic and timing of the perforator and the direction of tape movement and (2) the data logic and solenoid driver amplifiers. Refer to Block Diagram, Figure 4-1.

Proper operation requires that the Direction (DIR) and Data (DATA) inputs be present when the Punch Command (PC) is given. Applying the PC signal triggers the clock pulse one-shot, SS1, which in turn triggers the punch delay one-shot, SS2 and the voltage doubler one-shot, SS7. In addition, SS1, also triggers the Damp Delay (DAMPD) one-shot SS5 and the motor control flip-flops FF9 and FF10. These flip-flops comprise a three stage counter which is advanced one count and causes the sprocket to move to its next position. SS1\* output also serves as the data strobe which latches the input data at Z13 and Z18.



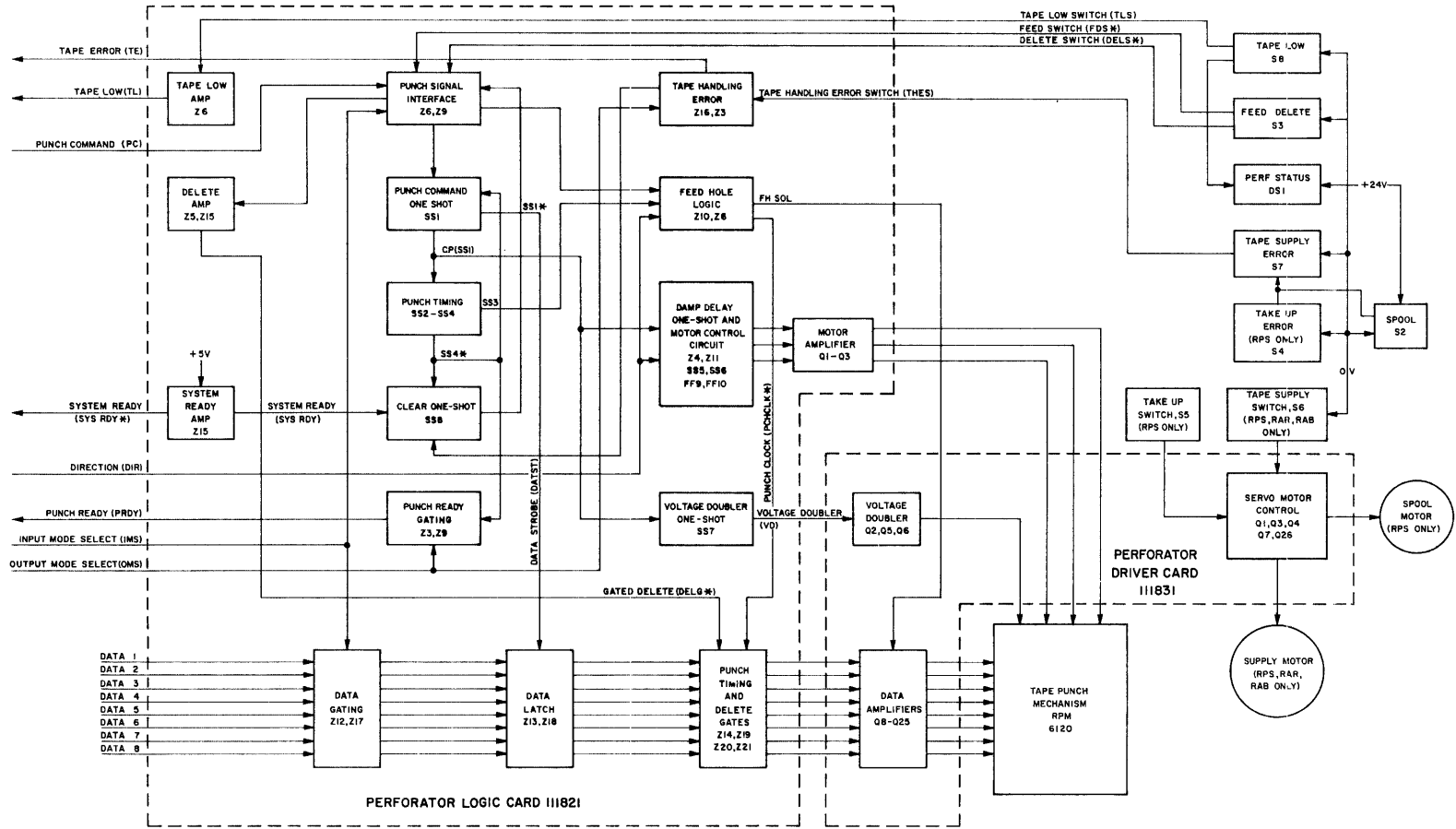


Figure 4-1. Block Diagram, Perforator Section

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When SS2 times, the Punch Delay (PD\*) signal triggers the Punch Timer (PT) one-shot, SS3, and the Punch Return one-shot, SS4, the PT (SS3) output is used to operate the punch solenoids. At the end of the SS3 time, the solenoids will start their return stroke while SS4 continues to hold the system in the punch cycle (PRDY still in inactive state) until the return stroke is completed. At the end of the SS4 time, the clear one-shot, SS8, is triggered which clears the Feed and Delete circuits in the event they have been set. At this time the Punch Ready (PRDY) output goes to the active level.

Switch S3, FEED/DELETE, provides a second input to the perforator interface logic which also triggers SS1. An identical sequence is produced as previously described for the Punch Command except that in the FEED position, only the feed hole solenoid is energized. In the DELETE position all solenoids will be energized.

Switch S7 (RAR and RAB units only) is provided as a Tape Error (TE) signal at J1-20. This signal is present when a supply error is present (supply tape too loose causing S7 to actuate). On RAR and RAB units, tape supply switch S6 is used as the servo control to unwind tape. S8, Tape Low switch provides an external indication that the amount of tape remaining is below a preset level. This is for informational purposes only and does not affect the operation of the system.

#### 4.1.3 READER BLOCK DIAGRAM DESCRIPTION

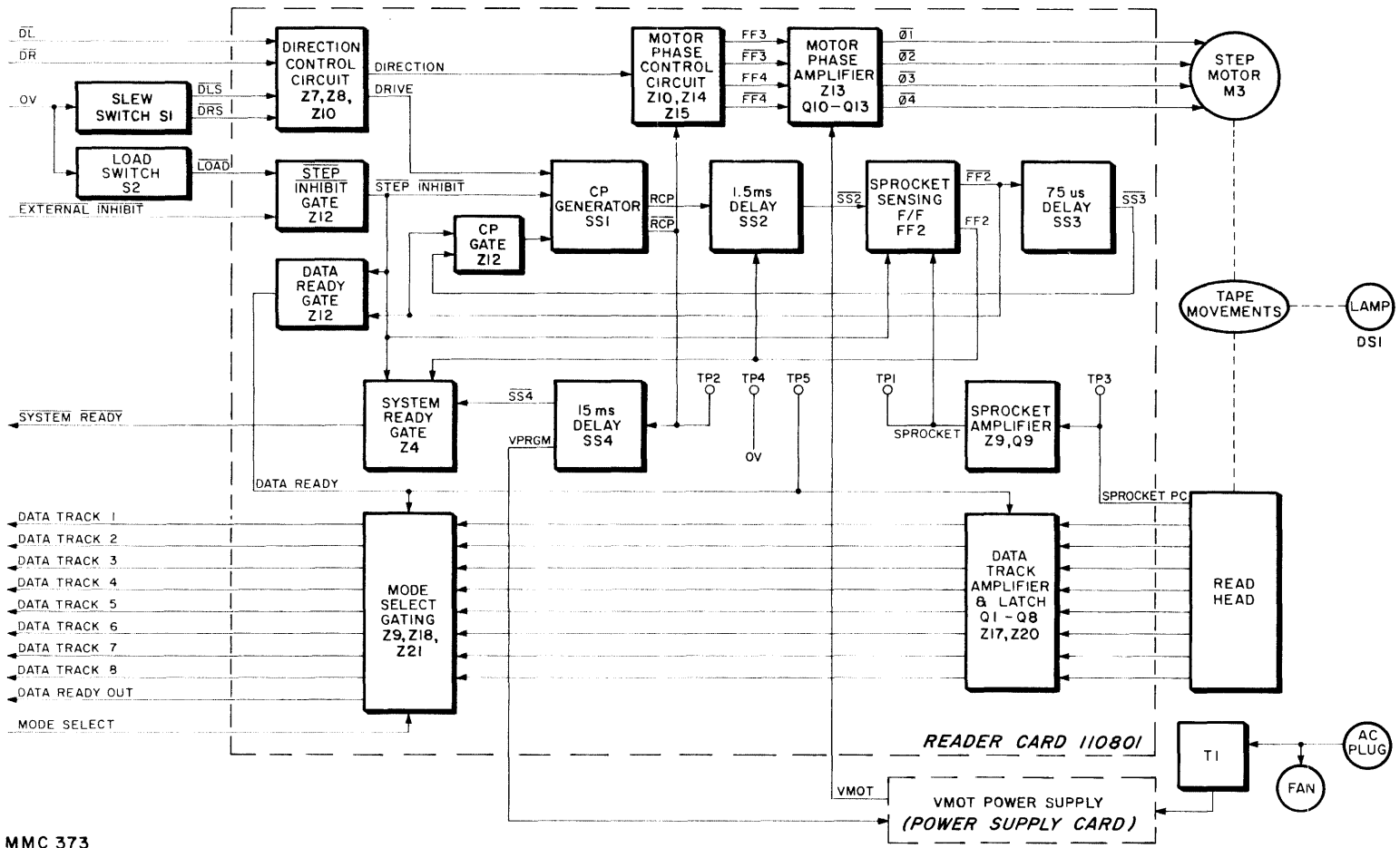
Reader Card 110801 performs two basic functions: (1) it drives tape in either direction over the read station and (2) converts the tape information into electrical signals. These two functions are shown in block diagram form in Figure 4-2. The electronic details are described in Section 4.2.3.

The drive system consists of a four phase stepping motor which is directly coupled to the sprocket drive wheel. Two phases of the motor are energized at a time in a sequence which advances the sprocket and tape one line either to the left or right depending upon the sequence order of the phases. The tape then stops on character and waits for the energizing of the next two motor phases.

The required motor phase signals are generated in response to the drive inputs. A 0V active drive signal or step pulse applied to the Drive Left (DL\*) or Drive Right (DR\*) input line or a drive command from the SLEW switch, S10, will set the direction memory, Z8, to the desired state and will generate the first system clock pulse, CP. The input signal also establishes the direction of rotation for the motor through the motor phase control circuit. The CP is used to advance the motor control circuit which steps the motor. A 1.5 ms singleshot, SS2, is also triggered by the CP so that any initial jitter in the sprocket is locked out as the sprocket goes off character.

When the next sprocket hole is read (approximately 3 ms. after the drive command), the Sprocket Sensing flip-flop FF2 is set which (1) latches up the data (through FF2\* and the Data Ready line) and (2) triggers the 75 us single-shot, SS3. This allows the external equipment approximately 75 us (specified as 50 us max) to examine data and make the stop-go decision.

An additional function performed by the CP signal is to trigger the 15 ms delay SS4. This is a retriggerable type single-shot which is recycled by each CP pulse. SS4 is used to program the step motor supply voltage, VMOT, up and down in order to reduce the



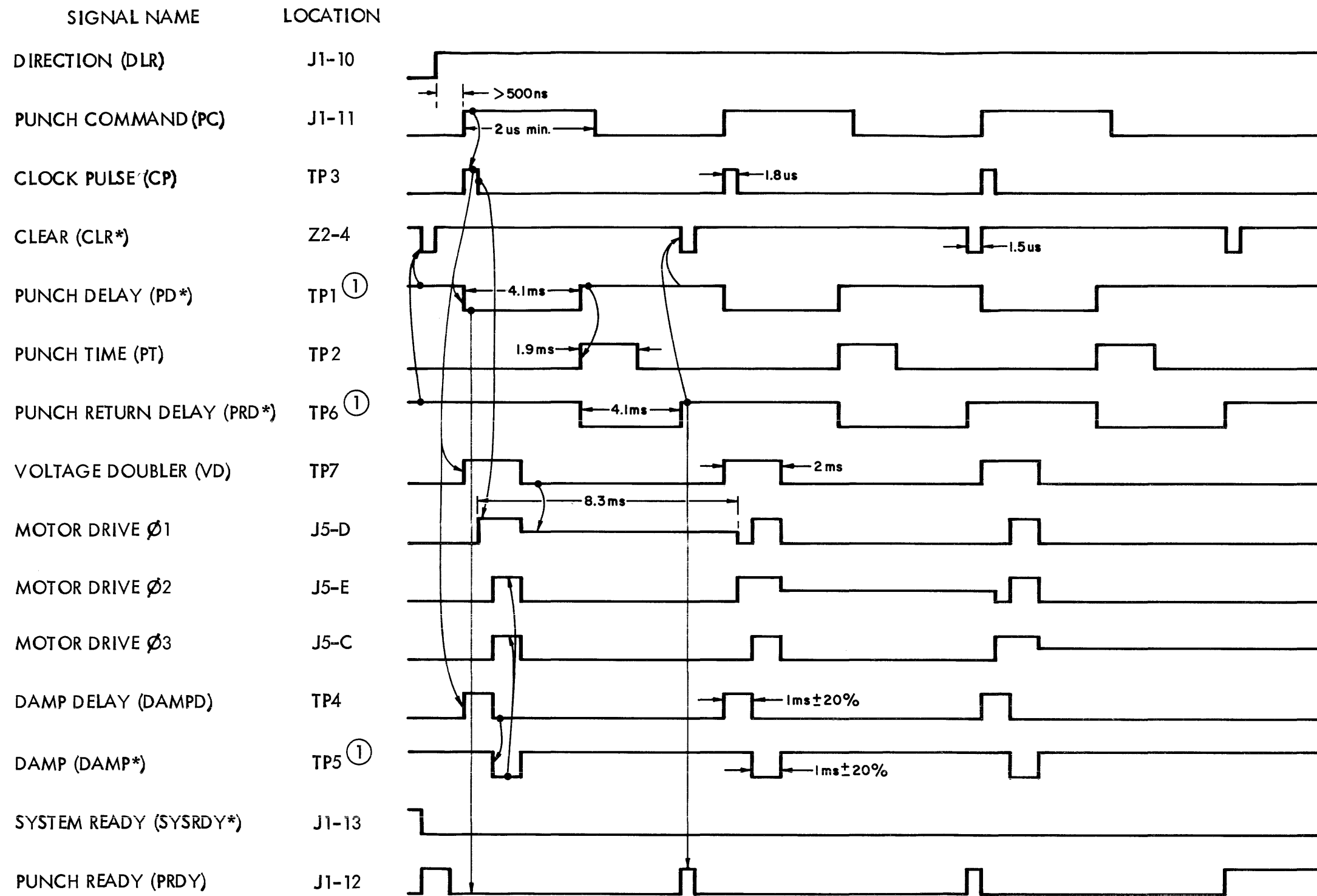
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Figure 4-2. Block Diagram, Reader Section

motor power dissipation during inactive periods. In addition, if no new sprocket is sensed (i.e., FF2 is not triggered) during the 15 ms, the Reader System Ready (RSYRDY)\* signal goes false indicating the reader is at the end of tape (EOT) or broken tape.

The CP generator is inhibited by either the LOAD switch or a true OV (External Inhibit)\* signal. Either signal generates the (Step Inhibit)\* signal which clears and locks up SS1 and FF2, inhibits the Data Ready signal and places the (System Ready)\* in the inactive condition (system not ready).

The readhead is located under the fiber optics and contains photovoltaic cells which are used to sense the tape perforations. As tape is advanced over the readhead by the sprocket drive, the photovoltaic cells are energized by the light source when the corresponding holes are present in the tape. The outputs from the readhead are then applied to the data track amplifiers and latch circuits on the card. A true, +5V, Data Ready signal locks up the two latch circuits, Z17 and Z20 storing that line of data and causing the Data Ready output signal to go true. The outputs of the latch circuits are applied to the Mode Select gates which produces either mode 5 or 6 outputs depending upon the mode selection made at the reader output select line.



① These test points show the inversion of the signal given in the waveform.

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Figure 4-3. Perforator Logic Timing Diagram

## 4.2 CIRCUIT DESCRIPTIONS

This section describes the theory of operation and electronic details of the two circuit cards used in the tape perforator system.

### 4.2.1 PERFORATOR LOGIC CARD 111821

The logic card is used to control the punch timing and logic of the punch mechanism motor and solenoids. Punching is accomplished by using the following inputs: (1) the external Punch Command, Direction and Data Input signals, (2) the FEED switch to punch feed holes only, or (3) the Delete switch to punch the all hole delete code on the tape. In addition this card generates four output signals: (1) Tape Error, (2) Tape Low, (3) (Punch System Ready)\*, and (4) Punch Ready. During the following discussion, refer to Figure 4-3 which shows the waveforms at selected points on the Perforation Logic Card. Figure 8-5 contains the schematic for this card.

Mode selection is accomplished by applying 0V or +5V to J1-14 for the mode selection of the Punch Command and Data Inputs and to J1-15 for the mode selection of the Ready and Tape Error outputs. 0V at these pins selects mode 5 (+5V active) while +5V selects mode 6 (0V active). A jumper is added between terminals G and H if it is required that the Tape Handling Error inhibit the punch ready signal (card assembly 111821-1). The jumper is removed if the inhibiting feature is not required (card assembly 111821-2).

#### 4.2.1.1 Punch Command Control

Before the Punch Command (PC) input signal can be applied, the following signals must be present as described in Sections 3.3.3 and 3.3.4: (1) the Punch Ready (PRDY) and the Punch System Ready (SYSRDY\*) signals at J1-12 and J1-13 must be active indicating the punch is cleared and ready to accept data, (2) a +5V Direction signal (for forward direction) at J1-10, (3) the desired Data input signals at J1-1 through J1-8 and (4) the FEED/DELETE switch must be off. See Table 3-1 for the voltage levels of the input signals corresponding to the particular mode being used.

Applying the PC signal to J1-11 produces a +5V signal at Z9-3 since the active level of the PC signal is of the opposite polarity to that of the input mode select signal at Z9-2. See Figure 8-5. As Z9-3 and Z6-13 go to +5V, Z6-11 (Punch Start, PSTRT) also goes to +5V which triggers the Clock Pulse (CP) one-shot, SS1. The CP\* (SS1\*) signal is inverted at Z15-12 and is used as the Data Store Pulse (DATST) to lock the input data latches at Z13 and Z18. The CP (SS1) output is used to perform the following functions: (1) at Z6-2 it is used to hold the clear input (Z2-11) at +5V until SS1 times out, (2) to trigger the Punch Delay (PD) one-shot, SS2, (3) to trigger the Voltage Doubler (VD) one-shot, SS7, (4) to trigger the Damp Delay (DAMPD) one-shot, SS5 and (5) to advance the motor phase counter, FF9 and FF10, by one. Each of these is discussed in detail in subsequent paragraphs.

The Punch Delay time (4.1 ms) is required to step the punch motor to advance the motor to the next character in preparation for the punch cycle. Flip-flops FF9 and FF10 are connected through Z9 and Z10 to form a three state counter which determines the energizing sequence of the punch step motor windings  $\Phi 1$ ,  $\Phi 2$  and  $\Phi 3$ . The direction of counting is determined by the Direction (DIR) line which places Z9-5 and Z9-13 at +5V for the forward direction ( $\Phi 1$ ,  $\Phi 2$  and then  $\Phi 3$  energizing sequence) or 0V for reverse direction ( $\Phi 1$ ,  $\Phi 3$  and then  $\Phi 2$  energizing sequence). The outputs of

FF9 and FF10 are gated at Z7 and Z10 with the Damp (DAMP\*) signal to cause Q1, Q2 or Q3 to turn on depending upon the state of the counter. The DAMP signal is generated approximately 1 ms after the step has started. When the DAMP D signal (SS5) has timed out, the DAMP\* turns on all three motor phases, for 1 ms, which minimizes the oscillations in the motor. At the same time the motor counter is updated, SS7 is triggered causing the VD and VD\* outputs to turn on the voltage doubler circuit contained on the Perforator Driver card. This circuit generates a 70V, 2 ms pulse which is applied as the motor supply voltage to increase the acceleration rate.

When SS2 times out, the positive going edge of SS2\* triggers SS3 and SS4. The Punch Time (PT) signal from SS3 is gated at Z10-4 with the DIR signal. If the direction signal is +5V (forward), Z10-6 is switched to 0V which energizes the feed hole solenoid through Z15-8 and Q17 and Q8 on the Perforator Driver card. A 0V DIR signal signal causes Z10-6 to remain at +5V and no FH to be punched. The 0V active signal at Z10-6 is gated with an inverted 0V signal from Z5-11 (tape feed switch inactive), causing a 0V active Punch Clock (PCHCLK\*) output at Z6-8. This signal is used by the data gates Z20 and Z21 to activate those solenoids which have their data lines active during SS3. When the feed switch is activated, Z6-10 is +5V, causing Z6-8 to remain at +5V, thereby inhibiting data. The pulse width of SS3 is set to 1.9 ms when punching all holes and is adjusted by R17. SS3 time will vary between 1.6 ms when punching FH only and 1.9 ms when punching all holes.

SS4 time is set by R21 for a 4.1 ms time period which is approximately twice the time of SS3. This extra time is inserted to make sure the punch pins have returned and that the system is ready for the next punch command. When SS4 times out, the positive going SS4\* signal is gated at Z3-13 causing Z3-11 and Z3-1 to rise to +5V (SS2 at Z3-12 is already at +5V). This causes Z3-3 to go to +5V which triggers the Clear (CLR) one-shot, SS8. The CLR output is used to unlatch the feed and delete circuits as described later. The punch ready output at Z9-8 then becomes active (0V or +5V depending upon the selected output mode) and indicates to the external equipment that the Punch System is ready for the next PC input. The logic card allows the mode of the PRDY and TE outputs to be selected by applying +5V (or open circuit) to J1-15 for mode 5 or 0V for mode 6 when B and C are jumpered (normal condition). Inverted output logic can be obtained by jumpering A to C.

#### 4.2.1.2 FEED/DELETE Switch Operation

Placing the FEED/DELETE switch into the FEED position generates almost the same sequence as described for the PC input. Actuation of the FEED switch places 0V at Z5-12 which sets the flip-flop composed of Z5 pins 11-13 and Z5 pins 1-3 and places 0V at Z10-2. This, in turn, causes both Z10-3 and Z6-11 to rise to +5V which triggers SS1. The same sequence as described for the PC signal occurs except only the feed hole is punched since the +5V signal at Z6-10 inhibits the PCHCLK\* signal. When SS4 has timed out and Z3-1 goes to +5V, Z3-3 also rises to +5V which triggers SS8. The resulting 0V CLR\* pulse at Z5-2 resets the feed flip-flop. The cycle is then repeated, providing the FEED switch is still actuated. It is necessary when using the FEED or DELETE switch that the Direction input at J1-10 be +5V or open circuit to be able to feed the tape in the forward direction.

The DELETE switch is provided as a means of placing an all hole code on the tape manually. Actuating the DELETE places 0V at Z5-9 which sets the flip-flop composed of Z5, pins 4-10 and places 0V at Z5-6. This, in turn, causes both Z10-3 and Z6-11

to rise to +5V which triggers SS1. In addition, the +5V signal at Z5-8 is inverted at Z15-6 and applied to the data logic, Z14 and Z19, causing all holes to be punched. When SS4 has timed out causing Z3-1 to go positive, Z3-3 goes to +5V which triggers SS8. This places a 0V 1.5 us pulse at Z5-5 which resets the delete flip-flop. If the DELETE switch is still actuated, the cycle is repeated. It is necessary when using the DELETE switch that DIR at J1-10 be +5V or open circuit to place the FF9-FF10 counter in the forward sequence of operation.

#### 4.2.1.3 (System Ready)\* Signal Description

The System Ready (SYSRDY\*) signal indicates that the system's voltages have reached the proper operating levels. When power is first turned on, C10 begins charging and continues charging until it reaches the level sufficient to switch the SYSRDY\* output at Z15-2 to 0V. Before this level of voltage is reached, the SYSRDY signal at Z15-10 begins at 0V and is applied to the clear input of FF9 and FF10 to set the counter to zero. It also applied to Z5-2 and Z5-5 through Z3, pins 5 and 6 to place the feed and delete flip-flops in their reset states. SS8 is also inhibited during this period of time. After C10 charges to a sufficient level, SYSRDY switches to +5V which enables SS8, FF9, FF8 and the feed and delete flip-flops.

#### 4.2.1.4 Tape Handling Error Description

The Tape Handling Error Signal (THES) at its input (Z16-10) is normally 0V. Activation of S7 removes the 0V signal which places the Tape Error (TE) output at J1-20 at +5V for mode 5 or 0V for mode 6. Optional mode jumpers for inverted mode selection are provided as discussed previously in Section 4.2.1.1. On systems requiring that the Tape Handling Error inhibit the PRDY output, the 0V signal at Z16-8 is applied to Z3-2 through jumpered terminals G and H. The resulting 0V output at Z3-3 places the PRDY signal at 0V and resets and holds SS1 in the cleared state. Systems which do not require the THE signal inhibit operation have the jumper between G and H removed.

#### 4.2.1.5 Tape Low Signal Description

The Tape Low Signal (TLS) is normally 0V when tape supply is sufficient. When the tape roll drops below a preset level (approximately 100 ft. remaining), S8 on the tape deck opens and removes the 0V signal from Z6-4 and 5, causing Z6-6 and J1-21 to go to +5V. In addition, the actuation of S8 applies 0V to J8/P8-5 causing the Perforator Status Lamp (PERF STATUS) to lite.

#### 4.2.1.6 Data Logic Control

Data to be punched is applied to J1, pins 1-8. The Input Mode Signal (IMS) at J1-14 allows the mode of the Data and PC inputs to be selected by applying +5V (or open circuit) to J1-14 for mode 5 or 0V for mode 6 during normal operation (terminals E and F are jumpered). Inverted mode selection is accomplished by jumpering D to F. Because the operation of all eight tracks are identical, only Track 1 will be used in this discussion. Applying the active data 1 signal to Z12-5 switches Z12-6 to +5V since Z12-4 is the opposite polarity to that of the required true data signal. The input to latch Z13, then, is always +5V for an active data input, regardless of the mode. Latch Z13 stores the input information at input 1D and transfers it to the output 1Q\* at DATST time (see



Section 4.2.1.1). The 1Q\* output will follow the data input at 1D as long as DATST remains high (approximately 1.7 us). When DATST goes to 0V, the information is retained at 1Q\* until DATST again goes high. Thus with +5V at Z13-2, the output at Z13-1 will be 0V and remain 0V until DATST drops to 0V and clocks in the new input data. DATST occurs simultaneously with CP at Z2-5. It is therefore important that the Data input be stable at the time DATST falls (approximately 1.5 usec after the leading edge of CP).

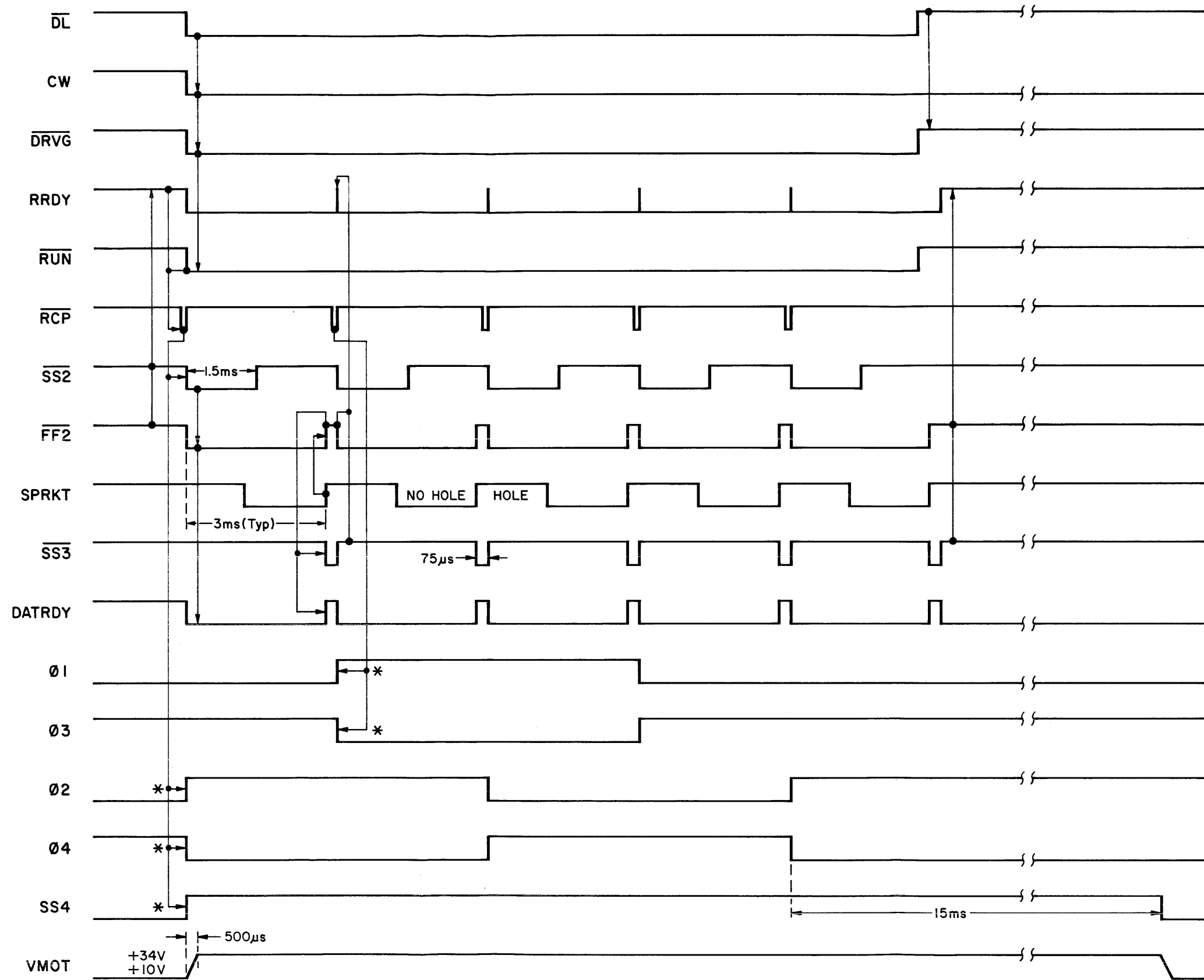
During the SS3 time period, the 0V PCHCLK\* is generated (See Section 4.2.1.1) and applied to Z20-3 for track 1. If data track 1 is active, Z14-6 will be 0V causing Z20-1 to go positive. This turns on data track 1 solenoid amplifier (on the Perforator Driver Card; See Section 4.2.2) and punches track 1.

#### 4.2.2 PERFORATOR DRIVER CARD

The Perforator Driver Card, 111831 contains the driver solenoid amplifiers, the Voltage Doubler circuit for the perforator stepper motor, and the supply voltages for the tape supply and take-up motor. Refer to Figure 8-6 for the schematic for this card. As described in Section 4.2.1.1, during the SS7 (VD) one-shot time a 70V, 2 ms pulse is applied to the perforator step motor to increase the acceleration rate. The VD and VD\* signals are applied to the Perforator Driver card and cause Q5 to turn off and Q6 to turn on. This places C7 in series with the +35V supply and the step motor (VD OUT) for approximately 2 ms causing VD OUT to rise to 70V as shown on the waveform for TP2 in Figure 8-6.

Amplifiers Q8-Q25 are used to operate the nine punch solenoids. As described in Section 4.2.1.6, a +5V signal represents the active state for a punch solenoid. Illustration track 1, a +5V applied to P4-H turns both Q18 and Q9 on which energizes punch solenoid 1.

Q4 is used only on the RAR and RAB systems and is turned on by a +28V signal from S5 when tape take-up is required (S5 deactuated). The tape supply circuitry is used only on the RAR and RAB systems and operated by switch S6. When S6 is actuated (N.O. closed), it indicates tape is too tight (arm rotated too far clockwise) and requires that the supply reel be unwound. This transfers 0V from S6-N.C. to S6-N.O. which turns on Q1 and supplies +12V through R3 to the Tape Supply Motor. Tape is unwound and the spring loaded arm follows the tape in a counter clockwise direction. When enough tape is supplied S6 deactuates and transfers 0V to the N.C. contact. This triggers the Brake (BRK) single-shot SS9 which causes Z1-1 to go to 0V. The 65 to 95 ms, 0V signal is inverted by current amplifier Q26 which operates into level shifter Q7. The collector of Q7 switches to 0V which turns on Q3. A -12V is thereby supplied to the motor as a reverse voltage, causing the tape supply platter to decelerate.



\* THESE SIGNALS ARE GENERATED BY RCP.

Figure 4-4. Timing Diagram, Reader Card 110801.

### 4.2.3 READER CARD 110801

This card is used (1) to generate outputs to drive the four phases of the stepping motor in response to the drive inputs, (2) and to provide amplification and gating of the read-head outputs. Refer to the Schematic Figure 8-7, sheets 1 and 2 during this discussion.

#### 4.2.3.1 Drive Circuits

Normal operations begin with the loading of the tape. Opening the Door Mechanism Assembly actuates S9. This applies 0V to pin 10 of Z12 causing Z12-8 (the Step Inhibit line, STPINH\*) to drop to its 0V active state. See Figure 8-7, sheet 1. The STPINH\* line performs four functions: (1) it clears and inhibits single-shot SS1, thereby preventing any drive signal from being recognized, (2) it clears and inhibits flip-flop FF2, thereby preventing any sprocket from being recognized, (3) it places the Data Ready (DATRDY) line at Z12-11 in the 0V state and (4) it places the System Ready (SYSRDY\*) output at J2-14 in the +5V inactive state (not ready). Note also that a 0V External Inhibit (EXTINH\*) signal applied to J2-15 will also generate these same four conditions.

After tape has been loaded, the Door Mechanism Assembly is closed and the inhibit effects of S9 are removed allowing the drive signals to be applied. During the following description, refer to Figure 4-4 which shows the waveforms and timing diagrams for the drive and step operations. This figure is intended as a guide to show the sequence of events and which signals initiate other signals. It must be cautioned that due to the wide range of pulse widths, no attempt has been made to draw the time axis to scale. Refer also to the schematic, Figure 8-7, sheet 1 during this description.

With the reader stopped on character, the sprocket signal (TP1) is +5V placing the FF2\* signal and, in turn, the Data Ready (DATRDY) signals at +5V. This indicates the reader is ready to accept the next command. Applying a 0V Drive Left (DL\*) signal at J1, pin 17, sets the direction flip-flop composed of Z8, pins 8-13, which places the CCW line at +5V. The following sequence of events occurs: DCCW\* at Z8-3 drops to 0V, DRV at Z10-6 rises to +5V DRVG\* at Z10-3 goes to 0V and because pin 2 of Z11 is tied to +5V for the -1 and -3 assemblies, the RUN\* signal at pin 3 of Z11 is 0V. In addition, the Reader Ready Line (RRDY) at Z5-10 is +5V due to both SS3\* and FF2\* being at +5V. When Z11-3 drops to 0V, single-shot SS1 is triggered producing the Reader Clock Pulse (RCP) and its inverted signal RCP\* (TP2) (approximately 1  $\mu$ s width). The RCP\* signal is used two places: (1) to trigger the two motor phase control flip-flops FF3 and FF4 and (2) to trigger the programmed voltage single-shot SS4. RCP is used to trigger the 1.5 ms single-shot SS2.

Single-shot output SS2 sets the FF2 flip-flop causing the Sprocket signal to be locked out for 1.5 ms. Since FF2\* is held at 0V, any noise or start-up jitter from the sprocket signal is prevented from generating a true Data Ready signal. At the end of the 1.5 ms period, FF2 is released. By this time, the tape is up to speed and the only signal available to reset FF2 is the positive-going sprocket signal.

Flip-flops FF3 and FF4 are gated with Z15 to energize the phase windings of the motors in the desired sequence. The order in which the windings are energized is determined by the direction line at Z9, pin 8 which places 0V at pin 13 of Z15 for drive right or +5V for drive left. Outputs FF3, FF3\*, FF4 and FF4\* are connected through Z13 in such a manner that two phase ( $\emptyset$ )\* lines are true (0V) at a time. The sequencing order for drive left is  $\emptyset$ 1\* and  $\emptyset$ 4\*,  $\emptyset$ 4\* and  $\emptyset$ 3\*,  $\emptyset$ 3\* and  $\emptyset$ 2\*, and then  $\emptyset$ 2\* and  $\emptyset$ 1\*. Drive right is the reverse order.

SS4 is a retriggerable single-shot which is timed for 15 ms. The first CP signal to trigger SS4 places SS4 at +5V and, in turn, Z13-8 at 0V. This has the effect of raising voltage VMOT from +10 Vdc to +34 Vdc. See Section 4.2.4. If SS4 is not retriggered within 15 ms, VMOT shuts down to reduce power when tape movement is not required. Output SS4\* is combined with FF2 to reproduce an end-of-tape sensor. After a drive command, if SS4 is not retriggered within 15 ms (SS4\* will go high) and if no sprocket is sensed (FF2 remains high) then the EOT\* signal at Z4-6 drops to 0V. The SYSRDY\* signal at Z4-3 then rises to the +5V inactive state, indicating that the system is not ready.

Then the tape comes back on character, the positive going sprocket signal resets FF2. The positive going output FF2\* is, in turn, used three places: (1) to trigger single-shot SS3, (2) to generate the positive going Data Ready (DATRDY) signal at pin 11 of Z12, and (3) is gated at pin 1 of Z12 along with SS3\* to hold the Reader Ready (RRDY) line in the +0V inactive state during the SS3 time period. The function of SS3 is to provide a 75  $\mu$ s time delay so that the external equipment can examine the data and make the go/no-go decision. If the decision to stop is made, the DL\* input line must be taken high within 50  $\mu$ s (actually 75  $\mu$ s but conservatively specified at 50  $\mu$ s). Otherwise, when SS3 times out, the positive going SS3\* will cause RRDY to go high, thereby generating the next CP and causing the tape to advance to the next character.

On units using the teletypesetter advanced feed hole tapes (110801-3 cards) SS5 is added. The jumper between terminals D and C is removed and jumpers between D and E and A and B are added. SS5 is a single-shot which provides a 150  $\mu$ s delay of the leading edge of the sprocket. This gives the electronic appearance of a non-advance sprocket which then resets FF2 in the manner previously described.

#### 4.2.3.2 Tape Reading Circuits

Nine photovoltaic cells in the readhead assembly sense the perforations in the tape. An illumination system consisting of a lamp and fiber optics provides a continuous beam which covers the area of the photocells. The tape is driven over the top of the photocell block and when a hole in any track appears between the photocell and the light source, the light energizes the photocell.

Each cell output is applied to the amplifier-latch circuit Q1-Q8, Z20 and Z17. Track 1 is used in the following discussion since it is typical of tracks 1-8 (the Sprocket signal is developed differently as described in a subsequent paragraph). When track 1 becomes energized, the negative going signal at the cathode of the photocell turns Q1 off. See Figure 8-7, sheet 2. Q1 is interconnected with pins 6 and 11 of Z20 in a manner which allows Q1 and the first stage of Z20 to function as a Schmitt trigger. The latching circuit follows all changes in the photocell until the Data Ready (DATRDY) signal is +5V (see Section 4.2.3.1). The +5V DATRDY signal is inverted at Z13-12 and locks up Z17 and Z20.

Track 1 output at Z20, pin 10 is +5V for a hole and is gated with the Mode Select signal at Z21, pins 9 and 10. A 0V input Mode Select input will provide mode 5 outputs at J2, pin 1, i.e., when Z21, pin 9 is 0V for the no hole condition, J2-1 will be 0V. When Z21, pin 9 is +5V for the hole condition, J2-1 will be +5V. Conversely, when the Mode Select signal is +5V (or open) and Z21, pin 9 is 0V, J2-1 will be +5V. The Data Ready Output (DATRDY OUT) is gated in the same manner as the track outputs at pins 12 and 13 of Z9.

The sprocket track is somewhat different than the other eight tracks in that its Schmitt trigger uses an inverter Q9 (sheet 1) rather than a latch. It is used to start the DATRDY signal and is not gated with the Mode Select Signal.

#### 4.2.4 POWER SUPPLY CARD 111841-1

Power Supply card 111841-1 supplies the various voltages used throughout the 6120 systems +35 VDC, +24 VDC, +5 VDC,  $\pm 12$  VDC, and VMOT. AC voltages are applied from the secondary windings of transformer T1 to the Power Supply card. See Figure 8-8. The +35 VDC is rectified from the 37.5 VRMS winding by CR5 and CR6, clamped by the 36V Zener CR11, filtered by C103 and passed through Q101 (located on the chassis). CR3 and CR4 generate the +24 VDC by rectifying the 20.4 VRMS output. It is then filtered by CR102 which is located on the chassis and applied to J109, pins 1-3. R1 and CR2 provide a discharge path for C102 when the POWER switch S1 is turned off and R4 and CR1 provide the discharge path for C103.

Diodes CR7 and CR8 rectify the 11 VRMS output which is filtered by R3 and C3 and applied to pin 1 of the five volt regulators Z1 and Z2 (an LM309K). R7 and R5 are in the ground paths of Z1 and Z2 and provide the adjustment for the +5V logic level output. Four diodes CR12-CR15 form a full bridge rectifier for the 12 VRM windings to generate the unregulated +12V and -12V.

CR9 and CR10 rectify the 75 VRMS from the transformer to produce approximately 52 VDC unregulated at the output of the filter network composed of C104 and R6. This voltage is applied to the collectors of the series pass darlington transistor Q102 (located on the heat sink assembly 111838-2) and to a constant current source comprised of Q1 and its bias network (located on the Power Supply card). Q1 on the card supplies the base drive (VMOT CONT) for Q102. Control of the pass transistor is achieved by shunting some of the current from Q1 through Q2 instead of allowing it to reach the base of the pass transistor, Q101. A resistive divider network composed of R14 - R16 applies a voltage proportional to VMOT to the base of Q2. Q2 compares this voltage to the 6.2 volts developed by Zener diode CR21 and shunts more or less of the pass transistor's base current as required to maintain VMOT constant.

When the step motor is stepping, the junction of R16 and R18 is held at ground potential by the VPRGM line and VMOT is set by R15 for approximately +34 VDC. During periods when the motor is stopped for longer than 15 ms, VPRGM appears as an open circuit and allows current to flow through R18 to 0V. This change in the divider network forces VMOT to regulate at approximately 1/3 of the running potential, thereby reducing motor dissipation during periods of inactivity.

#### 4.3 RPM 612X PUNCH MECHANISM

The operation and maintenance of the RPM612X Punch Mechanism is described in a separate manual. The RPM 612X consists of punch head, punch pin drive linkage, solenoids, stepper motor, tape guide and pathways. The three windings of the stepper motor control the movement of the tape and their energizing sequence determines the direction of movement. See the description of the punch control logic as described in Section 4.2.1.1 for the Perforator Logic Card. The solenoids are operated from Q8-Q25 along with suppression diodes CR5 and CR13 all of which are mounted on the Perforator Driver Card. Zener diode CR14 is used to speed the suppression process. Each solenoid is fused with a 2A, 250V fuse. These fuses are mounted on the Perforator Driver Card.

#### 4.4 LIGHT SOURCE

A filament type lamp rated at 5.0 VDC is used as the light source. It is operated at approximately 15% below rated voltage to provide a long life expectancy. The lamp is mounted in a sleeve at the rear of the front panel. A lens contained in the lamp focuses the light to the fiber optics system which, in turn, conducts the light to the photocells.

## SECTION V

### MAINTENANCE

#### 5.1 GENERAL

The REMEX tape perforator/reader systems are designed to keep maintenance as a simple and infrequent as possible. Table 5-1 lists the maintenance equipment required for the various procedures. To prolong the life of the equipment and minimize downtime, certain checks and preventive procedures are set up in Section 5.2 and 5.3 and Table 5-2 with suggested schedules. Section 5.4 outlines possible malfunctions along with probable cause and remedies. The remaining sections describe the required adjustment procedures. Replacement procedures are given in Section 6.

Table 5-1. Maintenance Equipment Required

Extended Board, REMEX Part Number 111041	1
Extractor Tool ( for pin removal on Amp plastic connectors) Amp 45447-1, REMEX P/N 716056-113	1
* Flexible Feeler Gauge, 0.010 to 0.011 inch or three pieces of 3.7 mil mylar tape stapled together. Plastic shim stock is available from the Artus Corp. Englewood, N.J. 07631	1
* Frequency Counter, 10 Hz to 10 MHz, 5V input	1
Miller-Stephenson MS-200 Magnetic Tape Head Cleaner (REMEM Part Number 716004-150)	1
* Pulse Generator, 10 Hz to 1MHz, up to +5V amplitude, 1 $\mu$ s to 100 ms width	1
* Oil, non-detergent, SAE-10	-
* Oscilloscope, DC to 10 MHz, single sweep	1
Spring Scale, 1 lb.	1
* Voltmeter, Digital, 0-0.1 ma, 0-100 m V dc, 0-100V dc, 100K impedance or greater	1

\* Not available from REMEX

#### 5.2 PREVENTIVE MAINTENANCE, PERFORATOR SECTION

Preventive maintenance, which includes inspection, cleaning and lubrication, should be done as described in Sections 5.2.1 through 5.2.3 in order to maintain peak performance. In addition, in order that the warranty remain in effect, the unit must be maintained in accordance with instructions outlined below (see Section 1.3 and page iii).

A preventive maintenance schedule and log are presented in Table 5-2 which indicates the item, frequency of action, and references the maintenance paragraph. For customer convenience the table is arranged so that a log can be kept of when each maintenance procedure was performed. Periodic service is determined by the number of rolls of tape punched (1000 ft. rolls). See Section 5.3 for preventive maintenance of the reader section.

#### NOTE

The frequency of service as listed in Table 5-2 has been adopted for clean environmental conditions and usage. These intervals, however, may vary from one installation to another. The punching of oiled paper tapes may increase the frequency of service. See the note in Section 5.2.1.

Table 5-2 gives the Preventive Maintenance Schedule for only the tape supply and take-up portion of the perforator system. Preventive maintenance and adjustment procedures for the RPM 6120 Punch are given in REMEX Technical Manual for the RPM 6120 Punch and must also be followed.

### 5.2.1 100 ROLL SERVICE

Preventive maintenance after every one hundred (100) rolls of tape consists of dust removal from the punch, a functional check and lubrication when used with certain types of tape. See the REMEX RPM 6120 Technical Manual for the details of the 100 roll service for the punch mechanism.

#### NOTE

When punching oiled paper tapes, more frequent dust removal is necessary since the dust and oil mixture will tend to adhere to the punch parts and may affect registration.

#### 5.2.1.1 Functional Check

The following items should be checked for the proper operation after every 100 rolls of tape:

- a. Check each of the front panel control switches to see that they perform the functions outlined in Table 3-2.
- b. Check each data line to verify that the appropriate track is punched when the data input line is in the true condition as described in Section 3.3.3.
- c. Verify the proper operation of Asynchronous Reverse Operation as described in Section 3.3.4.
- d. Verify the presence of the Punch Ready and (Punch Systems Ready)\* outputs at J1, pins 12 and 13, as described in Table 3-1.
- e. Check for proper hole registration as shown in Figure 1-6.

Table 5-2. Preventive Maintenance Schedule and Log, Perforator Section

Frequency, Rolls of Tape	Date	Initial	Frequency, Rolls of Tape	Date	Initial	100 Roll Service		700 Roll Service									
						5.2.1	5.2.1.1	5.2.2.1	5.2.2.2	5.2.2.3	5.2.2.4	5.2.2.4.1	5.2.2.4.2	5.2.2.4.3	5.2.2.4.4		
100			800			X	X										
200			900			X	X										
300			1000			X	X										
400			1100			X	X										
500			1200			X	X										
600			1300			X	X										
700			1400			X	X	X	X	X	X	X	X	X	X	X	X



## 5.2.2 700 ROLL SERVICE

Preventive maintenance after every 700 rolls of tape consists of those items outlined in Section 5.2.1 and those items called out after 700 rolls in the REMEX Technical Manual for the RPM 6120 Punch Manual. In addition, a check of those items listed in Section 5.2.2.1 through 5.2.2.5 is required.

### 5.2.2.1 Bearing Checks (RAB, RAR Units Only)

The bearings in the following areas should be checked and replaced if required:

- a. Supply Platter
- b. Tape Low Sensor Arm
- c. Tape Guide Rollers
- d. Supply Tension Arm

### 5.2.2.2 Control Logic

Check the adjustments on the control logic circuitry as described in Section 5.5.2. Line voltage should be set a nominal value for the voltage being used, not the  $\pm 10\%$  tolerance levels.

### 5.2.2.3 Power Supply Voltages

Measure and record all voltages listed in Table 5-3 with a voltmeter. All test points are located on the Power Supply Card. A change in voltage may be indicative of a gradual component failure. Before taking any measurements, allow a short period of time for warm up after turning on power. The +28V measurement should be made while punching all holes. The section describing each voltage adjustment is listed in the Table. All voltages given are with AC at nominal value for the voltage being used; not the  $\pm 10\%$  tolerance levels.



Care should be taken not to short the probe to the chassis when measuring the test points on the power supply card.

Table 5-3. Power Supply Voltage Measurements on Power Supply Card

Voltage	Measure		Pot Adjustment	Procedure Section
	From	To		
$-12 \pm 2.4$ VDC	TP2	TP1	-	-
$+12 \pm 2.4$ VDC	TP3	TP1	-	-
$+34 \pm 2$ V	TP5	TP1	-	-
$+28 \pm 3$ VDC	TP4	TP1	-	-
$+5.20 \pm 0.05$ VDC	TP6	TP1	R 7	5.5.3
4.3 - 4.7 VDC (Lamp Voltage)	TP7	TP1	R 5	5.6
VMOT	TP8	TP1	R 15	5.7

#### 5.2.2.4 Supply Deck Checks (RAB and RAR Units Only)

Sections 5.2.2.4.1 through 5.2.2.4.4 describe the areas of the supply deck which should be checked after every 700 rolls of tape.

##### 5.2.2.4.1 Tape Tension Arm

Measure the tension on the supply take-up arm. With the arm at the center of its travel area, the tension on the arm should be 1 to 2 ounces when measured at the tape roller. If this is not the case, replace the spring.

##### 5.2.2.4.2 Tape Low Switch Actuation

Measure the distance from inside edge of the tape low sensing arm to the hub at the point when the PERF STATUS lamp lights (S8 actuated). This distance should be  $5/16" \pm 1/32"$ . If this is not the case, perform Section 5.5.5.1.

##### 5.2.2.4.3 Supply Switch S6

Rotate the tape arm clockwise toward the rear bumper. S6 should deactuate when rear edge of the arm is  $0.20" \pm 0.02"$  from the rear bumper (tight tape position). If the switch does not operate as described, perform Section 5.5.5.2.

5.2.2.4.4 Supply Error Switch, S7

Rotate the tape arm clockwise toward the rear bumper. S7 should actuate when the arm is 0.40" ± 0.02" from the stop. If the switch does not operate as described, perform Section 5.5.5.2.

5.3 PREVENTIVE MAINTENANCE, READER SECTION

Preventive maintenance, which includes cleaning, should be checked periodically in order to maintain peak performance. In addition, in order that the warranty remain in effect, the unit must be maintained in accordance with the instructions outlined below (see Section 1.3 and page iii). A preventive maintenance schedule and log are presented in Table 5-4 which indicates the item, frequency of action and references the maintenance paragraph in this section. For customer convenience, the table is arranged so that a log can be kept of when each maintenance procedure was performed. Also refer to Section 3.6, Operational Maintenance.

NOTE

The frequency of cleaning as listed in Table 5-4 has been adopted for clean environmental conditions and usage. These times, however, may vary greatly from one installation to another. For example, a reader used in a machine shop to program numerical controls may require maintenance procedures considerably more frequently.

5.3.1 CLEANING



In all cleaning procedures, avoid using cleaning methods and materials other than those recommended in this manual. Certain cleaning compounds will damage parts of the reader, especially in the readout assembly area. REMEX primarily recommends the use of Miller-Stephenson MS-200 Magnetic Tape Head Cleaner (REMEX Part No. 716004-150) for most areas requiring cleaning. However, due to the degreasing nature of the cleaner, it should not be used in areas where the spray may come in contact with bearings or other oiled parts. This cleaner may be obtained from REMEX or directly from Miller-Stephenson Chemical Company at one of the following locations.

1001 East First Street  
Los Angeles, California  
90012

1350 West Fullerton Avenue  
Chicago, Illinois 60614

Route 7  
Danbury, Connecticut 06810

To use the cleaner, hold the spray can 4 to 6 inches from the area to be cleaned and allow spray to flush the dirt off. If a heavy buildup is present, loosen with the spray mist and scrub with a cotton swab. A 6-inch pin-point, spray nozzle extension is available for hard-to-reach areas or for delicate applications. Avoid spraying on lubricated surfaces or parts.

If the Miller-Stephenson cleaner is not available, a small amount of isopropyl alcohol applied to a clean, lint-free cloth or cotton swab may also be used. However, it should be used carefully and sparingly since damage to the photocell and the finish on the plastic covers may result. Use only clear, unadulterated isopropyl alcohol. Do not use ethyl alcohol or denatured alcohol as the denaturing agents vary and may damage reader.

### **CAUTION**

It is important that, whether the MS-200 cleaner or the isopropyl alcohol is used, only the amount required to clean the surfaces be applied. Never saturate or drench the areas to be cleaned. Never apply these materials to the lamp assembly.

#### 5.3.1.1 Readhead Assembly Cleaning

The top surface of the readhead assembly should be cleaned every two weeks (for most installations having clean environments; dirtier environments which contain dust, oil and sprays, such as machining areas, may require cleaning as much as every eight hours). Cleaning is extremely important because any dirt or foreign material in this area can create errors in readout. Use the bristle brush supplied or the cleaning materials and methods described in Section 5.3.1 and clean the surfaces of the readhead assembly and the upper tape guide assembly. Care should be exercised so that no residue remains from the recommended cleaning materials when the cleaning operation is completed.

#### 5.3.1.2 Sprocket Cleaning

The sprocket wheel should be checked for cleanliness every two weeks. Depending upon tape conditions, accumulations may build up on the sprocket and be transferred to the sprocket holes in the tape which may cause readout errors. Use the recommended cleaning materials described in the caution in Section 5.3.1. Care should be taken so that the alignment of the sprocket wheel is not disturbed. If the sprocket wheel requires adjustment, refer to Section 5.7.

#### 5.3.1.3 Tape Inspection

Repeated handling and usage of the tape leads to a build up of grease, oil and dirt on the tape. When the build up becomes excessive, this material will become lodged in the tape transport areas and could cause tape reading errors. To prevent this, the tape should be thoroughly inspected every two weeks and repunched if required.

#### 5.3.1.4 General Cleaning

The entire reader should be cleaned every year. Use the following procedure:

Using the bristle supplied with the unit and/or low pressure compressed air, remove all dust and dirt, paying particular attention to all moving parts. Use the recommended materials described in the caution in Section 5.3.1 to remove any grease or other accumulations. When cleaning, use care not to damage components on the circuit board.

#### 5.3.2 LUBRICATION

All points of rotation on the system have permanently lubricated bearings and should not require lubrication for the life of the part. The mechanism requires lubrication as described in the manual for that unit.

#### 5.4 TROUBLE-SHOOTING

Trouble-shooting is presented in the form of a chart, Table 5-5, which should be consulted whenever the performance of the system is unsatisfactory. The chart is divided into three columns: Indication – the way in which the malfunction became evident, Probable Cause – the possible reason or reasons for the malfunction, and Remedy – the manner in which the malfunction may be corrected.

### **CAUTION**

When operating the unit either in the rack or on a test bench, make sure it is elevated sufficiently such that the intake air flow through the fan at the bottom of the unit is not restricted. Damage to the unit, especially the punch, will result if sufficient cooling by the fan is impeded. Note also that the fan is attached to the power supply assembly. Thus, when the power supply is removed the source of cooling for the punch mechanism is also removed.

#### 5.5 ADJUSTMENTS, PERFORATOR SECTION

##### 5.5.1 GENERAL

Proper operation depends upon making and maintaining accurate adjustments. Although all adjustments are made at the factory, the following adjustments should be checked periodically (refer to Section 5.2 and Table 5-2) and should be performed when the perforator performance is unsatisfactory or when certain assemblies are replaced. Adjustments of the punch are covered in the REMEX Technical Manual for the RPM6120.

Table 5-4. Preventive Maintenance Schedule and Log, Reader Section

112670-052A

Frequency* Of Action Weeks	Date	Initial	Frequency* Of Action Weeks	Date	Initial	5.3.1.1			5.3.1.2			5.3.1.3			5.3.1.4			5.3.3			5.6			5.7			
						Cleaning			Check Adjustments																		
2			28			X	X	X																			
4			30			X	X	X																			
6			32			X	X	X																			
8			34			X	X	X																			
10			36			X	X	X																			
12			38			X	X	X																			
14			40			X	X	X		X	X	X															
16			42			X	X	X																			
18			44			X	X	X																			
20			46			X	X	X																			
22			48			X	X	X																			
24			50			X	X	X																			
26						X	X	X		X	X	X															
			52			X	X	X	X	X	X	X															

\*See Note on page 5-6..

Table 5-5. Trouble Shooting Chart

Indication	Probable Cause	Remedy
1. Tape does not punch.	1. AC power not present.	1. Check to see if ac power cord is plugged in.
	2. Fuse faulty.	1. Check fuse F1 and replace if blown.
		2. Check fuses F1 through F9 on Perforator Driver Card and replace if faulty.
	3. Switch S1 faulty.	1. Check switch S1 and replace if faulty.
	4. Tape Error present.	1. Check for presence of tape error at J1, pin 20. If present, correct supply error problem.
	5. +28V not present.	1. Check T1 and CR3 and CR4 on power supply card for proper operation.
6. +5V not present or not properly adjusted.	1. Check for presence +5VDC at TP6 on Power Supply Card. Readjust as described in Section 5.5.3. If not present, check the following for proper operation: T1 for 11 V RMS, CR7, CR8, C3, R3, R7, R8, CR19 or Z1 on Power Supply Card.	
2. Tape punches but does not feed.	1. Perforator logic card faulty.	1. Check operation of card for presence and proper sequencing of $\phi 1$ , $\phi 2$ , and $\phi 3$ outputs. Replace card if outputs are not correct.
	2. Drive Motor Malfunction	1. Check operation of drive motor for proper operation.
	3. +35V not present.	1. Check the following components on the Power Supply Card for proper operation: CR5, CR6, CR11, C5, C4, R2. Also check Q101 on the heat sink and T1.
	4. Voltage Doubler on Perforator Driver faulty.	1. Check the Voltage Doubler circuitry on the Perforator Driver Card.

Table 5-5. Trouble Shooting Chart (Continued)

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Indication	Probable Cause	Remedy
3. Tape feeds but does punch any data holes.	1. Data Input signals not present at input or improperly timed.	1. Check to see that data inputs are present and of correct timing. See Section 3.3.3.
	2. Perforator Logic card faulty; no Punch Clock signal.	1. Check Z6, pin 8 on Perforator Logic Card for negative going PCHCLK* signal. If not present, replace card.
		2. Check Z15, pin 12 on Perforator Logic card for positive going DATST. If not present, replace card.
4. No feed holes being punched. Data holes ok.	1. Perforator Logic	1. Check for presence of PFSDR output at Z15-8 on Perforator Logic card. Replace card if output is not present.
		2. Check operation of Q7 and Q8 on Perforator Driver card for proper operation and replace if faulty.
	2. Punch Solenoid or fuse faulty.	1. Check feed hole solenoid on punch and replace if faulty. Refer to Punch Mechanism Manual.
		2. Check fuse F1 on Perforator Driver Card and replace if faulty.
5. One data track not being punched when true input signal is present.	1. Perforator Logic card faulty.	1. Check associated output on Perforator Logic card for positive active signal when Data and Data Clock are present. If output not present, replace card.
	2. Perforator Driver Card faulty.	1. Check appropriate drive circuitry on Perforator Driver and replace if faulty.
	3. Punch Solenoid or fuse faulty.	1. Check appropriate solenoid on punch and replace if faulty. Check fuse on Perforator Driver Card.
	4. Card connector contacts dirty.	1. Clean connector contact.



Table 5-5. Trouble Shooting Chart (Continued)

Indication	Probable Cause	Remedy
6. Punched holes incomplete or ragged.	1. Timing improperly adjusted.	1. Adjust control logic timing as described in Section 5.5.2.
7. Supply reel unwinds too much tape; Supply switch actuates (RAB and RAR units)	1. Servo faulty	1. Check servo on Perforator Driver Card and replace card if faulty.
	2. Brake circuitry faulty.	1. Check brake circuitry on Perforator Driver card and replace if faulty.
	3. S6 malfunction.	1. Check for proper operation of S6 as described in Section 5.5.5.2.
8. No low tape indication when tape supply is low.	1. PERF STATUS light burned out.	1. Check PERF STATUS lamp and replace if burned out.
	2. Tape Low Switch Actuator misadjusted.	1. Adjust Tape Low Switch Actuator as described in Section 5.5.5.1.
	3. Switch S8 faulty.	1. Check S8 for proper operation and replace if faulty.
9. Tape FEED/DELETE Switch, S3, depressed, tape does not feed.	1. Switch S3 faulty.	1. Check switch S3 for proper operation and presence of OV at J8, pin 2, when switch is in FEED position or OV at J8, pin 1, when switch is in DELETE position.
	2. Perforator Logic card faulty.	1. Check operation of Z5, Z10 and Z15 on card and replace if faulty.
10. Tape FEED/DELETE switch, S3, in FEED position, Tape feeds, data tracks not inhibited.	1. PCHCLK* not inhibited.	1. Check for presence of OV at pin 8 of Z6 during punch cycle. If present, replace Perforator Logic card.
11. Same data line repunched on next line with new data present at input.	1. Perforator Logic card faulty.	1. Check for presence of positive going DATST signal at Z15, pin 18. If not present, replace Perforator Logic card.
		2. Check for proper operation of data latches Z13 and Z18.

Table 5-5. Trouble Shooting Chart (Continued)

Indication	Probable Cause	Remedy
12. Punch advances tape in one direction only.	1. Proper Direction Signal not present.	1. Check for presence of proper direction input signal as listed in Table 3-1.
	2. Perforator Logic card faulty.	1. If proper input is present, replace Perforator Logic card.
13. Wrong data being punched (more than one hole).	1. Perforator Logic card faulty.	1. Check for proper inputs at J1, pins 1-8. If correct inputs are present, replace Perforator Logic card.
	2. Data inputs not stable before Punch Command is issued.	2. Check operating instructions, Sections 3.3.3 and 3.3.4.
14. Holes being punched instead of no holes and no holes punched where holes are required.	1. Input mode not compatible.	1. Check inputs to see if they conform to the input mode selected at J1-14.
15. Short registration or double punching.	1. Punch mechanism faulty.	1. Check trouble shooting chart in punch manual.
	2. Incorrect control logic timing.	1. Check adjustments in Section 5.5.2.
	3. Punch pins sticking.	1. Lubricate punch per instruments in the RPM6120 manual.
16. No track outputs on any track.	1. Readhead dirty	Clean Readhead Assembly as described in Section 5.3.1.1.
	2. Fiber Optics Light misaligned	Check alignment of the Lamp Source as described in Section 5.7.
17. Outputs present on all but one track or one track intermittent.	1. Readhead dirty	Clean Readhead Assembly as described in Section 5.3.1.1.
	2. Defective Photocell	Check the output of the Readhead assembly as described in Section 5.7 and replace if defective as described in Section 6.7.
	3. Defective component on Reader Card	Check the components and IC modules associated with the particular track output. Refer to Tape Reading Circuit description, Section 4.2.3.2.

Table 5-5. Troubleshooting Chart (Continued)

Indication	Probable Cause	Remedy
18. Track output present with no hole punched in tape.	1. Tape transmissivity	Tape must have a transmissivity of 57% or less as specified in Table 1-2.
	2. Defective Photocell	Check the output of the Readhead assembly as described in Section 5.7 and replace if defective as described in Section 6.7.
	3. Defective component on Reader card	Check the components and IC modules associated with the particular track output. Refer to Tape Reading Circuit description, Section 4.2.3.2.
19. Window closed, POWER switch is ON, correct drive signals present; tape does not move.	1. POWER switch, S1, defective	Check switch S1 and replace if defective as described in Section 6.11.
	2. RUN-LOAD switch, S9, defective	Check switch S9 and replace if defective as described in Section 6.12.
	3. Defective component on reader card	Check operation of Reader card. Refer to description of Driver Circuits, Section 4.2.3.1.
	4. Step Motor defective	Check $\phi 1$ thru $\phi 4$ outputs from Reader card to see if they are present. If so, replace stepper motor as described in Sec. 6.9.
20. Tape does not stop on character	1. Improper reader alignment	Perform Section 5.7
	2. Defective component on Reader card	Check operation of Reader card. Refer to description of Driver Circuits, Section 4.2.3.1.
21. POWER switch ON; lamp does not turn on, no DC voltages	1. No AC power	Make sure AC power cord is plugged into outlet.
	2. Fuse F1 blown	Check fuse and replace if required.
	3. POWER switch, S1 defective	Check switch S1 and replace if defective as described in Section 6.11.
	4. Power Supply defective	Check Reader card for proper operation of +5V power supply. See Power Supply description, Section 4.2.4.
	5. Defective Transformer, T1	Check T1 and replace if faulty as described in Section 6.10.

Table 5-5. Troubleshooting Chart (Continued)

Indication	Probable Cause	Remedy
22. Continuous tape speed less than 300 characters/second	1. Tape out of registration	Check tape registration to make sure tape conforms to specifications as described in Section 3.7.
	2. Sprocket out of rotational alignment	Check alignment of reader as described in Section 5.7.
	3. Defective component on Reader card	Check Reader card for proper operation of drive circuits and single shot timings. See Drive Circuit Discussion, Section 4.2.3.1 and timing diagram, Figure 4-4.
23. Irregular movement of tape	1. Drive system improperly adjusted	Perform Reader alignment as described in Section 5.7.
	2. Sprocket wheel bent or worn	Replace sprocket wheel as described in Section 6.9.
	3. Tape guide assembly worn	Replace tape guide assembly
24. +5V supply voltage too low or too high	1. Defective regulator	Check operation of Z1 or power supply card and replace if required.
	2. T1 malfunction	Check for presence of 11 VRMS across the red and grey terminals of T1. Replace T1 if not present.

## 5.5.2 PERFORATOR LOGIC TIMING ADJUSTMENTS

The following single-shot adjustments on the Perforator Logic card control the punching cycle and are required any time the Perforator Logic card or punch is replaced. This procedure is to be performed with a nominal line voltage of 115 VAC or that voltage on which the transformer is set to run; not the 10% high or low tolerance. See Figure 5-1 for location of potentiometers and test points. Figure 4-3 shows the timing relationship of these signals.

- a. Install a roll of tape (RAR, RAB units) or a box of fan folded tape (RAF units) of the type to be used and thread it through the system. See Section 3.3.1.
- b. Perform Section 5.5.3. It is important that the +5V Power Supply be adjusted before finishing this procedure.
- c. Place the FEED/DELETE switch in the DELETE position. The remaining steps are to be performed with a nominal line voltage of 115 VAC (or that voltage on which the transformer is set to run; not the 10% high or low tolerance). The remaining procedure is performed while punching a delete (all hole pattern).
- d. Observe the positive pulse at TP1 and adjust R18 for pulse width of  $4.1 \pm 0.1$  msec. Ground can be picked up at J1, pins 18, 23 or 25.
- e. Place the scope probe at TP6 and adjust R21 for pulse width of  $4.1 \pm 0.1$  msec.
- f. Measure the solenoid dc voltage from TP4 to TP1 on the Power Supply Card.
- g. Place the scope probe at TB2 on the Perforator Logic Card and adjust R17 for a negative pulse as given in Table 5-6 depending upon the solenoid dc voltage measured in step f.
- h. Place the scope probe at TP4 and adjust R20 for a positive going pulse of  $1.0 \pm 0.2$  ms.
- i. Place the scope probe at TP5 and adjust R19 for a positive going pulse of  $1.0 \pm 0.2$  ms.
- j. Continue punching approximately 50 feet with all holes after steps d through h have been performed. Check punching performance at line voltages of 105 VAC and 125 VAC. Be sure holes are cleanly punched without ragged edges or elongation and that complete penetration is occurring. Repeat for each data channel punching alone at 10 cps and 120 cps.

Table 5-6. Solenoid D.C. Voltage vs Single-Shot Pulse Width

Solenoid Voltage	One Shot Time, ms +0.00 - 0.05	Solenoid Voltage	One Shot Time, ms +0.00 - 0.05
24	2.00	27	1.75
25	1.90	28	1.67
26	1.80		

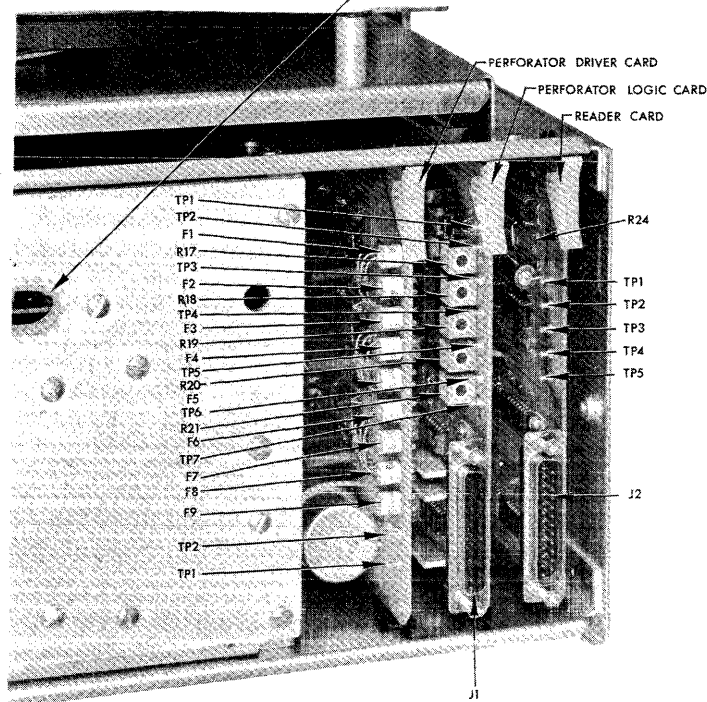
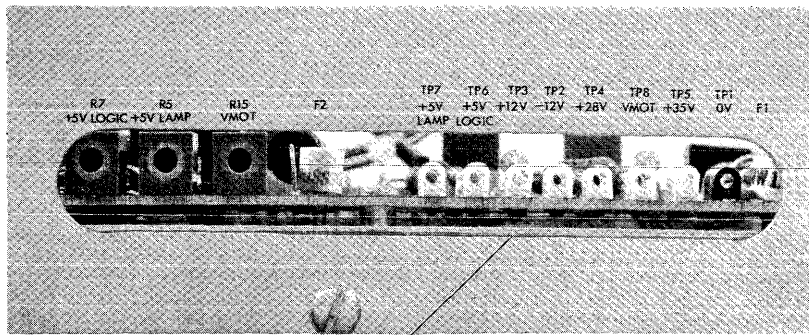


Figure 5-1. Location of Circuit Card Potentiometers and Test Points

### 5.5.3 +5V POWER SUPPLY

The following procedure describes the adjustment of the +5V power supply:

- a. Place the POWER switch into the ON position.
- b. Place a digital voltmeter across TP6 and TP1 on the Power Supply card.
- c. Adjust R7 until the meter reads  $+5.2 \pm 0.05$  VDC. Note: Circuit cards have noise filters that result in +5.0 VDC in circuits.
- d. Remove the meter leads.
- e. If the Power Supply card is ever replaced, the logic +5V must be adjusted prior to installing the other cards.

#### 5.5.4 SUPPLY DECK ADJUSTMENTS (RAR and RAB UNITS ONLY)

The following adjustments are required to insure proper mechanical operation of the supply deck.

##### 5.5.4.1 Tape Low Switch Actuator (RAR and RAB Units Only)

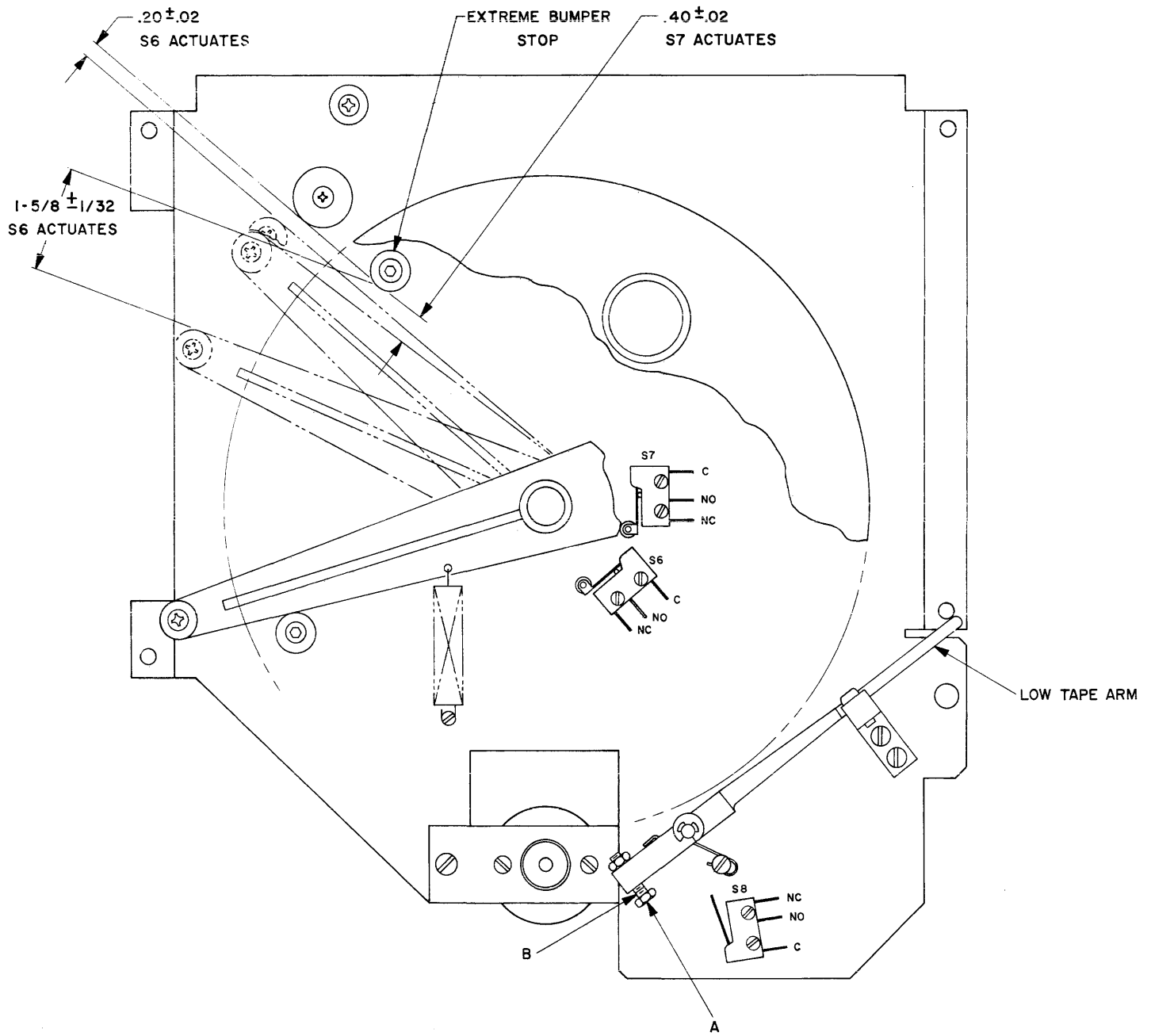
The adjustment of the tape low switch S8 actuator is performed as follows: All items in parenthesis refer to the items in Figure 5-2.

- a. Remove all power from the system by disconnecting P1, P2 and the power cord.
- b. Remove any tape from the deck assembly.
- c. Place an ohmmeter across the NO and C contacts of switch S8.
- d. Move the low tape arm in toward the hub and note the distance at which the switch actuates (meter read zero ohms). This distance should be  $5/16" \pm 1/32"$  from the hub.
- e. If it is not, loosen nut (A) and rotate screw (B) until S8 actuates at the distance specified in step d.
- f. Remove the ohmmeter.

##### 5.5.4.2 Supply Servo Switch S6 and Supply Error Switch S7 Adjustment (RAR and RAB Units Only)

The following procedure describes the adjustment of the servo supply switch, S6, and the supply error switch S7.

- a. Remove all power and control signals from the system by disconnecting P1, P2 and the power cord.
- b. Remove any tape from the deck assembly.
- c. Remove the set screw which holds the supply platter to the shaft. Remove the supply platter. Be careful not to lose the ball bearing in the shaft hole in the platter.
- d. Attach an ohmmeter across the NO and C contacts of S6. The ohmmeter should read infinite ohms (switch deactuated) with the arm in its extreme counterclockwise position.
- e. Rotate the arm clockwise toward its extreme bumper stop. S6 should actuate (ohmmeter reads zero ohms) when the edge of the arm nearest the bumper is  $1-5/8"$ . Continue rotating the arm clockwise to the extreme bumper and then back off. S6 should again actuate when the edge of the arm nearest the bumper is  $0.20 \pm 0.02$  inch from the bumper. If either or both of these conditions do not exist, loosen the screws which hold S6 and adjust S6 until these conditions are present.
- f. Attach the ohmmeter across the C and NO contacts of S7. The ohmmeter should read infinite ohms (switch deactuated) with the arm in its extreme counterclockwise position.



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Figure 5-2. Supply Deck Adjustments



- g. Rotate the arm clockwise toward its extreme bumper stop. S7 should actuate (ohmmeter reads zero ohms) when the edge of the arm nearest the bumper is  $0.40 \pm 0.02$  inch from the bumper. Rotate the arm counter-clockwise to its extreme bumper position. S7 should actuate when the edge of the arm nearest the bumper is  $1/8$ -inch from the bumper. If either or both of these conditions do not exist, loosen the screws which hold S7 and adjust S7 until these conditions are present.
- h. Replace the supply platter. It may be necessary to slightly push the drive roller away from the platter area to reinstall the platter.
- i. Perform the reverse of step a.

## 5.6 READER LAMP VOLTAGE ADJUSTMENT

The following procedure should be used when adjusting the reader lamp voltage:

- a. Place the POWER switch to its on position. The reader lamp should come on.
- b. Place a digital voltmeter across TP7 and TP1 on the Power Supply card.
- c. Adjust R5 until the meter reads +4.3 Vdc. See note below.
- d. Remove the meter leads.

### NOTE

The reader lamp voltage may require further adjustment to increase the cell outputs. See Section 5.7, step q. Do not increase the voltage at any time above 4.7 VDC.

## 5.7 READER ALIGNMENT

Proper operation depends upon making and maintaining accurate adjustments. Although all adjustments are made at the factory, the following adjustments should be checked periodically (refer to Table 5-4) and should be performed only when the tape reader performance is unsatisfactory or when any of the following items is replaced: distributor, readhead assembly, upper tape guide assembly, mechanism assembly, sprocket, step motor or circuit card. Letter designations in parenthesis refer to items called out in Figure 7-1.

Improper adjustment of this procedure will result in one or both of the following problems: (1) Reading errors, especially in computer applications and (2) Restriction of the tape tolerances capable of being read, i.e., either long or short tolerance tapes, not the  $\pm 0.025$  inch in either direction as specified in Section 3.7.

### **CAUTION**

This is a factory set adjustment and should not require readjustment unless one of the aforementioned components has been replaced or the reader performance is unsatisfactory.

- a. Remove all power and control signals by disconnecting P1, P2 and the power cord plug.
- b. Remove the Upper Cover Assembly (1) by loosening the two 6-32 binder head screws (A), flat and lock washers at the rear of the reader panel.
- c. Remove the Reader Panel Assembly from the Front Panel Assembly. Leave the cables attached to the unit. See Section 6.13. The Reader Panel Assembly should be moved out far enough to allow access the various items at the rear.

### **CAUTION**

The procedure outlined in steps d through k should not be performed unless the readhead assembly, mechanism assembly, sprocket or step motor has been replaced or the reader performance is unsatisfactory. Prior to adjustment, steps d, f, g and h should be checked and corrective steps e and/or i, j, k and l performed only if necessary.

- d. Remove the Upper Tape Guide. Check the clearance between the readhead housing tape riding surface and the sprocket perimeter high point by placing the end of a small steel rule on the surface and rock the sprocket in both directions. See Figures 5-3 and 5-4. Observe that the perimeter high point clears the steel rule by a few thousandths of an inch and no more than 0.007 max. If the sprocket is not positioned, as described perform step e.
- e. If the conditions of step d do not exist, loosen two screws (D) which hold the motor heat sink to the panel. Adjust the height of the motor so that the conditions in step d exist. Tighten screws (D). On some units it may also be necessary to loosen the four 8-32 socket head screws (B) at the rear of the panel which hold the Mechanism Assembly to the Front Panel and move the Mechanism Assembly to achieve the required setting. This should only be attempted if the adjustment cannot be made with the motor only. Tighten screws (B) if required. Check the conditions in step d again and perform step e as required.

### **WARNING**

If the motor has been running for a period of time, it or the heat sink may be too hot to touch comfortably. Allow sufficient time for the motor and heat sink to cool before any adjustment or use a cloth or pair of gloves.

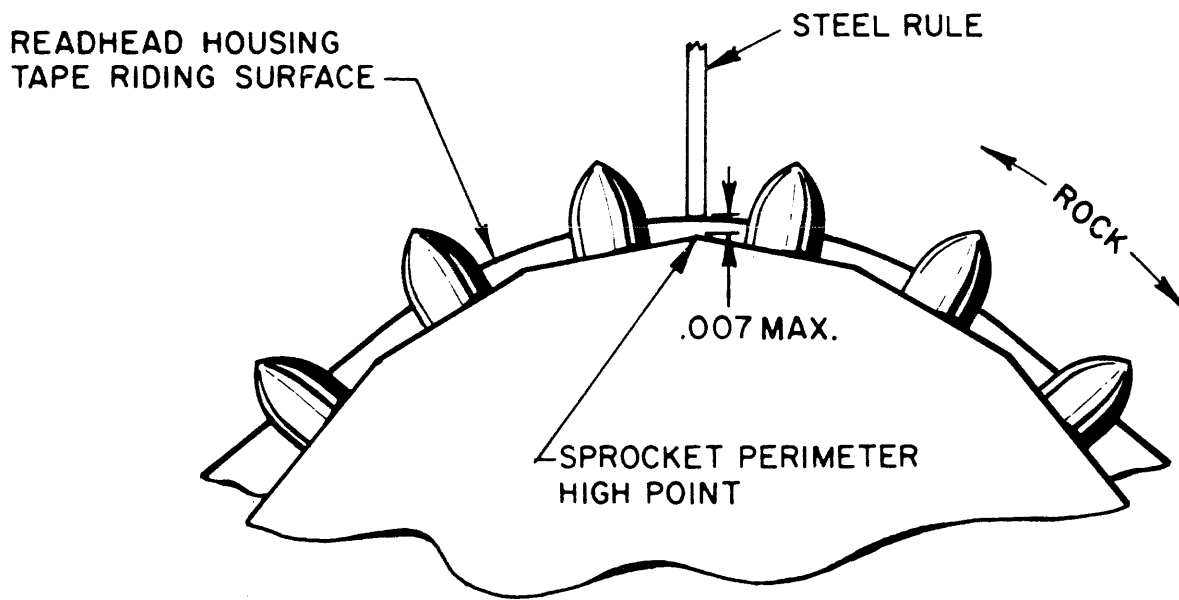


Figure 5-3. Sprocket Relation to the Tape Riding Surface.



Figure 5-4. Checking the Sprocket in Relation to Tape Riding Surface.

- f. Insert a loop of tape known to have been punched to within  $\pm 0.0025$  inch in a 5-inch span (0.05% error).

#### NOTE

Since repeatability of the feedhole placement in either direction is essential, a tape whose accumulated error in a 5-inch span is considerably better than  $\pm 0.025$  inches (as specified in Section 3.6) must be used in this procedure. Remex specifies a tape known to be punched to within  $\pm 0.0025$  inch in a 5-inch span ( $\pm 0.05\%$  tolerance). Note that most Remex punches are specified at  $\pm 0.025$  and therefore these tapes should not be used for this adjustment unless the tape has been checked on a registration gauge and found to be within  $\pm 0.0025$  inch.

- g. Loosen nut (T) which holds the fiber optics light source to the reader panel and rotate the light source away from the light tunnels.
- h. With the rear edge of the tape parallel to the front panel, align the holes over the light columns in the readout assembly so that they are concentric. See Figure 5-5. The tape must remain parallel to the front panel so that no skew is present. With the tape in this position, the sprocket teeth should be centered in the sprocket holes in the tape. Skewing is indicated by tracks 1 and 8 not being concentric.
- i. If the conditions of step h do not exist, loosen the two set screws (J) which hold the sprocket to the motor shaft move the sprocket in or out on the shaft until the teeth are centered in the feed holes and the tape holes remain concentric with the light tunnels. Tighten screws (J). Recheck the adjustment and readjust as required.
- j. Connect the power plug and place the POWER switch into the ON position. The motor should be energized.
- k. Loosen the single screw (S) which holds the motor to the heat sink (some earlier models may have two sets screws).
- l. Rotate the motor so that the holes in the tape are concentric with the light columns in the read head and the sprocket teeth are centered in the feed holes. Tighten the set screws. Recheck the adjustment and readjust as required.
- m. Remove the 0.05% tape.
- n. Place the POWER switch in the OFF position.
- o. Make sure jack screw (E) is not protruding below the surface of the Upper Tape Guide.
- p. Insert three layers of 0.0037 mylar tape (approximately 0.011 inch) stapled together at one end or a piece of 0.010 plastic shim stock (see Table 5-1) between the Upper Tape Guide and the Readhead Assembly.

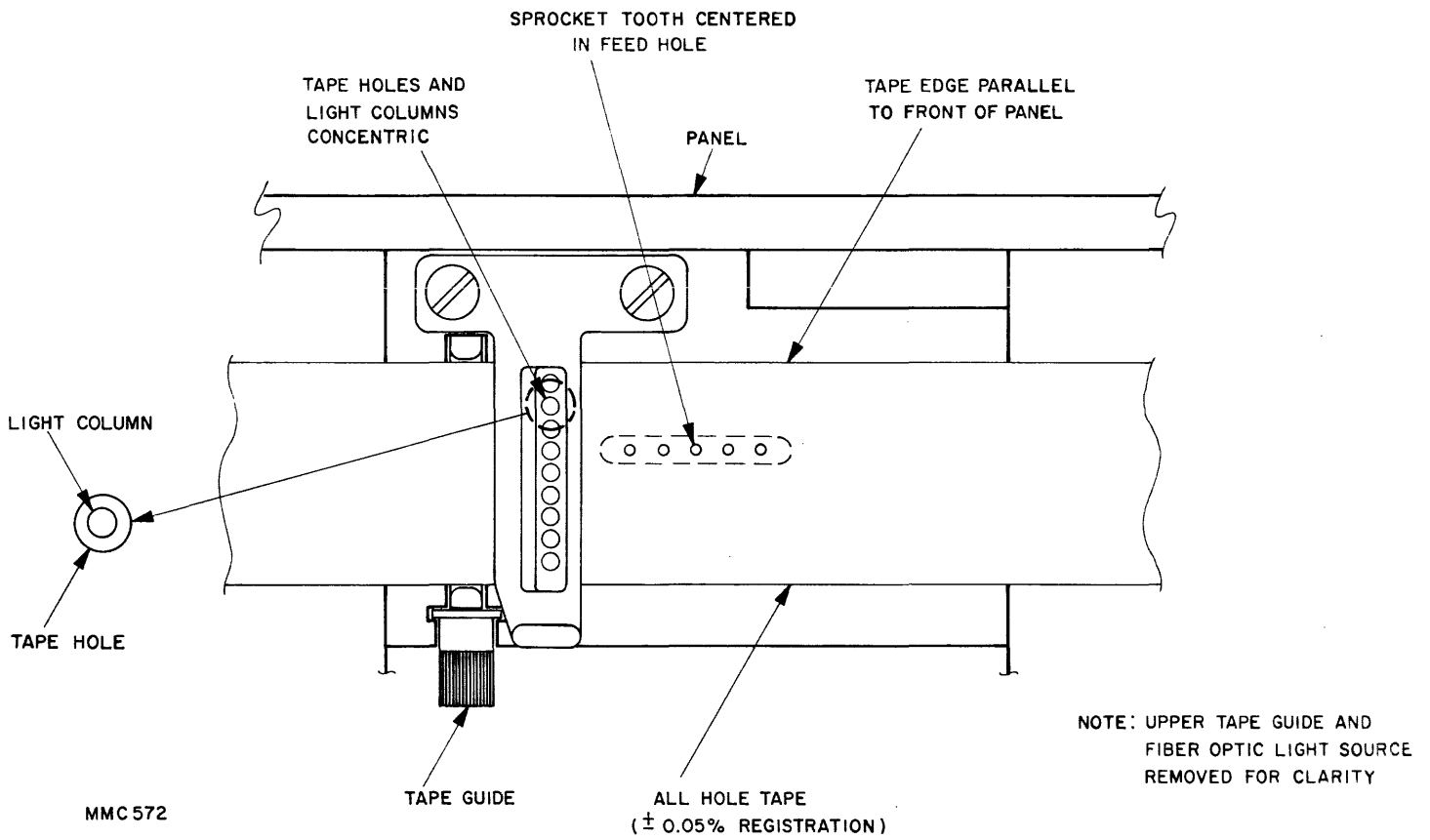


Figure 5-5. Alignment of the Sprocket with the Light Columns.

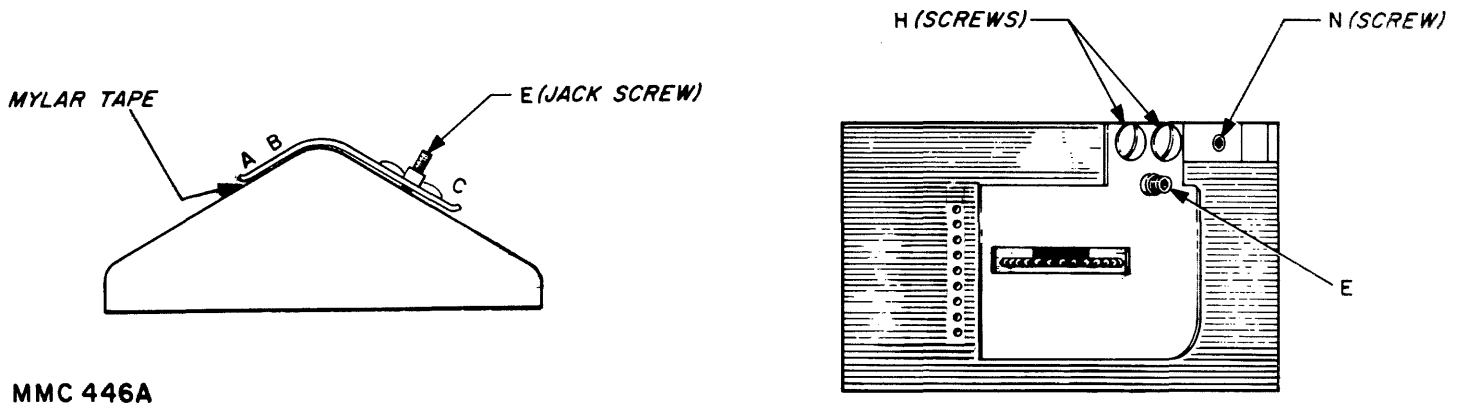


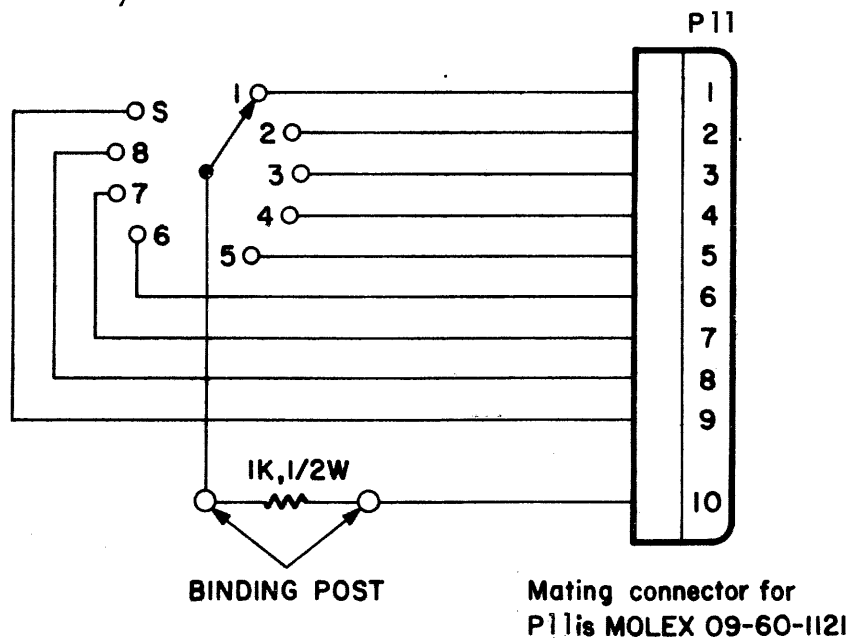
Figure 5-6. Adjustment of the Upper Tape Guide.

- q. Referring to Figure 5-6 use screws (H) and (N) to adjust the Upper Tape Guide so that there is maximum contact, firm pressure on the tape, and parallelism from A to B. Use screw (H) for lateral movement and screw (N) for rotational movement. From points B to C, the Upper Tape Guide will not show this parallelism.
- r. Remove the three layers of tape.
- s. Insert two layers of tape between points A and B only or a strip of 0.0075 shim stock.
- t. Screw down jack screw (E) which will raise the Upper Tape Guide slightly. Adjust screw (E) until there is free movement of two layers of tape or shim stock between points A and B. This should provide a gap of between 0.009 and 0.011 inch.
- u. Remove the two layers of tape or shim stock.
- v. Connect P11 coming from the Readhead Assembly to a test circuit as shown in Figure 5-7. Connect a digital voltmeter in parallel with a 1K resistor. Place the POWER switch in its ON position.
- w. Adjust the lamp voltage to +4.3 Vdc. See Section 5.6 for lamp voltage adjustment. This is a preliminary step. The final lamp voltage is adjusted in step x.
- x. The nut (T) holding the fiber optic light source to the front panel should already be loose (step g). Rotate the fiber optic light source until the current through the 1K resistor is between 100 and 110 microamps for the sprocket cell. If the current is excessive reduce the lamp voltage. If the current is below the minimum requirements, loosen nut (U) which locks the lamp in the sleeve and screw the lamp in or out to obtain the required current. Tighten nut (U). If the current is still below the minimum requirement, increase the lamp voltage slightly to obtain the required current. Do not increase the lamp voltage above +4.7 Vdc. When the required current is obtained for the sprocket, the minimum current for each of the data cells should be 80 microamps. The maximum output from any data cell should be 160 microamps so that tapes with the highest permitted transmissivity can be read without error.
- y. Place the POWER switch in the OFF position and reconnect P11.
- z. Place the POWER switch in the ON position and insert the 0.05% described in step f.
- aa. Drive tape in either direction using the direction switch or the external drive lines in continuous drive mode. Continuous drive is recommended rather than step mode operation since the tape speed must be above 60 cps.
- bb. Place a digital voltmeter across TP8 (VMOT) and TP1 (0V) on the Power Supply Card and adjust R15 for +34 Vdc at TP8. This is a preliminary step. The final voltage is set in step ff.

- cc. Connect a pulse counter to TP2 (Data Ready) and TP4 (0V) on the Reader Card.
- dd. Measure the drive left speed using a DL\* signal tied to 0V at J2-17. Repeat using a DR\* signal tied to 0V at J2-16. If the lowest speed is more than 5% slower than the highest speed, loosen screw (S) which holds the motor to the heat sink. Rotate the motor slightly so that the difference in drive left and drive right speeds is less than 5%. Tighten screw (S). Repeat step dd as required. When rotating the motor, make sure it is kept tight to the panel so that the adjustment in step i not disturbed. If steps i and l have been performed correctly only a slight adjustment of the motor should be necessary to obtain the 5% difference in speeds.

NOTE

The importance of steps cc and dd is not a specific interest in matching speeds, but rather that balancing speeds insures proper placement of the feedhole (via the sprocket) in relation to its aperture in the readhead. The 0.05% tape used virtually assures that there are no feedhole placement errors which are attributable to tape registration errors, but only to the position of the sprocket in relation to the feedhole aperture in the readhead. Thus measuring and balancing the slew speed is only an accurate, electronic method of assuring that this relationship exists. When the speeds in the two directions are properly balanced, feedhole placement error will be minimal and independent of the direction of the tape, thereby increasing tape readability to a maximum.

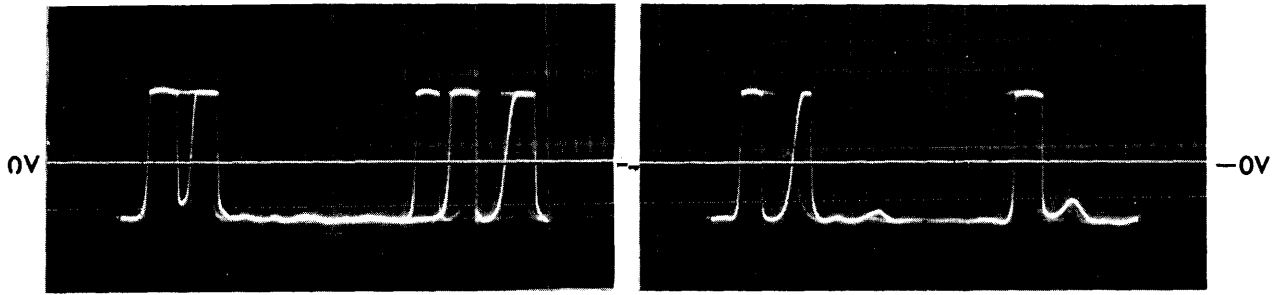


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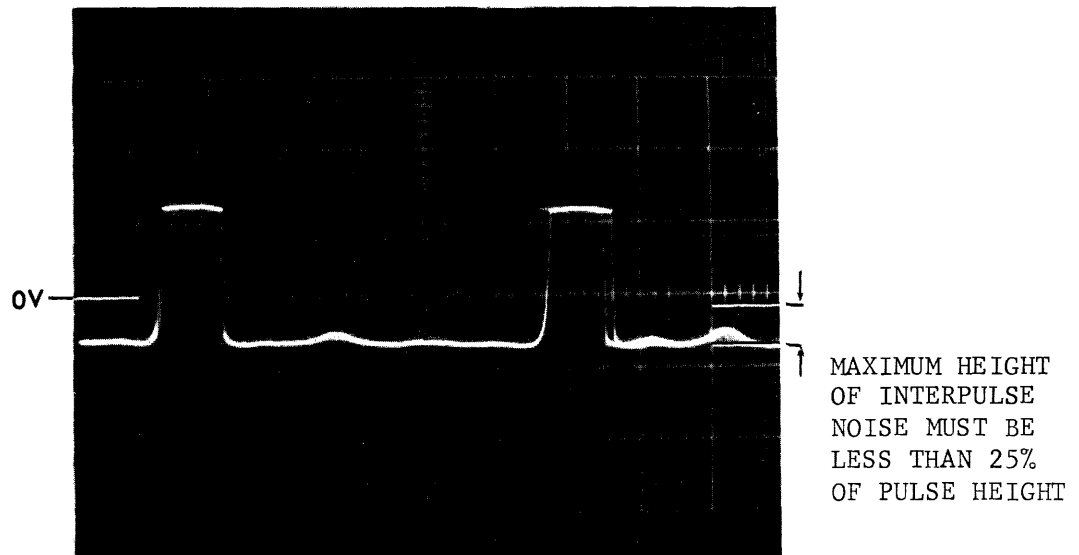
Figure 5-7. Photocell Output Test Circuit.

- ee. Connect a pulse generator to the DR\* input, J2-16. Set the pulse generator for 300 pps.
- ff. Connect an oscilloscope to the sprocket cell output at TP3 on the Reader Card and observe the jitter at the -0.3 Vdc level (do not be concerned about the jitter at the +0.6 Vdc level nor the time jitter in the leading or trailing edges of the waveform). Minimize the jitter by loosening the two set screws (R) which hold the collar to the motor shaft and move the collar in or out as required to obtain the least amount of jitter. See Figure 5-8. Cycle the reader between 20 and 330 characters/sec and adjust for minimum jitter. It may also be necessary to reduce the VMOT voltage set in step bb in addition to moving the collar. VMOT should not, however, be adjusted lower than +30 Vdc nor higher than +34 Vdc. Repeat steps ee and ff as required.
- gg. Repeat steps ee and ff for the DL\* input, J2-17.
- hh. Remove the tape loop, pulse generator, oscilloscope and counter and perform the reverse of steps b and then a.





Two Examples of Misadjustment



Upper Tape Guide and VMOT Properly Adjusted

MMC204A

Figure 5-8. Sprocket Cell Output Adjustment for Minimum Jitter.

TAPE SPLICING

If tape breakage occurs, this break may result in damage to one, two, or possibly three characters. When splicing tape for this reader, great care should be used to ensure that the proper sprocket hole spacing be preserved. A lap splice should not be used; use only a but type splice. To repair the tape without loss of characters, the process shown in Figure 5-9 is recommended and is accomplished as follows:

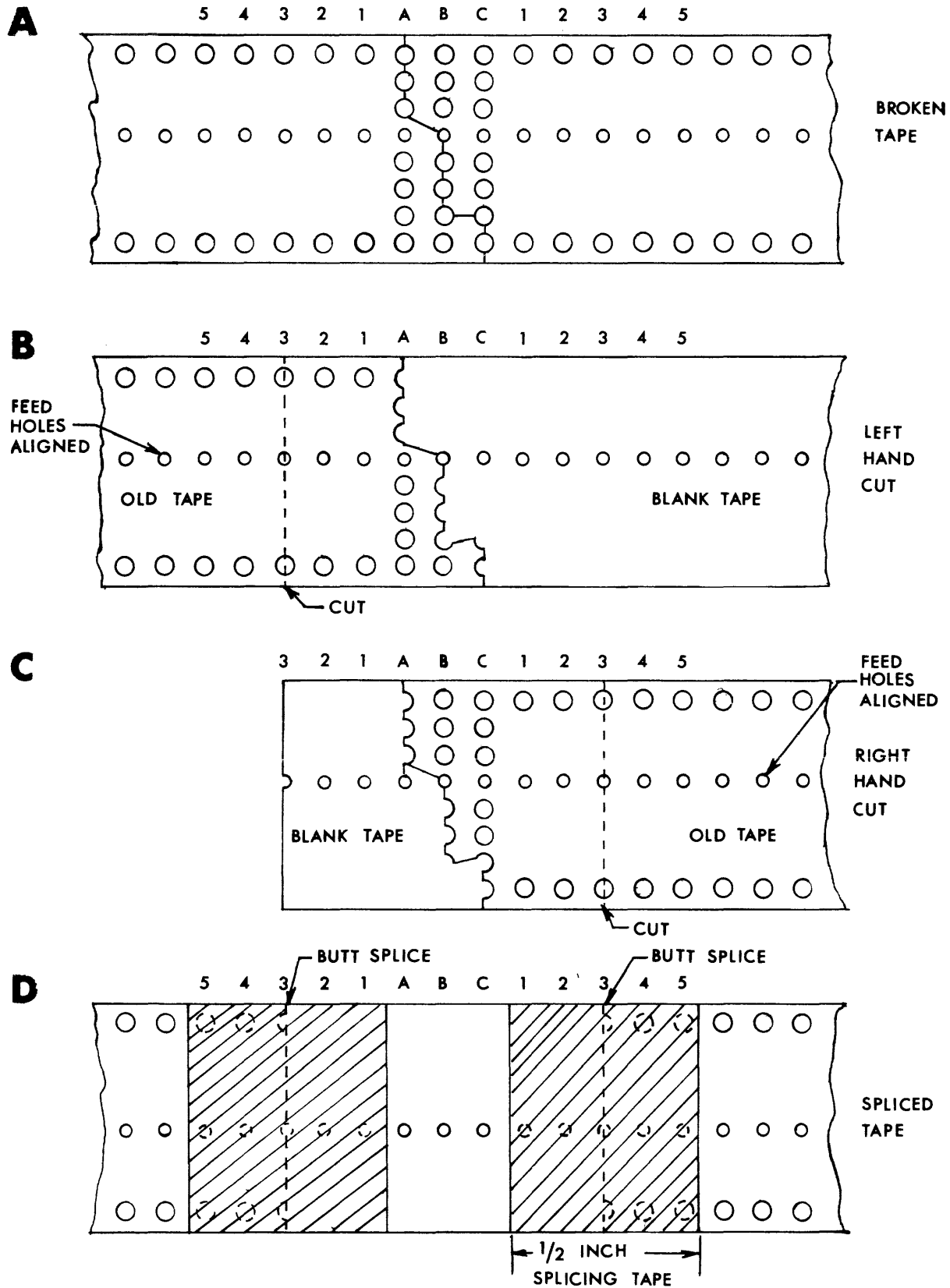
- a. Bring the tape ends together as shown in Figure 5-9A.
- b. Make a sketch of character(s) at the break (A-B-C) and five additional characters to the left (5-4-3-2-1) and five to the right (1-2-3-4-5) of the broken character(s) (A-B-C).
- c. Place the left end of the broken tape over a section of blank tape containing only feed holes so that at least eight or ten feed holes in each tape are aligned with one another as shown in Figure 5-9B. Cut the tapes at the third undamaged character to the left of damaged characters(A-B-C). Use care to insure that feed holes are aligned and make cut through the center of the holes in the third undamaged character. Characters 5, 4, and half of 3 should remain on the broken tape.
- d. Place the right end of the broken tape over the section of blank tape so that at least eight or ten feed holes are aligned with one another. Feed holes for one-half of 3, 2, and 1 on the blank tape cut in step c should be visible to the left of the broken tape end as shown in Figure 5-9C. Cut the tapes at the third undamaged character to the right of the damaged character. Be sure that feed holes are aligned and make the cut through the center of the holes in the third undamaged character.

## NOTE

One half of character 3 and characters 4 and 5 should remain in the broken tape.

- e. Place tape ends and new section on a flat surface with feed holes forward as shown in Figure Figure 5-9D (tape is bottom side up). Using Silver Scotch<sup>®</sup> tape, No. 852, splice the new section and the old tape ends as shown. That portion of tape that secures the old tape ends must cover the first two and a half characters (one-half of 3, 4, and 5) on the old tape ends. The edges of the tape should be between characters as shown. Use of 1/2 inch wide splicing tape is recommended as shown in Figure 5-9D.
- f. Repunch the characters recorded in step d.

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MMC 120A

Figure 5-9. Tape Splicing Procedure

## SECTION VI

### PARTS REPLACEMENT

#### 6.1 GENERAL

REMEX maintains service facilities at its manufacturing location and at service centers in major population areas for repair or replacement of components for their products. It is recommended that one of these centers be contacted for assistance in case of equipment malfunction. For the locations of service facilities in any area, contact REMEX at the address or telephone listed on the title page of the manual. Please direct inquiries to the attention of the Service Department.

When any part of the system requires replacement or disassembly, the procedures outlined below should be followed closely. The warnings and cautions are included to protect personnel and equipment. Notes are included to assist persons unfamiliar with the equipment. Before attempting any procedure, all instructions for that disassembly should be read and understood.

Quantities of replaceable items suggested as spares are listed in Section 7. All system components are identified in Section VII of this manual, along with illustrations showing part location. This information may be used to locate parts below unit level if replacement is required. Always reference the complete model number and serial number when making inquiries.

#### **WARNING**

Potentially dangerous line voltage is applied to components within this equipment. If adjustments must be performed with power applied, these points must be located and avoided. High voltage can be accidentally contacted at TB1 and TB2, at the OFF-ON switch/wiring connections, and on the circuit cards (rear of the unit).

#### 6.2 PUNCH REMOVAL

The following procedure should be used when removing the punch.

- a. Remove all power and control signals from the unit by disconnecting P1/J1, P2/J2 (on RAB, RAR and RAF units only) and the power cord.
- b. Disconnect P14/J14. Remove the chad box.
- c. Loosen the two screws (items A, Figure 7-8) which holds the punch to its support bracket.
- d. Loosen and remove the two screws (items B, Figure 7-8) which hold the punch mounting bracket to the punch shock mounts.

- e. The punch is now free and can be removed from the system.
- f. Replacement is the reverse of steps e, d, c, and then b.
- g. Perform Section 5.5.2.

### 6.3 FRONT PANEL-CHASSIS SEPARATION

The following procedure should be used when separating the front panel from the chassis.

- a. Remove all power and control signals from the unit by disconnecting P1/J1, P2/J2 (RAR, RAB and RAF units only) and the power cord.
- b. Remove the two screws which hold each handle to the chassis. Use care not to lose the attached spacers.
- c. From the rear of the front panel remove the four nuts which hold the front panel to the chassis.
- d. Carefully lower the front panel down and away from the chassis and allow room to perform step e.
- e. Disconnect P8/J8 (green). On RAR, RAB and RAF units, also disconnect P7/J7 (yellow), P10/J10 (orange) and P11/J11 (red).
- f. Slide the quick disconnect wires off S1 at terminals 2 (white wire), 3 (black) and 4 (red). Note terminals for proper replacement.
- g. The front panel is now free from the chassis.
- h. Reassembly is the reverse of steps g, f, e, d, c, b, and then a.

### 6.4 POWER SUPPLY ASSEMBLY REMOVAL

The following procedure should be used when separating the power supply assembly from the chassis.

- a. Remove all power and control signals from the unit by disconnecting P1/J1, P2/J2 and the power cord.
- b. Remove the four screws at the rear which hold the power supply to the chassis.
- c. Slide the power supply out sufficiently far to be able to disconnect P15/J15 (red, white and black wires coming from S1).
- d. Disconnect P16/J16 (white) and P109/J109 (red) on the power supply card.
- e. The chassis and power supply with the fan attached are now free.

## CAUTION

Never operate the punch without the fan in place to provide airflow. Permanent damage to the punch could result.

- f. Replacement is the reverse of steps e, d, c, b and then a.

### 6.5 CARD REMOVAL

The following precautions should be used when replacing or removing the printed circuit cards.

- a. Remove all power and control signals by disconnecting P1, P2 (on RAB, RAR and RAF units only), and the power cord.
- b. Never force a card into its connector. The cards pull out and push in firmly, but excessive force should never be required.
- c. If the Perforator Logic Card is replaced, perform Section 5.5.2.
- d. If the Power Supply card is replaced, perform Sections 5.5.3, 5.6, and steps t and u of Section 5.7.
- e. If the Reader card is replaced, perform Section 5.7.

### 6.6 READER UPPER COVER ASSEMBLY

The Upper Cover Assembly is held to the front panel by two 6-32 round head screws (Item A, Figure 7-1). It should be replaced as a complete assembly.

### 6.7 READHEAD MECHANISM DISASSEMBLY

This procedure is required when replacing the Upper Tape Guide Assembly, the Readhead Assembly (consisting of the Readhead Housing, Photocell Assembly and Light Columns), or the Mechanism Assembly (consisting of the Door Mechanism Assembly, Tape Guide Cam, Tape Guide Actuator, Slide and Spring). For ease of assembly, it is recommended that the Readhead Assembly (part number 110459-1) and Mechanism Assembly (part number 110740-1) be replaced as a complete assembly. However, Figure 7-2 is provided for those desiring to order the subassemblies that comprise the Mechanism Assembly. Figure 7-1 should be folded out from Section 7 to follow during this procedure. The following procedure is recommended when replacing any of the above mentioned items:

- a. Remove all power and control signals by disconnecting P1/J1, P2/J2, and the power cord.
- b. Remove the Upper Cover Assembly by performing Section 6.6.
- c. Disconnect P10/J10 and P11/J11.
- d. Loosen the four 8-32 socket head screws (Item B, Figure 7-1) which holds the Mechanism Assembly to the Front Panel at the rear of the front panel. The entire Readhead Mechanism Assembly consisting of the Tape Guide Assembly, the Readhead Assembly, and the Mechanism Assembly is now free to be removed from the panel.

- e. Remove the two 4-40 binder head screws (Item H, Figure 7-1) which hold the Tape Guide Assembly to the Mechanism Assembly. If no further disassembly is required, install the new Upper Tape Guide Assembly and perform the reverse of steps f through c. Perform Section 5.7.
- f. From the underside of the Mechanism Assembly remove the two 4-40 round head screws (Item I, Figure 7-1) which hold the Readhead Assembly to the Mechanism Assembly. The Readhead Assembly and the Mechanism Assembly are now separated and can be replaced as individual assemblies. It is not recommended that Mechanism Assembly be disassembled beyond this level.
- g. Reassembly is the reverse of steps f, e, d, and then c.
- h. Perform Section 5.7.

## 6.8 LAMP REPLACEMENT

The following procedure should be followed when replacing the Lamp:

- a. Remove all power and control signals by disconnecting P1/J1, P2/J2, and the power cord.
- b. Remove the two quick connect terminals at the rear of the lamp.
- c. Unscrew the lamp from the sleeve.
- d. Replacement is the reverse of steps c, b and then a.
- e. Perform Section 5.7, steps t, u and v.

## 6.9 MOTOR AND/OR SPROCKET REPLACEMENT

The following procedure should be followed when replacing the motor and/or sprocket:

- a. Separate the Reader Panel Assembly from the unit. See Section 6.13.
- b. Remove the Readhead Mechanism Assembly by performing Section 6.7, steps a through e.
- c. Loosen the two set screws (Item J, Figure 7-1) which hold the sprocket to the motor shaft. If only the sprocket needs replacing proceed to step g.
- d. Loosen the two set screws (Item G, Figure 7-1) which hold the motor to the heat sink and back the motor out. On some models the two set screws have been replaced with single screw S.
- e. Install the new motor by performing the reverse of step d. The motor should be up flush against the panel. Tighten set screws G of screw S.
- f. Install the sprocket wheel so that: (1) the distance of the back side of the sprocket to the front panel is  $0.862 \pm .003$  inch (see Figure 7-1) and (2) the 1/8 inch long set screw tightens on the flat of the motor shaft. Tighten set screws J.

- g. Install the Mechanism Assembly by performing the reverse of step b.
- h. Perform the reverse of step a.
- i. Perform Section 5.7.

#### 6.10 TRANSFORMER REPLACEMENT

The following procedure is recommended when replacing the transformer:

- a. Remove the Power Supply from the chassis by performing Section 6.4.
- b. Disconnect P103/J103 (black) connector.
- c. Remove the six quick disconnect wires as follows: white/green at TB1-8, white/yellow at TB1-7, white/orange at TB1-6, white/red at TB1-5, white brown at TB1-4, white at TB1-3.
- d. Remove the four screws which hold the transformer to the power supply chassis.
- e. Replacement is the reverse of steps d, c, b, and then a.

#### 6.11 FRONT PANEL SWITCH REPLACEMENT

When replacing any switch located on the front panel, it is recommended that the following procedure be used.

- a. Remove all power and control signals by disconnecting P1/J1, P2/J2, and the power cord.
- b. Remove the two screws which hold the switch plate cover to the front panel.
- c. Slide off the terminals of the switch to be replaced. Note each wire for correct replacement.
- d. Snap the switch out the front of the panel by pressing from the rear.
- e. Remove the switch. Lamps located inside certain switches are accessible after removing the rocker cap.
- f. Install the new switch by performing the reverse of steps e, d, c and b and then a.

#### 6.12 SWITCHES S9 AND S10 REPLACEMENT

The following procedure is recommended when replacing either S9 or S10.

- a. Remove all power and control signals by disconnecting P1/J1, P2/J2 and the power cord.
- b. Remove the two 4-40 round head screws (Item L, Figure 7-1) which holds Lower Cover Frame to the Mounting Block Assembly and drop the Lower Cover Frame.



- c. If the Slew Switch, S10, is to be replaced, unsolder the following wires: Orange at S10-1, Yellow at S10-2 and Green at S10-3. If the LOAD switch, S9, is to be replaced proceed to step f.
- d. Snap out the out switch S10.
- e. Replacement is the reverse of steps d, c, b and then a.
- f. If the LOAD switch, S9, is to be replaced, loosen the two 2-56 screws, (Item M, Figure 7-1) washers, and hex nuts which hold S9 to the Mounting Block Assembly.
- g. Unsolder the following wires: Blue at S9-C, and Violet at S9-NC.
- h. Replacement of S9 is the reverse of steps g, f, b, and then a.

### 6.13 READER PANEL ASSEMBLY REMOVAL

The following procedure is recommended when removing the Reader Panel Assembly.

- a. Remove all power and control signals by disconnecting P1/J1, P2/J2 and the power cord.
- b. Remove the two 6-32 socket screws which hold the lower cover frame to the panel assembly.
- c. The three 6-32 binder head screws should now be accessible which hold the reader panel assembly to the front panel. Remove these screws.
- d. On the RAF 612X, the tape tray may have to be removed to allow the reader panel assembly to be separated from the unit.

## SECTION VII

### PARTS LIST

#### 7.1 GENERAL

Tables 7-3 through 7-9 list the electronic and mechanical parts used on the RAB/RAR/RAF 612X series. Tables 7-1 and 7-2 list the recommended spare parts for these models. Standard hardware items are not listed. Indented items are part of the assembly under which they are indented and the quantity of the indented item is per each assembly. An X in a particular model number digit designator denotes any of the combinations given in Figure 1-6 for that designator is applicable.

Reference designations refer to the parts illustrated in Figures 7-1 through 7- . The reference designations include a figure number and a part designation number which appears on that figure to indicate the location of the part. For example, a "7-1; 12" appearing in the reference designation column indicates that the item listed in the description column is identified as item 12 in Figure 7-1. All electronic components are identified by letter - number combinations (such as S1 and T1) in the Reference Designation column and mechanical parts are identified by number. Reference designations contained in parenthesis are associated or function with the parenthetical item. These items are generally individual items and not part of an assembly but for reference are related back to the main item. All items are available from Spares Order Desk, REMEX, 1733 Alton Street, P. O. Box 11926, Santa Ana, California 92711.

#### 7.2 KIT OF PARTS

The kit of parts contains items used for installation and maintenance and is shipped with the unit. These items are listed in Table 1-1.

NOTE: WHEN ORDERING SPARE PARTS, CONTACT REMEX SPARES ORDER DESK AND REFERENCE COMPLETE MODEL AND SERIAL NUMBER OF UNIT. ALWAYS REFER TO ADDENDUM AT THE REAR OF THE MANUAL (IF APPLICABLE) FOR POSSIBLE PART NUMBER CHANGES.

Table 7-1. Recommended Spart Part, RAF612X

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Diode, Zener, IN4561	704022-103	1	CR1
Lamp, 28V, Chicago Miniature 399	715071-137	2	(S1, S3, DS1)
Switch, ON-NONE-ON C&K 5201Z3	715063-111	1	S1
Switch, (ON)-OFF-(ON), C&K 5205Z3	715063-114	1	S3
Fuse, 4A, Bussman, MDA	705710-128	1	F101
Transistor, Motorola MJ4035	704204-120	1	Q101
Printed Circuit Card Assembly, Perforator Driver	111831-1	1	
Printed Circuit Card Assembly, Perforator Logic, Model RAF612XBA-/550/Only	111821- <u>1</u>	1	
Printed Circuit Card Assembly Perforator Logic, Model RAF612XBA-/551/Only	111821- <u>2</u>	1	
Fuse, 4A (Power Supply Card)	705725-112	2	F2
Fuse, 2A (Power Supply Card)	705725-110	2	F3
Printed Circuit Card Assembly, Power Supply	111841-1	1	
Printed Circuit Card Assembly, Reader	110801-1	1	
Lamp, 5V, Welch Allyn 999079-6	715071-141	1	DS2
Readhead Assembly	110459-1	1	
Switch, SPDT, Cherry E61-00K	715058-120	1	S9
Switch, (ON)-OFF-(ON) C&K 5205	715063-104	1	S10
Fuse 1/4 A (Power Supply Card)	705725-102	2	F1

NOTE: WHEN ORDERING SPARE PARTS, CONTACT REMEX SPARES ORDER DESK AND REFERENCE COMPLETE MODEL AND SERIAL NUMBER OF UNIT. ALWAYS REFER TO ADDENDUM AT THE REAR OF THE MANUAL (IF APPLICABLE) FOR POSSIBLE PART NUMBER CHANGES.

Table 7-2. Recommended Spare Parts RAR612X and RAB612X

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Roller, Platter Drive	111814-1	1	
Switch, SPDT MicroSwitch 311SM68-H4	715058-125	1	S6, S7
Switch, SPDT MicroSwitch 311SM723-H4	715058-127	1	S8
Diode, Zener IN4561	704022-103	1	CR1
Lamp, 28V, Chicago Miniature	715071-132	1	(S1, DS1)
Switch, ON-NONE-ON, C&K 5201Z3	715063-111	1	S1
Switch, (ON)-OFF-(ON), C&K 5205Z3	715063-114	1	S3
Switch, (ON)-NONE-ON, C&K 5208Z3 (RAB612X Only)	715063-112	1	S2
Fuse, 4A, Bussman MDA	705710-128	2	F101
Transistor, Motorola MJ4035	704204-120	1	Q101, Q102
Printed Circuit Card Assembly, Power Supply	111841-1	1	
Printed Circuit Card Assembly, Perforator Driver	111831-1	1	
Printed Circuit Card Assembly, Perforator Logic, Model RAX612XBA-/66- <del>550</del> Only	111821-1	1	
Printed Circuit Card Assembly Perforator Logic, Model RAX612XBA-/66- <del>551</del> Only	111821-2	1	
Printed Circuit Card Assembly, Reader Card	110801-1	1	
Lamp, 5V, Welch Allyn 999079-6	715071-141	1	DS2
Readhead Assembly	110459-1	1	
Switch, SPDT, Cherry E61-00K	715058-120	1	S9
Switch, (ON)-OFF-(ON), C&K 5205	715063-104	1	S10
Fuse, 1/4 A (Power Supply Card)	705725-102	1	F1
Fuse, 4A (Power Supply Card)	705725-112	2	F2, F4
Fuse, 2A (Power Supply Card)	705725-110	1	F3

NOTE: WHEN ORDERING SPARE PARTS, CONTACT REMEX SPARES ORDER DESK AND REFERENCE COMPLETE MODEL AND SERIAL NUMBER OF UNIT. ALWAYS REFER TO ADDENDUM AT THE REAR OF THE MANUAL (IF APPLICABLE) FOR POSSIBLE PART NUMBER CHANGES.

Table 7-3. Parts List RAR612X and RAB612X

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Top Assembly RAR612X	111989-1	1	Ref
Top Assembly RAB612X	111824-1	1	Ref
The following Subassemblies apply to both the RAB612X and RAR612X unless specifically noted			
Bracket, Chad Box	112084-1	1	7-8, 1
Bracket, Punch Support	111825-1	1	7-8, 2
Chad Box	111991-1	1	7-8, 3
Chassis Assembly	112000-1	1	Ref
Bracket, Retainer	111748-1	4	
Cable Assembly Power Switch.	112139-1	1	(P15)
Connector, Housing, 3 pin, Molex P1 (03-06-2032)	706500-264	1	P15
Contact Male, Molex 02-06-2103	706530-157	3	(P15)
Lug, Quick Connect, Amp 61454-1	715005-137	3	
Cable Assembly, Power Supply	111995-1	1	(P6, P16)
Connector, Housing, White, 15 pin, Molex 09-50-7151	706510-226	2	7-11, P6, P16
Contact, Female, Molex 08-50-0106	706530-137	30	(P6, P16)
Cable Assembly, Power Supply	111995-2	1	(P18, P109)
Connector, Housing, Red, 3 pin, Molex 09-50-7031	706510-300	2	7-11, P18, P109
Contact, Female, Molex 08-50-0106	706530-137	6	(P18, P109)
Cable Assembly, Punch Mechanism	111986-1	1	(P12-P14)
Connector, Housing, Yellow, 12 pin, Molex 09-50-7121	706510-254	1	7-11, P12
Connector, Housing, White, 4 pin, Molex 09-50-7041	706510-268	1	7-8, P13
Connector, Housing, White 24 pin Molex R1(03-06-1242)	706510-296	1	7-11, P14
Contact, Female, Molex 08-50-0106	706530-137	15	(P12, P13)
Contact, Female, Molex 02-06-1105	706530-169	24	(P14)
Chassis	111829-1	1	7-8, 2
Connector, White, 3 pin, Molex, 09-50-7031	706510-258	1	7-11, P17
Contact, Connector, Molex, 08-50-0106	706530-137	3	(P17)
Deck Assembly, Tape Supply	112274-1	1	7-5, Ref
Arm Assembly	112330-1	1	Ref
Arm, Tape Supply	112147-1	1	7-5, 1
Axle, Tape Roller	109084-1	1	7-5, 2
Cam, Tape Supply Arm	112141-1	1	7-5, 4
Spacer, Amaton 8515-A-0632-1B	715030-219	1	7-5, 5
Tape Roller	104802-2	1	7-5, 3
Arm, Low Tape	110387-3	1	7-5, 6
Axle, Tape Roller	109084-1	2	7-5, 7
Bracket, Mounting, Catch	112659-1	1	7-5, 10
Bumper, Rubbercraft 9114	715021-115	2	7-5, 11

NOTE: WHEN ORDERING SPARE PARTS, CONTACT REMEX SPARES ORDER DESK AND REFERENCE COMPLETE MODEL AND SERIAL NUMBER OF UNIT. ALWAYS REFER TO ADDENDUM AT THE REAR OF THE MANUAL (IF APPLICABLE) FOR POSSIBLE PART NUMBER CHANGES.

Table 7-3. Parts List RAR612X and RAB612X (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Top Assembly RAR612X and RAB612X (Continued)			
Chassis Assembly (Continued)			
Deck Assembly, Tape Supply (Continued)			
Cable Assembly	112024-1	1	(P9)
Connector, Housing, 12 pin, Brown, Molex 09-50-7121	706510-244	1	7-5, P9
Contact Female, Molex 08-50-0106	706530-137	10	(P9)
Clip, Low Tape Arm, Bussman 5681-15 BW-801	715045-152	1	7-5, 12
Deck, Tape Supply	111834-1	1	7-5, 13
Grommet, General Cement 1043	715020-103	1	7-5, 14
Grommet, General Cement 1043-1	715020-116	1	7-5, 15
Motor Assembly, Platter Drive	112006-1	1	7-5, 16
Arm, Platter Drive	111749-1	1	
Motor, Platter Drive, Remex Specification	715075-168	1	
Roller Drive,	111814-1	1	
Platter Assembly	109580-2	1	7-6, 1
Hub, Platter	110386-1	1	
Ball, 0.375 dia. Stainless	716014-104	1	
Spring, Hub	109452-2	2	
Ring Retainer, Truarc 5100-37MF	715025-114	1	7-5, 17
Ring Retainer, Truarc 5144-18	715025-142	2	7-5, 18
Roller, Tape	104802-2	1	7-5, 8
Roller, Tape	112607-1	1	7-5, 9
Shaft, Low Tape Arm	112005-1	1	7-5, 26
Shaft, Platter	109568-1	1	7-5, 20
Spacer, 3/8 x 1/2 x 0.020, P.I.C. B3-10	715030-174	1	7-5, 21
Spacer, Tape Roller	112007-1	2	7-5, 22
Spring, Extension, Lane Spring Co.	714090-118	1	7-5, 23
Spring, Extension, Lee LE-022B-0(MW)	714090-143	1	7-5, 24
Spring, Low Tape Arm	112155-1	1	7-5, 25
Switch, SPDT Micro Switch 311SM68-H4	715058-125	2	7-5, S6, S7
Switch, SPDT Micro Switch 311SM723-H4	715058-127	1	7-5, S8
Diode, Zener 1N4561	704022-103	1	7-6, CR1
Guide, P.C. Card Unitrack RAD6875	716053-151	4	
Insulator, RCA 495320	715019-115	1	(CR1)
Spring Chad Box	111813-2	1	7-8, 4
		7	
Cover, Switch Plate	112R23-1	1	7-8, 5
Decal, Tape Load Path	109817-1	1	7-8, 6
Filler Block Assembly	111793-1	1	7-3, 1
Frame, Lower Cover	110440-2	1	7-3, 2

NOTE: WHEN ORDERING SPARE PARTS, CONTACT REMEX SPARES ORDER DESK AND REFERENCE COMPLETE MODEL AND SERIAL NUMBER OF UNIT. ALWAYS REFER TO ADDENDUM AT THE REAR OF THE MANUAL (IF APPLICABLE) FOR POSSIBLE PART NUMBER CHANGES.

Table 7-3. Parts List RAR612X and RAB612X (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Top Assembly RAR612X and RAB612X (Continued)			
Front Panel Assembly RAR612X	111988-1	1	
Front Panel Assembly RAB612X	112020-1	1	
The subassemblies for the 111988-1 and 112020-1 are identical except as specifically noted.			
Clamp, Weckesser A-30	715040-139	1	7-4, 1
Harness Assembly, RAR612X	112128-1	1	
Connector, Housing, Green, 12 pin, Molex 09-50-7121	706510-245	1	7-4, P8
Contact, Molex 08-50-0106	706530-137	7	(P8)
Switch Plate Assembly	111804-2	1	(S1, S3, DS1)
Bezel, C&K B7888-2	715063-201	3	(S1, S3, DS1)
Lamp, 28V, Chicago Miniature 399	715071-137	2	(S1, DS1)
Lamp Holder, C&K 5600	715072-109	1	(DS1)
Lens, Orange, PERF STATUS, C&K B7952-04	715072-111	1	7-4, DS1
Plate Switch	111840-2	1	
Rocker Cap, POWER, C&K 7922-1	715063-311	1	(S1)
Rocker Cap, FEED/DELETE, C&K 7922-1	715063-320	1	(S3)
Switch, ON-NONE-ON, C&K 5201Z3	715063-111	1	7-4, S1
Switch, (ON)-OFF-(ON), C&K 5205Z3	715063-114	1	7-4, S3
Terminal Strip, 6 Terminal, Kulka 511-6-KT11-K12	715010-148	1	7-4, TB2
Terminal	715005-137	4	(TB2)
Terminal, Amp 61060-1	715005-138	7	(TB2)
Harness Assembly, RAB612X	111836-1	9	
Connector, Housing, Green, 12 pin, Molex 09-50-7121	706510-245	1	7-4, P8
Contact, Molex 08-50-0106	706530-137	11	(P8)
Switch Plate Assembly	111804-3	1	(S1-S3, DS1)
Bezel, C&K B7888-2	715063-201	4	(S1-S3, DS1)
Lamp, 28V, Chicago Miniature 399	715071-137	2	(S1, DS1)
Lamp Holder C&K 5600	715072-109	1	(DS1)
Lens, Orange, PERF STATUS, C&K B7952-04	715072-111	1	7-4, DS1
Plate, Switch	111840-1	1	
Rocker Cap, POWER C&K 7922-1	715063-311	1	(S1)
Rocker Cap, FEED/DELETE, C&K 7922-1	715063-320	1	(S3)
Rocker Cap, REWIND, C&K 7922-1	715063-330	1	(S2)
Switch, ON-NONE-ON, C&K 5201Z3	715063-111	1	7-4, S1
Switch, (ON)-NONE-ON, C&K 5208Z3	715063-112	1	7-4, S2
Switch, (ON)-OFF-(ON), C&K 5205Z3	715063-114	1	7-4, S3
Terminal Strip, 6 terminal, Kulka 511-6-KT11-KT12	715010-148	1	7-4, TB2
Terminal, Amp 42470-1	715005-138	7	(TB2)
Terminal, Quick Connect, Amp 60972-2	715005-126	2	(M6)
Terminal, Quick Connect, Amp 61454-1	715005-137	6	(TB2)

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Table 7-3. Parts List RAR612X and RAB612X (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Front Panel Assembly RAB612X (Continued)			
Marking Strip, Kulka MS-411-6	715007-132	1	(TB2)
Motor Assembly, Rewind, RAB612X Only	110987-1	1	(M6)
Bar Retaining	110989-2	1	7-3,3
Hub	110998-1	1	7-3,4
Motor Rewind, 12 Vdc, Remex Specification	715075-168	1	7-4, M6
Plate, Back	110973-1	1	7-3,5
Post	111009-1	1	7-3,6
Shadow Plate	111120-1	1	7-3,7
Spacer	111008-1	1	7-3,8
Mounting Plate Reader, Lower	112341-1	1	7-4,2
Mounting, Plate, Reader, Upper	112341-2	1	7-4,3
Panel, Front, RAR612X	111987-3	1	7-4,4
Panel, Front, RAB612X	111985-3	1	7-4,4
Resistor, 150 ohm, 1W	701005-151	2	R1, R2
Spacer, NAS43DDO-8	715030-138	1	7-3,9
Tape Blade	111982-1	1	7-3,10
Gasket, Access Tube	111996-1	1	7-8,7
Grommet, Nylon Mould Co. G51H-B	715020-112	1	7-8,8
Guide, P.C. Card, Unitrack RAD6875	716053-151	2	7-8,10
Handle, Hartwell H565A6875B	714096-114	2	7-3,11
Insert, Color, Black	110441-4	1	7-3,12
Kit of Parts, See Table 1-1 for Contents	111987-1	1	
Label, I.D., REMEX Specification	716018-113	1	7-8,11
Nameplate, Patent Pending	108547	1	7-8,12
Perforator Assembly, RAB/RAR6121, 8 Track Steel	111730-1	1	7-8,13
Perforator Assembly, RAB/RAR6122, 8 Track Carbide	111730-2	1	7-8,13
Perforator Assembly, RAB/RAR6123, 6 Track Steel	111975-1	1	7-8,13
Perforator Assembly, RAB/RAR6124, 6 Track Carbide	111975-2	1	7-8,13
Plunger, Hartwell H323-3-4-1	713656-123	1	7-8,9
Power Supply Assembly	111839-1	1	7-7, Ref.
Bracket, Capacitor, STM FCMR	715045-103	1	(C102)
Bracket, Capacitor, Sangamo DCM-05	715045-123	1	(C103)
Bracket, Capacitor, Sangamo DCM-06	715045-106	2	(C104, C105)
Bracket, Support	111747-1	1	7-7,6
Bracket, Support	112247-1	1	7-7,2
Bracket, Support, Fan	111826-1	1	7-7,4
Cable Assembly	112011-2	1	(P107)
Connector, Housing, White, 3 pin, Molex 09-50-7031	706510-258	1	7-7, P107
Contact, Connector, Female, Molex 08-50-0106	706530-137	3	(P107)



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Table 7-3. Parts List RAR612X and RAB612X (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Top Assembly RAR612X and RAB612X (Continued)			
Power Supply Assembly (Continued)			
Cable Assembly	112011-1	1	(P108)
Connector, Housing, White, 3 pin, Molex 09-50-7031	706510-257	1	7-7, P108
Contact, Connector, Female, Molex 08-50-0106	706530-137	3	(P108)
Capacitor, 2 x 0.01 $\mu$ f, 125V	702127-103	1	7-7, C101
Capacitor, 21,000 $\mu$ f, Electrolytic STM 714C40CC213(71YZ40CC213)	702313-104	1	C102
Capacitor, 5,900 $\mu$ f, Electrolytic STM 91C75JC592	702317-119	1	C103
Capacitor, 2,500 $\mu$ f, Electrolytic, STM 91C75HC252	702317-118	2	C104, C105
Chassis	111827-1	1	7-7, 1
Connector Assembly	112012-1	1	(J15)
Connector, Housing, 3 pin Molex R (03-06-1031)	706510-294	1	7-7, J15
Contact, Female, Molex 02-06-1103	706530-156	3	(J15)
Terminal, Quick Connect, Amp 42470-1	715005-125	3	
Cover, Terminal Board	111727-1	1	7-7, 10
Decal, Warning	111934-1	1	
Fan Assembly	111844-1	1	7-7, M1
Fuse, 4A, Bussman MDA	705710-128	1	7-7, F101
Fuse Holder, Littlefuse 342004L	705750-100	1	(F101)
Grommet, Nylon Mould G51H-C	715020-113	1	
Grommet, General Cement 7566	715020-109	1	
Grommet, Power Cord, Heyman SR-6P-4	715020-117	1	(P101)
Heat Sink Assembly	111838-1	1	7-7, 3
Connector, Housing, 3 pin, blue, Molex 09-50-7031	706510-255	1	7-7, P104
Contact, Female, Molex, 08-50-0106	706530-137	3	(P104)
Heat Sink	111835-1	1	(Q101)
Insulator, RCA 495320	715019-115	1	(Q101)
Transistor, Motorola MJ4035	704204-120	1	7-7, Q101
Heat Sink Assembly	111838-2	1	7-7, 5
Cable Assembly	112246-2	1	
Connector, Housing, 3 pin, Gray, Molex 09-50-7031	706510-256	1	7-7, P105
Contact, Female, Molex 08-50-0106	706530-137	3	(P105)
Heat Sink	111835-1	1	(Q102)
Insulator, RCA 495320	715019-115	1	(Q102)
Transistor, Motorola MJ4035	704204-120	1	7-7, Q102
Power Cord	708000-027	1	7-7, P101
Printed Circuit Card Assembly, Power Supply	111841-1	1	7-7, PC1
See Table 7-9 for component listing			
Terminal, Quick Connect AMP 42470-1	715005-125	10	(TB1)

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Table 7-3. Parts List RAR612X and RAB612X (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Top Assembly RAR612X and RAB612X (Continued)			
Power Supply Assembly (Continued)			
Terminal Board Assembly	112008-1	1	(TB1)
Bracket, Support	112004-1	1	
Marker Strip, Kulka MS-411-9	715007-131	1	TB1
Standoff, Amaton 8167-A-0632-1B	715030-213	2	
Terminal Strip, 9 terminal, Kulka 511-9-KT11-KT12	715010-147	1	
Transformer Assembly	111809-2	1	(T1, P103)
Connector, Housing, Black, 15 pin, Molex 09-50-7151	706510-269	1	P103
Contact, Connector, Molex 08-50-0106	706530-137	14	(P103)
Terminal, Quick Connect AMP 42470-1	715005-125	8	
Transformer, REMEX Specification	703010-158	1	T1
Printed Circuit Card Assembly, Master Interconnect. See Table 7-5 for component listing.	111901-1	1	7-6, PC1
Printed Circuit Card Assembly, Perforator Driver See Table 7-6 for component listing	111831-1	1	7-8, PC2
Printed Circuit Card Assembly, Perforator Logic See Table 7-7 for component listing and dash number configuration	111821-X	1	7-8, PC3
Printed Circuit Card Assembly, Reader Card See Table 7-8 for component listing.	110801-3	1	7-8, PC4
Reader Panel Assembly	111980-1	1	
Cover Assembly	111819-1		
Gasket, Welch Allyn 11200182	715018-104	1	
Heat Sink	110448-1	1	
Insert Color, Black	110441-5	1	
Lamp, 5 volt, Welch Allyn 999079-6	715071-141	1	DS2
Light Source, Fiber Optics	112297-1	1	
Motor Assembly, Reader	110473-3	1	(M2)
Connector, Housing, Yellow, Molex 09-50-7051	706510-221	1	P7
Contact, Molex 08-50-0101	706530-138	1	(P7)
Collar	110866-1	1	7-1, 10
Collar, Spring	110869-1	1	7-1, 4
Damper Assembly	110867-1	1	7-1, 9
Face Plate	111386-1	1	7-1, 7
Motor, 28 Vdc, Stepper, Remex Specification	715075-176	1	7-1, M2
Plate, Friction	111385-1	1	7-1, 8
Spring	714090-136	1	7-1, 5

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Table 7-3. Parts List RAR612X and RAB612X (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Reader Panel Assembly (Continued)			
Panel, Reader	112137-1	1	7-4,2
Readhead Mechanism Assembly	112424-1	1	7-1,13
Bezel, Black, C&K B7888-2	715063-201	1	(S10)
Cap, Rocker, C&K 7922-1	715063-319	1	(S10)
Clamp, Cable, Weckesser A-30	715040-139	1	
Connector, Housing, Orange, Molex 09-50-7081	706510-223	1	7-1,P10
Contact, Connector, Molex 08-50-0103	706530-137	7	(P10)
Frame, Lower Cover	110440-3	1	7-1,15
Ground Plate Assembly	112423-1	1	7-1,19
Mechanism Assembly	110740-1	1	7-1,13
The following parts along with Figure 7-1 are listed for reference only. It is recommended that the entire Mechanism Assembly be replaced as a complete assembly.			
Actuator, Assembly	110769-1	1	
Cam, Tape Guide	110438-1	1	
Door Mechanism Assembly	110720-1	1	
Grounding Strap Assembly	110762-1	1	
Ring, Retainer, Truarc 5103-25	715025-148	1	
Slide	110432-1	1	
Spring, Associate Spring E0094-014-0620M	714090-127	1	
Readhead Assembly	110459-1	1	7-1,16
Connector, Red, Molex 09-50-7121	706510-224	1	7-1,P11
Contact, Molex 08-50-0101	706530-138	10	(P11)
Switch, SPDT, Cherry, E61-00K	715058-120	1	7-1,S9
Switch, (ON)-OFF-(ON), C&K 5205	715063-104	1	7-1,S10
Tape Guide, Fixed	112329-1	1	7-1,2
Tape Guide Assembly, Upper	112407-1	1	7-1,18
Sleeve	112319-1	1	7-1,21
Sprocket, Remex Specification	716057-102	1	7-1,12
Spacer, Nylon, Weckesser SP-41	715030-173	4	7-6,3
Tape Guide Assembly, RAB/RAR6121, 6122	112411-1	1	7-1,17
Tape Guide Assembly, RAB/RAR6123, 6124	112411-2	1	7-1,17

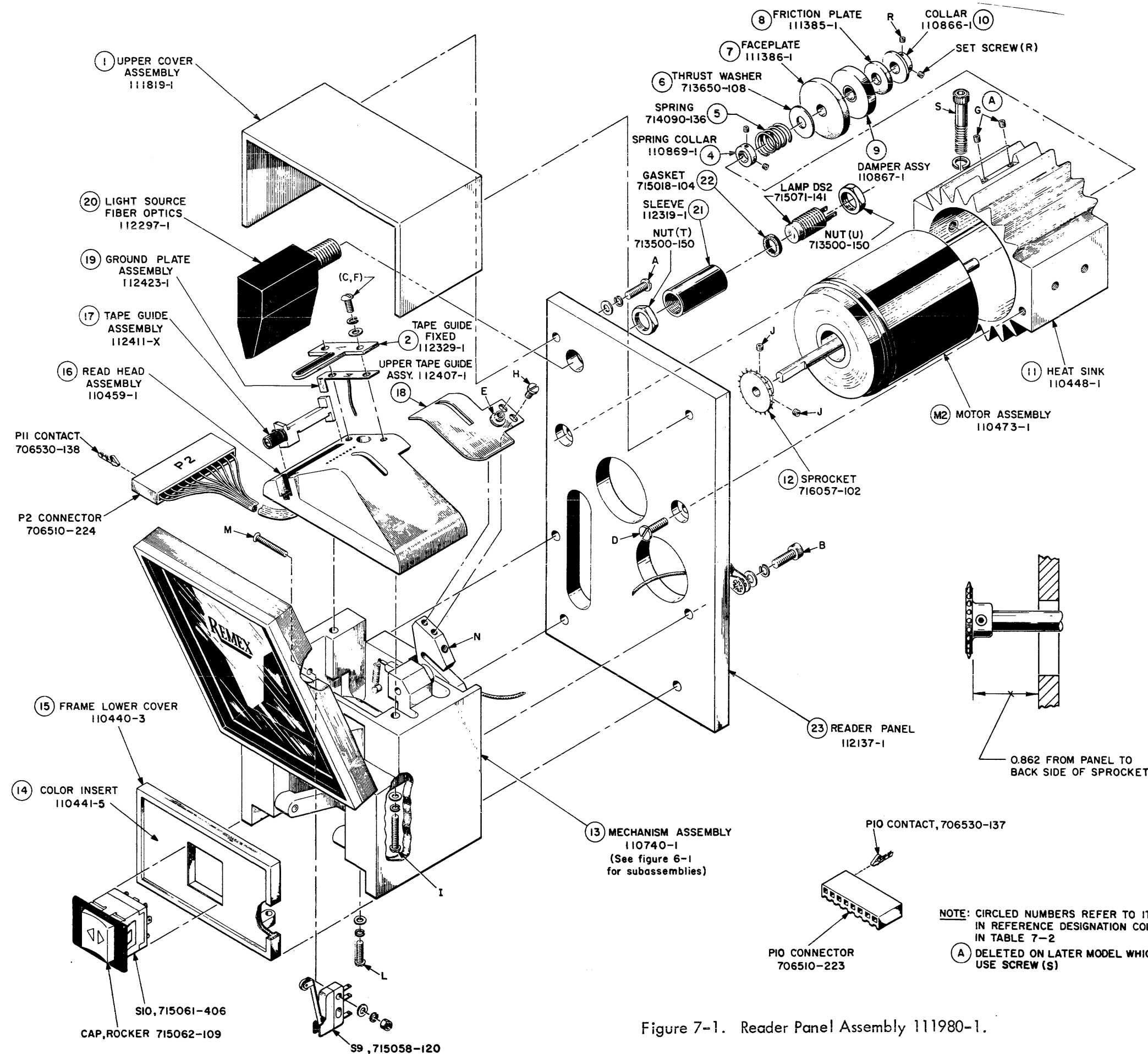
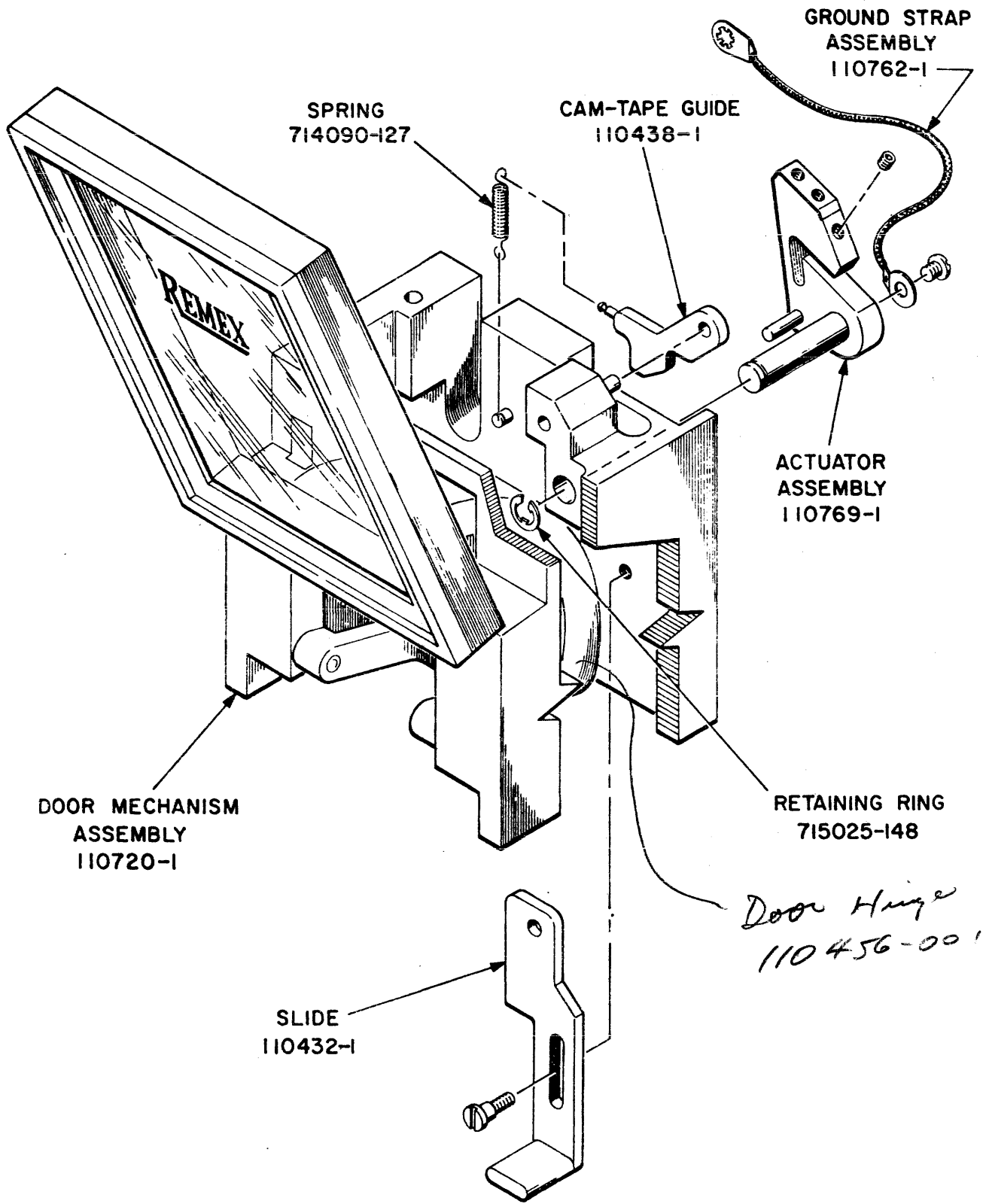


Figure 7-1. Reader Panel Assembly 111980-1.



MMC 357

Figure 7-2. Mechanism Assembly 110740-1.

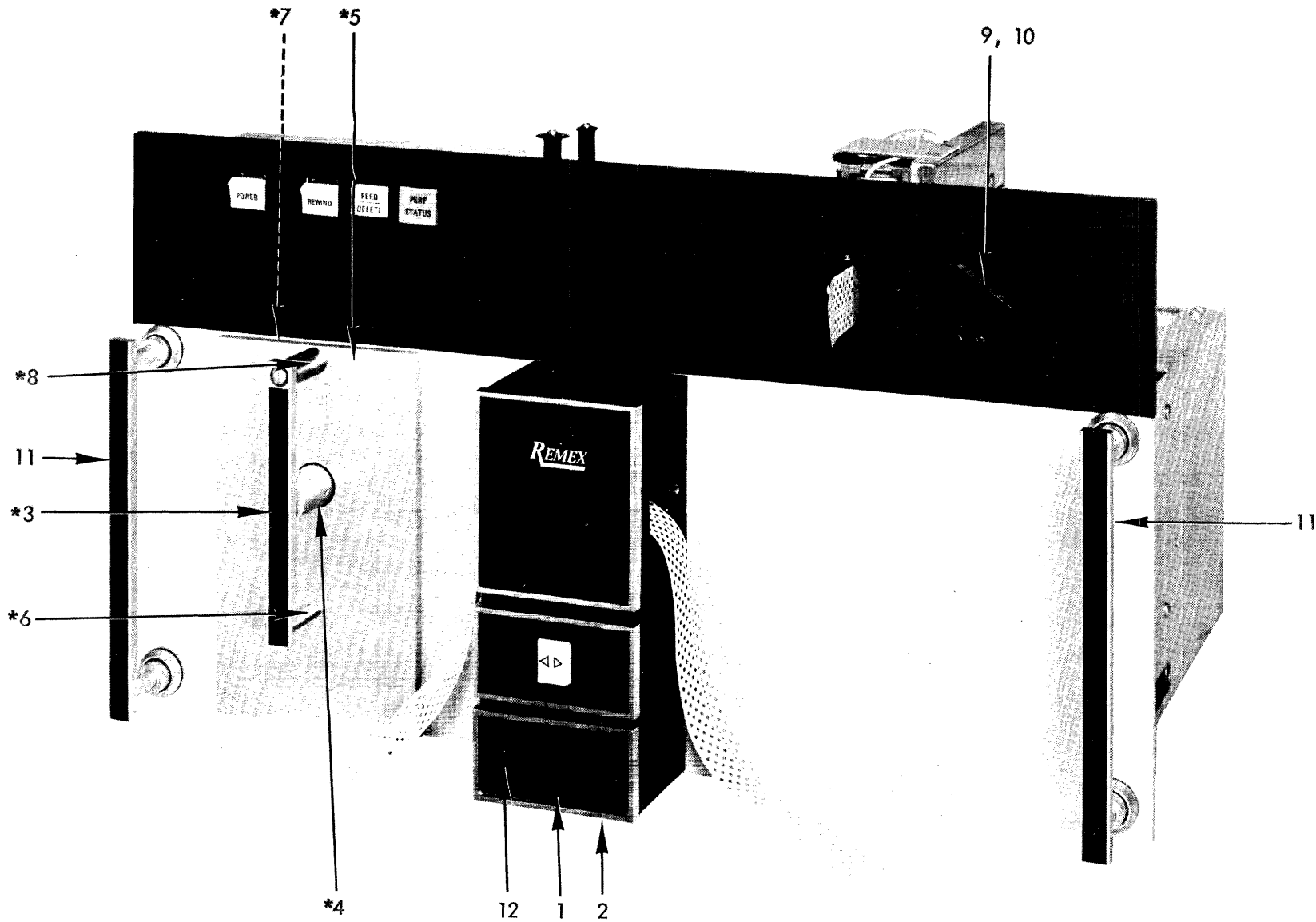


Figure 7-3. Front Panel RAB612X, Front View. The RAR6120 is Identical Except for the Deletion of Items Marked with an Asterisk (\*).

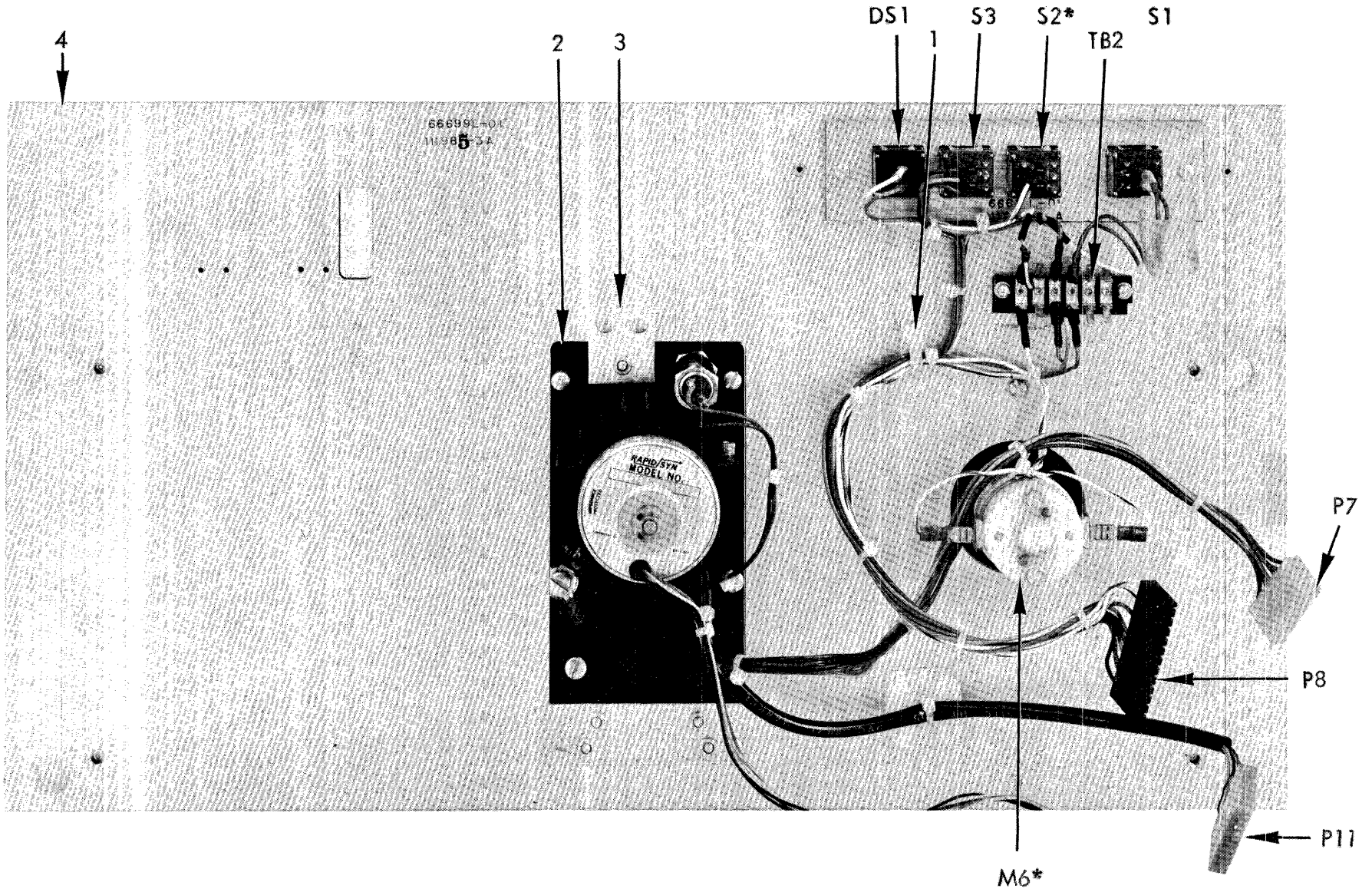


Figure 7-4. Front Panel RAB612X, Rear. The RAR6120 is Identical Except for the Deletion of Items Marked with an Asterisk (\*).

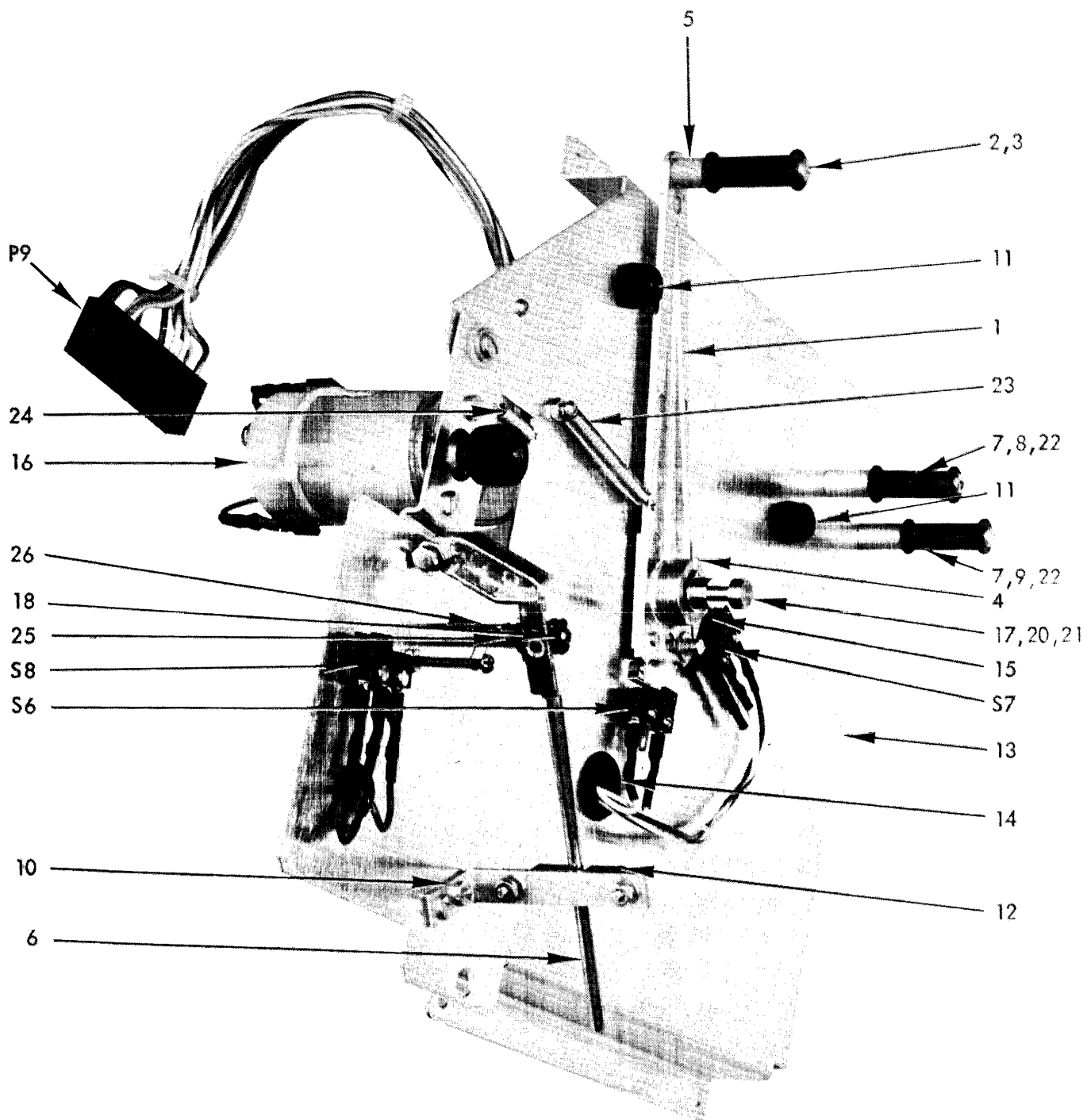


Figure 7-5. Deck Assembly, Tape Supply 112274-1 .



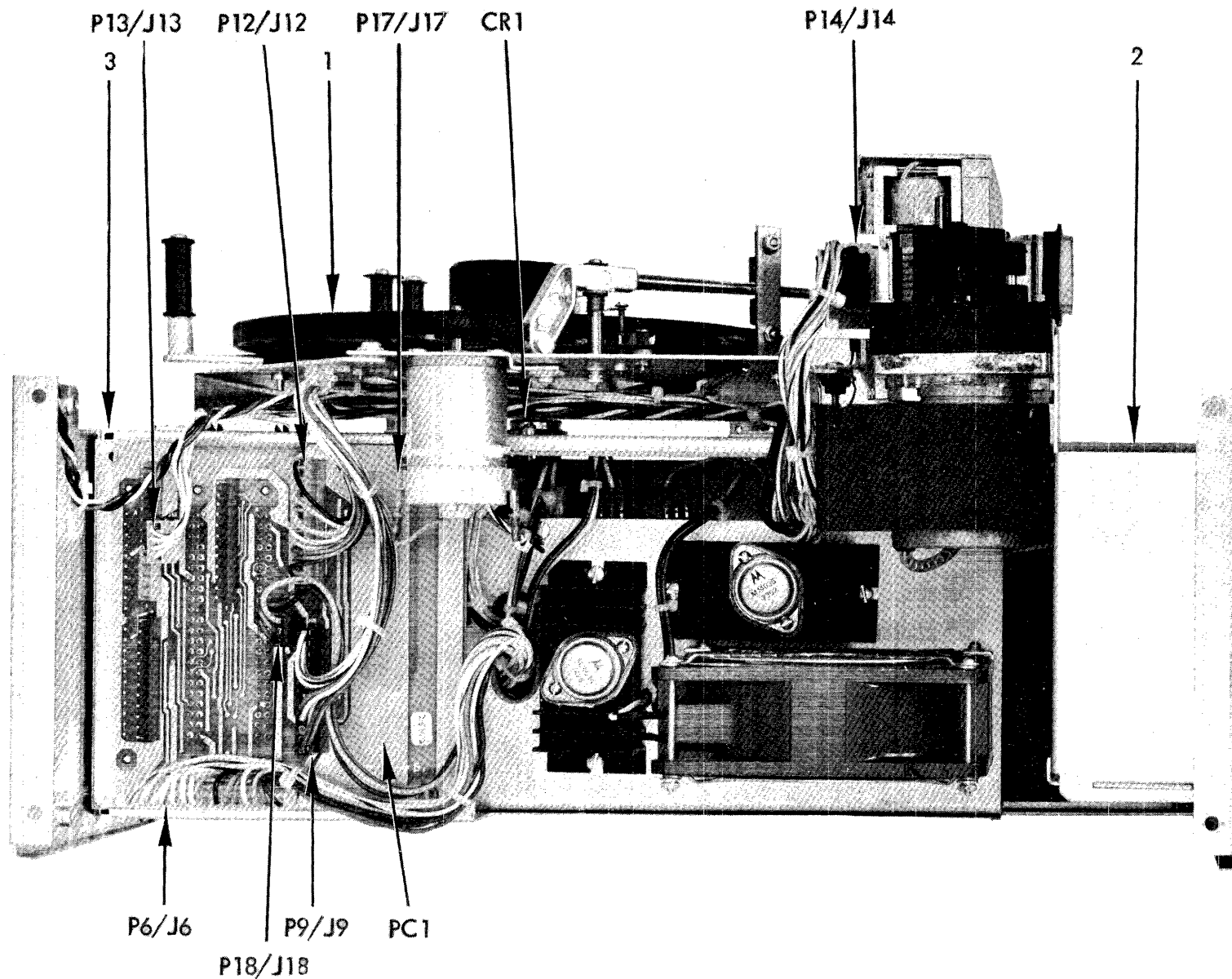


Figure 7-6. Chassis Assembly 112000-1, Inside View.

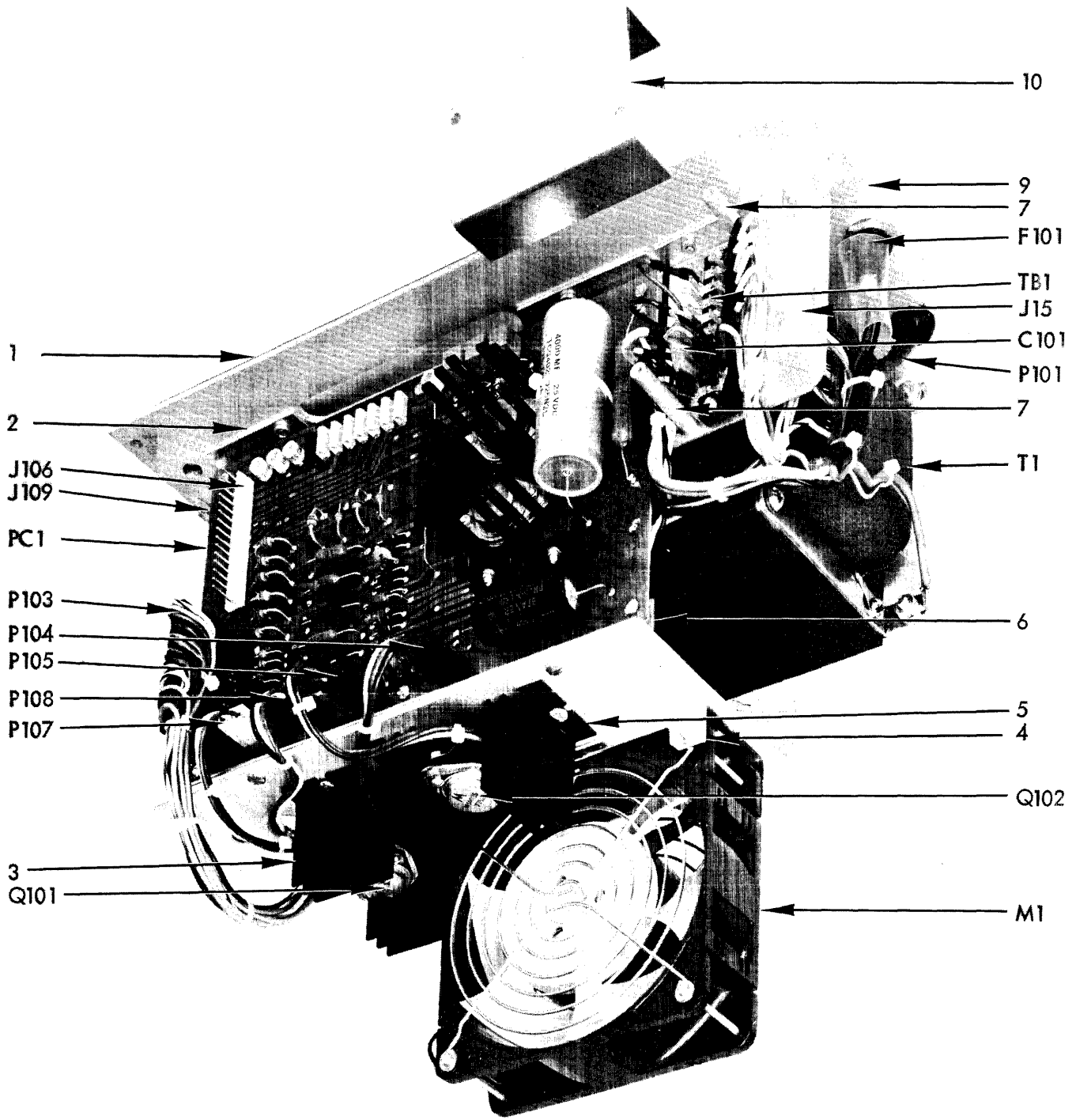


Figure 7-7. Power Supply 111839-1.

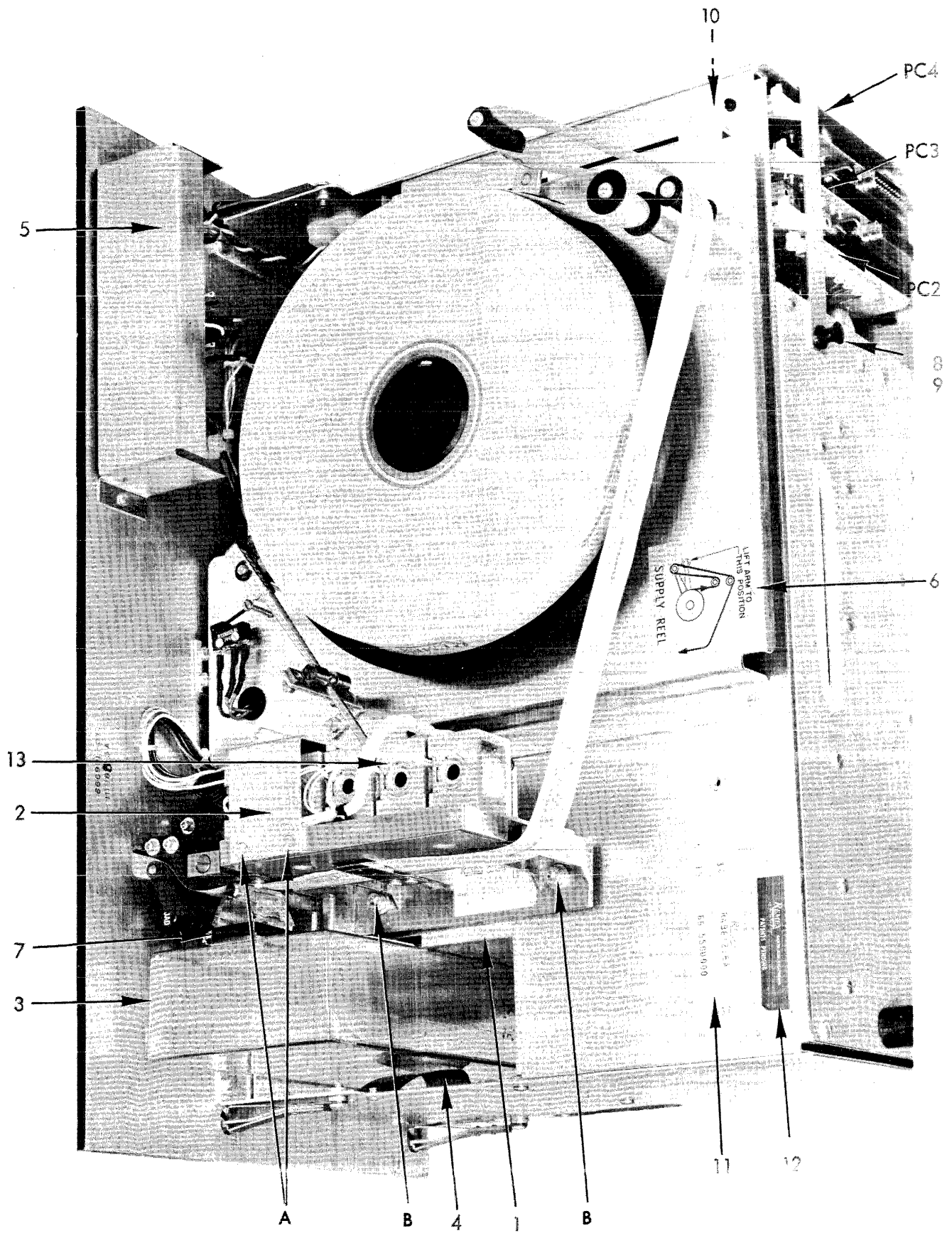


Figure 7-8. Top View, RAB612X. The Top View of the RAR612X is Identical.

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Table 7-4. Parts List RAF612X

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Top Assembly, RAF612X	111820-1	1	Ref
Bracket, Chad Box	111990-1	1	7-11,7
Bracket, Punch Support	111825-2	1	7-11,5
Chad Box	111991-2	1	7-12,1
Chassis Assembly	111998-1	1	7-11,Ref.
Bracket Retainer	111748-1	4	7-12,5
Cable Assembly, Power Switch	112139-1	1	(P15)
Connector, Housing, 3 pin, Molex P1 (03-06-2032)	706500-264	1	7-7,P15
Contact, Male, Molex 02-06-2103	706530-157	3	(P15)
Terminal, Quick Connect Amp 61454-1	715005-137	3	
Cable Assembly, Power Supply	111995-1	1	(P6,P16)
Connector, Housing, White, 15 pin, Molex 09-50-7151	706510-226	2	7-11,P6,P16
Contact, Female, Molex 08-50-0106	706530-137	30	(P6,P16)
Cable Assembly, Power Supply	111995-2	1	(P18,P109)
Connector, Housing, Red, 3 pin, Molex 09-50-7031	706510-300	2	7-11,P18; 7-7,P109
Contact, Female, Molex 08-50-0106	706530-137	6	(P18,P109)
Cable Assembly, Punch Mechanism	111986-1	1	(P12,P14)
Connector, Housing, Yellow, 12 pin, Molex 09-50-7121	706510-254	1	7-11,P12
Connector, Housing, White, 4 pin, Molex 09-50-7041	706510-268	1	7-11,P13
Connector, Housing, White, 24 pin, Molex R1(03-06-1242)	706510-296	1	7-11,P9
Contact, Female, Molex 08-50-0106	706530-137	15	(P12,P13)
Contact, Female, Molex 02-06-1105	706530-169	24	(P14)
Cable Assembly, Low Tape Switch	112138-1	1	(P9)
Connector, Housing 12 pin, Brown Molex 09-50-7121	706510-244	1	P9
Contact, Female, Molex 08-50-0106	706530-137	10	(P9)
Terminal, Solderless Amp 61060-1	715005-138	3	
Chassis	112013-1	1	7-11,6
Connector, White, 3 pin, Molex 09-50-7031	706510-258	1	7-11,P17
Contact, Connector, Molex 08-50-0106	706530-137	3	(P17)
Diode,Zener, 1N4561	704022-103	1	7-11,CR1
Grommet, Nylon Mould Co. G51H-B	715020-112	1	7-11,4
Guide, P. C. Card, Unitrack RAD 6875	716053-151	1	7-11,1
Insulator, RCA 495320	715019-115	1	(CR1)
Spring, Chad Box	111813-1	1	7-12,3
Tray Assembly, Tape Supply	112130-1	1	7-11,2
Cover, Switch Plate	112023-1	1	(S1,S3,DS1)
Frame, Lower Cover	110440-2	1	7-1
Front Panel Assembly	112018-1	1	Ref.

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Table 7-4. Parts List RAF612X (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Top Assembly, RAF612X (Continued)			
Front Panel Assembly (Continued)			
Clamp, Weckesser A-13	715040-139	1	7-10,4
Deflector, Fanfold tape	110777-1	2	7-9,7
Fastener, Pushbutton, Southco 34-10-101-10	713656-122	2	7-9,1
Harness Assembly Control Switches	112128-1	1	(P8)
Connector, Housing, Green, 12 pin, Molex 09-50-7121	706510-245	1	7-10,P8
Contact, Molex 08-50-0106	706530-137	7	(P8)
Switch Plate Assembly	111804-2	1	(S1, S3, DS1)
Bezel, C&K B7888-2	715063-201	1	(S1, S3, DS1)
Lamp, 28V, Chicago Miniature 399	715071-137	3	(S1, S3, DS1)
Lamp Holder, C&K 5600	715072-109	1	(DS1)
Lens, Orange, PERF STATUS, C&K B7952-04	715072-111	1	7-10,DS1
Plate, Switch	111840-2	1	7-10,3
Rocker Cap, Power, C&K 7922-1	715063-311	1	(S1)
Rocker Cap, FEED/DELETE, C&K 7922-1	715063-320	1	(S3)
Switch, ON-NONE-ON, C&K 5201Z3	715063-111	1	7-10,S1
Switch, (ON)-OFF-(ON), C&K 5205Z3	715063-114	1	7-10,S3
Terminal Strip, 6 Terminal, Kulka 511-6-KT11-K12	715010-148	1	
Terminal, Quick Connect, Amp 61454-1	715005-137	4	(TB2)
Terminal, Amp 61060-1	715005-138	7	(TB2)
Marking Strip, Kulka MS-411-6	715007-132	1	(TB2)
Panel, Front	112126-3	1	7-9,1
Plate, Back, Fanfold, Left	110446-3	1	7-9,2
Plate, Back, Fanfold, Right	110446-4	1	7-9,4
Plate, Mounting, Reader, Lower	112341-1	1	7-10,5
Plate, Mounting, Reader Upper	112341-2	1	7-10,2
Resistor, 150 ohm, 1W	701005-151	2	R1,R2
Tank, Fanfold, Left	110445-1	1	7-9,10
Tank, Fanfold, Right	110445-2	1	7-9,6
Gasket, Access Tube	111996-1	1	7-12,2
Grommet	713656-124	2	7-12,6
Guide, P.C. Card Unitrack RAD6875	716053-151	1	7-11,1
Handle	110929-2	1	7-9,9
Insert, Color, Black	110441-4	1	7-9,8
Kit of Parts, See Table 1-1 for contents	112134-1	1	Ref
Label, I.D.	716018-113	1	
Nameplate, Patent Pending	108547	1	
Perforator Assembly, RAB/RAR6121, 8 Track Steel	112860-1	1	7-12,4
Perforator Assembly, RAB/RAR6122, 8 Track Carbide	112860-2	1	7-12-4
Plunger	713656-123	3	7-12,6
Power Supply Assembly	111839-1	1	7-7,Ref
Bracket, Capacitor, STM FCMR	715045-103	1	(C102)

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Table 7-4. Parts List RAF612X (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Top Assembly, RAF612X (Continued)			
Power Supply Assembly (Continued)			
Bracket, Capacitor, Sangamo DCM-05	715045-123	1	(C103)
Bracket, Capacitor, Sangamo DCM-06	715045-106	2	(C104, C105)
Bracket, Support	111747-1	1	7-7,6
Bracket, Support	112247-1	1	7-7,2
Bracket, Support, Fan	111826-1	1	7-7,4
Cable Assembly	112011-2	1	(P107)
Connector, Housing White, 3 pin Molex 09-50-7031	706510-258	1	7-7, P107
Contact, Connector, Female, Molex 08-50-0106	706530-137	3	(P107)
Cable Assembly	112011-1	1	(P108)
Connector, Housing, White, 3 pin Molex 09-50-7031	706510-257	1	7-7, P108
Contact, Connector, Female, Molex 08-50-0106	706530-137	3	(P108)
Capacitor, 2 x .01 $\mu$ f, 125V	702127-103	1	7-7, C101
Capacitor, 21,000 $\mu$ f, Electrolytic STM 71C40CC213(71YZ40CC213)	702313-104	1	C102
Capacitor, 5,900 $\mu$ f, Electrolytic STM 91C75JC592	702317-119	1	C103
Capacitor, 2,500 $\mu$ f, Electrolytic, STM 91C75HC252	702317-118	2	C104, C105
Chassis	111827-1	1	7-7, 1
Connector Assembly	112012-1	1	(J15)
Connector, Housing, 3 pin Molex R (03-06-1031)	706510-294	1	7-7, J15
Contact, Female, Molex 02-06-1103	706530-156	3	(J15)
Terminal, Quick Connect, Amp 42470-1	715005-125	3	
Cover, Terminal Board	111727-1	1	7-7, 10
Decal, Warning	111934-1	1	
Fan Assembly	111844-1	1	7-7, M1
Fuse, 4A, Bussman MDA	705710-128	1	7-7, F101
Fuseholder, Littlefuse 342004 L	705750-100	1	(F101)
Grommet, Nylon Mould G51H-C	715020-113	1	
Grommet, General Cement 7566	715020-109	1	
Grommet, Power Cord, Heyman SR-6P-4	715020-117	1	(P101)
Heat Sink Assembly	111838-1	1	7-7, 3
Connector, Housing, 3 pin, blue Molex 09-50-703	706510-255	1	7-7, P104
Contact, Female, Molex 08-50-0106	706530-137	3	(P104)
Heat Sink	111835-1	1	(Q101)
Insulator, RCA 495320	715019-115	1	(Q101)
Transistor, Motorola MJ4035	704204-120	1	7-7, Q101
Heat Sink Assembly	11838-2	1	7-7, 5

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Table 7-4. Parts List RAF612X (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Heat Sink Assembly (Continued)			
Cable Assembly	112246-2	1	
Connector, Housing, 3 pin, Gray, Molex 09-50-7031	706510-256	1	7-7, P105
Contact, Female, Molex 08-50-0106	706530-137	3	(P105)
Heat Sink	111835-1	1	(Q102)
Insulator, RCA 495320	715019-115	1	(Q102)
Transistor, Motorola MJ4035	704204-120	1	7-7, Q102
Power Cord, Belden, 17408-S	708000-027	1	7-7, P101
Printed Circuit Card Assembly, Power Supply	111841-1	1	7-7, PC1
See Table 7-9 for component listing			
Terminal, Quick Connect AMP 42470-1	715005-125	10	(TB1)
Terminal Board Assembly	112008-1	1	(TB1)
Bracket, Support	112004-1	1	7-7, 9
Marker Strip, Kulka MS-411-9	715007-131	1	(TB1)
Standoff, Amaton 8167-A-0632-1B	715030-213	2	7-7, 7
Terminal Strip, 9 terminal, Kulka 511-9-KT11-KT12	715010-147	1	7-7, TB1
Transformer Assembly	111809-2	1	(T1, P103)
Connector, Housing, Black, 15 pin Molex 09-50-7151	706510-269	1	7-7, P103
Contact, Connector, Molex 08-50-0106	706530-137	14	(P103)
Terminal, Quick Connect AMP 42470-1	715005-125	8	(TB1)
Transformer, REMEX Specification	703010-158	1	7-7, T1
Printed Circuit Card Assembly, Master Interconnect. See Table 7-5 for component listing.	111901-1	1	7-11, PC1
Printed Circuit Card Assembly, Perforator Driver, See Table 7-7 for component listing.	111831-1	1	5-1, PC2
Printed Circuit Card Assembly, Perforator Logic See Table 7-6 for component listing and dash number configuration.	111821-X	1	5-1, PC3
Printed Circuit Card Assembly, Reader Card See Table 7-8 for component listing.	110801-1	1	5-1, PC4
Reader Panel Assembly	111980-1	1	7-1, Ref.
Cover Assembly	111819-1	1	7-1, 1
Gasket, Welch Allyn 11200182	715018-104	1	7-1, 22
Heat Sink	110448-1	1	7-1, 11
Insert Color, Black	110441-5	1	7-1, 14
Lamp, 5 volt, Welch Allyn 999079-6	715071-141	1	7-1, DS2
Light Source, Fiber Optics	112297-1	1	7-1, 20
Motor Assembly, Reader	110473-3	1	(M2)
Connector, Housing, Yellow, Molex 09-50-7051	706510-221	1	7-11, P7
Contact, Molex 08-50-010	706530-138	1	(P7)
Collar	110866-1	1	7-1, 10
Collar, Spring	11086 -1	1	7-1, 4
Damper Assembly	11086 -1	1	7-1, 9
Faceplate	111386-1	1	7-1, 7

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Table 7-4. Parts List RAF612X (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Top Assembly, RAF612X (Continued)			
Reader Panel Assembly (Continued)			
Motor, 28 Vdc, Stepper, Remex Specification	715075-176	1	7-1,M2
Plate, Friction	111385-1	1	7-1,8
Spring	714090-136	1	7-1,5
Panel, Reader	112137-1	1	7-4,2
Readhead Mechanism Assembly	112424-1	1	7-1,13
Bezel, Black, C&K B7888-2	715063-201	1	(S10)
Cap, Rocker, C&K 7922-1	715063-319	1	(S10)
Clamp, Cable, Weckesser A-30	715040-139	1	
Connector, Housing, Orange, Molex 09-50-7081	706510-223	1	7-1,P10
Contact, Connector, Molex 08-50-0103	706530-137	7	(P10)
Frame, Lower Cover	110440-3	1	7-1,15
Ground Plate Assembly	112423-1	1	7-1,19
Mechanism Assembly	110740-1	1	7-1,13
The following parts along with Figure 7-2 are listed for reference only. It is recommended that the entire Mechanism Assembly be replaced as a complete assembly.			
Actuator, Assembly	110769-1	1	
Cam, Tape Guide	110438-1	1	
Door Mechanism Assembly	110720-1	1	
Grounding Strap Assembly	110762-1	1	
Ring, Retainer, Truarc 5103-25	715025-148	1	
Slide	110432-1	1	
Spring, Associate Spring E0094-014-0620M	714090-127	1	
Readhead Assembly	110459-1	1	7-1,16
Connector, Red, Molex 09-50-7121	706510-224	1	7-1,P11
Contact, Molex 08-50-0101	706530-138	10	(P11)
Switch, SPDT, Cherry, E61-00K	715058-120	1	7-1,S9
Switch, (ON)-OFF-(ON), C&K 5205	715063-104	1	7-1,S10
Tape Guide, Fixed	112329-1	1	7-1,2
Tape Guide Assembly, Upper	112407-1	1	7-1,18
Sleeve	112319-1	1	7-1,21
Sprocket, La Vezzi A24B18F	716057-102	1	7-1,12
Spacer, Nylon, Weckesser SP-41	715030-173	2	7-11,3,8
Strap, P.C. Card Retaining	112465-1	1	7-12,7
Tape Guide Assembly, RAF 6121, 6122	112411-1	1	7-1
Tray, Tape	109860-1	1	7-9,3 7-12,7



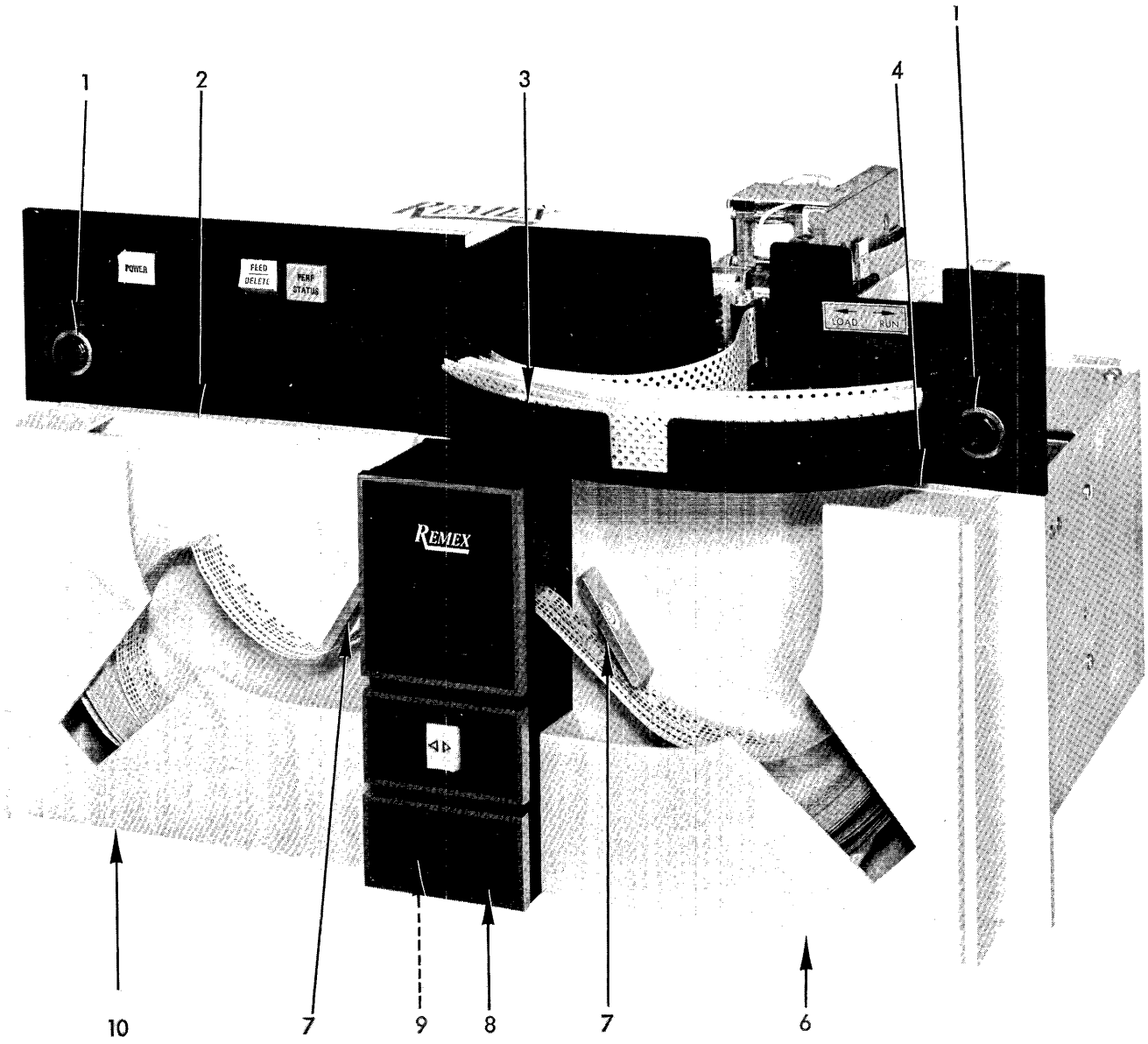


Figure 7-9. Front Panel, RAF612X, Front View.

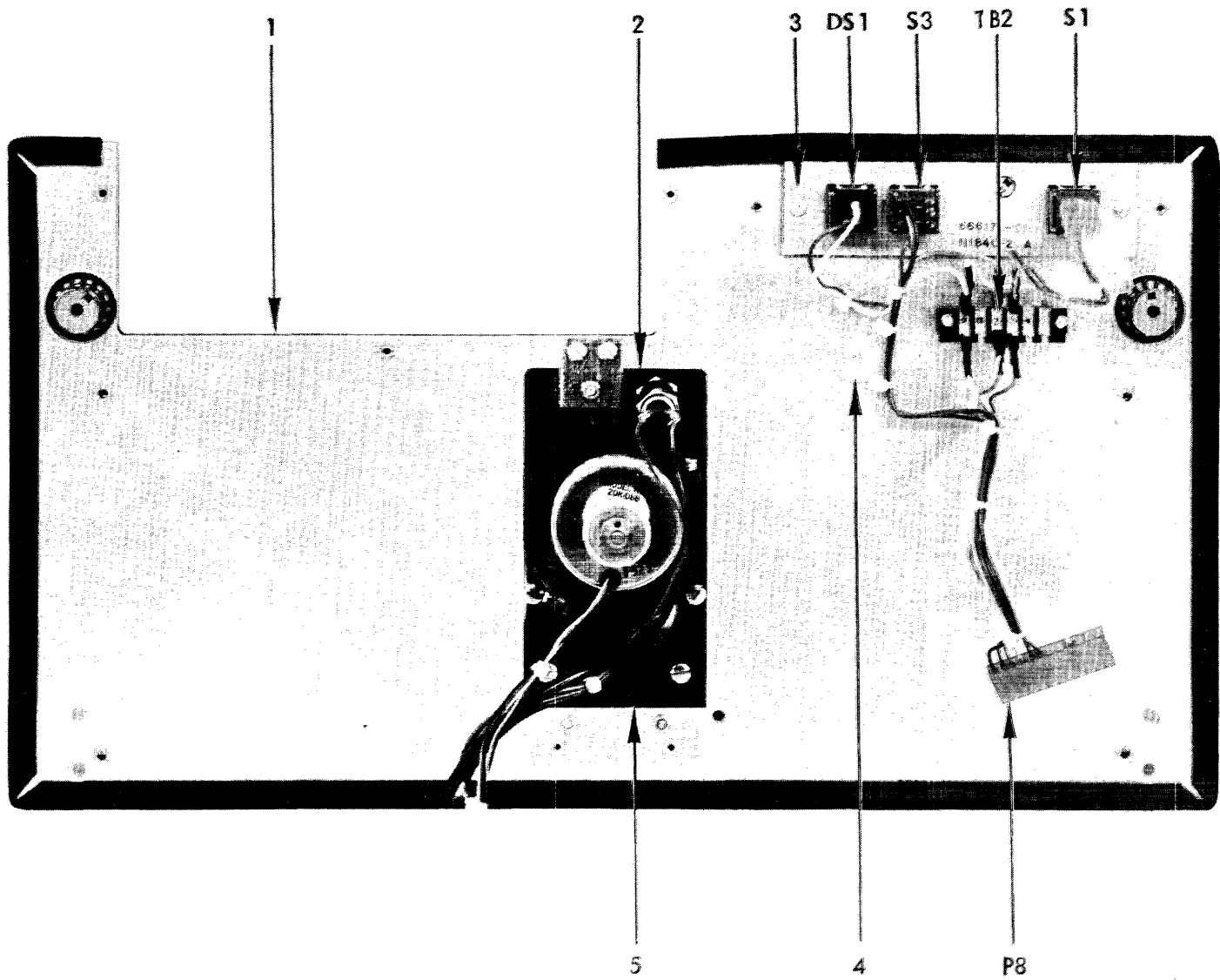


Figure 7-10. Front Panel RAF612X, Rear View.

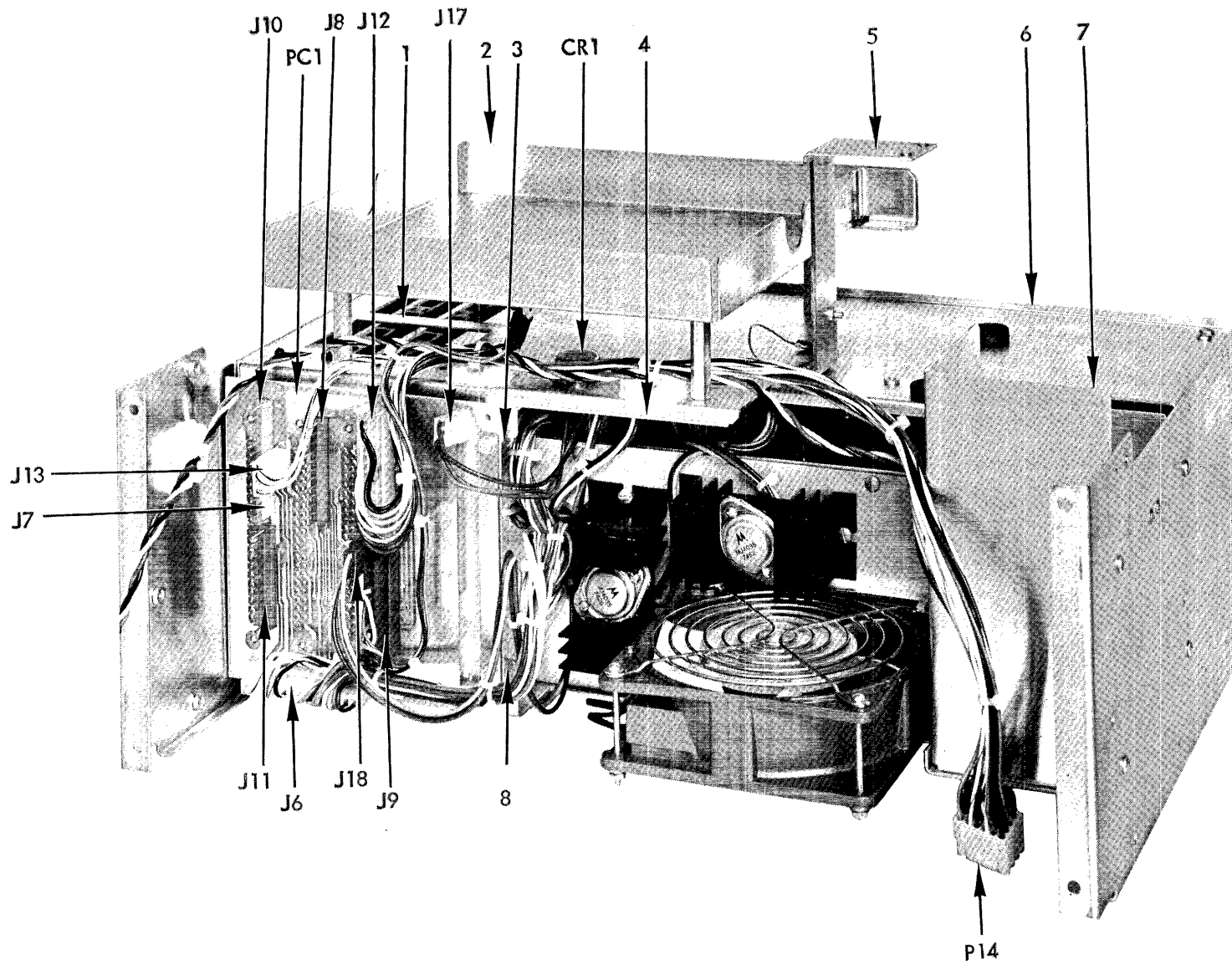


Figure 7-11. Chassis Assembly 111998-1, Inside View.

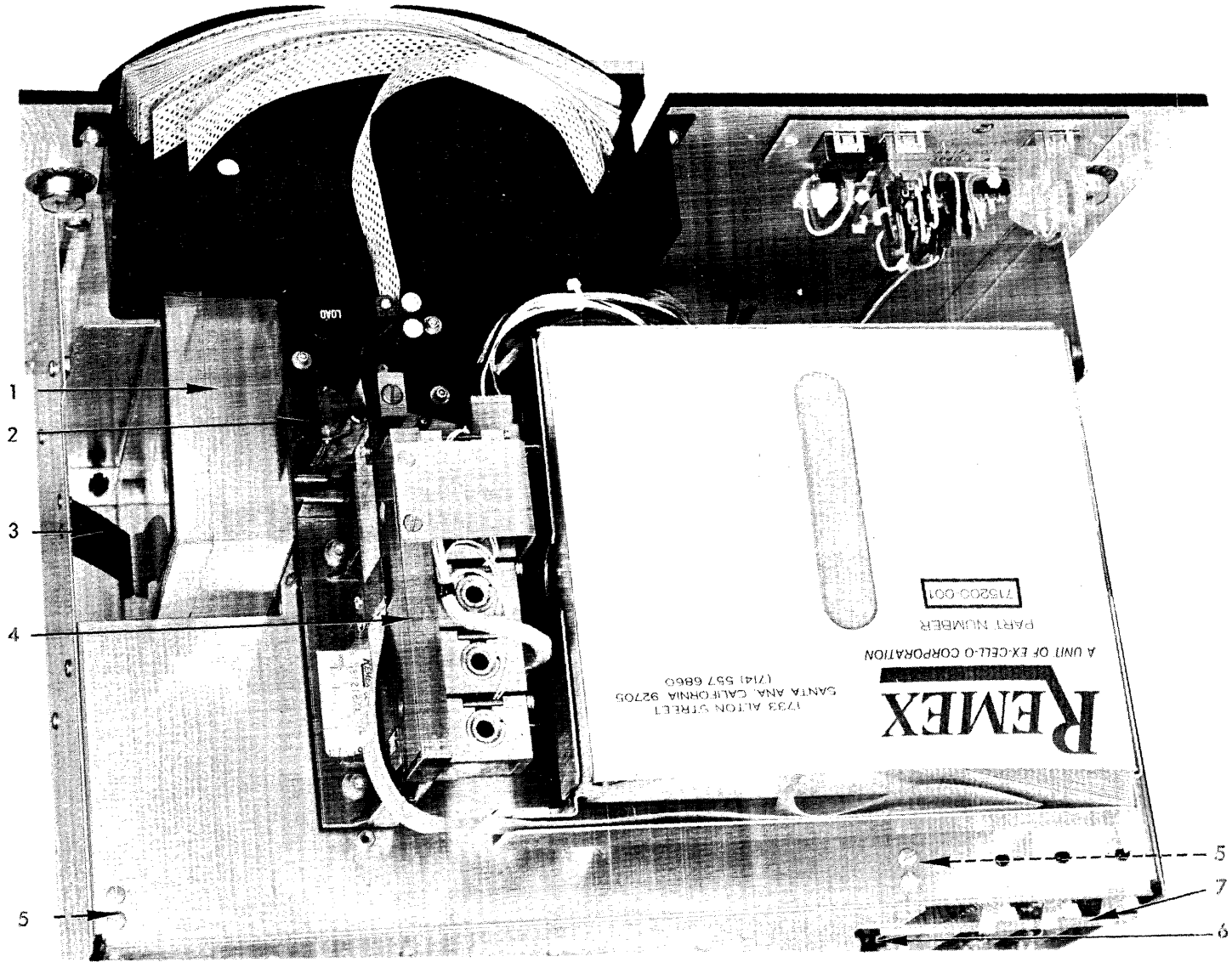


Figure 7-12. Top View, RAF612X.

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Table 7-5. Master Interconnect Card 111901-1, -2

Description and Manufacturer's Part No.	REMEX Part No.	-1 Quantity	-2 Quantity	Reference Designation
Connector, 22 pin, Viking 2VK22S/2-3	706510-280	1	-	J3
Connector, 44 pin, Viking 2VK22D/203	706510-279	2	2	J4, J5
Connector, 15 pin, White, Molex 09-60-1151	706501-159	1	1	J6
Connector, 5 pin, Yellow, Molex 09-60-1051	706501-054	1	1	J7
Connector, 12 pin, Green, Molex 09-60-1121	706501-125	1	-	J8
Connector, 12 pin, Brown, Molex 09-60-1121	706501-121	1	1	J9
Connector, 8 pin, Orange, Molex 09-60-1081	706501-083	1	-	J10
Connector, 12 pin, Red, Molex 09-60-1121	706501-122	1	-	J11
Connector, 12 pin, Yellow, Molex 09-60-1121	706501-124	1	1	J12
Connector, 4 pin, White, Molex 09-60-1041	706501-049	1	1	J13
Connector, 3 pin, White, Molex 09-60-1031	706501-039	1	1	J17
Connector, 3 pin, Red Molex 09-60-1031	706501-032	1	1	J18
Polarizing Key, Molex 091-0024-000	706540-138	3	2	(J3, J4, J5)

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Table 7-6. Perforator Logic Card Assembly 11821-1, -2

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
The components used on the 11821-1 and 11821-2 are identical except as specifically noted.			
Capacitor, 0.47 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B474K	702181-474	1	C1
Capacitor, 0.22 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B224	702181-224	1	C2, C5
Capacitor, 0.1 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B104	702181-104	3	C3, C4, C11
Capacitor, 0.068 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B683	702181-683	1	C6
Capacitor, 68 pf, 200V, Ceramic Type CK05	702128-680	1	C7
Capacitor, 47 pf, 200V, Ceramic Type CK05	702128-470	1	C8
Capacitor, 0.01 $\mu$ f, 100V, Ceramic Disc, Erie 805X5V103Z	702121-103	23	C9, C12, C32 C36
Capacitor, 330 $\mu$ f, 6V, Electrolyte, Tantalum, Mallory TAS337 M006P1	702384-337	1	C10
Capacitor, 3.3 $\mu$ f, 15V, Polarized, Solid Tantalum Sprague 196D	702394-335	2	C33, C34
Capacitor, 0.0047 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B472	702181-472	1	C35
Connector, 25 pin, Amp 205858-2	706510-267	1	(J1)
Diode, FD6666	704000-110	3	CR1-CR3
Diode, IN5059	704000-107	3	CR4-CR6
Ejector, Scambe S202 with roll pin	716053-105	1	
I.C. Package, SN74221N	704610-165	4	Z1, Z2, Z4, Z8
I.C. Package, SN7408N	704600-114	3	Z3, Z14, Z19
I.C. Package, SN7400N	704600-101	2	Z5, Z10
I.C. Package, SN7432N	704600-126	1	Z6
I.C. Package, SN7403N	704600-112	1	Z7
I.C. Package, SN7486N	704600-109	4	Z9, Z12, Z16, Z17
I.C. Package, SN74107N	704610-117	1	Z11
I.C. Package, SN 7475N	704610-105	2	Z13, Z18
I.C. Package, SN7404N	704600-110	2	Z15, Z27
I.C. Package, SN7402N	704600-106	2	Z20, Z21
I.C. Package, Resistor/Capacitor Network Keldron KD406	701950-001	5	Z22-Z26
Potentiometer, 20K, 1/2W, Spretrol 53-2-1-203	701658-203	3	R17, R19, R20
Potentiometer, 10K, 1/2W, Spretrol 53-2-1-103	701658-103	2	R18, R21
Resistor, 0.5 $\Omega$ , 3W, $\pm$ 5%, Dale RS-2C-23	701015-R50	1	R1
Resistor, 2.2K, 1/4W, $\pm$ 5%	701003-222	5	R2, R5, R7, R27 R28
Resistor, 10K, 1/4W, $\pm$ 5%	701003-103	1	R3
Resistor, 12K, 1/4W, $\pm$ 5%	701003-123	1	R4
Resistor, 22K, 1/4W, $\pm$ 5%	701003-223	2	R6, R13
Resistor, 6.8K, 1/4W, $\pm$ 5%	701003-682	2	R9, R12
Resistor, 39K, 1/4W, $\pm$ 5%	701003-393	2	R15, R23

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Table 7-6. Perforator Logic Card Assembly 11821-1, -2 (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Resistor, 36K, 1/4W, +5%	701003-363	1	R22
Resistor, 330 $\Omega$ , 1/4W, +5%	701003-331	3	R24-R26
Terminal, Test Point, Lerco 5025-B-1	715013-121	7	TP1-TP7
Transistor, 2N6045	704204-127	3	Q1-Q3
Transistor, 2N4403	704202-108	1	Q4
Screw Lock Assembly, Set of 2, Female, Cannon D-10418-2	706540-123	1	(J1)
CARD DASH NUMBER DETERMINATION			
RAX612XBA-/66-/550/UXXX uses 111821-1 Assembly			
RAX612XBA-/66-/551/UXXX uses 111821-2 Assembly			

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Table 7-7. Perforator Driver Card 111831-1

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Capacitor, 0.022 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B223	702181-223	1	C1, C2
Capacitor, 3.3 $\mu$ f, 15V, Polarized, Solid Tantalum, Sprague 196D	702394-335	3	C3, C8, C9
Capacitor, 0.01 $\mu$ f, 100V, Ceramic Disc, Erie 805X5V103Z	702121-103	1	C4
Capacitor, 2 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B205	702181-205	2	C5, C6
Capacitor, 1,000 $\mu$ f, 75V, Electrolytic, Aluminum, STM Model 61C	702351-101	1	C7
Capacitor, 2 $\mu$ f, 200V, Metallized Mylar, Electrocube 210B-1C205K	702192-205	1	C10
Capacitor, 1 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B105	702181-105	2	C11, C12
Diode, 1N5059	704000-107	10	CR1, CR5-CR13
Diode, Zener 1N4747A	704014-127	2	CR2, CR3
Diode, 1N5624	704005-138	1	CR4
Diode, Zener, 1N2808	704022-107	1	CR14
Diode, FD6666	704000-110	1	CR15
Ejector, w/roll pin, Scanbe S202	716053-105	1	
Fuse 2A, Bussman GMW	705725-110	9	F1-F9
Heat Sink, Ierc, HP1-T03B	715033-115	1	(CR14)
I.C. Package SN74121N	704610-115	1	Z1
Insulator, RCA495320	715019-115	1	(CR14)
Jack, Fuseholder Cambion 3704-1-03	706515-129	18	(F1-F9)
Resistor, 1K, 1/4W, $\pm$ 5%	701003-102	9	R1, R2, R5, R9, R11, R13-R15, R18
Resistor, 5 $\Omega$ , 3W, $\pm$ 5%	701015-5R0	1	R3
Resistor, 20 $\Omega$ , 3W, $\pm$ 5%	701015-200	1	R4
Resistor, 0.5 $\Omega$ , 3W, $\pm$ 5%, Dale RS-2C-23	701015-R50	1	R6
Resistor, 10K, 1/4W, $\pm$ 5%	701003-103	1	R8
Resistor, 4.7K, 1/4W, $\pm$ 5%	701003-472	1	R10
Resistor, 2 $\Omega$ , 3W, $\pm$ 5%	701015-2R0	1	R12
Resistor, 33K, 1/4W, $\pm$ 5%	701003-333	1	R16
Resistor, 2K, 1/4W, $\pm$ 5%	701003-202	20	R17, R19, R20, R22, R23, R25, R26, R28, R29, R31, R32, R34, R35, R37, R38, R40, R41, R43, R44, R46,
Terminal, Test Point, Lerc 5025-B-1	715013-121	2	TP1, TP2
Transistor, Motorola MJE1090	704212-108	11	Q1, Q6, Q8, Q16
Terminal, Test Point, Lerc 5025-B-1	704203-114	11	Q2, Q17, Q26
Transistor, Motorola MJE1100	704204-115	3	Q3-Q5
Transistor, Motorola MPSA56	704202-109	1	Q7



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Table 7-7. Perforator Driver Card 111831-1 (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Transistor, Motorola MJE1090	704212-108	11	Q1, Q6, Q8-Q16
Transistor, 2N4401	704203-114	11	Q2, Q17-Q26
Transistor, Motorola MJE1100	704204-115	3	Q3-Q5
Transistor, Motorola MPSA56	704202-109	1	Q7

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Table 7-8. Reader Card Assembly, 110801-3

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Capacitor, 1 $\mu$ f, 50V, Ceramic, monolythic, Sprague, 7C023105D8500E	702131-105	4	C1-C4
Capacitor, 470 pf, 200V, Ceramic Type CK05	702128-471	1	C5
Capacitor, 220 $\mu$ f, 10V, Electrolytic, Amperex, Model ET	702620-227	1	C6
Capacitor, 100 pf, 200V, Ceramic, Type CK05	702128-101	1	C7
Capacitor, 0.015 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B153K (-3 assembly only)	702181-153	1	C8
Capacitor, 220 pf, 200V, Ceramic, Type CK05	702128-221	2	C11, C21
Capacitor, 0.15 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B154K	702181-154	1	C14
Capacitor, 0.01 $\mu$ f, 100V, Ceramic Disc, Erie 805X5V103Z.	702121-103	3	C15, C17, C19
Capacitor, 1 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B105K	702181-105	1	C16
Capacitor, 0.68 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B154K	702181-684	1	C18
Connector, 25 pin, Amp 205857-2	706500-255	1	J2
Diode, 1N4003	704005-137	6	CR1-CR6
Ejector, Scanbe S-202 with roll pin	716053-105	1	
Heat Sink	109457-1	1	(Q10-Q13)
I.C. Package, SN74123N	704610-119	3	Z2, Z5, Z6
I.C. Package, SN7474N	704610-110	2	Z3, Z14
I.C. Package, SN7400N	704600-101	4	Z4, Z7, Z8
I.C. Package, SN7486N	704600-109	4	Z10
I.C. Package, SN7408N	704600-114	2	Z9, Z15, Z18
I.C. Package, SN7406N	704600-111	1	Z21
I.C. Package, R-C Network, Beckman 1899-4102-0	701950-004	2	Z11, Z12
I.C. Package, SN7475N	704610-105	2	Z13
I.C. Package, Resistor/Capacitor, Keldron DK406	701950-001	2	Z16, Z19
Resistor, 0.5 ohm, 3W, $\pm$ 5%, Dale RS-2C-23	701015-R50	2	Z17, Z20
Resistor, 4.7K, 1/4W, $\pm$ 5%	701003-472	10	Z22, Z23
Resistor, 1K, 1/4W, $\pm$ 5%	701003-102	2	R1, R2
Resistor, 2.2K, 1/4W, $\pm$ 5%	701003-222	3	R3-R10, R15, 16
Resistor, 22ohm, 1/4W, $\pm$ 5%	701003-220	3	R11, R20
Resistor, 100K, 1/4W, $\pm$ 5%	701003-104	1	R12, R22, R23
Resistor, 220 ohm, 1/4W, $\pm$ 5%	701003-221	1	R13, R14, R29
Resistor, 1.5K, 1/4W, $\pm$ 5%	701003-152	1	R17
Resistor, 33K, 1/4W, $\pm$ 5%	701003-333	2	R18
Resistor, 10 ohm, 1/4W, $\pm$ 5%	701003-100	1	R19
Resistor, 10K, 1/4W, $\pm$ 5%	701003-103	1	R21, R38
Resistor, 47 ohm, 1/4W, $\pm$ 5%	701003-470	1	R26
			R27
			R30

NOTE: WHEN ORDERING SPARE PARTS, CONTACT REMEX SPARES ORDER DESK AND REFERENCE COMPLETE MODEL AND SERIAL NUMBER OF UNIT. ALWAYS REFER TO ADDENDUM AT THE REAR OF THE MANUAL (IF APPLICABLE) FOR POSSIBLE PART NUMBER CHANGES.

Table 7-8. Read Card Assembly, 110801-3 (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity	Reference Designation
Resistor, 30K, 1/4W, +5%	701003-303	1	R31
Resistor, 47K, 1/4W, ±5%	701003-473	1	R32
Resistor, 330 ohm, 1/4W, +5%	701003-331	4	R34-R37
Screw Lock Assembly (Set of 2), Cannon D-20418-2	706540-123	1	(J2)
Terminal, Test Point, Lerco 5025-B-1	715013-121	5	TP1-TP5
Transistor, 2N5088	704203-119	9	Q1-Q9
Transistor, Motorola MJE 1100	704204-115	4	Q10-Q13

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Table 7-9. Power Supply Card Assembly, 111841-1, -2

Description and Manufacturer's Part No.	REMEX Part No.	-1 Quantity	-2 Quantity	Reference Designation
Capacitor, 0.1 $\mu$ f, 100V, Metallized Mylar, Electrocube 217A1B104K	702181-104	2	-	C1, C2
Capacitor, 4K $\mu$ f, 25V, Electrolytic, Aluminum, Cornell-Dublier WBR Series	702345-408	1	1	C3
Capacitor, 0.01 $\mu$ f, 100V, Ceramic Disc, Erie 805X5V103Z	702121-103	3	1	C4, C9, C10
Capacitor, 50 $\mu$ f, 150V, Electrolytic, Aluminum, Sangamo MT	702350-506	1	1	C5
Capacitor, 1.0 f, 50V, Ceramic, Type CK06	702128-105	1	-	C8
Connector, 15 pin black, Molex 09-60-1151	706501-150	1	1	J103
Connector, 3 pin, gray, Molex 09-60-1031	706501-038	1	1	J104
Connector, 3 pin, blue, Molex 09-60-1031	706501-036	1	-	J105
Connector, 15 pin, white, Molex 09-60-1151	706501-159	1	1	J106
Connector, 3 pin, white, Molex 09-60-1031	706501-039	1	-	J107
Connector, 3 pin, violet, Molex 09-60-1031	706501-037	1	1	J108
Connector, 3 pin, red, Molex 09-60-1031	706501-032	1	1	J109
Diode, 1N5059	704000-107	7	7	CR12-CR15, CR19
Diode, 1N5624	704005-138	8	6	CR3-CR10
Diode, 1N4753A	704014-131	1	1	CR11
Diode, 1N4003	704005-137	5	-	CR16-CR18, CR22, CR23
Diode, 1N4735A	704014-116	1	-	CR21
Fuse, 1/4A, Bussman GMW	705725-102	1	-	F1
Fuse, 4A, Bussman GMW	705725-112	2	1	F2, F4
Fuse, 2A, Bussman GMW	705725-110	1	1	F3
Heat Sink, IERC PA1-1B	715033-109	2	-	(Q1, Q2)
I.C. Package MC 7805CP	704520-120	2	1	Z1, Z2
Heat Sink, IERC LAT0127B5CB	715033-134	2	1	(Z1, Z2)
Insulator; Thermalloy 43-77-1	715019-122	2	-	(Q1, Q2)
Insulator, Thermalloy 43-77-2	715019-120	2	1	(Z1, Z2)
Jack, Fuse, Cambion 3704-1-03	706515-129	8	4	(F1-F4)
Potentiometer, 100 $\Omega$ , 1/2W, Spectrol 53-2-1-101	701658-101	2	1	R5, R7
Potentiometer, 2K, 1/2W, Spectrol 53-2-1-202	701658-202	1	-	R15
Resistor, 3 $\Omega$ , 3W, +5%	701015-3R0	2	2	R1, R4
Resistor, 2.2K, 1/4W, +5%	701003-222	1	1	R2
Resistor, 0.5 $\Omega$ , 3W, +3%	701015-R50	1	1	R3
Resistor, 0.5 $\Omega$ , 10W, +5%	701017-R50	1	-	R6
Resistor, 330 $\Omega$ , 1/4W +5%	701003-331	1	1	R8
Resistor, 330 $\Omega$ , 1/2W, +5%	701004-331	1	-	R9
Resistor, 2.2K, 2W, +5%	701014-222	1	-	R10
Resistor, 47 $\Omega$ , 1/4W, +5%	701003-470	1	-	R11
Resistor, 820 $\Omega$ , 3W, +5%	701015-821	1	-	R13
Resistor, 1.5K, 1/4W, +5%	701003-152	1	-	R14
Resistor, 470 $\Omega$ , 1/4W, +5%	701003-471	1	-	R16
Resistor, 10K, 1/4W, +5%	701003-103	1	-	R17, R18
Resistor, 35 $\Omega$ , 10W, 5%	701017-350	1	-	R19
Test Point, Black, Ucinite 119437	715078-112	1	1	TP1

NOTE: WHEN ORDERING SPARE PARTS, CONTACT REMEX SPARES ORDER DESK AND REFERENCE COMPLETE MODEL AND SERIAL NUMBER OF UNIT. ALWAYS REFER TO ADDENDUM AT THE REAR OF THE MANUAL (IF APPLICABLE) FOR POSSIBLE PART NUMBER CHANGES.

Table 7-9. Power Supply Card Assembly, 111841-1, -2 (Continued)

Description and Manufacturer's Part No.	REMEX Part No.	Quantity		Reference Designation
Resistor, 1 ohm, 35 W, $\pm 5\%$	701015-1R0	1	-	R20
Test Point, White, Ucinite 119437	715078-111	7	5	TP2-TP8
Transistor, 2N5195	704212-107	1	-	Q1
Transistor, Motorola MJE 803	704204-122	1	-	Q2

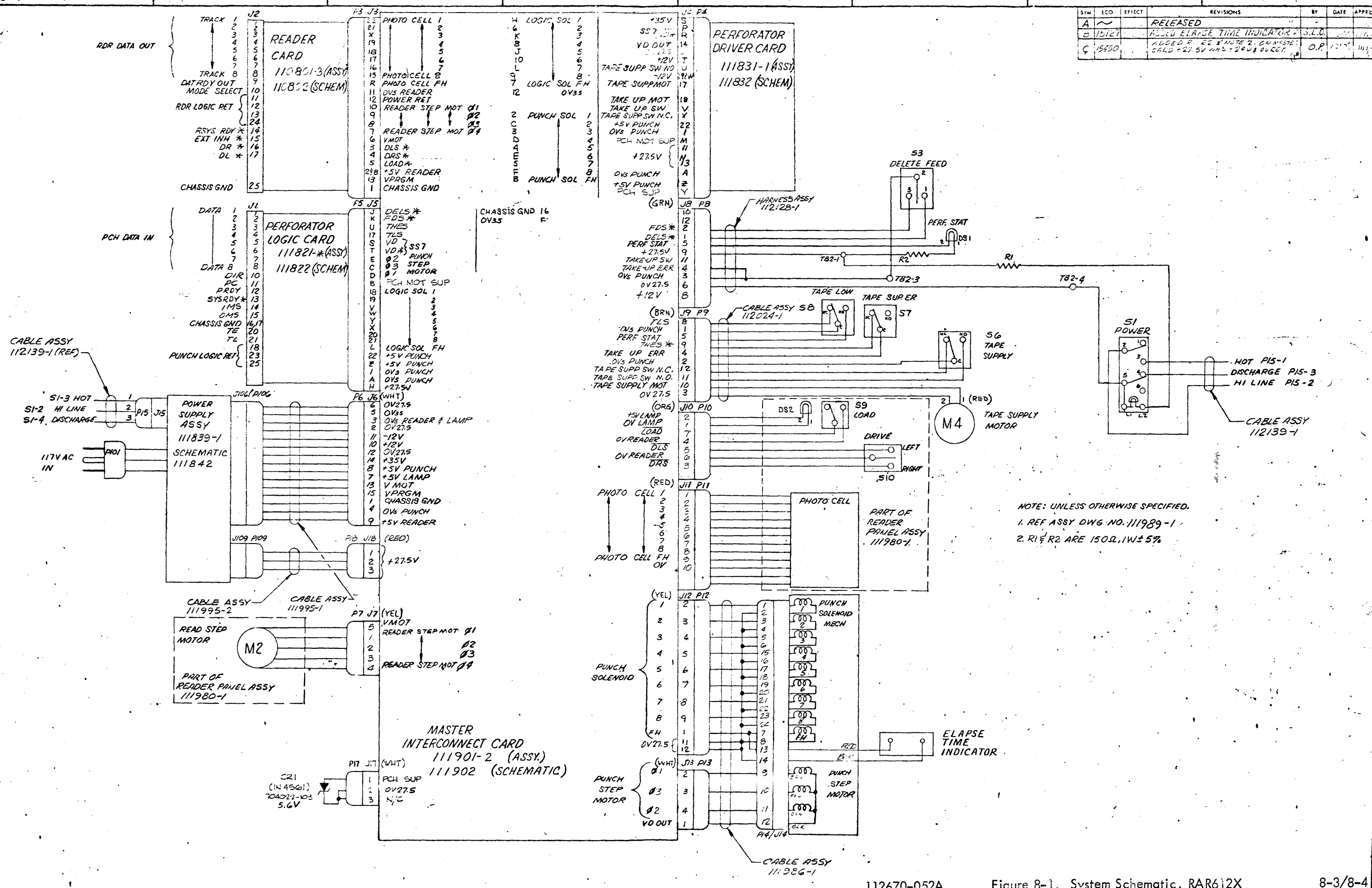
## SECTION VIII

### SCHEMATICS

#### 8.1 GENERAL

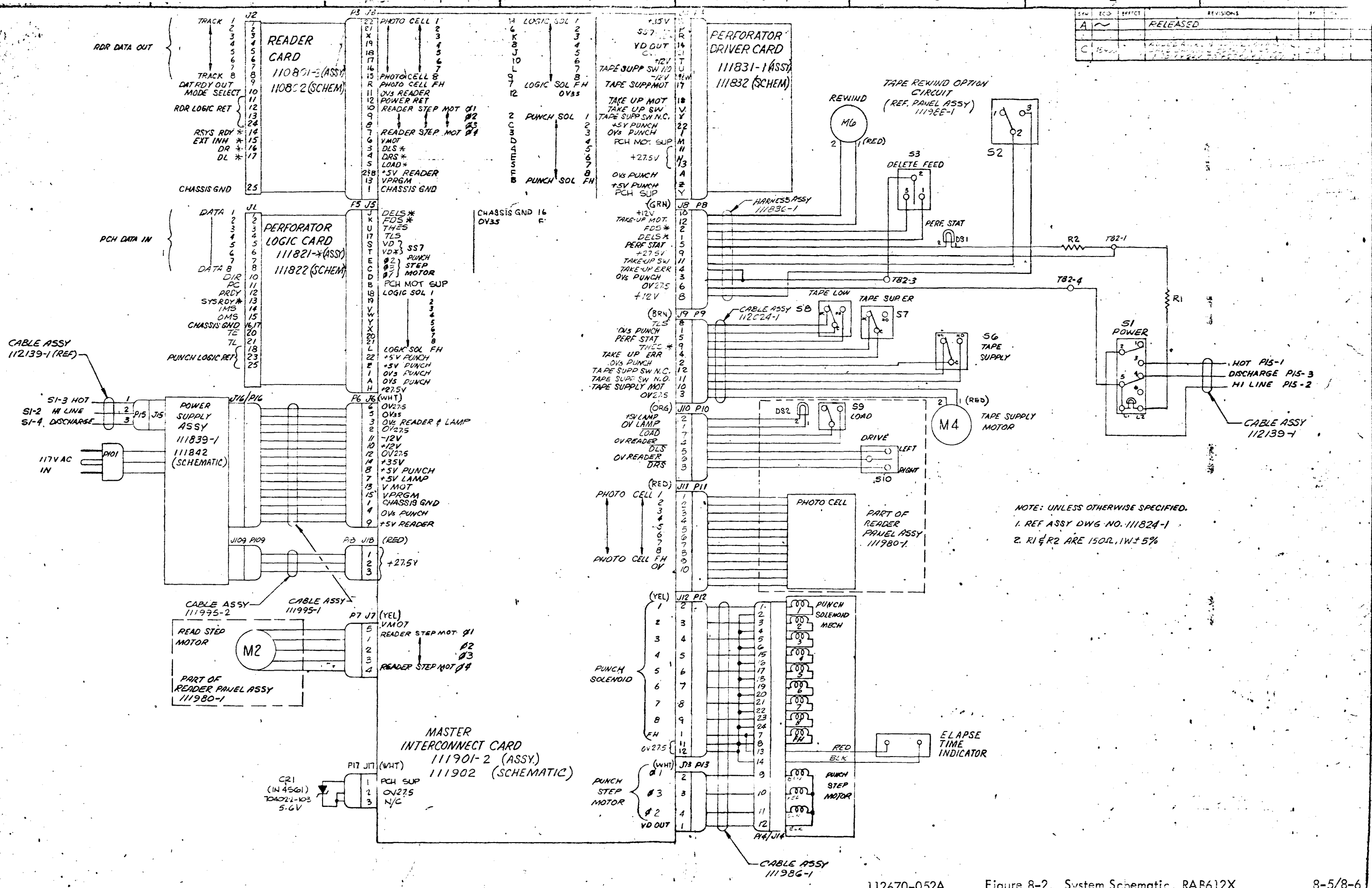
Figures 8-1 through 8-10 contain the schematics of the RAX612X systems and their cards. All I.C. Module outlines and truth tables are reproduced courtesy of Texas Instruments except for the 9602 which is reproduced courtesy of Fairchild Semiconductor.

SYM	ECO	EFFECT	REVISIONS	BY	DATE	APPROV
A	~	RELEASED				
B	15121	ADDED ELAPSE TIME INDICATOR		S.L.L.		
C	15450	ADDED P. 22 & NOTE 2. QUANTITY CALD +27.5V W/2-2904 PUNCH		O.P.	11/15/54	



112670-052A Figure 8-1. System Schematic, RAR6i2X 8-3/8-4

REV	ECO	EFFECT	REVISIONS
A			RELEASED
B			
C			



NOTE: UNLESS OTHERWISE SPECIFIED.  
 1. REF ASSY DWG NO. 111824-1  
 2. R1 & R2 ARE 150Ω, 1W ± 5%

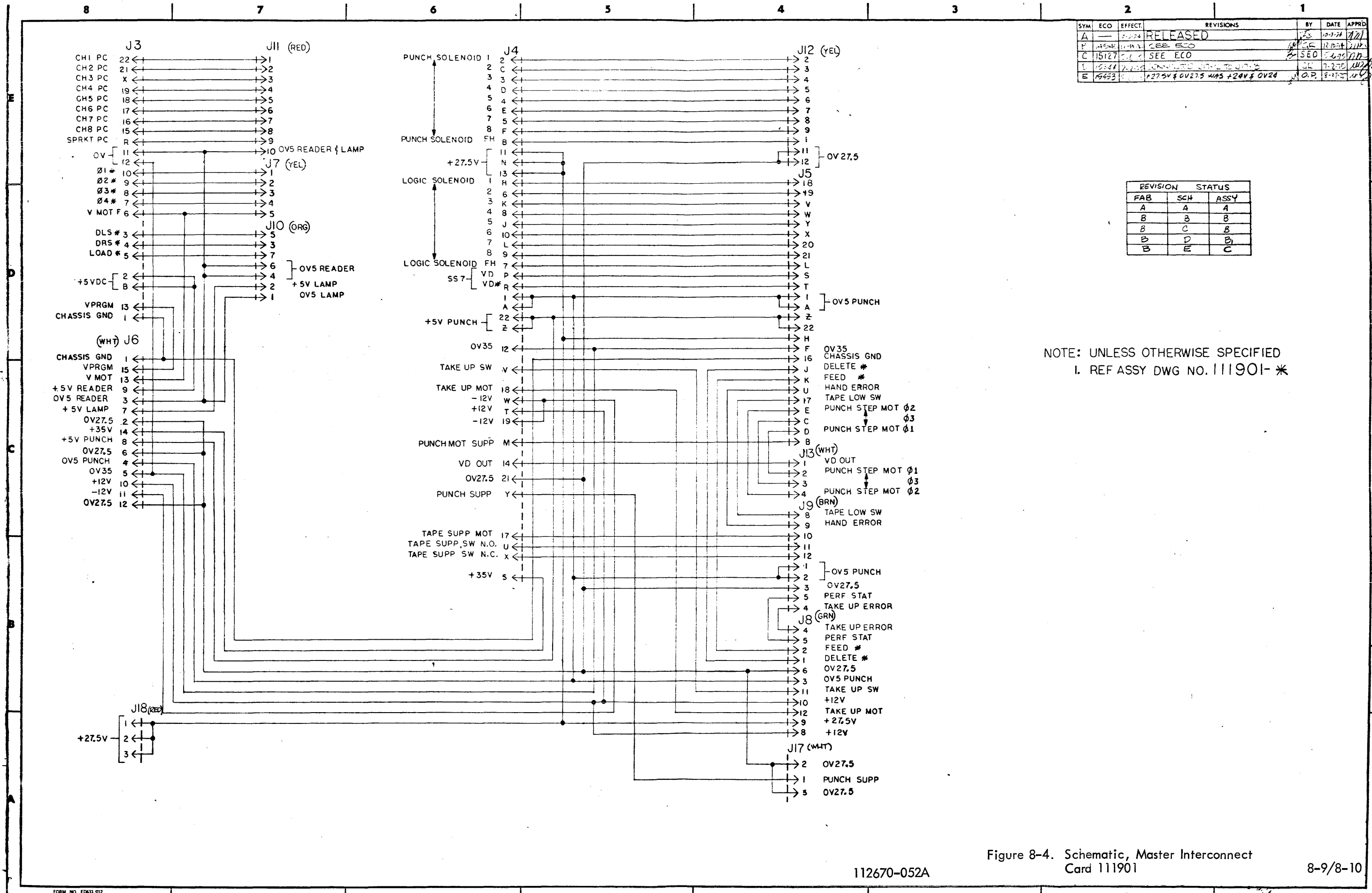




SYM	ECO	EFFECT	REVISIONS	BY	DATE	APPRD
A			RELEASED		10-3-74	
P	15127		SEE ECO	SEO	12-25-74	
C	15127		SEE ECO	SEO	12-25-74	
E	15453		+27.5V & OV27.5 WAS +20V & OV24	O.P.	8-9-75	

REVISION STATUS		
FAB	SCH	ASSY
A	A	A
B	B	B
B	C	B
B	D	B
B	E	C

NOTE: UNLESS OTHERWISE SPECIFIED  
I. REF ASSY DWG NO. 111901-\*

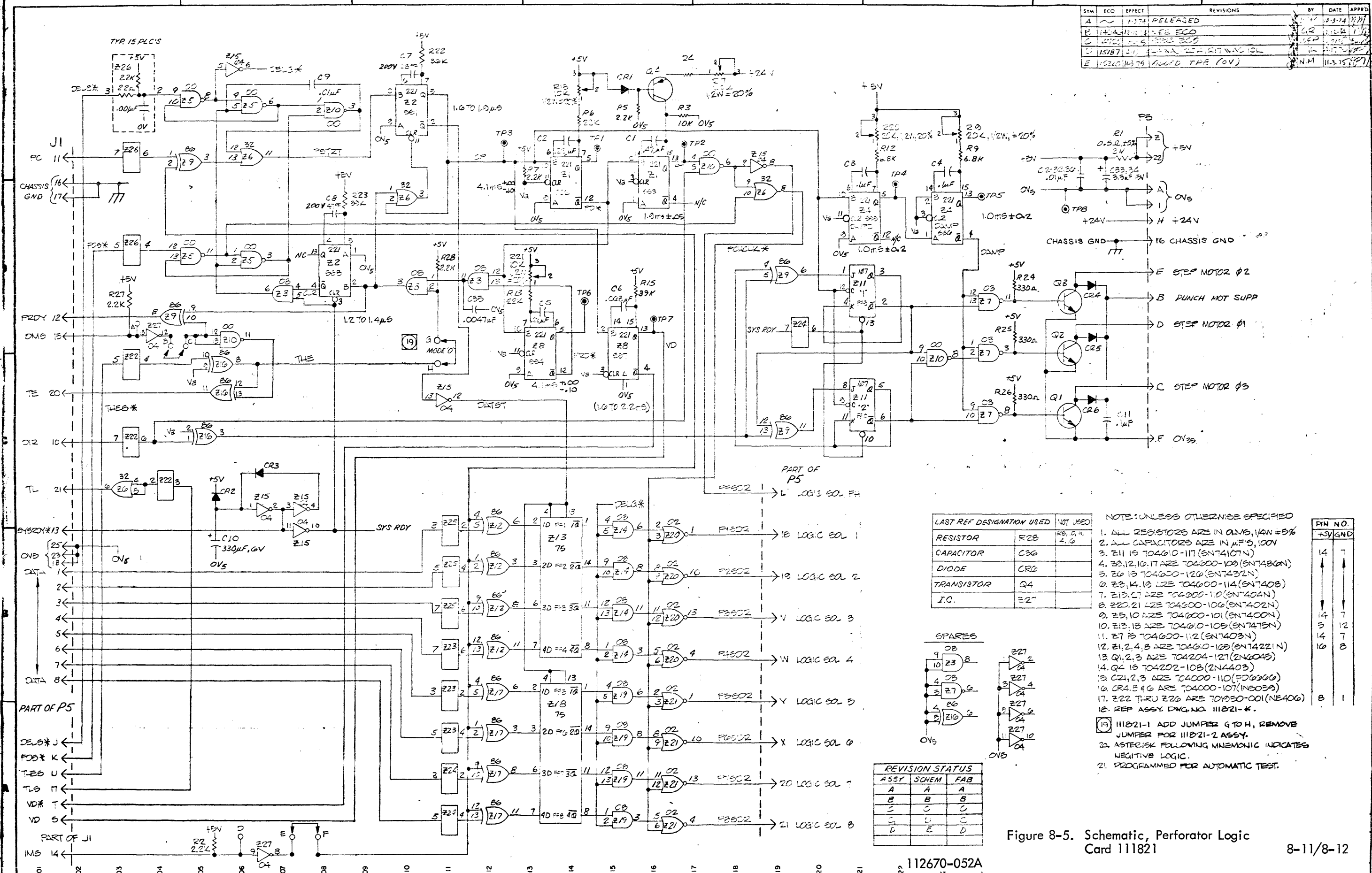


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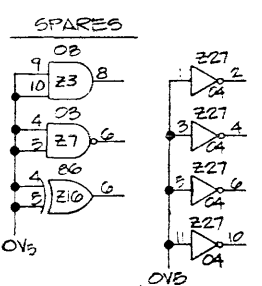
Figure 8-4. Schematic, Master Interconnect Card 111901

8-9/8-10

SYM	ECO	EFFECT	REVISIONS	BY	DATE	APPROV
A	1-3-74	RELEASED				
B	1-24-74	FREE ECO				
C	1-24-74	FREE ECO				
D	1-24-74	FREE ECO				
E	1-24-74	ADDED TP8 (OV)				



LAST REF DESIGNATION USED	NOT USED
RESISTOR	R28
CAPACITOR	C36
DIODE	CR6
TRANSISTOR	Q4
I.C.	Z2



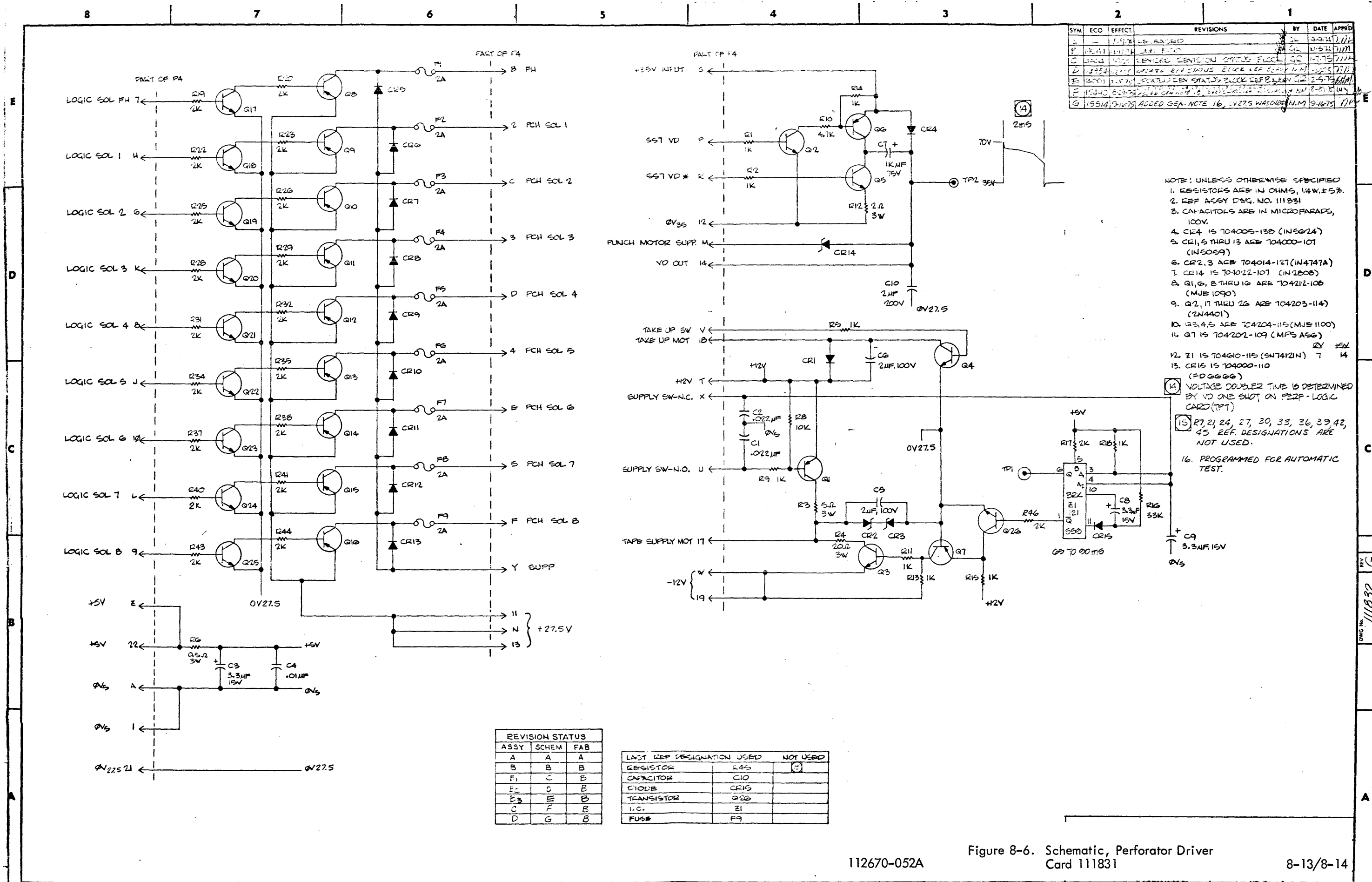
REVISION STATUS		
ASSY	SCHEM	FAB
A	A	A
B	B	B
C	C	C
D	D	D
E	E	E

- NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS, 1/4W ±5%
  2. ALL CAPACITORS ARE IN μF'S, 100V
  3. Z11 IS 704610-117 (SN74107N)
  4. Z2, 12, 10, 17 ARE 704300-109 (SN7406N)
  5. Z6 IS 704600-120 (SN7432N)
  6. Z3, 14, 13 ARE 704600-114 (SN7408)
  7. Z13, 17 ARE 704300-110 (SN7404N)
  8. Z20, 21 ARE 704300-106 (SN7402N)
  9. Z5, 10 ARE 704600-101 (SN7400N)
  10. Z13, 18 ARE 704610-105 (SN7415N)
  11. Z7 IS 704600-112 (SN7403N)
  12. Z1, 2, 4, 8 ARE 704610-105 (SN74221N)
  13. Q1, 2, 3 ARE 704204-127 (2N4004S)
  14. Q4 IS 704202-108 (2N4403)
  15. C21, 2, 3 ARE 704000-110 (FD300GG)
  16. CR4, 5 & 6 ARE 704000-107 (1N5003)
  17. Z22 THRU Z26 ARE 701950-001 (NE406)
  18. REF ASSY. DWG. NO. 111821-\*
- (19) 111821-1 ADD JUMPER G TO H, REMOVE JUMPER FOR 111821-2 ASSY.
20. ASTERISK FOLLOWING MNEMONIC INDICATES NEGATIVE LOGIC.
21. PROGRAMMED FOR AUTOMATIC TEST.

PIN NO.	
+	-
14	7
14	7
5	12
14	7
10	8

Figure 8-5. Schematic, Perforator Logic Card 111821 8-11/8-12

112670-052A



SYM	ECO	EFFECT	REVISIONS	BY	DATE	APPRD
A		RELEASED				
B		REVISED KEY STATUS BLOCK REF 2244				
C		REVISED KEY STATUS BLOCK REF 2244				
D		UPDATE KEY STATUS BLOCK REF 2244				
E		UPDATE KEY STATUS BLOCK REF 2244				
F		UPDATE KEY STATUS BLOCK REF 2244				
G		ADDED GEN. NOTE 16, 0V27.5 WAS OBSOLETE				

- NOTE: UNLESS OTHERWISE SPECIFIED
- RESISTORS ARE IN OHMS, 1/4W, ±5%.
  - REF ASSY DWG. NO. 111831
  - CAPACITORS ARE IN MICROFARADS, 100V.
  - CR4 IS 704005-130 (IN5024)
  - CR1, 5 THRU 13 ARE 704000-107 (IN5059)
  - CR2, 3 ARE 704014-127 (IN4747A)
  - CR14 IS 704022-107 (IN2800B)
  - Q1, 6, 8 THRU 16 ARE 704212-100 (MJE1090)
  - Q2, 17 THRU 26 ARE 704203-114 (2N4401)
  - Q3, 4, 5 ARE 704204-115 (MJE1100)
  - Q7 IS 704202-109 (MPS A56)
  - Z1 IS 704610-115 (5N74121)
  - CR15 IS 704000-110 (FD6666)
  - VOLTAGE DOUBLER TIME IS DETERMINED BY VD ONE SLOT ON PERFORATOR LOGIC CARD (TP1)
  - R7, 21, 24, 27, 30, 33, 36, 39, 42, 45 REF. DESIGNATIONS ARE NOT USED.
  - PROGRAMMED FOR AUTOMATIC TEST.

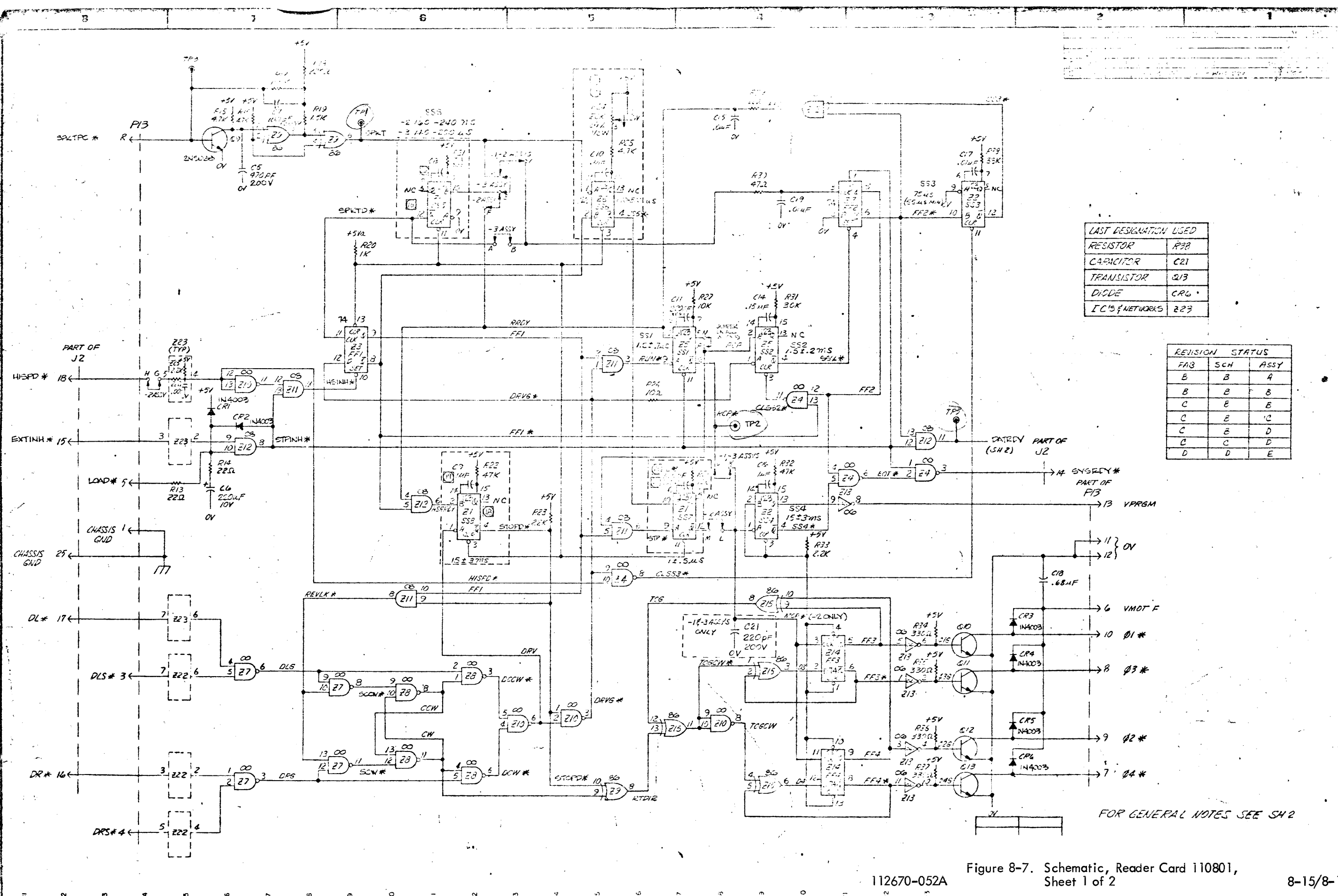
REVISION STATUS		
ASSY	SCHEM	FAB
A	A	A
B	B	B
F1	C	B
E2	D	B
E3	E	B
C	F	B
D	G	B

LAST REF DESIGNATION USED		NOT USED
RESISTOR	R45	( )
CAPACITOR	C10	( )
DIODE	CR15	( )
TRANSISTOR	Q26	( )
I.C.	Z1	( )
FUSE	F9	( )

Figure 8-6. Schematic, Perforator Driver Card 111831

112670-052A

8-13/8-14

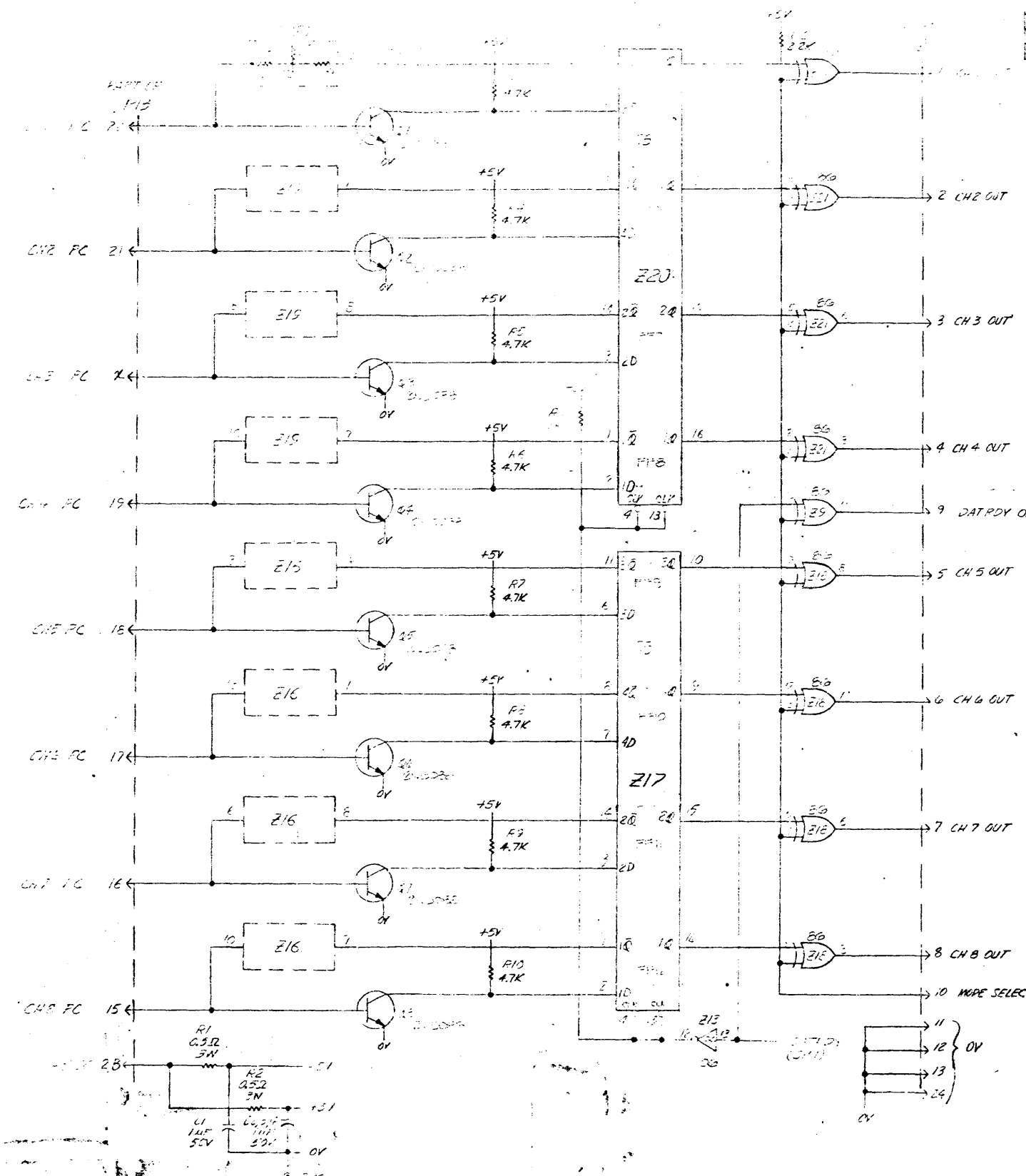


LAST DESIGNATION USED	
RESISTOR	R28
CAPACITOR	C21
TRANSISTOR	2N1003
DIODE	CR6
I.C.'S & NETWORKS	229

REVISION STATUS		
FAB	SCH	ASSY
B	B	A
B	B	B
C	E	B
C	E	C
C	E	D
C	C	D
D	D	E

FOR GENERAL NOTES SEE SH 2

112670-052A Figure 8-7. Schematic, Reader Card 110801, Sheet 1 of 2 8-15/8-16



NOTE: UNLESS OTHERWISE SPECIFIED  
 1. RESISTORS ARE 1/4W ± 5%  
 2. CAPACITORS ARE 100V ± 10%  
 3. REF ASSY DAK UO 10301  
 4. Q1, Q2 ARE 701950-004 (1899-4102-0)  
 5. Z17, Z20 ARE 704610-105 (SN7475N)  
 6. Z9, Z15, Z16, Z1 ARE 704600-109 (SN7486N)  
 7. Z3, Z4 ARE 704610-110 (SN7475N)  
 8. Z4, Z5, Z10 ARE 704600-101 (SN7400N)  
 9. Z13, Z15 ARE 704600-111 (SN7400N)  
 10. Z11, Z12 ARE 704600-114 (SN7400N)  
 11. Z1, Z2, Z5, Z6 ARE 704610-119 (SN7486N)  
 12. Z22, Z23 ARE 701950-001 (ND 405)  
 13. ASSY IS TYPESETTER  
 14. Q1-Q4 ARE 704203-119 (2N5030)  
 15. C1-C3 ARE 704204-115 (MJE 1100)  
 (POWER DARLINGTON)  
 16. R1, R2, R3, R4, R5, R6, R7, R8, R9, R10 ARE 5.6K, CB IS 100UF, 200V (-3 ASSY),  
 R11 IS 33K, CB IS 0.015UF (-3 ASSY)  
 17. C1-C6 ARE 704005-137 (1N4003)  
 18. FOR -1 ASSY (STANDARD) OMIT Z1, Z5, Z6,  
 C10, C13, R21, R22, R24, R25, R26,  
 R28  
 19. FOR -3 ASSY OMIT Z1, C9, C10, C13, R27, R28, R25,  
 R28  
 20. C2, R2 ARE OMITTED ON ALL ASSYS  
 21. SYMBOL \* MEANS THE SAME AS OVER  
 A LOGIC FUNCTION TO MAKE IT A  
 COMPLEMENTARY FORM

PIN #	REV
11	-
5	12
14	7
14	7
14	7
14	7
14	7
16	8
16	7

112670-052A

Figure 8-7. Schematic, Reader Card 110801, Sheet 2 of 2

8-17/8-18



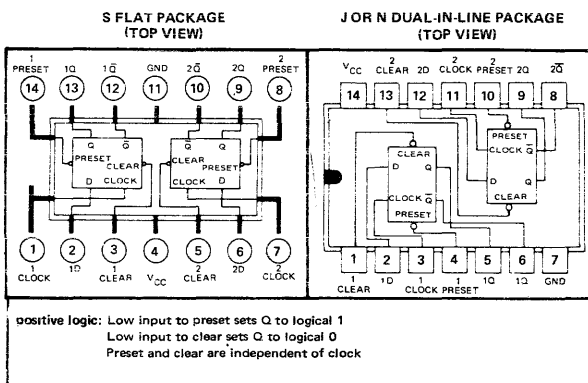
### SN7474

TRUTH TABLE (Each Flip-Flop)

$t_n$	$t_{n+1}$	
INPUT	OUTPUT	OUTPUT
D	Q	$\bar{Q}$
0	0	1
1	1	0

NOTES: 1.  $t_n$  = bit time before clock pulse.  
2.  $t_{n+1}$  = bit time after clock pulse.

### DUAL D-TYPE EDGE-TRIGGERED FLIP-FLOPS



positive logic: Low input to preset sets Q to logical 1  
Low input to clear sets Q to logical 0  
Preset and clear are independent of clock

### SN74123

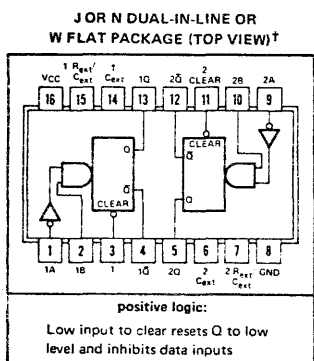
### RETRIGGERABLE MONOSTABLE MULTIVIBRATORS WITH CLEAR

NOTES:

- A. H = high level (steady state), L = low level (steady state),  $\uparrow$  = transition from low to high level,  $\downarrow$  = transition from high to low level,  $\text{—}$  = one high-level pulse,  $\text{—}$  = one low-level pulse, X = irrelevant (any input, including transitions).  
B. NC = No internal connection.  
C. To use the internal timing resistor of SN54122/SN74122 (10 k $\Omega$  nominal), connect  $R_{int}$  to  $V_{CC}$ .  
D. An external timing capacitor may be connected between  $C_{ext}$  and  $R_{ext}/C_{ext}$  (positive).

TRUTH TABLE (See Note A)

INPUTS		OUTPUTS	
A	B	Q	$\bar{Q}$
H	X	L	H
X	L	L	H
L	$\uparrow$	$\text{—}$	$\text{—}$
$\downarrow$	H	$\text{—}$	$\text{—}$



### TTL/ MONOSTABLE 9602 RETRIGGERABLE RESETTABLE MONOSTABLE MULTIVIBRATOR

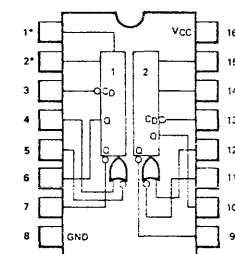
**GENERAL DESCRIPTION** - The TTL/Monostable 9602 is a dual retriggerable, resettable monostable multivibrator which provides an output pulse whose duration and accuracy is a function of external timing components. The 9602 has excellent immunity to noise on the  $V_{CC}$  and ground lines. The 9602 uses TTL inputs and outputs for high speed and high fanout capability and is compatible with all members of the Fairchild TTL family.

#### TRIGGERING TRUTH TABLE

PIN NO.'S			Operation
5(11)	4(12)	3(13)	
H $\rightarrow$ L	L	H	Trigger
H	L $\rightarrow$ H	H	Trigger
X	X	L	Reset

H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care  
H $\rightarrow$ L = HIGH to LOW Voltage Level transition  
L $\rightarrow$ H = LOW to HIGH Voltage Level transition

#### CONNECTION DIAGRAM DIP (TOP VIEW)



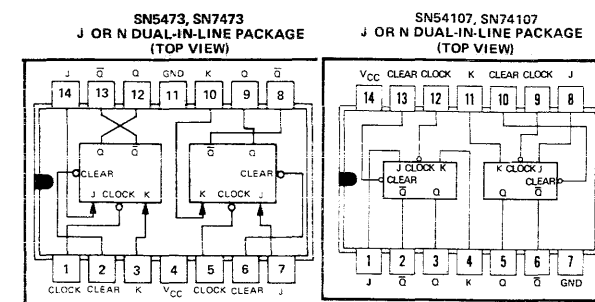
### SN7473, SN74107

TRUTH TABLE (Each Flip-Flop)

$t_n$	$t_{n+1}$	
J	K	Q
0	0	$\bar{Q}_n$
0	1	0
1	0	1
1	1	$\bar{Q}_n$

NOTES: 1.  $t_n$  = Bit time before clock pulse.  
2.  $t_{n+1}$  = Bit time after clock pulse.

### DUAL J-K MASTER-SLAVE FLIP-FLOPS



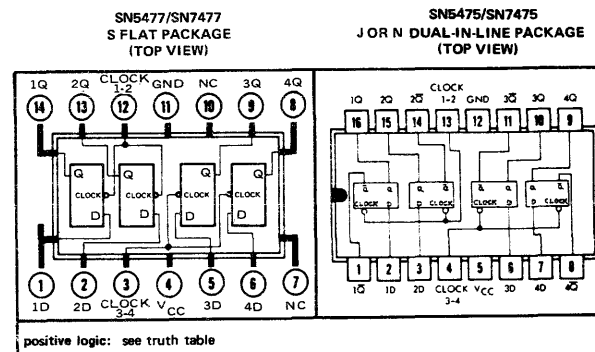
### SN7475, SN7477

TRUTH TABLE (Each Latch)

$t_n$	$t_{n+1}$
D	Q
1	1
0	0

NOTES: 1.  $t_n$  = bit time before clock pulse transition.  
2.  $t_{n+1}$  = bit time after clock pulse transition.  
NC - No Internal Connection

### 8-BIT AND 4-BIT BISTABLE LATCHES



### SN74121

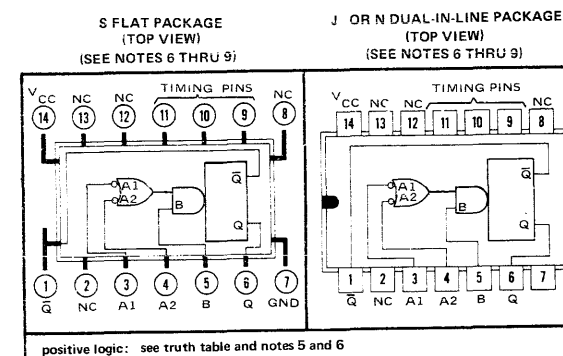
#### \*TRUTH TABLE (See Notes 1 thru 3)

$t_n$ INPUT			$t_{n+1}$ INPUT			OUTPUT
A1	A2	B	A1	A2	B	
1	1	0	1	1	1	Inhibit
0	X	1	0	X	0	Inhibit
X	0	1	X	0	0	Inhibit
0	X	0	0	X	1	One Shot
X	0	0	X	0	1	One Shot
1	1	1	X	0	1	One Shot
1	1	1	0	X	1	One Shot
X	0	0	X	1	0	Inhibit
0	X	0	1	X	0	Inhibit
X	0	1	1	1	1	Inhibit
0	X	1	1	1	1	Inhibit
1	1	0	X	0	0	Inhibit
1	1	0	0	X	0	Inhibit

1 =  $V_{in(1)} \geq 2V$   
0 =  $V_{in(0)} \leq 0.8V$

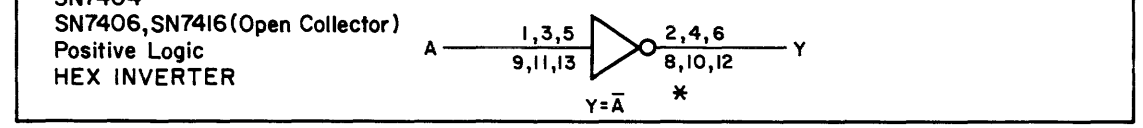
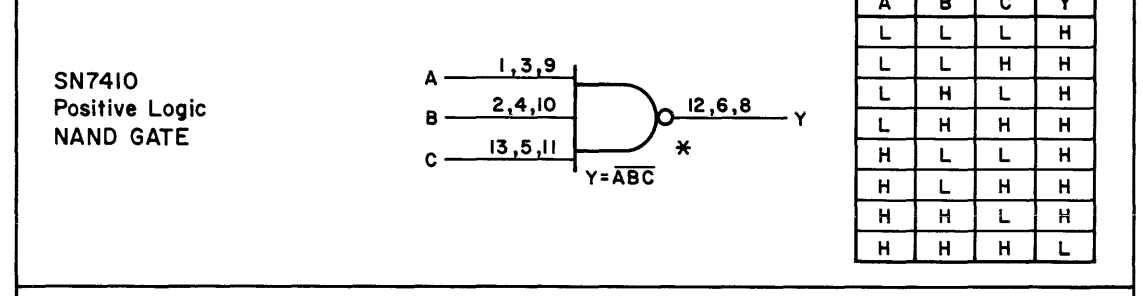
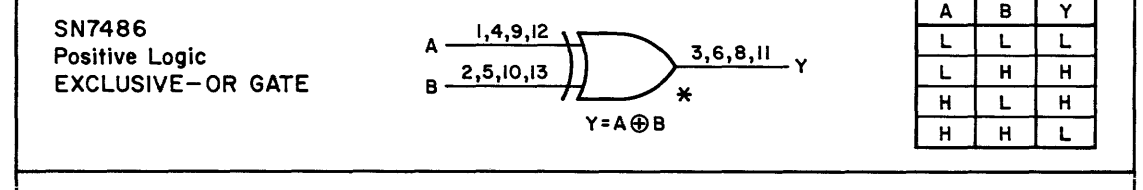
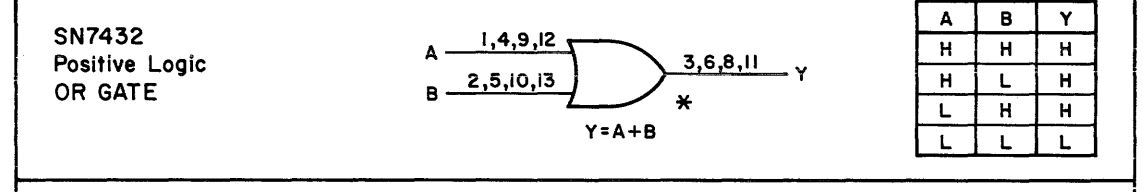
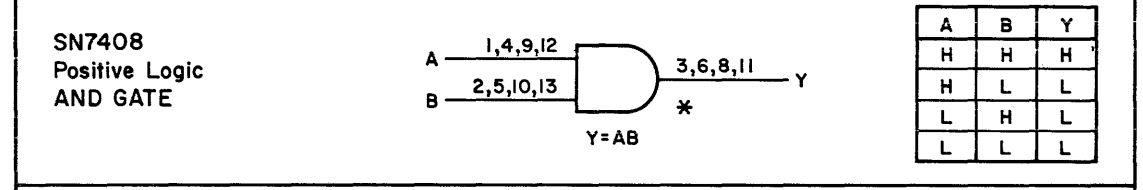
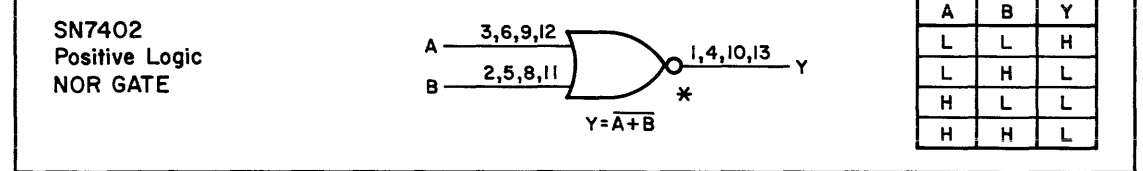
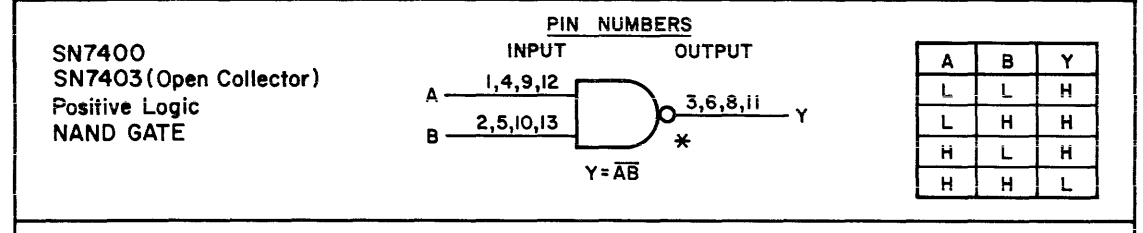
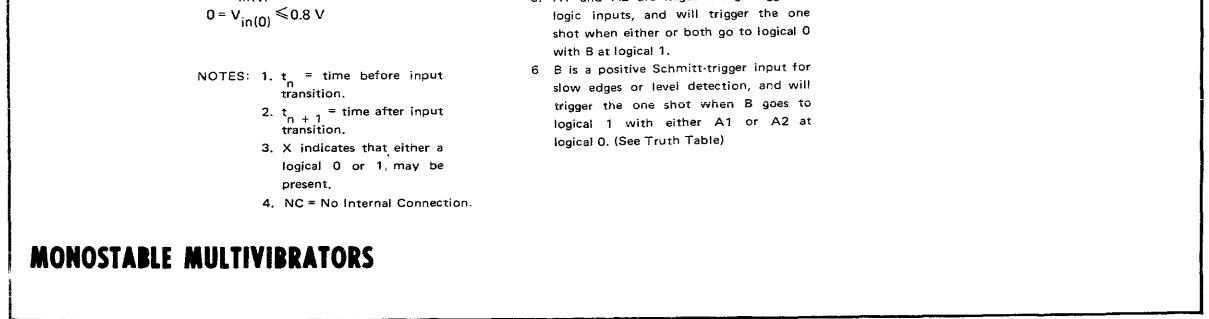
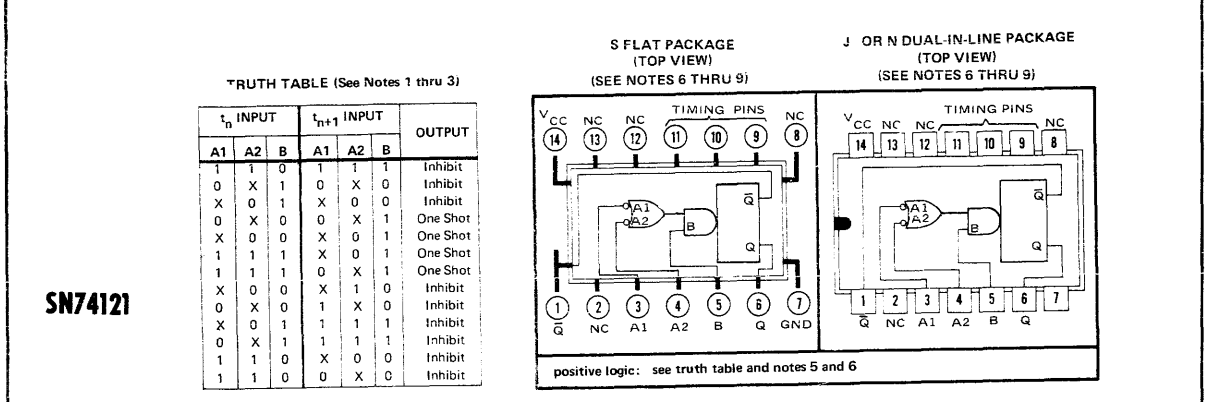
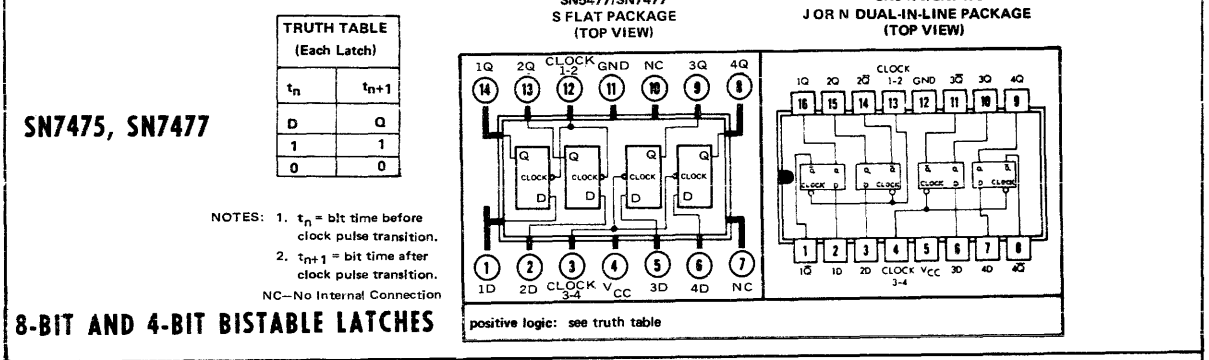
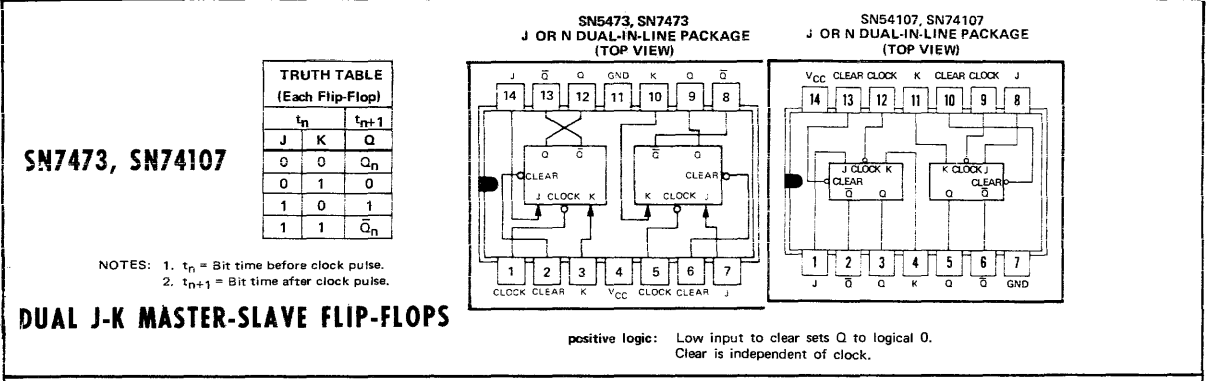
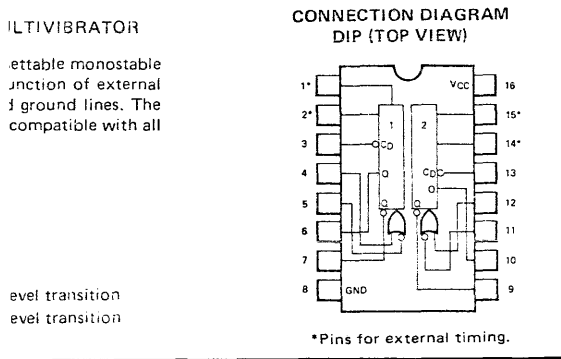
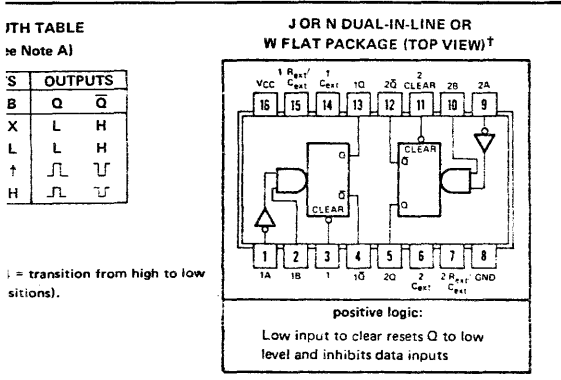
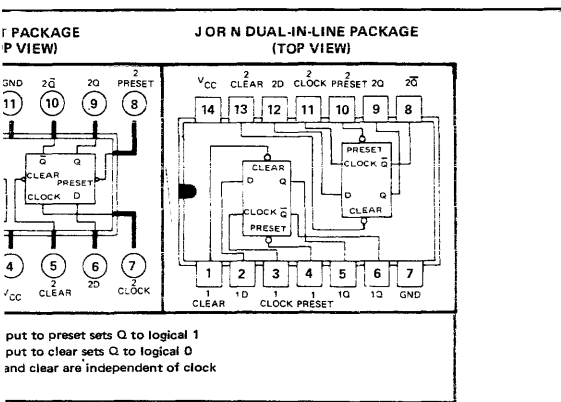
NOTES: 1.  $t_n$  = time before input transition.  
2.  $t_{n+1}$  = time after input transition.  
3. X indicates that either a logical 0 or 1, may be present.  
4. NC = No Internal Connection.

### MONOSTABLE MULTIVIBRATORS



5. A1 and A2 are negative-edge-triggered logic inputs, and will trigger the one shot when either or both go to logical 0 with B at logical 1.  
6. B is a positive Schmitt-trigger input for slow edges or level detection, and will trigger the one shot when B goes to logical 1 with either A1 or A2 at logical 0. (See Truth Table)





NOTE: Pin numbers are listed in the order in which they are related, for EXAMPLE, on SN7410, pins 1, 2, 13 and 12 function together on one gate. \* Pin 7 is Gnd, Pin 14 is Vcc

01	COMPONENT # REF DESIGNATOR	SYMBOL	REMARKS	COMPONENT # REF DESIGNATOR	SYMBOL	REMARKS
02	SWITCH, 'S'	S1 S2 (N.C.) (N.O.)		03	INTEGRATED CIRCUIT PACKAGE	INDICATES I.C. PKG. LOCATION ON P.C. CARD. (LEFT TO RIGHT TOP TO BOTTOM SEQUENCE) (X=NUMBER, Y=LETTER)
04	SAFETY INTERLOCK	S1 S2 N.O. N.C. S3 S4 N.C. N.O.		04	AND	
05	LIMIT SW.	S1 S2 N.O. N.C. S3 S4 N.C. N.O.		05	NOR	
06	POWER	S1 PWR ON		06	AND	
07	PUSH BUTTON, 'PB'	NC1 NC2 NO1 NO2		07	OR	
08	TRANSFER	S7 S5 NO1 C NC NO2 R NO OFF		08	EXCLUSIVE OR	
09	TIMER CONTACTS	SPDT 3 POSITION CENTER OFF ENERGIZED DE-ENERGIZED		09	INVERTER	
10	TRANSISTOR, 'Q'	Q1 Q2 PNP NPN		10	AMPLIFIER	
11	UJT, 'Q'	b2 b1 M1 M2 'N' TYPE 'P' TYPE	ARROW POINTS TOWARD M1 FOR 'N' TYPE & AWAY FROM M1 FOR 'P' TYPE	11		
12	FET, 'Q'	'N' TYPE 'P' TYPE		12		
13	DIODE 'CR' or 'D'		*USE 'D' ON N/C APPLICATIONS	13		
14	ZENER DIODE 'CR'	XXV	V=VOLTS	14		
15	TRIAC		INDICATE TERMINALS 1 AND 2	15		
16	SCR			16		
17	BRIDGE RECTIFIER 'BR' 'D'		*USE 'D' ON N/C APPLICATIONS	17		
18	CABLE RUN (OPTIONAL)	X1 X6 X2 X3 X4 X5 X7 X8		18		
19	CABLE, 2 OR MORE CONDUCTORS		IF SHIELDED CONDUCTOR SHOW TERMINATION OF SHIELD	19		
20	TWISTED WIRES	PAIR TRIPPLE		20		
21	COAXIAL CABLE			21		

STANDARD SCHEMATIC SYMBOLS  
107700  
C

NOTE: ALL SEMICONDUCTORS AND INTEGRATED CIRCUIT DEVICES ARE TO BE IDENTIFIED BY REMEX PART NUMBER ADJACENT TO DEVICE OR IN GENERAL NOTES. COMMERCIAL PART NUMBERS MAY ALSO BE SHOWN AT OPTION OF PROJECT ENGINEER.

Figure 8-10, REMEX Standard Schematic Symbols, Sheet 1 of 2

COMPONENT # REF DESIGNATOR	SYMBOL	REMARKS	COMPONENT # REF DESIGNATOR	SYMBOL	REMARKS
01 CAPACITOR 'C'		GIVE VOLTAGE ON ELECTROLYTICS, MOTOR AND A C CAPACITORS IN A C CIRCUITS. VOLTAGE OPTIONAL ON ALL OTHERS.	02 TERMINAL 'E'		USE % LOGICAL DESCRIPTION OR BOTH
03 CELL, PHOTOSENSITIVE 'V'					
04 GND					
05 COIL RELAY 'K' OR NUMERICAL DESIGNATOR CONTACTS					
06 CONTACT, CONNECTOR 'P', 'J'					
07 SEPARABLE CONNECTORS, ENGAGED		DEFINITION: PLUG: USUALLY MOVABLE JACK: USUALLY STATIONARY HERMIPRODITIC: PLUG: JACK:			
08 CONNECTORS, AC POWER 'P', 'J', 'S'					
09 FUSE, 'F'					
10 INDUCTOR, WINDING, REACTOR, OR SOLENOID		GIVE INDUCTANCE OR COVER IN NOTES			
11 TRANSFORMER 'T'		POLARITY DOTS TO BE SHOWN IF NECESSARY TO CIRCUIT FUNCTION			
12 LAMP, INDICATING 'DS'					
13 CRYSTAL, 'Y'					
14 BOARD, TERMINAL 'TB' OR FANNING STRIP 'YS'					
15 EYELET, PC CARD					
16 TEST POINT, 'TP'					
17 JUMPER, WIRE, PC		FOR OPTIONAL WIRING			
18 RESISTOR, FIXED, VARIABLE 'R'		OPTIONAL ADJUSTMENT SYMBOL:  SCREW DRIVER KNOB UNITAGE AND TOLERANCE TO BE SHOWN OR PUT IN NOTES			
19 LAMP, GLOW 'N'					
20 LINE CROSS					
21 LINE CONNECT					

Figure 8-10. REMEX Standard Schematic Symbols, Sheet 2 of 2

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