HSR 1 HIGH-SPEED READER
Technical Manual

PBC 1010

pb Packard Bell Computer

A SUBSIDIARY OF PACKARD BELL ELECTRONICS
1905 ARMACOST AVENUE • LOS ANGELES 25, CALIFORNIA

November 1, 1961

NOTICE

CONTENTS

		Page
I.	Description and Leading Particulars	1-1
	A. General	1-1
	B. Physical Description	1-1
II.	Principles of Operation	2-1
	A. General	2-1
	B. Connections	2-1
	C. Outputs	2-2
	D. Tape Read Amplifier Circuit	2-3
	E. Start-Stop Amplifier Circuit	2-4
III.	Operation	3-1
	A. Tape Loading	3-1
	B. Bootstrap Input	3-1
	C. Power Supply	3-3
	D. Input Routine	3-3
IV.	Checkout	4-1
V.	Maintenance	5-1
	A. General	5-1
	B. Lubrication	5-1

CONTENTS (Continued)

		Page
C.	Cleaning	5-1
D.	Pressure Roller and Brake Adjustment	5-1
E.	Data Channel Adjustments	5-2
F.	Sprocket Channel Adjustment	5-3
G.	Installation	5-3
VI.	Parts List	6-1

FIGURES

1-1.	HSR1 Photoelectric Tape Reader	1-2
3-1.	HSR1 Bootstrap Input Connector	3-2
5-1	HSR1 Installation Drawing	5-4

TABLES

1-1.	Leading Particulars	1-3
3-1.	HSR1 Input Routine II 0108A	3-4
5-1.	HSR1 Interconnecting Cable	5-5

I. DESCRIPTION AND LEADING PARTICULARS

A. GENERAL

This publication comprises operating and maintenance instructions for the HSR1 photoelectric tape reader (Figure 1-1) manufactured by Digitronics Inc., Albertson, New York, to be used as a high-speed tape input unit for the Packard Bell Computer PB250 Computer.

The Digitronics Model 3500 Dykor Perforated Tape Reader (Appendix Figure 4) is a completely transistorized unit which provides multichannel digital information from opaque perforated tape. Silicon photodiodes are used for reading both the information channels and the sprocket channel.

An interconnecting cable provides code lines from the PB250 to the HSR1 for "start read" and "stop read" commands and carries digital information from the tape to the PB250 for automatic operation.

B. PHYSICAL DESCRIPTION

A single-speed, hysteresis synchronous motor (Appendix Figure 5) provides constant speed for the tape drive. Tape motion is in one direction, from right to left at a rate of 300 characters per second at 10 characters per inch. Tape used is opaque and perforated, either in short strips or loops. Any width of tape can be used, from 11/16 inch to 1.0 inch and 5-level plus sprocket to 8-level plus sprocket. The photodiodes are mounted on 0.100 inch centers and incorporate built-in glass lenses which protrude slightly from the mounting block (Appendix Figure 7) avoiding dust-collecting

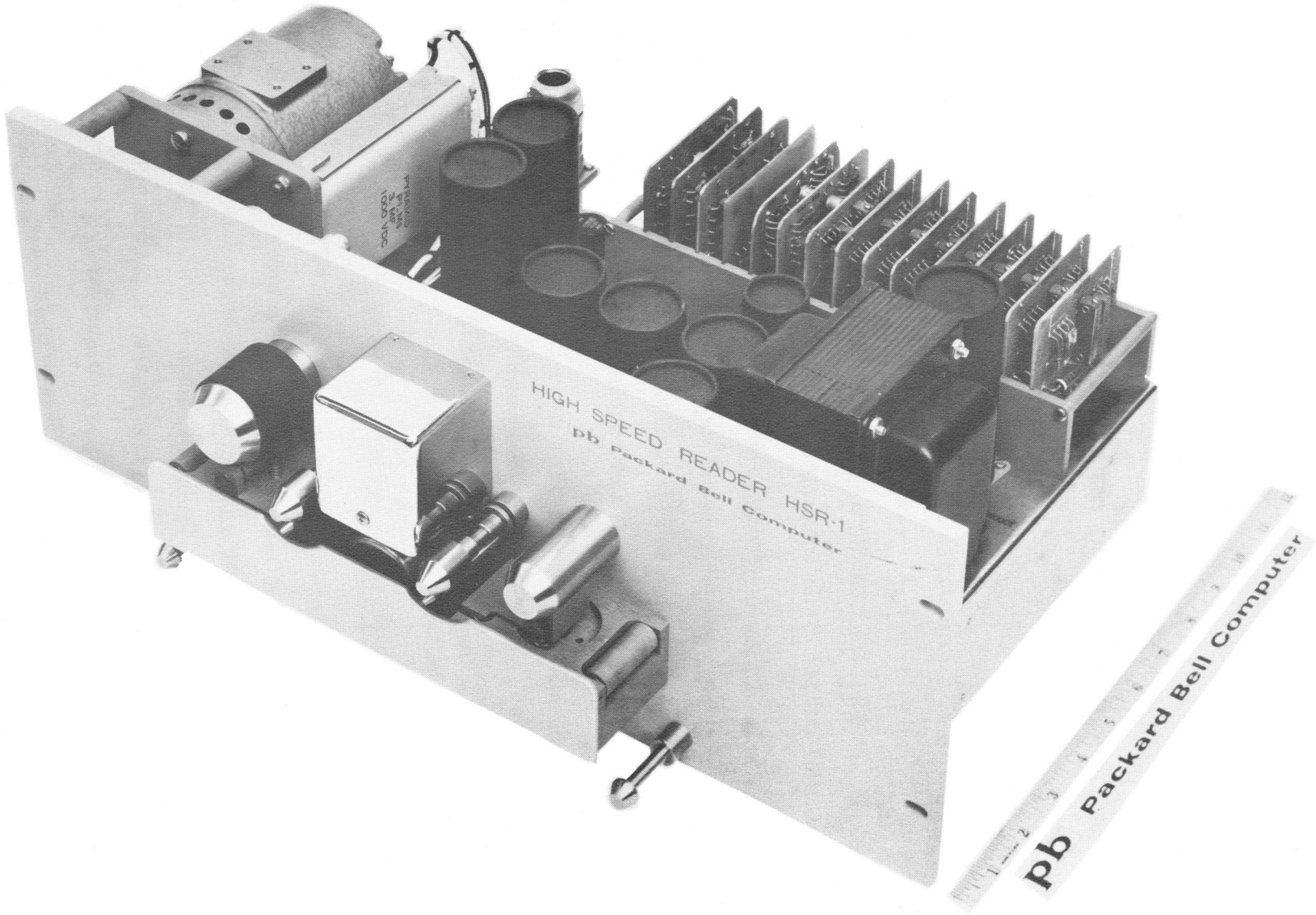


Figure 1-1. HSR1 High-Speed Reader

II. PRINCIPLES OF OPERATION

A. GENERAL

Tape inserted in the HSR1 reader head mechanism (Appendix Figure 4) is moved in one direction (from right to left) by triggering an amplifier to activate a solenoid driver which in turn operates a fast-acting solenoid. The solenoid moves a roller to press the tape against a continuously rotating capstan, causing the tape to be moved across the photoelectric read head. To stop the tape, the stop amplifier is triggered, releasing the drive solenoid and activating the brake solenoid. This pinches the tape against the stationary braking surface.

The HSR1 chassis (Appendix Drawing B-G612) contains the tape reading amplifiers, sprocket shaper and amplifiers, start-stop amplifiers, start-stop flip-flop, solenoid driver amplifiers and solenoid drivers. Also included in the chassis, is the power supply (Appendix Drawing B-H329) and voltage-regulated lamp supply.

B. CONNECTIONS

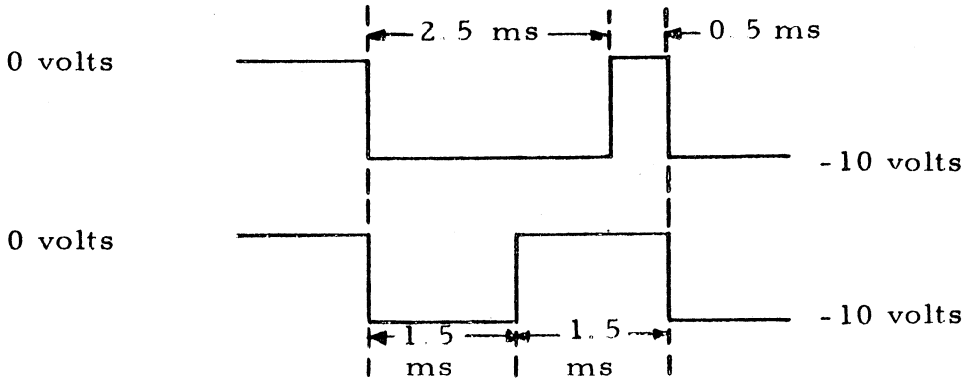
Connections between the different cards are shown in Appendix Drawing B-G612. The numbers from 1 to 13 indicate the physical location of each card and correspond to numbered slots; numbers in hexagonal boxes indicate test points. Only 13 of the 15 available slots are used on the standard unidirectional strip reader. The SPG card is a Packard Bell Computer module (PBC 124-1C5326).

The sprocket photodiode is connected to the input of the PSB card (Appendix Drawing A-H324) which consists of an amplifier followed by a Schmitt trigger. Output of the PSB card is fed to an amplifier on the AAA card (Appendix Drawing A-H291) which in turn drives a second amplifier on the AAA card and eight cards, in each of the PGB cards (Appendix Drawing A-H326). Eight data photodiodes are each connected to the input of a PGB card consisting of an amplifier followed by a gated amplifier with an amplified and shaped sprocket signal operating the gate.

Motor connections (Appendix Drawing A-K219) to the chassis are to terminal strip TB1 through plug P4, and jack J4.

C. OUTPUTS

For the information channels no hole is zero volts and hole is -10 volts at a rated output load of 5 ma. For the sprocket channel, no hole is zero volts and hole is -10 volts at a rated output load of 10 ma. The unloaded output for the data channels is -14 volts. Maximum current that can be delivered before the output voltage becomes zero, is 15 ma. Maximum current that the sprocket channel can deliver before its output voltage becomes zero, is 30 ma. Duty cycle of the output pulses is adjustable as follows:



from 1.5 ms to 2.5 ms in the "on" state

from 1.5 ms to 0.5 ms in the "off" state

D. TAPE READ AMPLIFIER CIRCUIT

The sprocket channel photodiode (Appendix Drawing A-H293) connects to one stage of amplification followed by a Schmitt trigger. Terminal PHD goes to one end of the photodiode. The other end of the photodiode goes to the negative bias of -10 volts. The bias is taken off of the potentiometer in the power supply (Appendix Drawing B-H329).

Each of the data channel photodiodes goes to a two-stage amplifier (Appendix Drawing A-H326) with provision for gating with the sprocket channel. The terminal PHD goes to one end of the photodiode. The other ends of the photodiodes are tied together with the end of the photodiode of the sprocket channel and this common connection is made to the minus bias potentiometer in the power supply (Appendix Drawing B-H329). Refer also to the wiring diagram of the read head connections (Appendix Drawing A-K201). In the dark, a small reverse current of a few microamperes flows. When the cell is illuminated, several hundred microamperes of reverse current flows.

Each photodiode is connected to a two-stage, transistor amplifier. Transistors are PNP types GT-2N520A and GT-1170. In the "no hole" condition of the photodiode, diode current is low, and the bias voltage at the base of the first transistor (GT-2N520A) is positive. The base of the transistor is more positive than the emitter, cutting off the transistor. The collector voltage puts a negative bias on the second stage allowing the transistor (GT-1170) to conduct. When light passing through a hole in the tape strikes the photodiode, the resistance of the photodiode decreases and more current passes through from the negative bias source into the transistor. The collector voltage goes negative. Assuming a load current of approximately 5 ma, then the collector will be at -10 volts.

Only two of the three circuits on the auxiliary amplifiers AAA module card (Appendix Drawing A-H291) are used in the unidirectional photoreader. The three circuits are identical direct-coupled inverter amplifiers each having an output capability of 30 ma. Output of the PSB card (Appendix Drawing A-H324) is fed to one of the amplifiers whose output is fed to the other amplifier. This amplifier drives the gated inverter on the SDA-PB card (Appendix Drawing A-H388).

E. START-STOP AMPLIFIER CIRCUIT

The start and stop amplifiers (Appendix Drawing A-H297) which each have two inputs, are identical. These amplifiers trigger a start-stop flip-flop (Appendix Drawing A-H293) in the HSR1 when either the direct-coupled input to the flip-flop is grounded or the pulse input receives a positive going pulse of at least 5 volts amplitude and a minimum of 10 μsec duration. This stage can also be triggered by the positive going edge of a negative pulse if the pulse has an amplitude of at least 5 volts and 20 μsec duration. The positive going edge of the triggering pulse should have a rise time 2 μsec or faster. If a slower rise time is used, the amplitude of the pulse must be greater than 5 volts.

To start the HSR1 from the PB250, address line 28 should be specified in the PTU command. To stop the HSR1 from the PB250 the specified address line should be 29. The PTU command causes the HSR1 to start or stop through the pulse input to the start or stop amplifiers. The direct-coupled input of both amplifiers is brought out to the connector, for external use.

If the dc inputs of the start-stop amplifiers are used, care must be taken not to ground both inputs at the same time, otherwise the brake solenoid and the pinch roller solenoid will be simultaneously energized.

III. OPERATION

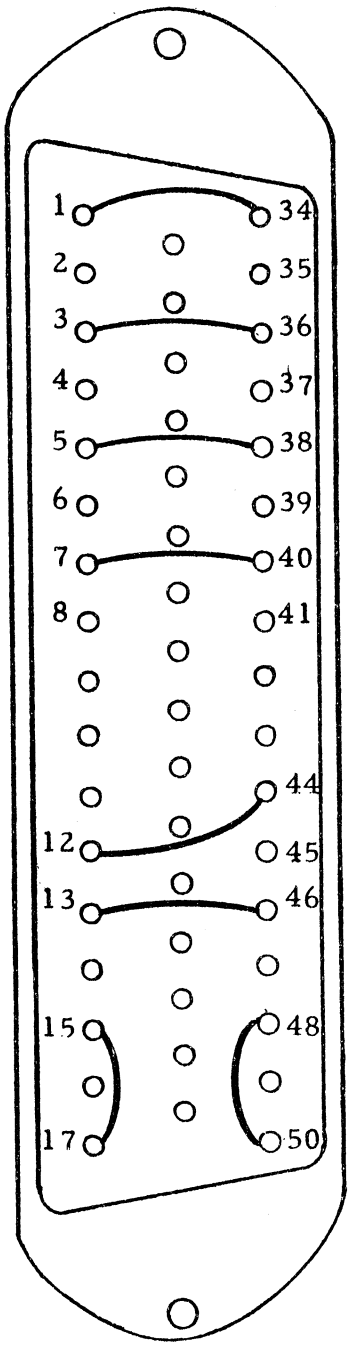
A. TAPE LOADING

When preparing tape for loading, at least six inches of leader is required. An identifying code such as (,) should be punched as the first symbol to identify the end of the leader and the beginning of the information.

Since the tape is punched from the bottom to the top and read from the top to the bottom, it must be loaded upside down relative to the way it was punched. If the photoreader has been stopped by a stop code or PTU signal, the brake solenoid will be energized and the brake shoe will be against the braking block. To load or unload tape when the brake is on, manually depress and hold down the brake drum until loading or unloading is completed. On certain HSR1 units, operation of an ON/OFF switch performs this function.

B. BOOTSTRAP INPUT

The HSR1 may be used for loading the bootstrap into the PB250. A special connector (Figure 3-1) is provided with each reader for the J12 (bootstrap) connector in the PB250. The HSR1 is connected to the PB250 and the bootstrap tape must be prepared in the normal manner where an H is 1 and a zero is 0. The space codes must be punched after each bit, whether it be a one or a zero, in order to provide the proper computer timing. Instead of a 0 or 1 bit at P1, a carriage return should be punched for ease of identifying the beginning of a word.



DD 50P

B6	12P1	-	12P34	S6
B5	12P3	-	12P36	S5
B4	12P5	-	12P38	S4
B1	12P7	-	12P40	S1
Mr	12P12	-	12P44	0 v
$\overline{Mr}$	12P13	-	12P46	-12 v
HSSt	12P17	-	12P15	Start
HSSp	12P50	-	12P48	Stop

Figure 3-1. HSR1 Bootstrap Input Connector

C. POWER SUPPLY

The power supply schematic (Appendix Drawing B-H329) shows a power transformer with center tapped secondary windings feeding full wave rectifiers. Since filtering requirements are not severe, simple resistor-capacitor filtering is used. The negative 30 volts section supplies the current for the solenoid driver amplifiers and the solenoid drivers. The positive and negative 15 volts are supplied to each of the small printed circuit boards. A negative voltage is taken from a 1K potentiometer and is used to bias the photodiodes. This bias can be measured at the test point adjacent to the potentiometer.

The lamp circuit takes power from the unfiltered positive and negative 15 volt sources. Remove the lamp and fuse F5 when making this measurement. The lamp is rated at 10 watts at 12 volts. The derating on this lamp assures maximum life. If the lamp should fail, fuse F5 will blow to protect the Zener diode. R5 should be adjusted so that as the line voltage is changed from 80 to 90 volts the voltage on the Zener diode will increase at least 0.4 volts and when the line voltage changes from 90 volts to 100 volts the Zener diode voltage will increase less than 0.2 volts. For a line voltage change of 90 to 130 volts the voltage across the Zener diode should not vary more than 0.3 volts. R6 should be adjusted to give from 8.6 to 8.9 volts for any line voltage input of 90 to 130 volts.

D. INPUT ROUTINE

The HSR1 Input Routine II 0108A, applicable flow diagrams, and program listing are provided in Table 3-1.

Table 3-1. (Sheet 1 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

Purpose:	To provide high-speed read in, by means of the HSR1 Photo Reader, of paper tape prepared in Octal Utility Package binary format. This routine can be used as an extension of the Octal Utility Package or as a subroutine for use by a larger program.
Restrictions:	The format of the tape must be the same as that prepared by the Octal Utility Package binary punching routine. The tape may have location settings at the beginning of the binary block and a W at the end; however, when the program operates as a subroutine, any location setting on the tape will override that specified by the calling sequence. There must be a W at the end of the binary block or the BREAK POINT switch must be down for the input routine to return control to either the Octal Utility Package or to the controlling program. Only lines 01 through 36 may be filled with a location setting on the tape. Through the subroutine calling sequence or the keyboard control mode, line numbers of 40 through 77 may be loaded into the Index register.

Table 3-1. (Sheet 2 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

Storage:	The routine requires all of one command line, plus F00-F02 and F15-F17. The Index register holds the number of the line to be filled.
Timing:	Approximately 2.6 seconds are required to read one block of tape, not counting leader.
Use:	
Loading	Load the routine into the specified line (a version will be available for all command lines) under control of the Octal Utility Package.
Octal Utility Package Control	Load the tape to be read into the photo reader. Transfer to sector 000 of the line in which the input routine is located (000LL). The Flexowriter light will come on and the number of the line to be filled may be typed, followed by an F. If a line number followed by a $ or F has been previously punched on the tape to be read, it is only necessary to type F to start the loading operation. The photo reader input routine reads tapes in the same manner as the Octal Utility Package, and any location setting on the tape will supersede that entered from the keyboard. After reading a binary block and comparing the check sums, the routine will, if the check

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

	sums compare, continue reading tape for a new location setting unless either the BREAK POINT switch is down or a W is read. In either of these cases, the photo reader will be stopped and control will be returned to the Octal Utility keyboard mode. Care should be taken to make certain that single blocks of tape have a W at the end, and also that there is a W at the end of a multi-block tape. If the check sums do not compare, the routine will stop the photo reader and halt with a line number of $37)_8$, regardless of the position of the BREAK POINT switch or the presence or absence of a W on the tape. When parity is cleared, control will automatically be returned to the Octal Utility keyboard mode.
Subroutine	This routine may be used as a subroutine to read tapes prepared in Octal Utility Package binary format. The calling sequence for the subroutine is as follows: Set Index register with number of line to be filled (see * on page 3-7). LDA normal return command LDB error return command TRU 100LL

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

*(If a location setting is on the tape, this is not necessary since the tape setting will override any previous setting.)

The subroutine will read the tape and fill the line indicated, computing a check sum as it fills. This sum is compared with that on the tape and if they do not agree, the reader is stopped and the error return executed. If they do agree, the normal return will be executed if the BREAK POINT switch is down or if a W is read from the tape. If the BREAK POINT switch is not down and there is no W on the tape, the routine will continue to read tape for a new location setting. It is possible in this way to fill several lines with only one entrance to the subroutine.

There are three entrances to the subroutine as follows:

Location	Function
000	Standard entrance. This will move the program from the line it is in to the line in which it will operate. It also presets returns and gives keyboard control.
100	Normal subroutine entrance. Stores the two returns contained in A and B. (A = error return, B = normal return.)

PHOTO READER (HSR 1) INPUT ROUTINE II 0108A

	200 Previous mode entrance, does not set returns or give keyboard control, but starts tape and begins reading. This entrance should only be used when all necessary codes are on tape or when the Index has been set and the exits have been previously set. There are essentially three parts to this routine: 1. The entrance control part has two sections, one for Octal Utility control and one for subroutine control. a. When entrance is at sector 000, the returns are present and the program waits in a keyboard read sequence for further control. After an F has been typed, the previous two octal digits are stored in the Index register, the photo reader is started, and control is transferred to part 2 of the routine. b. Entrance at sector 100 for subroutine operation bypasses the keyboard phase of 1a and stores the two return commands instead. The reader is then started and control passes to part 2.

Table 3-1. (Sheet 6 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

	2. This part of the routine reads the tape by testing for a sprocket hole signal every 768 μ sec. When a signal is found, the character is loaded into A and compared with each of three control code configurations, G, and a 6X code for either $ or F. If the input character agrees with none of the three, then the least significant three bits of the character are shifted into the least significant three bits of an accumulating number. When a 6X code, representing $ or F is found, the last six bits of the accumulating word are stored in the Index register and control comes back to part 2. When a G code is encountered, the check sum in F15 is cleared to zero and control passes on to part 3. If a W code is read at any time during part 2, the photo reader will be stopped and the normal return executed. 3. After reading the G code, all further information is interpreted as binary for 771 characters. Each group of three characters is assembled as a 22-bit word and stored away except for the last word, which is compared with the computed check sum. If they agree, the BREAK POINT switch is tested, and if on, the reader is stopped and the normal return

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

	executed. If the BREAK POINT switch is not on, control drops back to part 2. In the event the check sums do not agree, the reader is stopped and the error return executed. In line 00, F15 holds the check sum, F16 holds the modified store command, and F17 holds one of the four TRU commands which returns control to the routine after the store is executed.

Table 3-1. (Sheet 8 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A FLOW DIAGRAM

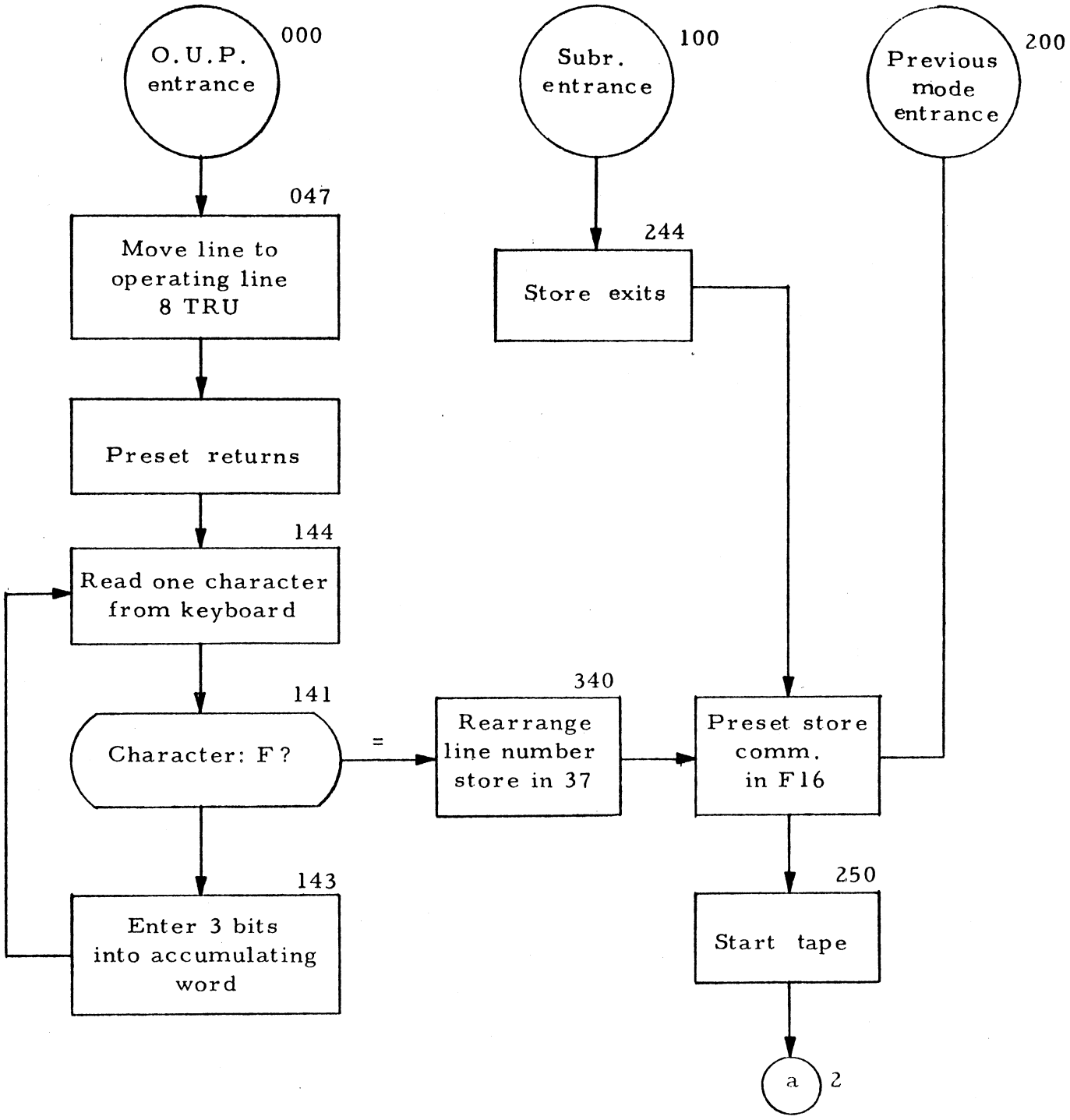


Table 3-1. (Sheet 9 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A FLOW DIAGRAM

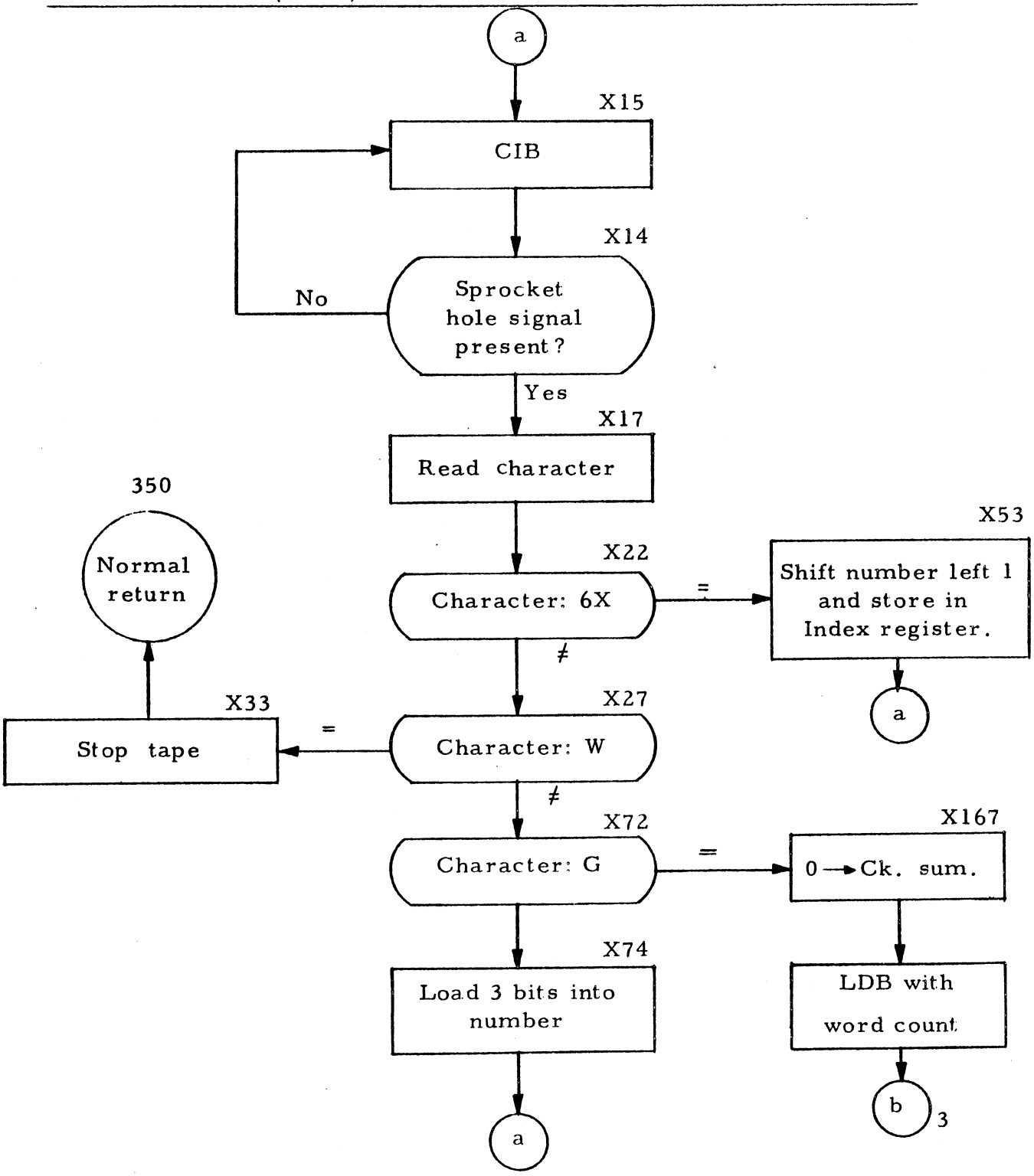
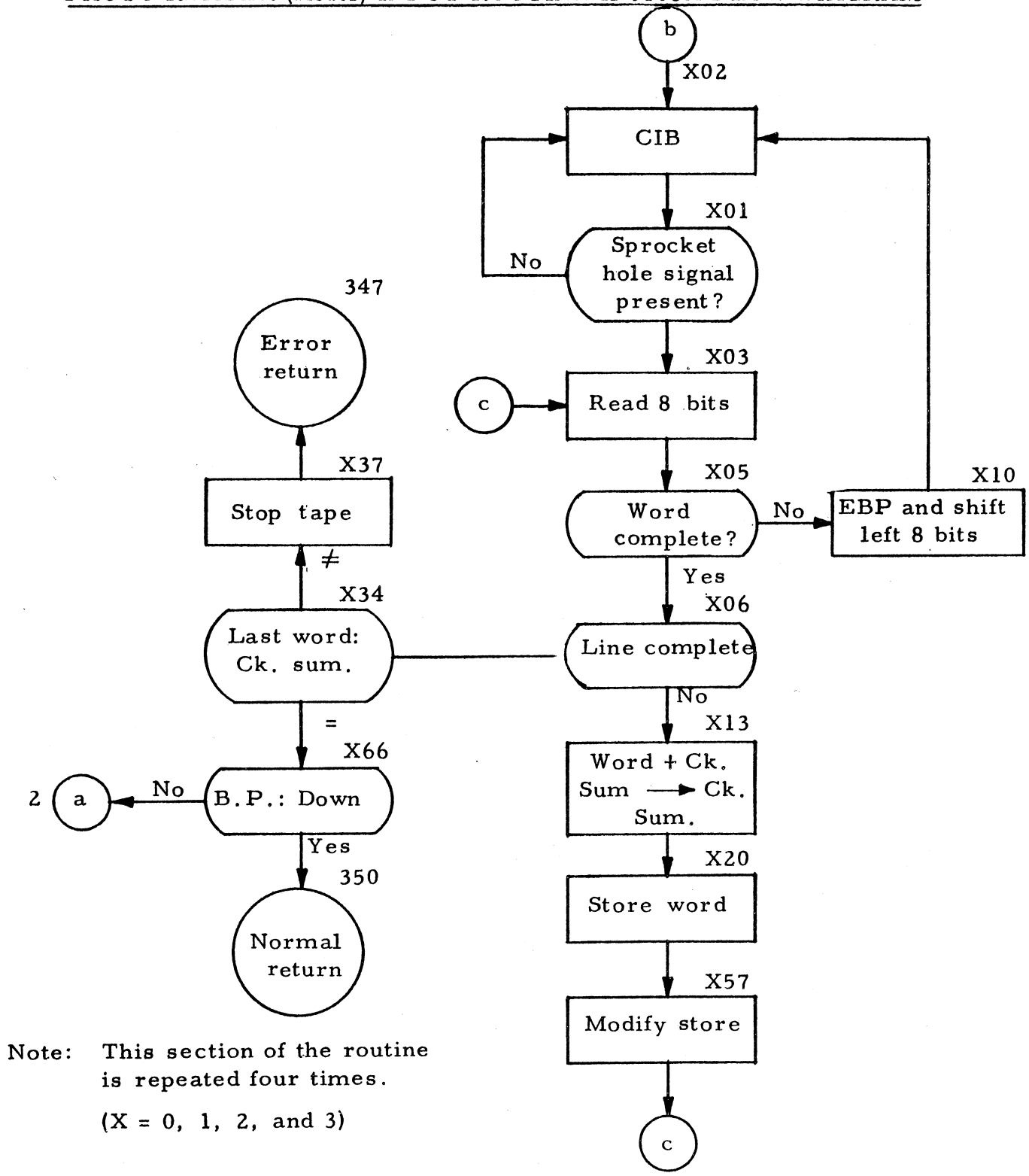


Table 3-1. (Sheet 10 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A FLOW DIAGRAM



Note: This section of the routine is repeated four times.

(X = 0, 1, 2, and 3)

Table 3-1. (Sheet 11 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

Location	Instruction	Symbolic op Code	Remarks
00007$	040S07001	LDP	[O. U. P. Entrance]
001	003 7734;	TES	For sprocket hole
002	100S5700;	CIB	To next TES S. H.
003	004S5507;	LAI	
004	000 01771	CONST	+0000377 (Mask)
005	010 3607;	TBN	If word not complete
006	034 7507;	TOF	O. F. = End of line
007	010S0030;	MAC	
010	170S4007;	EBP	EBP Mask
011	012S0607;	LDB	Store returner
012	051S3707;	TRU	[Store returner]
013	015S1400;	ADD	Ck. sum
014	017 7734;	TES	For sprocket hole
015	113S5700;	CIB	To next TES S. H.
016	017S1200;	STB	Return jump
017	021S5507;	LAI	
020	036S7500;	TOF	To (Store) reset $\overline{\text{O. F.}}$
021	+0000070;	CONST	
022	023S5607;	CAM	$ - F code
023	+00C0C60	CONST	($ - F code)
024	153 7507;	TOF	$ - F

Table 3-1. (Sheet 12 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

Location	Instruction	Symbolic op Code	Remarks
025	026S5507;	LAI	
026	+0000077	CONST	
027	030S5607;	CAM	W code
030	+0000046	CONST	(W code)
031	033 7507;	TOF	W
032	072S5607;	CAM	G code
033	133 7035;	PTU	Stop
034	035S5600;	CAM	Ck. sum
035	061S2210;	RSO	19
036	160 7507;	TOF	If Ck. sum O, K.
037	137S7035;	PTU	Error stop
040	000 0037;	HLT	O. U. P. Error halt
041	000S3701;	TRU	O. U. P. Normal exit
042	043S71071	MCL	To operating line
043	044S3707;	TRU	To operating line
044	347 1307;	STD	Store O. U. P. exits
045	046S0507;	LDA	Initial store
046	177 10001	STC	[Initial store]
047	016 1100;	STA	(Store)
050	242S4400;	CLB	
051	053S5700;	CIB	

Table 3-1. (Sheet 13 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

Location	Instruction	Symbolic op Code	Remarks
052	056S2210;	RSO	3
053	055S2110;	LSO	[1 $ - F]
054	057S2500;	IAM	Store ck. sum, Pick up (Store)
055	060S1237;	STB	In Index register
056	134S0100;	IAC	
057	062S1507;	SUB	Sector increment
060	333 7735;	TES	B. P.
061	076S4500;	CLA	
062	001 0000;	CONST	[Sector increment]
063	064S0607	LDB	Word marker
064	377S7720;	CONST	[Word marker]
065	074S4400;	CLC	
066	075S1000;	STC	Ck. sum
067	164S0707;	LDP	To LDB with word marker
070	377 0000;	CONST	-7740000 [EBP Mask]
071	102S2110;	LSO	8
072	+0C00047	CONST	(G code)
073	167 7507;	TOF	G
074	151S020C	IBC	
075	103S2500;	STA	Replace store
076	100S5700;	CIB	
077	114S4400;	CLC	
100	243S5700;	CIB	[Subroutine entrance]

Table 3-1. (Sheet 14 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

Location	Instruction	Symbolic op Code	Remarks
101	103 7734;	TES	For sprocket hole
102	200S5700;	CIB	To next TES S. H.
103	104S5507;	LAI	
104	000 01771	CONST	+0000377 (Mask)
105	110 3607;	TBN	If word not complete
106	134 7507;	TOF	O. F. = End of line
107	110S0031;	MAC	
110	270S4007;	EBP	EBP Mask
111	112S0607;	LDB	Store returner
112	151S3707;	TRU	[Store returner]
113	115S1400;	ADD	Ck. sum
114	117 7734;	TES	For sprocket hole
115	213S5700;	CIB	To next TES S. H.
116	117S1200;	STB	Return jump
117	121S5507;	LAI	
120	136S7500;	TOF	To (store), reset O. F.
121	+0000070	CONST	
122	123S5607;	CAM	$ - F code
123	+0000060	CONST	($ - F code)
124	253 7507;	TOF	$ - F
125	126S5507;	LAI	
126	+0000077	CONST	
127	130S5607;	CAM	W code

Table 3-1. (Sheet 15 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

Location	Instruction	Symbolic op Code	Remarks
130	+0000046	CONST	(W code)
131	133 7507;	TOF	W
132	172S5607;	CAM	G code
133	233S7035;	PTU	Stop
134	135S5600;	CAM	Ck. sum
135	161S2210;	RSO	19
136	260 7507;	TOF	If ck. sum O. K.
137	237S7035;	PTU	Error stop
140	204 5507;	LAI	
141	300 5607;	CAM	F code
142	340 7507;	TOF	Fill start
143	237S0200;	IBC	
144	137S5100;	RTK	Read new char.
145	146 5100;	RTK	[Read key board]
146	145 7736;	TES	Reject old char.
147	144 7736;	TES	Test for new char.
150	146S5700;	CIB	To $ - 1
151	153S5700;	CIB	
152	156S2210;	RSO	3
153	155S2110;	LSO	1 [$ - F]
154	157S2500;	IAM	Store ck. sum, pick up (Store)
155	160S1237;	STB	In Index register
156	234S0100;	IAC	

Table 3-1. (Sheet 16 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

Location	Instruction	Symbolic op Code	Remarks
157	162S1507;	SUB	Sector increment
160	033 7735;	TES	B. P.
161	176S4500;	CLA	
162	001 0000;	CONST	[Sector increment]
163	164S0607;	LCB	Word marker
164	377S7720;	CONST	[Word marker]
165	174S4400;	CLC	
166	175S1000;	STC	Ck. sum
167	264S0707;	LDP	To LDB with word marker
170	377 0000;	CONST	07740000 [EBP Mask]
171	202S2110;	LSO	8
172	+0000047	CONST	G code
173	267 7507;	TOF	G
174	251S0200;	IBC	
175	203S2500;	IAM	Replace store
176	200S5700;	CIB	
177	204S4400;	CLC	
200	246S5700;	CIB	[Previous mode entrance]
201	203 7734;	TES	For sprocket hole
202	300S5700;	CIB	To next TES S. H.
203	204S5507;	LAI	
204	000 01771	CONST	+0000377 (Mask)
205	210 3607;	TBN	If word not complete

Table 3-1. (Sheet 17 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

Location	Instruction	Symbolic op Code	Remarks
206	234 7507;	TOF	O. F. = End of line
207	210S0032;	MAC	
210	370S4007;	EBP	EBP Mask
211	212S0607;	LDB	Store returner
212	251S3707;	TRU	[Store returner]
213	215S1400;	ADD	Ck. sum
214	217 7734;	TES	For sprocket hole
215	313S5700;	CIB	To next TES S. H.
216	217S1200;	STB	Return jump
217	221S5507;	LAI	
220	236S7500;	TOF	To (Store) reset $\overline{\text{O. F.}}$
221	+0000070	CONST	
222	223S5607;	CAM	$ - F code
223	+0000060	CONST	($ - F code)
224	353 7507;	TOF	$ - F
225	226S5507;	LAI	
226	+0000077	CONST	
227	230S5607;	CAM	W code
230	+0000046	CONST	(W code)
231	233 7507;	TOF	W
232	272S5607;	CAM	G code
233	333S7035;	PTU	Stop
234	235S5600;	CAM	Ck. sum

Table 3-1. (Sheet 18 of 22)

PHOTO READER (HSR1) INPUT ROUTINE II 0108A

Location	Instruction	Symbolic op Code	Remarks
235	261S2210;	RSO	19
236	360 7507;	TOF	If ck. sum O. K.
237	337S7035;	PTU	Error stop
240	244 2210;	RSO	3
241	000 0100;	IAC	
242	266 2210;	RSO	19
243	144S4500;	CLA	To read keyboard
244	347 1307;	STD	Returns
245	044 0507;	LDA	Initial store
246	016 1100;	STA	(Store)
247	000 4500;	CLA	
250	314S7034;	PTU	Start
251	253S5700;	CIB	
252	256S2210;	RSO	3
253	255S2110;	LSO	1 [$ - F]
254	257S2500;	IAM	Store ck. sum, pick up (Store)
255	260S1237;	STB	In Index register
256	334S0100;	IAC	
257	262S1507;	SUB	Sector increment
260	133 7735;	TES	B. P.
261	276S4500;	CLA	
262	001 0000;	CONST	[Sector increment]
263	264S0607;	LDB	Word marker

Table 3-1. (Sheet 19 of 22)

PHOTO READER (HSR1) INPUT ROUTINE 11 0108A

Location	Instruction	Symbolic op Code	Remarks
264	377S7720;	CONST	[Word marker]
265	274S4400;	CLC	
266	275S1000;	STC	Ck. sum
267	364S0707;	LDP	To LDB with word marker
270	377 0000;	CONST	-7740000 [EBP Mask]
271	302S2110;	LSO	8
272	+0000047	CONST	G code
273	367 7507;	TOF	G
274	351S0200;	IBC	
275	303S2500;	IAM	Replace store
276	300S5700;	CIB	
277	314S4400;	CLC	
300	+0000066	CONST	[F code]
301	303 7734;	TES	For sprocket hole
302	000S5700;	CIB	To next S. H.
303	304S5507;	LAI	
304	000 01771	CONST	+0000377 (Mask)
305	310 3607;	TBN	If word not complete
306	334 7507;	TOF	O. F. = End of line
307	310S0033;	MAC	
310	070S4007;	EBP	EBP Mask
311	312S0607;	LDB	Store returner
312	351S3707;	TRU	[Store returner]

IV. CHECKOUT

Complete test and checkout procedure for the HSR1 is as follows:

1. Make a visual check of all component parts and wires and replace each damaged or broken part or wire.

2. Check all modules (Appendix Figure 5) for proper location in the unit.

3. Check all fuse holders (Appendix Figures 5 and 6) for the correct value fuse (F1-F4, 2 amp; F5, 1 amp)

4. Connect control circuits (Appendix Figure 2) for test.

5. Check the gap between the pressure roller and drive capstan and also between the brake solenoid shoe and brake block. Refer to Section V for the proper adjustments and clearances.

6. Before operating tape in the HSR1, check all voltages by reference to the table of nominal voltages in the appendix.

7. To test the HSR1, pink-colored tape should be used, with each character punched at all eight channels, plus sprocket.

8. With the power disconnected (ac power is supplied by way of a line cord mounted on the chassis), thread the tape as shown in Appendix Figures 3 and 4.

9. Turn on the HSR1. The unit can be operated manually by grounding test point ⟨2⟩ on the FRA module card (Appendix Drawing A-H293) to start the reader or ground test point ⟨1⟩ to stop the reader. Ground is at pin H of J1 connector.

10. Check that the HSR1 is capable of reading 300 characters per second (3.3 ± 10% msec per character read).

V. MAINTENANCE

A. GENERAL

The quality and derating of all components used in the HSR1 provides for a trouble-free unit, with a required minimum of maintenance.

B. LUBRICATION

All bearings, including those of the drive motor, are permanently lubricated and require no further attention. Double-shielded ball bearings are used throughout the tape transport to prevent entry of dust.

C. CLEANING

It is recommended that dirt deposited from the tape be removed at least once a week by using a cotton swab dipped in an alcohol solution. Dirt particles should be removed from read head, tape rollers, guide posts and capstans.

D. PRESSURE ROLLER AND BRAKE ADJUSTMENT

Clearance between the pressure roller and drive capstans (Appendix Figure 4) has been set at the factory to 0.011 inch. A similar clearance has been set between the brake shoe and the braking block. If readjustment should become necessary, the correct gap is established as follows. Remove the cover plate by taking out two mounting screws under the solenoid blocks

(blocks are held to the panel by number 10 socket-head screws). By loosening these screws, the blocks may be positioned to adjust the clearance. Use a feeler gauge to establish the correct setting within 0.001 inch, and securely tighten the socket-head screws.

NOTE

The pinch roller gap is set with its solenoid deenergized. The brake is adjusted with its solenoid energized.

E. DATA CHANNEL ADJUSTMENTS

Data channel output pulses have an adjustable pulse width of 1.5 to 2.5 ms. The output of each data channel is adjusted (test point ⟨2⟩ Appendix Drawing A-H326) to approximately 2 ms wide (but in any event, wider than the sprocket signal) for proper timing with the PB250 and for proper gating with the sprocket signal. Amplitude should be between -10 and -12 volts. If the data channel outputs are out of adjustment, they can be readjusted by observing test point ⟨1⟩ of each PGB module card (Appendix Drawing A-H326) and adjusting the potentiometer on each card until the proper width is attained. The width of this pulse should be adjusted during the positive portion of the pulse. Resistor R12 (Appendix Drawing B-H329), which furnishes a negative bias voltage for the photodiodes, is adjusted to give optimum performance for any given type of paper. Papers varying from opaque black mylar to white tracing paper can be used without changing the bias setting. However, the duty cycle will become greater with increased transparency of the paper.

NOTE

To make this adjustment, the first AAA amplifier card (Appendix Figure 5 and Drawing A-H291) must be removed, so that the data channel will not be gated with the sprocket.

F. SPROCKET CHANNEL ADJUSTMENTS

The sprocket channel output has an adjustable negative pulse width of 1.2 to 1.9 ms. This output is adjusted (Appendix Drawing A-H324) to 1.6 ms for proper timing with the PB250. Amplitude should be approximately 7 volts but not smaller than 5 volts. If the sprocket pulse is out of adjustment, the width of the pulse can be readjusted by observing test point ⟨1⟩ of the PSB module card (Appendix Drawing A-H324) and adjusting the potentiometer until the proper width is attained. The width of this pulse should be adjusted during the negative portion of the pulse.

Using an oscilloscope, observe the junction of the 2.2k and 22k resistors (Appendix Drawing A-H324) and regulate the output of the sprocket photodiode by adjusting resistor R12 (Appendix Drawing B-H329) between 0.7 volt peak-to-peak minimum to 0.9 volt peak-to-peak maximum.

G. INSTALLATION

Refer to Figure 5-1 for details covering the installation of the HSR1. Ensure that the interconnecting cable is properly plugged into connector J14 in the PB250 and connector J1 in the HSR1. The continuity of the interconnecting cable may be checked in accordance with Table 5-1.

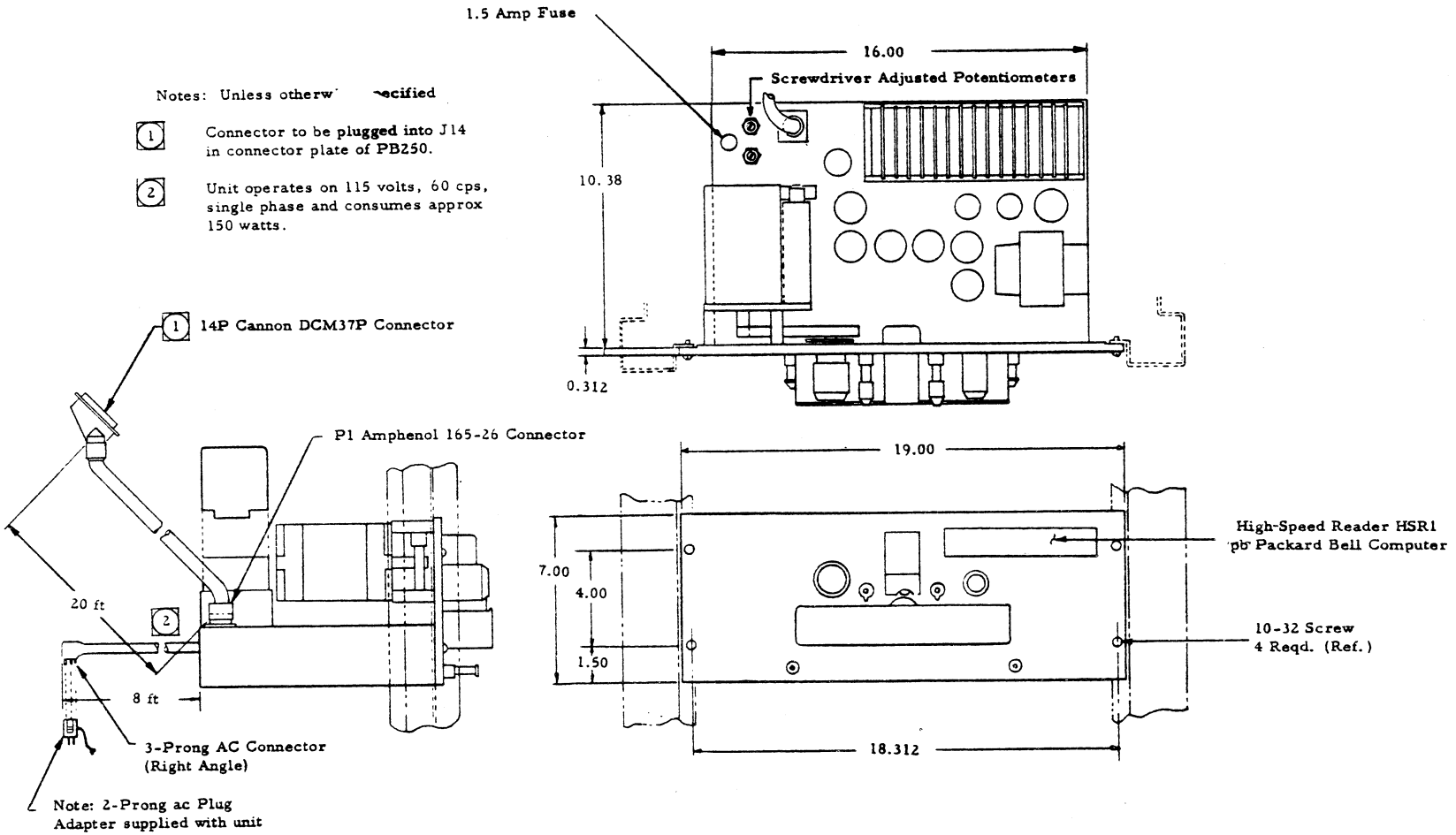


Figure 5-1 HSR1 Installation Drawing

Table 5-1. (Sheet 1 of 2)

HSR1 INTERCONNECTING CABLE

HSR1 Connector Amphenol No. 165-26 P1	PB250 Connector Cannon No. DCM 37P	Term
A	21	Cpg
B	17	L5
C	27	Spare
D	28	Spare
E	16	L4
F	15	L3
H	24	Gnd
J	14	L2
K	13	L1
L	1	(S1)
M	2	(S2)
N	3	(S3)
P	4	(S4)
R	5	(S5)
S	6	(S6)
T	7	(S7)
U	8	(S8)
V	9	(Sc)
W	22	Rf Tf
X	36	Spare
Y	33	Start
Z	35	Spare

Table 5-1. (Sheet 2 of 2)

HSR1 INTERCONNECTING CABLE

HSR1 Connector Amphenol No. 165-26 P1	PB250 Connector Cannon No. DCM 37P	Term
a	37	Stop
b	34	Spare
	26	Spare
	10	K3'
	11	K2'
	12	K1'
	18	01
	19	02
	20	03
	Note: Pins 23 and 25 must be blank.	

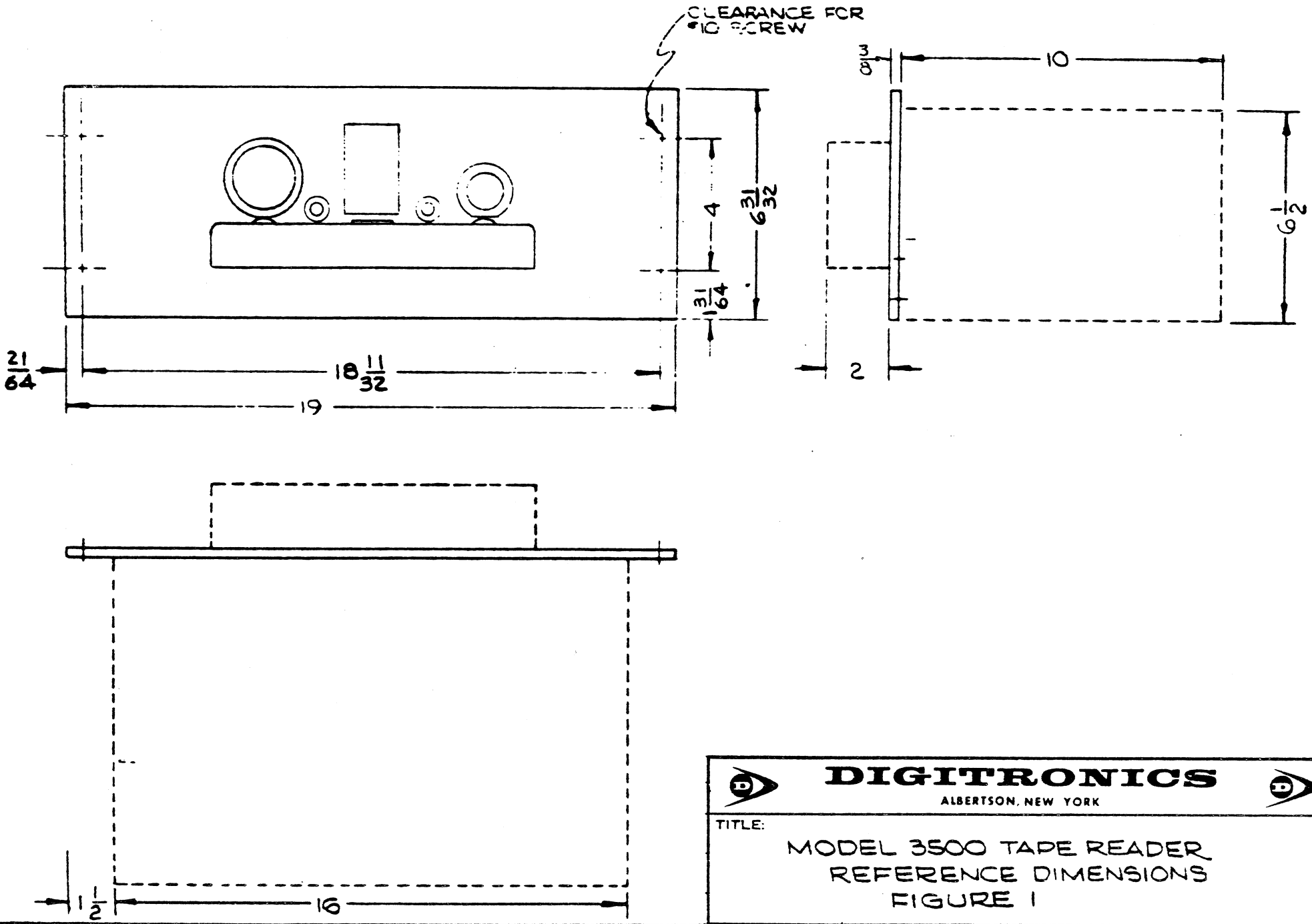
VI. PARTS LIST

Details pertaining to the Digitronics Model 3500 Dykor Perforated Tape Reader are covered in the appendix to this manual. The following parts list shows Packard Bell Computer items included in the HSR1.

Description	Part Number	Quantity
Cable, Assembly	124-1A5321	1
Connector, Bootstrap	124-1C5262	1
Suppressor	821-1A3472	

APPENDIX

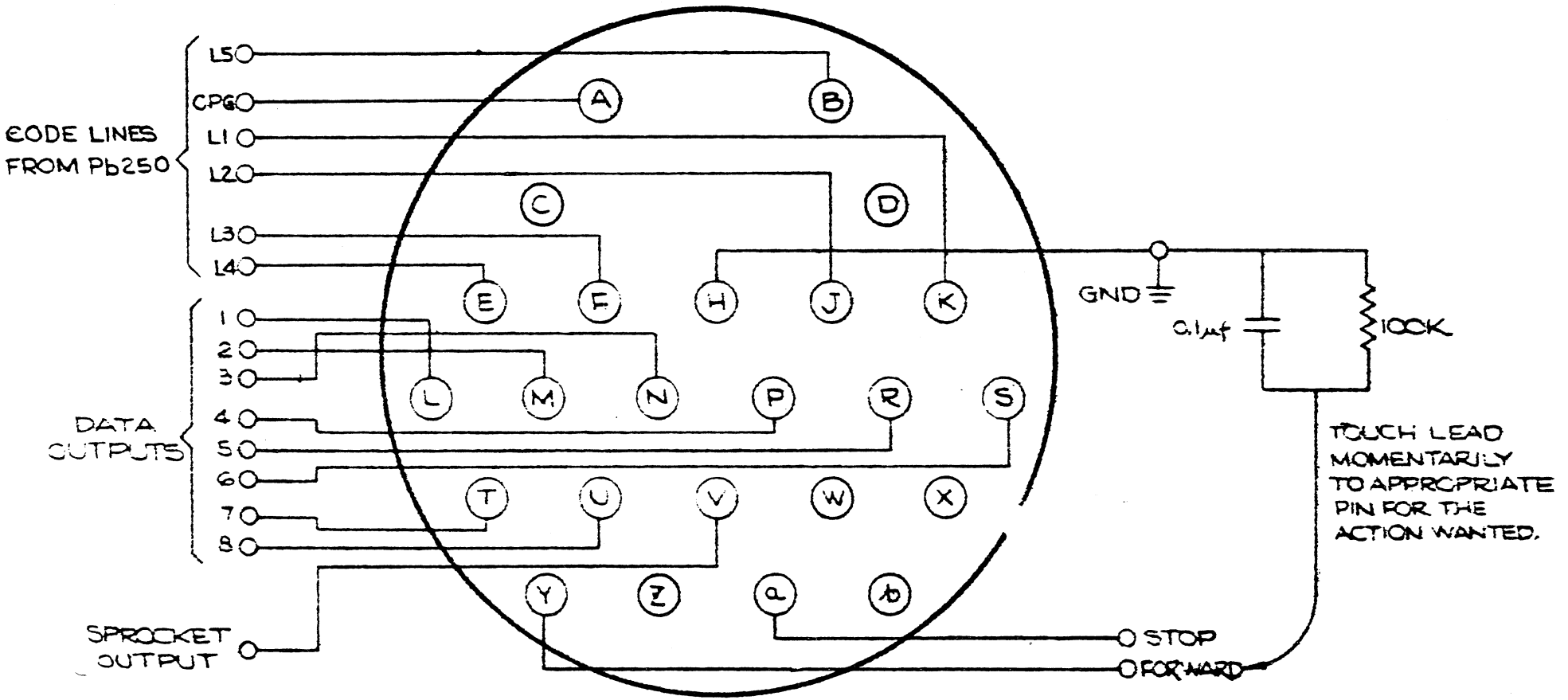
The appendix to this manual consists of figures, drawings, and parts lists by Digitronics Inc. References are made through the manual to items in this appendix.



DIGITRONICS
ALBERTSON, NEW YORK

TITLE:

MODEL 3500 TAPE READER
REFERENCE DIMENSIONS
FIGURE 1



REV	E.C.O.	DWN	CHKD.	APP'D.	MO. DAY YR.
A		DFK			12-28-60

DIGITRONICS
ALBERTSON, NEW YORK

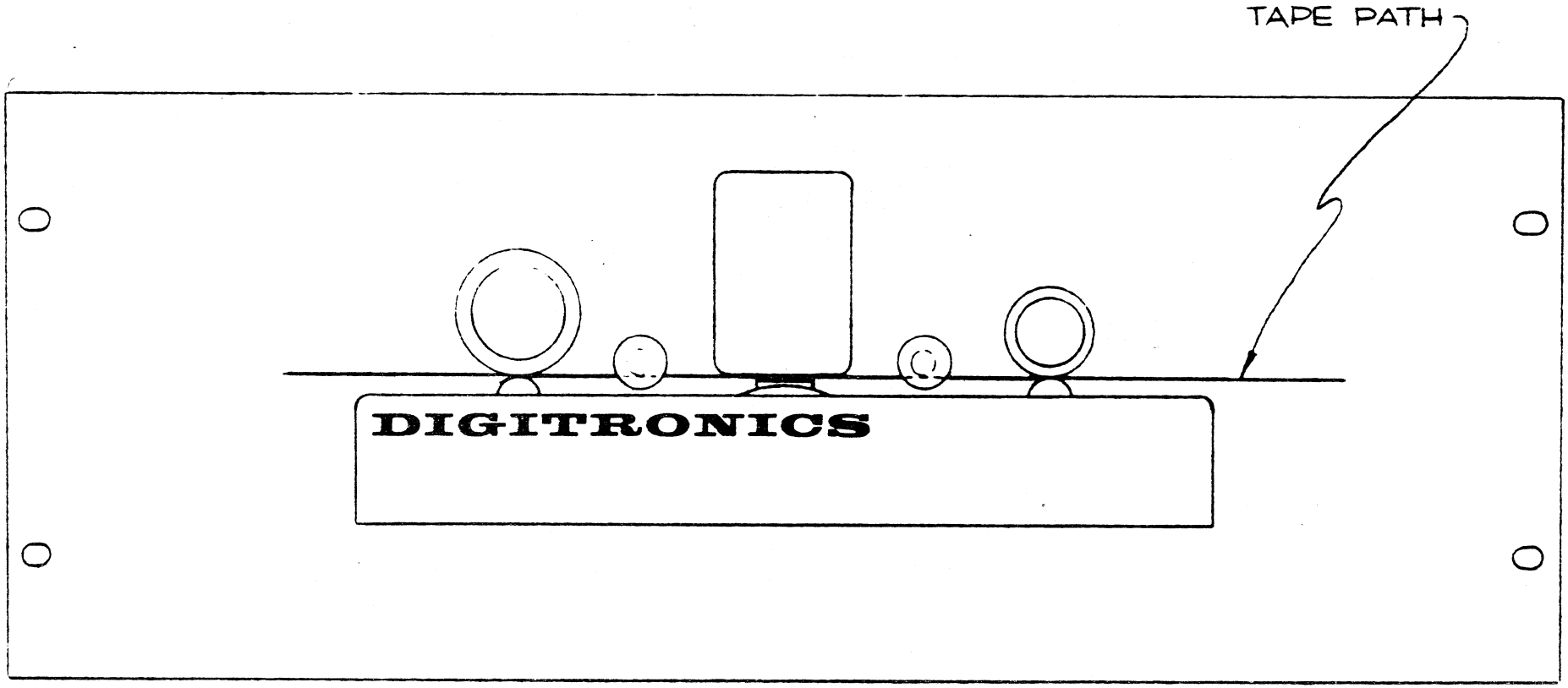
TITLE:

TEST PROCEDURE

FIGURE 2

USED ON: PACKARD-BELL

DRAWING NO.



DIGITRONICS
ALBERTSON, NEW YORK

TIT E

MODEL 3500 TAPE READER
THREADING PATH
FIGURE 3

FIGURE 4 PANEL, FRONT VIEW

Reference No.	Description	Digitronics Part No.
1	Panel	D-A1653-4
2	Capstan Assy.	A-C78
3	Head Assy.	B-C462
4	Tape Guide Assy.	B-C726
5	Brake Assy.	B-C428
6	Roller Solenoid Mount Assy.	C-C81-5
7	Cover	B-E65
8	Brake Solenoid Mount Assy.	B-C79-5

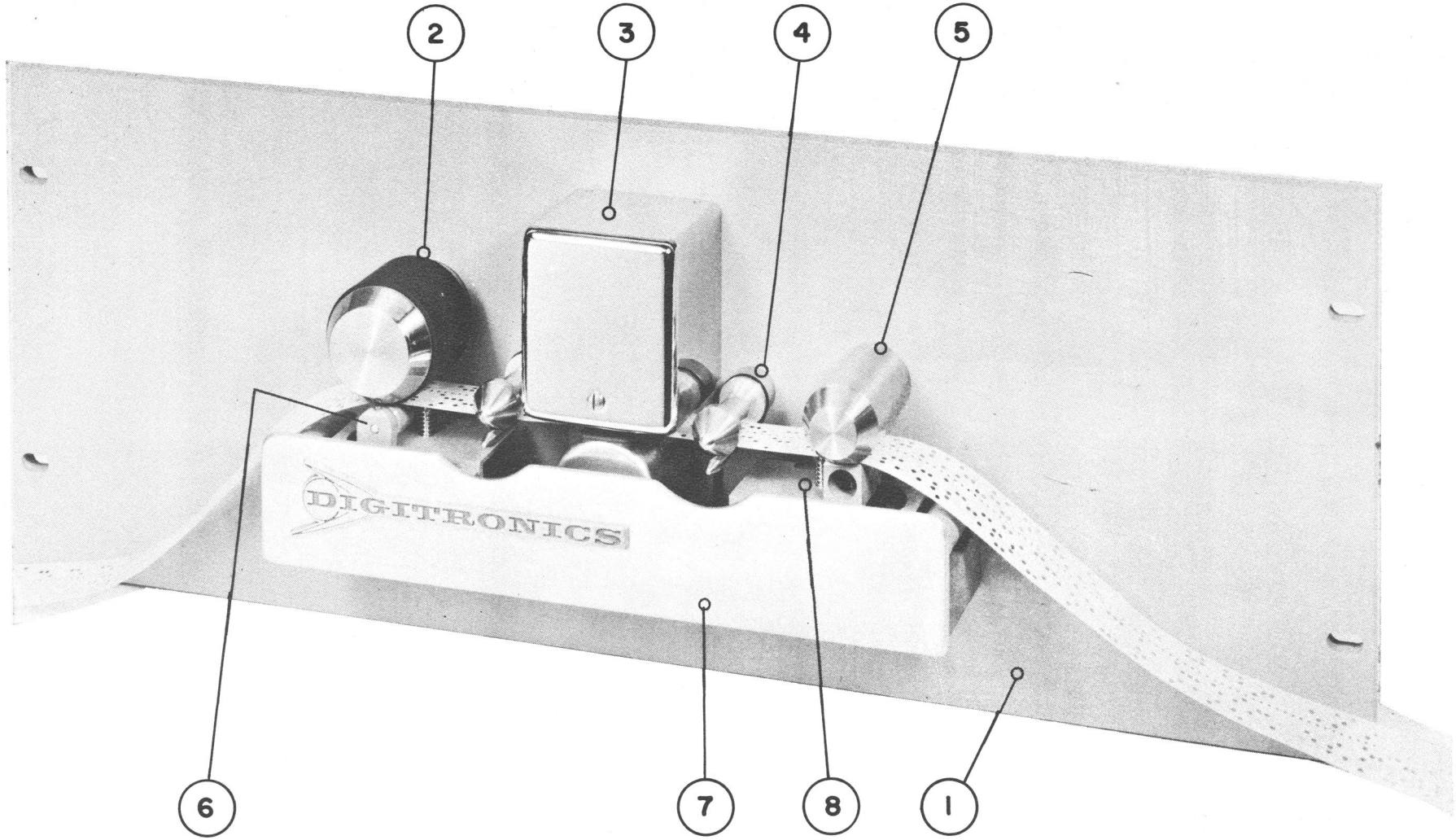


FIG. 4

PANEL
FRONT VIEW

DIGITRONICS

FIGURE 4A PANEL, FRONT VIEW

Reference No.	Description	Digitronics Part No.
1	Panel	D-A1653-3
2	Capstan Assy.	A-C78
3	Head Assy.	B-C462
4	Tape Guide Assy.	B-C726
5	Brake Assy.	B-C428
6	Roller Solenoid Mount Assy.	C-C81-5
7	Cover	B-E65
8	Brake Solenoid Mount Assy.	B-C426
9	Roller Assy.	A-B42

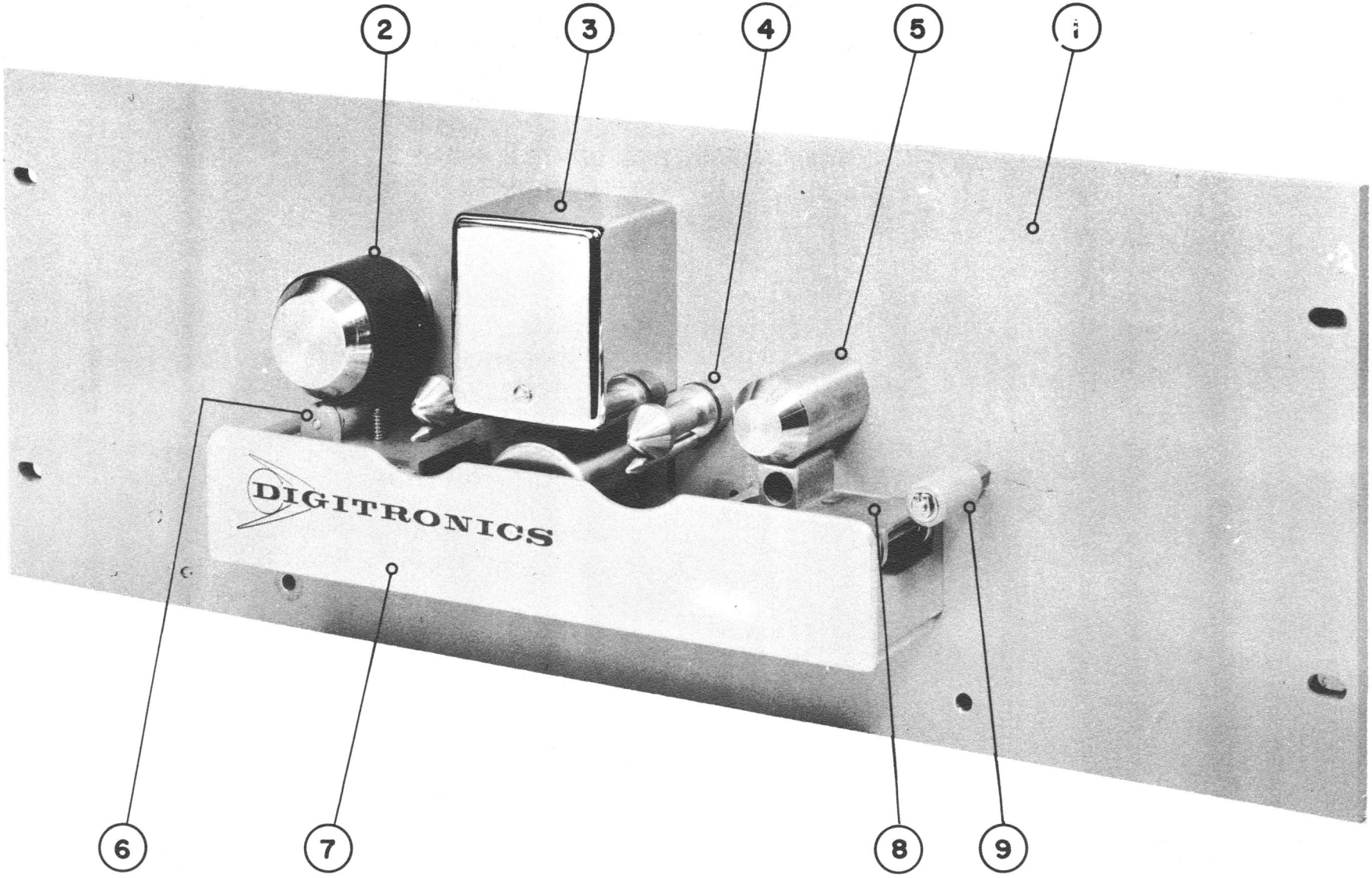
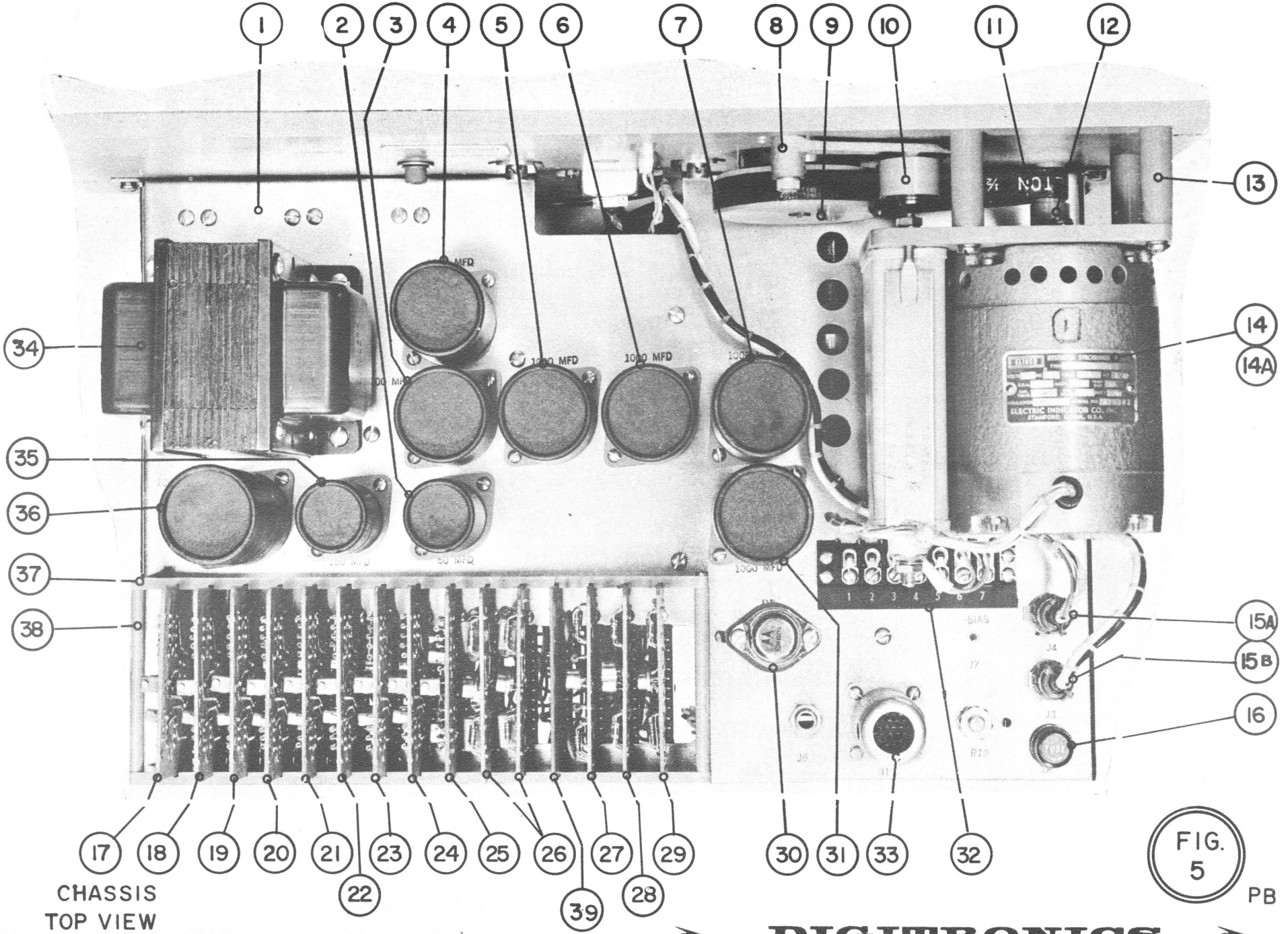


FIG. 4A

PANEL
FRONT VIEW

FIGURE 5 CHASSIS, TOP VIEW

Reference No.	Description	Digitronics Part Number
1	Chassis	D-A 1658
2	Capacitor 50 MFD/150 V Pyramid TMS-20	
3-6 incl.	" 1000 MFD/25 V " TMS-11	
7	" " " 50 V " TMS-16	
8	Idler Tension Arm	A-B32
9	Capstan Pulley	
10	Idler Tension Roller	A-A235-1
11	Belt	
12	Motor Pulley	
13	Spacer, Motor Mount	A-A1384
14	Motor	
14a	Capacitor	
15a	Receptacle 7 pin Winchester M7S-LRN	
15b	" 9 pin " M9S-LRN	
16	Fuse 3AG 2 AMP	
17-24 incl.	P. C. Board Assy. PGB	B-C615
25	" PSB	B-C614
26	" AAA	B-C416
27	" SSA	B-C417
28	" FRA	B-C412
29	" SDA-PB	B-C795
30	Diode Motorola #50M 10Z	
31	Capacitor 1000 MFD/50 V Pyramid TMS-16	
32	Terminal Blocks Kulka 600 A-Y7	
33	Connector	
34	Transformer	A-1133
35	Capacitor 100 MFD/150 V Pyramid TMS-22	B-T53
36	" 1000 MFD/50 V " TMS-16	
37	Track, Printed Card	B-A1346
38	Spacer, Track	A-A1347
39	P. C. Board Assy' SPG (Supplied by P-B)	



CHASSIS
TOP VIEW

FIG. 5

PB

DIGITRONICS

FIGURE 6 CHASSIS, BOTTOM VIEW

Reference No.	Description	Digitronics Part Number
1	Resistor 50 ohm, 40W WARD LEONARD TYPE 40S	
2 & 3	Resistor adjustable 25 ohm, 50 W OHMITE 0562	
4	Printed Card Assy. (SPA)	C-C419
5	Rectifier Stack GE 4JA411AC1BD1	
6	" " GE 4JA411AC1AD1	
7	" " GE 4JA411BC1BD1	
8 & 9	Fuse Littlefuse 2A, 3AG	
10	" " 1A, 3AG	
11	" " 2A, 3AG	
12	Resistor Board Assy.	B-C621
13	Resistor 470 ohm, 1W, 5%	
14	Potentiometer 1K, 2W, AB Type JLU	
15	Resistor 470 ohm, 1W, 5%	

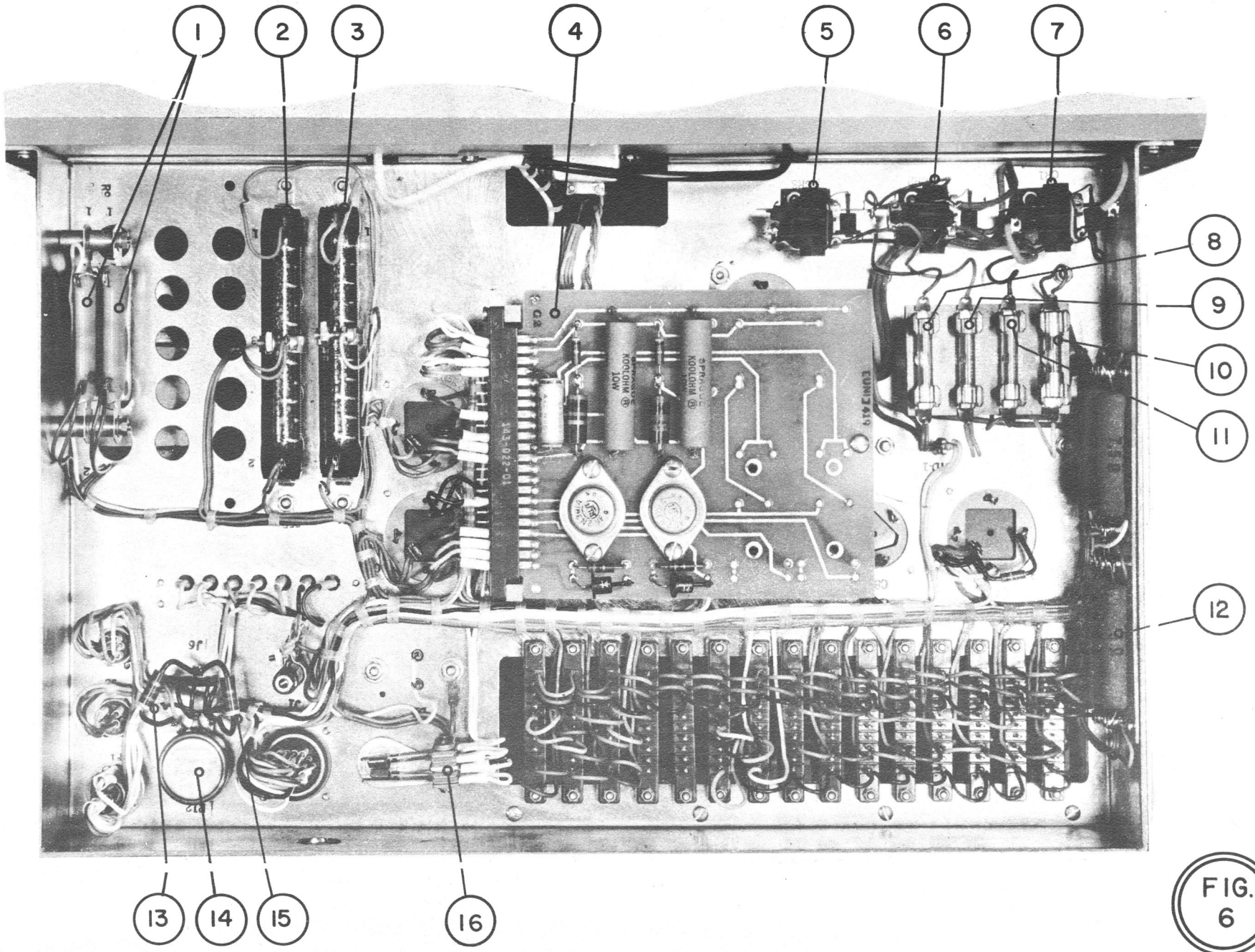


FIG. 6

CHASSIS
BOTTOM VIEW

FIGURE 7 - LAMP ASSEMBLY, UNCOVERED

Reference No.	Description	Digitronics Part No.
1	Lamp Holder Assy.	B-C461
2	Lamp	S-129
3	Lens	A-A1434

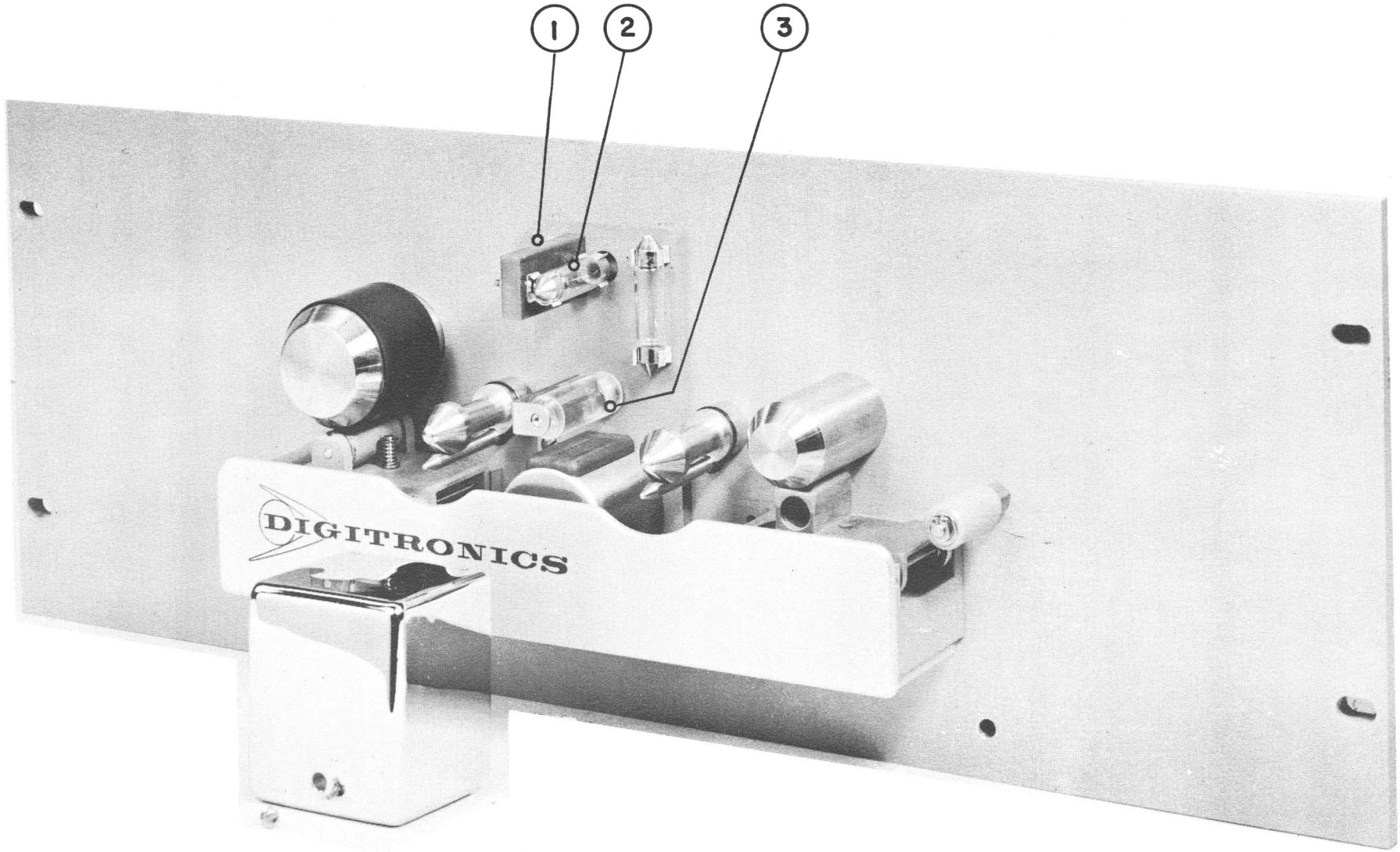


FIG. 7

LAMP ASSEMBLY
UNCOVERED

TABLE OF NOMINAL VOLTAGES

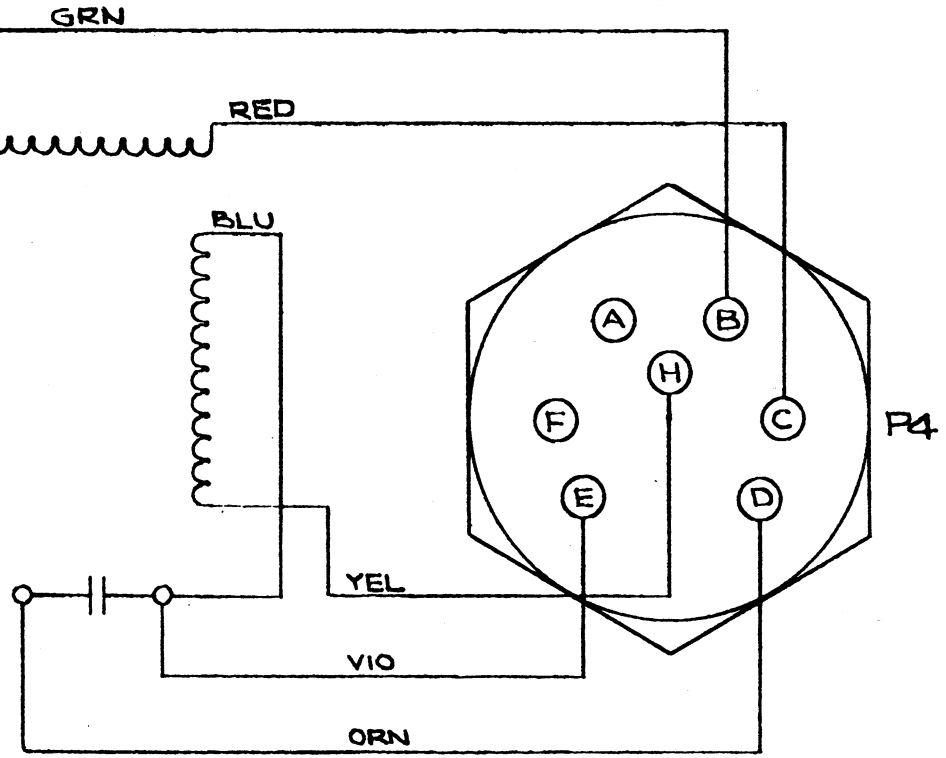
Terminal Board TB-1 pin 14 to pin 15	115 V AC
Rectifier CR1, YEL to YEL	60 V AC
Rectifier CR3, YEL to YEL	30 V AC
Zener Diode, Pine to Case	9.5 V DC
Lamp	8.7 V DC

Following voltages to chassis ground

		D.C.	Running	Halted	Hole*	No Hole*
PGB	Pin J				-15 V	0.0 V
PSB	Pin H				-5 V	0.0 V
AAA	Pin H				0.0 V	-6 V
	F				-15 V	0.0 V
SSA**	Pin E	0.0 V				
	J	0.0 V				
FRA	Pin F		-7 V	0.0 V		
	H		0.0 V	-7 V		
	J	+1.8 V				
SDC	Pin F		-7 V	0.0 V		
	L		0.0 V	-7 V		
SPA	Pin A	-30 V				
	B	+15 V				
	D	-15 V				
	J		0.0 V	-7 V		
	K	+8 V				
	L	Ground				
	M	+1.8 V				
	N		-7 V	0.0 V		
	W		-30 V	-3 V		
	X		-30 V	-1 V		
	Y		-1 V	-30 V		
	Z		-3 V	-30 V		

(*) For appropriate card. Printed Circuit Cards #1 through #8 carry data from channels #1 through #8 respectively, cards #9 and #10 carry the sprocket. NO LOAD VOLTAGES.

(**) When D.C. inputs are not used.



1. WIRING IS FOR ELINCO TYPE MOTOR
2. UNI-DIRECTIONAL READER WIRE AS SHOWN
3. BI-DIRECTIONAL INTERCHANGE CONNECTIONS B & C

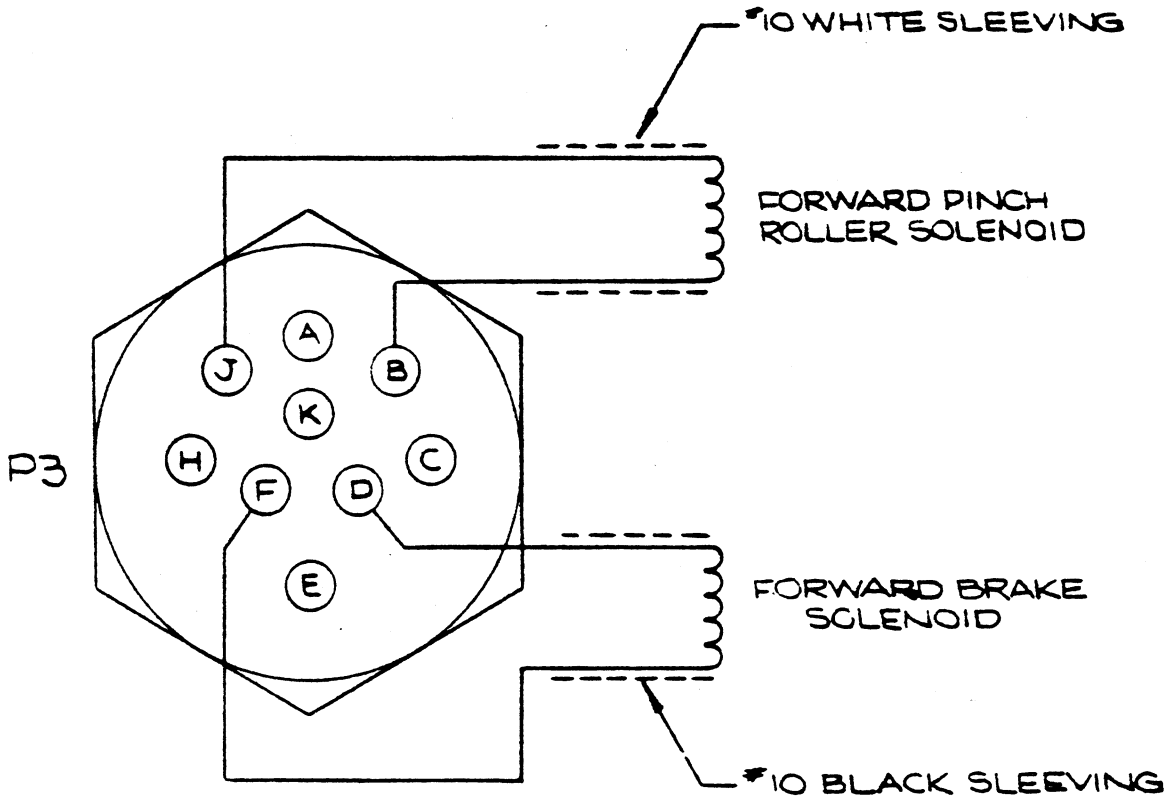
REV		DWN.	CHKD.	APP'D.	MO. DAY YR.
A	ADDED NOTES 2 & 3	DFK		BJ	11-28-60
MATERIAL		JTD	RM	WK	10-6-60
		SCALE:			
FINISH					
TOLERANCES UNLESS OTHERWISE NOTED	DEC. ± .005	FRAC. ± 1/64	ANGLE ± 1/2°		

DIGITRONICS
ALBERTSON, NEW YORK

TITLE:
MOTOR WIRING
(SINGLE SPEED)

USED ON:

DRAWING NO.
A-K 219



REV	E.C.O.	DWN.	CHKD.	APP'D.	MO. DAY YR.
A		DRN.			10-7-60

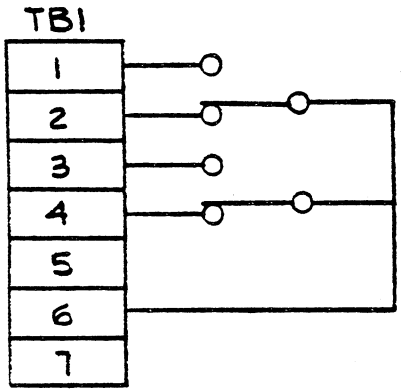
DIGITRONICS
ALBERTSON, NEW YORK

TITLE:

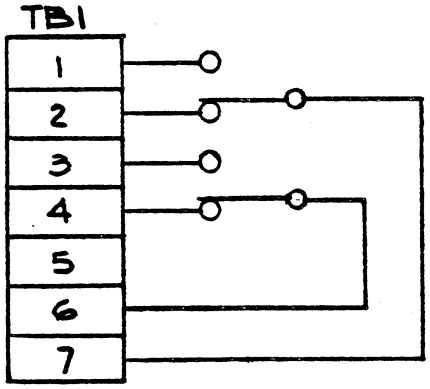
SOLENOID WIRING (UNI-DIRECTIONAL)

USED ON:

DRAWING NO. A-K225



UNI-DIRECTIONAL



BI-DIRECTIONAL

NOTE:
SWITCHES ARE SHOWN IN
LOW SPEED POSITION

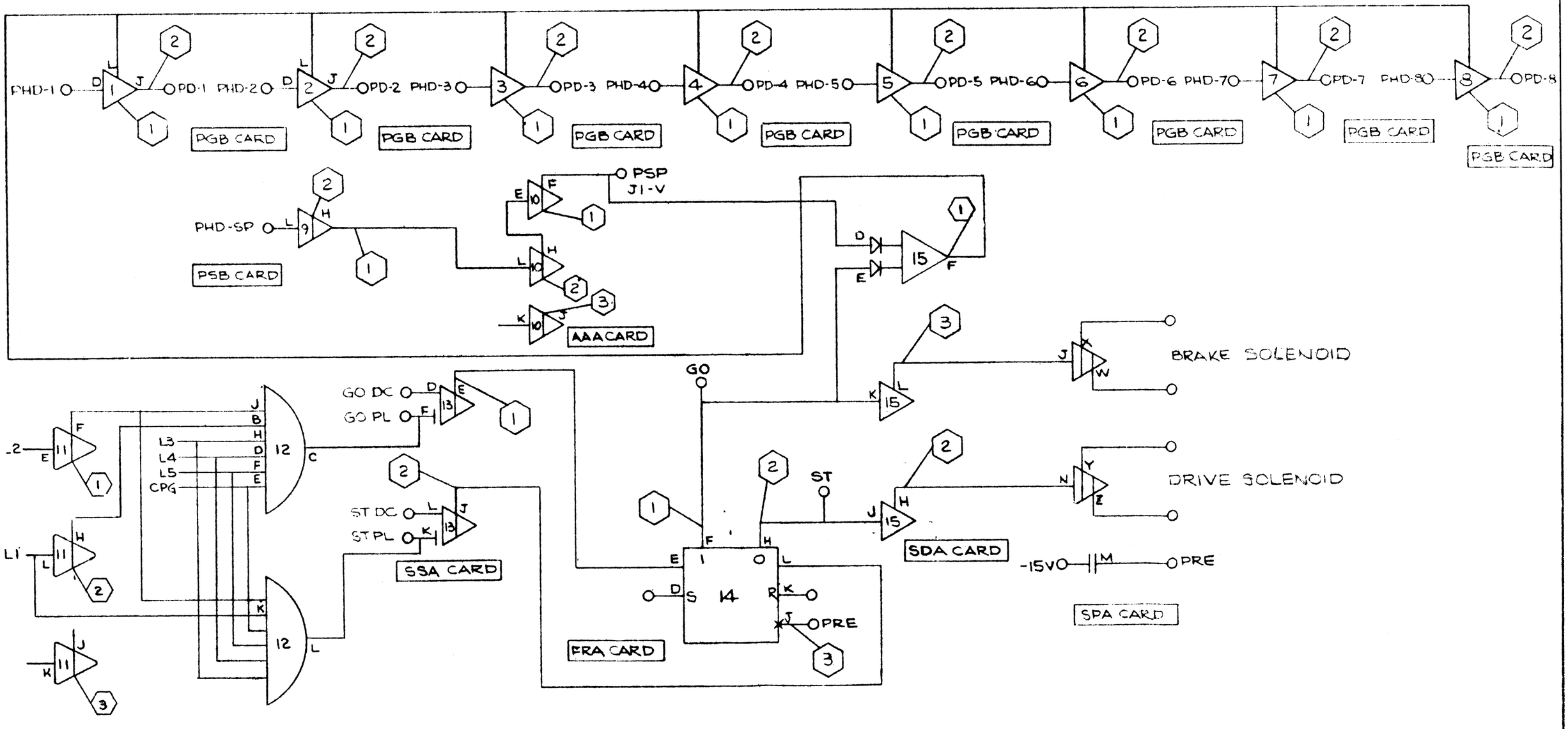
REISSUED	DFK		10-6-60
	DFK		6-29-60

DIGITRONICS
ALBERTSON, NEW YORK

TITLE: WIRING DIAGRAM-SPEED SWITCHING (EXTERNAL)

USED ON:

DRAWING NO. A-K227



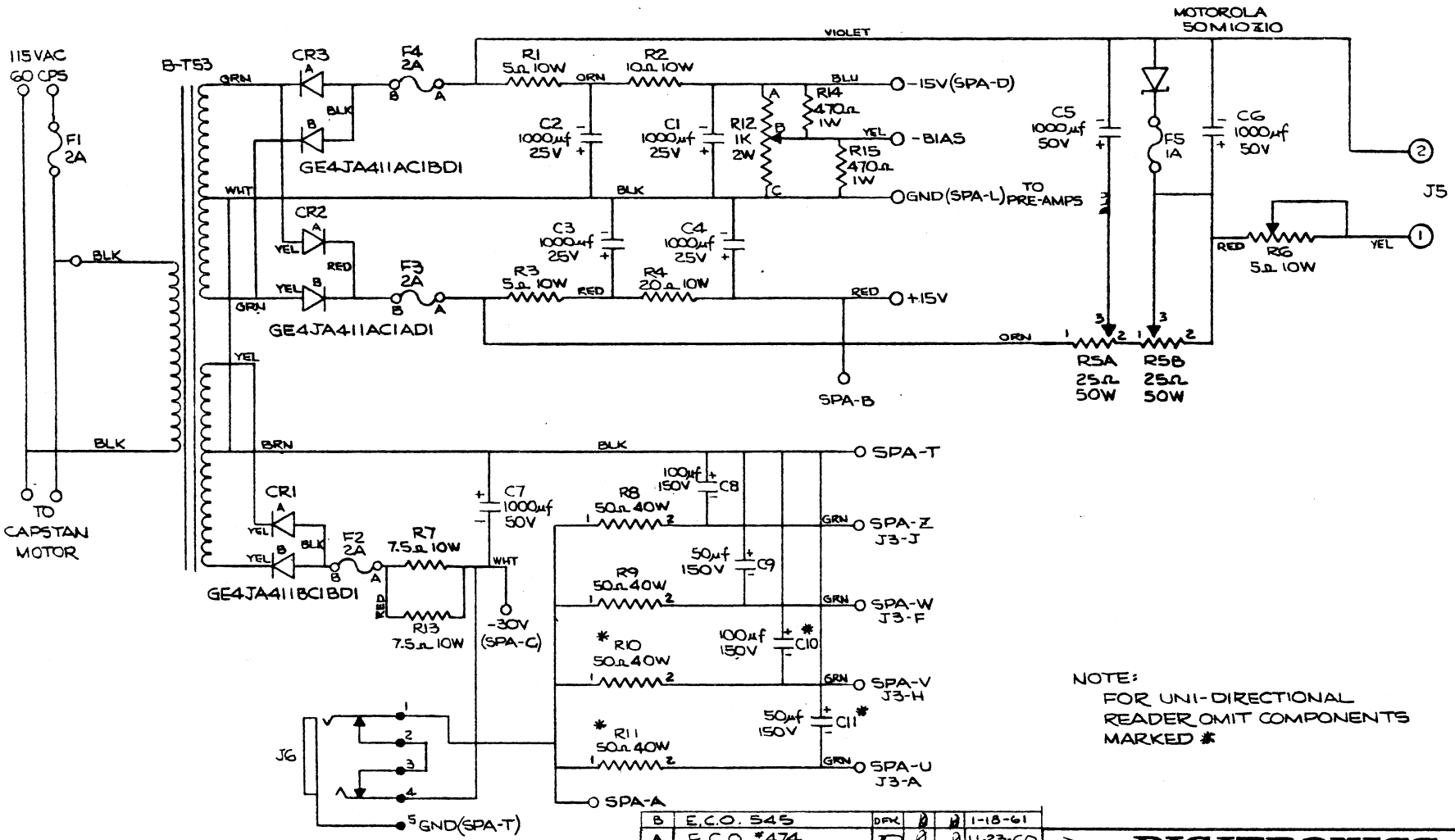
REV	E.C.O.	DWN	CHKD	APP'D.	NO. DAY YR
A		DFK			12-28-60

DIGITRONICS
ALBERTSON, NEW YORK

TITLE:
BLOCK DIAGRAM
UNI-DIRECTIONAL STRIP READER

USED ON: PACKARD BELL

DRAWING NO. B-G612



NOTE:
FOR UNI-DIRECTIONAL
READER OMIT COMPONENTS
MARKED *

REV	E.C.O.	DWN.	CHKD.	APP'D.	MO. DAY YR.
B	E.C.O. 545	DFK			1-18-61
A	E.C.O. *474				11-23-60

MATERIAL

SCALE:

FINISH

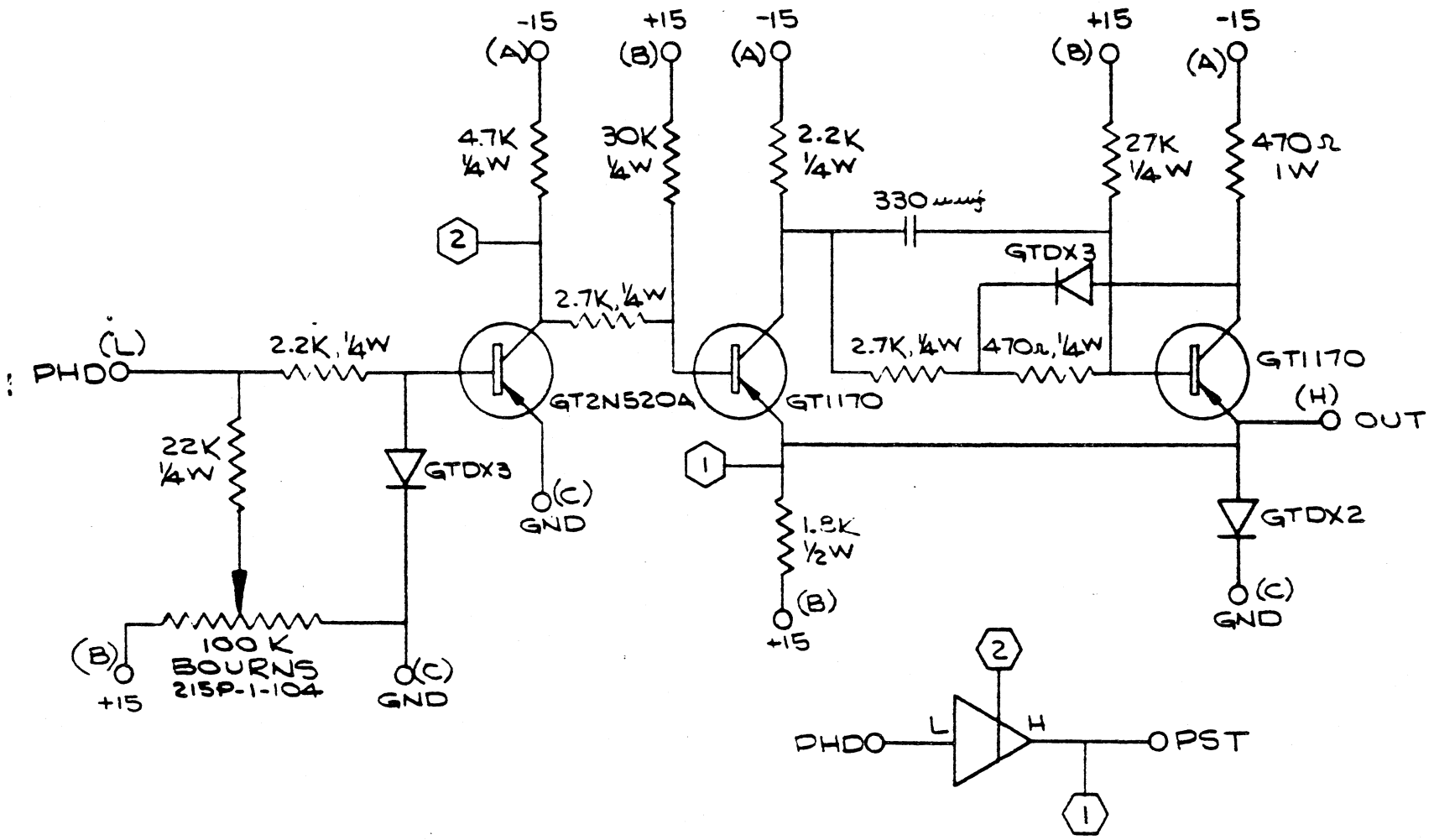
TOLERANCES UNLESS OTHERWISE NOTED: DEC. ± .005 | FRAC. ± 1/64 | ANGLE ± 1/2°

DIGITRONICS
ALBERTSON, NEW YORK

TITLE:
SCHEMATIC - POWER SUPPLY
PAPER TAPE READER

USED ON:

DRAWING NO.
B-H329



REV	E.C.O.	DWN.	CHKD.	APP'D.	MO. DAY YR.
A	RELEASED	DFK		D	10-6-70
		RW			6-1-60

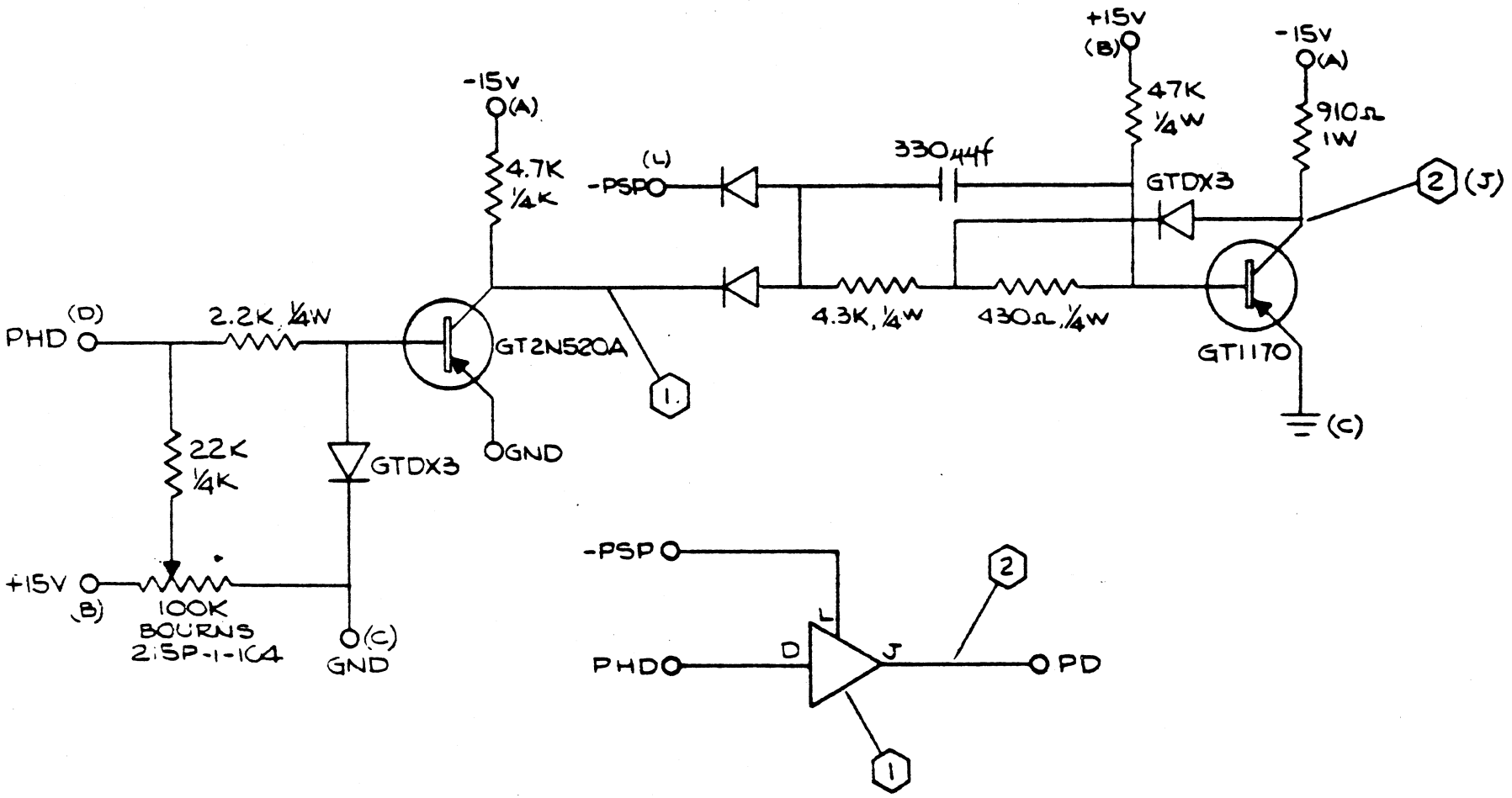
SCALE:

DIGITRONICS
ALBERTSON, NEW YORK

TITLE:
SPROCKET AMPLIFIER & SHAPER
PSB BOARD

USED ON: 10001

DRAWING NO. A-H324



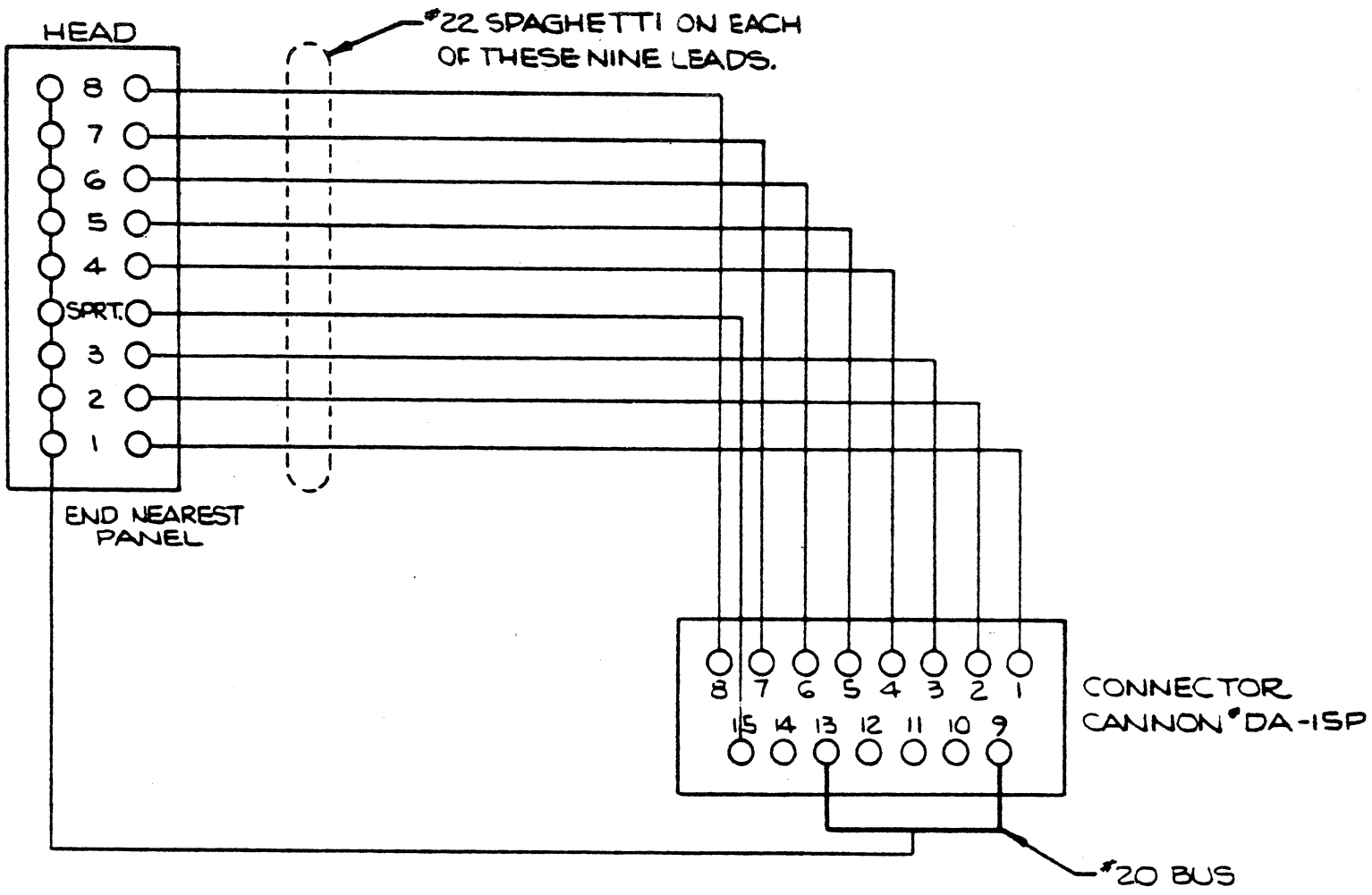
A					
REV	E.C.O.	DWN.	CHKD.	APP'D.	MO. DAY YR.
		JD	RN	wdc	10-7-60

DIGITRONICS
ALBERTSON, NEW YORK

TITLE:
PAPER TAPE GATED AMPLIFIER
PGB BOARD

USED ON:

DRAWING NO.
A-H326



A					
REV	E.C.O.	DWN.	CHKD.	APP'D.	MO. DAY YR.
		JD	RN		10-11-60

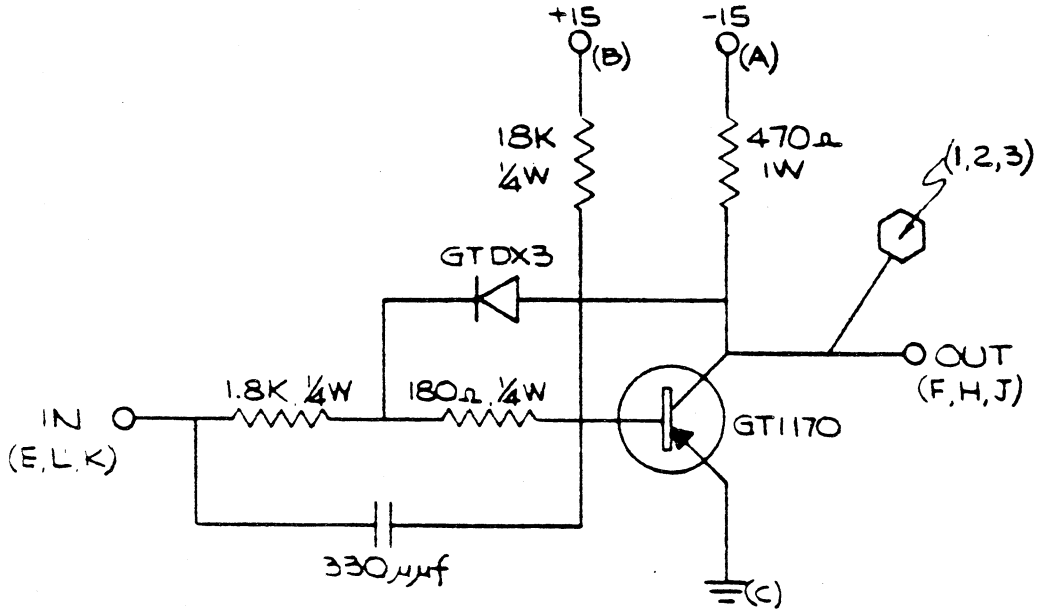
DIGITRONICS
ALBERTSON, NEW YORK

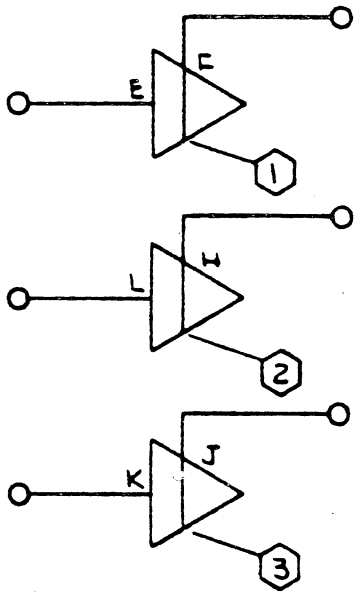
TITLE:

HEAD CONNECTIONS
PAPER TAPE READER

USED ON:

DRAWING NO.
A-K201





NOTE: 3 AMPLIFIERS PER CARD

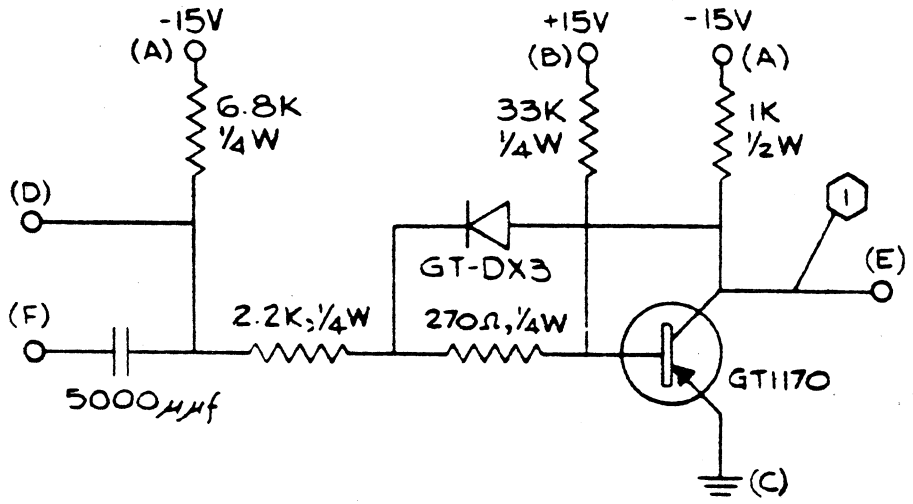
REV	E.C.O.	DWN.	CHKD.	APP'D.	MO. DAY YR.
A		JD	RN		10-11-60

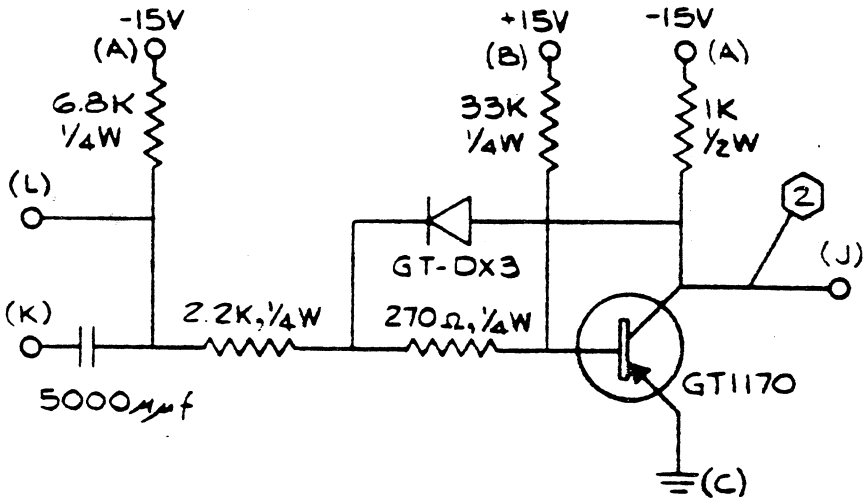
DIGITRONICS
ALBERTSON, NEW YORK

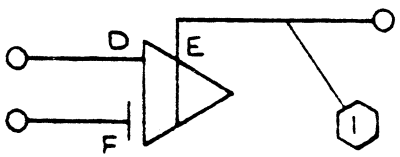
TITLE:
AUXILIARY AMPLIFIERS
"AAA" BOARD

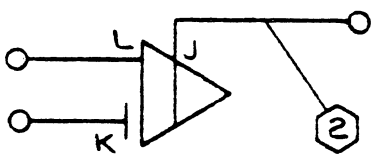
USED ON:

DRAWING NO.
A-H291









REV	E.C.O.	DWN.	CHKD.	APP'D.	MO. DAY YR.
A		DFK	RNJ		10-11-60

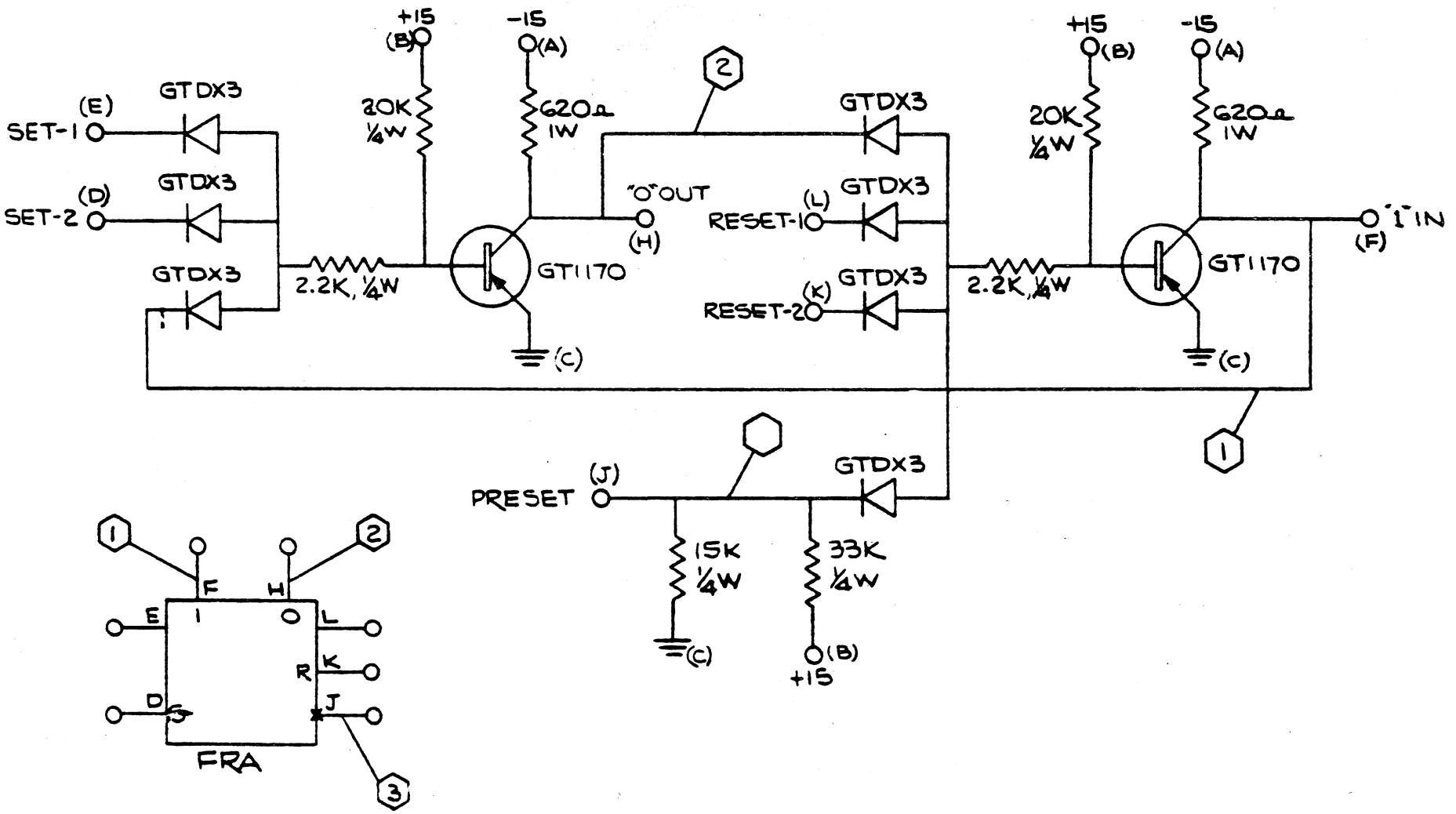
DIGITRONICS
ALBERTSON, NEW YORK

TITLE.

START-STOP AMPLIFIERS
SSA BOARD

USED ON: 10015

DRAWING NO. A-H297



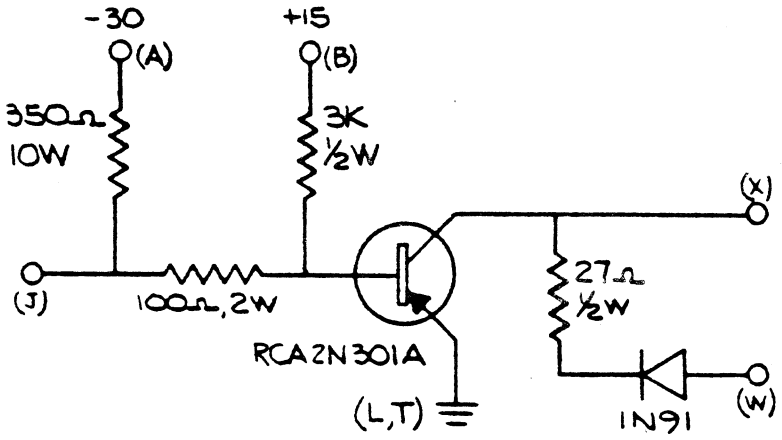
REV	E.C.O.	DWN.	CHKD.	APP'D.	MO. DAY YR.
A		JD	RN	WC	10-11-60

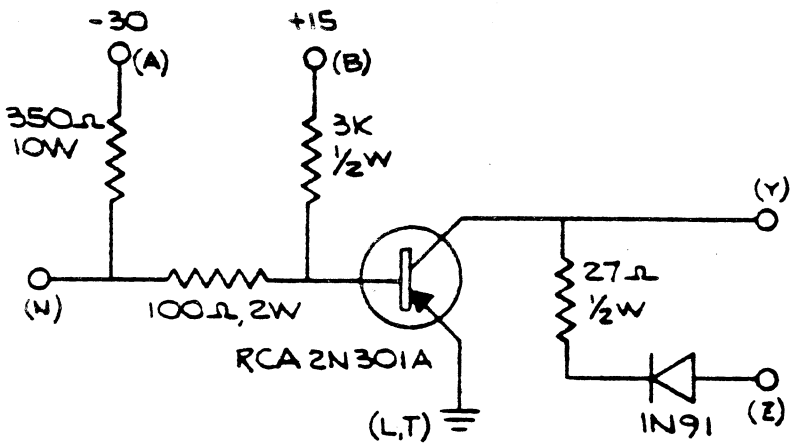
DIGITRONICS
ALBERTSON, NEW YORK

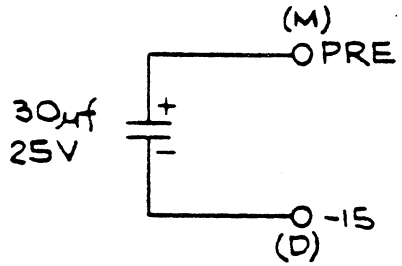
TITLE:
START - STOP FLIP FLOP (STRIP READER)
"FRA" BOARD

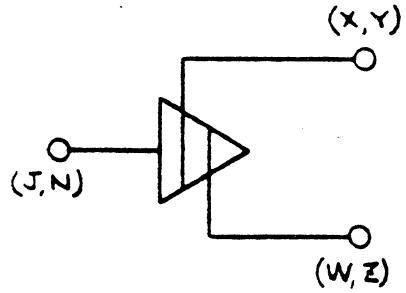
USED ON:

DRAWING NO.
A-H293









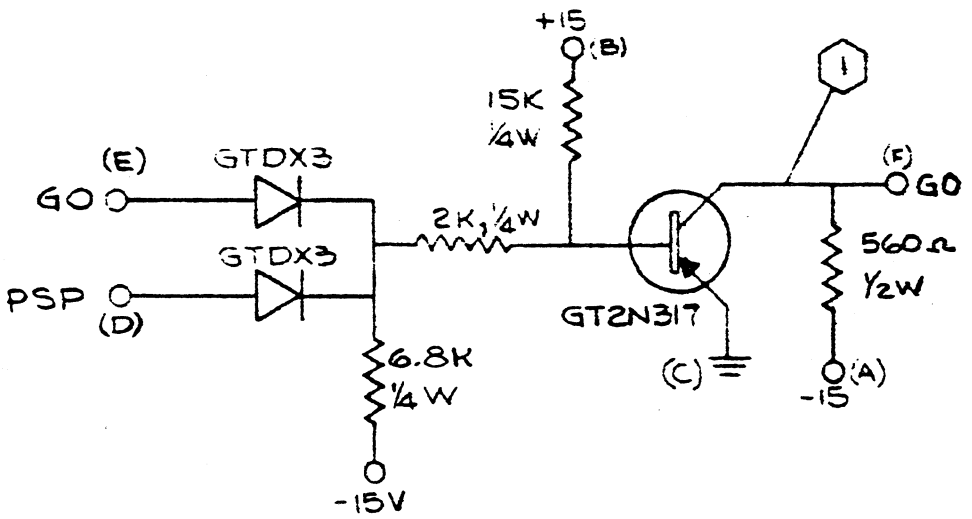
REV	E.C.O.	DWN.	CHKD.	APP'D.	MO. DAY YR.
A		DRN.	DC		10-11-60

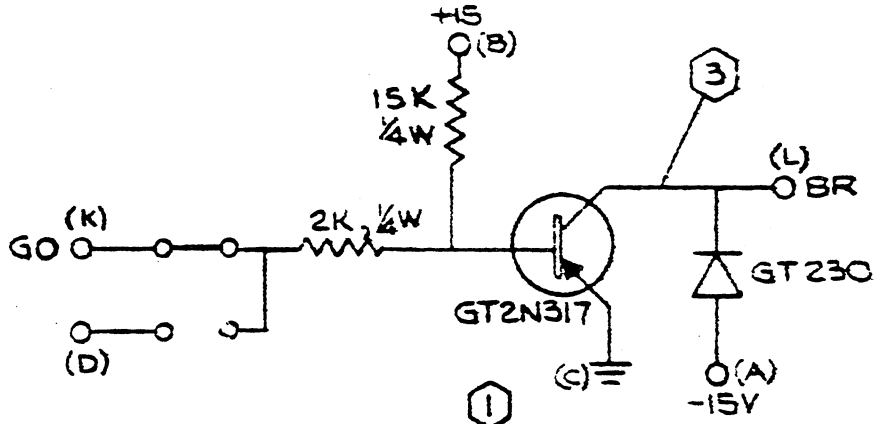
DIGITRONICS
ALBERTSON, NEW YORK

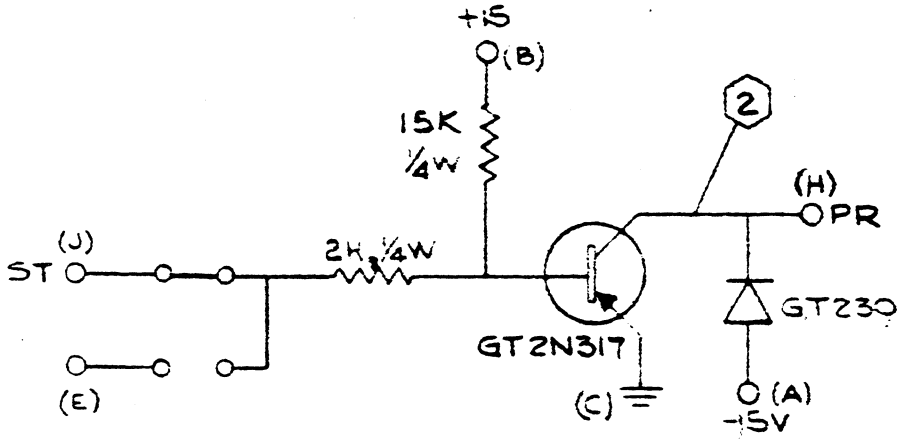
TITLE:
SOLENOID POWER AMPLIFIERS
(UNI-DIRECTIONAL STRIP READER)
"SPA" BOARD

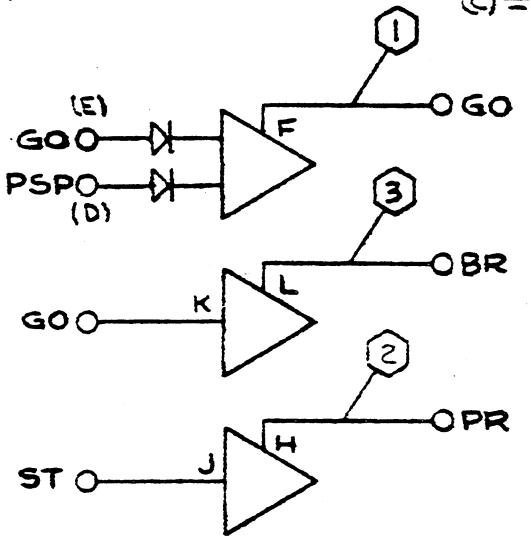
USED ON:

DRAWING NO.
A-H308









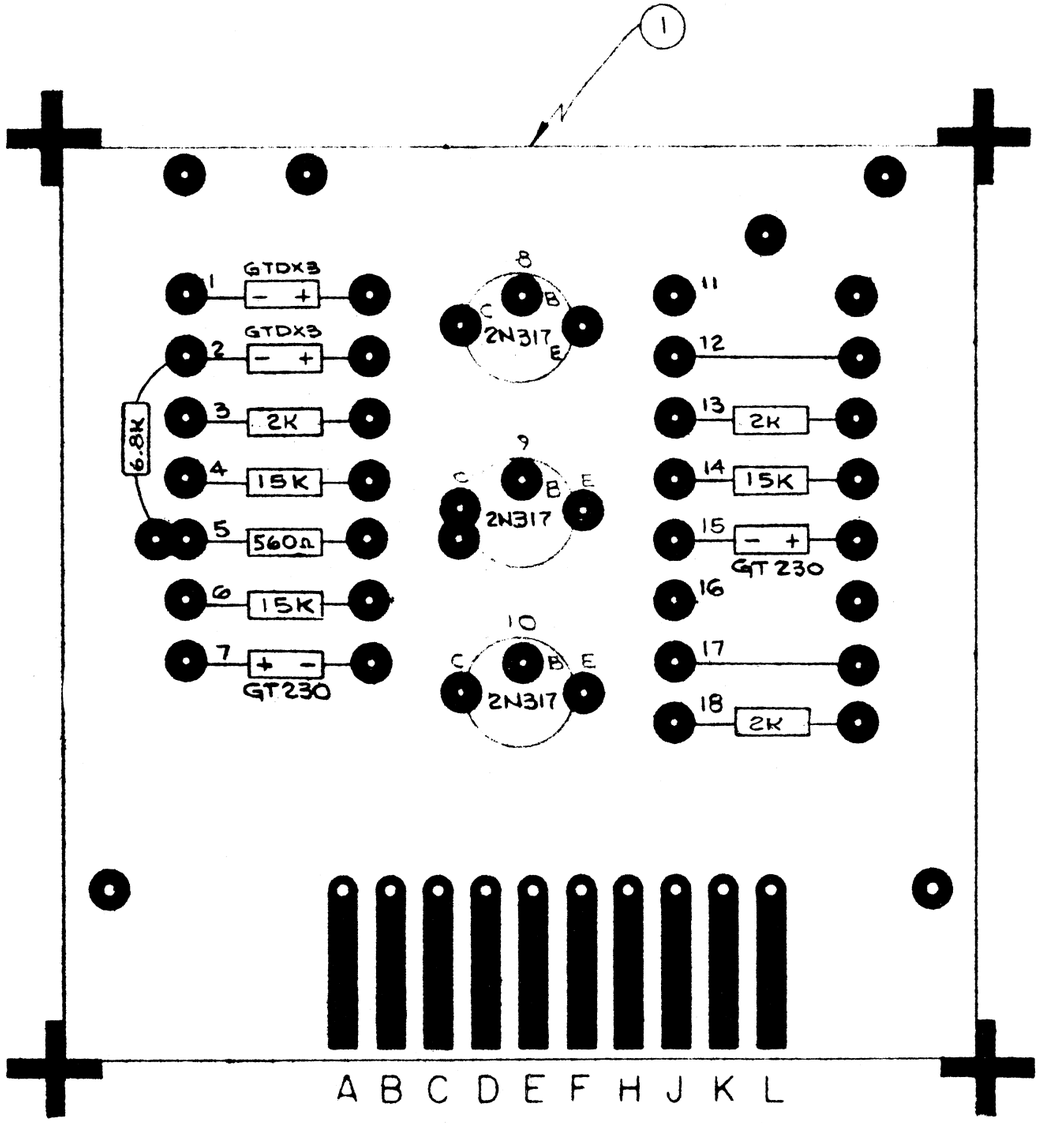
REV.	E.C.O.	DFK	CHK'D.	APP'D.	MO DAY YR.
A	E.C.O. 565	DFK			2-2-61
		DFK	A		12-28-60

DIGITRONICS
ALBERTSON, NEW YORK

TITLE:
SOLENOID DRIVER AMPLIFIER
SDA-PB BOARD

USED ON.
PACKARD-BELL

DRAWING NO.
A-H388



LOCATION	QUAN	DESCRIPTION	DWG NO	ITEM
	1	P.C. MASTER	P-C153	1
3,13&18	3	RESISTOR 2K 1/4W 5%		2
4,6&14	3	" 15 K " "		3
5	1	" 560Ω 1/2W 5%		4
1,2	2	DIODE GTDX3		5
7&15	2	" GT230		6
				7
8,9&10	3	TRANSISTOR 2N317		8
SEE NOTE 2&3	40	EYELET	S179-2	9
SEE NOTE 1&2	15	EYELET	S179-1	10
2	1	RESISTOR 6.8K 1/4W 5%		11

REF. - SCHEMATIC DWG. A-H388

NOTE:

1. DRILL .067 FOR ITEM 10.
2. INSERT ITEM 10 FROM OPPOSITE SIDE
3. DRILL .052 FOR ITEM 9.

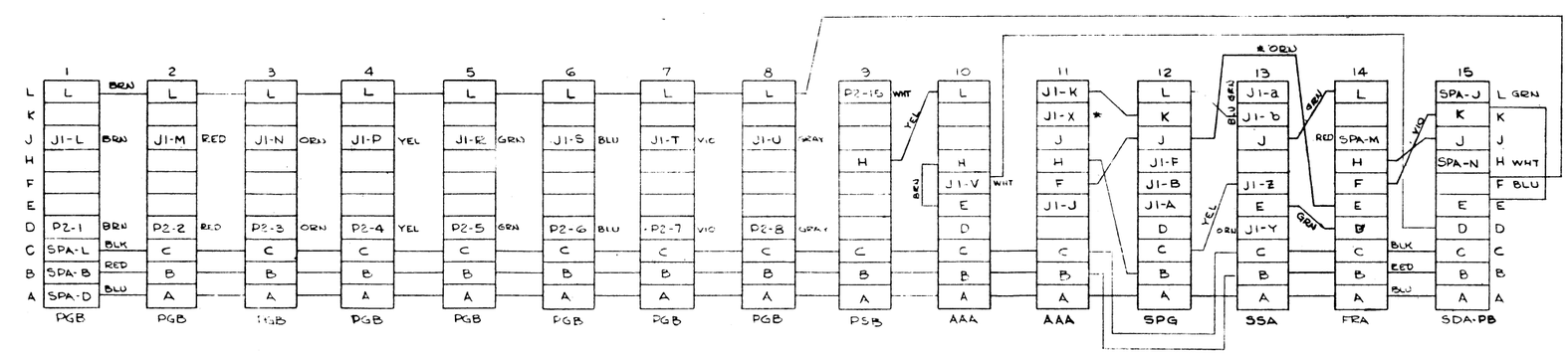
A	E.C.O 565		DFK			2-2-61
	DES.	DWN.	CHKD.	APP'D.	NO. DAY YR.	
		DFK	[illegible]	[illegible]	12-28-60	

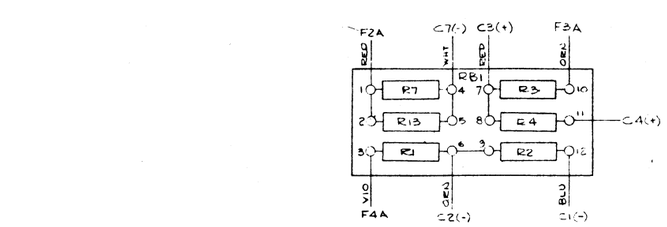
DIGITRONICS CORPORATION

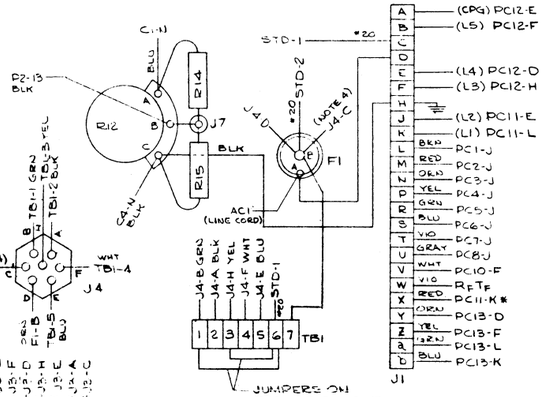
TITLE: P.C. BOARD ASSEMBLY, "SDA-PB

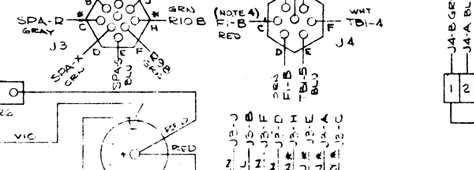
USED ON: PACKARD BELL

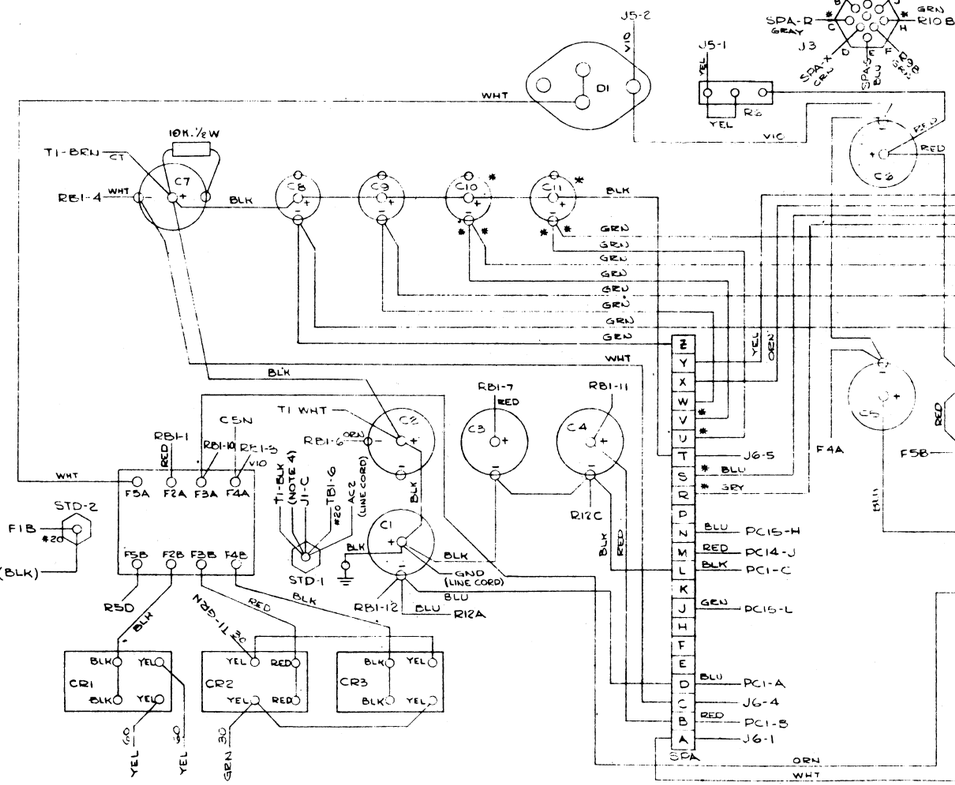
DRAWING NO. B-C795











P2

1	PC1-D	BRN
2	PC2-D	RED
3	PC3-D	ORN
4	PC4-D	YEL
5	PC5-D	GRN
6	PC6-D	BLU
7	PC7-D	VIO
8	PC8-D	GRAY
9		
10		
11		
12		
13	R12-B	BLK
14		
15	PC9-L	WHT

NOTE:
1. WIRING AS SHOWN IS FOR BI-DIRECTIONAL MODEL.
2. FOR UNI-DIRECTIONAL OMIT WIRING MARKED WITH ASTERISK.(*)
3. USE 22 GA WIRE UNLESS OTHERWISE SPECIFIED.
4. FOR B3500 DUAL SPEED MOTOR OMIT F1B TO J4C & ADD J4C TO STD1.

REV	E.C.O.	DRW.	CHKD.	APP'D.	NO. DAY YR.
A		DFK	LWC		12-28-60

DIGITRONICS
ALBERTSON, NEW YORK

TITLE:
WIRING DIAGRAM
UNI & BI DIRECTIONAL TAPE READER

USED ON:

DRAWING NO.
D-K242