DOCUMENT NO. 454
Revision 2
September, 1963

INSTALLATION & OPERATION INSTRUCTIONS

SCANNER-TAPE PUNCH

MODEL RS3

This document is complete when accompanied by the following drawings:

15097-012 Sheet 2
15097-013 Sheet 2
15097-014 Sheet 2
15097-070 Sheet 2A
15097-070 Sheet 2B
15004-059
15004-129
15004-203
2539

In addition, the following are shipped with each RS3 Scanner-Tape Punch:

1 ea 15004-129 Cable
1 ea 97-3106B-14S-7S-426 Connector with AN3057-6A Adapter
1 ea 97-3106B-14S-7P-426 Connector with AN3057-6A Adapter
1 ea 500C4-75X2-J-SH Connector with 65 each 97502 Sockets — or equivalent
1 ea Cable to Digital Voltmeter, if specified on customer work order; otherwise, one 500C4-75X2-J-SH connector with 75 each 97502 sockets, or equivalent, are shipped.
1 ea XAC104P-D-3A-700 Connector, or equivalent, with 25 2-way jumpers, 10 3-way jumpers, and 30 100-1020P pins.
80 ea 5003-002 Diodes
1 ea 1000 ft. roll of white oiled perforator tape, 1 inch wide unless otherwise specified on customer work order.

NON-LINEAR SYSTEMS, INC.

Del Mar, California

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INTRODUCTION

The NLS Model RS3 Scanner-Tape Punch is a versatile, low-cost data logger. It consists of an input scanner and tape punch in one package, designed to operate with any NLS **Digital Voltmeter, and to produce a** punched tape compatible with any Flexowriter or digital computer whose required format is within the capability of the RS3. A digital voltmeter is not supplied with Model RS3 and must be ordered separately. When greater scanner capacity is required, a NLS Model 261 or 262 may be connected, and the RS3 used only as a tape punch.

SPECIFICATIONS

Number of input channels - 20, double pole

Inputs through accessory - Any number of the 20 inputs may be programmed so that it is automatically routed to an external AC-DC converter, preamplifier, filter, or other device. The output voltage of the accessory is then connected to the digital voltmeter.

Visual Display - The input channel number (00 thru 19) is displayed in the readout on the front panel. The readout also indicates whether the input number shown is connected directly to the digital voltmeter or through an accessory; low tape supply, tape jam, or runout are also shown.

Punched word capacity - 33 or 11 characters per word, selected by jumper in program connector.

Number of punched characters - 75, consisting of the digits 0 thru 9, +, -, A, X, V, S, decimal point, and eight special codes which may be used for tabulate, carriage return, start word, end of word, end of card, space, etc.

Tape codes - any 5, 6, 7, or 8 channel tape code can be accommodated. Coding is determined by the location of diodes on a plug-in board.

Tape - 11/16", 7/8", or 1" wide oiled paper or plain mylar tape. Use of metalized or aluminized mylar tape is not recommended.

Hole size - .046" diameter feed hole, .072" diameter code hole. Teletype "Chadless" punching not available, but tape punched by the RS3 can be read by Teletype readers.

Feed Hole Spacing - .100" both longitudinally and transversely. Feed holes in line with code holes transversely is standard. Feed holes .013" in advance of the code holes available on special order.

Feed Hole Location - .394" from guiding edge of tape. Feed holes .4375" from guiding edge available on special order.

Tape Feed - Switch on front panel causes tape to feed out of punch to provide a leader on a data tape. Tape feed code may be sprocket hole only, or any code required.

Data Sources

Digital Voltmeter (4 digits, Polarity, Function, and decimal location.) (5 digits on special order.)

Scanner Position (2 digits, or may be connected so that when input number is 00, "start-of-run" code is punched and for input number 19, "end-of-run" code is punched.)

Signal Routing (code indicating "direct" or "via accessory" can be punched.)

External Digits (digits 0-9, and special codes from external contact closures.)

NOTE:

The DVM output (reading, polarity, function and decimal) may be connected in parallel with other output accessories which merely sense voltage levels, such as the NLS Model 155 Printer or Model 180 Output Adapter. All other RS3 input data must be from isolated contact closures, and numerical data must be in 10-line decimal form.

Decimal Position Format - Floating (.XXXX, X.XXX, XX.XX, or XXX.X) or Fixed (XXXX.4, XXXX.3, XXXX.2, etc. Decimal may be in any position.)

Tape Capacity - 1000 feet (8" diameter) supply roll. 6" diameter take-up spool with snap-on outer flange holds 500 feet of punched tape.

Chad Disposal - Self-contained removable receptacle eliminates chad disposal problems. Transparent window shows when emptying is required.

Modes of Operation

Auto Cycle: System repeatedly samples, measures, and records the entire range of inputs from 00 to 19.

One Cycle: Operation steps after reaching input 19.

Punch: Scanner is not advanced after punching. May be used for repeatedly sampling one input.

Manual Advance - Front-panel switch advances scanner stepping switch manually.

Punching Speed - 20 characters per second nominally. Recording with 11-digit format takes approximately .55 seconds, and 33-digit format approximately 1.65 seconds.

Parity Check Contacts - Available on special order.

Dimensions - 12 1/4 high, 15 1/16 deep, for mounting in standard 19" rack. Rack cabinet is not supplied with Model RS3.

Input Power - 110-125V, 60 cps. Other voltages and frequencies on special order.

Weight - Approximately 70 lbs. net, 90 lbs. shipping.

INSTALLATION

The Model RS3 may be operated on the bench, or may be installed in a standard 19" rack cabinet after removing the rubber feet.

NOTE:

The unit contains a mercury wetted contact relay; therefore after installation is completed, the chassis must be within 30° of horizontal.

Before installation or operation of the Model RS3, it must be set up to be compatible with the required tape coding and format.

TAPE CODING

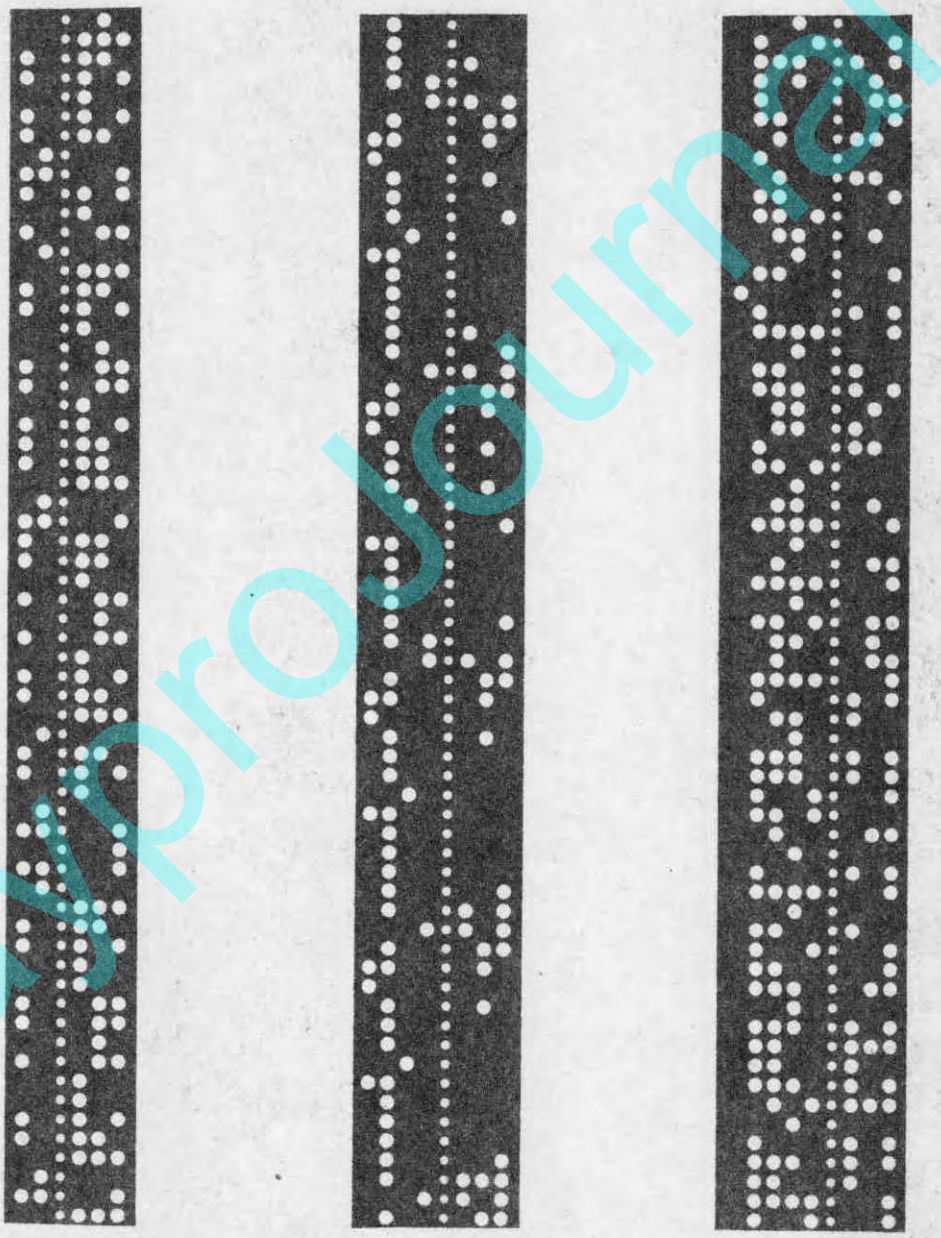
Information is recorded on paper tape by punching holes according to a pre-determined pattern. (See Figure 1.) Each horizontal row of holes represents one character or one digit, and the configuration of holes which are punched is the coding of the digit represented by that row of holes.

The coding for the various digits and symbols varies considerably from one application to another, and is largely determined by the requirements of the device which will read the tape, such as a Flexowriter, digital computer, etc. Some typical tape codes are shown in Figure 2.

In the Model RS3, coding is controlled by the location of diodes on a plug-in board, shown in Figure 3. 26 vertical rows are provided, each of which corresponds to one character, or one horizontal row of holes in Figure 1 or 2. Diode positions corresponding to the code channels or columns (vertical rows in Figure 1 or 2) are indicated on the right side of the board. In addition to the eight possible code holes, a "common" diode position is provided for each character (indicated by "C" on the board). This diode controls the pulse to the clutch in the tape punch mechanism which causes the code to be punched in the tape; a "C" diode must be installed on the diode board for each character to be punched.

To install diodes on the code matrix board, proceed as follows:

1. Obtain the required coding in the form shown in the example in Figure 4. If not already known, this information can be obtained from the individual or department who is going to use the tape punched by the RS3.



5-channel code
11/16" tape

7-channel code
7/8" tape

8-channel code
1" tape

FIGURE 1

CHARACTER	COLUMN NO. EL	X	O	CH	8	.	4	2	1	COLUMN NO. 6	5	4	.	3	2	1	COLUMN NO. 1	2	.	3	4	5
0			0			.					0		.					0	.	0		0
1						.			0		0	0	.				0	0	.	0		0
2						.		0			0		.	0			0	0	.			0
3				0		.		0	0		0	0	.	0			0		.			
4						.	0				0		.		0			0	.		0	
5				0		.	0		0		0	0	.		0				.			0
6				0		.	0	0			0		.	0	0		0		.	0		0
7						.	0	0	0		0	0	.	0	0		0	0	.	0		
8					0	.					0		.			0		0	.	0		
9				0	0	.			0		0	0	.			0			.		0	0
. (Decimal)		0	0		0	.		0	0	0	0	0	.		0				.	0	0	0
-(Minus)		0				.				0	0	0	.				0	0	.			
Space				0		.				0	0		.						.	0		
Tab			0	0	0	.	0	0					.	0	0		0		.		0	
Carriage Return	0					.							.		0				.		0	
Tape Feed		0	0	0	0	.	0	0	0				.				0	0	.	0	0	0

Figure 2

Each 0 in Figure 2 represents a hole punched in the tape. The sprocket hole, represented by . in Figure 2, is always punched regardless of the coding.

FIGURE 3

CHARACTER	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
+	
-	
A	
K	
V	
R	
.	
space	(SP1)
carriage return	(SP2)
tape feed	

8	7	6	5	4		3		
~~EL~~	~~X~~	~~0~~	CH	~~8~~	.	~~4~~	2	1
		0			.			
					.			0
					.		0	
			0		.		0	0
					.	0		
			0		.	0		0
			0		.	0	0	
					.	0	0	0
				0	.			
			0	0	.			0
	0	0	0		.			
	0				.			
	0	0			.			0
	0		0		.		0	
		0			.	0		0
	0			0	.			0
	0	0		0	.		0	0
				0	.			
0					.			
.	0	0	0	0	.	0	0	0

← Guiding edge

↑ Feed Hole

Figure 4

2. Remove the top cover of the RS3 and take out the code matrix board (the plug-in board nearest the front of the chassis).

3. If necessary, re-number the columns in the tape coding as shown in Figure 4 to agree with the locations indicated on the code matrix board. Number the columns from right to left, starting with the guiding edge of the tape. The feed hole is always three holes from the guiding edge of the tape.

4. Install diodes on the board according to the coding required

for each digit. The presence of a diode indicates that the corresponding hole will be punched, and no holes will be punched corresponding to locations where diodes are omitted. Observe polarity of all diodes - the cathode or striped end must be toward the lower left when facing the front of the board. Be sure to install a "common" diode (bottom row) for each digit used. A "common" diode must be installed for any character for which the code is "feed hole only".

For symbols which are not listed on the board, use the special code columns designated SP1 through SP8. In the example of Figure 4, SP1 is used for space, and SP2 is used for carriage return. Be sure to note which SP codes are assigned, because this information is again needed for wiring of the Program Connector (see below). Figure 5 shows the diode arrangement for the coding of Figure 4.

80 diodes are supplied with each RS3. If more diodes are required, they may be obtained from NLS, part no. 5003-002. Silicon diodes such as Rheem RD1542, Texas Instruments G-405, Clevite CSD2749, or Hughes HD 6359 are satisfactory. Germanium diodes can not be used because of their low back resistance.

5. Solder all diode leads to the etched circuitry on the reverse side of the board. On the connections which have feed-through eyelets, be sure to solder the diode lead to the eyelet, and the eyelet to the etched circuit. After soldering, spattered solder and excess rosin should be removed.

6. Install diode matrix board in RS3. Be sure pins enter mating connectors properly, and are fully engaged. Replace top cover.

PROGRAM CONNECTOR

The format of the data punched in the tape is dependent on the location of jumpers in the Program connector (J6 on the rear panel of the RS3 chassis). Jumpers, which are supplied with the RS3, are to be installed as explained below and illustrated by the following examples. The program connector is shown schematically in Figure 6.

The pulses which cause the data to be sequentially punched in the tape appear in the right side of the connector, as shown in Figure 6. Pin AL is the first pulse, and pin CS is the last.

Pins H,S, and a determine whether the sequence consists of 11 or 33 pulses. If the required punched format or "word" consists of 11 characters or less, jumper pin H to pin S. If the word contains 12 to 33 characters, jumper pin H to pin a.

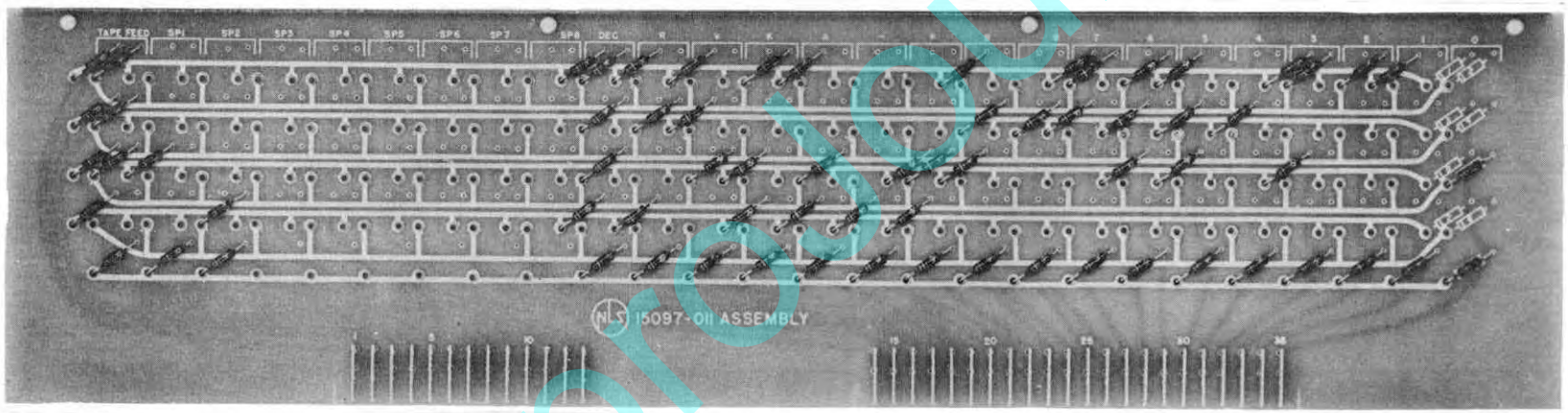


FIGURE 5

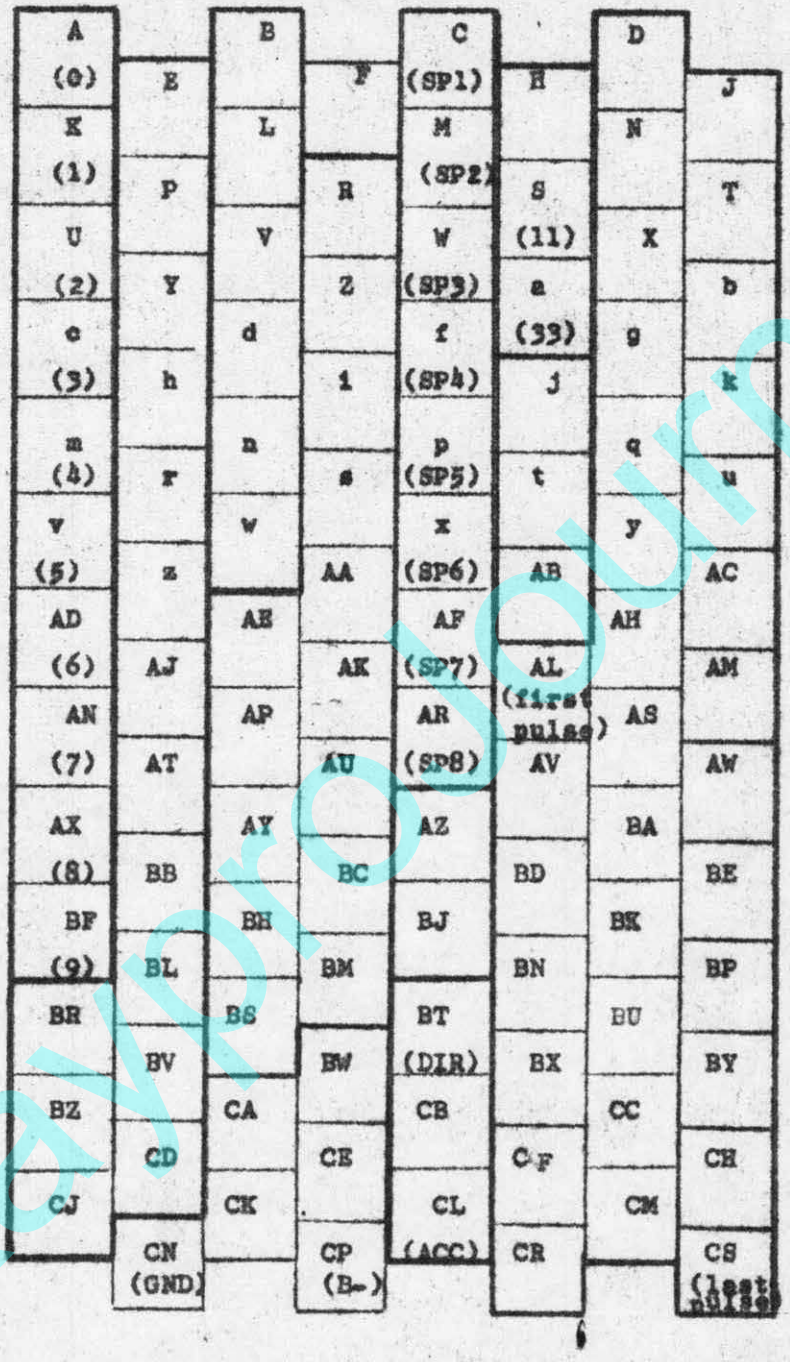


Figure 6

EXAMPLE 1

Required format - Y Y (space) P . X . X . X .XF (Carriage Return)

Where Y is scanner position from 00 to 19;
P is polarity (+, -, or A for AC);
X is Digital Voltmeter reading with properly located floating decimal point;
F is function - V for volts, K for kilohms, and R for ratio.

Coding - as shown in Figure 4.

1. Install diodes on the code matrix board as shown in Figure 5.

2. Count number of characters in required format. In this example, the number is 14, including each possible decimal location. Since this is more than 11, connect pin H to pin a in the program connector. This causes 33 pulses to appear in sequence on the connector pins indicated in Figure 6. However, since the required format has less than 16 characters, recording time may be reduced by using pulses 1 thru 16, and pulses 17 thru 33, for alternate readings. This is done by jumpering Pulse 1 to pulse 17, 2 to 18, etc.

   Assign pulse numbers and pin numbers for the pulses corresponding to each digit in the required word as follows:

Y	Y	Sp	P	.	X	.	X	.	X	.	X	F	CR	word
1	2	3	4	5	6	7	8	9	10	11	12	13	14	Pulse No.'s
CM	J	T	b	k	u	AC	AM	AW	BE	BP	BY	CH	CS	
BD	BN	BX	CF	CR	D	N	X	g	q	y	AH	AS	BA	Pulse pin No.'s from Fig. 6)

3. Pins C, M, W, f, p, x, AF, and AR control the special codes SP1 through SP8 respectively. In the required format or "word", the last character is Carriage Return, and special code SP2 has been assigned for this function (see Figure 4 and Figure 5). Therefore, jumper pin CS and BA (the last pulses) to pin M (SP2 code).

4. Pins B, L, V, and d are DVM decades 4, 3, 2, and 1 respectively; pin n is Function (V, K, or R); and pin w is polarity (+, -, or A). Connect these pins as follows: B to u and D (pulse 6), L to AM and X (pulse 8), V to BE and q, d to BY and AH, n to CH and AS, and w to b and CF.

5. Pins AE, AP, AY, BH, BS, AA, AK, AU, BC, and BM control the decimal point location. For "floating" decimal point, as in the required format, these are connected as follows:

   BS to BM, k, and CR
   BH to BC, AC and N
   AY to AU, AW and g
   AP to AK, BP and y
   AE to AA

6. Since special code SP1 was assigned for "space" (see Figures 4 and 5), connect pin C (SP1) to pin T and BX (pulse 3).

7. Pins AZ, CA, BJ, CE, BW, and CK are for control of an external input scanner. Since the internal scanner is to be used in this example, jumper these pins as follows:

   AZ to CA; BJ to CE; and BW to CK.

8. Pins A, K, U, c, m, v, AD, AN, AX, and BF are the digits 0 through 9 respectively. Pins E, P, Y, h, r, z, AJ, AT, BB, BL, BV, CD, BR, BZ, and CJ are the connections to the RS3 scanner stepping switch. These are to be jumpered as follows for the required format:

   A to E and P
   K to Y and BR
   U to h
   c to r
   m to z
   v to AJ
   AD to AT
   AN to BB
   AX to BL
   BF to BV and CD
   BZ to J and BN (pulse 2)
   CJ to CM and BD (pulse 1)

9. The program connector wiring is now complete for the format of Example 1. This wiring is shown schematically in Figure 7.

   CAUTION: When reassembling the program connector, be sure to install the jackscrews correctly. The female jackscrew must be at the pin A end of the connector, and the male at the pin CR end.

EXAMPLE 2

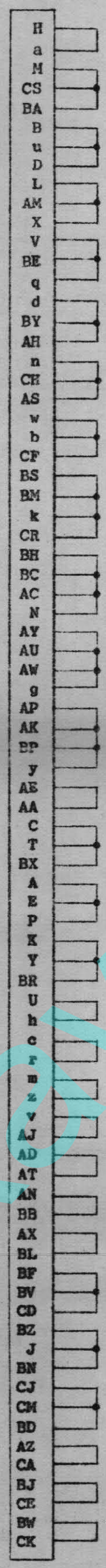
Required Format - Y Y S P X X X X . Z T
   Where Y is scanner position from 00 to 19
   S is space
   P is polarity (+ or -)
   X is DVM reading
   Z is digit from 1 to 4 telling number of places to move the fixed decimal point to the left; i.e., if XX.XX is the DVM reading, XXXX.2 is punched.
   T is tabulate.

Coding - 6 Channel, 7/8" tape (See Page 14).

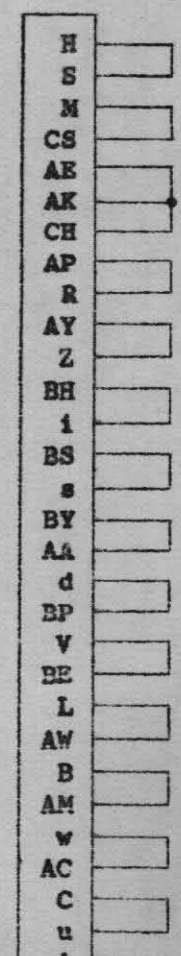
1. Using SP1 for "space" and SP2 for "Tab", install diodes on the code matrix board as shown in Figure 8.

2. Assign pulse and pin numbers for each digit as follows:

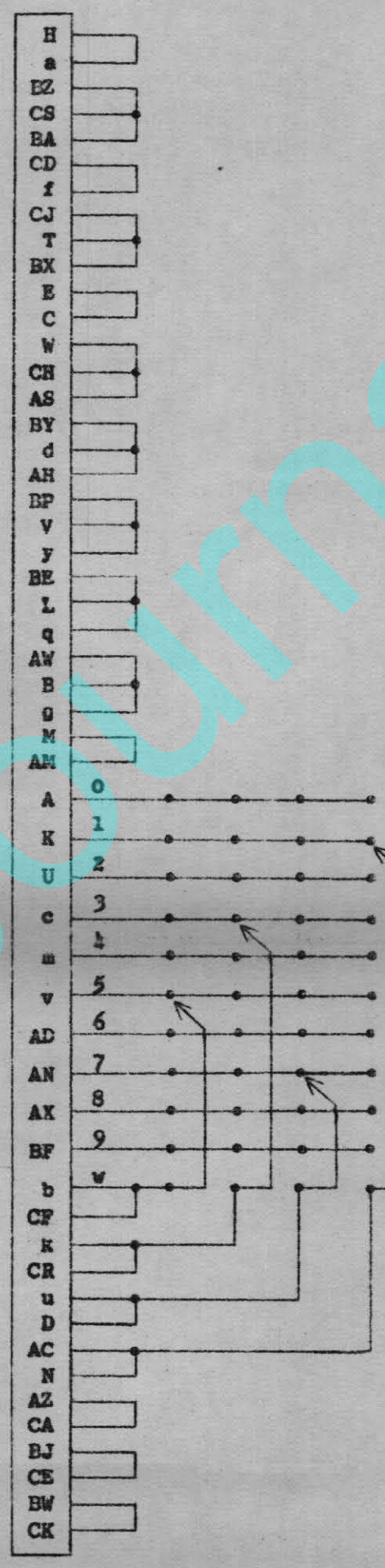
Y	Y	S	P	X	X	X	X	.	Z	T	
1	2	3	4	5	6	7	8	9	10	11	pulse no's
b	k	u	AC	AM	AW	BE	BP	BY	CH	CS	pin no's



EXAMPLE 1



EXAMPLE 2



EXAMPLE 3

Program Connector Wiring

FIGURE 7

CHARACTER		COLUMN NO.						
		6	5	4	.	3	2	1
0			0		.			
1			0	0	.			
2			0		.	0		
3			0	0	.	0		
4			0		.		0	
5			0	0	.		0	
6			0		.	0	0	
7			0	0	.	0	0	
8			0		.			0
9			0	0	.			0
.		0	0	0	.		0	
+		0	0		.	0		
-		0	0	0	.			
Space	(SP1)	0	0		.			
Tab	(SP2)				.	0	0	
Tape Feed					.			

← Guiding edge

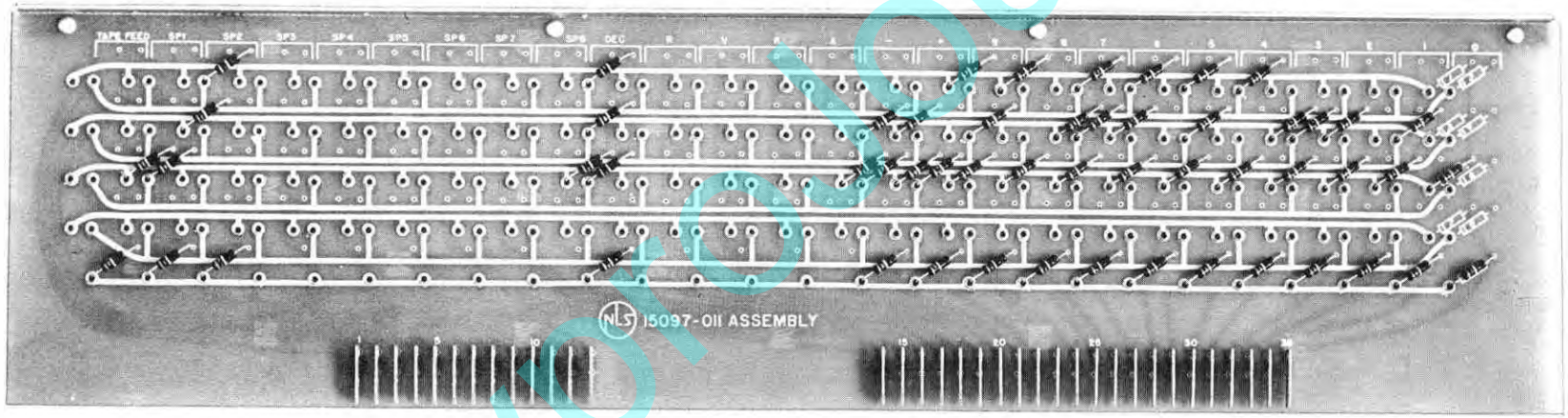


FIGURE 8

Since the word consists of only 11 digits, jumper pin H to pin S.

3. Jumper pin M (SP2 code, for tab) to pin CS (pulse 11).

4. Pins R, Z, i, s, AK, AE, AP, AY, BH, and BS control the digit indicating decimal point location. There are connected as follows:

AE to AK and CH (Pulse 10)
AP to R
AY to Z
BH to i
BS to s

5. Jumper pin BY (pulse 9) to pin AA to punch the fixed decimal point.

6. For the four DVM digits and polarity, connect:

d to BP
V to BE
L to AW
B to AM
w to AC

7. Jumper pin C (SP1 code, for space) to pin u (pulse 3).

8. For the scanner position digits, connect as follows:

A to E and P
K to Y and BR
U to h
c to r
m to z
v to AJ
AD to AT
AN to BB
AX to BL
BF to BV and CD
BZ to k (pulse 2)
CJ to b (pulse 1)

9. Since the internal scanner is to be used, connect:

AZ to CA
BJ to CE
BW to CK

Connector wiring for Example 2 is shown schematically in Figure 7.

EXAMPLE 3

Required Format - F Y Y Y Y S X X X X T C
Where F is Figures Shift Code, to be punched at the

beginning of each run only (when scanner is in position 00).
Y is setting of four external 10-position switches.
S is Space
X is DVM reading
T is Tabulate
C is Carriage Return, to be punched at the end of each run only (when scanner is in position 19).

Coding - 5 channel, 11/16" tape.

CHARACTER		COLUMN NO. 5 4 3 2 1
		1 2 . 3 4 5
0		0 . 0 0
1		0 0 . 0 0
2		0 0 . 0
3		0 . 0
4		0 . 0 ← Guiding edge
5		. 0
6		0 . 0 0
7		0 0 . 0
8		0 . 0
9		. 0 0
Figs. Shift	(SP1)	0 0 . 0 0
Space	(SP2)	. 0
Tab	(SP3)	0 . 0
Carriage Return	(SP4)	. 0
Tape Feed		0 0 . 0 0 0

1. Renumber tape columns from the guiding edge as shown above to agree with the locations on the code matrix board. Assign SP1, SP2, SP3, and SP4 codes to Figures Shift, Space, Tab, and Carriage Return respectively. Install diodes on code matrix board as shown in Figure 9.

2. Assign pulse and pin numbers for each digit as follows:

F	Y	Y	Y	Y	S	X	X	X	X	T	C	word
1	2	3	4	5	6	7	8	9	10	11	12	Pulse No.'s
T	b	k	u	AC	AM	AW	BE	BP	BY	CH	CS	Pin No.'s
BX	CF	CR	D	N	X	g	q	y	AH	AS	BA	

Since the word consists of more than 11 characters, jumper pin H to pin a.

3. Pins E, CD, BZ, and CJ control the punching of special codes when the scanner is in position 00 or 19. To punch Carriage Return code when scanner is at 19, connect:

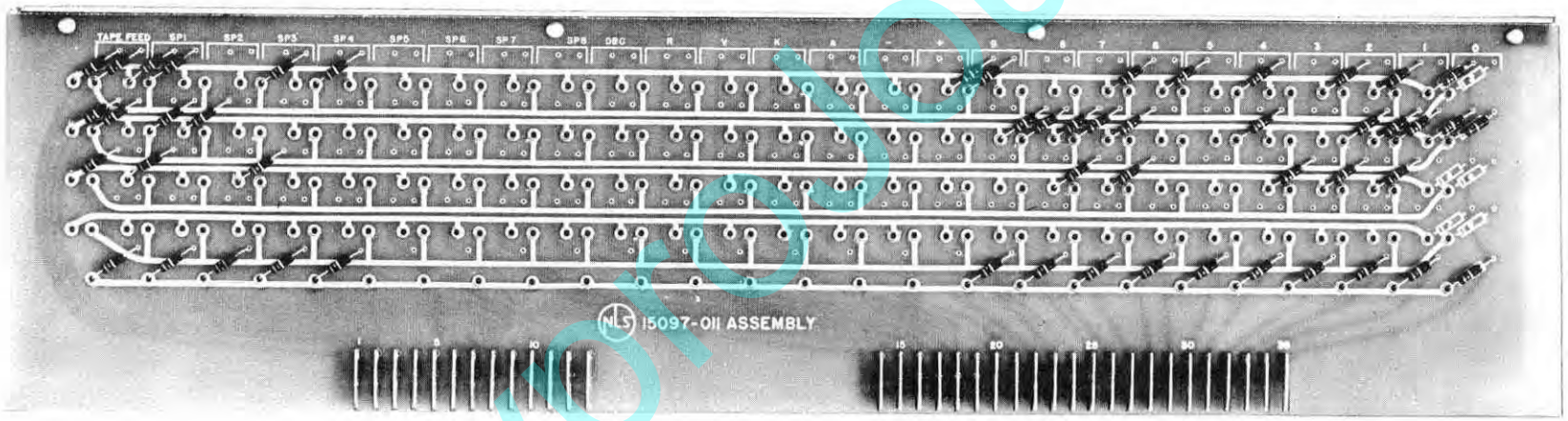


FIGURE 9

BZ to CS **and BA (pulse 12)**
CD to f (SP4, assigned to Carriage Return)

To punch Figures Shift Code when scanner is at 00, connect:

CJ to T **and BX (pulse 1)**
E to C (SP1, assigned to Figures Shift)

4. Jumper pin W (SP3, for Tab) to pin CH **and AS (pulse 11).**

5. For the four DVM digits, connect:

BY to **AH and d**
BP to **y and V**
BE to **q and L**
AW to **g and B**

6. Jumper M (SP2, for Space) to AM **and X (pulse 6).**

7. For the external digits, the four 10-position switches are connected as follows:

Position	0	of	each	switch	to	Pin	A
"	1	"	"	"	"	"	K
"	2	"	"	"	"	"	U
"	3	"	"	"	"	"	c
"	4	"	"	"	"	"	m
"	5	"	"	"	"	"	v
"	6	"	"	"	"	"	AD
"	7	"	"	"	"	"	AN
"	8	"	"	"	"	"	AX
"	9	"	"	"	"	"	BF

Wiper of first digit switch to Pin b **and CF (Pulse 2)**
" " second " " " " k **and CR (" 3)**
" " third " " " " u **and D (" 4)**
" " fourth " " " " AC **and N (" 5)**

8. Since the internal scanner is to be used, connect:

AZ to CA
BJ to CE
BW to CK

Program Connector wiring for Example 3 is shown schematically in Figure 7.

EXAMPLE 4

Required Format - R W W W S W W W S P X X . X X V B T C

or R Y Y S P X X . X X V B T C

Where one format or the other is selected by an external switch or relay;

R is "Print Red" code and B is "Print Black" code, selected by external switch contacts when an out-of-tolerance reading is to be printed in red;

W is data from external 10-position switches;

S is space;

Y is RS3 scanner position from 00-19;

P is polarity (+ or -) from the DVM;

X is the DVM reading with properly located (floating) decimal point;

V is V for volts or M for millivolts, selected when any input to the RS3 scanner is automatically routed through an external preamplifier;

T is Tabulate;

C is Carriage Return, selected by external switch.

Coding - 7 channel, 7/8" tape.

CHARACTER		COLUMN NO. 7 6 5 4 2 3 1
0		0
1		0 1
2		0 2
3		0 2 1
4		0 3
5		0 3 1 ← Guiding edge
6		0 3 2
7		0 3 2 1
8		0 4
9		0 4 1
+		0 0 3
-		0 0 3 1
.		4 3
Space	(SP1)	0 3
Print Red	(SP2)	4 3 2 1
Print Black	(SP3)	4 3 2
V	(SP4)	0 0 3 2
M	(SP5)	0 3
Tab	(SP6)	5 3
Carriage Return	(SP7)	3 1
Tape Feed		3

1. Renumber tape columns from the guiding edge as shown above. Assign SP1 thru SP7 to Space, Print Red, Print Black, V, M, Tab, and Carriage Return respectively.

NOTE

The code matrix board has a space on it designated "V"; however, this "V" is for one of the outputs of the digital voltmeter (DC volts) and is used as shown in Example 1 only. In the present example, since "V" comes from a source other than the DVM, one of the SP codes on the matrix board must be used.

Install diodes on the board as shown in Figure 10.

2. Rewrite the two formats as follows, putting in all possible decimal point locations and lining up portions of the formats which are the same, to minimize the amount of external switching required:

Format 1	R	W	W	W	S	W	W	W	S	P	.	X	.	X	.	X	.	X	V	B	T	C
Format 2	R						Y	Y	S	P	.	X	.	X	.	X	.	X	V	B	T	C
Pulse No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Pin No.	q	y	AH	AS	BA	BK	BU	CC	CM	J	T	b	k	u	AC	AM	AW	BE	BP	BY	CH	CS

Assign pulse and pin numbers as shown. Since more than 11 characters are required, jumper pin H to pin a.

3. An external SPST switch is required to select punching of the carriage return code remotely. Connect pin CS (Pulse 22) via the external switch to pin AF (SP7, assigned to Carriage Return).

4. Jumper pin x (SP6, for Tab) to pin CH (Pulse 21).

5. A DPST external switch is used for controlling the Print Red and Print Black codes. Connect pin BY (Pulse 20) via one pole of the external switch to pin W (SP3, for Print Black). Connect pin q (Pulse 1) via the other pole to pin M (SP2, for Print Red).

6. Pins BT, CB, and CL are controlled by the relay in the RS3 scanner which selects "Direct" or "via accessory" routing of the DVM input signal. Pin CB is connected to pin BT for "Direct" or pin CL for "Accessory". Connect jumpers as follows:

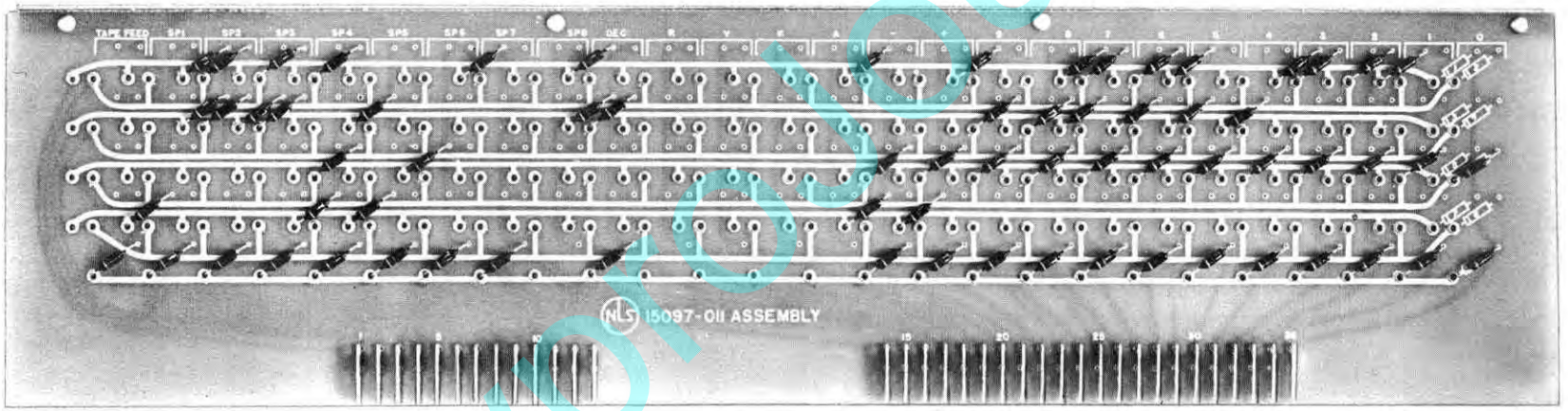


FIGURE 10

CB to BP (pulse 19)
BT to f (SP4, for V)
CL to p (SP5, for M)

7. For the DVM digits and polarity, connect:

d to BE (pulse 18)
V to AM (pulse 16)
L to u (pulse 14)
B to b (pulse 12)
w to J (pulse 10)

8. For the floating decimal point, connect:

BS to BM and T (pulse 11)
BH to BC and k (pulse 13)
AY to AV and AC (pulse 15)
AP to AK and AW (pulse 17)
AE to AA

9. For the external digits and the scanner position, the six 10-position switches, and pins E, P, Y, h, r, z, AJ, AT, BB, BL, BV, CD, and BR are connected as follows:

Position	0	of	each	switch	to pins	A , E , and P
"	1	"	"	"	" "	K , Y , " BR
"	2	"	"	"	" "	U and h
"	3	"	"	"	" "	c " r
"	4	"	"	"	" "	m " z
"	5	"	"	"	" "	v " AJ
"	6	"	"	"	" "	AD " AT
"	7	"	"	"	" "	AN " BB
"	8	"	"	"	" "	AX " BL
"	9	"	"	"	" "	BF, BV, and CD

10. An external 7-pole switch is required for selecting the six external digits and space, or the scanner position. Connect:

pin C (SP1, for space) to pin CM (pulse 9) and via the external switch to pin BA (pulse 5).

pin CC (pulse 8) via the switch to pin BZ (scanner) or to external digit switch wiper.

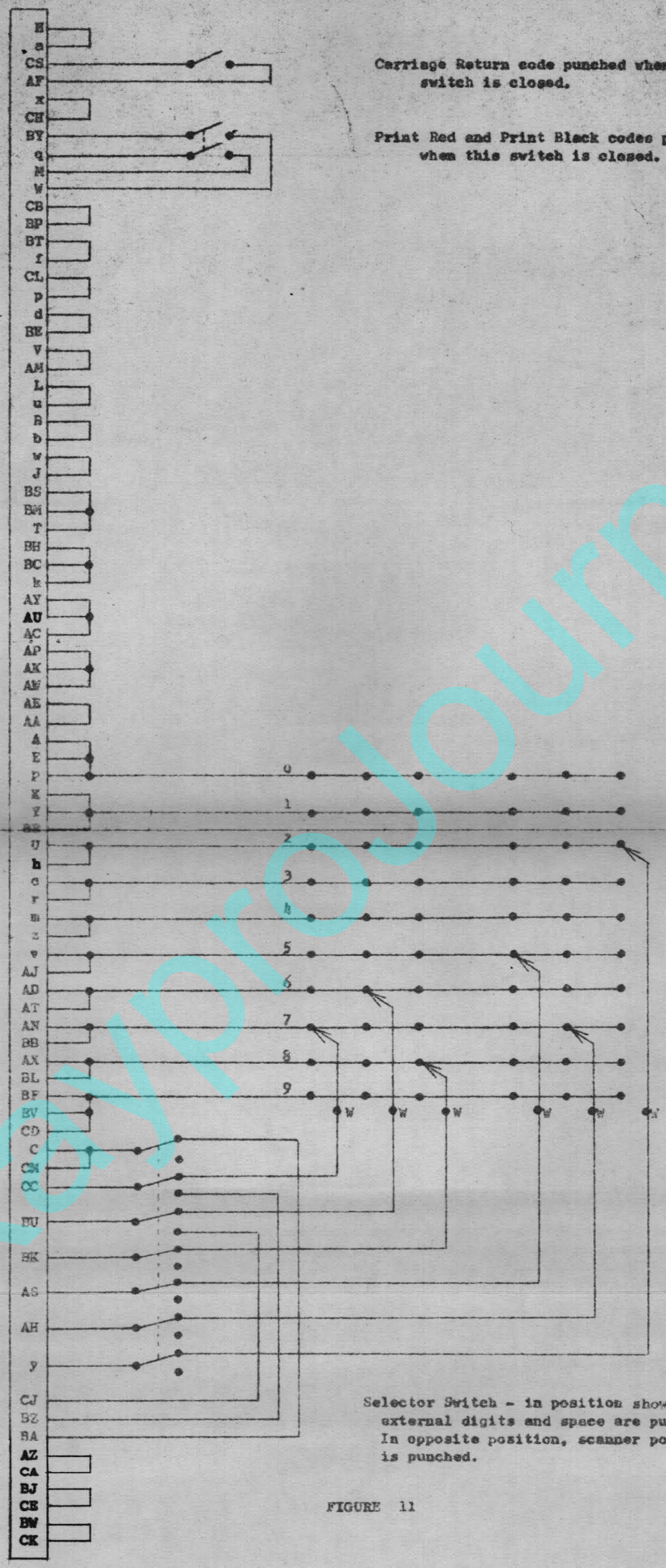
pin BU (pulse 7) via the switch to pin CJ or to external digit switch wiper.

pins BK, AS, AH, and y (pulses 6, 4, 3, and 2) via the selector switch to the wipers of the remaining 10-position switches.

11. Since the internal scanner is to be used, connect:

AZ to CA
BJ to CE
BW to CK

Program Connector wiring for Example 4 is shown schematically in Figure 11.



Carriage Return code punched when this switch is closed.

Print Red and Print Black codes punched when this switch is closed.

Selector Switch - in position shown, 6 external digits and space are punched. In opposite position, scanner position is punched.

FIGURE 11

EXAMPLE 5

Required Format - Y Y (Space) P . X . X . X . X X F (Space) (CR)
Where Y is scanner position from 00 to 99 from an external NLS Model 262 Scanner;
P is polarity (+, -, or A for AC)
X is reading of a 5-digit Digital Voltmeter, with properly located floating decimal point;
F is function - V for volts, K for kilohms, and R for ratio.
Carriage Return code is to be punched every 5 readings.

Coding - as shown in Figure 4.

1. Install diodes on the code matrix board as shown in Figure 5.

2. Assign pulse and pin numbers for each digit as follows:

Y	Y	S	P	.	X	.	X	.	X	.	X	X	F	S	CR
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
BU	CC	CM	J	T	b	k	u	AC	AM	AW	BE	BP	BY	CH	CS
AL	AV	BD	BN	BX	CF	CR	D	N	X	g	q	y	AH	AS	BA

3. Since the word contains more than 11 characters, jumper pin H to pin a.

4. The Model RS3 Scanner-Tape punch is available on special order with a factory-installed modification kit for the 5th DVM decade. This digit is connected to pin F of the program connector, but it is Decade 1, not Decade 5. Pins B, L, V, and d are now Decades 5, 4, 3, and 2 respectively. Therefore, connect jumpers as follows:

B to b and CF
L to u and D
V to AM and X
d to BE and q
F to BP and y

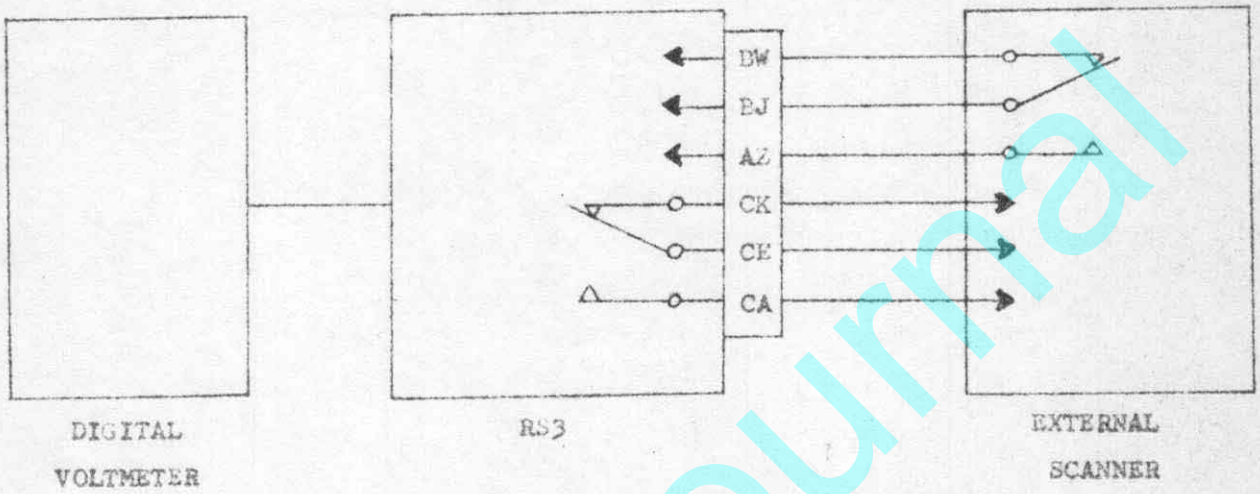
5. For polarity and function, connect;

w to J and BN
n to BY and AH

6. For the floating decimal point, connect;

BS to BM, T and BX
BH to BC, k and CR
AY to AU, AC and N
AP to AK, AW and g
AE to AA

7. When the RS3 is used with an external scanner, pins BW, BJ, AZ, CK, CE, and CA in the program connector are to be connected as follows:



Momentary transfer of the contact in the external scanner causes the DVM to make a measurement at the completion of the momentary transfer. The DVM triggers the RS3 at the completion of measurement. After punching is complete, the contacts in the RS3 are momentarily transferred to trigger the external scanner.

In the present example, the above pins are connected to the Model 262 Scanner as follows:

MODEL RS3 PROGRAM CONNECTOR		MODEL 262 PRINTER CONNECTOR (J1)
BW	to	DD
BJ	to	FF
AZ	to	HH
CK	to	CC
CE	to	BB
CA	to	r

8. For the Space codes, connect as follows:

BD and CM (pulse 3) to CH and AS (pulse 15) to C (SP1 code)

9. For the scanner position digits, connect as follows:

MODEL RS3 PROGRAM CONNECTOR		MODEL 262 PRINTER CONNECTOR (J1)	
A	to	M and A	(0)
K	to	N and B	(1)
U	to	P and C	(2)
c	to	R and D	(3)
m	to	S and E	(4)
v	to	T and F	(5)
AD	to	U and H	(6)
AN	to	V and J	(7)
AX	to	W and K	(8)
BF	to	X and L	(9)
BU and AL	to	z	(pulse 1)
CC and AV	to	AA	(pulse 2)
CN	to	k	(power ground)

10. When an external scanner is used to switch the input signals to the DVM, the internal RS3 scanner may be used to control punching of special codes every 2nd, 5th, 10th, or 20th reading.

In the present example, the Carriage Return code is added every 5 readings by wiring the program connector as follows:

BZ to CS and BA (Pulse 16)
P to AJ to M (SP2 code, for Carriage Return)

Program connector wiring for Example 5 is shown schematically in Figure 12.

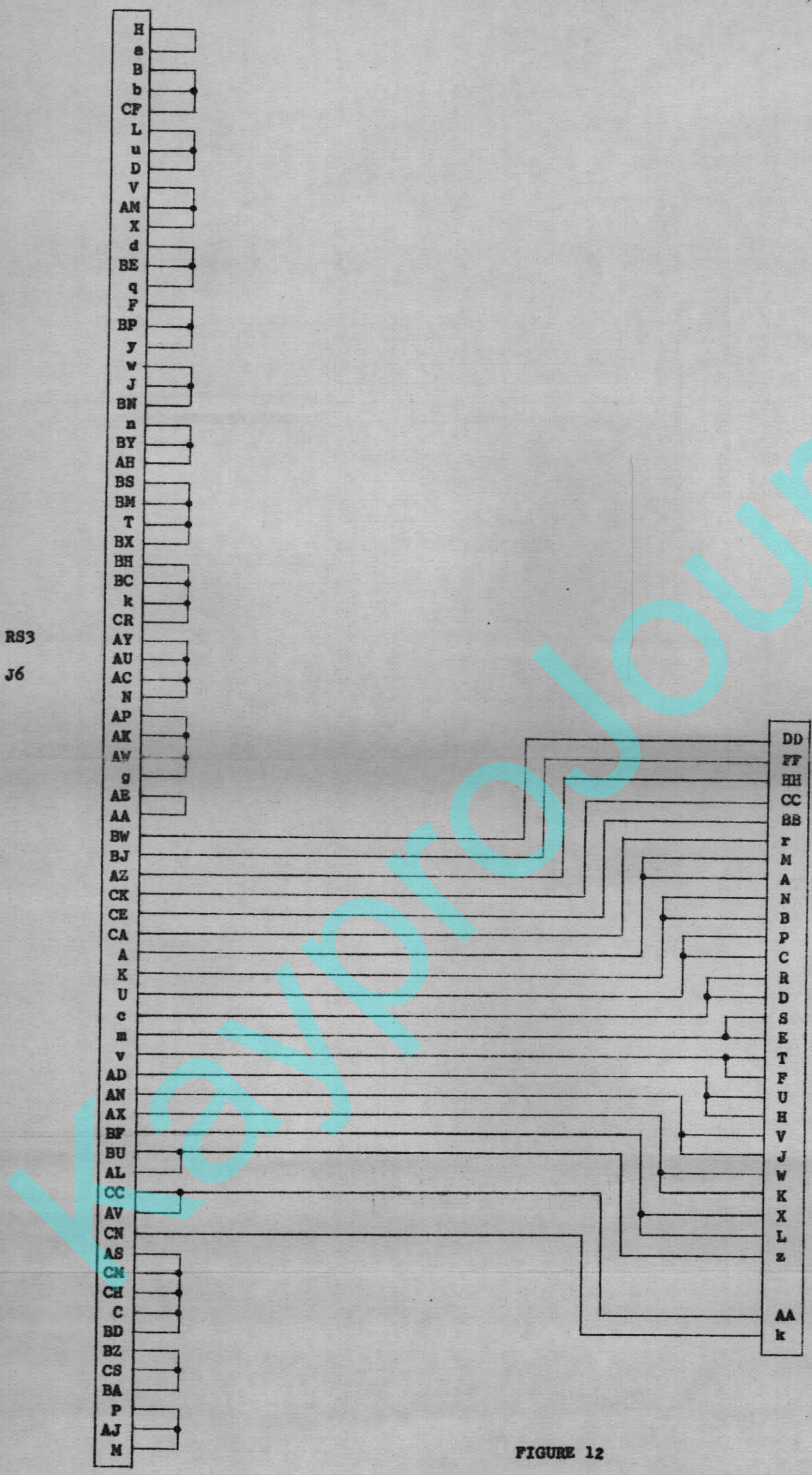

RS3
J6
H
e
B
b
CF
L
u
D
V
AM
X
d
BE
q
F
BP
y
w
J
BN
n
BY
AH
BS
BM
T
BX
BH
BC
k
CR
AY
AU
AC
N
AP
AK
AW
g
AE
AA
BW
BJ
AZ
CK
CE
CA
A
K
U
c
m
v
AD
AN
AX
BF
BU
AL
CC
AV
CN
AS
CM
CH
C
BD
BZ
CS
BA
P
AJ
M
DD
FF
HH
CC
BB
r
M
A
N
B
P
C
R
D
S
E
T
F
U
H
V
J
W
K
X
L
z
AA
k
262
SCANNER
J1

FIGURE 12

INPUT CONNECTIONS

Input connections are as shown in the table below. Cable connector type is CEC 500C4-75X2-J-SH with 97502 sockets, or equivalent.

INPUT NO.	SIGNAL PINS	ACCESSORY PIN
00	3 and 7	1
01	11 14	8
02	17 21	15
03	24 27	22
04	30 33	28
05	36 39	34
06	42 45	40
07	48 51	46
08	54 57	52
09	60 64	58
10	2 5	4
11	10 13	12
12	16 20	18
13	23 26	25
14	29 32	31
15	35 38	37
16	41 44	43
17	47 50	49
18	53 56	55
19	59 63	62
Shield Ground	82	

To route any input signal through the accessory AC-DC Converter, Preamplifier, or other device, jumper the pin indicated above which corresponds to the input number to pin 76 or 79.

Output connections are as follows:

Pin A - First column of above signal input pin connections
B - Second column of above signal input pin connections
C - Shield Ground

Cable Connectors for "To Accessory" and "To Digital Voltmeter" are Amphenol 97-3106A-14S-7P-426 or equivalent.

Cable Connectors for "From Accessory" and input to digital voltmeter are Amphenol 97-3106A-14S-7S-426 or equivalent.

Cables to Digital Voltmeter

Signal Cable, all NLS Digital Meters 15004-129

Data Cable, Models 484A, 784, V60C, M24, [illegible] 15004-059
M25, R65B, V24, R24, and V44

Data Cable, Models V34A, V34B, V34RB, V91P	15004-203
Data Cable, Models V35A, V35B, V35RB	2539

One 15004-129 cable is shipped with each RS3. Schematics of the 15004-059, 15004-203, and 2539 cables are a part of this manual. 15004-059, 15004-203, and 2539 cables are not shipped with the RS3 unless specified on order.

TAPE THREADING

1. Remove the Tape Supply drawer from the RS3. Place the roll of tape on the turntable so that it feeds toward the rear as shown in Figure 13.

   Tape should be oiled perforator tape, available from NLS, or plain mylar. Metalized mylar or aluminized mylar should not be used because it reduces the life of the punch.

2. Feed the tape around the Brake Pulley and between the Tape Guide and Guide pulley as shown. Replace the Tape Supply drawer in the RS3 chassis.

3. Move the tape Hold-Down Arm away from the sprocket, which raises the Tape Run-out Arm as shown in Figure 14. Feed the tape through the guide on the Tape Tension arm, and under the Tape Run-out Arm. Slide the tape under the Punch Die, taking care that the tape is all the way to the rear and straight. Close the Tape Hold-Down Arm.

4. If necessary to adjust the punch for a different tape width, loosen the screw on the Tape Run-out Arm and move the guide so that it holds the tape toward the rear of the punch, but not so tight as to cause crimping or curling of front edge.

5. Be sure that the Chad Receptacle is in place (see Figure 14). Empty the receptacle, if necessary.

OPERATION

NOTE

Prior to operation of the Model RS3, the Code Matrix Board and Program Connector must be wired as explained above under INSTALLATION. If this is not done, the tape punch will not operate.

1. Turn the Mode Switch on the RS3 to "STOP". The readout will light, and the punch unit may punch one or more random codes.

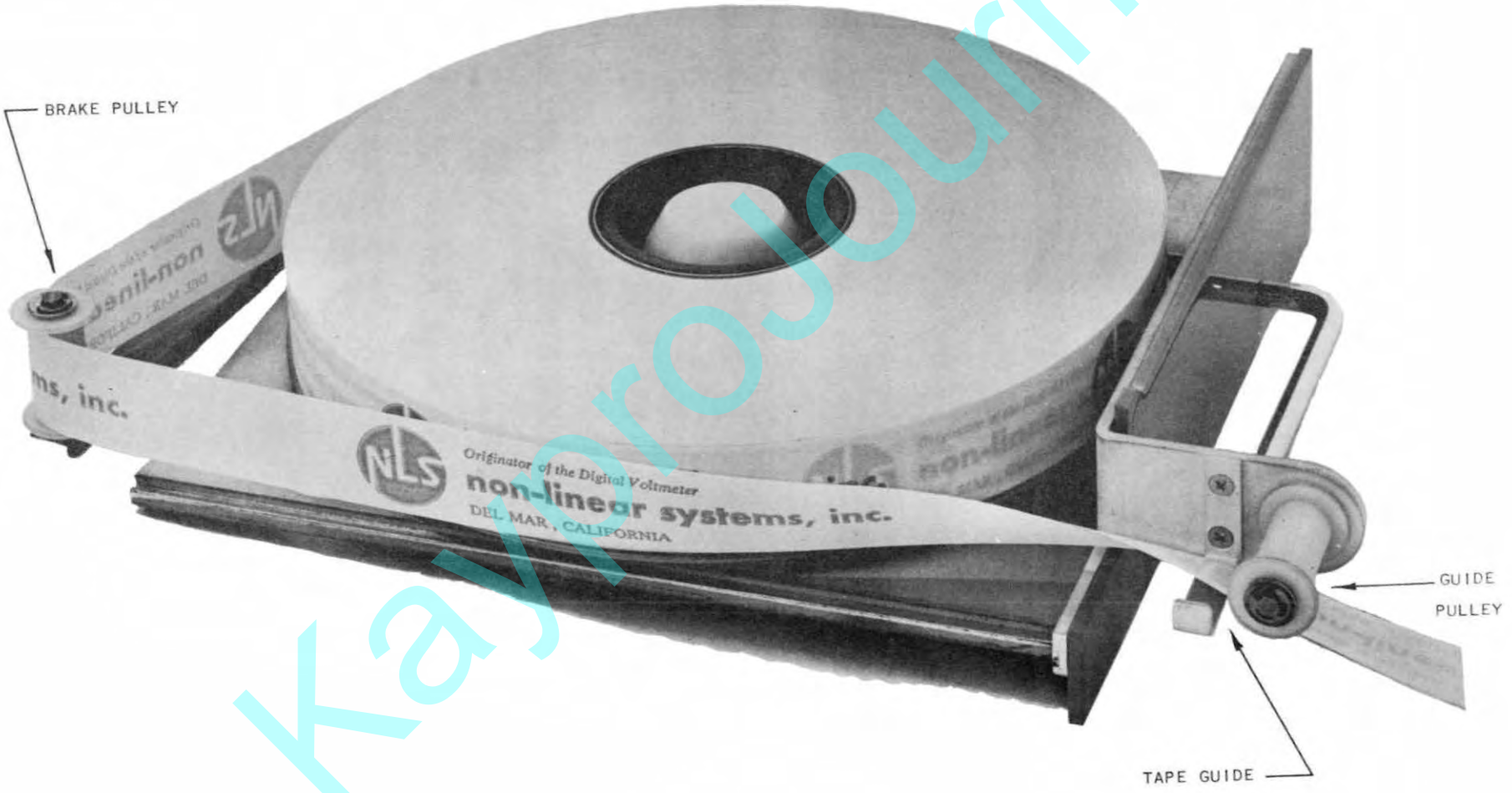


FIGURE 13

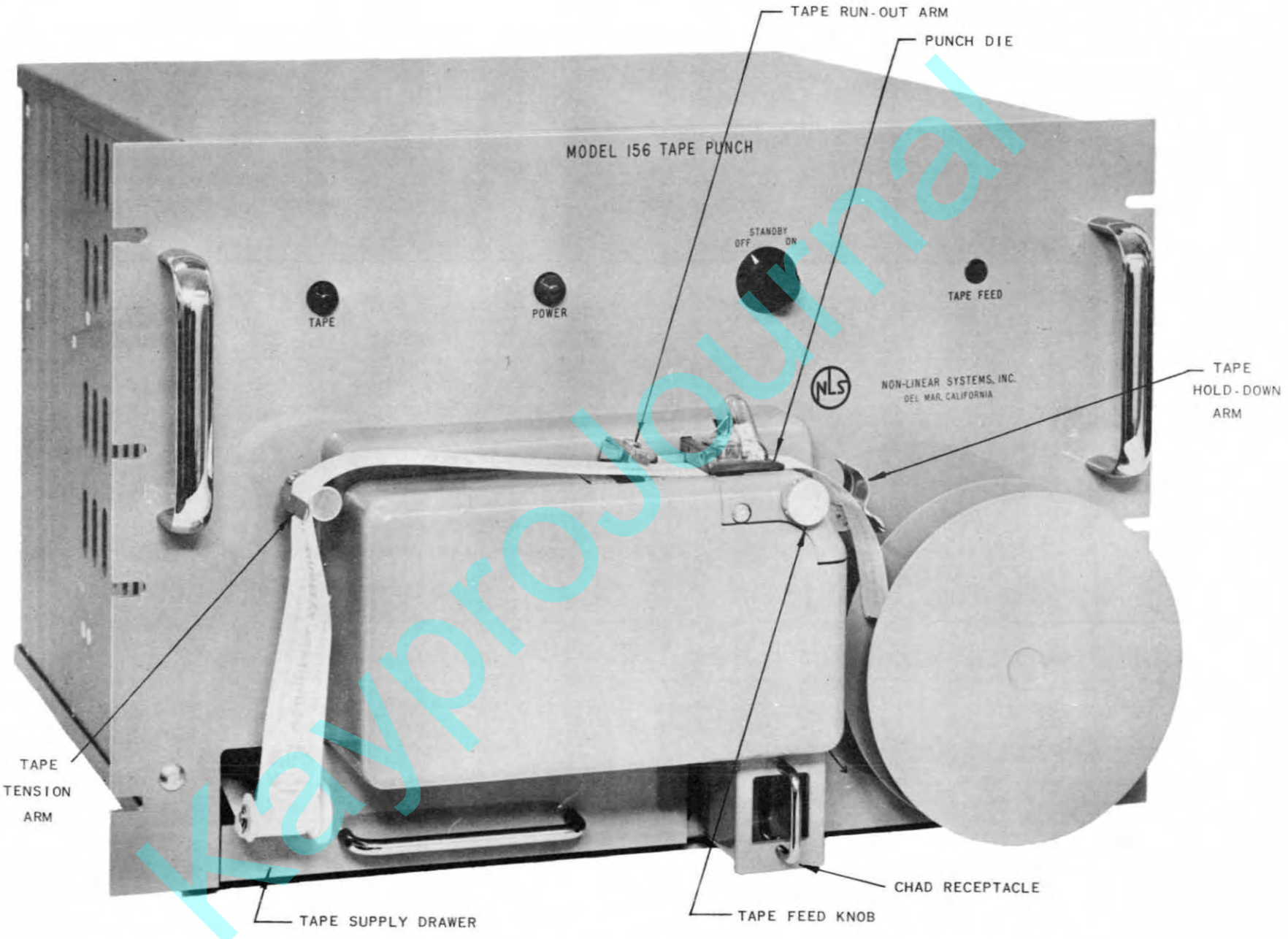


FIGURE 14

2. Depress the Tape Feed switch to feed out several inches of tape. Tear off and discard any codes that were punched when the power was first turned on.

If a new roll of tape has been installed, pull gently on the end of the tape while depressing tape feed switch until enough sprocket holes are produced to reach from the punch die to the sprocket, after which the tape will feed normally.

3. Set the Digital Voltmeter to the "CONTINUOUS PRINT" ("EXTERNAL TIMING" for the Model V44) mode as described in the appropriate handbook.

NOTE

Do not set the Digital Voltmeter mode switch to "AUTO" if the RS3 mode switch is set to "ONE CYCLE" or "AUTO CYCLE".

4. Momentarily set the Digital Voltmeter switch to "SINGLE SCAN" or "MANUAL", depending on the voltmeter type. After recording is completed, press the "TAPE FEED" switch to run out a few inches of tape. Tear off and discard the punched data. This operation insures that the serializing stepping switch is in the zero or "home" position.

5. To wind the punched tape on the take-up reel, press the Tape Feed switch and feed out enough tape to reach the center of the take-up reel. Remove the outer flange of the reel and slip the end of the tape between a spring clip and stud. Replace outer flange.

6. Momentarily operate the "ADVANCE" button on the scanner-tape punch to set the scanner to the desired starting point.

7. Start operation by momentarily turning the RS3 Mode Switch to "START", and then to the desired operating mode, as follows:

AUTO CYCLE: In this mode the system repeatedly samples, measures, and records the entire input range from channel 00 to channel 19. This mode is also used when the RS3 is used in a system with an external scanner, and the RS3 scanner is programmed to punch special codes every 2nd, 5th, 10th, or 20th reading as in Example 5.

ONE CYCLE: In this mode, the system automatically stops when it reaches channel 19.

PUNCH: In this mode one input is measured and punched without advancing the scanner. This mode is also used when the RS3 functions as a tape punch only, as when an external scanner is used.

8. Operation may be stopped by turning the Mode switch on the RS3 to "STOP".

9. After completion of a run, press the Tape Feed switch and run out several inches of tape before tearing tape off of punch. Observe condition of chad receptacle, and empty it if necessary. If chad receptacle is allowed to fill up, the tape punch mechanism can be damaged due to chads backing up in the chad exhaust chute and jamming the punch.

VISUAL DISPLAY

The voltage measurement (4 digits, polarity sign and decimal point location) is displayed on the readout on the digital voltmeter, and the input number is shown on the readout on the scanner-printer. The latter readout also indicates whether the scanner output signal goes directly to the voltmeter (DIRECT) or whether it is routed through the external AC-DC converter or amplifier (ACCESS). This readout also indicates low tape supply (LOW TAPE), and improper tape feeding, such as tight tape, tape run-out, or tape hold-down arm not in place (TIGHT TAPE).

LUBRICATION

For lubrication of the punch mechanism, see page 38.

Caution: Do not use lubricants intended for the punch mechanism for the stepping switch and vice versa.

The scanner stepping switch should be lubricated at three month intervals. Use the Standard Lubrication Kit, Clare part number RP-9466, containing brushes, application papers, and three lubricants designated "A", "B", and "C". These lubricants are identified as follows:

"A" - Nyes Clock Oil #55022: Swartchild and Co., 29 E. Madison Street, Chicago 2, Illinois

"B" - Light Colorless Mineral Oil: Pharmacy

"C" - A 1:1 mixture by volume of clock oil (Lubricant "A") and fine powered mica: "Motor-Mica", Scientific Lubricants Co., 3469 N. Clark St., Chicago, Illinois

Lubricate most points with the small artists' brushes. Use a separate brush for each lubricant. A dip is the amount remaining on the brush when it is immersed one half its bristle length in the lubricant, and then drawn across the edge of the container to remove the excess. In no case should a droplet form. The stepping switch parts are identified on page 36.

Apply Lubricant "A" as follows:

Withdraw the wiper assembly bearing pin, apply one dip to each end, and replace the pin.

One dip to each side of a strip of bond paper. Pass the strip between each pair of wiper tips in four levels of the wiper assembly. Repeat for each additional four levels; then rotate the wiper assembly several times to lubricate the bank contacts.

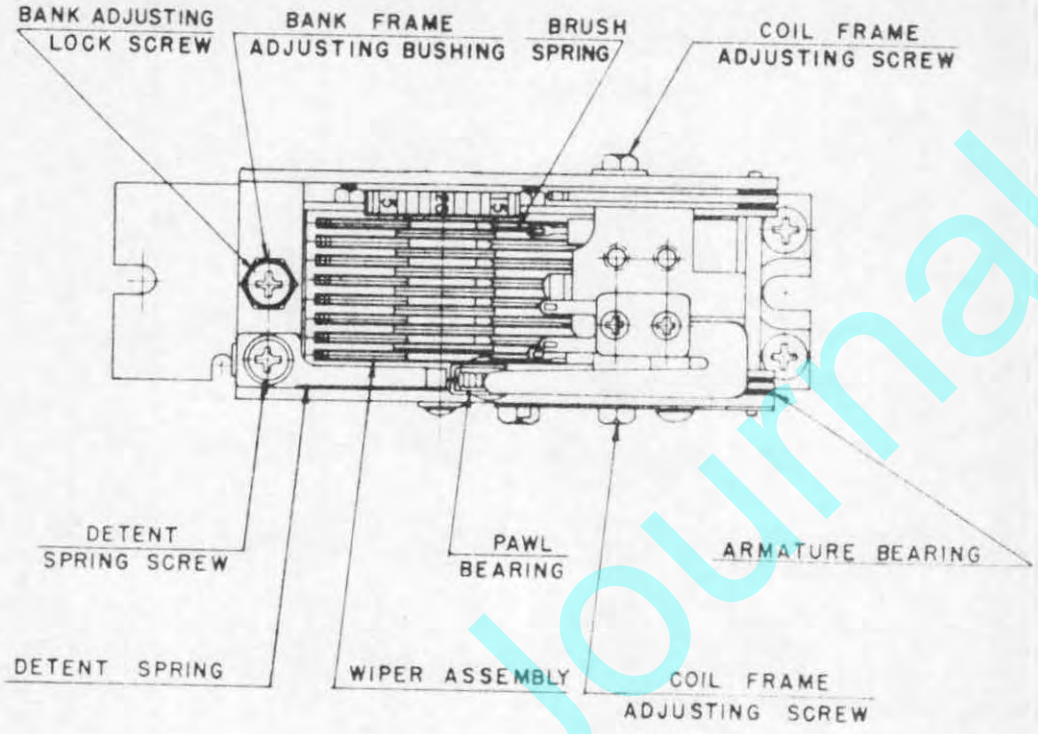
Divide one dip among four levels of wipers at the inner surfaces where the brush springs ride. Repeat for each additional four levels, then rotate the wiper assembly several times to distribute the lubricant.

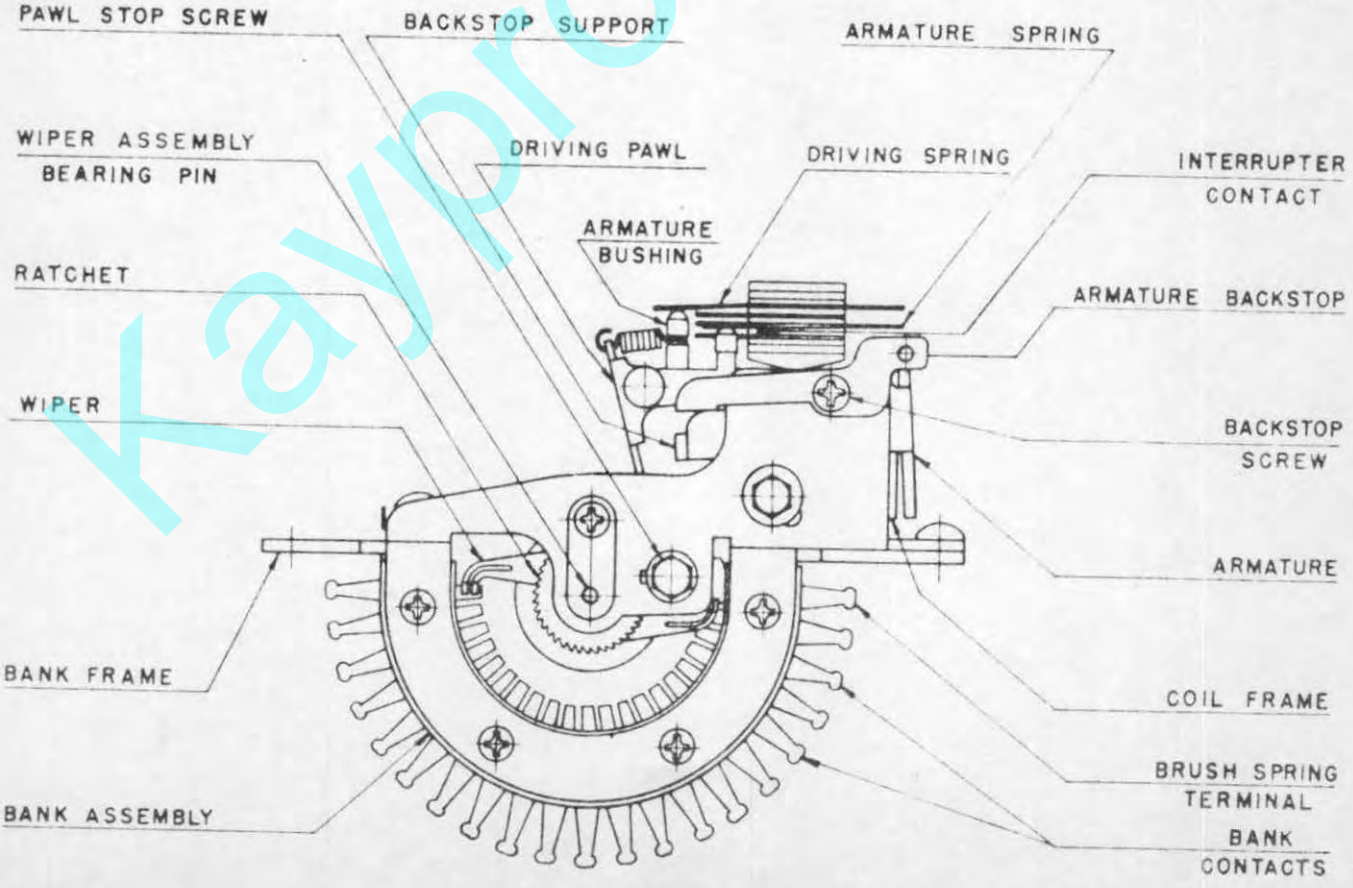
One dip to each side of a strip of bond paper. Pass the strip between each armature arm bushing and the spring it deflects.

Apply Lubricant "B" as follows:

Remove the armature bearing pin, work one dip well into each armature bearing, and replace the pin. On switches with an armature bearing felt, saturate the felt.

TYPE 20 SWITCH
IDENTIFICATION OF PRINCIPAL PARTS





One dip to the pawl bearing, working the lubricant in between the bearing, armature arm, and pawl.

Apply the residue on the brush into each pawl spring hook at the eyelets.

Apply Lubricant "C" as follows:

Stir the lubricant to the consistency of a smooth paste, and distribute two dips evenly over the ratchet teeth while rotating the wiper assembly.

INSPECTION AND READJUSTMENT

The scanner stepping switch will retain its initial adjustments for a considerable time with no attention aside from periodic lubrication. After each 500,000 wiper assembly revolutions, inspect the switch, and perform any needed readjustments in accordance with the procedure and sequence given below. It is not unusual for the switch to meet all requirements during one or more inspections.

Manually step the switch to position 0 and observe wipers. Wiper tips should be centered on the bank contacts within approximately 1/64".

Eliminate excessive forward play of the wiper tips by advancing the pawl stop toward the pawl until they touch. Tighten the screw carefully to avoid a change of setting.

Eliminate excessive reverse play of the wiper tips by moving the detent spring toward the ratchet, but not so far as to prevent its dropping freely into each ratchet tooth during manual stepping. Center the detent spring on the ratchet.

Manually step the switch to position 19 and check wiper tips for being centered on the bank contacts. If necessary to adjust, loosen bank adjusting lock screw, turn bank frame adjusting bushing, and tighten lock screw.

Armature Stop

The armature arm should rest against the armature backstop. Inspect by inserting a 0.0015-inch thickness gauge between the armature arm and the backstop. The gauge should drag during withdrawal.

If the gauge does not drag, adjust as follows:

Loosen the backstop screw and the nearest coil frame adjusting screw. Lift the backstop and backstop support against the armature, but not to the extent of lifting the pawl from its stop.

After tightening the two screws, recheck for gauge drag and for positive action of the detent spring during manual stepping of the switch. An ideal adjustment is to have the armature arm and pawl strike their stops simultaneously.

The tape punch mechanism should be lubricated at 6-month intervals. For access to the punch mechanism, the punch covers and electronic chassis assembly must be removed as follows:

1. Loosen, but do not remove, two screws located at left and right sides of punch. Remove lower punch cover.

2. Remove readout. Loosen, but do not remove, one screw located to the right of the punch magnet assembly, and remove upper punch cover.

   For access to the interior of the punch mechanism for lubrication of the punch clutch, the electronic chassis assembly is removed as follows:

3. Remove mode switch knob. Remove top cover and disconnect 22-pin etched circuit connector to punch unit.

4. Remove screws indicated by arrows in Figure 15. Slide chassis assembly to rear and lift out.

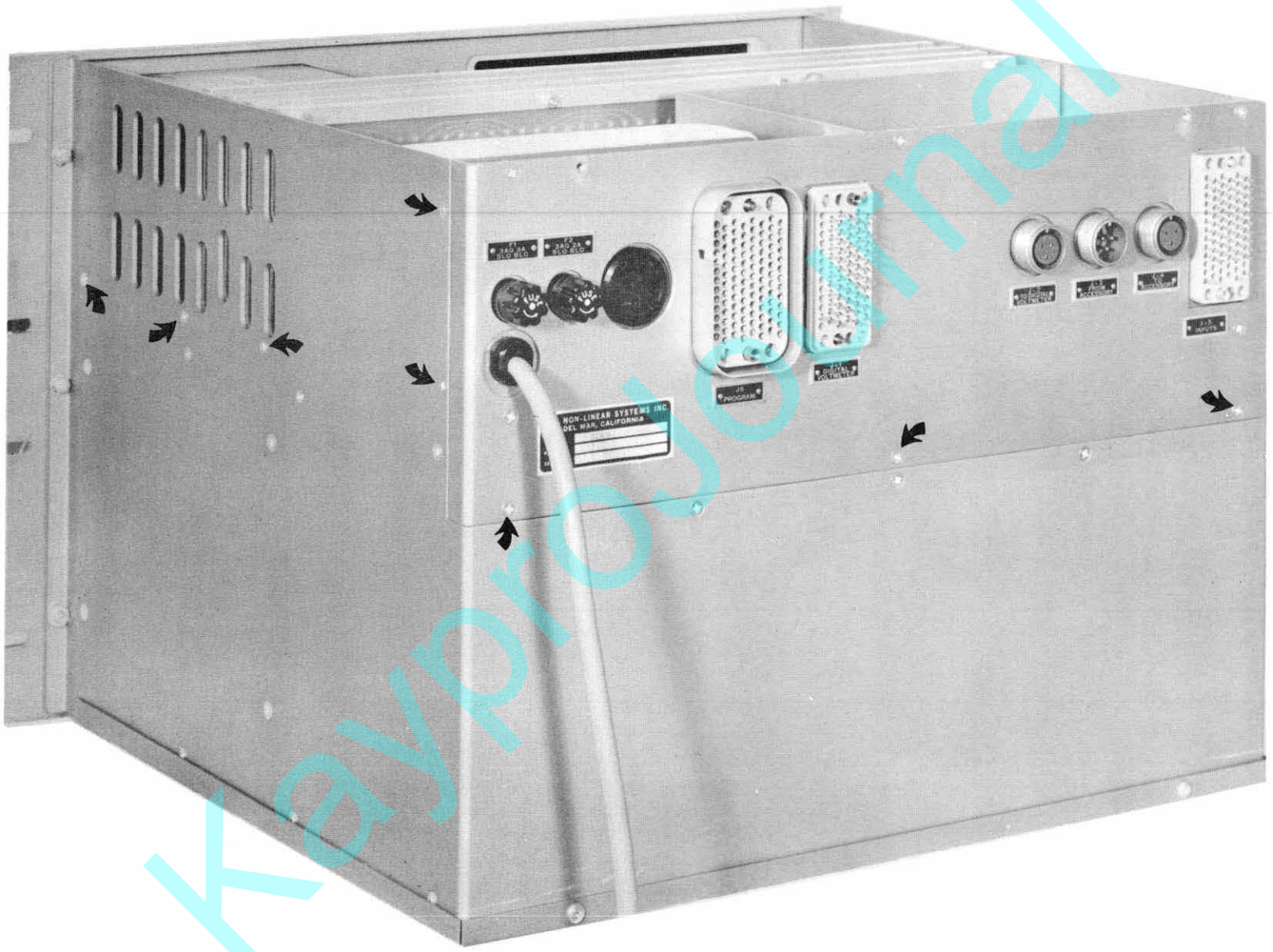


FIGURE 15

LUBRICATION

The lubrication points for the various components in the Motorized Tape Punch are shown on figures 16 through 22.

The following points should be lubricated with C. C. lubricant number 6: All latching surfaces, on armatures where knock-off bails contact, detent, cam surfaces, drive gear teeth, clutch sleeve and collar surfaces, (where armatures contact), restoring bail and spring ends.

The cam roller bearings should be lubricated with C. C. lubricant number 1 and then followed by C. C. lubricant number 6.

All other moving parts, pivots or bearings not otherwise shown should be lubricated with C. C. lubricant number 1.

The numbers in each figure indicate the type of lubricant to use at a specific point. These numbers and their associated lubricants are listed below.

CC Lubricant Number	General Description	Approved Source	Lubricants Name
1	A light oil which has good lubricating and rust preventative properties.	Shell Oil Co.	Shell Tellus Number 27
2	For all Porous Metal Bearings.	Socony Vacuum	Gargoyle DTE 797
6	A grease of light consistency which contains oxidation resistant additives and provides good lubrication without excessive channeling.	Shell Oil Co.	Retinax "T"

These lubricants, and a grease gun for the grease fitting on the clutch shaft, may be obtained from NLS, or from Friden, Inc., San Leandro, Calif.

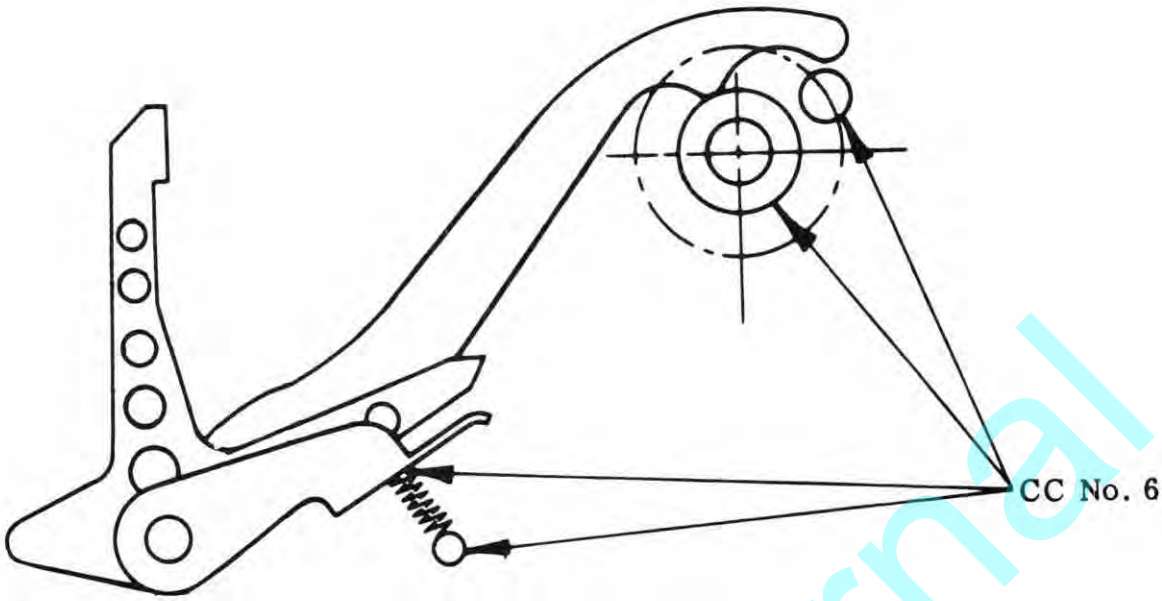


Figure 16 - Latch Restoring Mechanism

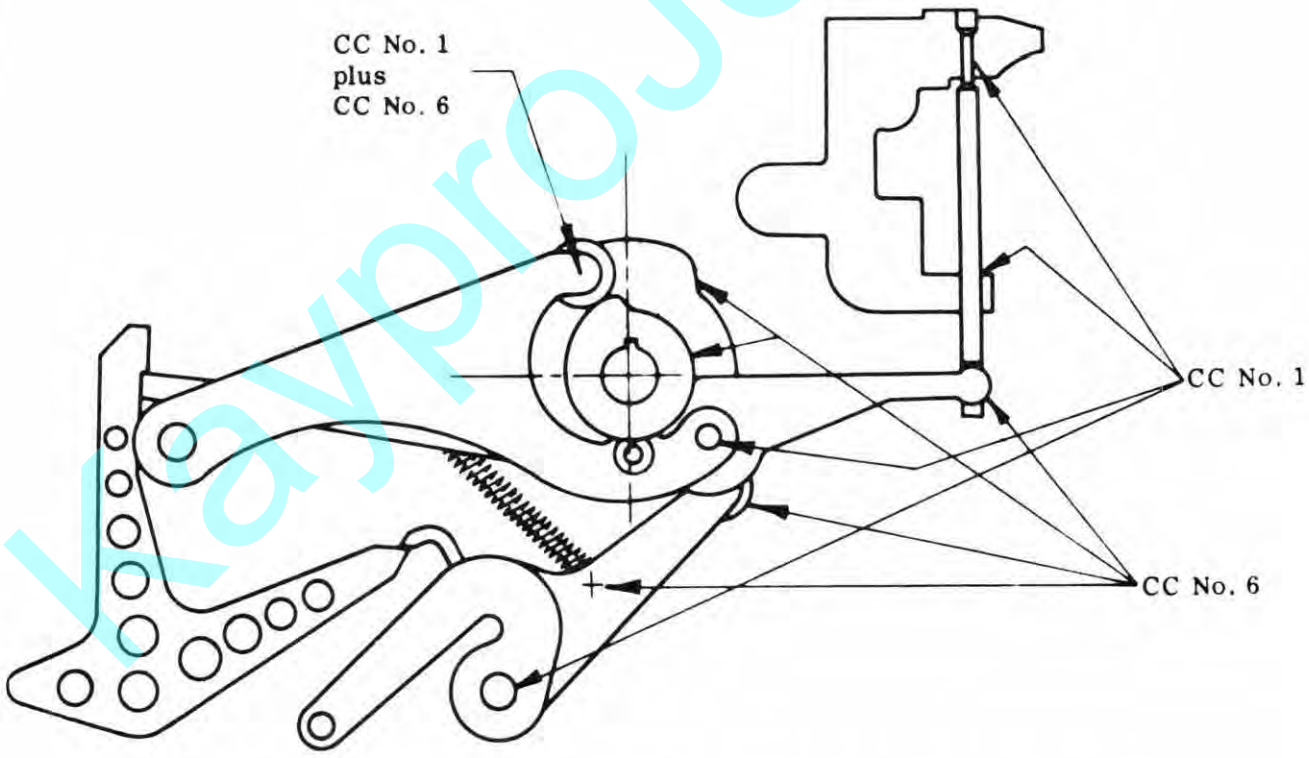


Figure 17 - Latches, Operating Levers and Punch Pins

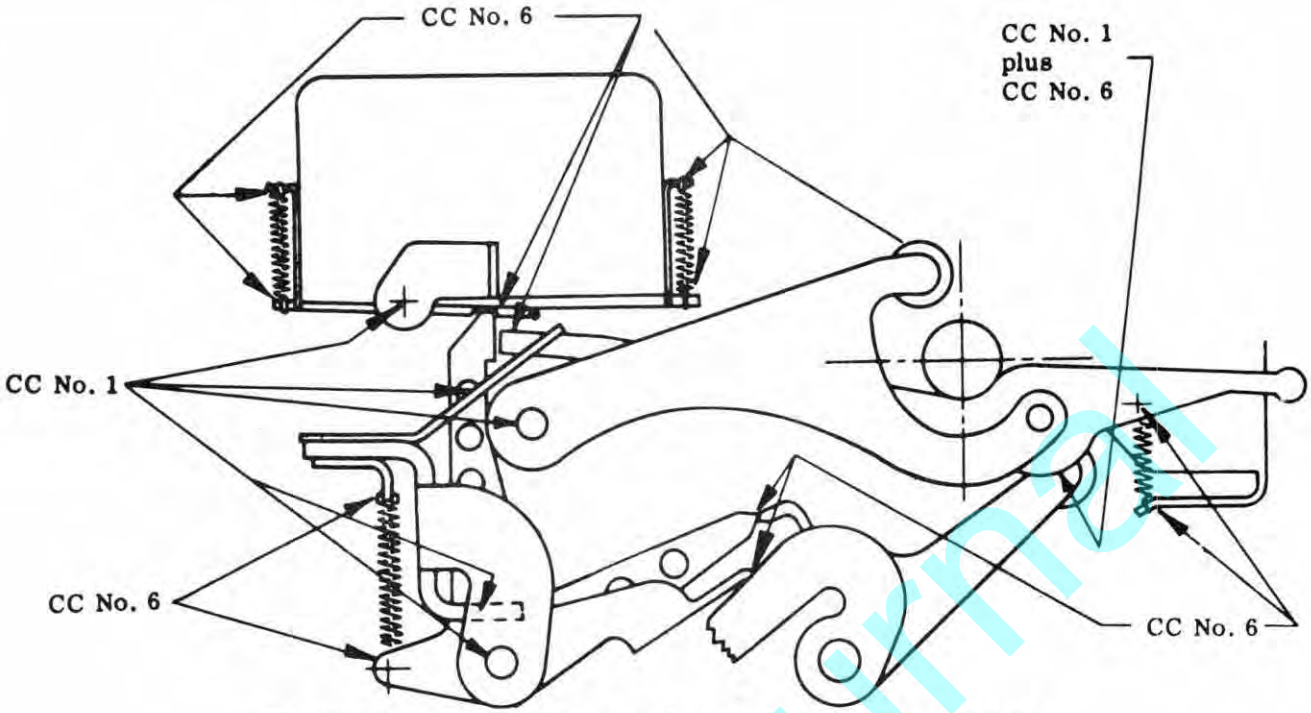


Figure 18 - Armature, Latches and Operating Levers

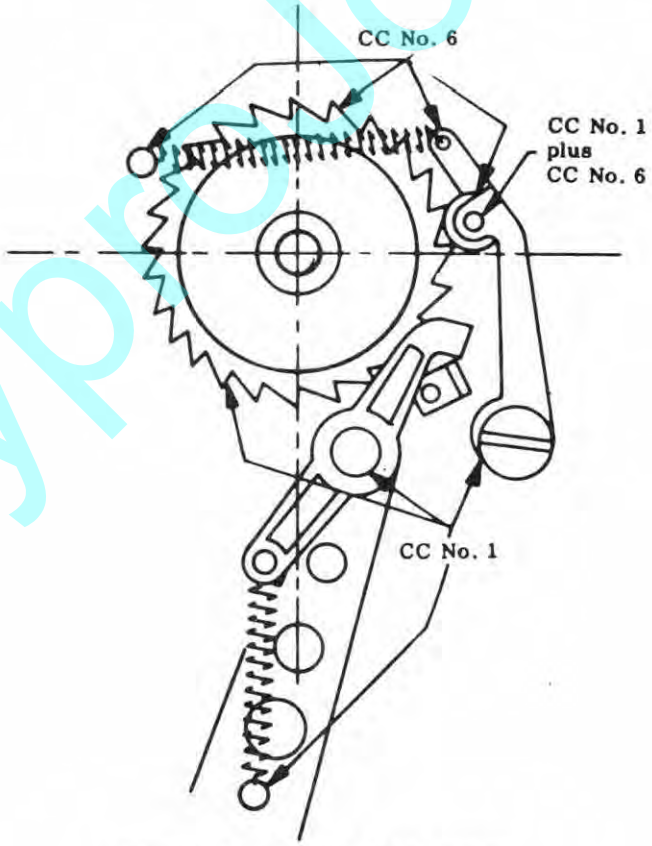


Figure 19 - Feed Mechanism

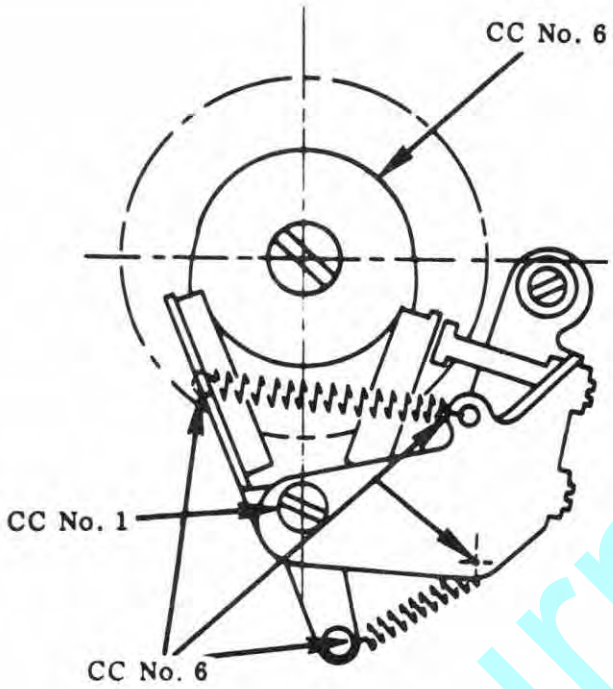


Figure 20 - Clutch Mechanism

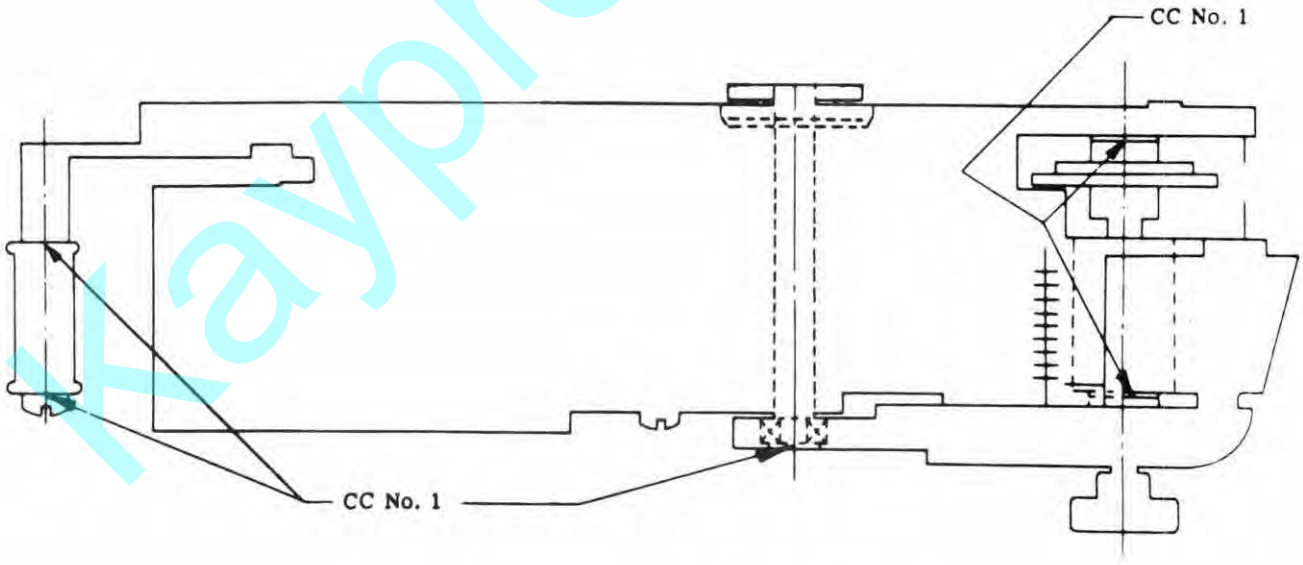


Figure 21 - Tape Punch (Top)

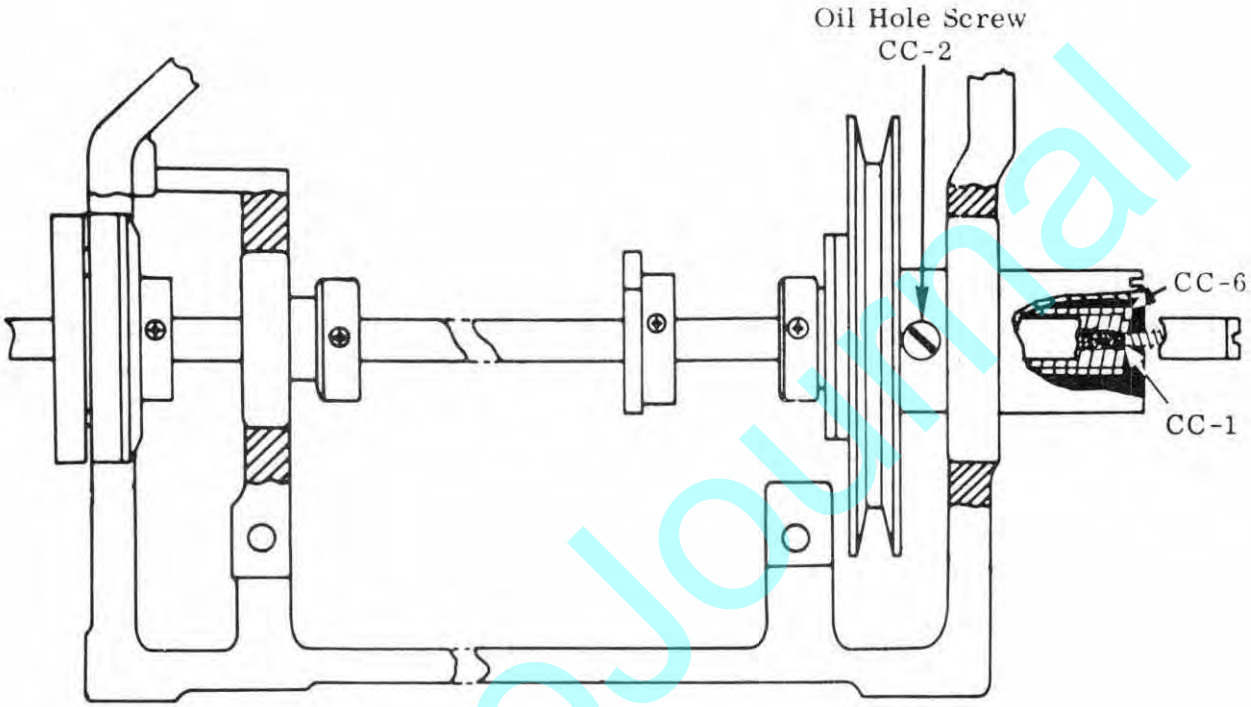


Figure 22 - Power Frame

THEORY OF OPERATION, ELECTRICAL

A block diagram of the RS3 is shown in Figure 23. Jumpers in the program connector are shown by dashed lines. It is shown wired for the following format:

Y Y SP1 P . X . X . X . X F SP2

where

Y	is	scanner position
SP1	is	space
P	is	polarity
X	is	DVM reading
F	is	function
SP2	is	tabulate

For schematics of the RS3, see Drawings 15097-012 Sheet 2, 15097-013 Sheet 2, 15097-014 Sheet 2, 15097-070 Sheet 2A, and 15097-070 Sheet 2B.

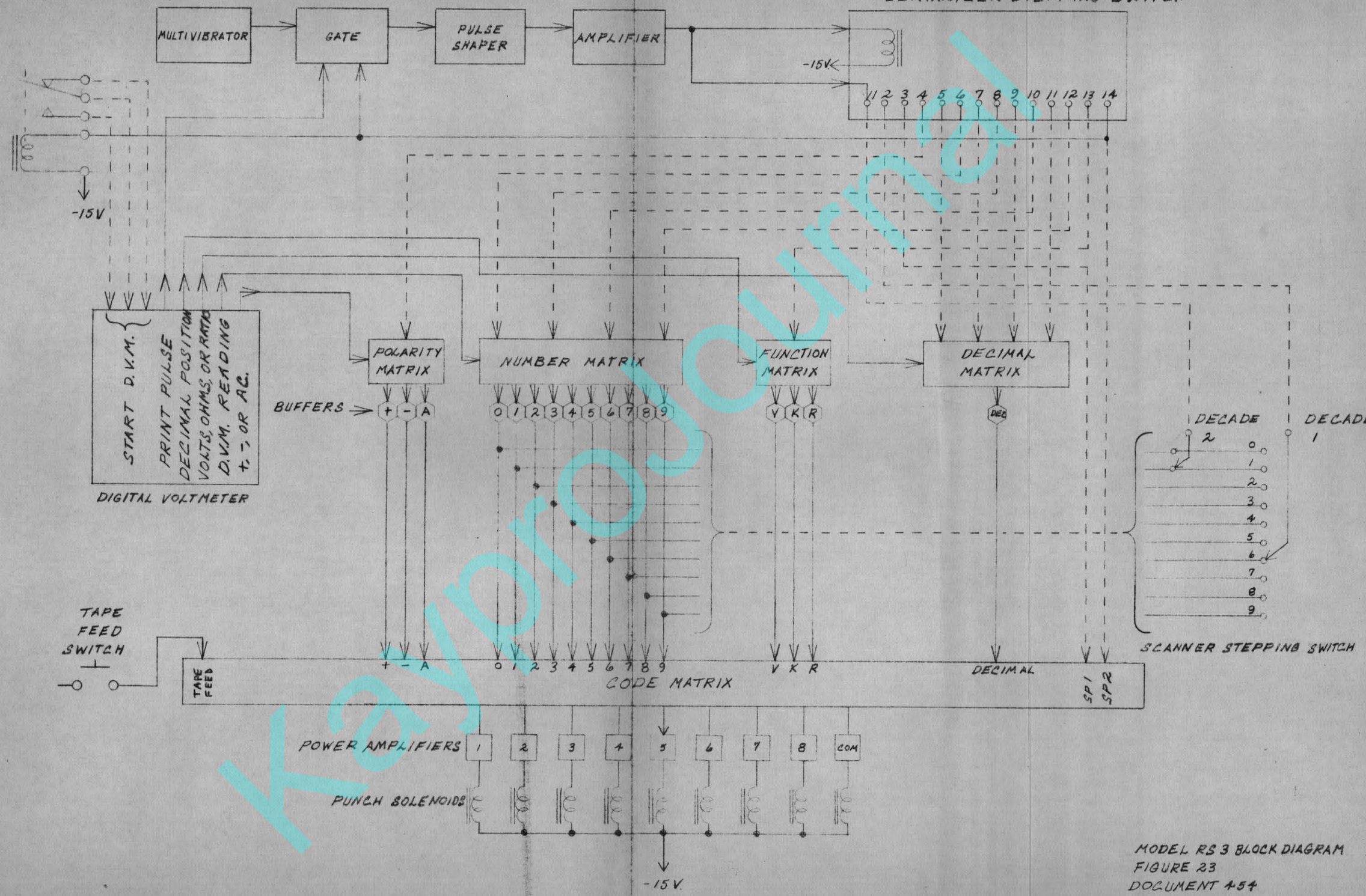
Pulses for operating the RS3 are generated by a multivibrator consisting of Q1 and Q2 on the "B" board (see Drawing 15097-013 Sheet 2). A gate circuit consisting of Q3, Q4, CR1 & CR2, upon receipt of a negative print command pulse from the digital voltmeter, allows the multivibrator pulses to reach the pulse-shaping flip-flop consisting of Q5 and Q6. This monostable flip-flop produces pulses of the proper length for operating the punch magnets.

These pulses are routed via pin 10 of the "B" board to pin 38 of the "A" board (see Drawing 15097-012 Sheet 2), where Q1 & Q2 provide sufficient power to operate the serializer stepping switch and the punch magnets.

The serializer stepping switch consists of a fully enclosed, oil-bathed, 4-level, 11-position switch. Three levels are modified by removing certain wipers so as to produce a single pole, 33-position switch. The pulses from pin 43 of the "A" board are connected to the coil of the stepping switch, and from pin 42 of the "A" board to pin H of the program connector. Pin H is jumpered either to Pin S, which connects to the wiper of the eleven position section of the serializer switch, or to pin a, which connects to the wiper of the 33 position section.

The output pulses from the stepping switch are all brought out to the program connector, and may be connected with jumpers as shown in Figure 23.

Pulses 1 and 2 are routed to decades 2 and 1 respectively of the scanner stepping switch for recording the input channel number. Pulse 3 is routed directly to the code matrix board to punch a space code in the tape. Pulses 4 thru 13 are routed to the "C" board for recording the data from the DVM.



MODEL RS 3 BLOCK DIAGRAM
FIGURE 23
DOCUMENT 454

The "C" board (see Drawing 15097-014 Sheet 2) contains diode logic circuits to cause each input pulse to reach the output line corresponding to the digital input of each decade, polarity, function, and decimal.

Pulse 4 produces an output pulse corresponding to +, -, or A, if the DVM is reading +, -, or AC respectively. Pulse 5 produces an output pulse for punching a decimal code if the decimal point in the DVM is in the decade 4 position (.XXXX); if not, no output pulse is produced.

Pulse 6 produces an output pulse corresponding to the digit (0-9) of Decade 4 of the DVM reading. Pulse 7 is for a decimal in decade 3 position (X.XXX); again, if the decimal point is elsewhere, no output pulse is produced.

Similarly, pulses 8, 10, and 12 produce output pulses for the three remaining DVM decades, and pulses 9 and 11 produce a decimal output pulse at the proper time. Pulse 13 causes a pulse output for V, K, or R to be produced, depending on whether the DVM is reading volts, ohms, or ratio.

Each input pulse line to the logic circuits on the "C" board requires a resistor connected to B- (see Drawing 15097-014 Sheet 2). When the decimal matrix is connected as shown in Figure 23, R53, R54, R55, & R56 are externally jumpered to pins 35, 36, 37, and 38 respectively. Pin 39 is the output pulse.

When the decimal position is to be punched as in Example 2, i.e., XXXX.Z, where Z is a digit from 1 to 4 indicating the number of places to move the fixed decimal point to the left, pin 39 of the "C" board becomes the input pulse. Pins 35, 36, 37, and 38 are jumpered to pins 6, 7, 8, and 9 respectively. R53 is connected to the input pulse by jumpering pin 25 to 39.

Because the output pulses from the "C" board logic circuits do not have sufficient power to drive the code matrix and punch solenoid amplifiers, each of these outputs is routed to buffers located on the "A" board (see Drawing 15097-012 Sheet 2).

The output pulses from the "A" board buffers, from the scanner stepping switch, and from all other sources such as external switches are routed to the code matrix board. The configuration of diodes on the code matrix board determines which combination of punch solenoids are energized for each code (see Tape Coding, page 3). Power amplifiers located on the "B" board provide the power required to drive the punch magnets.

The last pulse from the serializer stepping switch is also routed to the gate via pin 4 of the "B" board. The gate flip-flop (Q3 and Q4) then returns to the opposite state, preventing any additional pulses from occurring. The last pulse is also routed to the scanner stepping switch coil, and to relay K4, as shown in Figure 24.

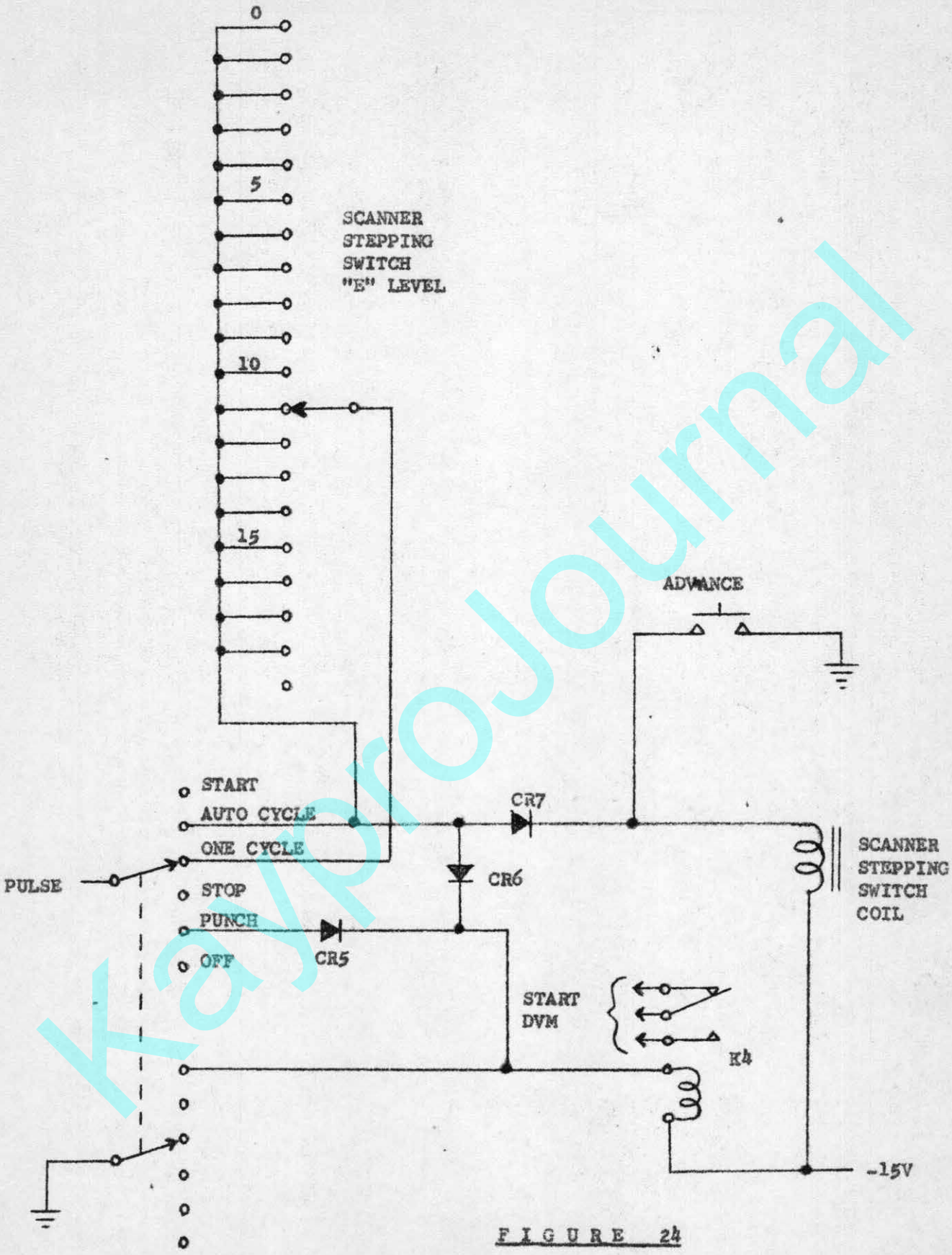


FIGURE 24

When the mode switch is in the AUTO CYCLE position, the scanner stepping switch coil is energized via CR7. The pulse also energizes relay K4, which triggers the digital voltmeter for the next reading.

In the ONE CYCLE mode, the pulse is routed thru the "E" level of the scanner stepping switch so that when the scanner reaches position 19, the circuit is opened and operation stops. In the "PUNCH" mode, the scanner stepping switch is not energized, in order to allow repetitive measuring and punching of the one input.

Tape feed pulses are generated as shown in Figure 25.

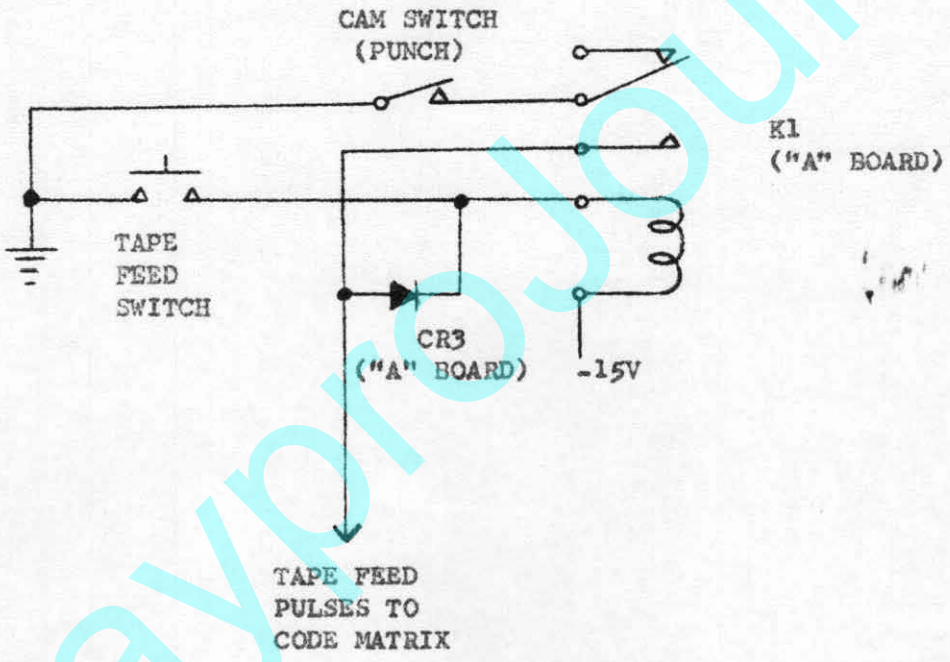


FIGURE 25

When the Tape Feed switch is closed, relay K1 on the "A" board is energized, connecting ground to the code matrix board via the normally closed cam-operated contact in the tape punch mechanism. As the punch main shaft rotates, the cam switch opens and closes, generating pulses as long as the Tape Feed switch is held closed. K1 locks in via CR3, to prevent a short pulse from being produced if the Tape Feed switch is opened during a pulse.

MECHANICAL SEQUENCE OF OPERATION

NOTE:

Part numbers are Friden, not Non-Linear Systems.

The code punched in the tape is selected by energizing individual code magnets (punch magnets) for each unit of the code. The punch magnets and clutch magnet are normally impulsed simultaneously. (This control impulse should have a minimum duration of 15 milliseconds and should not exceed the cycle time of the driven cam shaft to avoid repeat operation.)

When the punch clutch magnet is energized, the clutch connects the constantly running drive pulley with the punch cam shaft.

The mechanical operation of the clutch is as follows: (See Figure 26.)

The clutch spring (301) is close wound and made from rectangular wire. The dimension of the inside diameter when the spring is not expanded is held very accurately. This insures a secure grip on both

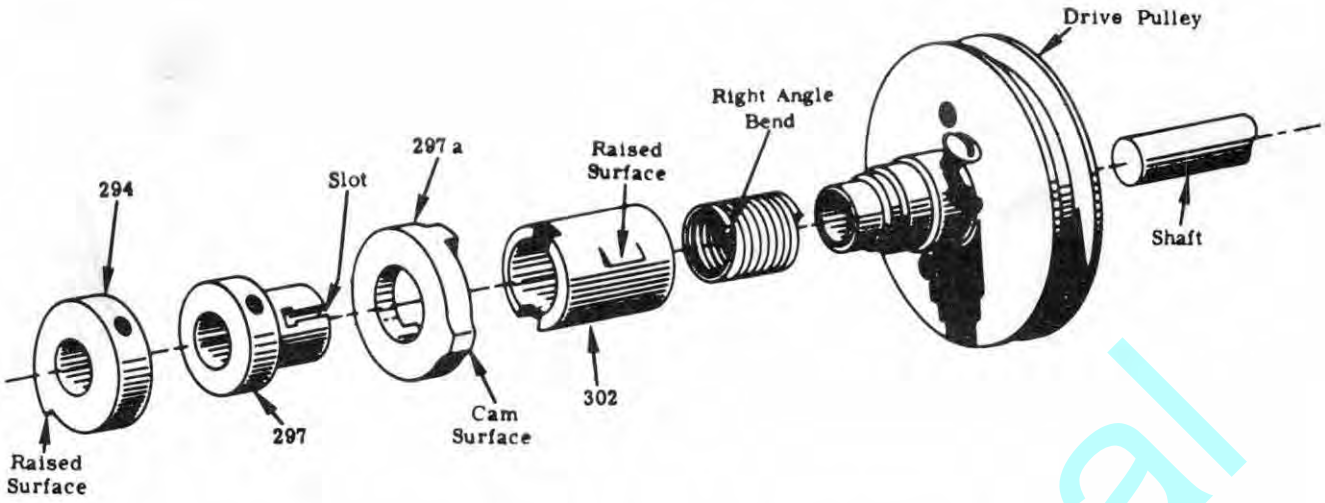


Figure 26 - Clutch Mechanism Disassembled

the drive hub and the clutch collar (297) on which the ends of this spring assemble.

The end of the spring (301) which the clutch collar assembles has a right angle bend. This bend fits into a slot in the collar.

The opposite end of the clutch spring strikes against a protruding point on the inside of sleeve 302.

The spring, when assembled, will ride over the clutch collar as far as the end of the slot. The other end will ride the drive hub. The sleeve itself will assemble over the spring and the two ends will fit the surface provided for it on both the drive hub and the clutch collar.

When the clutch magnet is not energized and its armature is resting against the raised edge of the clutch sleeve (302), the spring (301) is expanded enough so that it does not grip the drive hub. Therefore, the drive pulley is allowed to rotate freely without turning the cam shaft.

If the armature is operated (due to the clutch magnet being energized) the tension of the spring (301), due to it being slightly forced in an unwound position, will be exerted against the sleeve (302) by the end of the spring in the slot. This will cause the sleeve to start to rotate, allowing the spring to grip the drive hub. The drive pulley's motion will rotate the spring & also tend to wind the spring tighter.

The rotation of the spring will be transferred to the collar (297), the detent (294), and finally the cam shaft.

The spring rotation also causes the rotation of sleeve 302, due to the end of the spring riding against the protruding point on the sleeve's inner surface.

When the clutch armature is released, it will engage the raised edge on the sleeve (302) (near the end of the punch cycle), and the rotation of the sleeve will be stopped.

The rotation of the spring will exert a pressure against the edge of the slot which will tend to unwind the spring. This will

increase the I.D. such that the spring no longer grips the drive hub, thus allowing the drive pulley to run free again.

The speed of rotation will cause the detent (294) to overthrow and lock in position so that the spring is held with this enlarged I.D. until the armature is again released.

Also, a knockoff cam and overtravel stop (297a) is used for greater efficiency of operation at high speeds. This cam is set screwed to the collar 297 in such a manner as to limit the overtravel of the clutch. This stopping action is necessary to prevent unnecessary movement after the clutch is detented.

The cam surface is used to operate an armature knockoff bail for positive release of the clutch armature away from the cores of the clutch magnet.

When a punch magnet is energized, its armature (351) will be attracted to the core.

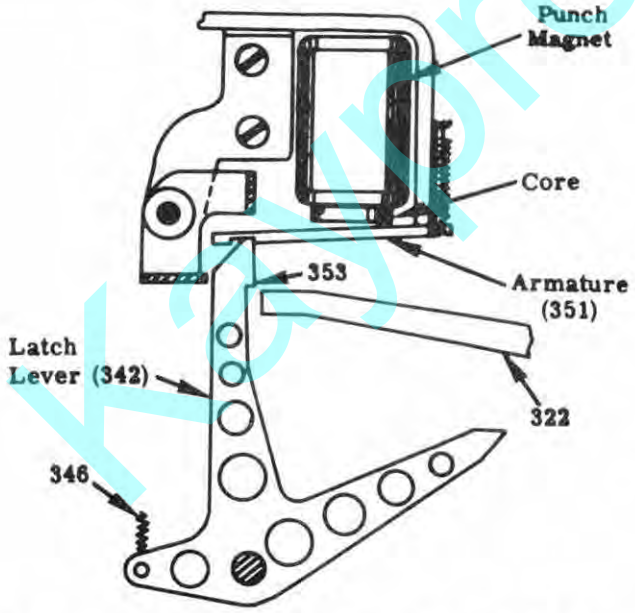


Figure 27- Punch Magnet and Latch Lever

In so doing, the latch lever (342) will pivot in a clockwise direction (Figure 27) because of the tension of spring (346). The point 353 of the latch lever will engage with the tip of punch lever (322).

When the punch cam shaft (315) starts its rotation, the following actions take place.

The roller (358) of the latch lock bail (357) reaches the low side of cam 354 (approx. 60 degrees). This will move the latch lock bail so that it will lock the latch levers in their latched or unlatched position. (See Figure 28). Also, the movement of the latch lock bail will operate the punch lock contacts (PLC).

Following the locking of the punch latch levers, the punch lever and frame assembly (324) begins to rise by action of cam 335 (Figure 29). During the upward movement of lever and frame assembly (324), the rod (323), on which the punch levers (322) are pivoted, is also moved upward. If the left hand ends of the punch levers (322) are not held down against the stop rod (327) by their respective latch levers (342), then the left hand end will be moved upward while the right hand end will be held down by the tension of spring 328. On the other hand, if the left hand ends of the punch levers are engaged by their respective latch levers and held against stop 327, the upward movement of rod 323 will move the right hand end of the punch levers upward. This upward movement of the punch levers will carry their respective code punches upward through the tape, punching a code for those

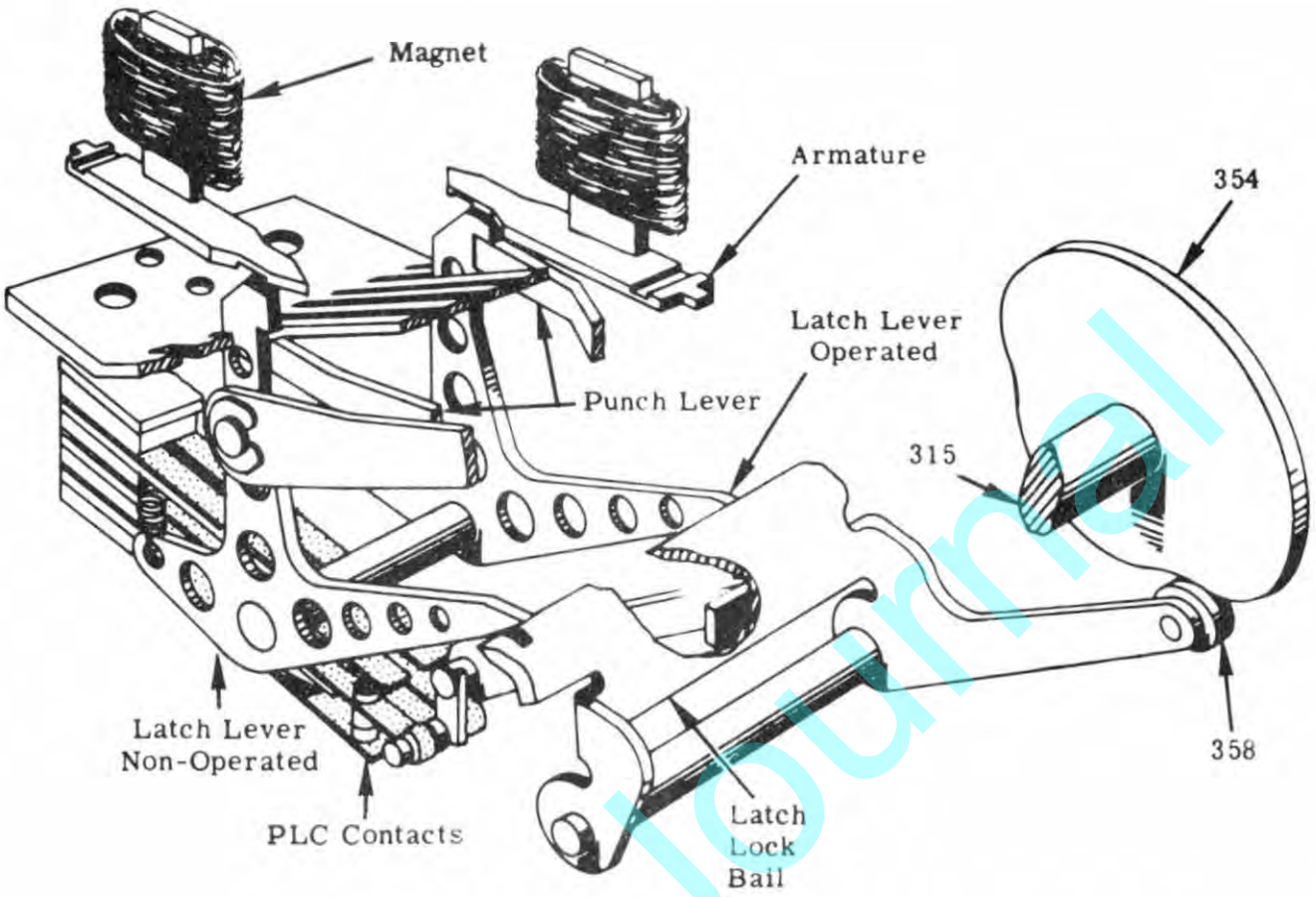


Figure 28 - Latch Lock Bail

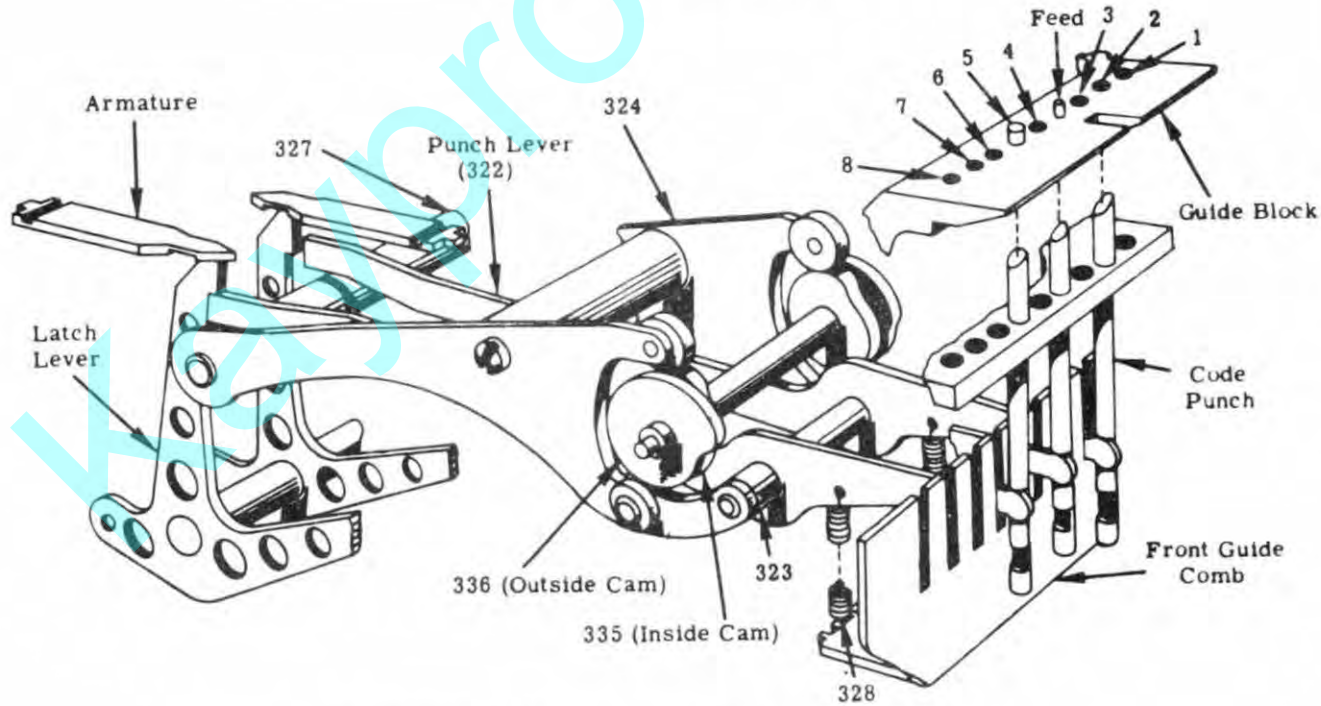


Figure 29 - Latch, Operating Lever and Punch

positions for which the punch magnet has been energized. (The punching takes place at approx. 178 degrees rotation of the cam shaft.)

The punch lever corresponding to the feed punch position is permanently held down against stop 327 by a fixed arm. Therefore, for each revolution of shaft 315, a feed hole will be perforated in the tape.

When the punches have traveled their maximum upward movement, the latch lock bail (357), due to cam 354, starts its movement away from the latch levers (approx. 180 degrees).

During the unlocking of the punch levers, cam 336 returns the punch lever and frame assembly (324). This causes the punches to be returned from the die and to their normal position.

During the mid-part of the punch cycle (the latch lock bail (357) has moved back past the tip of the latch levers), the stud (380) engages the outer end of latch lever restoring bail (379), (Figure30). This action pivots the restoring bail counter-clockwise on its pivot (343). Thus, the restoring bail engages all of the latch levers (342) and moves them counter-clockwise past their armature latching position. In so doing, the lower-most latch lever engages an arm of

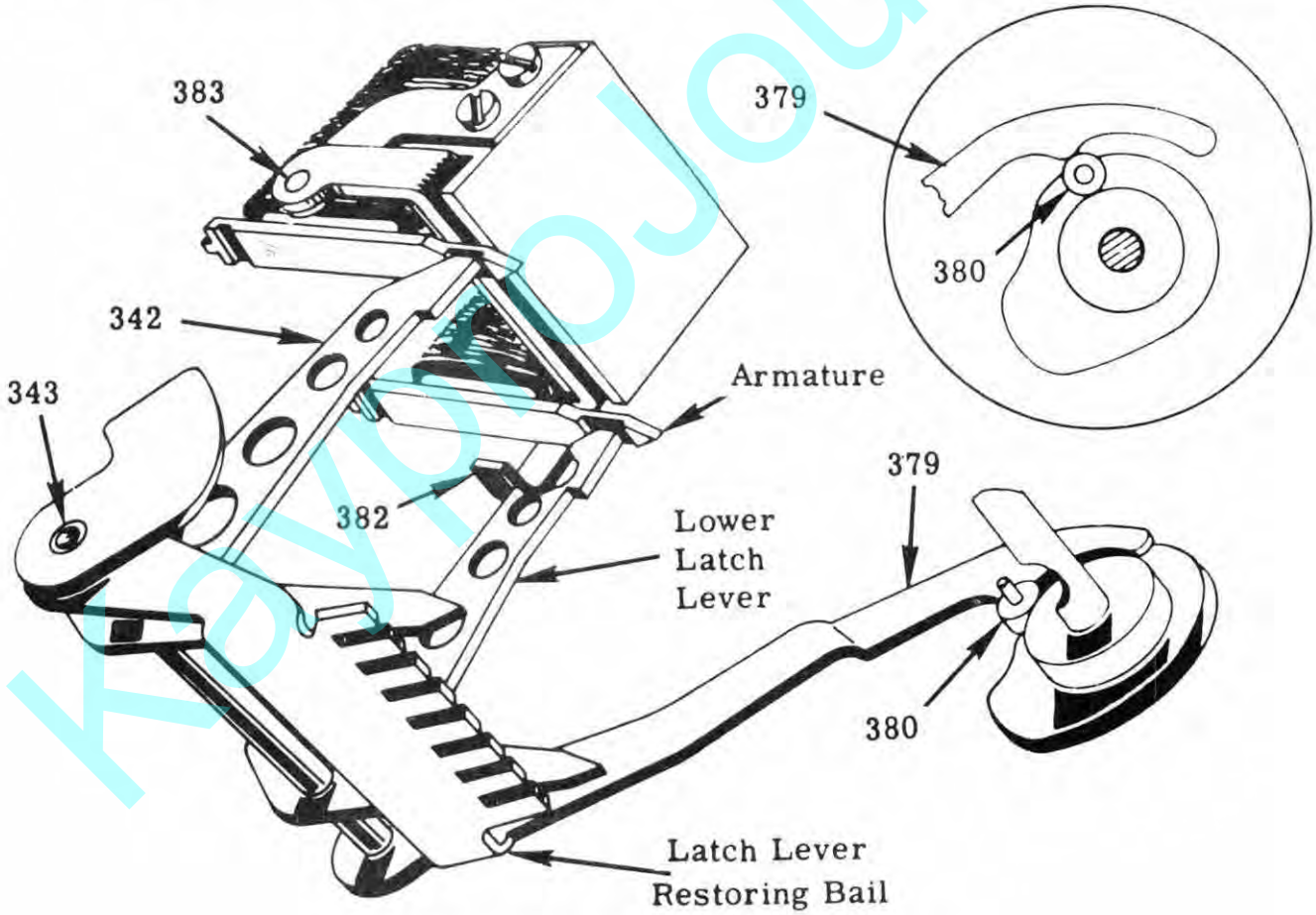


Figure 30- Latch Lever Restoring

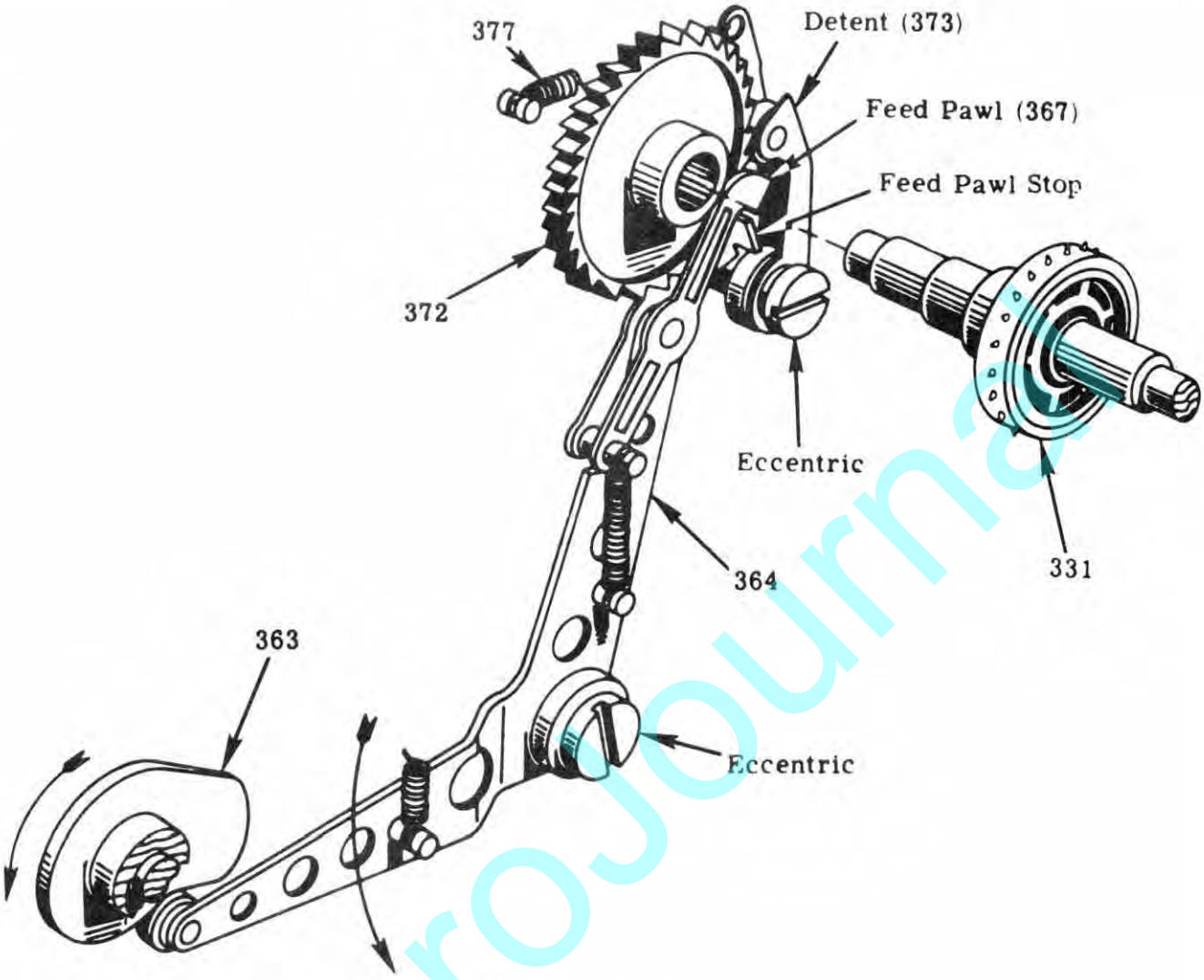


Figure 31- Tape Feed Mechanism

the knockoff bail (382) which pivots on a rod (383). The knockoff bail (382) will pivot in a clockwise direction and engage and release any armature which may be stuck against its punch magnet core. Thus, all armatures (351) will be positioned against the ends of their related latch levers and held there by their related springs (352).

When the knockoff action is completed, stud 380 allows the restoring bail (379) to return to its normal position. Thus, the latch levers (342), due to their related springs (346), will move clockwise until they engage in the notch of their respective armatures.

During the latch restoring and armature knockoff operation just explained, the feed pawl lever arm (364) starts rotating in a counter-clockwise direction, due to cam 363. (Figure 31). This moves the feed pawl (367), engaging a tooth and indexing the ratchet wheel in a clockwise direction. The rotation of the ratchet wheel (372) will rotate the tape feed sprocket (331) and, in turn, advance the tape 1/10 of an inch.

A detent lever (373) is adapted to engage the teeth of the ratchet wheel. The spring (377) keeps the roller of lever (373) in contact with the teeth of the ratchet wheel (372) and thereby stabilizing the operation of the tape feed mechanism.

PUNCH TAPE CONTACT MECHANISM

To light the red warning lamp when the tape runs out, the tape binds or the hold down arm is not in operating position, there are provided three arms, namely: the runout arm, the tension arm, and the tape hold down arm.

The following explains the operation of each of the above mentioned levers: (See Figure 32).

Hold Down Arm - When the tape hold down arm is pivoted clockwise, link 391 moves in the direction shown. The link (391) will move the run-out arm upward pulling link 398 in the direction shown. This will pivot bail 400 clockwise, closing the PTC contact.

Run-Out-Arm - If the tape tears or runs out, the run-out arm will drop below the tape table, pulling on arm 398 and pivoting bail 400 so that the PTC contact will close.

Tape Tension Arm - If the tape binds during operation, the tension arm will move in the direction shown, contacting bail 400 and closing the PTC contact.

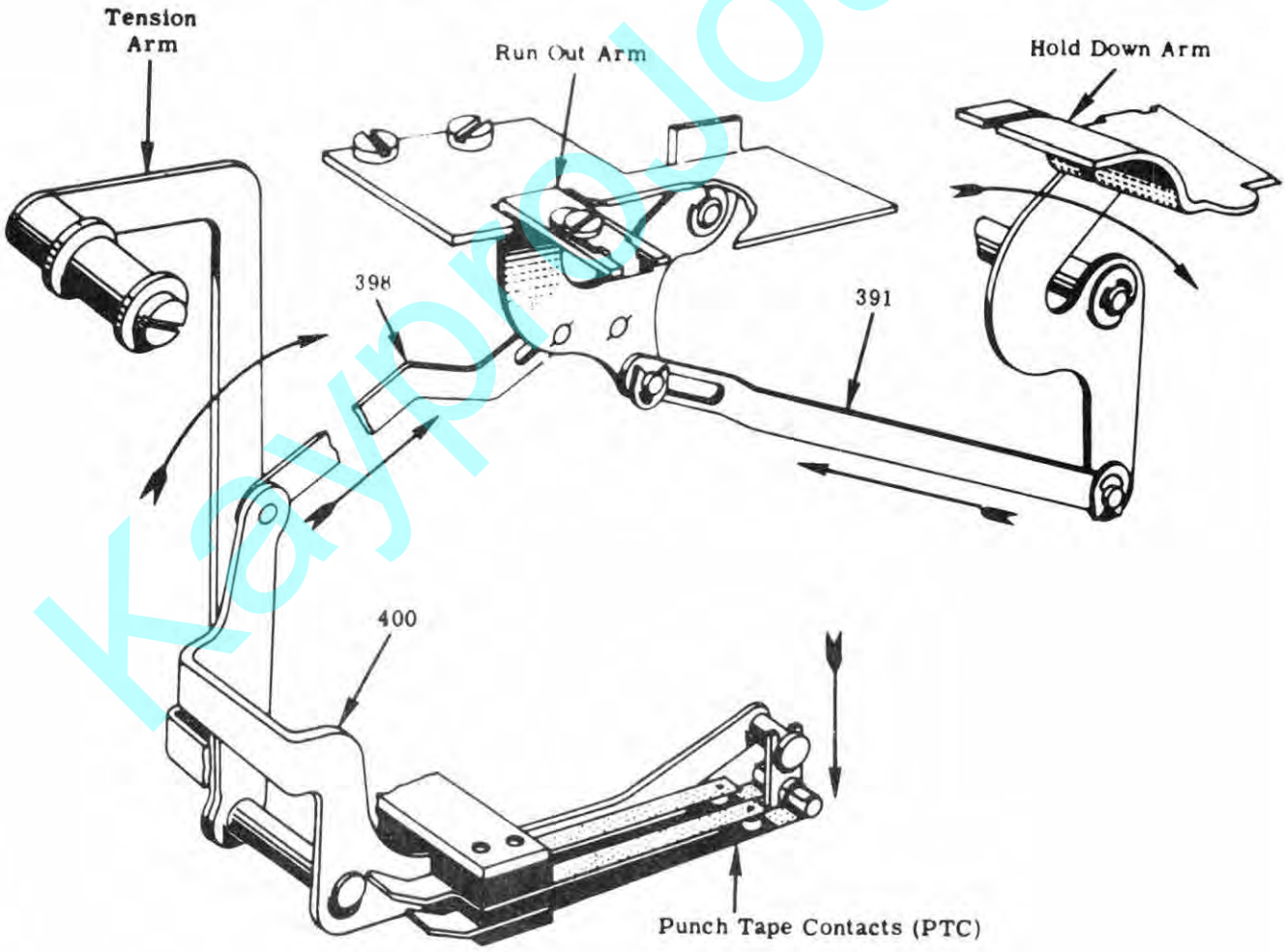


Figure 32- Punch Tape Contact Mechanism

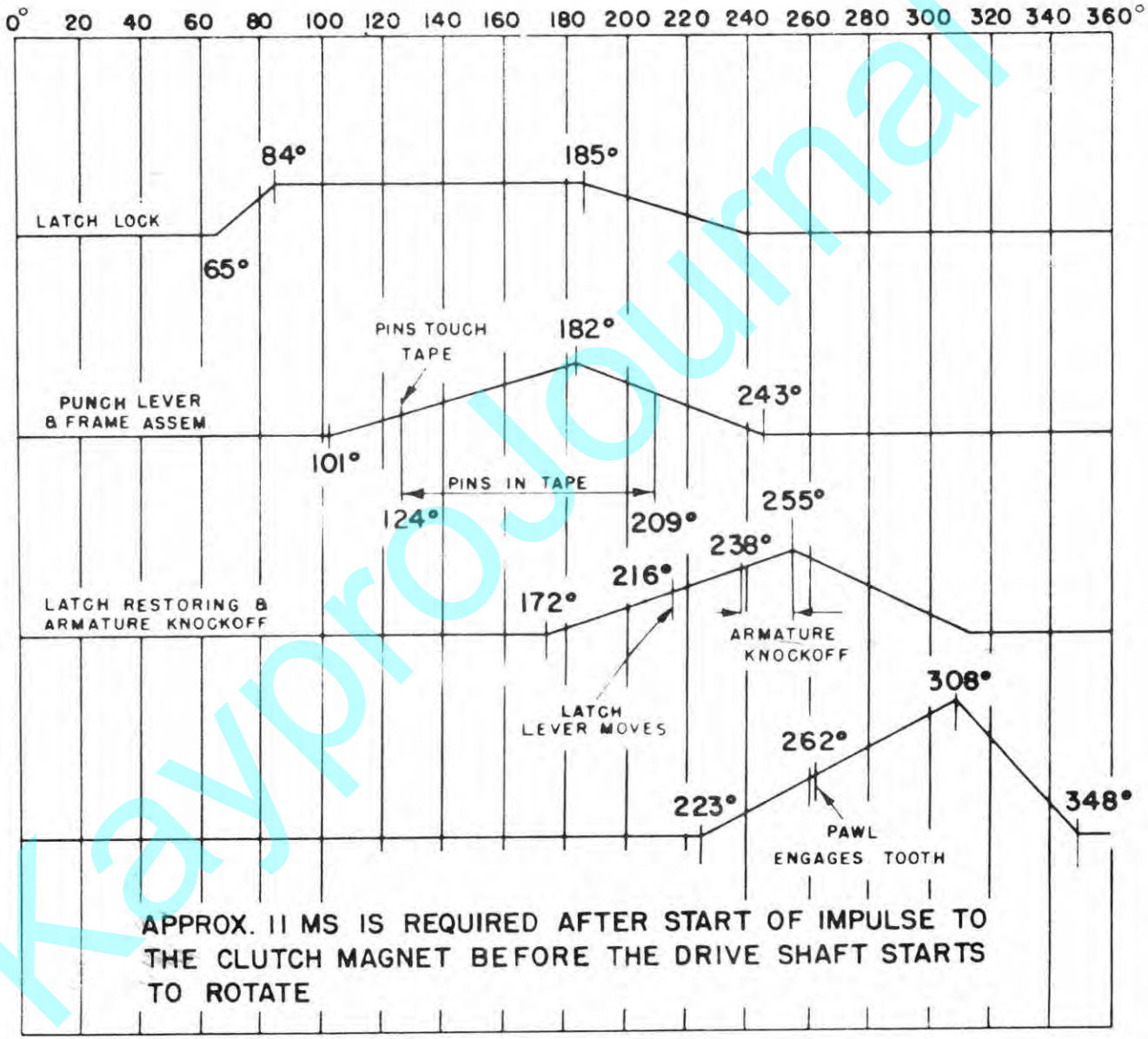
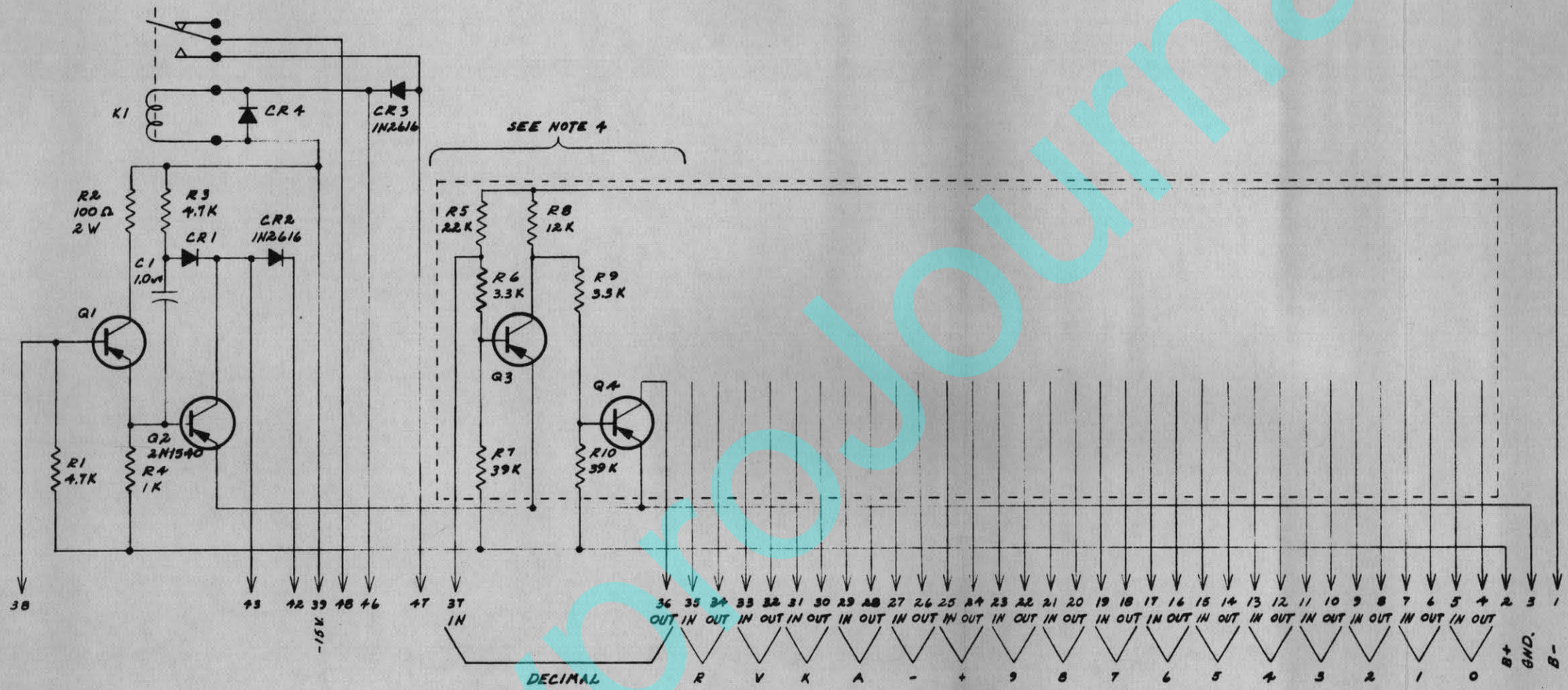


Figure 33 - Timing Chart

REVISIONS					
SYM	ZONE	EFFECT.	DESCRIPTION	DATE	APPROVED
1		ALL	REDRAWN - NO CHANGE	1-7-63	HHalbert



15097-012 SHEET 2

1

4. CIRCUIT IS TYPICAL 17 PLACES
3. RESISTORS ARE ½ W. 10% TOL.
2. DIODES ARE NLS 5003-002
1. TRANSISTORS ARE 2N1374

NOTES, UNLESS OTHERWISE SPECIFIED

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.	NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
PARTS LIST						APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED	DRAWN	H. WALBERT	6-19-62
DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS ± .010 FRACTIONS ± 1/32 ANGLES ± 0° 30'	CHECK		
	APPR	HHalbert	9-17-62
SURFACE ROUGHNESS PER MIL-STD-10 ✓	MATERIAL		
DO NOT SCALE THIS DRAWING	FINISH		
RELEASE DATE 1-7-63			

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

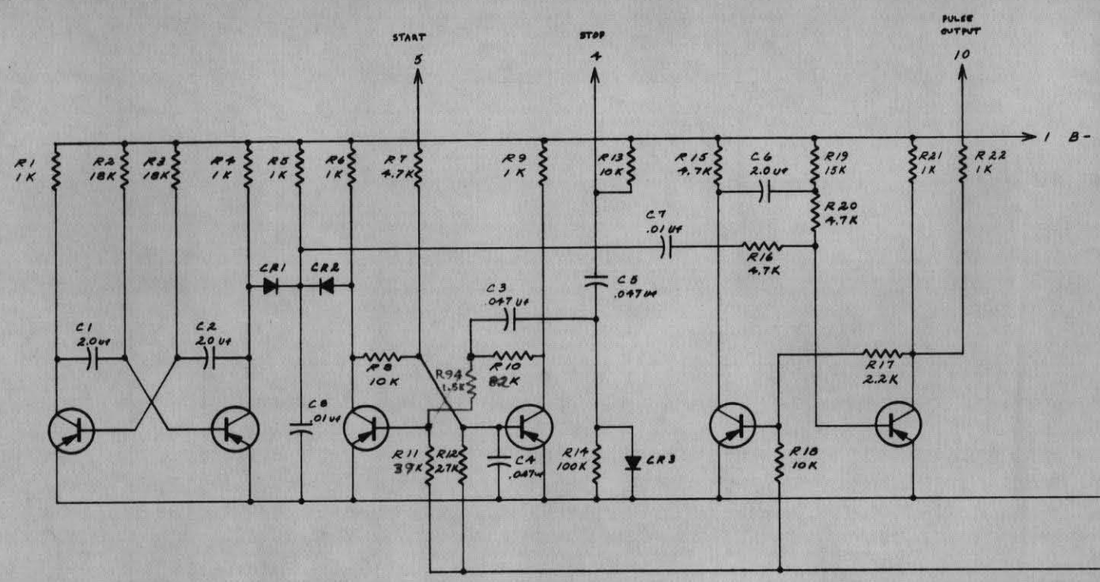
SCHEMATIC

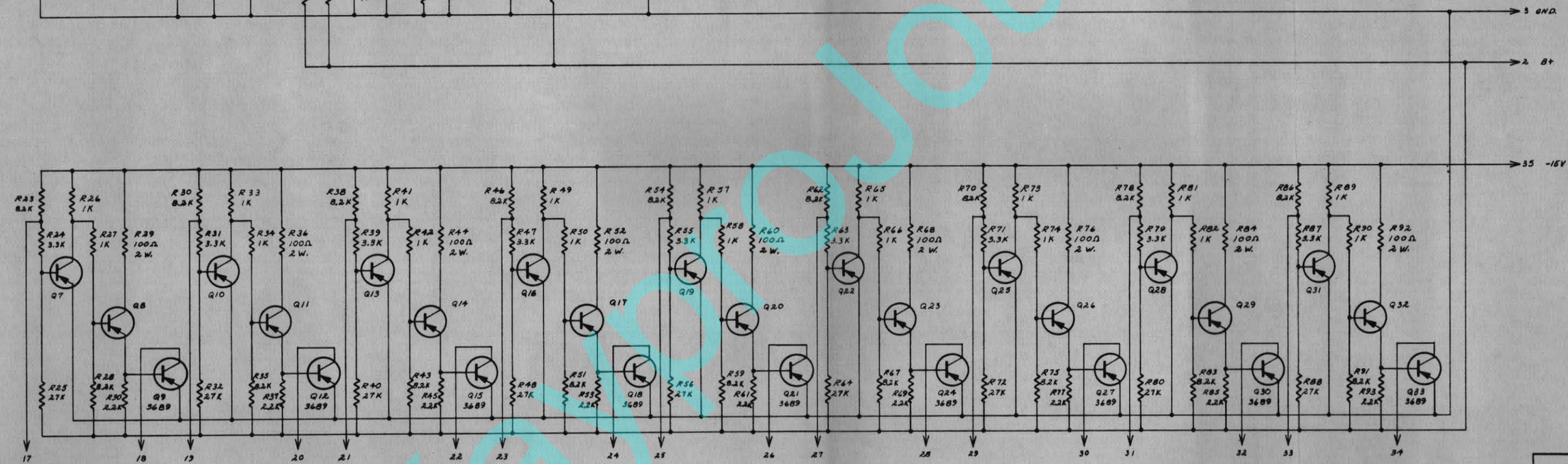
"A" BOARD ASSEMBLY

MODEL RS3

CODE IDENT NO.	SIZE	
03626	C	15097-012
SCALE	WEIGHT	SHEET 2

REVISIONS					
SYM	ZONE	EFFECT.	DESCRIPTION	DATE	APPROVED
1		R53.1 R55.5 & SUBS	R23,30,38,46,54,62,70,78,86 were 10K R26,32,40,48,56,64,72,80,88 were 22K C8 ADDED	10-29-62	H Halbert
2		N.A.	REDRAWN - NO CHANGE	1-8-63	H Halbert
3		R54.4 R58.5 R53.11 & SUBS	R10 WAS 10K; R11 WAS 27K; R94 ADDED	3-8-63	H Halbert





15097-013
B

4. ALL CAPACITORS ARE IN MICRO FARADS.
3. ALL RESISTORS ARE ½W 10% TOL.
2. ALL TRANSISTORS ARE 2N1374
1. ALL DIODES ARE NLS 5003-002
NOTES, UNLESS OTHER WISE SPECIFIED.

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.	NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
		PARTS LIST				APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010
ANGLES ± 0° 30'
FRACTIONS ± 1/32
SURFACE ROUGHNESS PER MIL-STD-10 ✓
DO NOT SCALE THIS DRAWING
RELEASE DATE 10-1-62

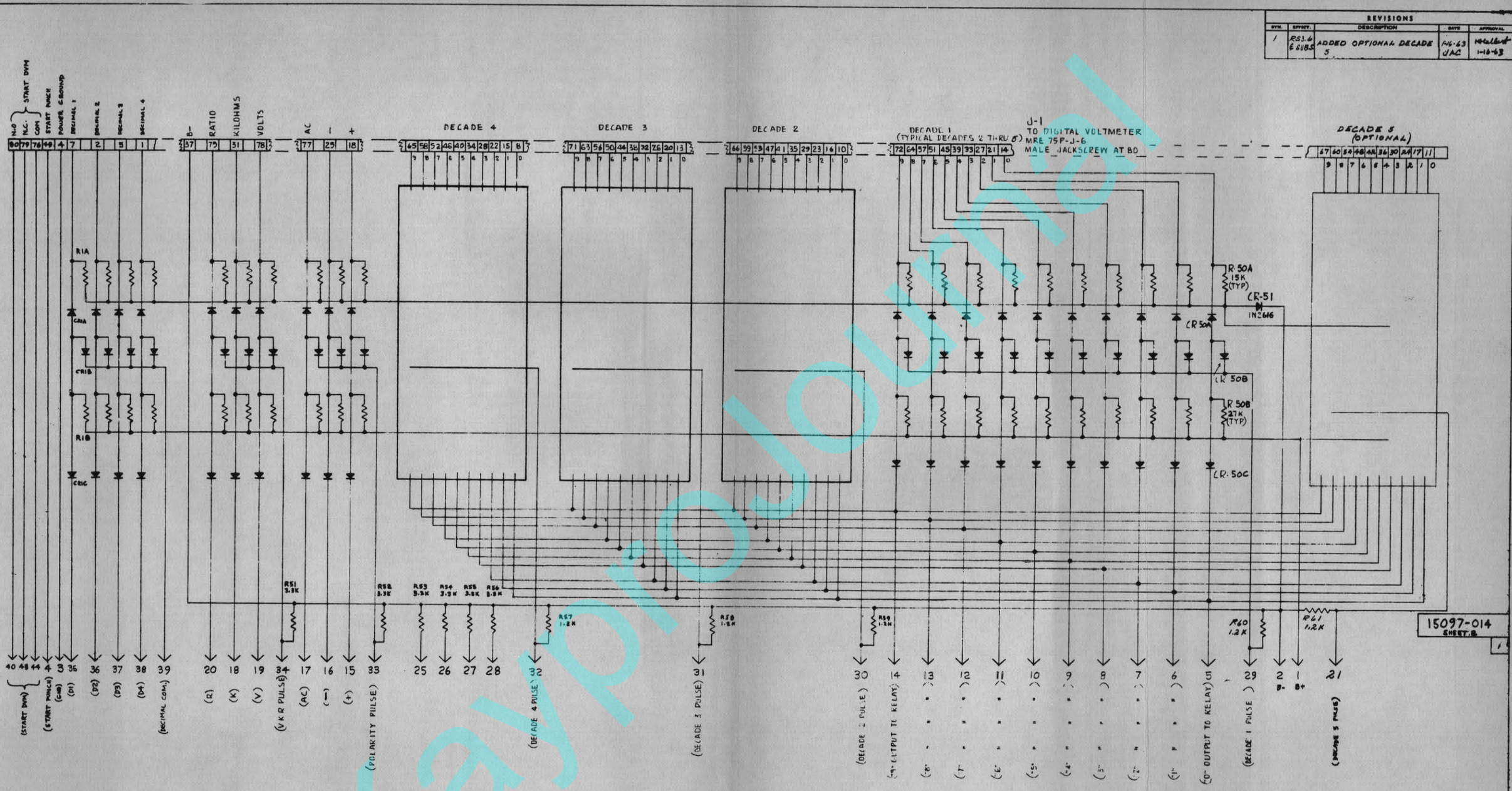
DRAWN	H HALBERT	6-15-62
CHECK		
APPR	H HALBERT	9-17-62
MATERIAL		
FINISH		

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC
"B" BOARD ASSEMBLY
MODEL RS 3

CODE IDENT NO.	SIZE	
03626	D	15097-013
SCALE	WEIGHT	SHEET 2 OF 2

REVISIONS				
SYM.	EFFECT.	DESCRIPTION	DATE	APPROVAL
1	RS3.6 & 6185	ADDED OPTIONAL DECADE 5	11-6-63 JAC	11-18-63



15097-014
SHEET 2

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED	DRAWN BY	DATE 6-15-62
DIMENSIONS ARE IN INCHES	CHECKED BY	DATE
TOLERANCES ON FRACTION ± DECIMAL ± ANGLES ±	APPROVED BY	DATE 9-17-62
MATERIAL	FINISH	

TITLE
SCHEMATIC
"C" BOARD ASSEMBLY
MODEL RS3

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER 15097-014
SCALE | WT. | SHEET 2 OF 2

REVISIONS				
SYM.	EFFECT.	DESCRIPTION	DATE	APPROVAL

— INPUTS —

J5
CEC 300C4-75X1-JR
97503 PINS
(MALE JACKSCREW AT 1)

J3
97-3102A-145-7P-426
FROM ACCESSORY

J2
97-3102A-145-7S-426
TO DIGITAL VOLTMETER

J4
97-3102A-145-7S-426
TO ACCESSORY

K2

K1

H

G

F

E

D

C

B

A

J6

OUT CYCLE

AUTO CYCLE

READOUT

"LOW TAPE"

"TIGHT TAPE"

"INPUT"

GND

"DIRECT" AC/AMPL"

B-

-15V

K1 COIL

GND

TO MAIN BOARD

COMMON

CLUTCH

COLUMN 8

COLUMN 7

COLUMN 6

COLUMN 5

COLUMN 4

COLUMN 3

COLUMN 2

COLUMN 1

B-

TIGHT TAPE

COM

TAPE FEED

LOW TAPE

S1

S2

S3

L10 L9 L8 L7 L6 L5 L4 L3 L2 L1

PUNCH SUB ASSEMBLY

15097-070
SHEET 2A

⚠ SEE DRAWING 15097-070 SHEET 2B FOR REMAINDER OF MAIN BOARD WIRING.

NOTES: UNLESS OTHERWISE SPECIFIED—

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

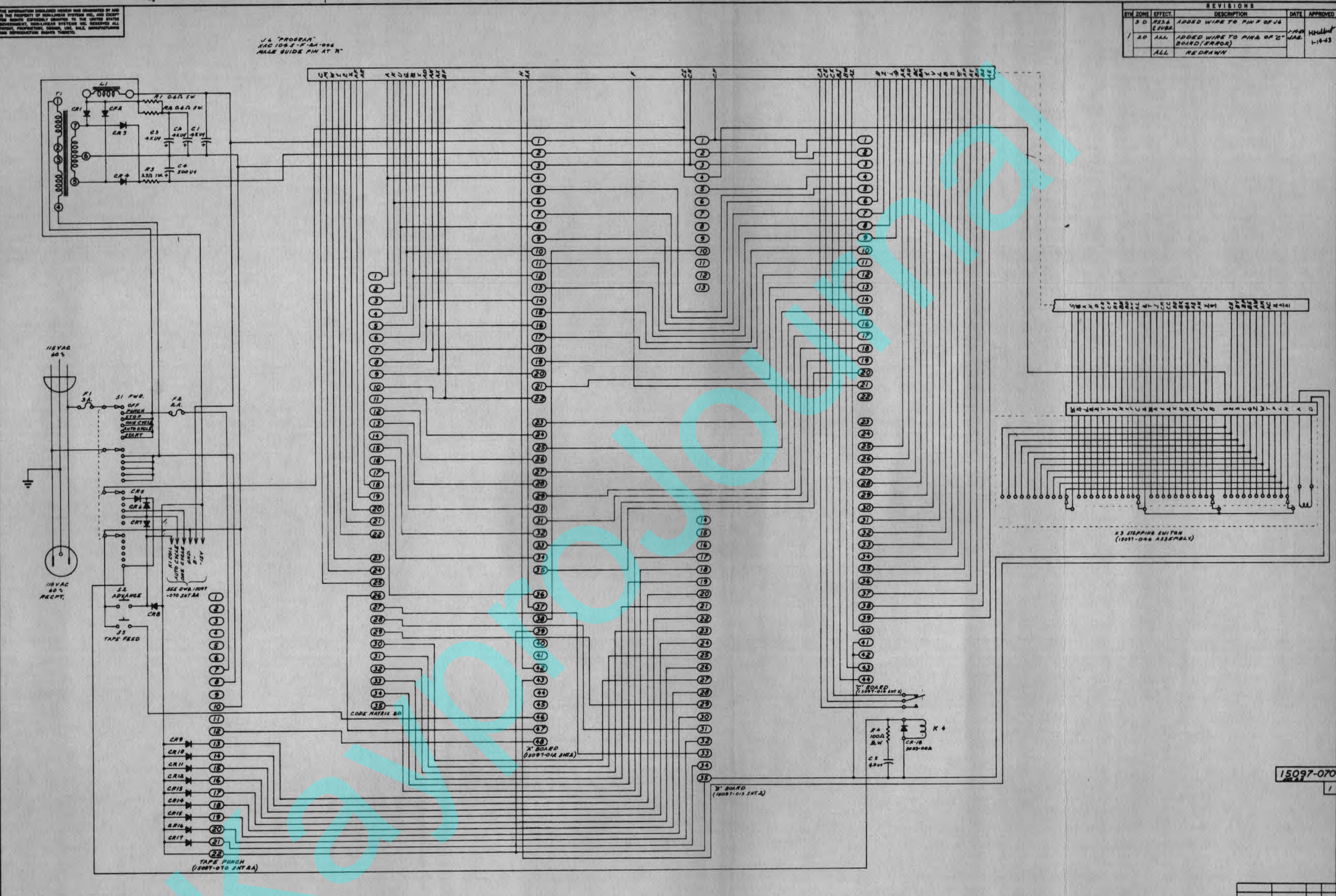
UNLESS OTHERWISE SPECIFIED	DRAWN BY	DATE
DIMENSIONS ARE IN INCHES	[illegible]	7-7-62
TOLERANCES ON	CHECKED BY	DATE
FRACTION DECIMAL ANGLES	[illegible]	8-17-62
± ± °	APPROVED BY	DATE
MATERIAL	[illegible]	8-17-62
	FINISH	

TITLE
SCHEMATIC
SCANNER & PUNCH
MODEL RS3

SCALE | WT.

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER
15097-070
SHEET 2A OF



3. CAPACITORS ARE IN MICRO FARADS.
2. SEE DWG. 15097-070 SHT. AA FOR SCANNER, TAPE PUNCH, & REMAINDER OF J6 WIRING.
1. DIODES ARE IN281L
NOTES, UNLESS OTHERWISE SPECIFIED.

QTY REQD	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MFR. CODE	CIRCUIT REF.	ITEM NO.	NEXT ASSY.	FINAL ASSY.	NEXT ASSY.	FINAL ASSY.
PARTS LIST						APPLICATION		QTY.	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .010 ANGLES ± 0° 30'
FRACTIONS ± 1/32
SURFACE ROUGHNESS PER MIL-STD-10 ✓
DO NOT SCALE THIS DRAWING
RELEASE DATE 1-16-63

DRAWN H. HALBERT 6-21-62
CHECK
APPR H. HALBERT 9-17-62
MATERIAL
FINISH

NON-LINEAR SYSTEMS, INC.
DEL MAR, CALIFORNIA

SCHEMATIC
MAIN BOARD ASSEMBLY
RS 3

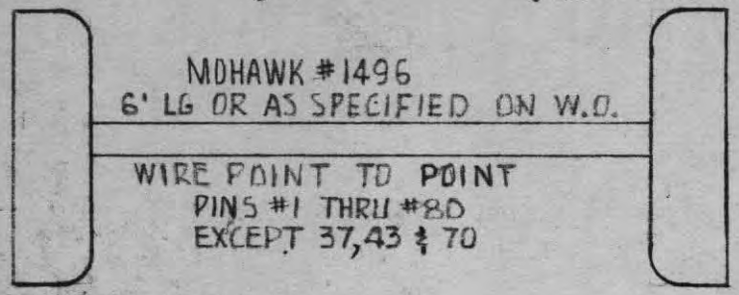
CODE IDENT NO. 03626 | SIZE E | 15097-070
SCALE | WEIGHT | SHEET 2B

DRAWING NUMBER 15004-059 | 3

REVISIONS				
SYM.	EFFECT.	DESCRIPTION	DATE	APPROVAL
1		ADDED -1	21 JAN '59	J. CLEMENT H Clement
2		ADDED NOTE "MARK OR STAMP "15004-059 ETC)	25 MAY 59 ARW	MTS H Clement
3		REMOVED MARKING "CABLE ASSY "A" UNIT TO RELAY ENTRY CONVERTER"	HDB 5-6-60	MTS H Clement

P-1
MRE 75P-JTC-H-6
(MALE JACK SCREW AT "77")

P-2
MRE 75S-JTC-H-6
(MALE JACK SCREW AT "1")



MARK OR STAMP "15004-059" ON CONNECTOR HOOD.

-1 P-2 TO BE MRE 75S-JTC-H-1-6 (HOOD OPENING AT SAME END AS PIN 1.) P-1 TO BE MRE 75P-JTC-H-1-6 (HOOD OPENING AT OPPOSITE END FROM PIN 1.)

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTION ± DECIMAL ± ANGLES ±

MATERIAL

DRAWN BY	Wallin	DATE 24 Sept '58
CHECKED BY	J. CLEMENT	DATE 24 Sept 58
APPROVED BY	H Clement	DATE 9-26-58

FINISH

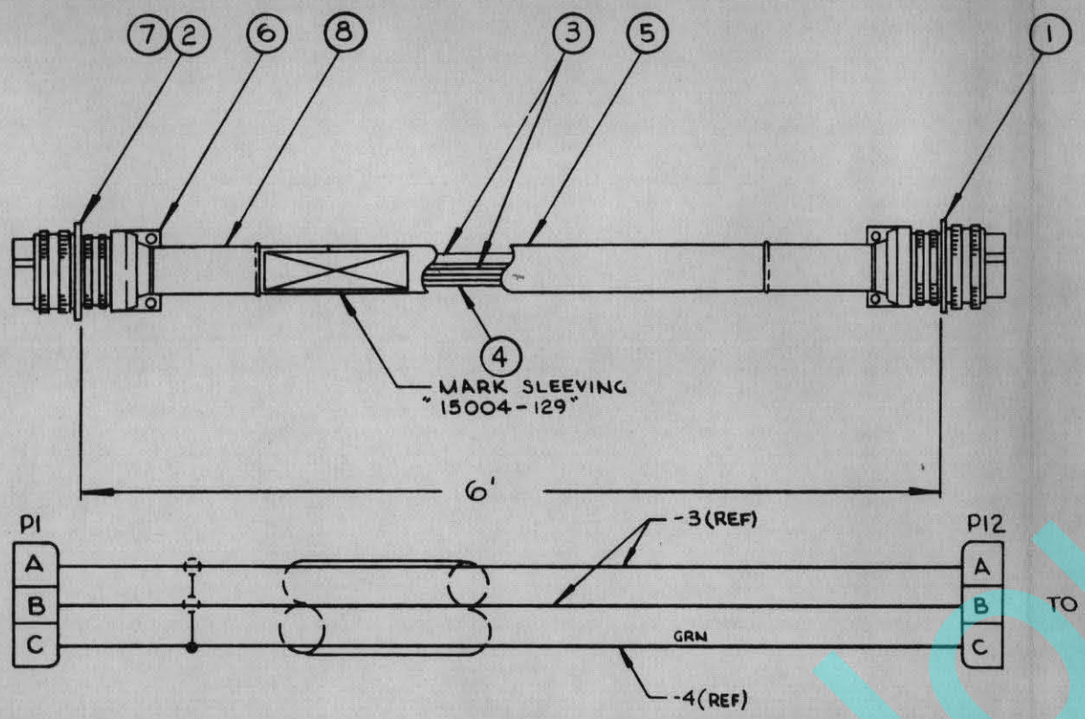
TITLE
CABLE ASSY-

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER 15004-059

SCALE | WT. | SHEET OF

REVISIONS				
SYM	EFFECT	DESCRIPTION	DATE	APPROVAL
1	ALL	REVISED & REDRAWN - LAST CHG "O"	5-21-62	5-26-62
2	ALL	CORRECTED ITEM 6 - WAS MS 3057-6B	7-29-63	C.B.M.



15004-129
2

LIST OF MANUFACTURERS	
NAME	ADDRESS
AMPERITE CO.	NEW YORK, N.Y.
AMPHENOL CORP.	BROADVIEW, ILL.
BELDEN CO.	CHICAGO, ILL.
ALPHA WIRE CORP.	NEW YORK, N.Y.
ILLUMITRONIC ENG. CO.	SUNNYVALE, CALIF.

ITEM	REQ'D	PART NUMBER	DESCRIPTION	MATERIAL OR MANUFACTURER	NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
			LIST OF MATERIAL		APPLICATION		QTY REQD	
	9	A/R	QQ-S-571B	SOLDER,				
	8	2	323932	FERRULE, TERMASHIELD	AMP			
	7	2	18022-6	INSERT, RUBBER	AMPHENOL			
	6	2	MS3057-6A	CLAMP,				
	5	A/R	V105	SLEEVING, VINYL 5/16" ID .02 WALL	ILLUMITRONIC			
	4	A/R	1553	WIRE, TYPE MW 20GA. PLASTIC INSULATED, GRN	ALPHA			
	3	A/R	RG122/U	CABLE, COAXIAL	BELDEN			
P1	2	1	97-3106A-14S-7S-426	CONNECTOR, (BLUE D.A.P. GOLD)	AMPHENOL			
P12	1	1	97-3106A-14S-7P-426	CONNECTOR, (BLUE D.A.P. GOLD)	AMPHENOL	18077	18077	1	1

NOTES:
1. ALL SOLDER CONNECTION TO BE PER MIL-S-6872.

H4-03626

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTION ± 1/32, DECIMAL ±, ANGLES ±

DRAWN BY CUBAN D&M DATE 5-21-62
CHECKED BY A. Chiotta DATE 6-22-62
APPROVED BY L. McGrath DATE 5-26-62

MATERIAL

FINISH

TITLE
CABLE, OUTPUT, ASSY.
AC CONVERTER MODEL 125E TO SERIES 30

MODEL 125E STD

SCALE 1 TO 1 | WT. ~

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER
15004-129

SHEET 1 OF 1

REVISIONS				
SYM.	EFFECT.	DESCRIPTION	DATE	APPROVAL
1	ALL	REQUIREMENTS FOR VINYL SLEEVING (8000 WIRE DELETED); LENGTH ADDED; CUSTOMER NAME & W.O. NO. DELETED.	1-10-68	HW Gilbert

MRE-75P-JTC-H-6
MALE JACK SCREW AT PIN #2

P117

14	10
21	16
27	23
33	29
39	35
45	41
51	47
57	53
64	59
72	66
80	79
76	76
79	80
43	31
37	37
49	49
4	4
82	73
62	78
55	75
81	74
12	12
18	18
25	25
70	77
1	3
3	7
7	2
2	5
5	1
75	
11	14
17	21
24	27
30	33
36	39
42	45
48	51
54	57
60	64
67	72
78	
77	
74	
10	13
16	20
23	26
29	32
35	38
41	44
47	50
53	56
59	63
66	71
13	8
20	15
26	22
32	28
38	34
44	40
50	46
56	52
63	58
71	65

MRE-75S-J-6
MALE JACK SCREW AT PIN #5

P1

V34A VOLTMETER

264 CONVERTER
(4 DIGIT)

15004-203
1

1. CABLE TO BE 8 FEET LONG.

NOTES, UNLESS OTHERWISE SPECIFIED

NEXT ASSY	USED ON	NEXT ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTION ± DECIMAL ± ANGLES ±
MATERIAL

DRAWN BY M. HICKS DATE 12-7-61
CHECKED BY DATE
ENGINEER BY DATE
FINISH

TITLE
CABLE ASSEMBLY
DIGITAL VOLTMETER TO SERIAL CONVERTER
V34A TO 4 DIGIT RG4

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER
15004-203

SCALE WT. SHEET OF

2539

REVISIONS				
QTR.	EFFECT.	DESCRIPTION	DATE	APPROVAL

MRE 75S-JTC-H-6

3	5	7	4	1	2	8	10	11	12	13	14	15	16	17	18	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	62	63	64	65	66	67	70	71	72	73	74	75	76	77	78	79	80	82

MALE JACKSCREW
AT PIN 5

8 FEET LONG

MRE 75P-JTC-H-6

1	2	3	4	5	7	8	10	11	12	13	14	15	16	17	18	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	62	63	64	65	66	67	70	71	72	73	74	75	76	77	78	79	80	82

MALE JACKSCREW
AT PIN 2

AF 2539

SHEET ASSY	USED ON	SHEET ASSY	FINAL ASSY
APPLICATION		QTY REQD	

UNLESS OTHERWISE SPECIFIED	DRAWN BY L.H. Hallett	DATE 6-26-63
DIMENSIONS ARE IN INCHES		
TOLERANCES ON FRACTION DECIMAL ANGLES	APPROVED BY	DATE 6-26-63
MATERIAL	FINISH	

TITLE

CABLE

V-358 VOLTMETER TO
156, R53, & 180

NON-LINEAR SYSTEMS INC.
DEL MAR AIRPORT
DEL MAR, CALIFORNIA

DRAWING NUMBER
2539

SCALE | WT. | SHEET OF