

LA-6759-M

Manual

MASTER

Automatic Sample Changers

Maintenance Manual

University of California



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Automatic Sample Changers Maintenance Manual

Thomas A. Myers

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CONTENTS

ABSTRACT 1

I. INTRODUCTION 1

II. USING THE MANUAL 2

III. STEP-BY-STEP PROCEDURES 3

 1-24 Power Turn On 3

 25-41 Normal Change and Sodeco Time Out 5

 42-49 Skipping A Position and Fast Advance 7

 59-65 Set Time and Start Count 9

 66-73 Master and Slave Clocks 9

 74-156 Readout 10

APPENDIX A:

Model 110 Sample Changer Control 15

Model 110 Data Input Panel D 16

Model 110 Data Input Panel D10 17

Model 1000 Slave Clock 18

Model 1000 Master Clock 19

Model 500 Master Clock 20

Model 500 Slave Clock 21

Sample Changer Control Wiring 22

APPENDIX B:

Sample Changer Control Relay Layout 23

Data Input Panel-Relay Contact Locations 23

Hydraulics Layout 24

AUTOMATIC SAMPLE CHANGERS MAINTENANCE MANUAL

by

Thomas A. Myers

ABSTRACT

This manual describes and provides trouble-shooting aids for the Automatic Sample Changer electronics on the automatic beta counting system, developed by the Los Alamos Scientific Laboratory Group CNC-11. The output of a gas detector is shaped by a preamplifier, then is coupled to an amplifier. Amplifier output is discriminated and is the input to a scaler. An identification number is associated with each sample. At a predetermined count length, the identification number, scaler data plus other information is punched out on a data card. The next sample to be counted is automatically selected. The beta counter uses the same electronics as the prior count did, the only difference being the sample identification number and sample itself.

This manual is intended as a step-by-step aid in trouble-shooting the electronics associated with positioning the sample, counting the sample, and getting the needed data punched on a 80-column data card.

The manual does not cover the front end of the sample changers, such as the detector, gas flow, NIM electronics, or high-voltage power supply. Also not included is the timer-scaler operation, although input to the timer and output from the scaler are used in the step-by-step maintenance manual.

I. INTRODUCTION

MECHANICAL SYSTEM: A 24-position, automatically controlled wheel positions sample plates, with or without absorber and/or spacer, at 3 selectable heights in relationship to a rigidly mounted gas detector (Fig. 1).

ELECTRONIC SYSTEM: Sample changer controller, data panel, slave clock, master clock (which can service give automatic changers), gas detector, and preamplifier (Fig. 1). Solid-state electronics and a timer scaler, 625 punch control and a 526 card punch.

OPERATION: A sample is selected and positioned at one of three shelves. A 12-row 38-column data card is read (Fig. 2). One of the many things read is a predetermined count length. Counting begins at the click of a clock. Counts are stored in the scaler as the timer counts up. Counting will stop when count length equals timer time. Data

from the scaler and data card are automatically punched on a 12-row 80-column data card, by an IBM 526 summary punch (Fig. 3).

At present, 18 systems of this type are connected in the automatic counting system.

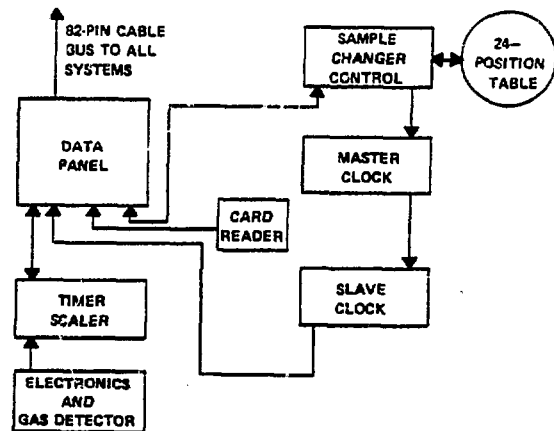


Fig. 1 - Major blocks of one system.

6201650363010732942089999+17670-4

SAMPLE IDENTIFICATION			COUNT			ZERO			CHEM.			LAMBDA			SPARE		
SHOT	UJG	MASS	LENGTH	Y	DAY	YIELD	Z	ZERO	CHEM.	LAMBDA	Z.A.Z.	SPARE	SPARE	SPARE	SPARE	SPARE	
000	000	000	000	000	000	000	000	000	000	000	000	000	000	000	000	000	
111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111	
222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	222	
333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	333	
444	444	444	444	444	444	444	444	444	444	444	444	444	444	444	444	444	
555	555	555	555	555	555	555	555	555	555	555	555	555	555	555	555	555	
666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	666	
777	777	777	777	777	777	777	777	777	777	777	777	777	777	777	777	777	
888	888	888	888	888	888	888	888	888	888	888	888	888	888	888	888	888	
999	999	999	999	999	999	999	999	999	999	999	999	999	999	999	999	999	

Fig. 2 - Data input card.

62016503614 0145948700009 10100279375942089999+17670-4

SAMPLE IDENTIFICATION			DATE	SCALE	ING. OF	SCAL.	COUNT	BACK	Z	ZERO	CHEM.	LAMBDA
SHOT	UJG	MASS	Y	LIGHT FACTOR	LENGTH	GROUND	Y	TIME	YIELD	Z.A.Z.		
000	000	000	000	000	000	000	000	000	000	000	000	000
111	111	111	111	111	111	111	111	111	111	111	111	111
222	222	222	222	222	222	222	222	222	222	222	222	222
333	333	333	333	333	333	333	333	333	333	333	333	333
444	444	444	444	444	444	444	444	444	444	444	444	444
555	555	555	555	555	555	555	555	555	555	555	555	555
666	666	666	666	666	666	666	666	666	666	666	666	666
777	777	777	777	777	777	777	777	777	777	777	777	777
888	888	888	888	888	888	888	888	888	888	888	888	888
999	999	999	999	999	999	999	999	999	999	999	999	999

Fig. 3 - Data output card.

II. USING THE MANUAL

Reference locations in the following step-by-step procedure are keyed to "Model 110 Sample Changer Control" (schematic Dwg. No. D2 in Appendix A). In Step 1, "AC Switch" will be found at co-ordinate 4H on that drawing, KS will be found at 4C, (11) will be found at 5F, and so forth.

Only two other drawings in Appendix A use the co-ordinate system: data input panels 010 and 011. Reference to these will occur in the step-by-step as, for instance, 10-5C or 11-7A. Note that the "10" of "10-5C" references the drawing and the "5C" the co-ordinate on that drawing.

Relay layouts for the sample changer control and data input panel that appear in Appendix B are useful in troubleshooting the electronics. For example, in the sample changer control the error condition is being entered all the time. In the sample changer control relay layout, K17 is the error relay and contacts A and C are not being used. Either A or C could be used to start the change sequence over again when the error condition was entered. The layout is thus extremely helpful in the location of relay coils and their associated contacts.

III. STEP-BY-STEP PROCEDURES

Manual, change, index wait, no fast-advance ac on data panel, master and slave clock with 55-kPa (80-psi) air supply connected.

- 1 AC Switch turns on sample changer control. K5 picks. (11) is B+. With card reader opened and sample out, (10) is supplied with B+; this picks K5.

Ref.	Co-ord.
AC Switch	4H
K5	4C
(11)	5F
(10)	4C

- 2 DC On depressed. K15 picks and is held on through K15C. B+ and B- are supplied to sample changer control through K15B. K3 picks, closes K3A. K13 picks if KS is in correct position (home) one of three.

DC On	5F
K15	5F
K15C	5F
B+ B-	5E
K15B	5E
K3	2C
K3A	4C
K13	3F
KS-1-3	4F

- 3 K15A, K15D, K3A, all closed, supply 115 Vac to (7) and (8). Rotate table, and hold index solenoid will energize, causing table to rotate till index switch is made.

K15A	3D
K15D	3D
K3A	4C
(7) (8)	4D

- 4 When table is indexed, switch is made. (11) B+ is supplied through "index," "spacer out," and "absorber out" switches. This applies B+ to (6). K picks "indexed" lights. K4A holds K3 picked with K5A.

(11)	5F
B+	5E
(6)	4B
K4	4B
"Indexed"	4B
K4A	2C
K3	2C
K5A	2C

- 5 K4 being picked. K4A holds K3 picked. K4B will pick K7 for 0.5 s by discharge of 70- μ F capacitor (cap). K4C is redundant. K4D closed will supply 115 Vac through K6D and K1C to (3) and (4).

K4	4B
K4A	2C
K3	2C
K4B	2D
K7	2D
K4C	4E
K4D	3B
K6D	3B
K1C	3B
(3) (4)	4B

- 6 With 115 Vac on (3) and (4) solenoid that inserts sample and closes reader will be energized. When reader is closed and sample is in, (10) will no longer have B+. K5 opens. K5A is opened, but K4A holds K3. K5B is opened, but K4C connects (14) to table. K5C closed enables (22) and (23). K5D contacts (closed) light "reader closed" lamp.

(3) (4)	4B
(10)	4C
B+	5E
K5	4C
K5A	2C
K4A	2C
K5	2C
K5B	4E
K4C	4E
(14)	4E
K5C	2F
(22) (23)	2F
K5D	3C

7 When K4B is closed, K7 picks. With K7 energized, two 70- μ F caps charge. After 0.5 s, K7 opens. This picks K9 for 1 s. K9 picks K8.

K4B	2D
K7	2D
K9	2E
K8	2E

8 K8A and K8B opening and closing at this time do nothing. K8C charges 70- μ F cap. K9 opens after 1 s.

K8B	2F
K8C	2F
K9	2E

9 K8C closes. (22) and (23) are now satisfied because sample is all the way up (in), which closes a switch. K10 picks.

K8C	1F
(22) (23)	2F
K10	2F

10 K11 picks through K12A and K10B. K12 picks through K11A and K10B. The 70- μ F cap already charged will hold K11 picked for 0.07 s through K11C.

K11	2G
K12A	2G
K10B	2G
K12	2G
K11A	2G
70 μ F	2G
K11C	2G

11 When K10 picked, K10C picked K16. K16A closes (3) and (4) connects to data panel. This allows the card on the table to be read. K16C holds K16 picked.

K10	2G
K10C	2H
K16	2I
K16A	3E
(3) (4)	3E
K16C	2I

12 With K12 picked. K12A opens, allowing K11 to time out. K12B steps KS1. K12D connects (3) (5); K12C connects (11) (6) to data panel.

K12	2G
K12A	2G
K11	2G
K12B	2H
KS1	2H
K12D	4F
(3) (5)	4G
K12C	4G
(11) (6)	4H

13 KS1 stepped from position B to C. K13 de-energizes. K13A closes. K13C closes.

KS1 1st step, at C

KS1	2H
K13	3F
K13A	2C
K13C	2F

14 KS1-3 in position C de-energizes K13. K13A closes, holding K10 picked. K13C closes.

KS1	2H
K13	3F
K13A	2G
K13C	2F

15 K12 is picked. K11 times out. K11A opens. K12 de-energizes. With K12 de-energized, K12A completes path to pick K11 again. K11C starts cap charge.

K12	2G
K11	2G
K11A	2G
K12A	2G
K11C	3G

16 At this time KS1 is stopped at position C.

KS1	2H
-----	----

17 K11 picks. K11A picks K12. K11 starts time out through K11C cap discharge, because K12A opens. K12B steps KS1. K12D connects (3) to (7); K12C connects (11) to (8).

(3)	(7)
(11)	(8)

K11	2G
K11A	2G
K12	2G
K11C	3G
K12A	2G
K12B	2H
KS1	2H
K12D	4F
3	7
K12C	4H
11	8

18 K11 times out. K11A opens. K11C charges cap when K12 de-energizes through K12A.

K11	2G
K11A	2G
K11C	3G
K12	2G
K12A	2G

19 At this time KS1 is stopped at position D.

KS1 2nd step, at D

20 K11 picks. K11A picks K12. K11 starts time out through K11C, when K12A opens. K12B steps KS1. K12D connects 3 to 9. K12C connects 11 to 10 in data panel.

K11	2G
K11A	2G
K12	2G
K11C	3G
K12A	2G
K12B	2H
KS1	2H
K12D	4F
3	9
K12C	4F
11	10
	4H 3H

21 K11 times out. K12 de-energizes, because K11A opens. K11 picks through K12A. K11A closes. K11C charges cap. KS1 is now stopped at position E.

KS1 3rd step, now at E

K11	2G
K12	2G
K11A	2G
K12A	2G
K11C	3G
KS1	2H

22 K12 picks. K12A opens. K12B closes, stepping KS1. K11 starts time out. K12D connects 3 to 5. K12C connects 11 to 6. KS1 is now at position F.

KS1 4th step, now at F

23 K13 picks through KS1-3F. K13A opens. K10 de-energizes, K11 and K12 de-energize. K13C closes.

K13	3F
KS1-3F	3F
K13A	2G
K10	2F
K11	2G
K12	2G
K13C	2F

24 At this time the table is indexed, the sample is all the way up, and the card reader is all the way down and is being read.

*Normal cycle would start here to collect data, at click of next clock.
Normal change and Sodeco time out.*

25 At the next click of the clock, K14 picks then de-energizes. Clock clicks are 86 s apart. K14A opens. K16 de-energizes. K16A opens 3 and 4.

K14	6F
K14A	1I
K16	2I
K16A	3E
3	4
	3E

26 K14B drives Sodeco relay down one count (relay is preset, usually at 99).

K14B 6F

The count of 99 going to zero will insure that a card is punched and that the changer will go to the next sample. The maximum count from

cards is 100 min; 99 clicks of the clock would equal 99 x 86 s, well over 100 min.

- 27 Two things are being done here: (1) a normal change is gone through, and (2) an error condition is checked for (Sodeco time out). Assume Sodeco count has counted down to zero (this is an error). Sodeco relay closes. K17 picks. K17C closes. $\diamond 16$ has B+ applied to it. K17B closes, which lights "time out." With $\diamond 16$ having B+, K11 in data input panel picks.

Sodeco relay	6E
K17	6F
K17C	7F
$\diamond 16$	6I
B+A	4G
K17B	7F
"Time out"	7E
K11	10-4E

- 28 When K11 (DIP) picks, $\diamond 1$ and $\diamond 2$ are closed; this will reset the Sodeco drive count to 99 (preset value).

K11 (DIP)	10-4E (DIP)
$\diamond 1$ $\diamond 2$	1A 10-5E (DIP)
Drive	6E

- 29 $\diamond 1$ and $\diamond 2$ supply B+ to K1. K1 picks. K1A closes. K1 is held picked through K1A and K8A. K1B closes. The 100- μ F cap already charged picks K2. K1C opens, which removes 115 Vac from $\textcircled{3}$ and $\textcircled{4}$.

$\diamond 1$ $\diamond 2$	1A
B+	1I
K1	2B
K1A	2B
K8A	2B
K1B	2B
K2	2C
K1C	3B
$\textcircled{3}$ $\textcircled{4}$	4B

- 30 Remember that two solenoids are connected between $\textcircled{3}$ and $\textcircled{4}$. One, normally open, closes to insert sample and close reader. Two, normally closed, opens to insert sample and close reader. This second solenoid will close with no 115 Vac on $\textcircled{3}$ and $\textcircled{4}$. The

reader will come up and the sample will come out.

$\textcircled{3}$ $\textcircled{4}$ 4B

- 31 With reader up and sample out, $\textcircled{10}$ will be supplied with B+ $\textcircled{11}$.

$\textcircled{10}$ 4C
 $\textcircled{11}$ 5F

- 32 K5 picks. K18 picks. K2 being picked holds K1 picked.

K5 4C
K18 3C
K2 2C
K1 3A

- 33 K5A closes. K5B connects $\textcircled{14}$ to 115 Vac. K5C opens; this does nothing now because K10 was already de-energized in step 23. K5D opens, and the "reader closed" lamp goes off.

K5A 2C
K5B 4E
 $\textcircled{14}$ 4E
K5C 2F
K10 2F
K5D 3C
"reader closed" 4C

- 34 K18C opens. K3 de-energizes. K18D adds more time to K2 being energized.

K18C 2C
K3 2C
K18D 2B
K2 2C

- 35 K2 will remain picked for 4 s then time out. K3A opens. 115 Vac is removed from $\textcircled{7}$ and $\textcircled{8}$. There are two solenoids between $\textcircled{7}$ and $\textcircled{8}$. One, normally open, closes to rotate table and hold index solenoid, when $\textcircled{7}$ and $\textcircled{8}$ have 115 Vac applied. Two, normally closed, will open when $\textcircled{7}$ and $\textcircled{8}$ do not have 115 Vac.

K2 2C
K3A 4C
 $\textcircled{7}$ $\textcircled{8}$ 4C

36 "Closed if indexed" switch will open. (11) will no longer supply (6) with B+.

(11)	4F
(6)	4B
B+	5E

37 K2 times out. K2 wiper returns to contacts 4,5. K3 picks. K3A closes. (7) and (8) supply 115 Vac to rotate table and hold index solenoid.

K2	2C
K2 4,5	1C
K3	2C
K3A	4C
(7) (8)	4C

38 Table will rotate till index switch is closed. When this happens, (11) B+ will be supplied to (6). K4 picks; "indexed" lamp will light. K4A will close. K4B will close. Already charged cap will pick K7. K4C will supply 115 Vac to (14). K4D closes.

(11)	4F
B+	5E
(6)	4B
K4	4B
"indexed"	4B
K4A	2C
K4B	2D
K7	2D
K4C	4E
(14)	4E
K4D	3A

39 K7 being picked connects contacts 1, 2 to charge caps. K7 times out. K9 picks through contacts 4,5. K8 picks through K9 contacts 1,2.

K7	2D
K7 1,2	1E
K9	2E
K7 4,5	1E
K8	2E
K9 1,2	1E

40 K8A opens. K1 de-energizes. K8B is used only on fast advance. K8C charges cap.

K8A	2B
K1	2B
K8B	1F
K8C	1F

41 K1A opens. K1B opens. K1C closes. 115 Vac is supplied to (3) and (4). Reader will start down (to close), sample will start up.

K1A	2A
K1B	2B
K1C	3B
(3) (4)	4B

This completes the normal change and error time out to punch out blank card.

Reader is all the way down and sample is all the way up. K9 times out. This takes us back to Step 8 and would end at Step 24.

SKIP

Now skipping a position and fast advance will be covered.

42 A pin will be inserted in the skip position on the table. Skip switch closes. (5) being B+ will supply B+ to (12). K6 picks. K6A closes, which does nothing. K6B closes - this will pick K2 when K8 picks. K6C opens, which will inhibit K10 from energizing. K6D opens, removing 115 Vac from (3) and (4).

(5)	4B
B+	4B
(12)	4D
K6	2D
K6A	1C
K6B	1F
K2	2B
K8	2E
K6C	2F
K10	2F
K6D	3A
(3) (4)	4A

43 K5 and K18 are already energized from (11) B+ through "reader open" and "sample out" switches. This was set up by completion of previous change. K3 picks through K5A. K3A

supplies 115 Vac to (7) and (8). Table starts to rotate and does so till table is indexed.

K5	4C
K18	3C
(11)	5F
B+	5E
K3	2C
K5A	2C
K3A	4C
(7) (8)	4C

44 (11) now supplies B+ to (6) through "index closed" switch. K4 picks. K4A closes, hold-K3 energized. K4B closes, which picks K7. K4D closes, but K6D is still open, which inhibits reader closing and sample going up.

(11)	5F
B+	5E
(6)	4B
K4	4B
K4A	2C
K3	2C
K4B	2D
K7	2D
K4D	3A
K6D	3A

45 K7 1,2 charges caps. K7 times out. K7 4,5 picks K9. K9 4,5 picks K8. K8A opens. K8B closes. Already charged cap picks K2. K8C charges cap. K9 times out. K9 4,5 open. K8 de-energizes. K8A closes. K8B opens. K8C opens.

K7 1,2	1E
K7	2D
K7 4,5	1E
K9	2E
K9 4,5	1E
K8	2E
K8A	2B
K8B	1F
K2	2C
K8C	1F
K9	2F
K9 4,5	1E

46 K2 4,5 opens. K3 de-energizes. K3A opens. With no 115 Vac on (7) and (8), index arm retracts. "Closed if indexed" switch opens. Pin (11) B+ no longer supplies (6) with B+.

K2 4,5	1C
K3	2C
K3A	4D
(7) (8)	4C
(11)	5F
(6)	4B

47 K4 de-energizes, and "indexed" lamp goes out. K4A closes. K4B charges cap. K4C opens; K4D opens.

K4	4B
K4A	2C
K4B	2D
K4C	4E
K4D	3A

48 When 80- μ F cap through K8B and K6B times out, K2 de-energizes. K2 4,5 opens. K3 picks. K3A supplies 115 Vac to (7) and (8). Table will rotate till indexed. When table started to rotate, (5) B+ to (12) opened. K6 de-energizes.

80 μ F	2F
K8B	1F
K6B	1F
K2	2C
K2 4,5	1C
K3	2C
K3A	4C
(7) (8)	4C
(5)	4B
B+	4B
(12)	4D
(K6)	2D

49 K6A opens. K6B opens. K6C closes. K6D closes, allowing 115 Vac to (3) and (4) when K4 is picked, if that position is not a skip.

K6A	1C
K6B	1F
K6C	2F
K6D	3B
③ ④	4A
K4	4B

End of Skip

Data input panel. Select relays to set time and start count.

- 50 Back at Step 13. At position C on KS1. K16 still picked. K21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32 are all picked (10-4F-G).
- 51 This disconnects all the card reader columns from J1, which goes to IBM 526 summary punch. K14, 15, 16 (10-5 and-6J) contacts are all open; this disconnects all rows.
- 52 At this time, count length on card reader is being read. Assume a count length of 1 min. This is a punch in row 0 column 11, row 0 column 12, and row 1 column 13 = 0 0 1.
- 53 Rows 1, 2, and 5 are being read from card at 11-1K through K29B, K29C, and K30B.
- 54 With KS1-2 in SCC (sample changer control) (4F) at position C with K12D closed (step 12), ③ which is B+A from Data Panel (10-4E) is connected to ⑤ (10-6A), and ⑪ B-A is connected to ⑥ (10-5E).
- 55 This puts B+A on ⑤ (11-6A). K26B is closed. ③⑦ (11-6A) is card reader column 11. B+A is at column 11 on card reader; however, only rows 1, 2, or 5 would supply B-A to pick a relay at 10-5F, G, H. No relay picks.
- 56 KS1 in SCC steps to D (Step 17). Now ③ 4G in SCC is connected to ⑦, and ⑪ is connected to ⑧. ⑦ (11-6B) through K26C connects 38, which is column 12 on card. Again card is not punched in row 1, 2, or 5.
- 57 KS1 in SCC steps to E (step 20). ③ connects to ⑨. ⑪ connects to ⑩. ③ being B+A through ⑨ (11-6C) through K26D to ③⑨ (11-6C) supplies B+A to column 13 on card reader. Rows 1, 2, and 5 (11-1K) are being sensed. B-A comes back through row 1. ②⑤

(11-1K) through K29B (10-5E) picked contacts.

- 58 KS1 in SCC is at position ⑩ K29B. No contacts being closed (11-1K) supplies B+A to (10-5E). ⑩, being B-A, picks K36. K36A and K36B close, holding K36 energized (10-5G). K36C (10-6A) closes. ②⑤ is connected to ④② in PCI. K36D (10-5I) closes. Because ②⑤ is connected to ④②, PCI starts when K14 in SCC picks 6F.

Timer and scalars — start to count and collect data from electronics.

500 Model Master Clock

- 59 When power is on, B+ is supplied to KS1 through KS5.
- 60 We are using only the two least significant bits KS1 and KS2. Assume that KS1 is at position 8 and KS2 is at position 1.
- 61 A click of the clock comes (clicks are 86.4 s apart = 1000/day). K101 picks; B- path is completed for KS1. KS1 picks, stepping wider from position number 8 to 9.
- 62 Another click of the clock comes; B- path again is completed. KS1 picks, steps from 9 to first blank. This picks the interrupter on KS1.
- 63 On KS1 top cam contacts close, complete B-path for KS2. KS2 picks, stepping from position 1 to 2.
- 64 Both cam switches being closed, the interrupter closed the bottom switch. KS1 will step again from bottom of KS1 coil through middle cam switch through interrupter to B-, stepping KS1 to 0.
- 65 Each switch can step and switch to any position manually. The same action would happen going from 9 → 0 (step 64).

Model 500 Slave Clock (see Fig. 5)

- 66 B+ and B- are supplied when ac is turned on. Pin 16 and 17 J201 go to K40 (10-7D) in data panel — to set time in slave.

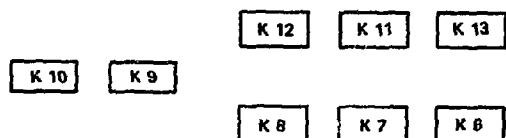


Fig. 4 - Relay layout of Model 500 slave clock.

- 67 As soon as K40 in data input panel picks, K40 is picked by K32C. K32C is picked by K16A in SCC.
- 68 Pin 17 is shorted to pin 16 on J201. This supplies B- to relays. K11, K13, and K12 all pick.
- 69 Assume master clock reads xxx09 and slave reads xxx07. KS1 in slave must step to xxx09. B2 is applied to KS1 top, picking up B- at KS1 bottom.
- 70 Through interrupter of KS1. Through K13 bottom contacts 4. Through K6B to B-. This will step KS1 from 7 to 8. Interrupter on KS1 will open while stepping.
- 71 KS1 interrupter closes, and the same path as in step 70 will happen again. KS1 steps from 8 to 9.
- 72 KS1 in master and KS1 in slave are both at position number 9. Pin 10 on cable will be supplied with ground from master.
- 73 Pin 10 on cable, being ground, supplies M in slave with ground. M being at ground, K6 will pick. This will break B- path to KS1. KS1 will no longer step. Slave now displays xxx09.
- 74 Readout can happen in four different ways: (1) if count length is reached, (2) if stop on scaler timer is depressed, (3) if read switch on data input panel is depressed, (4) if Sodeco timer times out.
- 75 One minute has timed out. J33 pin 42 connects to J35 pin 25. This comes from J6-20, a BC20 logic card in PC1-3.
- 76 This will put J27 pin 18 of DL30 at +6 V in PC1-2. This causes J26 pin 15 of UF30 to go false. This causes J26 pin 26 of UF30 to go

true. This output is on pin 44 of J33 (OCI-2).

- 77 This input appears in data input panel (10-2H) 44. This true level starts V3 to conduct. K9 picks (10-2I).
- 78 K9A (10-3H) picks K10 (10-3H). K10 pin 2 and 3 close (10-2K). "Read out" lamp (10-2J) comes on. B+1 from 526 at J1 pin 1 through K10 pins 2 and 3 closed contacts.
- 79 We are using counter number 25 phase pins 77 and 78, and connector J8 in the 526. Jumpers are inserted between B+1 blanks and pin 78, and from lower blank to 77 (10-2J).
- 80 B+1, now on pin 78 of data input panel, goes to pin 78 of (526-1B). This picks K8-1. K8-1A (526-2B) closes. K8-1C closes (526-3B).
- 81 K7 (526-9A) will be picked if cards are inserted properly in punch. K7B and K7D (526-4B) will be closed, supplying B-2 (526-5D) to K1.
- 82 K8-1B (526-5B) being closed supplies B+2 through its contacts through K1B closed contacts and K7A and K7C closed contacts (526-5E). This will pick K3 through K2A contacts (526-5E). This steps KS1 from position A to B (526-4A through E).
- 83 When K3A is closed, K2 picks (526-5E). K2A de-energizes K3; K3B opens. KS1 is now stopped at B. K3A opens; K2 de-energizes.
- 84 K3 picks through K2A closed contacts. K3B closes, stepping KS1 to position C. K2 picks through K3A closed contacts. K2A opens. K3 de-energizes. K3A opens. K2 de-energizes. KS1 is now at position C (526-5E).
- 85 We have gone through steps 82, 83, and 84. KS1 is now stopped at position H.
- 86 K3 picks through K2A. K3B closes, stepping KS1 to position J. K3A closes, picking K2. K2A opens. K3 de-energizes. K3A opens. K2 de-energizes.
- 87 When KS1 steps to position J, B+2 through K8-1C will pick K1 through K7B and K7D (526-4B). K1-B opens, taking B+2 away from

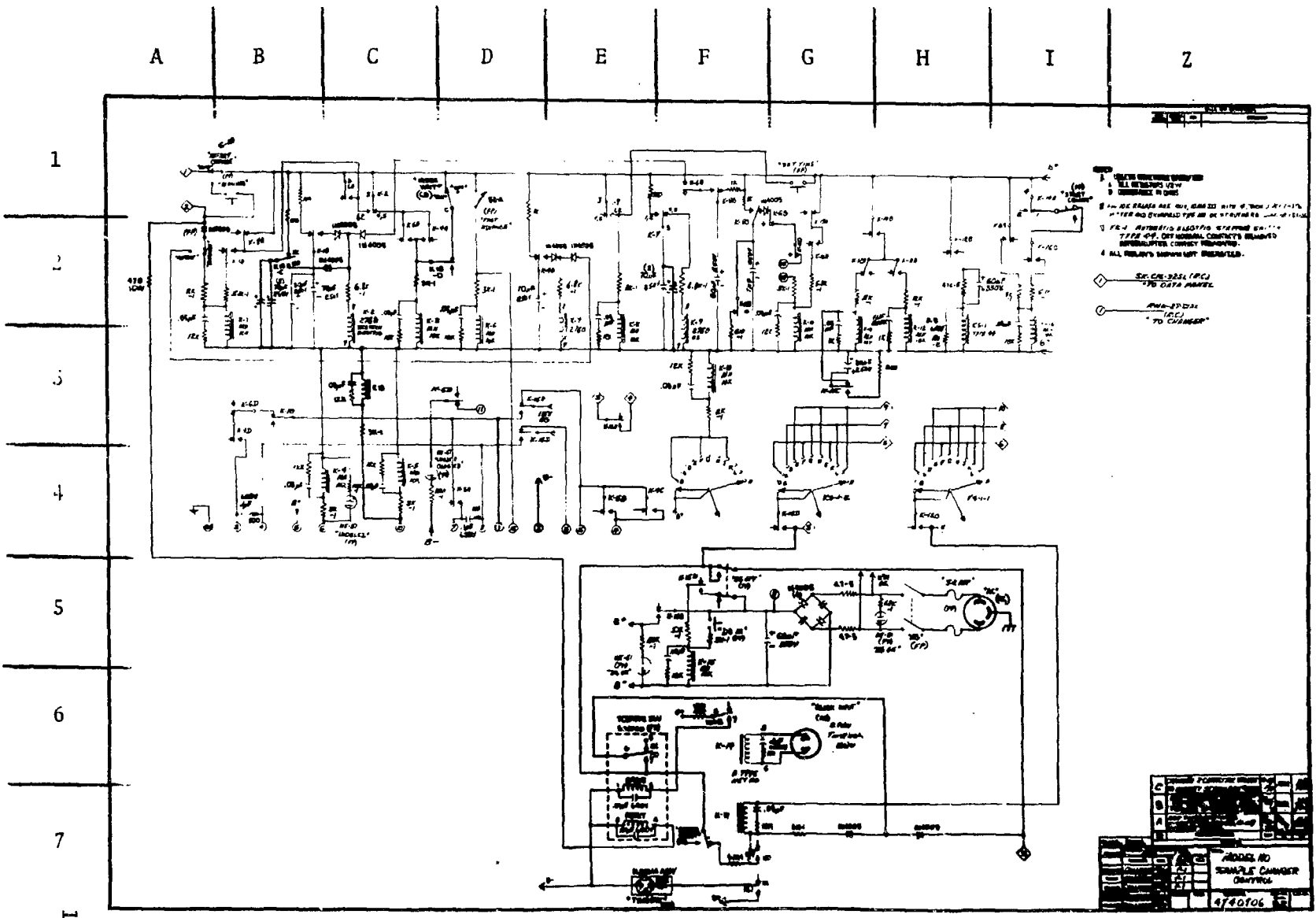
- KS1, K3, and K2 (526-5E); all remain de-energized.
- 88 K1A closes; B+2 is supplied to KS1-4, KS1-5, and KS1-6 (526-4D). KS1-4J picks K8-2 (526-5B). KS1-5J picks K18-2 (526-5D). KS1-6J picks K28-2 (526-5F).
- 89 Using phase pin 77 (step 79) uses J8 on the 526 when K8-2 picked B+1 through K8-2A (526-8A) to J8 pin 77.
- 90 This picks K13 in data input panel (10-3K). K13A closes (10-3G). This picks K14, K15, and K16. K14A through K14D, K15A through K15D, and K16A through K16D connect rows of card to be punched. K13B closes (10-3K). K13C closes, which charges cap (10-4D).
- 91 Once the auto mode in the IBM punch is entered, the IBM punch automatically times column advance and punching.
- 92 Any time a row and column are selected at J8 and the IBM punch is at the selected column, the punch die will activate.
- 93 When K1 (526-4B) picks, K1-C (526-9A) opens. K4 de-energizes 1.6 s later. This picks K5. K5 contacts 3, 1, 2 (526-9B) will close for 0.08 s. I-36 (526-9B), being +48Vdc from 526 through S-3 "punch power on," puts +48 Vac at I-6. I-6 is the auto state in the 526 which picks relays in the 526 to start column timing and causes card in punch to advance from column 1 to column 2.
- 94 On data input panel (11-2A), ② from card is column 1 on card on table. (Fig. 2). This being true from sample, card row 6 will be punched in column 2. S1 (11-1A) will be in the blank position. K21A will be closed.
- 95 Punch advances to column 3. S2 (11-1B) will be in blank position and K21B will be closed ③, which is column 2 on card on table. This will punch a 2.
- 96 Punch advances to column 4. S3 (11-1C) will be in blank position. K21C will be closed. A 0 will be punched in column 4.
- 97 Punch advances to column 5. S4 (11-1C) will be in blank position. ⑤ being column 4 from card on table, a 1 will be punched in column 5.
- 98 Punch advances to column 6. S5 (11-1D) will be in blank position. K22A will be closed. ⑥ being column 5 from card on table, a 6 will be punched in column 6.
- 99 Punch advances to column 7. S6 (11-1E) will be in blank position. K22B will be closed. ⑦ being column 6 from card on table, a 5 will be punched in column 7.
- 100 Punch advances to column 8. S7 (11-1F) will be in blank position. K22C will be closed. ⑧ being column 7 from card on table, a 0 will be punched in column 8.
- 101 Punch advances to column 9. S8 (11-1F) will be in blank position. K22D will be closed. ⑨ being column 8 from card on table, a 3 will be punched in column 9.
- 102 Punch advances to column 10. S9 (11-1G) will be in blank position. K23A will be closed. ⑩ being column 9 from card on table, a 6 will be punched in column 10.
- 103 Punch advances to column 11. Counter number is selected from two rotate switches in data panel. On sample card C N number is 14. Switch A (11-1H) is set to a 1. This supplies continuity between row 1 and column 11, and a 1 is punched in column 11.
- 104 Punch advances to column 12; switch (11-1I) is set to a 4. This supplies continuity between row 4 and column 12, and a 4 is punched in column 12.
- 105 Punch advances to column 13. A skip is wired into the punch at this column. This is the date switch in (526-10E).
- 106 Punch advances to column 14. The second bit of the date dialed in (526-10E) will be punched in column 14. Sample card was punched with a 3.

- 107 Punch advances to column 15. Now we pick up the remaining five bits of data from the slave clock. This time was set at set time and was taken from the master at that time. We will punch 14584.
- 108 $\triangle 5$ (11-4J) is a 1 from the slave clock through stepping switch KS-5 level 5 through $\nabla 4$ (10-7E) to J1-65. K12 in (526-8F) will be energized. K12B and K12D (526-10F) will be picked. This completes column-row continuity, and a 1 will be punched in column 15.
- 109 Punch advances to column 16. Next digit is a 4, $\triangle 8$ from slave (11-4J) goes to row 4. Pin $\nabla 5$ from clock (10-7E) goes to J1 pin 66. A 4 will be punched in column 16.
- 110 Punch advances to column 17. $\triangle 9$ (11-5J) being row 5 and $\triangle 1$ from slave being column 17, a 5 will be punched in column 17.
- 111 Punch advances to column 18. $\triangle 12$ (11-5J) being row 8 and $\triangle 2$ being column 18, an 8 is punched in column 18.
- 112 Punch advances to column 19. The last digit of time will now be punched. $\triangle 3$ being row 4 through pin $\triangle 3$ (11-6F) being column 19, a 4 will be punched in column 19.
- 113 Punch advances to column 20. S = shelf that was used when testing sample. This is dialed in at (11-3C). This goes to J1 pin 20. On sample card, shelf used was a 3; a 3 will be punched in column 20.
- 114 Punch advances to column 21.
- 115 Now we start taking data from the scaler. K13-B (10-2J) being closed, all we need is KS drive to pick off first bit of scaler data. I1 to I7 EAM start picks K8 (10-3J). K8A (10-2A) closes. Scaler readout stepping switch steps to position B.
- 116 K7A (10-3B) closes. A 0-V level from scaler will allow relays to pick. But +6 V will not allow transistor to conduct, so relay remains de-energized; +6 V will be at scaler output pins if that light is lit in scaler. We have 0 V at pins 21, 22, 23, and 24 (10-1). Both sections of V1 and V2 will conduct. K17, K18, K19, K20 energize.
- 117 Punch advances to column 23. With both halves of V1 and V2 conducting, K7A closes contacts through K20A through K17A through K18A through K19A. A zero 0 will be punched in column 23 row 0.
- 118 Punch advances to column 24. KS drive picks K8. K8A (10-2A) closes. This steps the scaler stepping switch to position C. Again all zeros from scaler. Same path as in step 117. Column 24 row 0 is punched.
- 119 Punch advances to column 25. Same as in step 117. A zero 0 is punched in column 25.
- 120 Punch advances to column 26. Same as in step 117. A zero 0 is punched in column 26.
- 121 Punch advances to column 27. Same as in step 117. A zero 0 is punched in column 27.
- 122 Punch advances to column 28. Scaler readout stepping switch stepped with above step and is now stopped at position G.
- 123 To punch a 9, which is showing on scaler lights, we need A(B.C.D.) of 8+1. This will have V1A cutoff K17 de-energized. With V1B conducting, K18 picked. With V2A conducting, K19 picked. With V2B cut off, K20 de-energized.
- K17 de-energized
K18 energized
K19 energized
K20 de-energized
- K7A closed contacts. K20A de-energized contacts through K17B de-energized contacts. A 9 will be punched in column 28.
- 124 Punch advances through columns 29, 30, 31, 32, 33, 34, 35 by use of skips on the 526.
- 125 Scale factor is decoded at (526-6F) by a jumper from row 1 column 36. A 1 is punched in column 36 row 1.
- 126 Punch advances to column 37. Count length is read from card reader on table and punched on output card. Pin $\textcircled{37}$ from card reader (11-6A). This is column 11 on card reader. There is continuity between row 0 column 11 from card on table. This going to the card punch, a 0 is punched in column 37.

- 127 Punch advances to column 38. Again there is continuity from card reader row 1 column 12 through data input panel (11-6A) to the 526, and a 1 will be punched in column 38.
- 128 Punch advances to column 39. Again, there is continuity from card reader column 13 row 0 through data input panel 116-A to the 526. A 0 will be punched in column 39.
- 129 Punch advances to column 40. Background is taken from five dials on front panel switches. On sample card, number punched is 02793, which would equal 027.93. From row 0 through switch, which would be set to 0 through diode (11-3F), to pin 40 of J1 to the 526, a 0 will be punched in column 40.
- 130 Punch advances to column 41. From sample card, we know a 2 was dialed in. From row 2 through S-19 to pin 41 of J1 to the 526, a 2 will be punched in column 41.
- 131 Punch advances to column 42. A 7 was dialed in. From row 7 through S-20 through diode to pin 42 of J1 to the 526, a 7 will be punched in column 42.
- 132 Punch advances to column 43. A 9 was dialed in. From row 9 through S-21 through diode to pin 43 of J1 to the 526, a 9 will be punched in column 43.
- 133 Punch advances to column 44. A 5 was dialed in. From row 5 through S-22 through diode to pin 44 of J1 to the 526, a 5 will be punched in column 44.
- 134 Punch advances to column 45. First digit of Y is punched.
- 135 Punch advances to column 46. Last digit of Y is punched.
- 136 Punch advances to column 47. Zero day from card reader will be punched as zero time. (47) (11-5B) is column 16 from card reader through K23-D through S25 blank position through diode to pin 47 of J1 to the 526. A 2 will be punched in column 47.
- 137 Punch advances to column 48. (48) (11-5C) is column 17 from card reader through K24-A through S26 blank position through diode to pin 48 of J1 to the 526. A 9 will be punched in column 48.
- 138 Punch advances to column 49. (49) (11-5D) is column 18 from card reader through K24-B through S27 blank position through diode to pin 49 of J1 to the 526. A 4 will be punched in column 49.
- 139 Punch advances to column 50. (50) (11-5E) is column 19 from card reader through K24-C through S28 blank position through diode to pin 49 of J1 to the 526. A 2 will be punched in column 50.
- 140 Punch advances to column 51. (1) (11-5E) is column 20 from card reader through K24D through S29 blank position through diode to pin 51 of J1 to the 526. A 0 will be punched in column 51.
- 141 Punch advances to column 52. (11) (11-5F) is column 21 from card reader through K25A through S30 blank position through diode to pin 52 of J1 to the 526. An 8 will be punched in column 52.
- 142 Punch advances to column 53. "Chem. yield" from card reader will be punched as "chem. yield" on card. (12) (11-5G) is column 22 from card reader through K25B through S31 blank position through diode to pin 53 of J1 to the 526. A 9 will be punched in column 53.
- 143 Punch advances to column 54. (13) (11-5G) is column 23 from card reader through K25-C through S32 blank position through diode to pin 54 of J1 to the 526. A 9 will be punched in column 54.
- 144 Punch advances to column 55. (14) (11-5H) is column 24 from card reader through K25D through S33 blank position through diode to pin 55 of J1 to the 526. A 9 will be punched in column 55.
- 145 Punch advances to column 56. (15) (11-5I) is column 25 from card reader through K26A through S34 blank position through diode to pin 56 of J1 to the 526. A 9 will be punched in column 56.

- 146 Punch advances to column 57. "LAMDA" from card reader will be punched on card. S38 (11-6C) is in blank position. This connects row 12 and (16) which is column 26 to J1 pin 57 to the 526. A "+" will be punched in column 57.
- 147 Punch advances to column 58. (17) (11-6D) is column 27 from card reader through K27B through S39 blank position through diode to pin 58 of J1 to the 526. A 1 will be punched in column 58.
- 148 Punch advances to column 59. (18) (11-6E) is column 28 from card reader through K27C through S40 blank position through diode to pin 59 of J1 to the 526. A 7 will be punched in column 59.
- 149 Punch advances to column 60. (19) (11-6F) is column 29 from card reader through K27D through S41 blank position through diode to pin 60 of J1 to the 526. A 6 will be punched in column 60.
- 150 Punch advances to column 61. (20) (11-6G) is column 30 from card reader through K28A through S42 through diode to the 526. A 7 will be punched in column 61.
- 151 Punch advances to column 62. (21) (11-6G) is column 31 from card reader through K28B through S43 through diode to the 526. A 0 will be punched in column 62.
- 152 Punch advances to column 63. (22) (11-6H) is column 32 from card reader through K28C through S44 through diode to the 526. A "-" will be punched in column 63.
- 153 Punch advances to column 64. (23) (11-6I) is column 33 from card reader through K28D through S45 through diode to the 526. A 4 will be punched in column 64.
- 154 All this time, the rows of the card on table were being read at (10-K).
- 155 IBM 526 will skip columns 65 through 80 and will stack card.
- 156 K13 (10-2K) will now de-energize. K13A (10-3G) will open. B+A will step K51 back to its home position. K13B (10-3K) will open. K13C (10-4D) will open. Already charged cap picks K11. K11A (10-5D) closes. (1) and (2) will enable K1 in the SCC to pick. This will start the sample change routine.

Model 110 Sample Changer Control



Model 110 Data Input Panel D

16

A B C D E F G H I J K

1

2

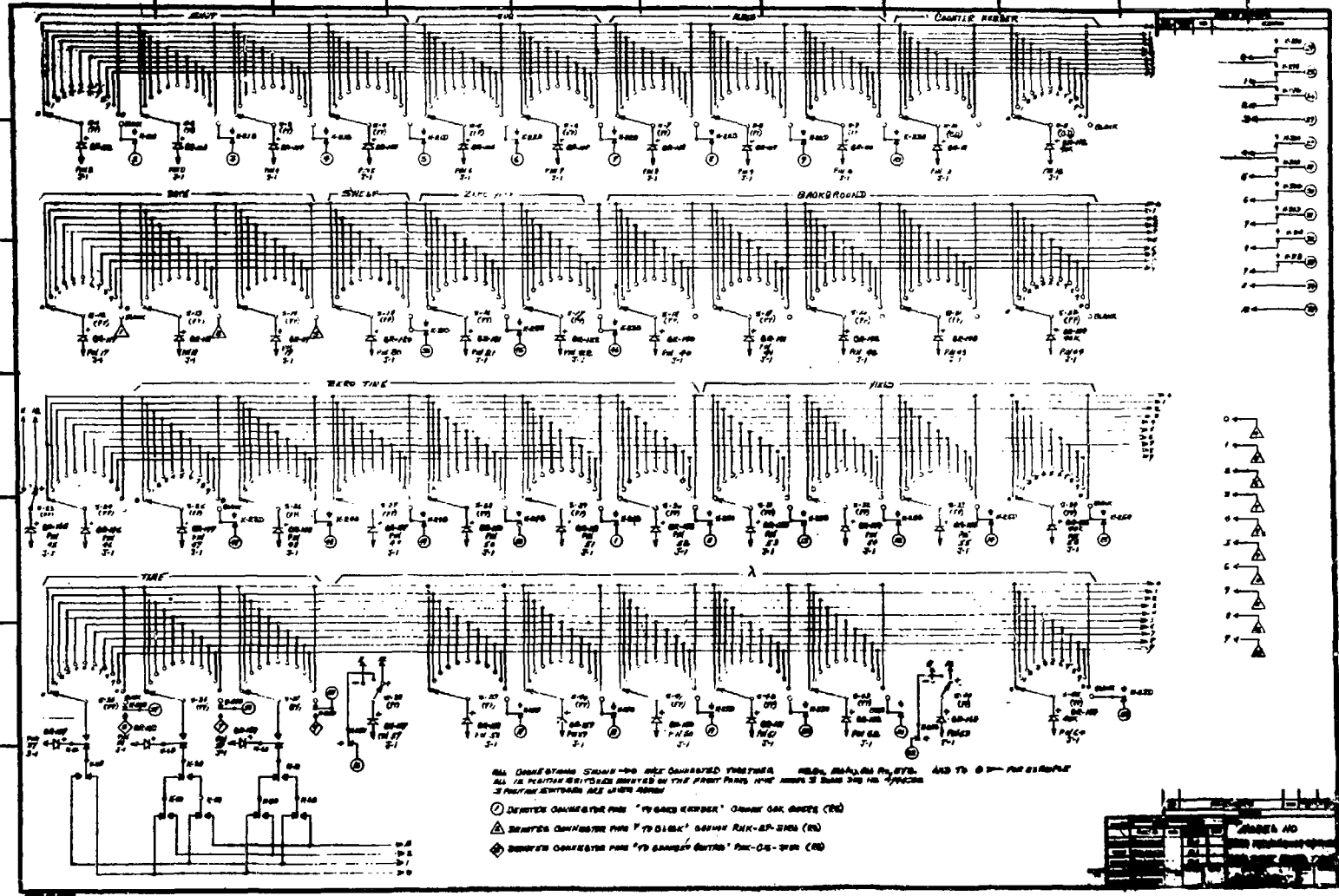
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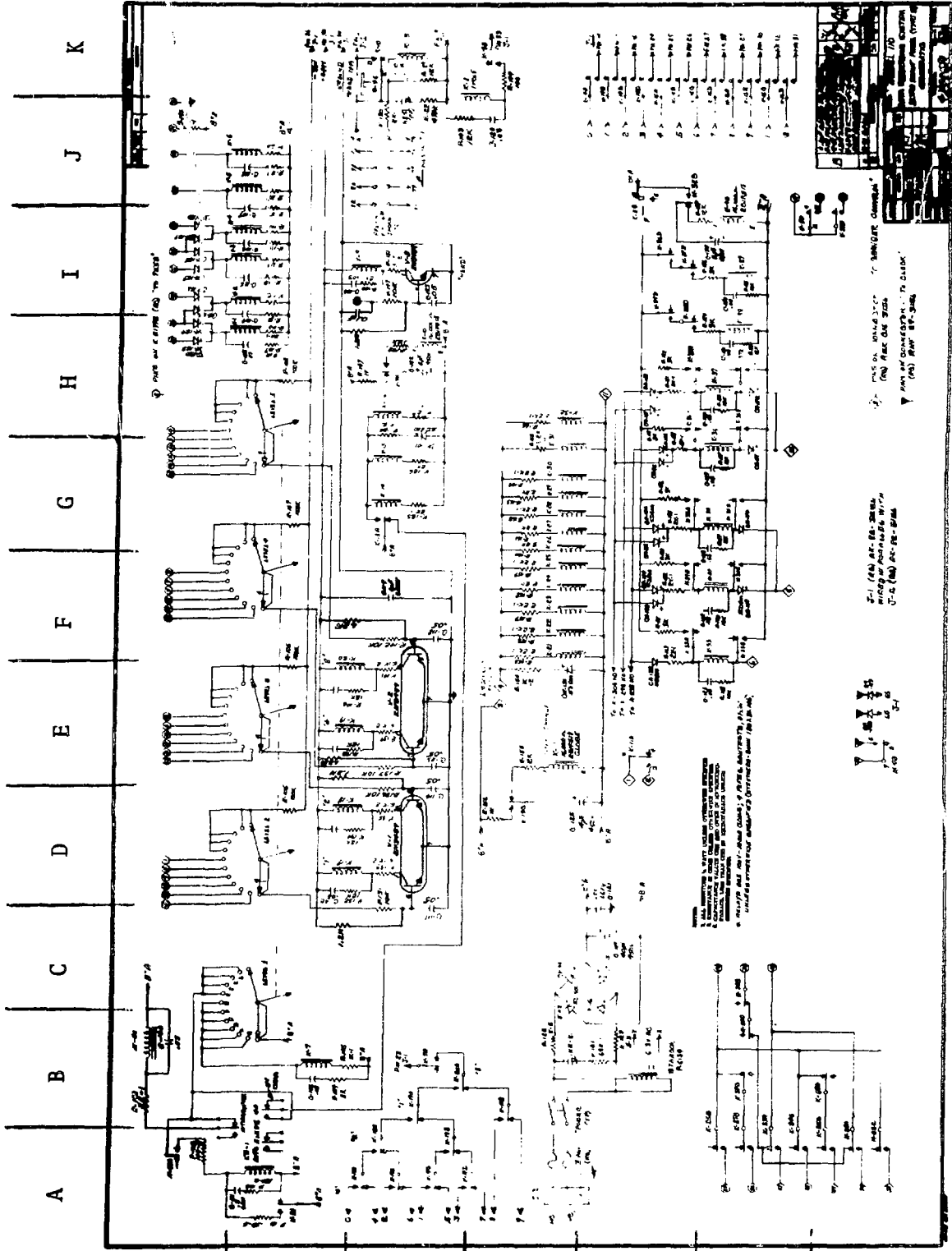
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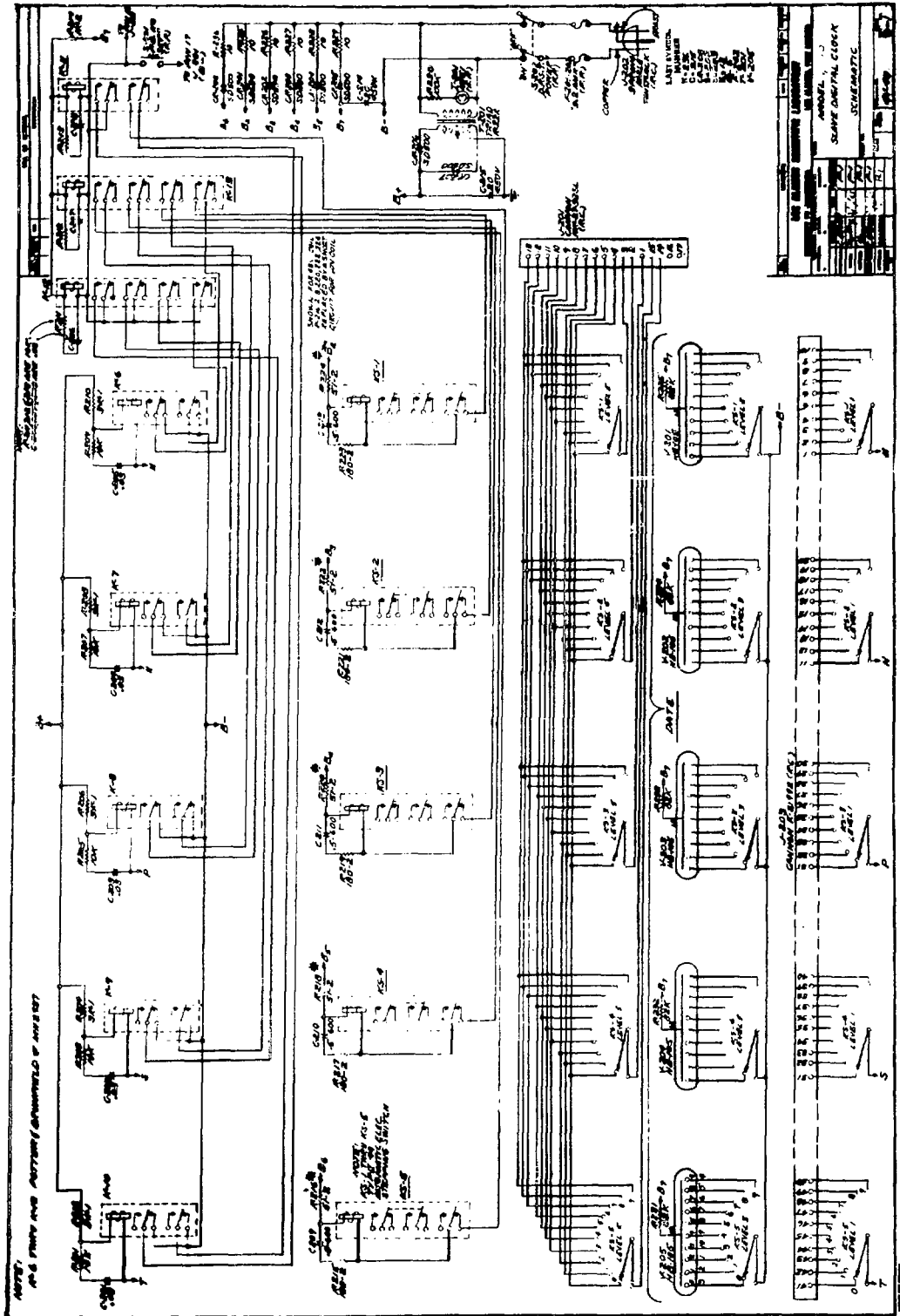
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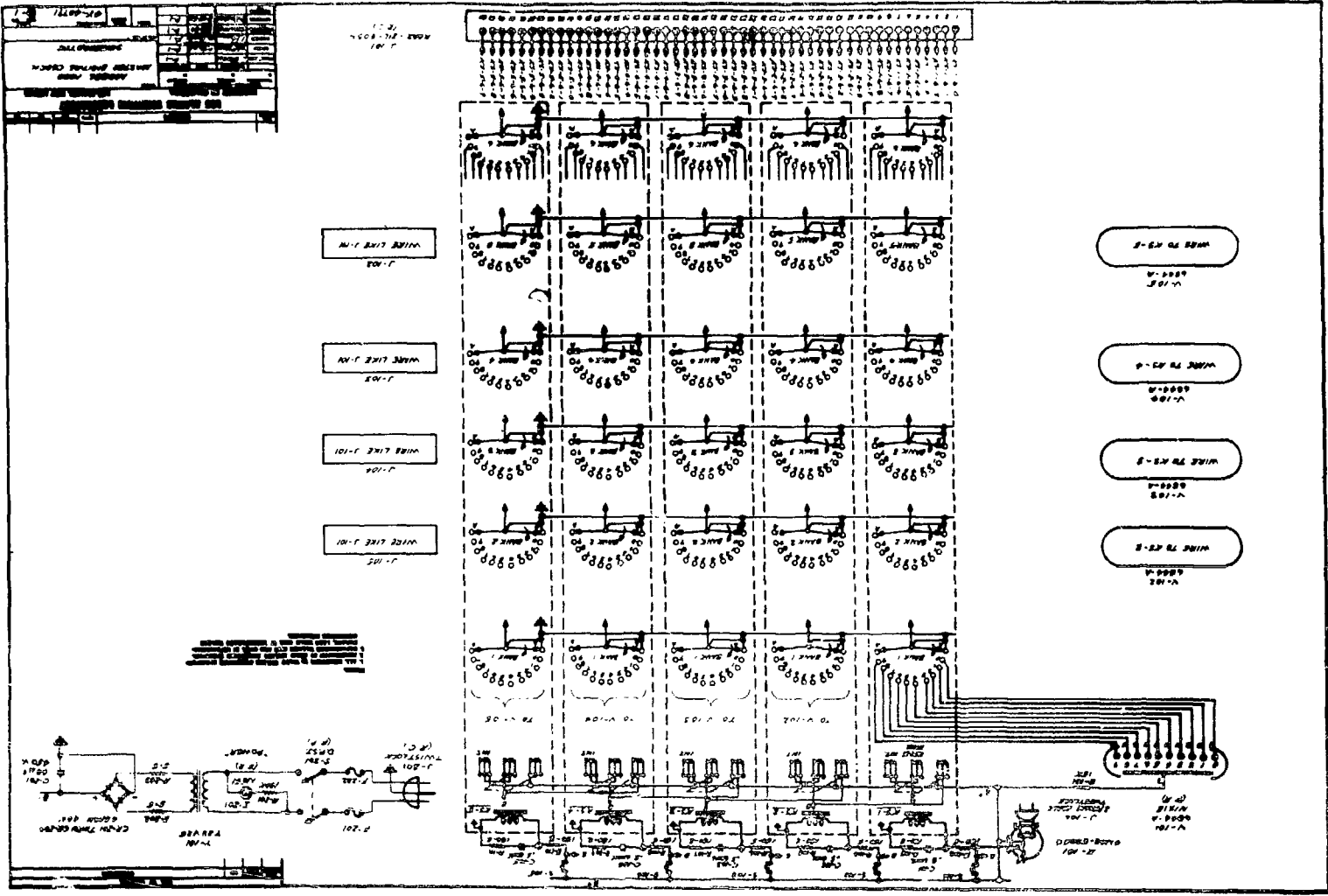


Model 110 Data Input Panel D10



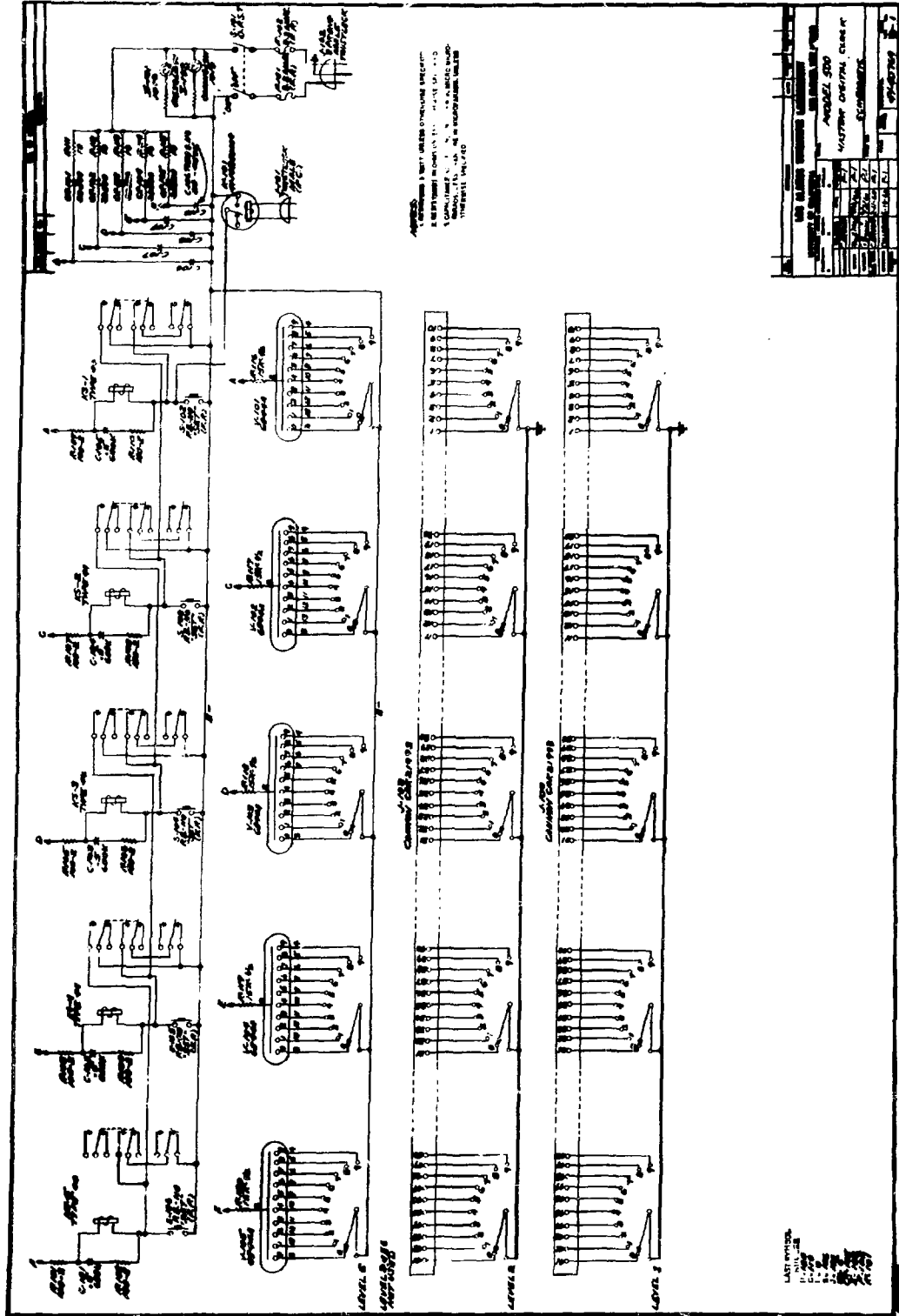
Model 1000 Slave Clock





Model 1000 Master Clock

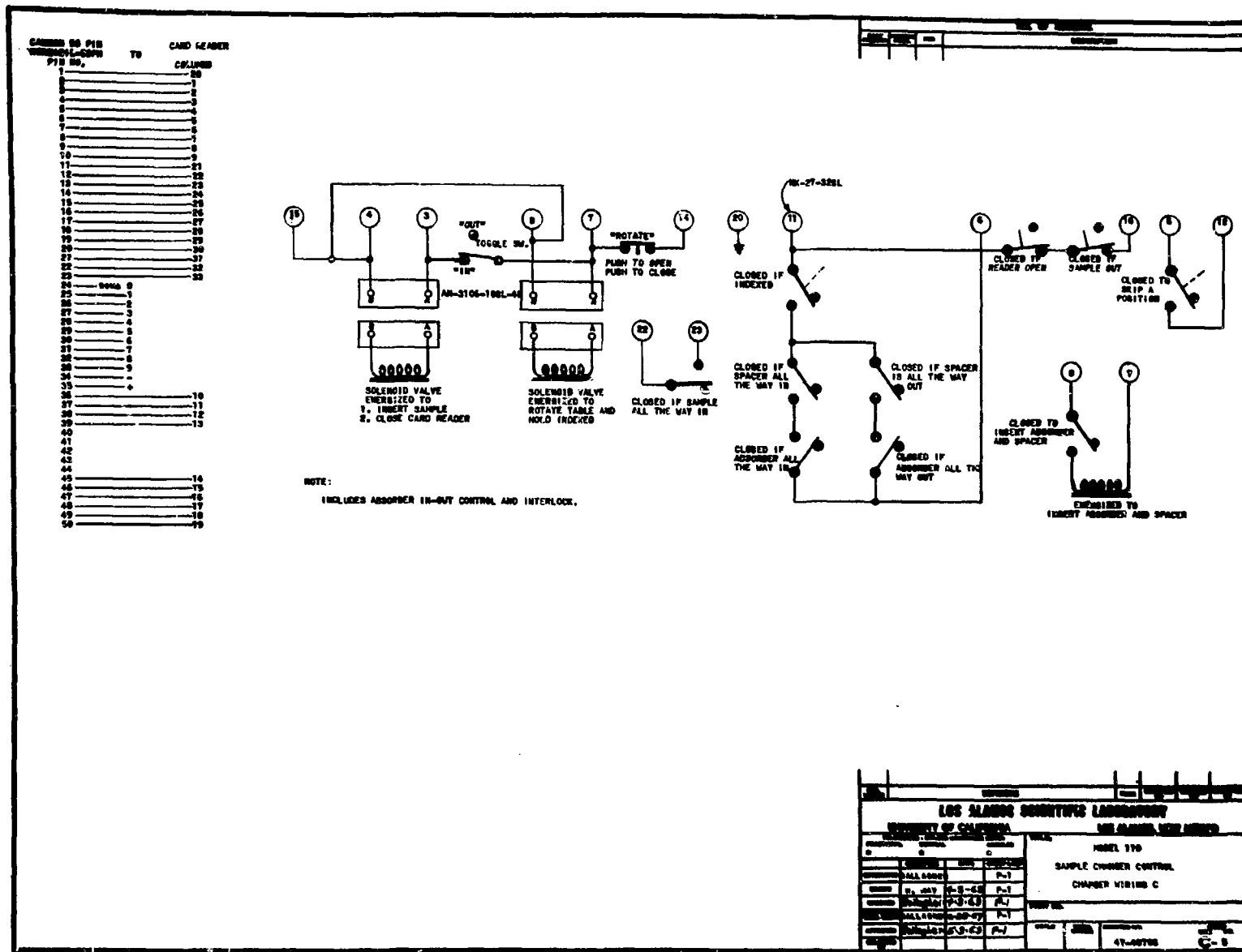
Model 500 Master Clock



LAST PAGE

Sample Changer Control Wiring

22



APPENDIX B

Sample Changer Control Relay Layout

Relays and sections used in sample change

Control Model 7100

<u>Relay</u>	<u>Sections Used</u>	<u>Not Used</u>	<u>Name</u>	<u>Location</u>
K1	A,B,C	D	Change	2B
K2	Both used wired together		Delay	2C
K3	A	B,C,D	Index Wait	2C
K4	A,B,C,D		Indexed	4B
K5	A,B,C,D		Ready	4C
K6	A,B,C,D		Skip	2D
K7	Both used wired together			
K8	A,B,C	D	Delay	2E
K9	Both used wired together		Delay	2E
K10	A,B,C	D	Enable Set Time	2F
K11	A,C	B,D	Mul 1	2G
K12	A,B,C,D		Mul 2	2G
K13	A,C	B,D	Enable Set Time	3F
K14	Both used		Clock	6F
K15	A,B,C,D		Power On	5E
K16	A,C	B,D	Read	2I
K17	B,D	A,C	Error	6F
K18	C,D	A,B	Hold Index	

Data Input Panel - Relay Contact Locations

K37A-105H	K37B-105G	K37C-106A	K37D-105I
K38A-107A	K38B-106B	K38C-106A	
K39A-106A	K39B-106B	K39C-106A	
K40 Plug In	2,3,4 106I	5,6,7 107D	
KS-1	101B thru 101H		
K41A-101A			

Hydraulics Layout

