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**KIM-1 USER MANUAL**



The program you have entered is a simple loop to add two 8 bit binary numbers together and present the result on the display. For a programmer, the listing of the program entered might appear as follows:

```

POINTL      = $FA
POINTH      = $FB
START       = $1C4F
0000        VAL1
0001        VAL2
0002  18    PROG    CLC
0003  A5 00    LDA  VAL1
0005  65 01    ADC  VAL2
0007  85 FA    STA  POINTL
0009  A9 00    LDA  #00
000B  85 FB    STA  POINTH
000D  4C 4F 1C  JMP  START

```

Stated in simple terms, the program will clear the carry flag (CLC), load VAL1 into the accumulator (LDA VAL1), add with carry VAL2 to the accumulator (ADC VAL2), and store the result in a location POINTL (STA POINTL). A zero value is stored in a location POINTH (LDA #00 and STA POINTH) and the program jumps to a point labelled START (JMP START). This pre-stored program will cause the display to be activated and will cause the address field of your display to show the numbers stored in locations POINTH and POINTL. Note that the result of the addition has already been stored in location POINTL.

The hex codes appearing next to the address field of the listing are exactly the numbers you entered to store the program. We refer to these as machine language codes. For example, 4C is the hex code for the JMP instruction of the microprocessor. The next two bytes of the program define 1C4F (START) as the jump address.

As yet, you are not able to run the program because you have not yet entered the two variables (VAL1 and VAL2). Lets try an actual example:

Press Keys	See On Display	Step #
<input type="button" value="AD"/>	000F 1C	18
<input type="button" value="0"/> <input type="button" value="0"/> <input type="button" value="0"/> <input type="button" value="0"/>	0000 xx	19
<input type="button" value="DA"/>	0000 xx	20
<input type="button" value="0"/> <input type="button" value="2"/>	0000 02	21
<input type="button" value="+"/> <input type="button" value="0"/> <input type="button" value="3"/>	0001 03	22
<input type="button" value="GO"/>	0005 xx	23
<input type="button" value="+"/>	0002 18	22A

Keep the leads as short as possible and avoid running the leads near sources of electrical interference. The connections shown are for typical, portable type units. The Audio Data Out (LO) signal has a level of approximately 15 mv. (peak) at pin M. Should you desire to use more expensive and elaborate audio tape equipment, you may prefer to connect the high level (1 volt peak) audio signal available at pin P to the "LINE" input of your equipment.

Return the connector (A) to its correct position on the KIM-1 module and turn on the power supplies. To verify the operation of your audio cassette equipment, try the following procedures:

1. Reenter the sample program following the procedures outlined in the previous section (2.4). Try the sample problem again to be sure the system is working correctly.
2. Install a cassette in your tape equipment and REWIND to the limit position.
3. Define the starting and ending address of the program to be stored and assign an identification number (ID) to the program:

Press Keys	See On Display	Step #
AD	xxxx xx	1
1 7 F 5	17F5 xx	2
DA 0 0	17F5 00	3
+ 0 0	17F6 00	4
+ 1 0	17F7 10	5
+ 0 0	17F8 00	6
+ 0 1	17F9 01	7
AD	17F9 01	8
1 8 0 0	1800 xx	9

You will recall that the program we wish to store on tape was loaded into locations 0000 to 000F of the memory. Therefore, we define a starting address for recording as 0000 and store this in locations 17F5 and 17F6 (Steps 1 to 4). We define an ending address for recording as one more than the last step of our program and stored the value 0010 (= 000F + 1) in locations 17F7 and 17F8 (Steps 5, 6). Finally we pick an arbitrary ID as 01 and store this value at location 17F9 (Step 7).



The starting address of the tape recording program is 1800. In Steps 8 and 9 we set this address value into the system. If we were to press **GO**, the system would proceed to load data on to the magnetic tape. But first, we'd better start the tape!

4. Select the Record/Play mode of the tape recorder. Wait a few seconds for the tape to start moving and now:

Press **GO**

5. The display will go dark for a short time and then will relight showing:

0000 xx

6. As soon as the display relights, the recording is finished and you should STOP the tape recorder.

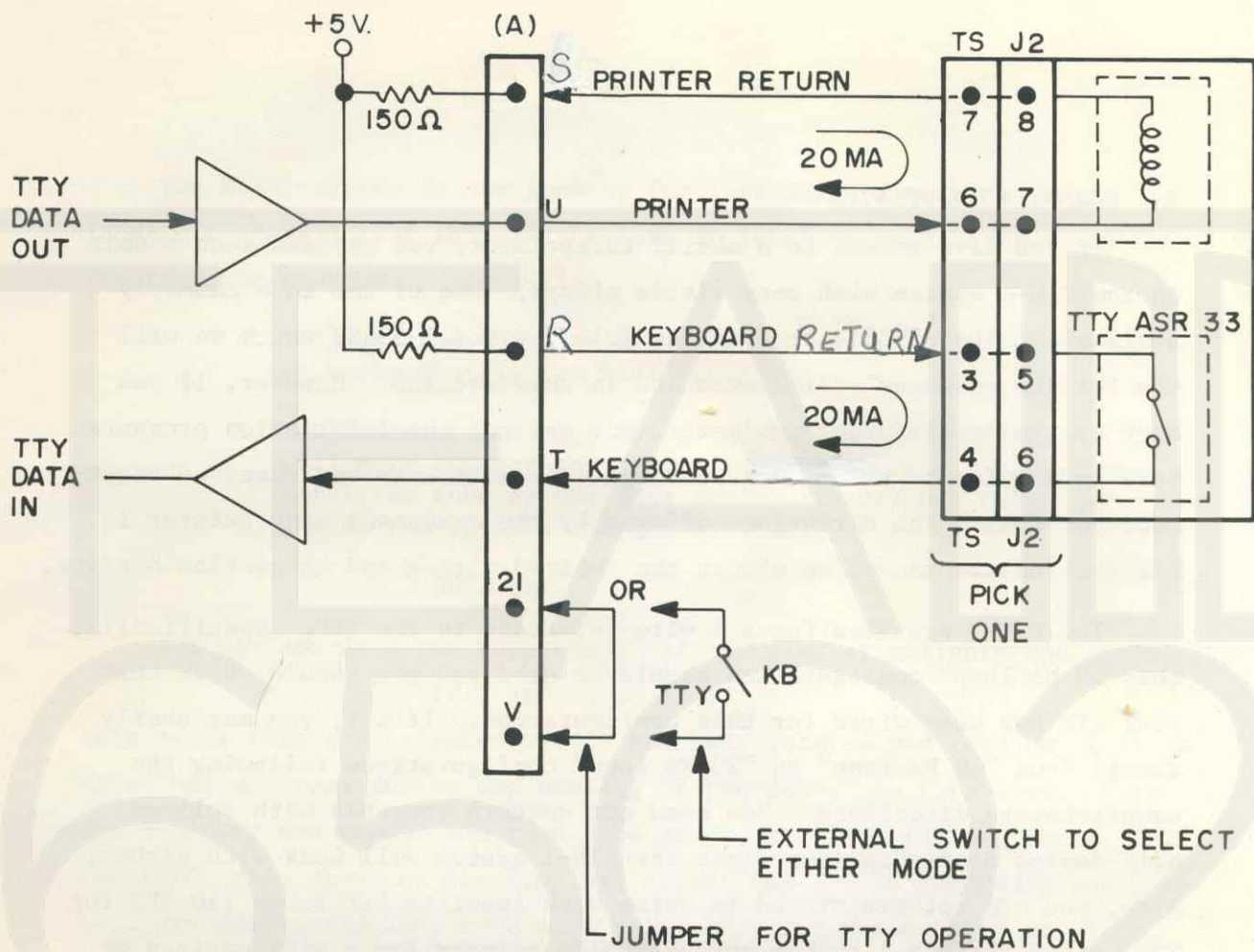
Now, you should verify that the recording has taken place correctly. This can be proven by reading the tape you have just recorded. Proceed as follows:

1. Rewind the tape cassette to its starting position.
2. Turn off the system power supplies and then later, turn them back on.

This has the effect of destroying your previously stored program which you already have recorded on tape.

3. Prepare the system for reading the tape as follows:

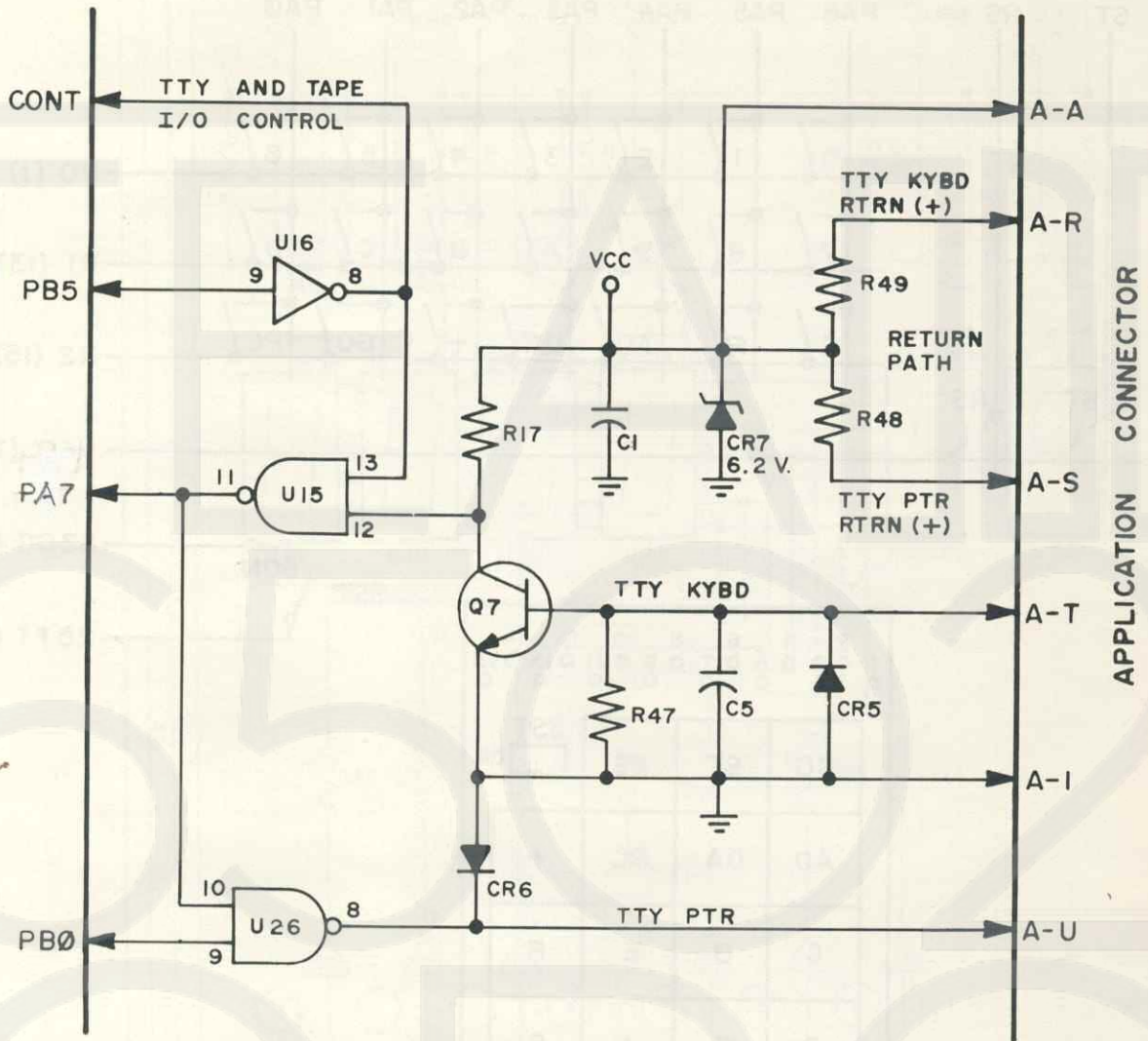
<u>Press Keys</u>	<u>See On Display</u>	<u>Step #</u>
<b>AD</b>	xxxx xx	1
<b>1</b> <b>7</b> <b>F</b> <b>9</b>	17F9 xx	2
<b>DA</b>	17F9 xx	3
<b>0</b> <b>1</b>	17F9 01	4
<b>AD</b>	17F9 01	5
<b>1</b> <b>8</b> <b>7</b> <b>3</b>	1873 xx	6
<b>GO</b>	(Dark)	7



TTY Connections  
FIGURE 2.4

3. The jumper wire from A-21 to A-V is used to define for the KIM-1 system that a teleprinter will be used as the only input/display device for the system. If you expect to use both TTY and the KIM-1 keyboard/display, you should install the switch shown instead of the jumper. Now, the switch, when open, will allow use of the keyboard and display on the KIM-1 module and, when closed, will select the teleprinter as the input/display device. (Of course, you may use a clip-lead instead of the switch if you desire).
4. Be sure pins A-21 and A-V are connected. Reinstall connector (A) and return power to the system. Turn-on the TTY.
5. Press the **RS** key on the KIM-1 module then press the **RUB OUT** key on the TTY. This step is most important since the KIM-1 system adjusts automatically to the bit rate of the serial teleprinter and requires this first key depression to establish this rate.

PERIPHERAL BUS TO 6530-002



TTY Interface  
FIGURE 3.7



22	KB Col D
21	KB Col A
20	KB Col E
19	KB Col B
18	KB Col F
17	KB Row $\emptyset$
16	PB5
15	PB7
14	PA $\emptyset$
13	PB4
12	PB3
11	PB2
10	PB1
9	PB $\emptyset$
8	PA7
7	PA6
6	PA5
5	PA4
4	PA1
3	PA2
2	PA3
1	VSS GND

Z	KB Row 1
Y	KB Col C
X	KB Row 2
W	KB Col G
V	KB Row 3
U	TTY KYBD
T	TTY PTR
S	TTY PTR RTRN(+)
R	TTY KYBD RTRN(+)
P	AUDIO OUT HI
N	+12v
M	AUDIO OUT LO
L	AUDIO IN
K	DECODE ENAB
J	K7
H	K5
F	K4
E	K3
D	K2
C	K1
B	K $\emptyset$
A	VCC +5v

Application Connector  
FIGURE 3.9

00EF = PCL  
 00F0 = PCH  
 00F1 = Status Register (P)  
 00F2 = Stack Pointer (SP)  
 00F3 = Accumulator (A)  
 00F4 = X Index Register  
 00F5 = Y Index Register

#### 4.2 USING THE AUDIO TAPE RECORDER

There are two basic operations possible when working with your audio tape system. You may transfer data from the KIM-1 memory and record it on tape. Or, you may read back a previously recorded tape, transferring the data on tape into the KIM-1 memory.

##### Recording on Audio Tape

The procedure for recording on audio tape requires that you perform the following steps:

1. Define an identification number (ID) for the data block you are about to record. This two digit number is loaded into address 17F9. Don't use ID = 00 or ID = FF.

2. Define the starting address of the data block to be transferred. This address is to be loaded into locations:

17F5 = Starting Address Low (SAL)  
 17F6 = Starting Address High (SAH)

3. Define the ending address as one greater than the last address in the data block to be recorded. The ending address is to be loaded into locations:

17F7 = End Address Low (EAL)  
 17F8 = End Address High (EAH)

As an example, assume you wish to record a data block from address 0200 up to and including address 03FF. (All of Pages 2 and 3). You wish to assign an ID number of 06 to this block. Using the KIM-1 keyboard, you should load the data shown into the addresses indicated so that:

17F5 = 00 (SAL)  
 17F6 = 02 (SAH)  
 17F7 = 00 (EAL)  
 17F8 = 04 (EAH) } = 03FF + 1  
 17F9 = 06 (ID)



### Load Paper Tape

Paper Tapes suitable for use with the KIM-1 system are generated using the format shown in Appendix F. To read such a tape into the KIM-1 system, proceed as follows:

1. Load the punched paper tape on to the tape mechanism
2. Type (L)
3. Activate the paper tape reader

The paper tape will advance and data will be loaded into addresses as specified on the tape. A printed copy of the data read will be generated simultaneously with the reading of the paper tape.

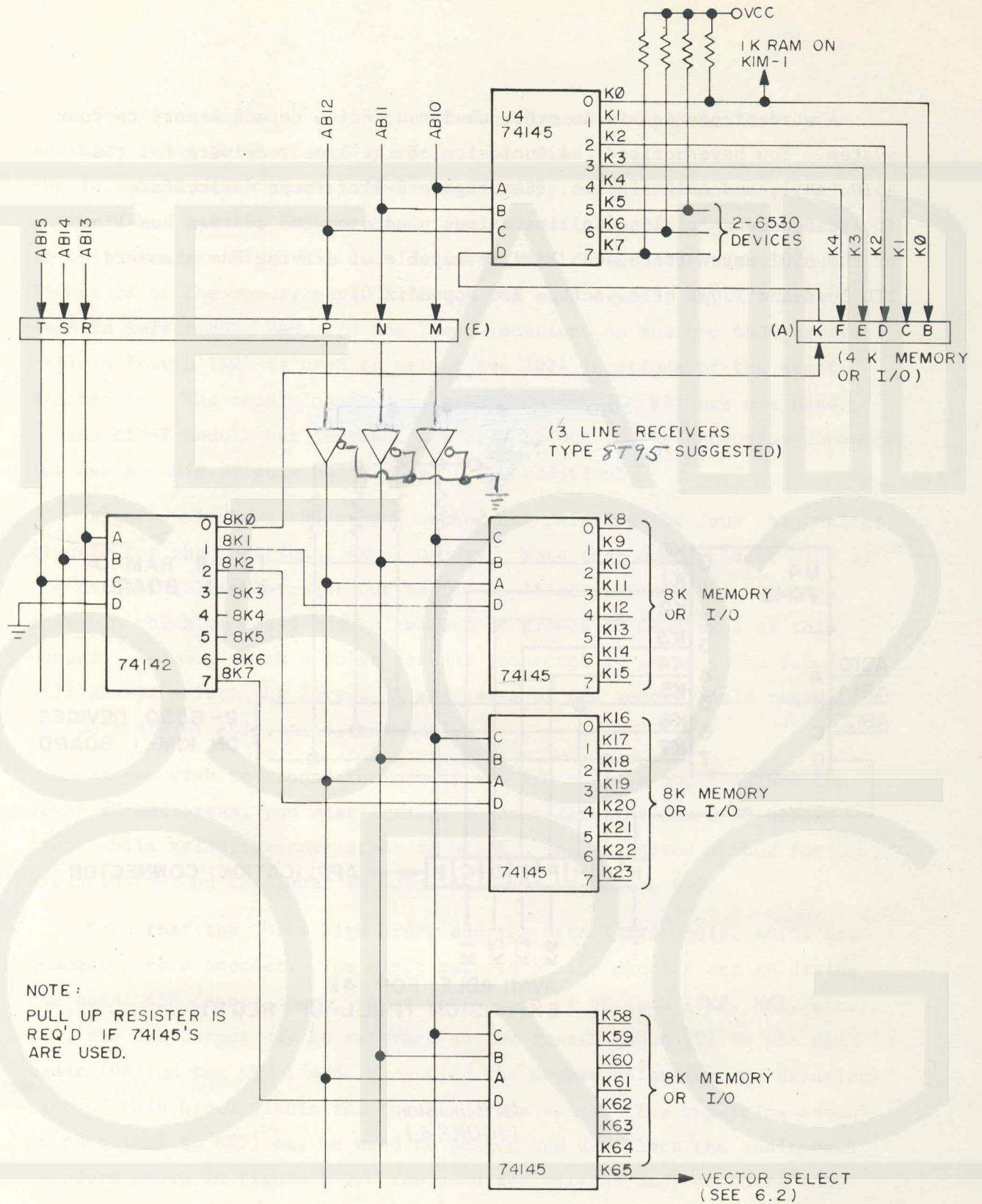
Check-sums are generated during the reading of the paper tape and are compared to check-sums already contained on the tape. A check-sum error will cause an error message to appear in the printed copy.

### Punch Paper Tape

The KIM-1 system can be used to punch paper tapes having the format described in Appendix F. The procedures for generating these tapes is as follows:

1. Define the starting address and ending address of the data block to be punched on the paper tape.
2. Load blank paper tape on the punch unit and activate the punch.

Type:	<sup>(17F7)</sup> F5	SPACE
See Printed:	17F7 XX -00F5-xx	FF •
Type:	<sup>(00)</sup> 00	
See Printed:	17F8 XX -00F6-xx	03 •
Type:	<sup>(02)</sup> 02	
See Printed:	17F9 XX -00F7-xx	200
Type:	<sup>(FF)</sup> FF	SPACE
See Printed:	0200 XX -00F8	
Type:	<sup>(03)</sup> 03	
See Printed:	00F9-xx	



65K Expansion  
FIGURE 6.2



### Load Paper Tape

Paper Tapes suitable for use with the KIM-1 system are generated using the format shown in Appendix F. To read such a tape into the KIM-1 system, proceed as follows:

1. Load the punched paper tape on to the tape mechanism
2. Type (L)
3. Activate the paper tape reader

The paper tape will advance and data will be loaded into addresses as specified on the tape. A printed copy of the data read will be generated simultaneously with the reading of the paper tape.

Check-sums are generated during the reading of the paper tape and are compared to check-sums already contained on the tape. A check-sum error will cause an error message to appear in the printed copy.

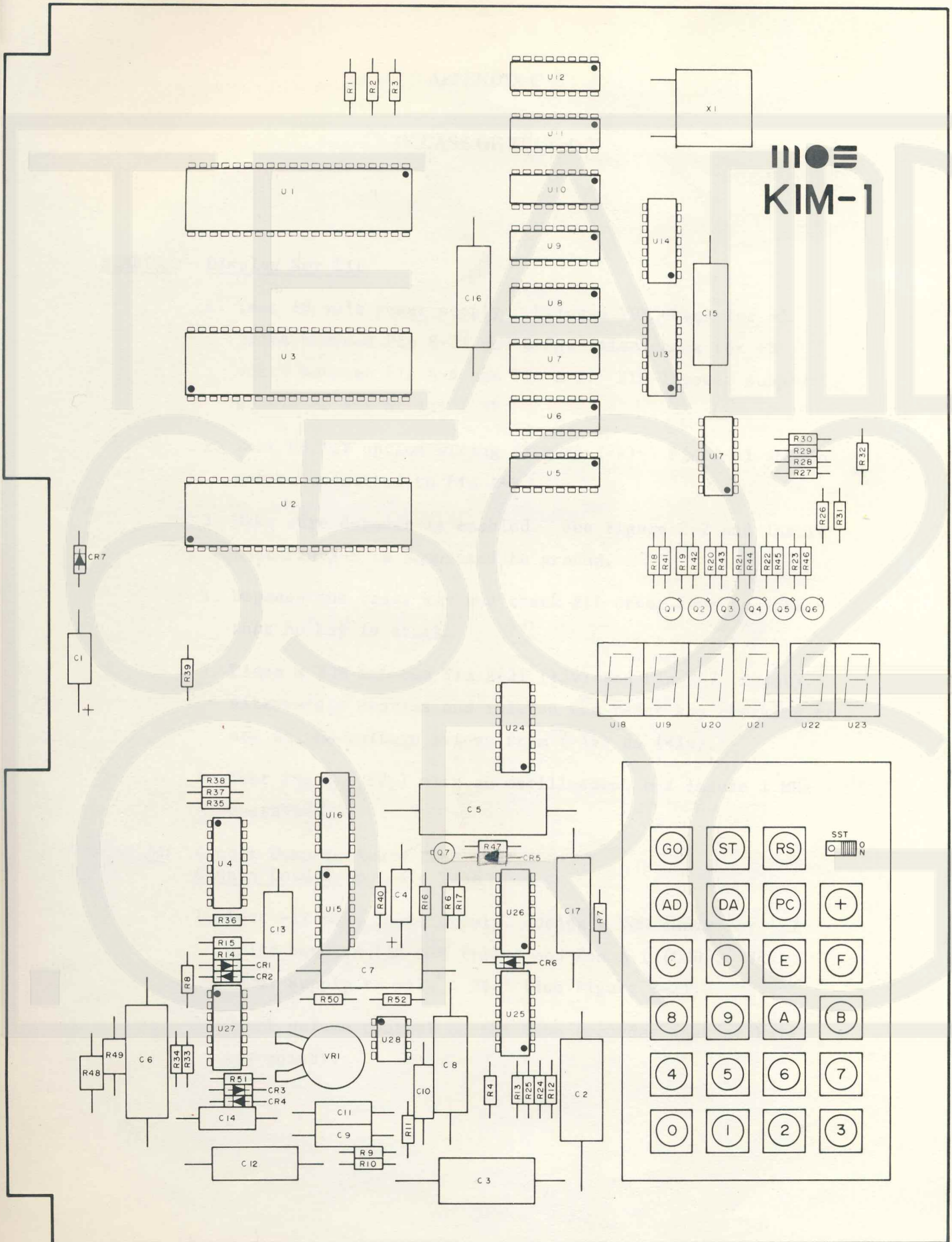
### Punch Paper Tape

The KIM-1 system can be used to punch paper tapes having the format described in Appendix F. The procedures for generating these tapes is as follows:

1. Define the starting address and ending address of the data block to be punched on the paper tape.
2. Load blank paper tape on the punch unit and activate the punch.

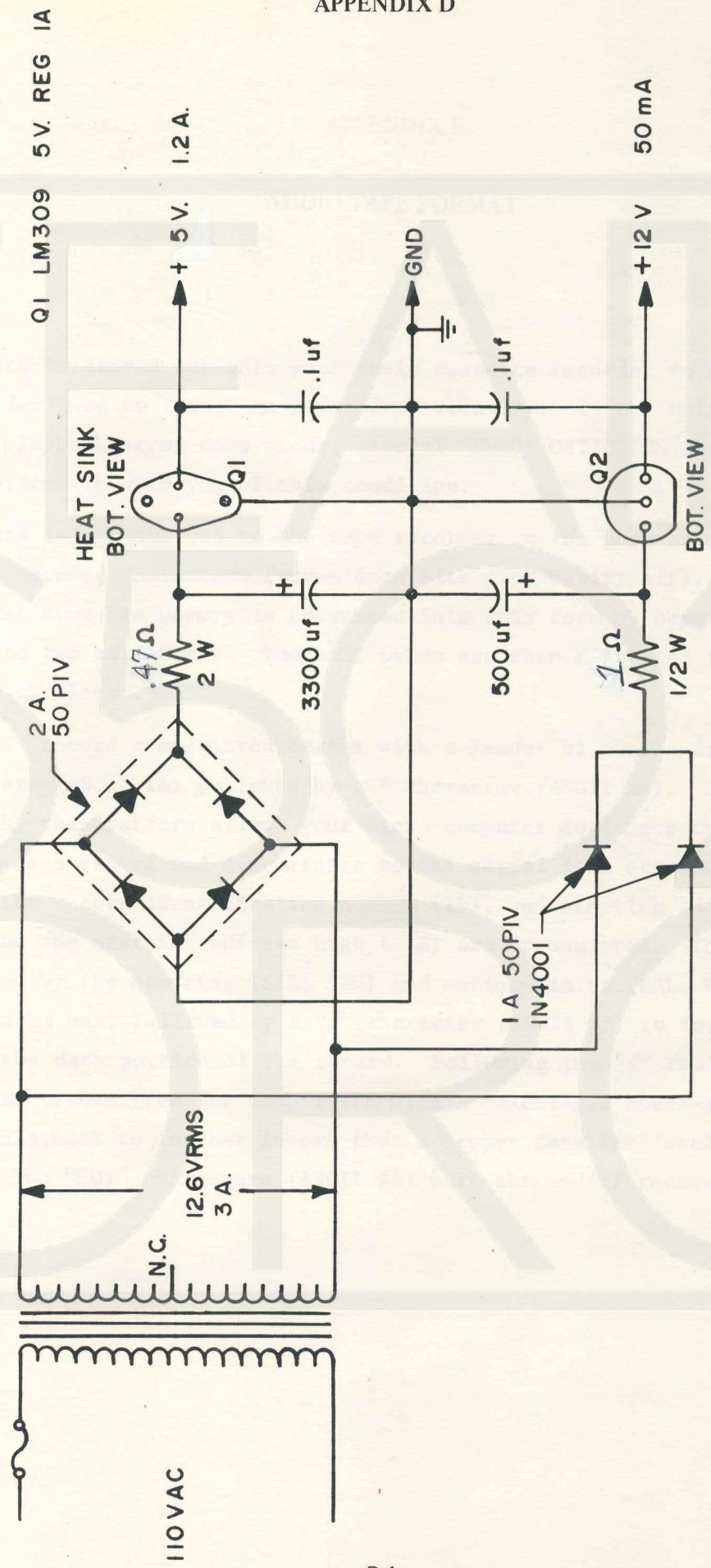
Type:	17F7 XX	(17F7)	(F5)	SPACE
See Printed:	<del>00F5</del> xx	FF.		
Type:	17F8 XX	(00)		
See Printed:	<del>00F6</del> xx	03.		
Type:	17F9 XX	(02)		
See Printed:	<del>00F7</del> xx	200		
Type:	0200 XX	(EF)		SPACE
See Printed:	<del>00F8</del>			
Type:		(03)		
See Printed:	<del>00F9</del> xx			

APPENDIX B  
KIM-1 PARTS LAYOUT

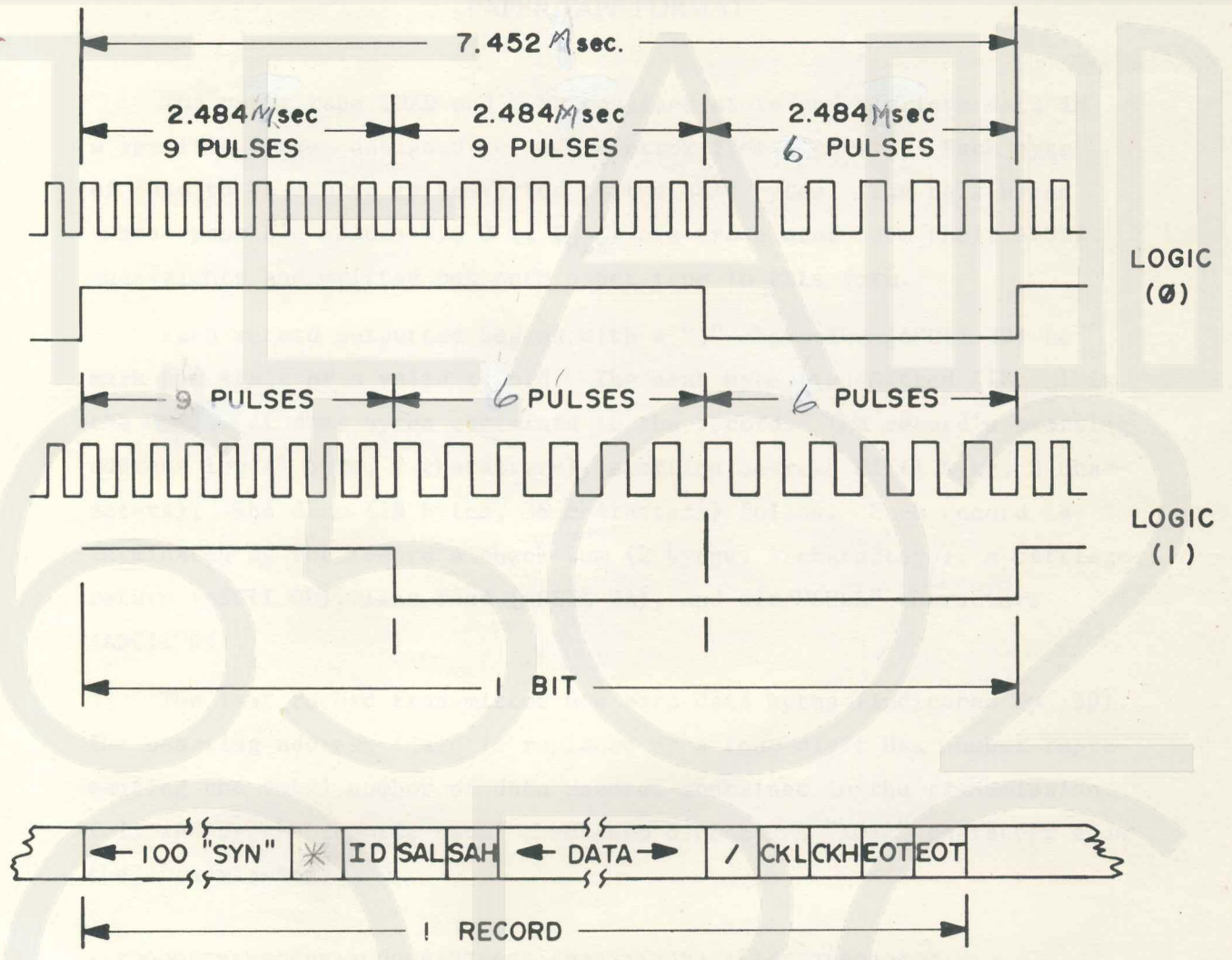




APPENDIX D



*Suggested Power Supply*



Audio Tape Format  
FIGURE E-1