

SERVICE MANUAL

~~POST 70~~ 9900

AUTOMATIC COMPUTING ELECTRONIC SCALE

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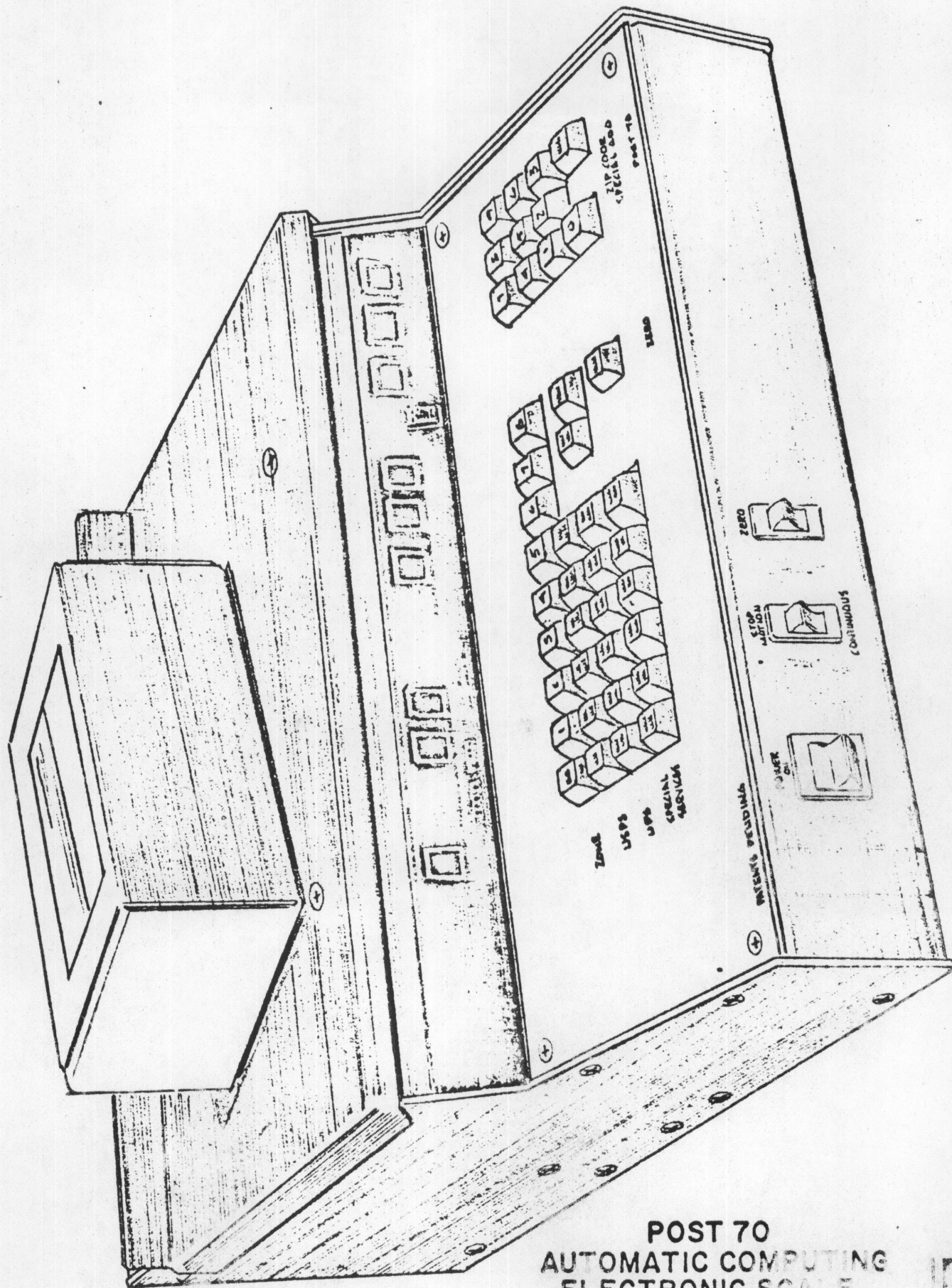
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SECTION I - INTRODUCTION



POST 70
AUTOMATIC COMPUTING
ELECTRONIC SCALE

Figure 1.1



SECTION I - INTRODUCTION

1.2 The POST 70 Electronic Computing Postal Scale is a highly accurate and versatile scale incorporating proven weighing principles and highly reliable electronic circuitry. The POST 70 combines sophisticated micro-computer technology with a rugged load cell weighing circuit to give fast and accurate postage computation. Parcels or letters weighing from 1/32 of an ounce to 70 pounds may be handled on the same scale, which allows for faster and more efficient mail handling.

The POST 70 by itself is a powerful addition to any Mailroom operation, but can be used with a variety of options to provide the end user with the kind of capability that suits his specific requirements. Some of the additional options include International Rates, Library Rates, Count Capability, Remote Display, Accumulating Printer and Postal Meter Interface.

One of the most advantageous features of the POST 70 Electronic Scale is the simplicity with which a postal rate change can be implemented. The change only requires that a small plug in electronic component or program board be removed and a new component or board be inserted. Most of the optional features can be handled in a similar manner.

Since there are no moving parts other than the fan, the maintenance of the scale will require nothing more than a periodic testing with test weights.

SECTION II - KEYBOARD OPERATION

SECTION II - KEYBOARD OPERATION

2.1 Front Panel Keyboard Operation

ON: Applies primary power to scale. 10 sec. will elapse before the digital display becomes valid.

OFF: Removes primary power to scale.

STOP MOTION - CONTINUOUS

STOP MOTION: Allows the digital display to operate statically. The digital display will change only after the applied weight has stabilized.

CONTINUOUS: Allows the digital display to operate dynamically. Changes in applied weight will be displayed immediately.

ZERO-PUSH TO OPERATE: Causes the scale to rezero itself. The zero can also be used to subtract (tare) a container weight. When used as tare control, place empty container on scale and push to tare. Zero light will light. Place parcels or parts in container. The correct weight will be displayed. If counting option is used, then weight and count will be displayed.

SECTION II - KEYBOARD OPERATION

2.2 USPS Key Operation

First Class

The scale will use the current first class rates to compute the mailing cost for any parcel weighing up to the limit for first class mail. Selection of a Zone Key is not necessary for first class. For parcels weighing more than the first class limit, the scale will use the current priority rates to compute the mailing costs. The scale will also flash the zone lights to indicate to the operator that a zone must be specified for priority mail.

Air Mail

The scale will use the current air mail rates to compute the mailing cost for any parcel weighing up to the limit for air mail. Selection of a Zone Key is not necessary for air mail. For parcels weighing more than the air mail limit, the scale will use the current priority rates to compute the mailing costs. The scale will also flash the zone lights to indicate to the operator that a zone must be specified for priority mail.

Third/Fourth

The scale will use the current third class rates to compute the mailing cost for any parcel weighing up to the limit for third class mail. Selection of a zone is not necessary for third class. For parcels weighing more than the third class limit, the scale will use the current parcel post (Fourth Class) rates to compute the mailing cost. The scale will also flash the zone light to indicate to the operator that a zone must be specified for parcel post.

Book Rate

The scale will use the current book rate (Special Fourth Class Rate).

SECTION II - KEYBOARD OPERATION

2.2 USPS Key Operation (Cont.)

to compute the mailing cost for any parcel up to 70 lbs. Selection of a zone is not necessary for book rate.

USPS Special Services

Registered Mail

The scale will add the current rate for registering items valued up to \$100 to the computed mailing cost. Only certain USPS Services are eligible to be registered. The scale will ignore an attempt to register an ineligible service.

Certified Mail

The scale will add the current rate for certified mail to the computed mailing cost. Only certain USPS Services are eligible to be certified. The scale will ignore an attempt to certify an ineligible service.

Insurance

The scale will add the current rate for insuring items valued up to \$50 to the computed mailing cost. Only certain USPS Services are eligible to be insured. The scale will ignore an attempt to insure an ineligible service.

SECTION II - KEYBOARD OPERATION

2.3 UPS Key Operation

Intrastate

The scale will use the current UPS rates for the state where the scale is located, to compute the mailing cost for any parcel weighing up to 50 lbs.

The scale will flash the zone lights to indicate to the operator that a zone must be selected to compute an intrastate rate. If a zone is selected which doesn't exist on the rate chart, the scale will display a mailing cost of flashing zero's. This indicates to the operator a valid zone is still needed.

If no intrastate rate chart exists for the state where the scale is located, selection of a Zone Key will always display a mailing cost of flashing zero's.

Interstate

The scale will use the current UPS interstate rates to compute the mailing cost for any parcel weighing up to 50 lbs.

The scale will flash the zone lights to indicate to the operator that a zone must be selected to compute an interstate rate.

Blue Label Service

The scale will use the current UPS blue label rates, for the selected blue label service, to compute the mailing cost for any parcel weighing up to 50 lbs.

Selection of a Zone Key is not necessary for UPS blue label.

The Blue Label Service keys will depend on the scale location.

SECTION II - KEYBOARD OPERATION

2.3 UPS Key Operation (Cont.)

Special Delivery

The scale will add the current rate for special delivery to the computed mailing cost. Special Delivery may be applied to any USPS Service.

Special Add

When an additional special charge is desired, the Special Add Key may be used. Use the following procedure to add any additional charges to the computed mailing cost:

1. Check for zero light indication.
2. Put the item to be mailed on the Postal Scale.
3. Select the desired UPS or USPS Keys.
4. The scale will display the weight and mailing cost.
5. Depress Spec./Add Key.
6. Use the Z/Z Keyboard to Key in any additional charges up to \$9.99.
7. Depress Spec./Add.
8. The scale will display the weight and new mailing cost.
9. The dollars display will accumulate more than one special charge. For each additional special charge, repeat 6 and 7 above.

SECTION II - KEYBOARD OPERATION

2.4 Zip to Zone and Miscellaneous Key Operation

Large Package

Both USPS and UPS have a minimum charge for parcels which exceed a specified size. The Large Package Key will automatically compute the minimum charge when depressed.

Print

If an external printer or postal meter is attached to the scale, use this key to activate the external device.

Zip to Zone

If the zone is known, press any of the appropriate zone keys. The Zone Key will light when depressed. If the zone is not known, enter the first three digits of the zip code in zip code keyboard. The proper zone will be selected.

2.5 Option Key Operation

Library Rate

The scale will use the current library rate to compute the mailing cost for any parcel up to 70 lbs. Selection of a zone is not necessary for library rate.

International Rate

The scale will use the current international rate for the selected country to compute the mailing cost. The following procedure should be used to compute an international rate:

1. Check for zero light indication.
2. Put item to be mailed on Postal Scale.
3. Depress International Key.

SECTION II - KEYBOARD OPERATION

2.5 Option Key Operation (Cont.)

4. Use Z/Z keyboard to enter 3 digit international code. See APPENDIX I for code explanation.

5. Scale will display weight and mailing cost.

S = 8, Count

The scale will use the weight of 8 sample items to compute the number of items on the scale.

The following procedure should be used to count pieces with a Postal Scale:

1. Check for zero light indication.
2. Depress S=8, Count Key.
3. Put 8 sample pieces on the Postal Scale.
4. The scale will display weight and a count of 8.
5. Add pieces to be counted.
6. The scale will display weight and total count.

SECTION III - CALIBRATION

SECTION III - CALIBRATION

1. Turn ON scale.
2. Allow 15 min. warm-up.
3. Remove scale deck.
4. Move Gross Test switch to ON position. In test mode, the display is read as follows:

L 0
B XX Z XX \$ XX.XX

LB = Pounds

OZ = 0 thru 15 Ounces

\$XX.00 = 0 thru 15, 1/16 Ounces

\$00.XX = 0 thru 15, 1/256 Ounces

The Auto Zero switch is disabled in gross test mode.

5. Adjust R5 on the load cell amplifier card until the display reads 39 lbs. 8 oz.
6. Observe the 1/256 ounces display. Changes in this display should be no greater than $\pm 4/256$ oz. ($\pm 1/64$).
7. Move Gross Test switch to OFF. Move Net Test switch to ON.
8. Add 40 lbs. of weight to the load cell.
9. Depress the Auto Zero switch.
10. Remove the 40 lbs. of weight.
11. Adjust R4 on the load cell amplifier card until the display reads -40 lbs. 0 oz. 0 1/16 oz 0 1/256 oz. $\pm 4/256$ oz.
12. Repeat Steps 9 thru 11 as needed.

The Postal Scale is now calibrated. Replace the scale deck and run the following test: (Net Test switch ON)

- A. With no weight on scale deck, depress the Auto Zero switch.
- B. Add 4 lbs. to scale deck.

SECTION III - CALIBRATION PROCEDURE

- C. Display should read 4 lbs. $\pm$ 8/256 oz. (1/32).
- D. Increase weight on scale deck to 10 lbs.
- E. Display should read 10 lbs. $\pm$ 1/16 oz.
- F. Increase weight on scale deck to 20 lbs.
- G. Display should read 20 lbs. $\pm$ 2/16 oz. (1/8).
- H. Increase weight on scale deck to 30 lbs.
- I. Display should read 30 lbs. $\pm$ 3/16 oz.
- J. Increase weight on scale deck to 50 lbs.
- K. Display should read 50 lbs. $\pm$ 8/16 oz. (1/2).
- L. Increase weight on scale deck to 70 lbs.
- M. Display should read 70 lbs. $\pm$ 12/16 oz. (3/4).

Remove the scale deck and move the Net Test switch to the OFF position.

Replace the scale deck.

The scale is now ready to be returned to operation.

If the scale fails to perform during any part of the calibration procedure, refer to the Troubleshooting Guide.

NOTE: In computing mode, the Postal Scale will read 1/32 oz. low.

This is to give the customer the benefit of the $\pm$ 1/32 oz. Post Office accuracy specification.

The scale may be checked as follows:

1. Depress Reset and Auto Zero.
2. Add 4 lbs. to the scale deck.
3. Display will show 3 lbs., 15.5 oz.
4. Add 1/32 oz. to the scale deck.
5. Display will show 4 lbs., 0 oz.

SECTION IV - THEORY OF OPERATION

SECTION IV - THEORY OF OPERATION

The descriptions in this manual are given to acquaint service personnel with the operating functions of this scale. Each major section will be discussed. A simplified block diagram of the circuit will accompany the description.

The POST 70 Postal Scale consists of two major sections, Analog and Digital.

The Analog section converts the force (weight) of a letter or parcel to a proportional voltage within a range of from 0 to 70 pounds.

The Digital section converts the weight proportional voltage to a digital quantity and processes it to compute postage and provide a display to the operator.

4.0, System Block Diagram Description

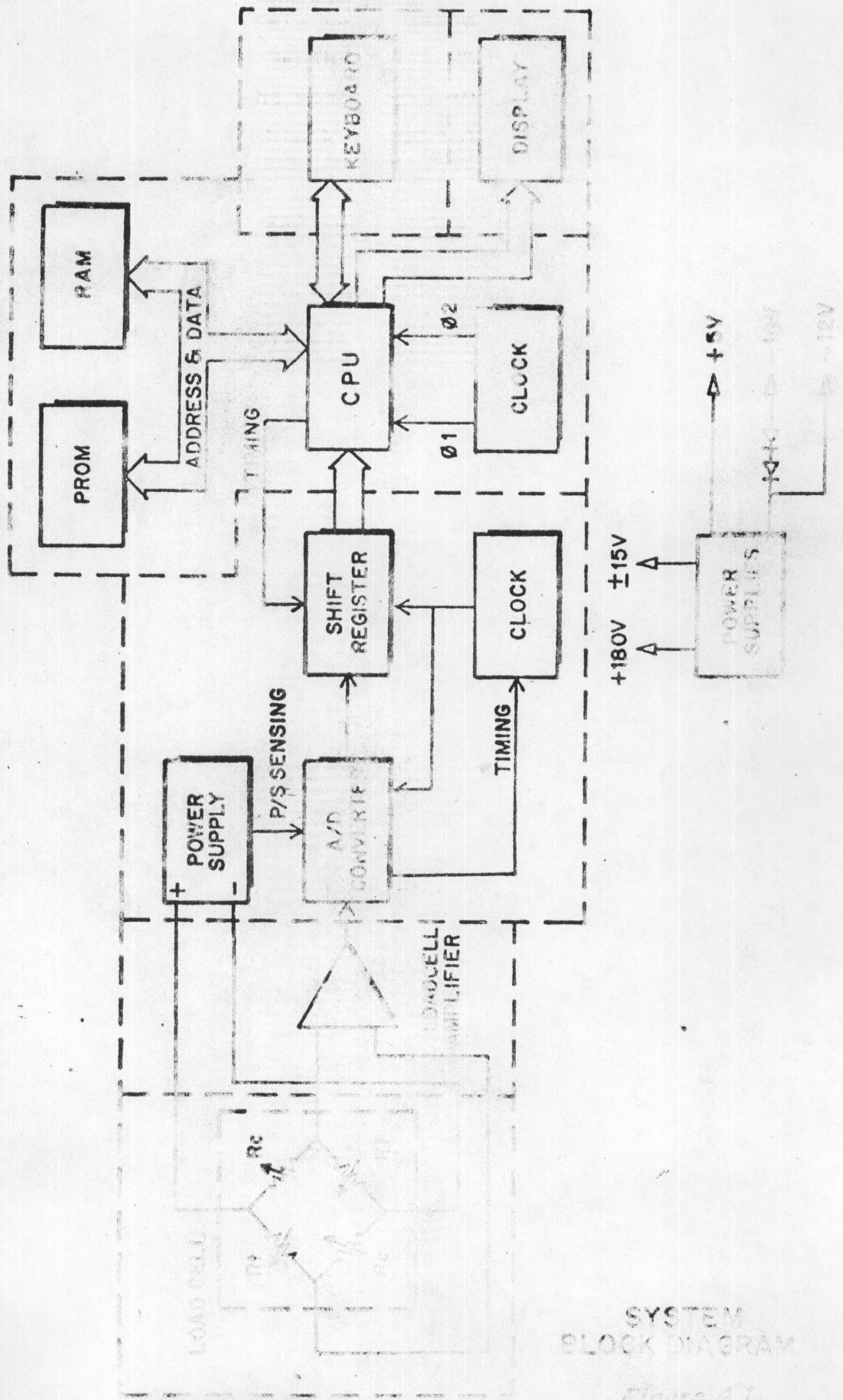
Figure 4.1 is an overall block diagram of the scale, showing the major circuit signal flow. The output of load cell is sent to the load cell amplifier and passed on to the Analog to Digital Converter. The Analog to Digital Converter comprises a power supply, shift register and clock circuit. The power supply supplies excitation voltage to the load cell. "Power supply sensing" signals sense any unwanted change in excitation voltage at the load cell and adjusts the output of the Digital to Analog Converter to compensate. The clock circuit is controlled by the Analog to Digital Converter and in turn controls the shift register. The shift register counts clock pulses relative to the signal that is present at the input to the Digital to Analog Converter. A zero input to the A to D Converter represents zero clock pulses collected in the shift register and 2 V input represents 32000 clock pulses. From the above, it can be seen that each shift register count equals 80 microvolts of input signal. The CPU comprises control clocking signals

SECTION IV - THEORY OF OPERATION

4.0 System Block Diagram Description (Cont.)

and RAM and PROM memory circuits.

The CPU receives a data ready signal from the shift register. The CPU sends out pulses to the shift register to retrieve the information that is in the registers, so that it can be stored in RAM memory. The control program is stored in PROM memory and directs the CPU to operate on the stored information along with inputs from the keyboard and other constants that are also programmed in memory. The resulting outputs are sent to the display for visual presentation.



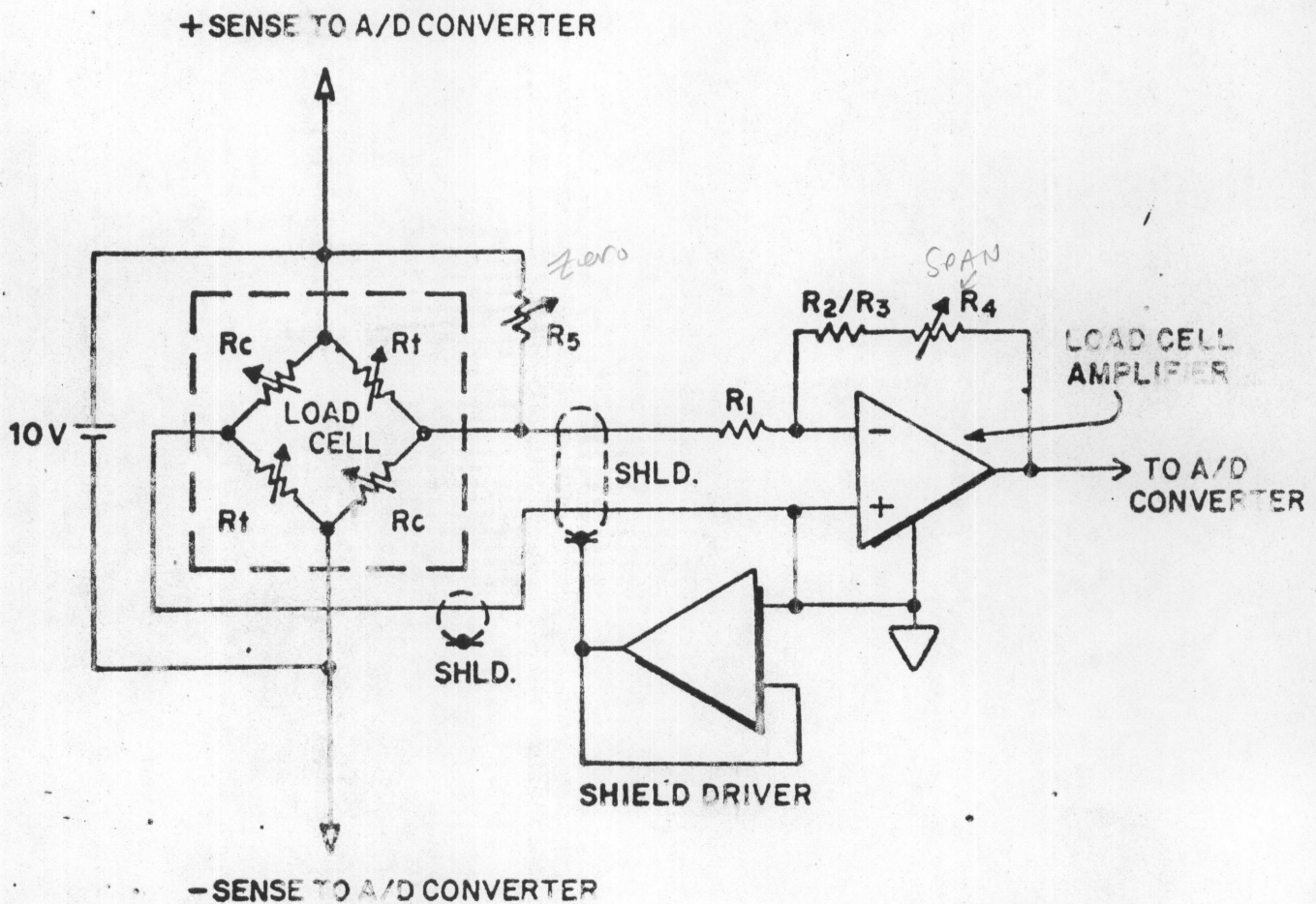
SYSTEM
BLOCK DIAGRAM

Figure 4.1

SECTION IV - THEORY OF OPERATION

4.2 Load Cell and Amplifier Description

The circuit shown in Figure 4.3 consists of a power supply, load cell and load cell amplifier. The power supply supplies an excitation voltage to the load cell. The load cell is a mechanical device designed with strain gauges formed to an electrical configuration of a balanced wheatstone bridge. The excitation voltage is applied to two terminals of the bridge. When there is no force applied to the load cell, the bridge is balanced with no output voltage present. When a compression force is applied to the load cell, the R_c gauges change resistance causing an unbalance of the wheatstone bridge and an output voltage which is approximately equal to 2 MV per volt of excitation times a constant K where K equals 1 at capacity. Since the input to the Analog to Digital Converter has a maximum input of ± 2.5 volts, the load cell has been intentionally unbalanced by resistor R5 so that the load cell output with no force applied is set close to half of its maximum positive output, which is approximately +10 millivolts. When a compression force is applied the load cell output would change in a negative direction thru zero to half of its negative output, which is approximately -10 millivolts. This is done to obtain more resolution from the Analog section by making full use of the Analog to Digital Converters full ± 2.5 volt range. The load cell amplifier is used to amplify the ± 10 millivolt signal from the load cell to a ± 2.5 volt signal used as an input to the Analog to Digital Converter.



LOADCELL AMPLIFIER
BLOCK DIAGRAM

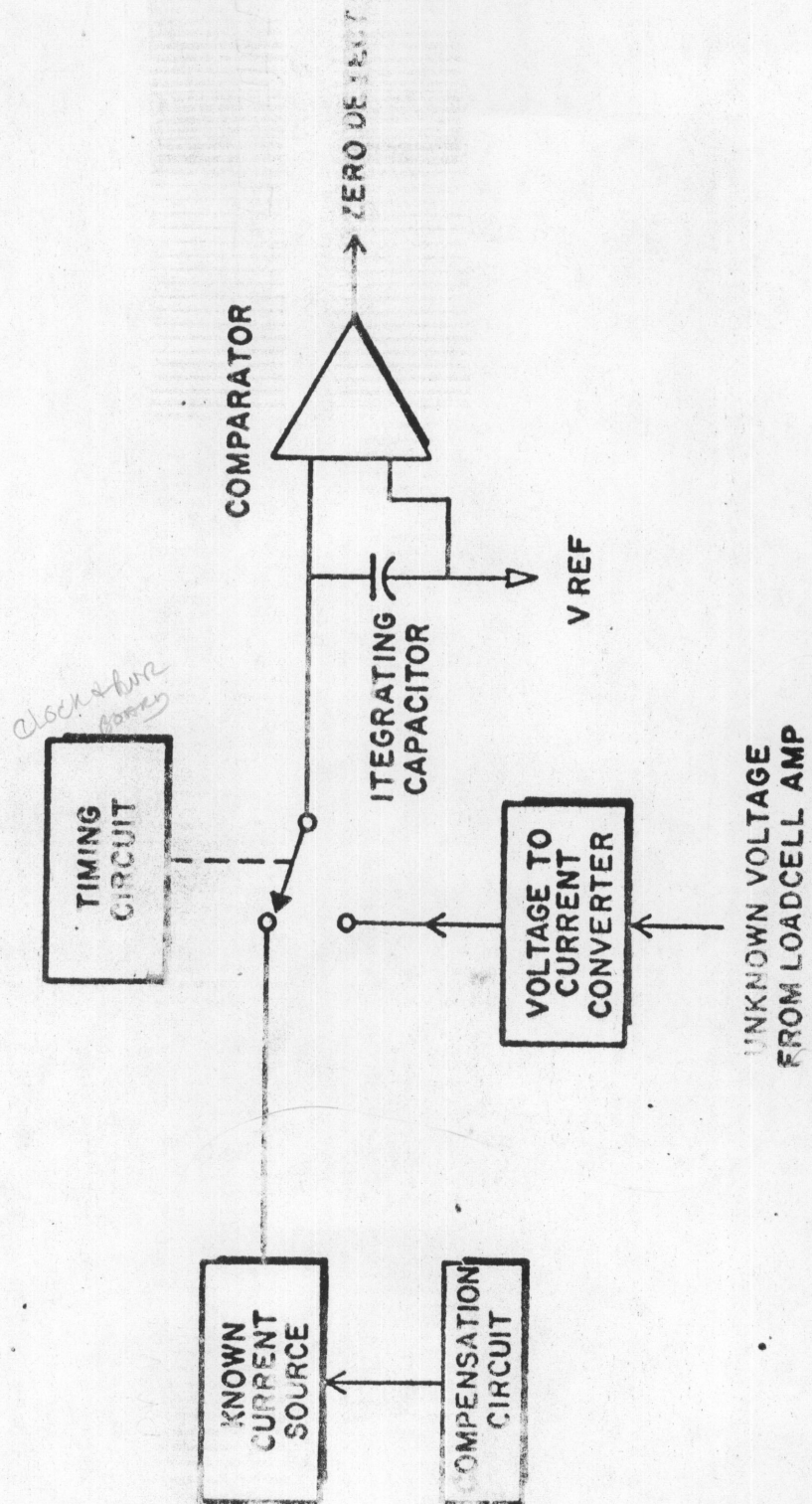
Figure 4.3

SECTION IV - THEORY OF OPERATION

4.4 Analog to Digital Converter

The Analog to Digital Converter is a dual slope type converter. (See Figure 4.5) This process of conversion is summarized as follows:

The analog voltage from the load cell amplifier is applied to the input of Analog to Digital Converter and is converted to a current. This current (I_x) discharges an integrating capacitor for a predetermined length of time (16,000 clock counts). When the time period ends, a solid state switch switches a known current source to charge the capacitor back to its starting point. The known current source is calibrated such that if the input voltages were 2V, it would take 32,000 clock pulses to charge the integration capacitor back to the starting point. The comparator's function is to detect the zero or the starting point to control the timing circuitry and shift register. The current source compensation is provided to correct for load cell excitation supply changes.



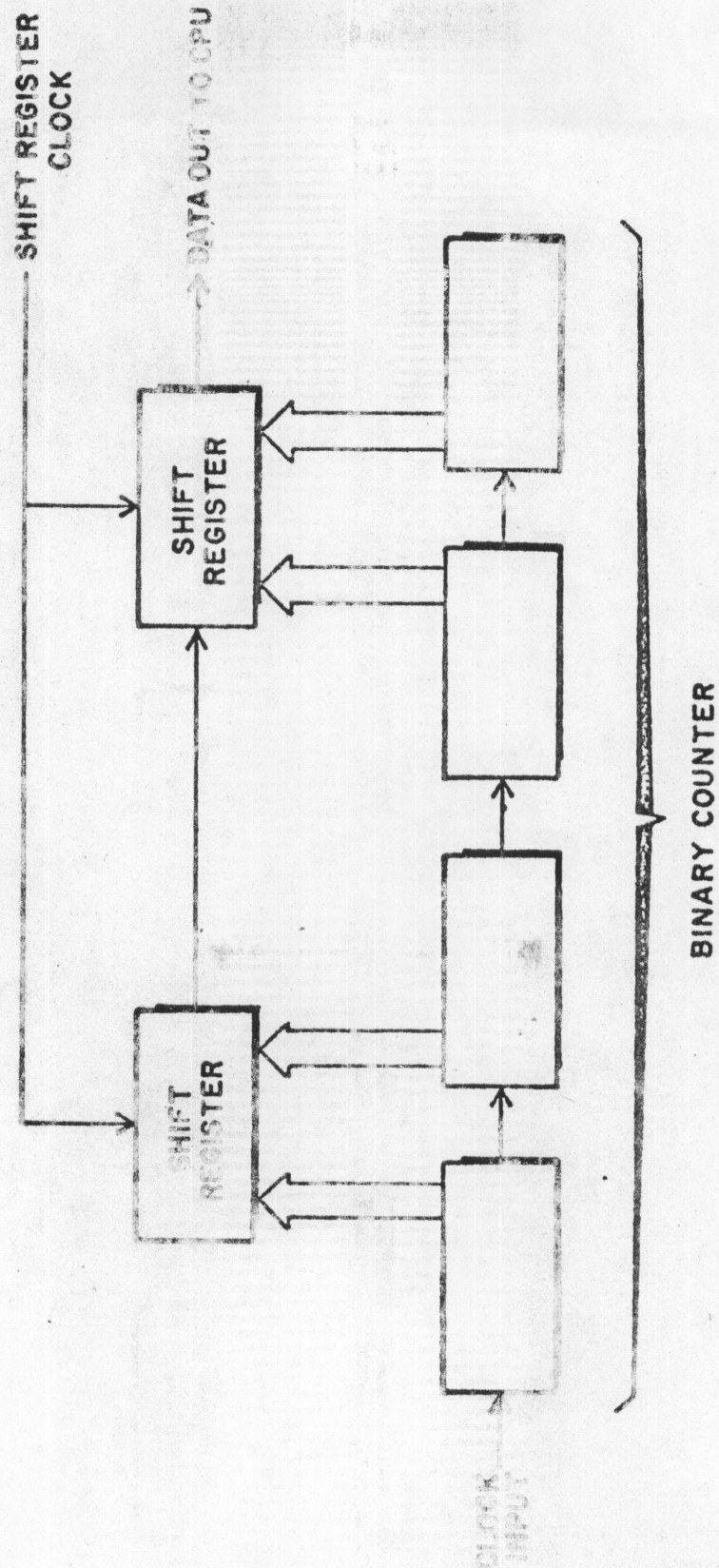
ANALOG TO DIGITAL
CONVERTER

Figure 4.5

SECTION IV - THEORY OF OPERATION

4.6 Counter and Shift Register

The Counter and Shift Register (Refer to Figure 4.7) is an integral part of the Analog to Digital Converter. The Shift Register receives the clock pulses from the converter and stores them in a binary counter. At "Zero Detection" time the binary counter stops accumulating the clock pulses from the converter. The contents of the binary counter is now a binary number directly proportional to the weight on the scale and is in a form that can be used by the microprocessor. The information from the binary counter is loaded into the Shift Register. A Shift Register clock signal command comes from the microprocessor to the Shift Register, as a command to output data on the data out line which returns to the microprocessor.



COUNTER AND
SHIFT REGISTER

Figure 4.7

SECTION IV - THEORY OF OPERATION

4.8 Microprocessor Description

The NCI Postal System uses a 4 bit microprocessor, reference Figures 4-10 and 4-11. All data is transmitted between the system elements in Groups of 4 bits. The instruction cycle for the computer requires eight, 4 bit time intervals. The eight time intervals accomplish program memory addressing, instruction retrieval and instruction execution. The 12 bit address required to address up to 4096 words of program memory, is sent from the CPU (4004) to the program memory (1702) via the (4008) in three time intervals defined as A1, A2 and A3. The eight bits of instruction for each word are sent from the addressed program memory (1702) via the (4009) to the CPU (4004) in two time intervals defined as M1 and M2. During the last three time intervals defined as X1, X2, and X3, the CPU executes the instructions.

Each time interval is generated by the operation of a two phase CPU clock circuit. A sync. pulse is generated by the CPU (4004) to keep the RAM's (4402) and interface devices (4008, 4009) in step with the CPU.

The microprocessor communicates with the Postal System via the output buss, input buss, address buss, and memory port 0.

Memory Port 0 consists of the 4 latched outputs of RAM 0. These four lines go to the data clock control section of the keyboard assy. where they are decoded to enable one of the data control clocks.

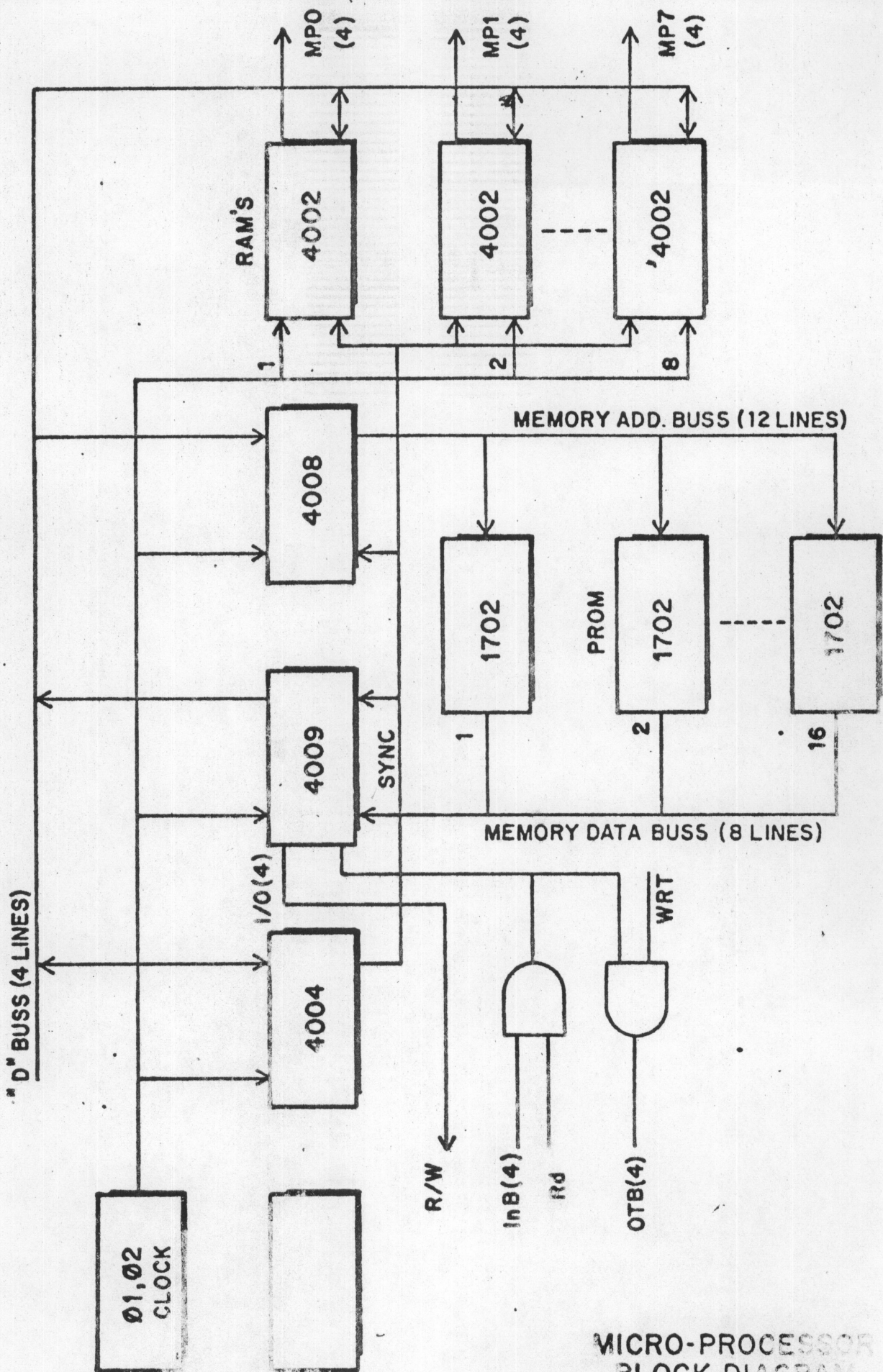
The four output buss lines go to the display board, lamp board and ROM address register. Whenever a write output buss command is executed by the computer, a hexadecimal character is presented on the output buss. During the write command, a WRT-pulse is generated.

SECTION IV - THEORY OF OPERATION

4.8 Microprocessor Description

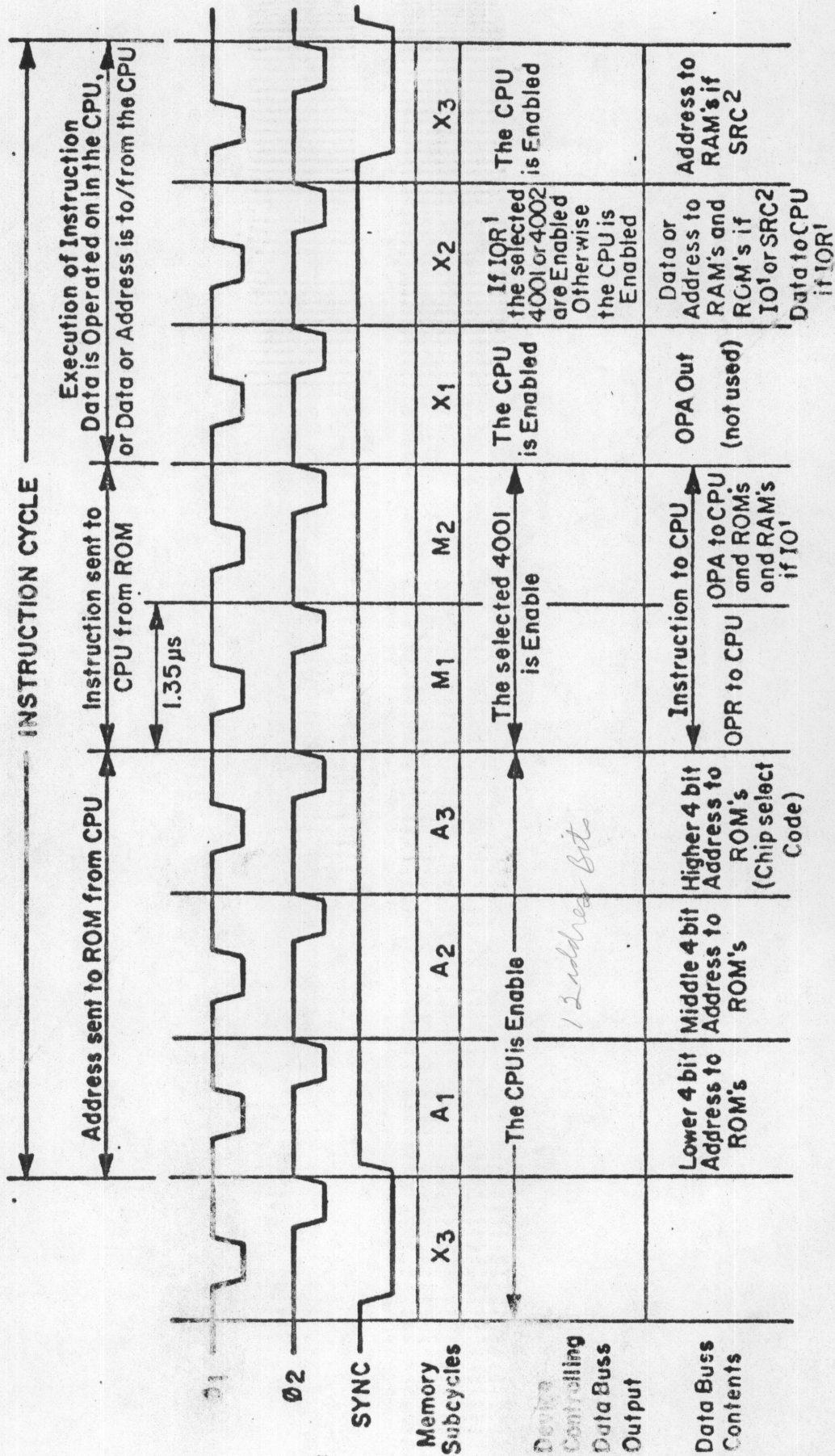
This pulse generates a data clock which clocks the output buss data into the appropriate board.

The 4 input buss lines are used to bring 4 bits of data from the Postal System back to the computer. By changing the value of the address buss, the keyboard data, ROM data, front panel switches, or the meter data can be presented on the input buss. The computer uses the read input buss command to retrieve data from the input buss.



MICRO-PROCESSOR
BLOCK DIAGRAM

Figure 4.3



- (1) IO instructions control the flow of information between accumulator in CPU, I/O lines in ROM's and RAM storage. IOR stands for IO Read. In this case the CPU will receive data from RAM storage locations of 4001's.
- (2) The SRC instruction designates the chip number and address for a following IO instruction.

**MICRO-PROCESSOR
TIMING DIAGRAM**

Figure 4.10

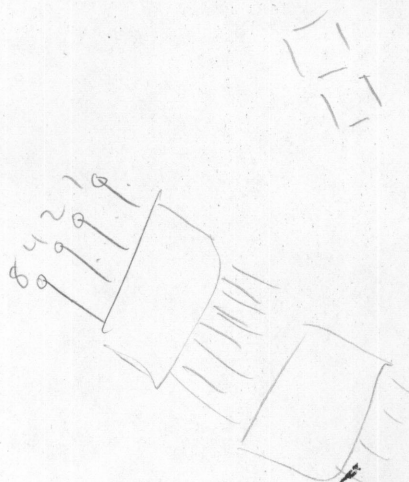
SECTION IV - THEORY OF OPERATION

4.11 Display Description (Ref. Figure 4.12)

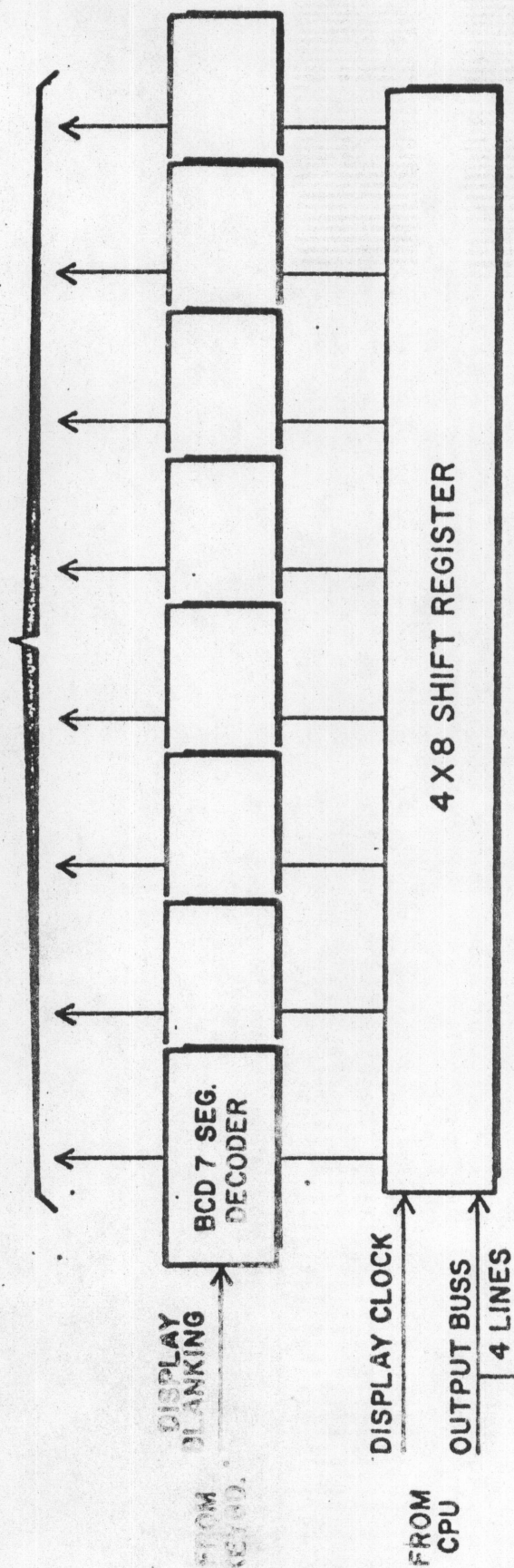
The digital display receives eight 4 bit characters from the computer. These characters are shifted into the 4 x 8 Shift Register by eight display clocks. The display is blanked during loading. When the display is fully loaded, the blanking is removed and the characters are decoded and displayed. BCD to seven segment decoders are used to drive seven segment gas discharge display modules.

The 180V high voltage to drive the displays comes from a remote power supply located on the Analog to Digital Converter.

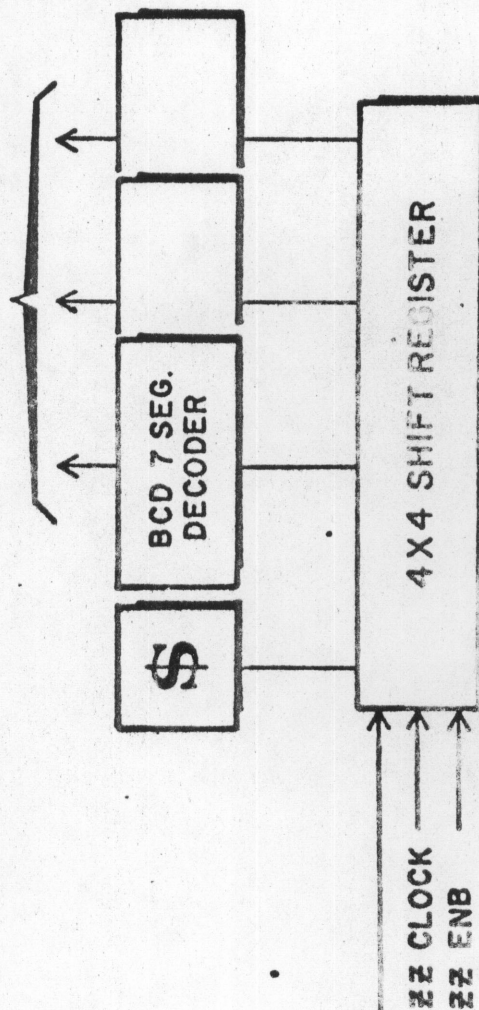
The Z/Z board is similar to the digital display except it is only four characters long.



SPERRY 7-SEGMENT DISPLAY



ZZ DISPLAY



DISPLAY
BLOCK DIAGRAM

Figure 4.12

SECTION V - TROUBLESHOOTING GUIDE

SECTION V - TROUBLESHOOTING GUIDE

5.1 Troubleshooting Guide - Digital

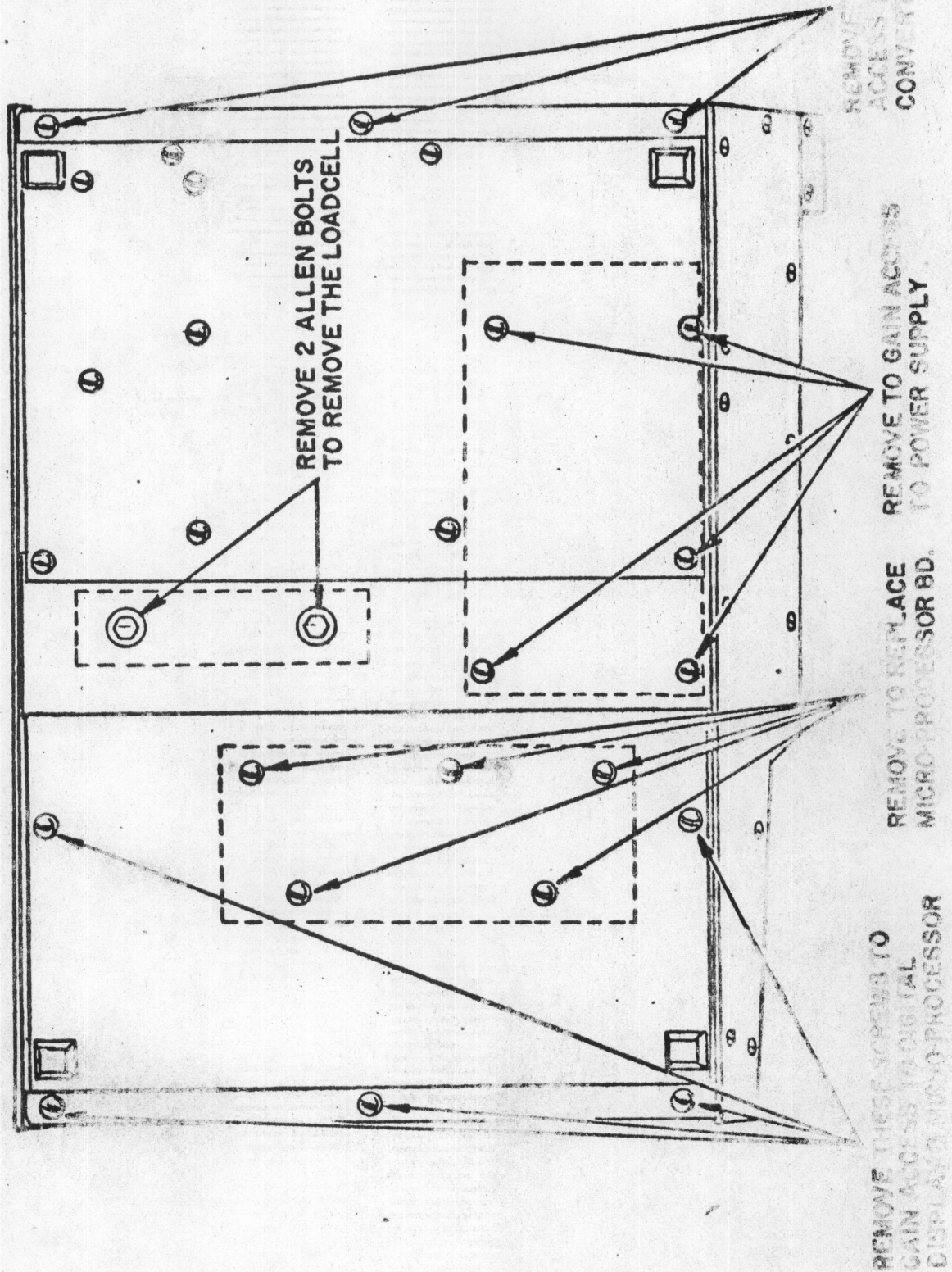
<u>TROUBLE</u>	<u>POSSIBLE SOLUTION</u>
No dollar sign and no keyboard lamps.	Replace fuse. Replace line filter.
No dollar sign or display. Keyboard lamps O.K.	Replace A/D Converter.
Random numbers on display. Keyboard lamps O.K.	Replace display.
Keyboard lamps random. Display O.K.	Replace keyboard. Replace microprocessor.
Display random or blank. Lamps random.	Check +5, - 9.5 supply. Replace microprocessor. Replace Memory A. Replace keyboard. See Analog section.
One bad character on display.	Replace display.
Weight O.K., bad rates.	Replace Memory A. Replace microprocessor.
Weight O.K., Z/Z bad.	Replace Memory B. Replace microprocessor.

SECTION V - TROUBLESHOOTING GUIDE

5.2 Troubleshooting Guide - Analog

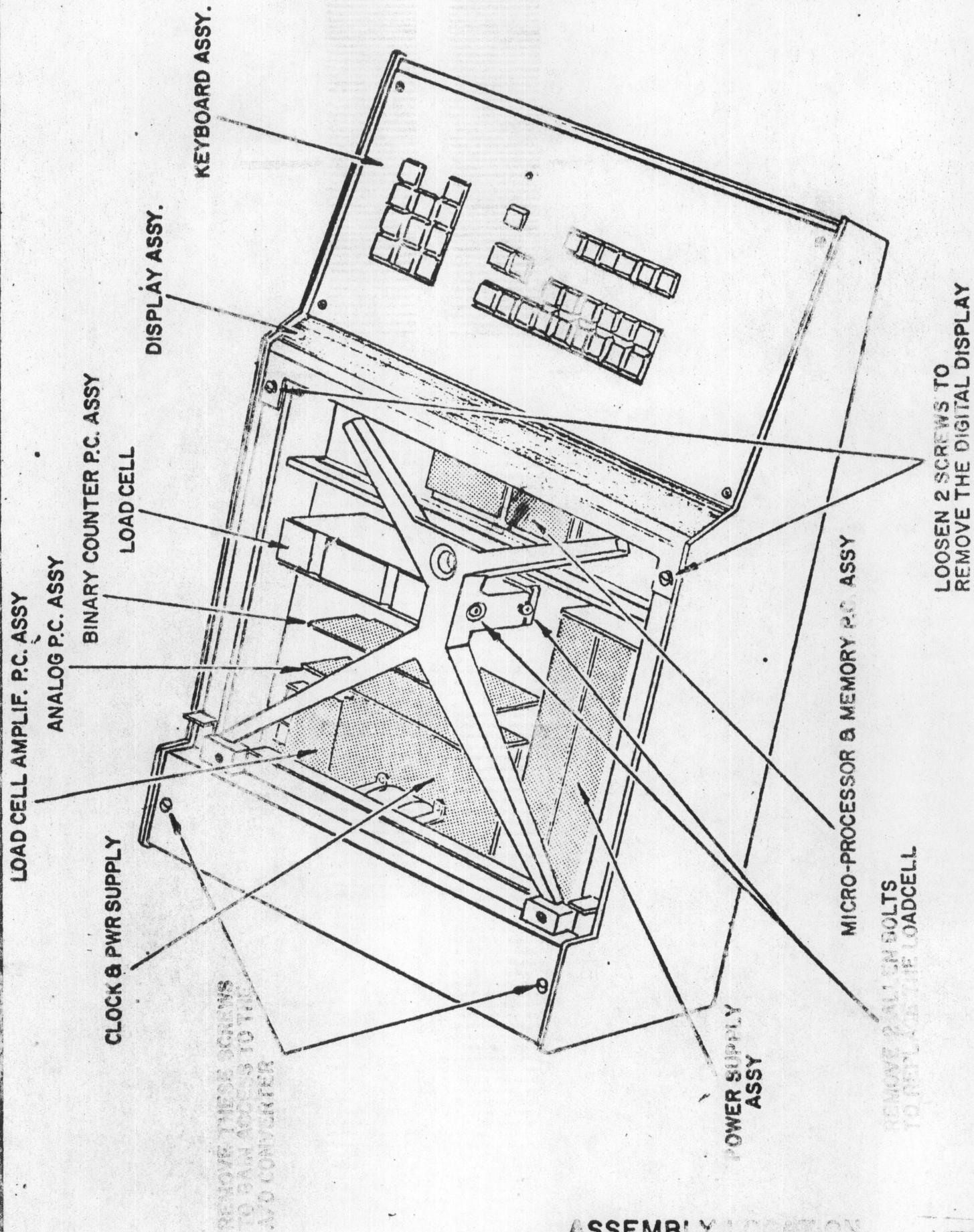
<u>TROUBLE</u>	<u>POSSIBLE SOLUTION</u>
Display random and lamps random.	Replace A/D Converter. Replace load cell amp. Replace load cell. See Note 1 for isolating problem.
Zero light blinks on and off.	Same as above.
Weight incorrect.	See Calibration. Replace A/D Converter. Replace load cell amp. Replace load cell.
Note 1: Use the following procedure to isolate problems in the Analog section.	
1. Put gross test switch in the ON position. Use a clip lead to short Pin 18 to Pin P on the A/D Converter Card. Display should read 0 lbs. $\pm$ 1 lb. If this test fails, replace the A/D Converter.	
2. Move clip to short the green to white wires on the end of the load cell cables. Display should read 0 lbs. $\pm$ 1 lb. If this test fails, replace the load cell amp.	
3. If test 2 passes and a problem still exists, replace the load cell.	

Use this procedure to isolate electrical noise also. The units portion of the display can be used to determine noise, $\pm$ 4 digits of instability are allowed. If more noise is present, use Note 1 to isolate the noise to a portion of the Analog section.



**BOTTOM COVER
REMOVAL DIAGRAM**

Figure 5.3

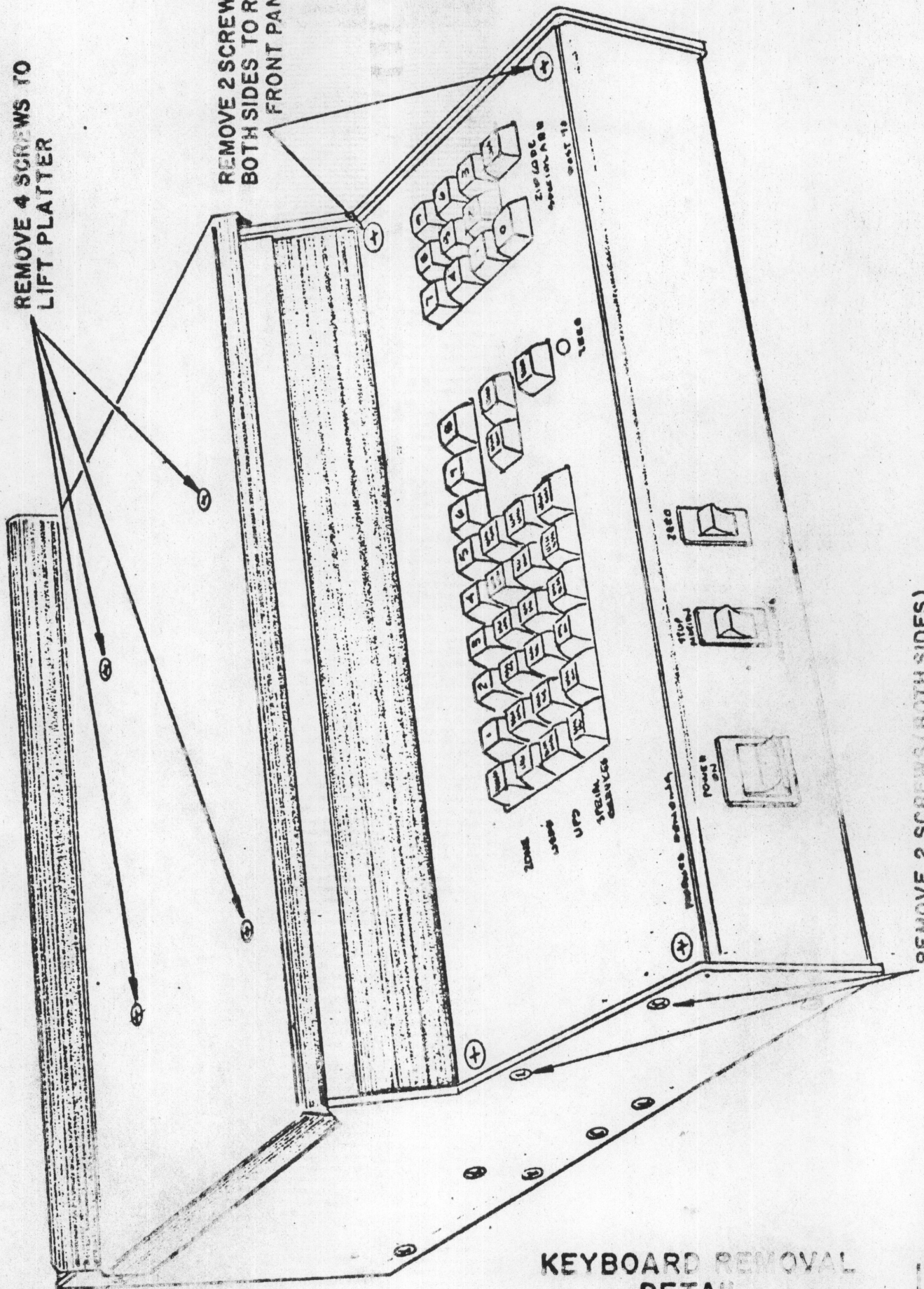


ASSEMBLY LOCATION
DIAGRAM

Figure 5-4

REMOVE 4 SCREWS TO
LIFT PLATTER

REMOVE 2 SCREWS
BOTH SIDES TO RAISE
FRONT PANEL



KEYBOARD REMOVAL
DETAIL

Figure 5.5

SECTION V - TROUBLESHOOTING GUIDE

5.6 Load Cell Removal Procedure (Ref: Figures 5.3 and 5.4)

1. Turn off "Power ON" switch and unplug scale from power outlet.
2. Four Phillips head screws hold the scale deck in place. Remove these screws and lift the deck from the Postal Scale.
3. Two aluminum head bolts hold the load cell spider on the load cell. Remove these bolts and lift the spider from the load cell.
4. The load cell cable must now be disconnected. The load cell cable connects to a 7 position TB on the load cell amp. card. Loosen all screws on the load cell amp. TB and remove the load cell cable.
6. Turn the Postal Scale on its side.
7. Hold the load cell with one hand and remove the two aluminum head screws which hold the cell to the chassis, with the other.

SECTION V - TROUBLESHOOTING GUIDE

5.7 Removal of Load Cell Amplifier (Ref: Figure 5.4)

1. Turn off "Power ON" switch and unplug the scale from power outlet.
2. Four Phillips head screws hold the scale deck in place. Remove these screws and lift the deck from the Postal Scale.
3. Loosen the 7 screws that hold the load cell cable to the load cell amp. TB.
4. Remove the two slot head screws on either end of the load cell amp. TB.
5. Remove the load cell amplifier card.

SECTION V - TROUBLESHOOTING GUIDE

5.8 Removal of Analog to Digital Converter (Ref: Figures 5.3 and 5.4)

1. Turn off "Power ON" switch and unplug the scale from power outlet.
2. Four Phillips head screws hold the scale deck in place. Remove these screws and lift the deck from the Postal Scale.
3. To gain access to the A/D Converter, the rear panel must be removed. The rear panel is held in place by (5) slot head screws. Remove the (2) screws on the top of the rear panel. Turn the scale on its side. Remove the (3) screws on the bottom of the rear panel. Push outward on the bottom of the rear panel until it clears the bottom panel of the Postal Scale. Remove the rear panel from the chassis and let it rest to the rear of the Postal Scale. Removal of the wire harness is not necessary.
4. Remove the edge connector on the A/D Converter.
5. Remove the 4 Phillips head screws that hold the A/D Converter to the chassis.
6. Remove the A/D Converter.

SECTION V - TROUBLESHOOTING GUIDE

5.9 Removal of the Microprocessor (Ref. Fig. 5.3)

1. Turn off "Power ON" switch and unplug the scale from power outlet.
2. Turn the scale on its side.
3. Remove the (5) slot head screws from the front bottom panel.
4. Let the panel lay on the table top.
5. Remove the edge connector from the microprocessor.
6. Remove the 5 Phillips head screws that hold the microprocessor to the bottom panel.
7. Remove the microprocessor card.

SECTION V - TROUBLESHOOTING GUIDE

5.10 Removal of the Display Board (Ref: Figures 5.3 and 5.4)

1. Turn off "Power ON" switch and unplug the scale from power outlet.
2. Four Phillips head screws hold the scale deck in place. Remove these screws and lift the deck from the Postal Scale.
3. An aluminum bracket holds the top of the display board in place. Loosen the two screws that hold this bracket in place.
4. Turn the scale on its side.
5. Remove the (5) slot head screws that hold the bottom panel in place. Let the bottom panel lay on the table.
6. Remove the edge connector from the display board.
7. Remove the (3) hex nuts that hold the display board in place.
8. Remove the display board. Be careful not to damage the polaroid window when removing the display board.

5.11 Removal of Keyboard (Ref: Figure 5.5)

1. Turn off "Power ON" switch and unplug scale from power outlet.
2. Remove the (4) Phillips head screws that hold the keyboard panel in place.
3. Remove the (4) Phillips head screws that hold the keyboard to the chassis.
4. Remove the keyboard panel.
5. Remove the (2) Phillips head screws that hold the keyboard to the display assembly.
6. Lift the keyboard until the edge connector can be removed.
7. Remove the keyboard.

5.12 Removal of Power Supply (Ref. 5.3 and 5.4)

1. Turn off "Power ON" switch and unplug scale from power outlet.
2. Remove the (4) Phillips head screws that hold the scale deck in place. Remove the scale deck.
3. Turn the scale on its side.
4. Remove (3) Phillips head screws and (1) slot head screw that holds the power supply to the bottom panel of the scale.
5. Turn the scale so it is resting in a normal position.
6. Remove the (2) Phillips head screws that hold the power supply terminal strip in place.
7. Remove the power supply.

SECTION VI - RATE CHANGE PROCEDURES

SECTION VI - RATE CHANGE PROCEDURES

USPS Rate Changes

USPS rate changes are accomplished by changing the integrated circuits on the Memory A and Memory B boards.

NCI will supply the modified integrated circuits or modified memory boards prior to the effective date of the rate change.

In the event that the new rates are not announced prior to the rate change NCI will supply the modified integrated circuits or modified boards within the two week period following the rate change.

The parts necessary for the rate changes will be enclosed with a written and pictorial description of the steps necessary to implement the change. See APPENDIX II.

It is very important to install the modified parts in the scale for which they are intended. The scale serial number is written on the first page of the instruction write-up. Installation of a rate change kit in any scale other than the specified scale will result in improper operation.

NCI insists that the old integrated circuits or memory boards be returned within 30 days. In the event that the parts are not returned the appropriate charges will apply.

UPS Rate Changes

The procedure for implementing a UPS rate change is identical to the USPS rate changes.

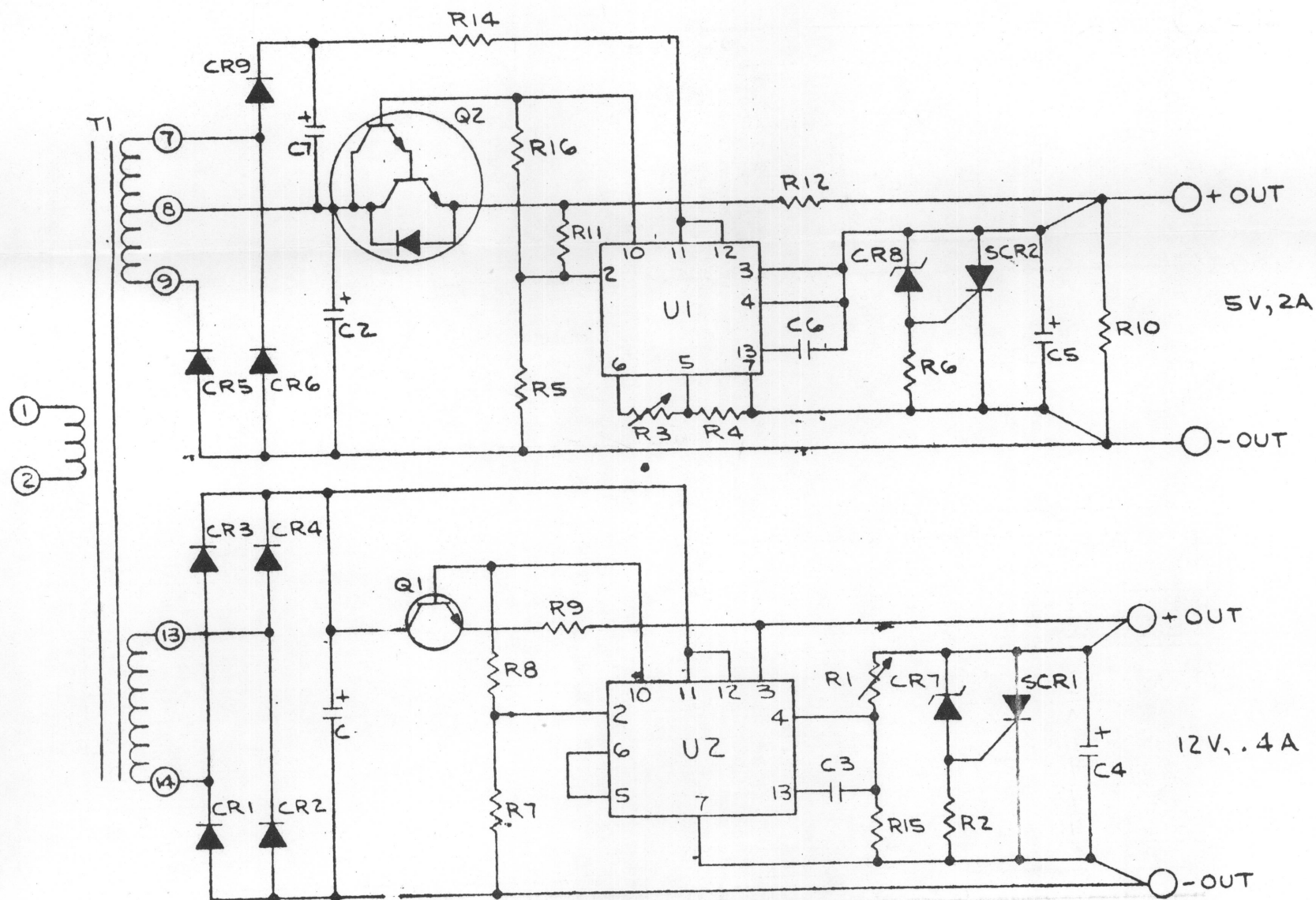
SECTION VII - SCHEMATICS

REF DES	HAA 512	DESCRIPTION
C1	330/35	CAPACITOR, ALUM.ELECT.
C2	9000/15	
C4	100/35	
C5,7	220/16	ALUM.ELECT.
C3	.001/100	MYLAR
C6	.003/100	CAPACITOR, MYLAR
CR1,2,3,4,9	AE1C	DIODE, 1A, 200V
CR5,6	AE3B	DIODE, 3A, 100V
CR8		DIODE, ZENER, 200MV
SCR2		3A SCR
Q1	12500-4	TRANSISTOR, NPN
Q2	2N6055	TRANSISTOR, DARL. NPN
CR7, R2, SCR1		
R5	1K	RESISTOR, 1/2 W, CARB.
R6		
R7		
R	240 Ω	
R14,16	270 Ω	1/2 W, CARB.
R4	2.81K	1/4 W, M.F.
R15	1.18K	1/4 W, M.F.
R9	1.5 Ω	1/2 W, CARB.
R12		RESISTOR, 2W, WW, BWH
R1,3	1.5K	POTENTIOMETER, 2W, WW
U1,2	uA723	I.C. VOLTAGE REGULATOR
T1		TRANSFORMER
P.C.B.	12666	P.C. BOARD
CHASSIS	11091	CHASSIS, ALUM.

MADE FROM 12653

POWER-ONE, INC.

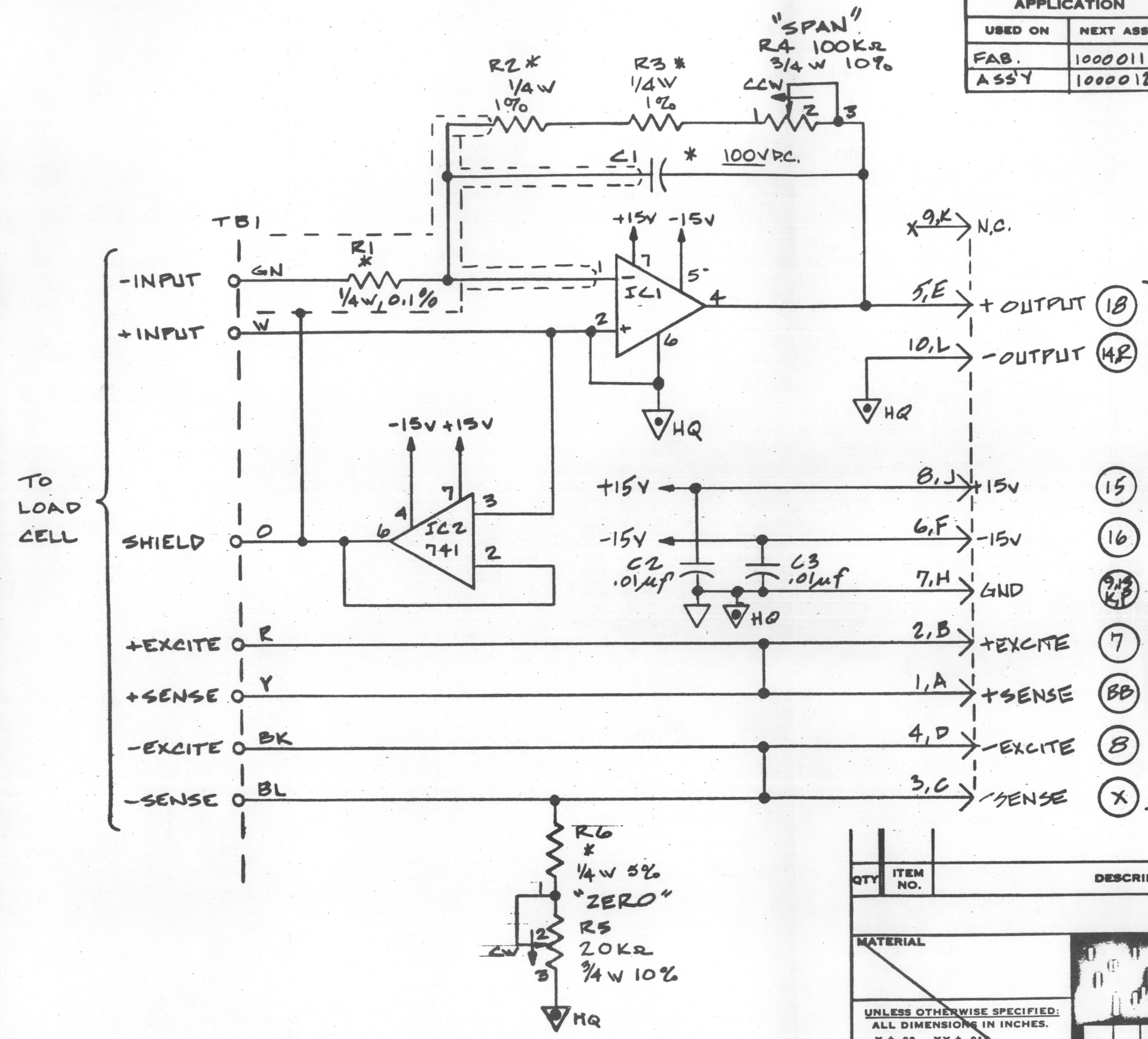
SCALE	NO. 3
DATE	8-4-75
BY	J. E. H.
APPROVED	J. E. H.
REV.	1
DATE	8-4-75



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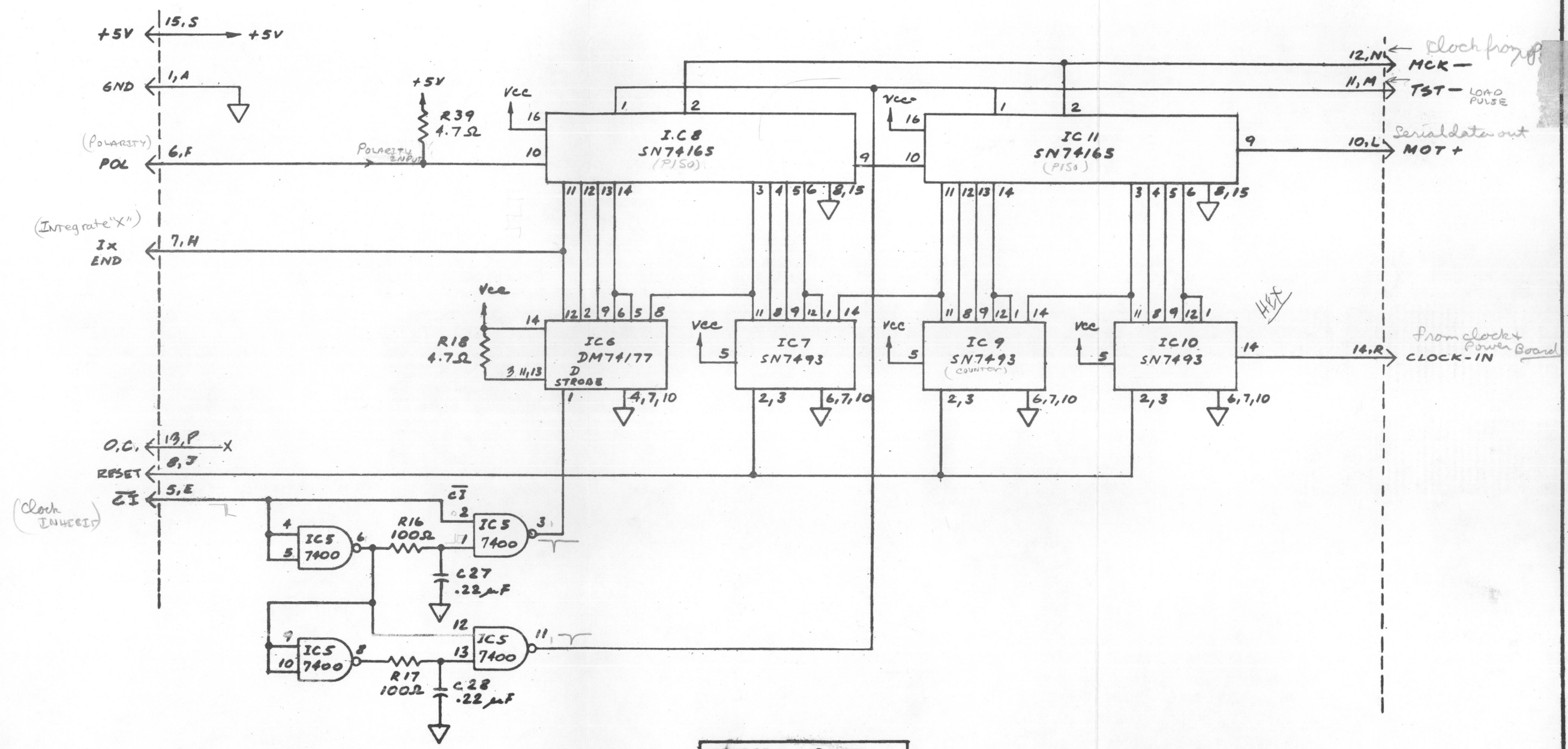
APPLICATION		REVISIONS			
USED ON	NEXT ASS'Y	LETTER	DESCRIPTION	DATE	APPD.
FAB.	1000011	A	ADDED COMPONENT VALUES	10-13-75	
ASSY	1000012				

* COMPONENT VALUE CHART				
SCALE	FBSTAL	COUNTING		
CAPACITY	50/100	10	25	1/50/100
R1	4.65K	2K	4.65K	4.65K
R2	1 MEG	348K	1 MEG	1 MEG
R3	549 K	499K	200K	200K
R6	90.9 K	113K	68.1K	68.1K
C1	.1uf	.47uf	.1uf	.1uf



QTY	ITEM NO.	DESCRIPTION	PART NO.	MANUFACTURER CODE IDEN. NO.	MATERIAL
BILL OF MATERIAL					
MATERIAL		DR. <i>[Signature]</i>	TITLE		
		CHK.	SCHEMATIC		
		APPD. <i>[Signature]</i>	LOAD CELL AMPLIFIER		
UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS IN INCHES. .X ± .03 .XX ± .015 .XXX ± .005 FRACTIONS ± 1/32 ANGLES ± 1/2° MACHINE FINISH		DATE 1/12/75	SCALE 1	CUSTOMER POSTAL/COUNTING	JOB NO.
NATIONAL CONTROLS, INC. SANTA ROSA, CALIF.				DWG. NO. B-1000010 SHEET 1 OF 1	REV. A

APPLICATION				REVISIONS			
USED ON	NEXT ASSY	LETTER	DESCRIPTION	DATE	APPR.		

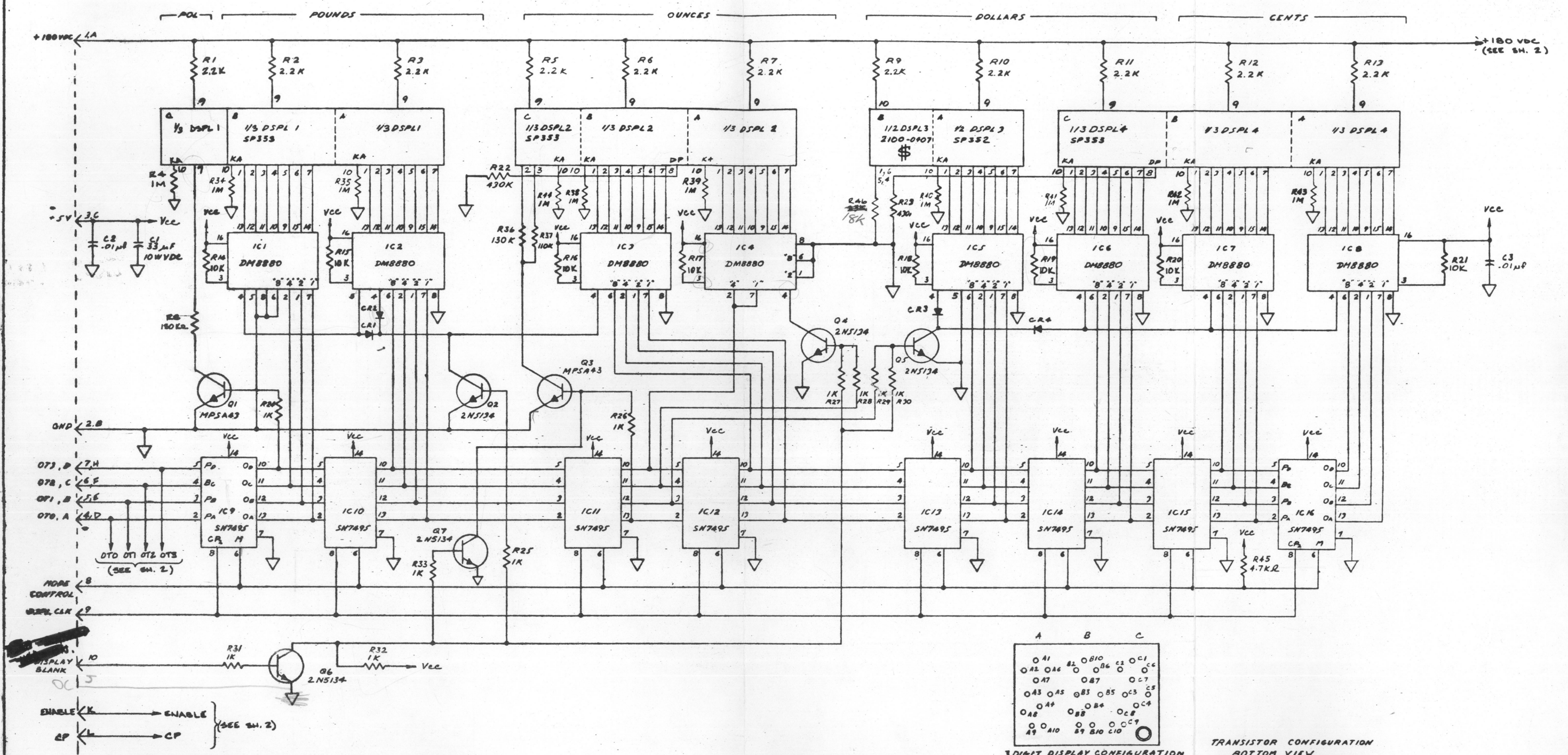


- NOTES: EXCEPT AS NOTED.
- RESISTORS ARE 1/4W, 5%. .
 - REFERENCE DRAWINGS:
FABRICATION: 1000005-01
ASSEMBLY : 1000006-01
ARTWORK: 1000005-01 (ISSUE-001)

REFERENCE DESIG.	
LAST USED	UNUSED
I.C.5 - I.C.11 R39	IC1 - IC4 R1 - R15 & R19 - R38
UNUSED CONTACTS	
2, 3, 4, 9, 13 B, C, D, K, P	

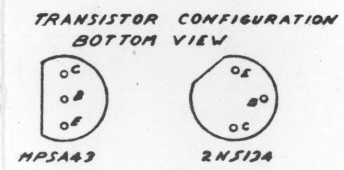
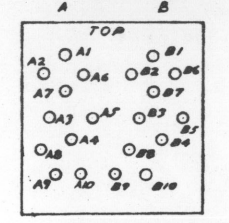
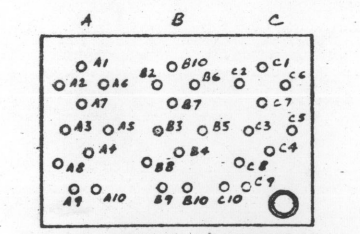
QTY	ITEM NO.	DESCRIPTION	PART NO.	MANUFACTURER CODE	MATERIAL
BILL OF MATERIAL					
MATERIAL		DR. G.M. TITLE BINARY COUNTER AND SHIFT REGISTER SCHEM. DATE 1.6.75 SCALE — CUSTOMER POSTAL SYSTEM			
UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS IN INCHES. .XX 2.00 .XX 2.015 .XXX 2.000 FRACTIONS 1/32 ANGLES 1/2° MACHINE FINISH		NATIONAL CONTROLS, INC. SANTA ROSA, CALIF.			
		DWS. NO. C-1000004		REV. 1	

APPLICATION		REVISIONS			
USED ON	NEXT ASST	LETTER	DESCRIPTION	DATE	APPRO
		A	ADDED R46 - E. 4. 8. 1966	1/5/66	
		B	REMOVED - ADDED SH. 2	4/14/75	



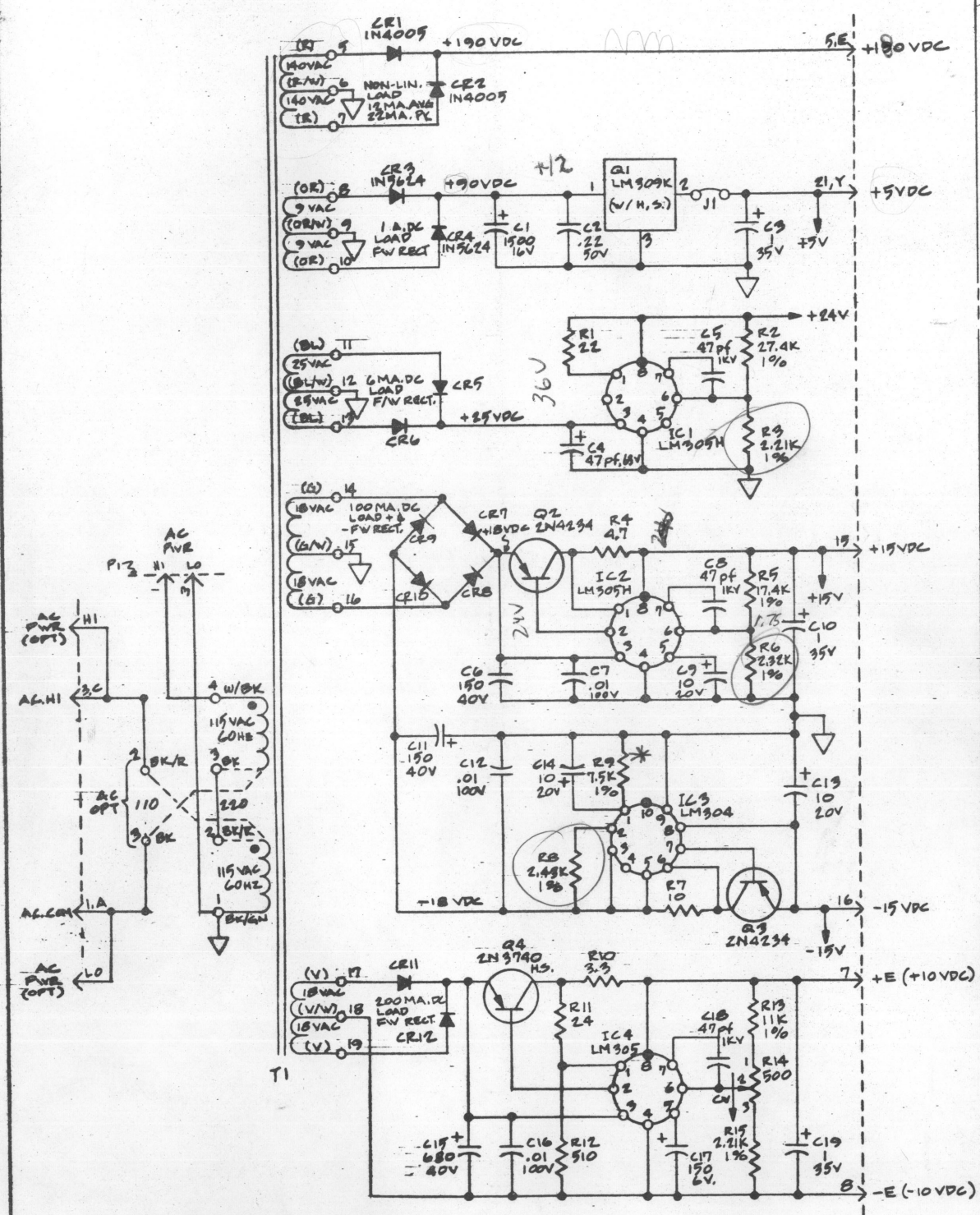
NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
 2. ALL DIODES ARE IN4148.
 3. ASSEMBLY NO 1000015-02.
 4. FAB NO. 1000014-02.

REFERENCE DESIGNATORS USED	
LAST USED	UNUSED
R 61	
Q 8	
IC 24	
CR 4	
DSPL 6	
C 4	



QTY	ITEM NO	DESCRIPTION	PART NO	MANUFACTURER	MATERIAL
BILL OF MATERIAL					
MATERIAL: UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS IN INCHES: FRACTIONS 1/32: ANGLES 1/2: MACHINE FINISH: 320					
SCHEMATIC DIGITAL DISPLAY (POSTAL SCALE) DATE: 4/14/75 CUSTOMER: NCI STP JOB NO: 6890 Dwg NO: D-1000013 SHEET 1 OF 2					

APPLICATION		REVISIONS		DATE	BY
USED ON	TEST APPY	LETTER	DESCRIPTION		
		A	REVISED & REDESIGNED	6-9-75	
		B	ADDED AL. INDICATION	8-25-75	

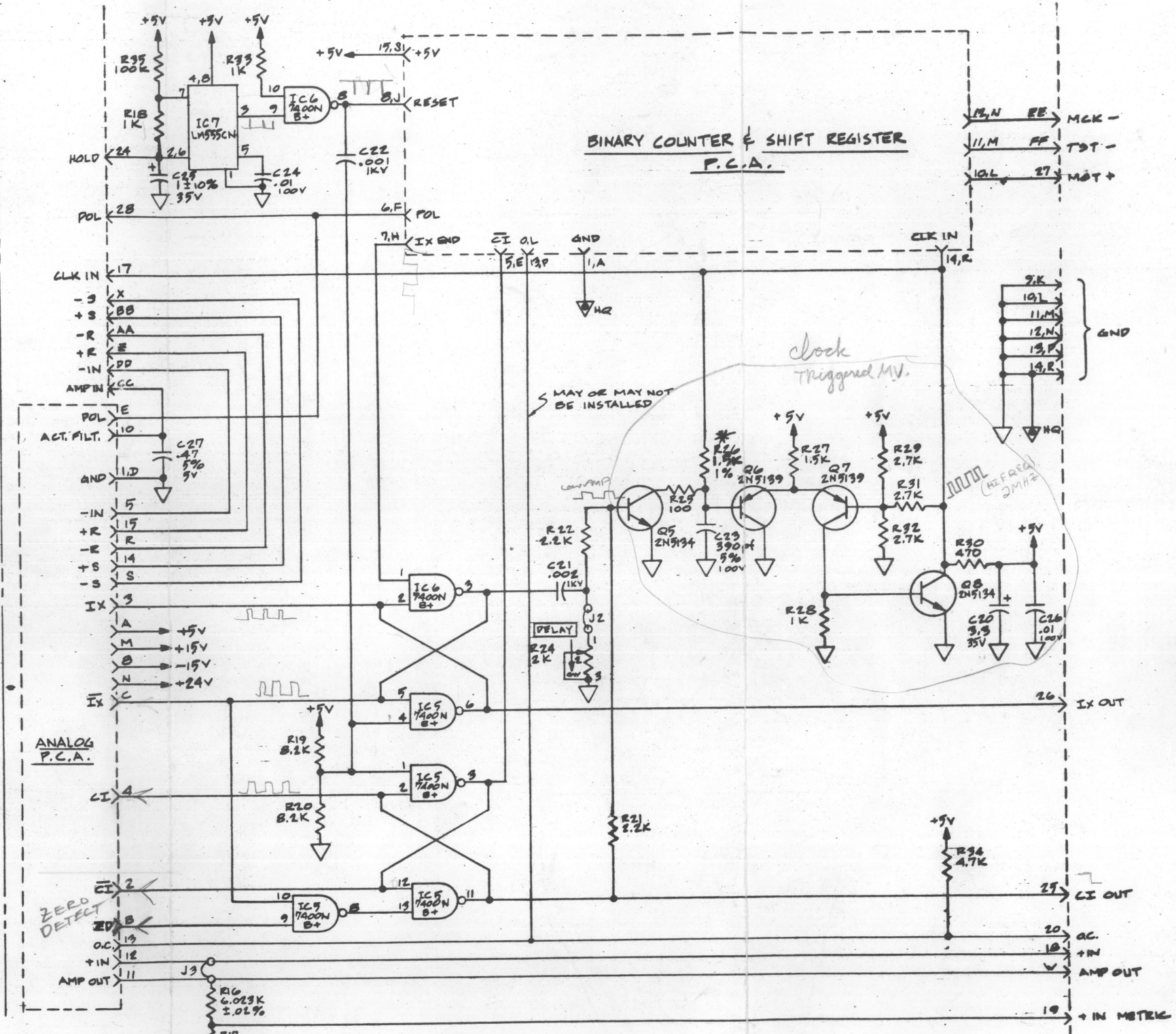


NOTE: UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 W, 5% & 1% RESISTORS ARE 1/8 WATT
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. ALL DIODES ARE IN4002
4. Q1 & Q4, REQUIRE HEAT SINK
5. Q2 & Q3 REQUIRE TRANSISTOR SPACE PAD.
6. REF. DRAWINGS; FABRICATION: 1000003-01
ASSEMBLY: 1000003-01
- * 7. R26 IS 1K ON COUNTING VERSION
1000003-02.

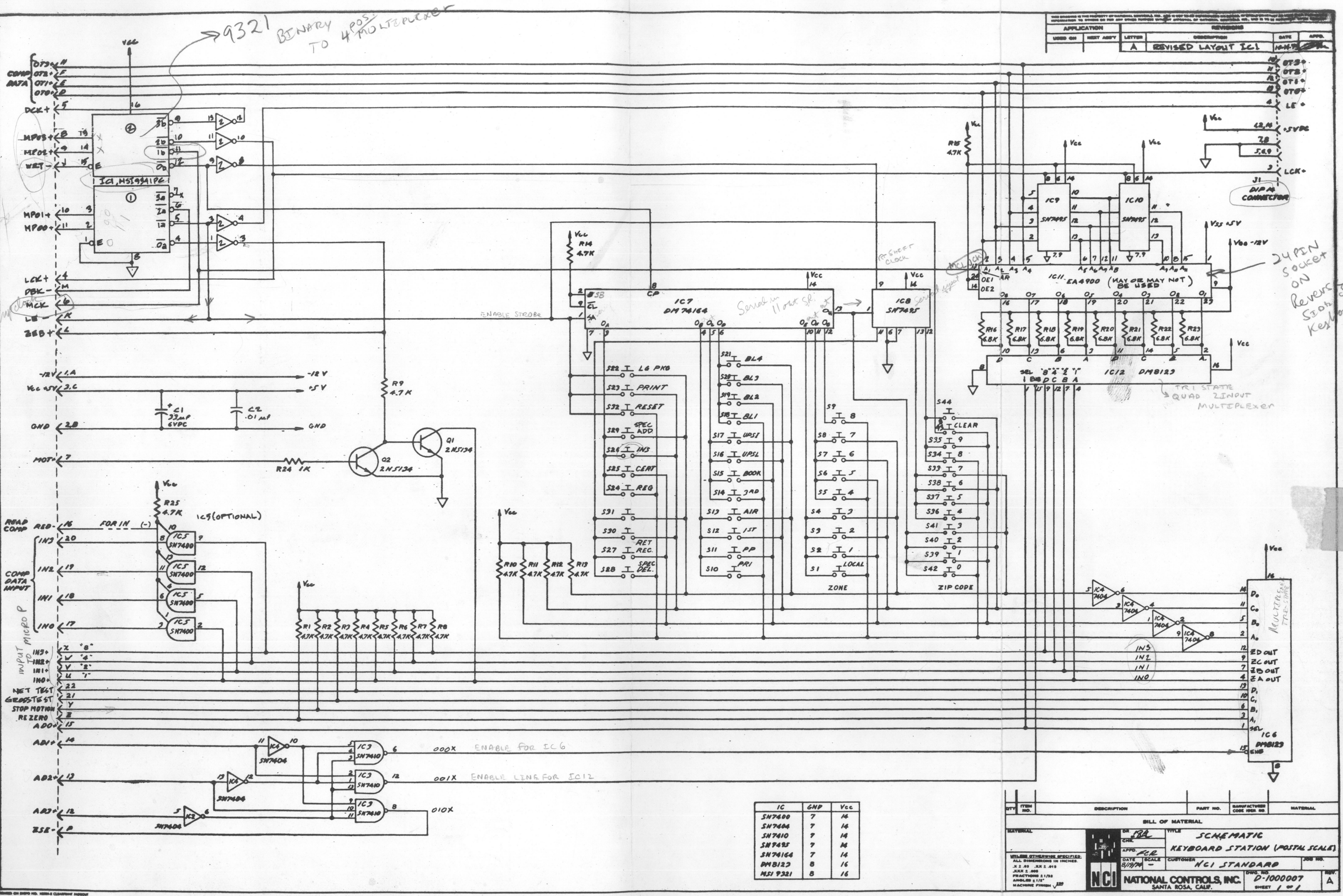
UNUSED CONNECTOR CONTACTS	
B, D, F, H, J, S, T, U, V	2, 4, 6, 22, 23

COMPONENT DESIGNATIONS	
LAST USED	UNUSED
Q8	
T1	
R35	
IC7	
CR12	
C27	
J3	



IC	DEVICE	PWR	+5V(Vcc)	GND
1	LM 305H	3	-	4
2	LM 305H	3	-	4
3	LM 305H	3.5	-	9
4	LM 305H	3	-	4
5	2N7400NB	-	14	7
6	2N7400NB	-	14	7
7	LM555CN	-	4, 8	1

ITEM NO.	DESCRIPTION	PART NO.	MANUFACTURER CODE	MATERIAL
BILL OF MATERIAL				
TITLE: CLOCK & POWER SUPPLY SCHEMATIC				
DATE: 6-9-75				
SCALE: CUSTOMER				
POSTAL SCALE				
NATIONAL CONTROLS, INC. D-1000001				
SANTA ROSA, CALIF.				
SHEET 1 OF 1				



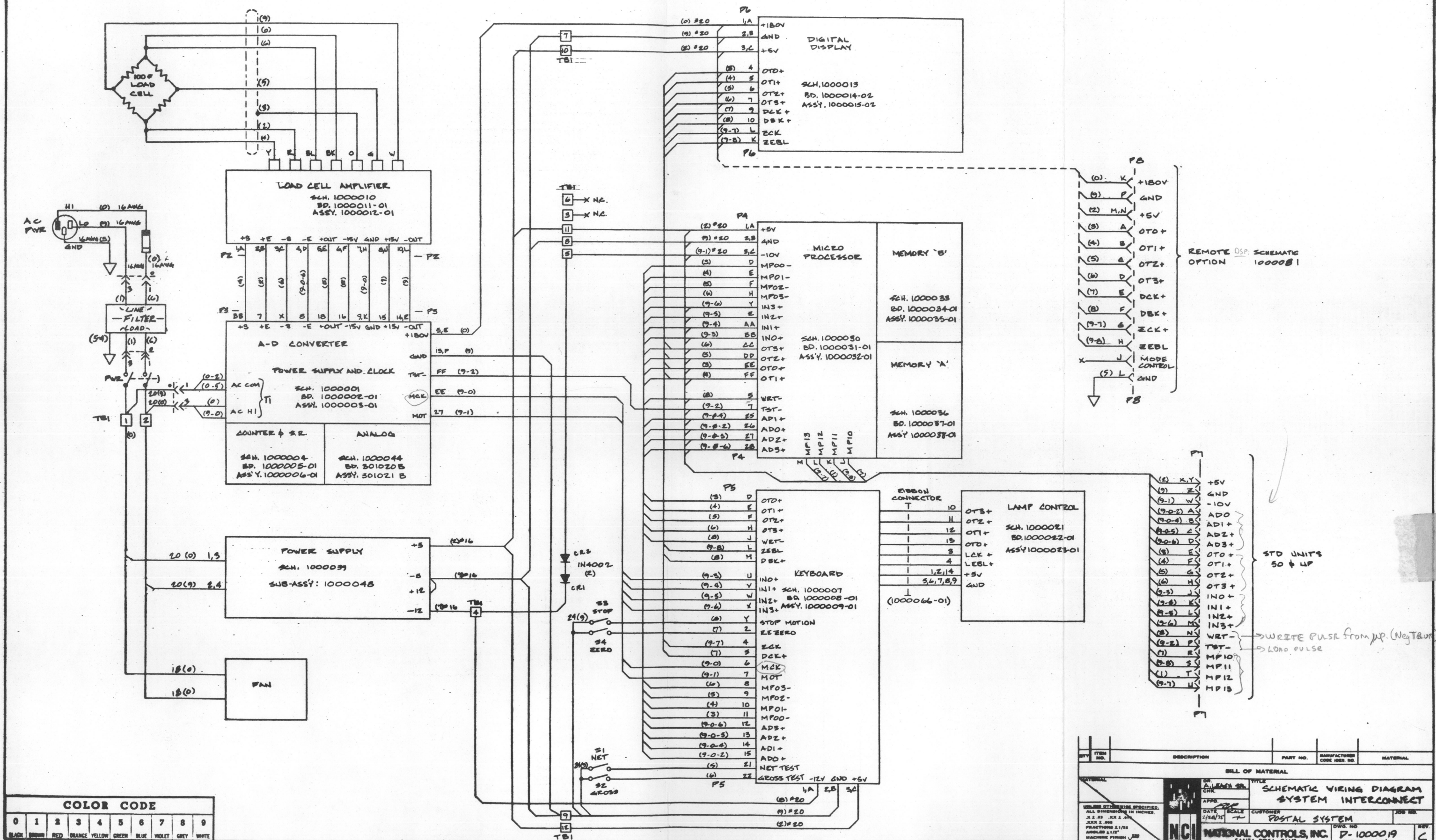
APPLICATION		REVISIONS		DATE	APPD.
USED ON	TEST APPY	LETTER	DESCRIPTION		
		A	REVISED LAYOUT I.C.I	10-1-78	

IC	GND	Vcc
SN7400	7	14
SN7404	7	14
SN7410	7	14
SN7495	7	14
SN74164	7	14
DMB123	8	16
MSI 9321	8	16

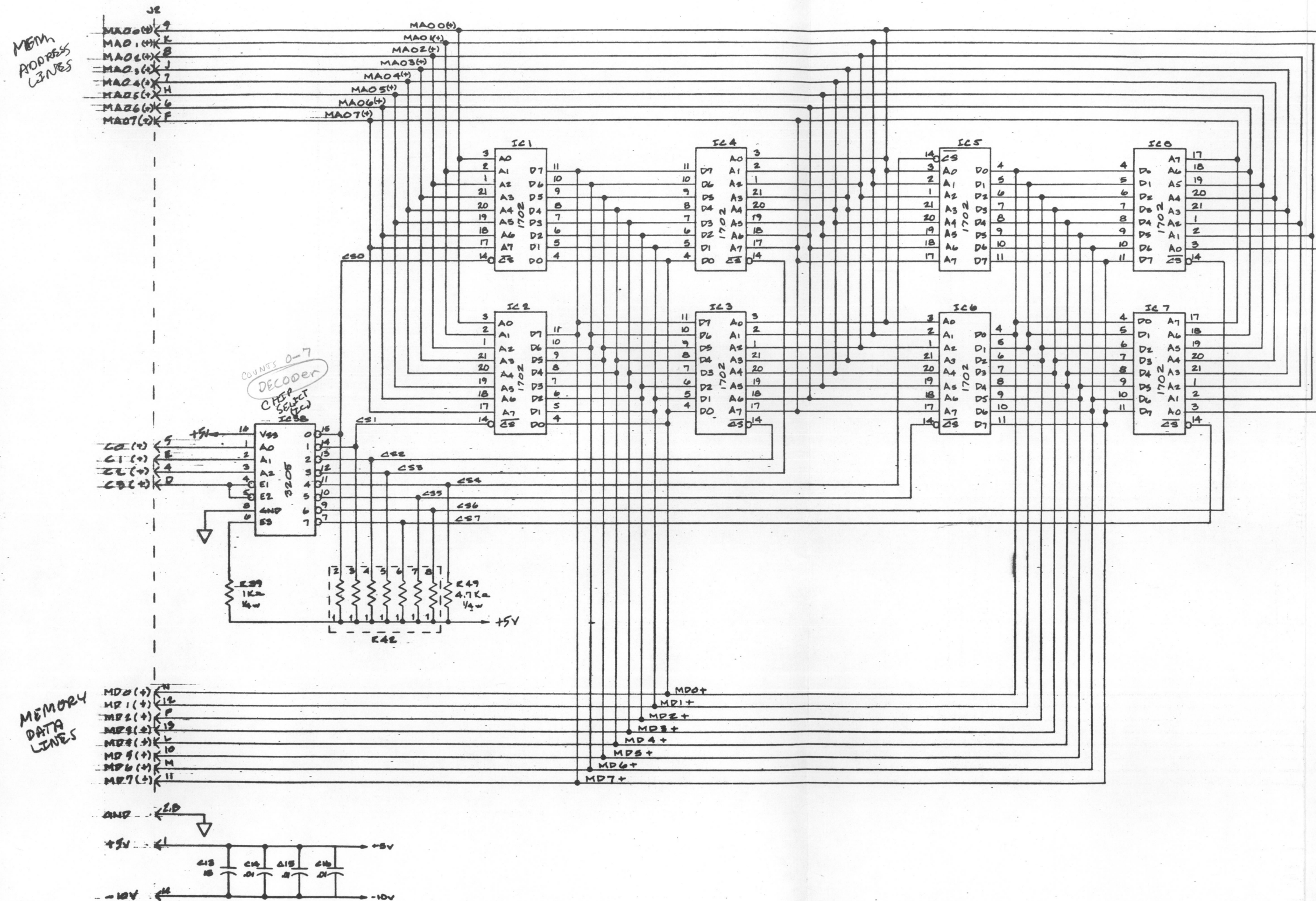
ITEM NO.	DESCRIPTION	PART NO.	MANUFACTURER	MATERIAL
BILL OF MATERIAL				
TITLE: SCHEMATIC				
KEYBOARD STATION (POSTAL SCALE)				
DATE: 8/1/78				
CUSTOMER: NCI STANDARD				
JOB NO.				
DWG. NO. D-1000007				
SHEET 1 OF 1				

NCI NATIONAL CONTROLS, INC. SANTA ROSA, CALIF.

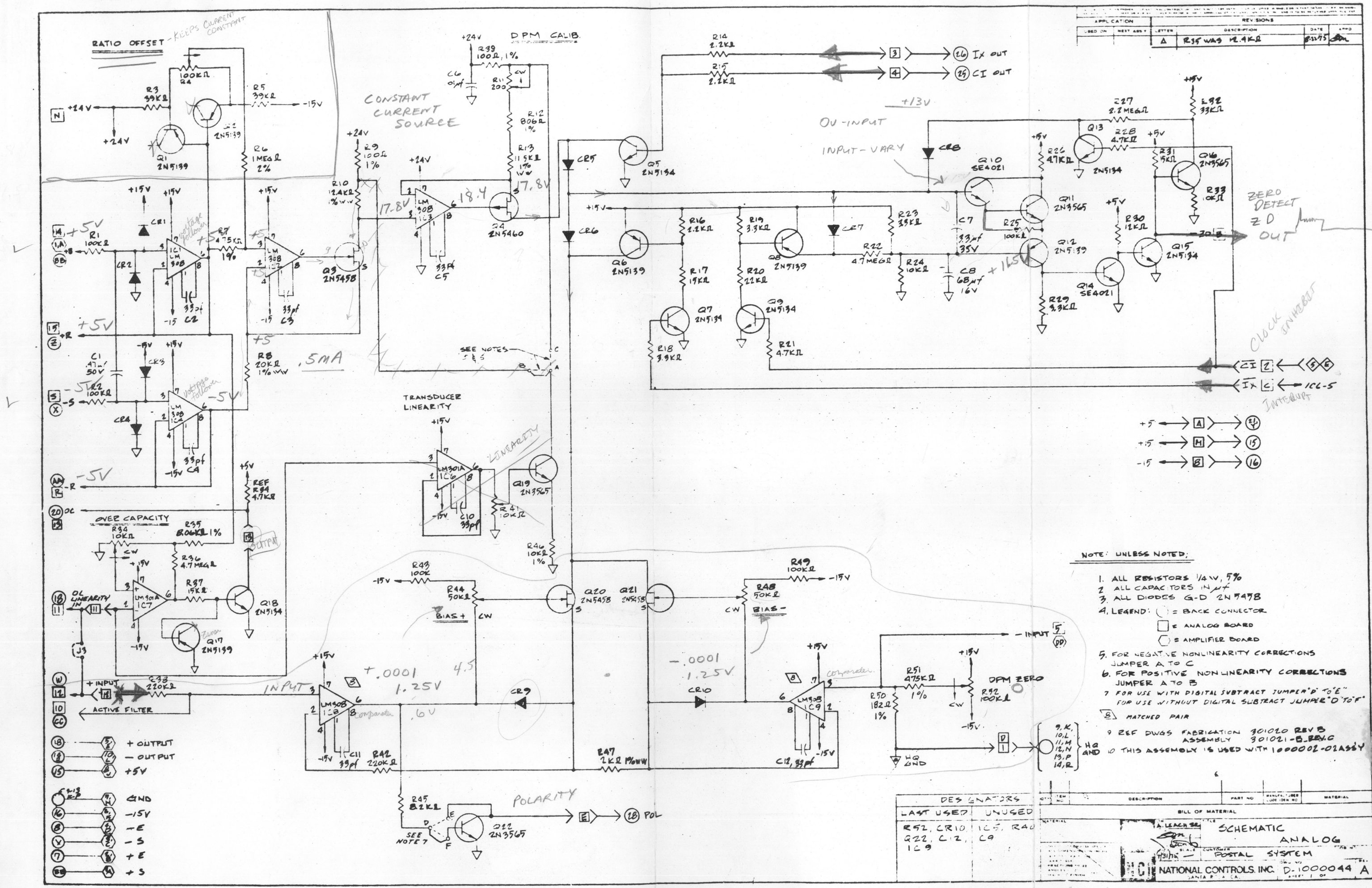
APPLICATION		REVISIONS			
USED ON	NEXT ASSY	LETTER	DESCRIPTION	DATE	BY
		A	REVISED INTERCONNECT	4/8/78	RL
		B	IN4002 WAS IN4001	4/11/78	RL
		C	ADDED LINE FILTER	4/11/78	RL



QTY	ITEM NO.	DESCRIPTION	PART NO.	MANUFACTURED CODE	MATERIAL
BILL OF MATERIAL					
NATIONAL		TITLE		JOB NO.	
A-1000001		SCHEMATIC WIRING DIAGRAM		P-1000019	
DATE 4/8/78		SCALE 1/8"		CUSTOMER POSTAL SYSTEM	
NATIONAL		NATIONAL CONTROLS, INC.		SANTA ROSA, CALIF.	
DWS: RD		REV. C		1 of 1	



NOTE:
1. R42 IS AN 8 PIN RESISTOR PACK 750-81-4.7K
2. IC'S 1-8 (1702'S) POWER AND GND. PINS, VDD(+5V) VSS(-10V) GND 12,13,22,23 16,24
3. ALL CAPACITORS ARE IN μ F.



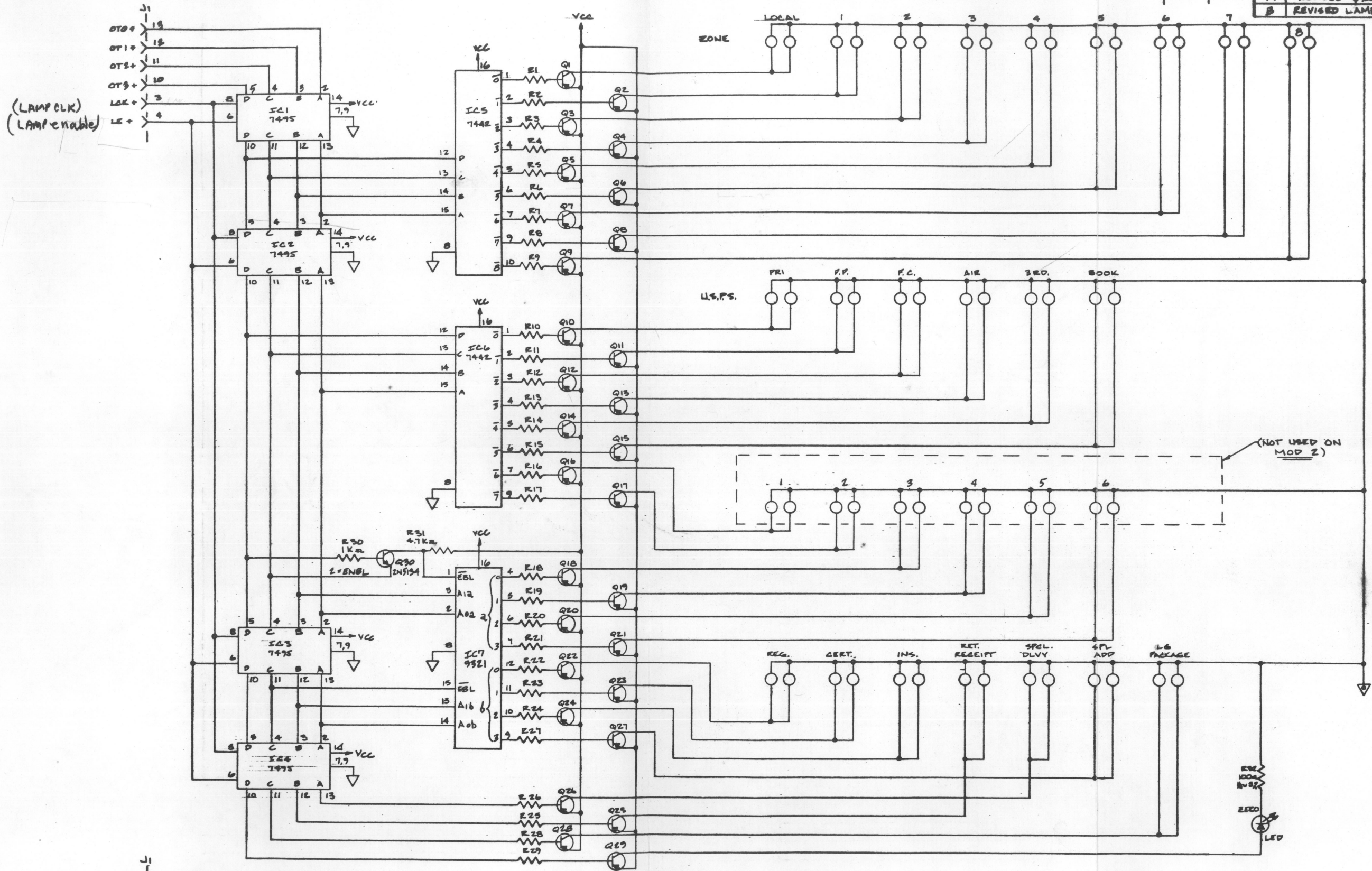
APPLICATION		REV. NO.		DATE	APPD
USED ON	NEXT ASSY	LETTER	DESCRIPTION		
		A	R35 WAS 1.4KΩ	8/75	

NOTE: UNLESS NOTED:

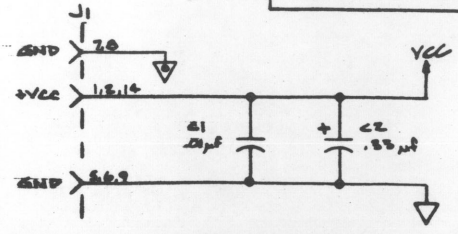
1. ALL RESISTORS 1/4W, 5%
2. ALL CAPACITORS IN uF
3. ALL DIODES G-D 2N5478
4. LEGEND: () = BACK CONNECTOR
[] = ANALOG BOARD
[] = AMPLIFIER BOARD
5. FOR NEGATIVE NONLINEARITY CORRECTIONS JUMPER A TO C
6. FOR POSITIVE NONLINEARITY CORRECTIONS JUMPER A TO B
7. FOR USE WITH DIGITAL SUBTRACT JUMPER 'D' TO 'E' FOR USE WITHOUT DIGITAL SUBTRACT JUMPER 'D' TO 'E'
8. MATCHED PAIR
9. REF DWGS FABRICATION 301020 REV B ASSEMBLY 301021-B REV C
10. THIS ASSEMBLY IS USED WITH 1000002-02A35Y

DESIGNATORS		BILL OF MATERIAL	
LAST USED	UNUSED	ITEM NO.	DESCRIPTION
R52, CR10, IC5, R40			
R22, C12, C9			
		SCHEMATIC ANALOG	
		POSTAL SYSTEM	
		NATIONAL CONTROLS, INC. D-1000044 A	

APPLICATION		REVISIONS			
USED ON	HEAT ASBY	LETTER	DESCRIPTION	DATE	APPD.
		A	REVISED & REDRAWN	2/28/76	
		B	REVISED LAMP DESIGN	7-7-75	



(LAMP CLK)
(LAMP enable)

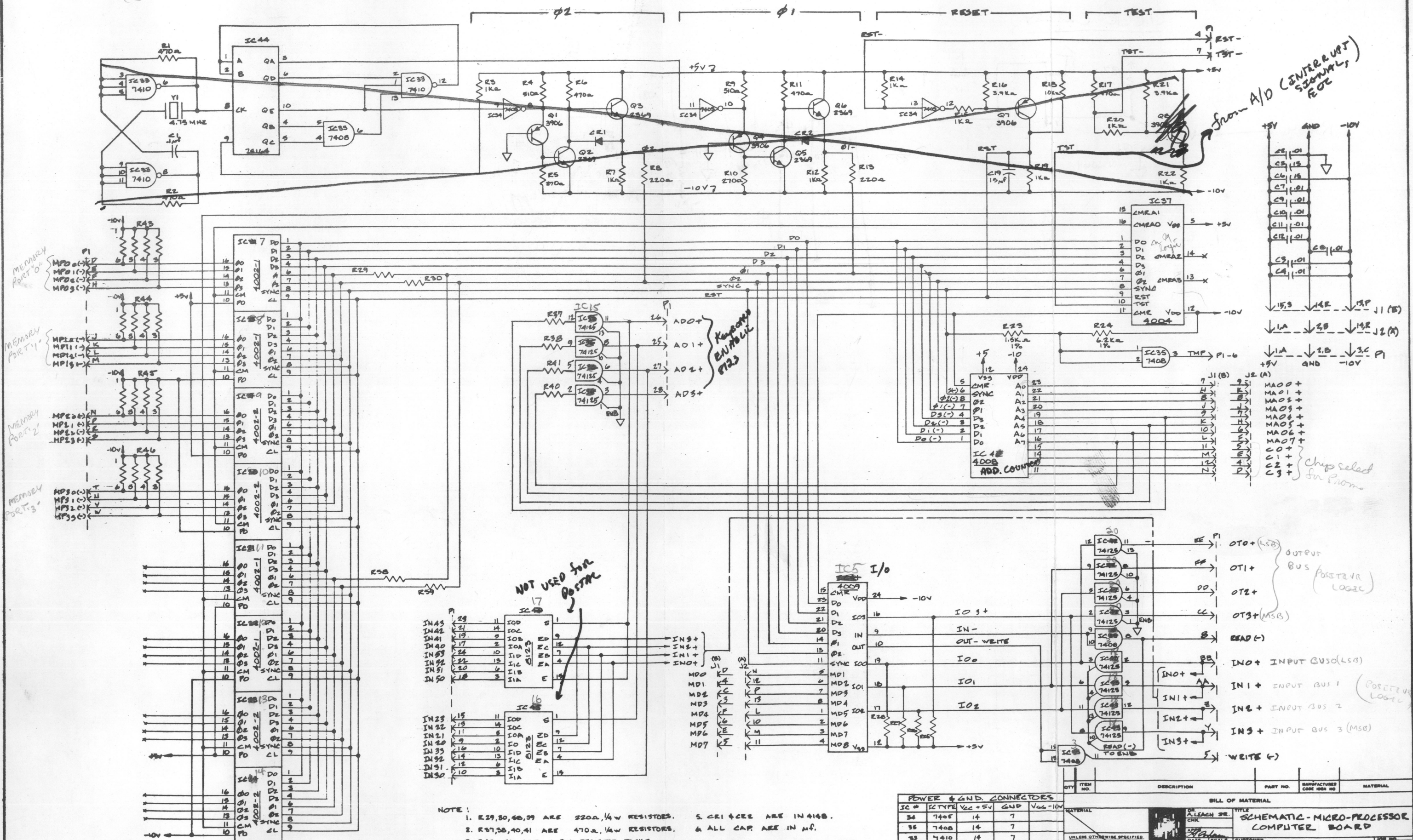


- NOTES: UNLESS OTHERWISE NOTED.
1. ALL RESISTORS ARE 470Ω, 1/4W, 10%.
 2. ALL TRANSISTORS ARE 2N5143.
 3. LED IS MVS253 (MONSANTO)

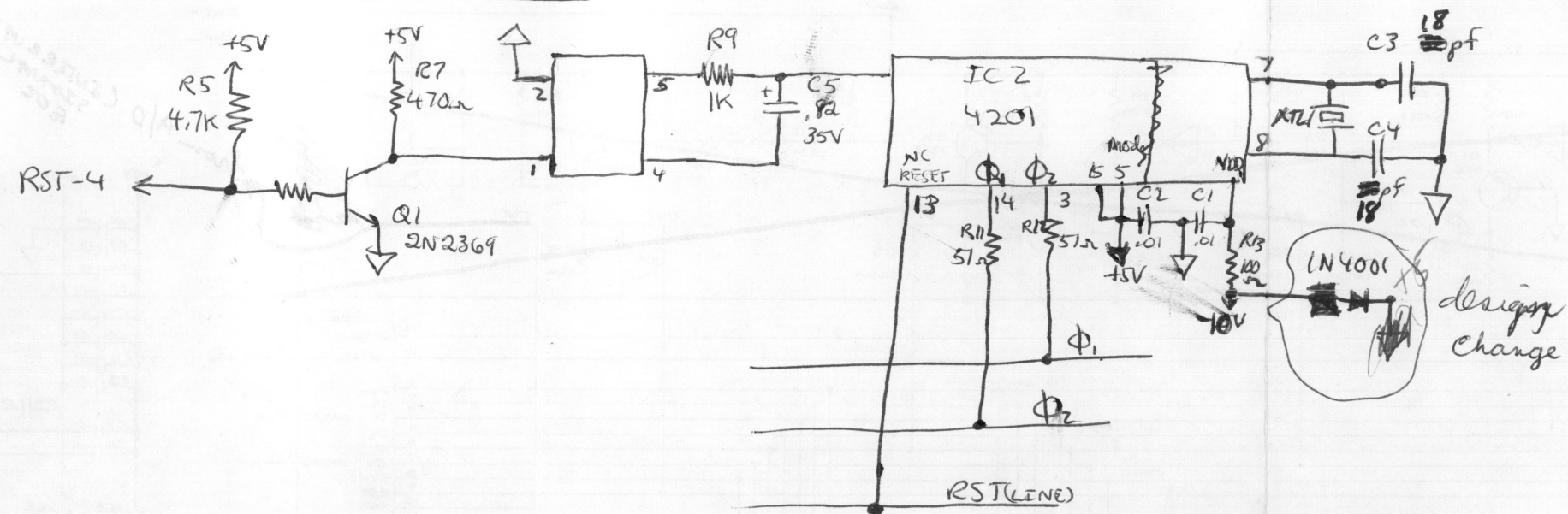
ITEM NO.	DESCRIPTION	PART NO.	MANUFACTURER	MATERIAL
BILL OF MATERIAL				
KEYBOARD LAMP CONTROL				
POSTAL SYSTEM				
NATIONAL CONTROLS, INC. SANTA ROSA, CALIF.				
D-1000021 B				

(+) - means POSITIVE TRAIL
 (-) - means NEGATIVE TRAIL

APPLICATION		REVISIONS	
USED ON	TEST ASBY	LETTER	DESCRIPTION
		A	MADE PIN CORRECTIONS



CLOCK CKTRY



SECTION VIII - APPENDIX

SECTION VIII - APPENDIX - POSTAL RATE CHANGE PROCEDURE

Procedure for Replacing Memory "A" Circuit Board

1. Unplug power cord.
2. Self-contained scale: Remove four (4) screws from scale deck.
Remote Platform scale: Remove eight (8) screws from bottom panel.
3. Remove two (2) screws holding Memory "A" circuit board.
4. Remove original Memory "A" board and install new Memory "A" board.
5. Replace two (2) screws holding Memory "A" circuit board.
6. Replace holding screws on scale deck or scale bottom panel.
7. The scale is now ready to be returned to operation.

Procedure for Replacing Memory "B" Circuit Board

1. Unplug power cord.
2. Self-contained scale: Remove four (4) screws from scale deck.
Remote Platform scale: Remove eight (8) screws from bottom panel.
3. Remove two (2) screws holding Memory "B" circuit board.
4. Remove original Memory "B" board and install new Memory "B" board.
5. Replace two (2) screws holding Memory "B" circuit board.
6. Replace holding screws on scale deck or scale bottom panel.
7. The scale is now ready to be returned to operation.

Procedure for Replacing IC's on Memory "A" or Memory "B" Boards

1. Replace IC's on Memory "A" or Memory "B" (Reference Figure 1)
 - A. Unplug power cord.
 - B. Self-contained scale: Remove four (4) screws from scale deck.
Remote Platform scale: Remove eight (8) screws from bottom panel.
 - C. Remove two (2) screws holding Memory "A" or Memory "B" circuit board.

SECTION VIII - APPENDIX - POSTAL RATE CHANGE PROCEDURE

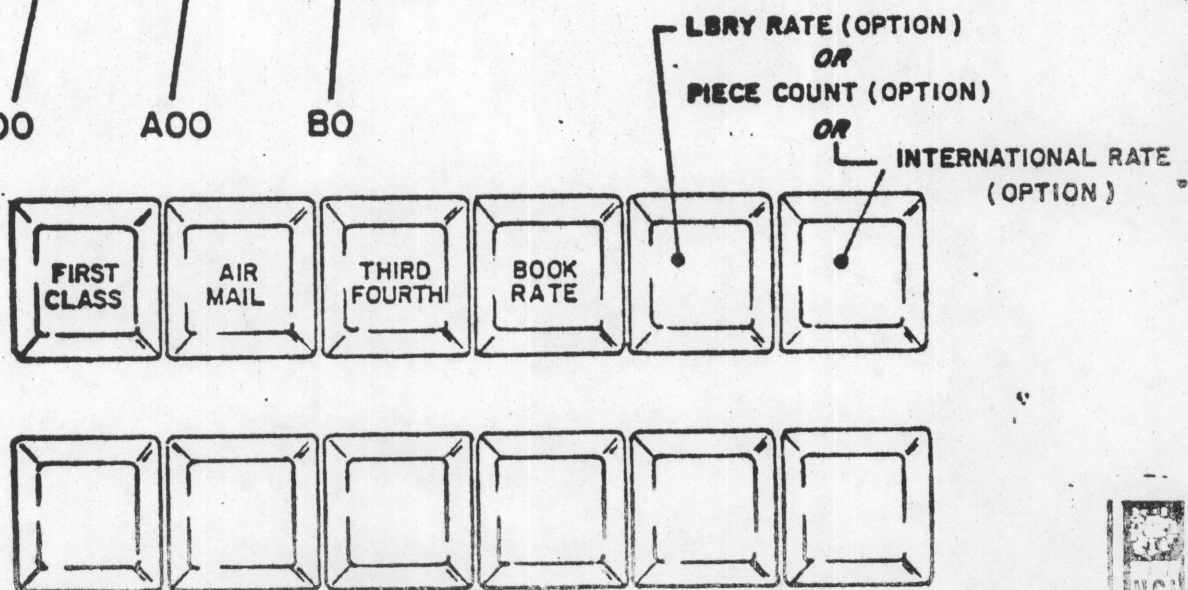
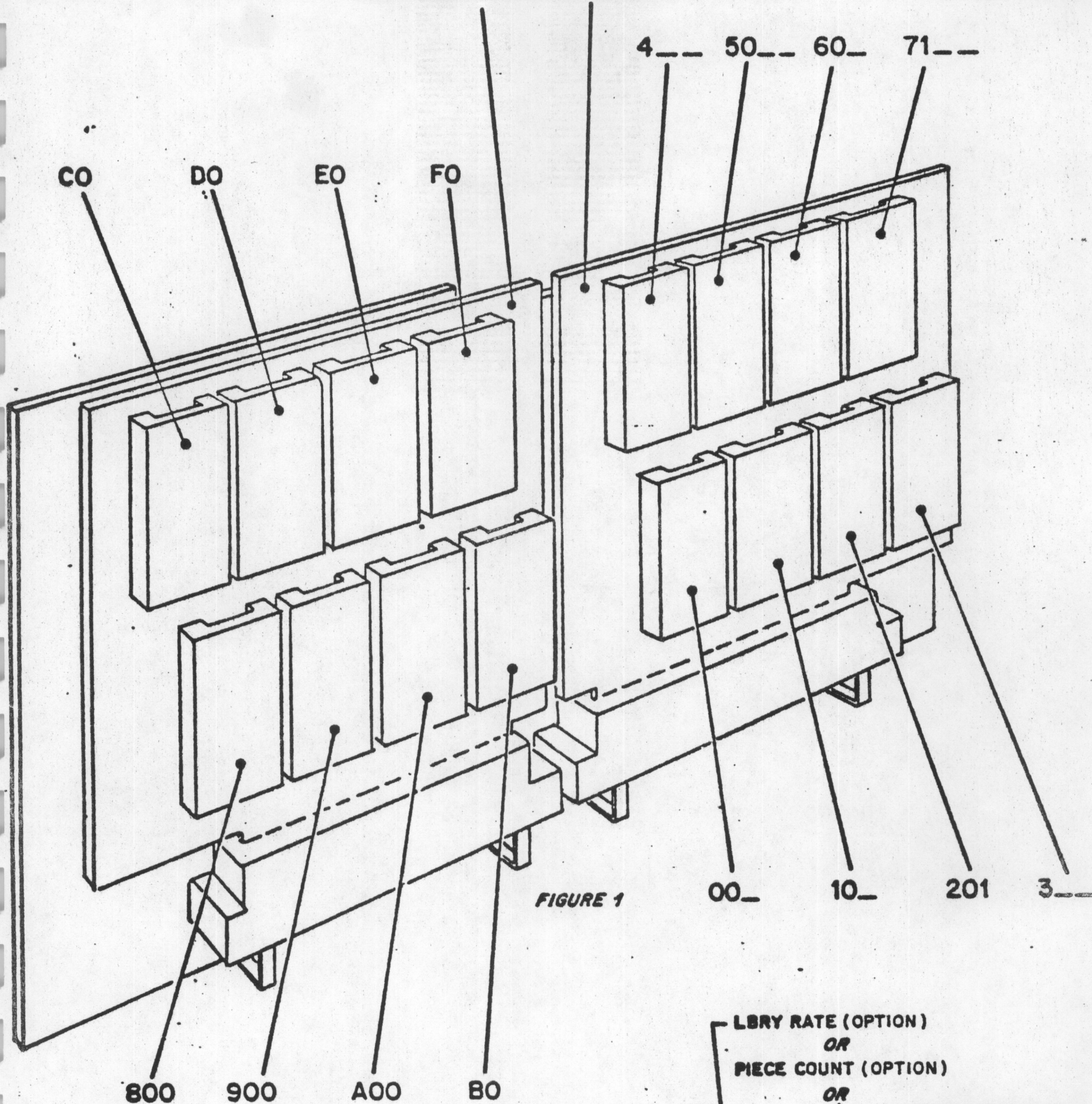
- D. Remove Memory "A" or Memory "B" circuit board and place on a flat surface such as a desk or table.
- E. Gently remove the IC's being replaced (two methods may be used to remove the IC's).
 - 1. Insert a small screwdriver or pen knife between the end of the IC and the plastic socket. Pry the IC gently upward. Move the screwdriver to the opposite end of the IC and repeat the prying operation described above. Move from end to end as needed to work the IC completely out of the socket. Do not try to make this a two step operation as this will result in bent IC pins.
 - 2. Hold the ends of the IC between thumb and first finger. Gently lift one end at a time until the IC is clear of the plastic socket. Once again, do not try to remove the IC in one motion as this will bend or break the IC pins.
- F. Using Figure 1 as a guide, insert the new IC's. (Note: While inserting the IC's, check carefully for bent IC pins. If a bent pin is detected, remove the IC and straighten the pin with needlenose pliers).
- G. Replace Memory "A" or Memory "B" circuit board.
- H. Replace holding screws on scale deck or bottom panel.
- I. The scale is now ready to be returned to operation.

NOTE: The Intel IC's used on the NCI Memory Boards will work only when properly inserted. A black dot is printed on the IC. This dot locates Pin 1. Pin 1 on the IC socket is identified by a 45° corner cut into the plastic. Pin 1 on the IC must match Pin 1 on the IC socket.

Procedure for Replacing Key Tops

- 1. Refer to Figure 1 to determine new key top layout.
- 2. Turn power switch to OFF position.
- 3. Gently remove key tops to be replaced. Use a small screwdriver or knife blade on one side for support and push upward with fingers.
- 4. Install new key tops by pressing into place.
- 5. The scale is now ready to be returned to operation.

MEMORY-B MEMORY-A



TEST PROCEDURE
POSTAL PRINTED CIRCUIT ASSEMBLIES

PURPOSE: To insure all postal boards meet all specifications before assembly.

EQUIPMENT:

1. Analogic voltage standard
2. Oscilloscope
3. DVM
4. Load cell simulator
5. NCI postal test station
6. One good set of postal boards

CONTEXT:

1. Power one
2. Clock and power
3. Analog
4. Binary counter
5. Display board
6. Keyboard
7. Micro processor
8. Mem A
9. Mem B
10. Load cell amplifier

PROGRAMS NEEDED:

1. Postal test program - PT000 - PT100 - PT200
2. Postal table test - PTT 4/15
3. Memory A test - Mem A PO, PX
4. Memory B test - Mem A PO - Mem B PX, Mem B, BO

1. POWER ONE

- 1.1 Inspect unit for faulty assembly
- 1.2 Install unit in Power One test rack, or connect 115 vac to transformer with AC cord
- 1.3 Test +5v and -12v outputs with DVM for correct voltages and stability
- 1.4 Measure AC ripple with scope
 - 1.4.1 AC ripple should be less than 10 mv

2. CLOCK AND POWER

- 2.1 Use postal test program PT
- 2.2 Inspect board for wrong parts, backward parts, and solder bridges

- 2.3 Power on. Measure all voltage supplies with a DVM
 - +15v + .5v
 - 15v + .5v
 - +24v +.75v
 - 10v adjustable 2v
 - 180v - 20v
- 2.4 With scope, check the reset pulse time for 60 to 78 ms
- 2.5 Plug in good Binary Counter. Display should go to - FFFF
- 2.6 Plug in good Analog card. Check for active reading
- 2.7 Adjust excitation voltage to 10.000 +5mv
- 2.8 With analogic, adjust analog input to 00.000v. Adjust Analog zero pot R52 so the reading just trips from - to +. Adjust zero width pot R24, on meter board until display reads 00.000.
- 2.9 Set input to +100 μ v and check to see that display reads +00.002
- 2.10 Set input to -100 μ v. Display should read -00.002
- 2.11 Set input to 2v. Display should read 8000. Analog span can be adjusted to obtain this reading
- 2.12 Check for stability of +1 digit on display

3. ANALOG P.C.B.

- 3.1 Program used
 - 3.1.1 Use postal test program PT, or 5800
 - 3.1.2 Select (F) on keyboard switches
 - 3.1.3 Use known good clock and power
 - 3.1.4 Use known good binary counter
- 3.2 Visual Inspection
 - 3.2.1 Inspect PCB for correct installation of all components
 - 3.2.2 Inspect PCB for solder shorts
- 3.3 Insert analog and binary counter into clock and power. Power on
- 3.4 + and - bias adjustment
 - 3.4.1 Set R4~~8~~ and R4~~9~~ bias pots full CCW
 - 3.4.2 Set input voltage to 00.0000v
 - 3.4.3 Adjust meter zero pot R52 to where display just trips from - minimum to + minimum. The minimum should be less than 4 counts.
 - 3.4.4 Adjust zero width pot R24 on clock and power PCA until display reads 0000
 - 3.4.5 Set input to +100 μ v and check to see that display reads +0002
 - 3.4.6 Set + bias pot R4~~5~~ for an output (Pin 6 of IC8) of +1.25v +.05v. Monitor with DVM
 - 3.4.7 Apply input of -100 μ v
 - 3.4.8 Set - bias for and output (Pin 6 of IC9) of +1.25v +.05v. Monitor with DVM
- 3.5 Zero and span adjustment
 - 3.5.1 Set input voltage to zero
 - 3.5.2 Adjust zero pot R52 for reading of +0000
NOTE: If zero pot is less than 20% CW or CCW, change R50 on analog
 - 3.5.3 Set input voltage to +2.000v
 - 3.5.4 Adjust span pot R39 for reading of 8000
NOTE: If span pot is less than 20% CW or CCW, change R12 on analog

- 3.5.5 Apply input of -2.000v and verify that display reads -8000 $\pm$ 2 counts
- 3.6 Linearity
- 3.6.1 Check zero and span
- 3.6.2 Check the following values with both positive and negative voltage inputs
- | Analog Input | Display Reading |
|--------------|-----------------|
| .0000v | 0000 |
| .5000v | 2000 |
| 1.0000v | 4000 |
| 1.5000v | 6000 |
| 2.0000v | 8000 |
- 3.6.3 The meter readings should be within a 2 count tolerance
- 3.7 Ratio offset
- 3.7.1 Turn ratio offset pot R₄ full CCW
- 3.7.2 Turn excitation supply pot full CCW
- 3.7.3 Using a simulator, apply full scale positive input to analog amp.
- 3.7.4 Rotate excitation supply pot from maximum CCW to maximum CW and note range of meter change
- 3.7.5 Rotate ratio offset pot slightly CW and repeat step 3.7.4.
- 3.7.6 Continue steps 3.7.4 and 3.7.5 until meter change is $\pm$ 10 counts
- 3.7.7 Reset excitation voltage to 10.000 v $\pm$ 5mv
- 3.8 Hi-Low line
- 3.8.1 Set input to zero
- 3.8.2 Adjust variac from 105 vac to 130 vac. There should be no change in meter reading
- 3.8.3 Set input to full scale
- 3.8.4 Repeat step 3.8.2. The meter should not change more than 1 digit
- 3.8.5 Set excitation supply for 10.000v $\pm$ 5mv

4. BINARY COUNTER

- 4.1 Use known good clock and power supply. Use known good analog card
- 4.2 Plug binary to be tested and analog card into clock and power supply
- 4.3 Use postal program PT0, PT1, PT2. Select "F" for meter display, power on.
- 4.4 Adjust analog input to 0.0v. Display should read 00.00
- 4.5 Adjust analog input to 2.0v. Display should read 7FFF
- 4.6 This test will check each decade for both zero and full capacity output. If there is any doubt, check each decade individually. Adjust analog input so display counts from 0 to F for each decade.

5. DISPLAY BOARD

- 5.1 Inspect PCB for backwards and wrong components. Check for solder bridges.

- 5.2 Use postal test program PT0, PT1 and PT2. Select (3) on the keyboard switches
- 5.3 Power on. Watch for bad segments and leaky drivers. Observe test routine and check for bad numbers

6. KEYBOARD

- 6.1 Run the following test routines with postal test
 - 6.1.1 Keyboard lamps. Switch (1) and (B). Check all lamps and switches
 - 6.1.2 Display. Switch "3" check all digits
 - 6.1.3 Meter switch F. Check for active meter reading
- 6.2 Use postal table test 415 to check prom socket and associated circuitry
 - 6.2.1 Plug Rom 49190 in prom socket on bottom of keyboard
 - 6.2.2 Select 1 on keyboard switches. Power on.
 - 6.2.3 Select "0" on switches. Display will count 00 to 75. When display reaches 75 successfully, the test is complete.

7. MICRO-PROCESSOR

- 7.1 Run the following test routines
 - 7.1.1 Postal test PT0, PT1, PT2
 - Lamp test - switch (1)
 - Display test - switch (3)
 - Keyboard test - switch (B)
 - Meter test - switch (F)
 - 7.1.2 Postal table test (PTT 415)
 - 7.1.3 Memory A test
 - Plug in prom (Mem A pgo) in page (0), memory A board.
 - Plug (Mem A pg x) in pages (1) through (7). Power on.
 - Select 1 to 7 on keyboard switches. Display will run from 000 to 7FF. Test is complete when display successfully reaches 7FF.
 - 7.1.4 Memory B test
 - Insert prom (Mem A pgo) in page (8). Insert prom (Mem B px) in pages 9 to F. Insert prom (Mem B pgo) in page (0). Power on. Select 8 to F on keyboard switches. Display will run 800 to FFF successfully to complete test

8. MEMORY A TEST

- 8.1 Refer to 7.1.3

9. MEMORY B TEST

- 9.1 Refer to 7.1.4

10. LOAD CELL AMPLIFIER

- 10.1 Inspect PCB

- 10.2 Insert amplifier to be tested into the postal test harness
- 10.3 Power on. With program PT0, PT1, PT2 select F on the keyboard switches. Observe active meter reading with ± 4 digit stability

DB:kw