

INITIAL TEST DIFFICULTIES

TEST POINT	TROUBLE	CAUSE
1	GATE lamp does not light.	No +5 volt supply.
2	Lamp does not blink.	1. OSCILLATOR switch not in INT. 2. IC's 19-26.
3	Lamp not on.	D5, IC17, or IC18.
3 (Button in)	Lamp not off.	RESET button.
4	Lamp not on.	IC18.
4 (Button in)	Lamp not off.	D5.
5	Lamp does not blink.	1. IC13, IC15. 2. MODE and TIME BASE switches.
6	Lamp does not blink.	IC16, IC18, IC17.
7	Lamp not off.	IC17, IC18, IC14.
7 (Button in)	Lamp not on.	D5.

FINAL ASSEMBLY

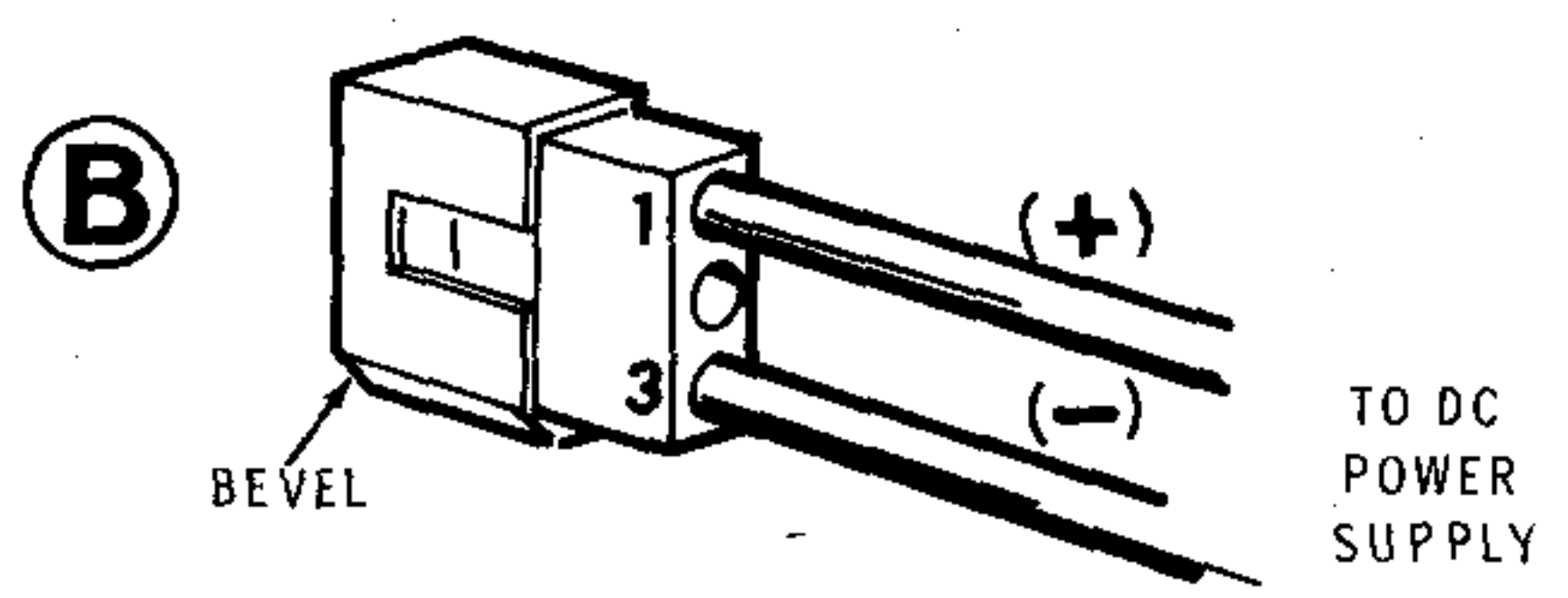
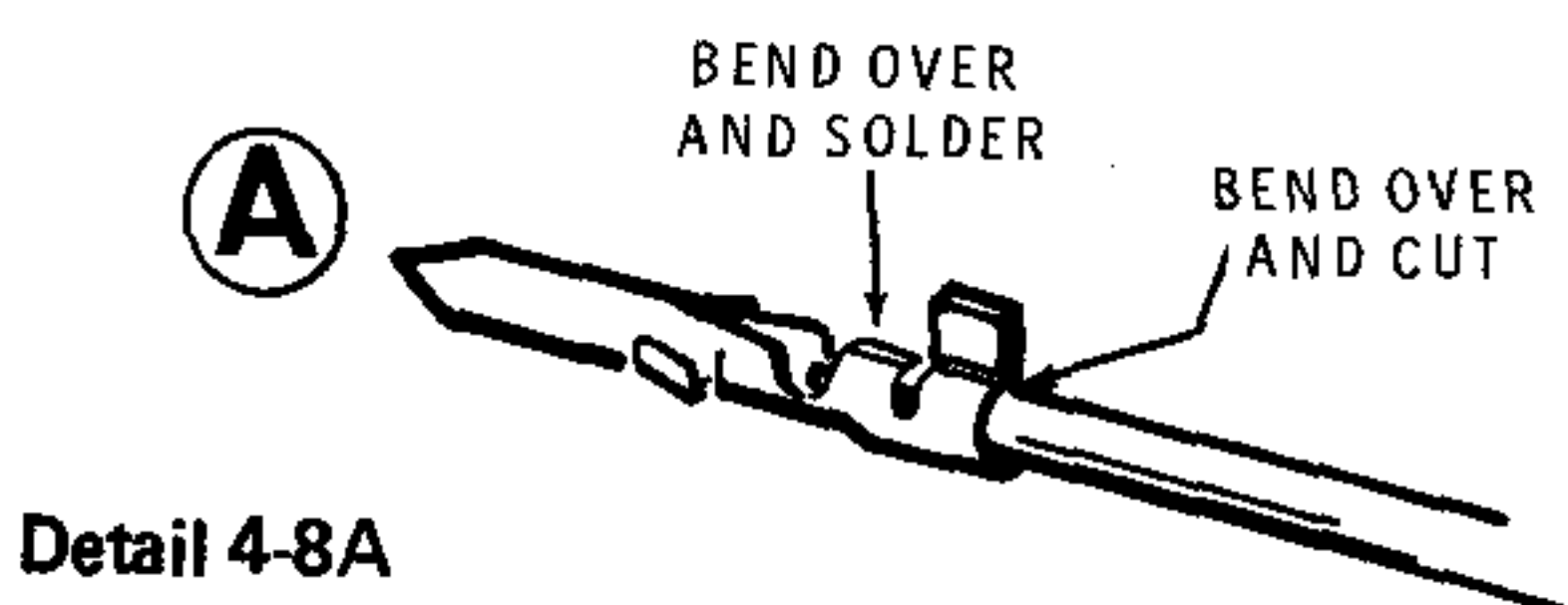
Refer to Pictorial 4-8 in the Illustration Booklet for the following steps.

- 1) Mount the cabinet to the chassis with four 6-32 x 3/8" black screws.
- 2) Refer to the inset drawing and mount the plastic handle grip on the handle.
- 3) Mount the handle to the cabinet with two 10-32 x 3/8" thumbscrews and two 1/4" lockwashers as shown.
- 4) Carefully peel away the backing paper from the blue and white identification label. Then press the label onto the chassis bottom. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.

NOTE: If you intend to operate your Counter from a DC power supply, perform the following steps. Otherwise, proceed directly to "Calibration."

- () Refer to Part A of Detail 4-8A and install male connector pins on the positive and negative leads of your DC power supply as shown.
- () Refer to Part B of the Detail and position the connector plug with its beveled edges as shown. Then insert the pin attached to the positive lead of the power supply into hole 1. Insert the other pin into hole 3.
- () Refer to the Pictorial and push the connector plug onto connector socket AR.

This completes the assembly of your kit. Proceed to "Calibration."



CALIBRATION

- () Refer to Figure 3 and push the alignment tool blade into the small end of the nut starter as shown. This will be used as an alignment tool in the following steps.

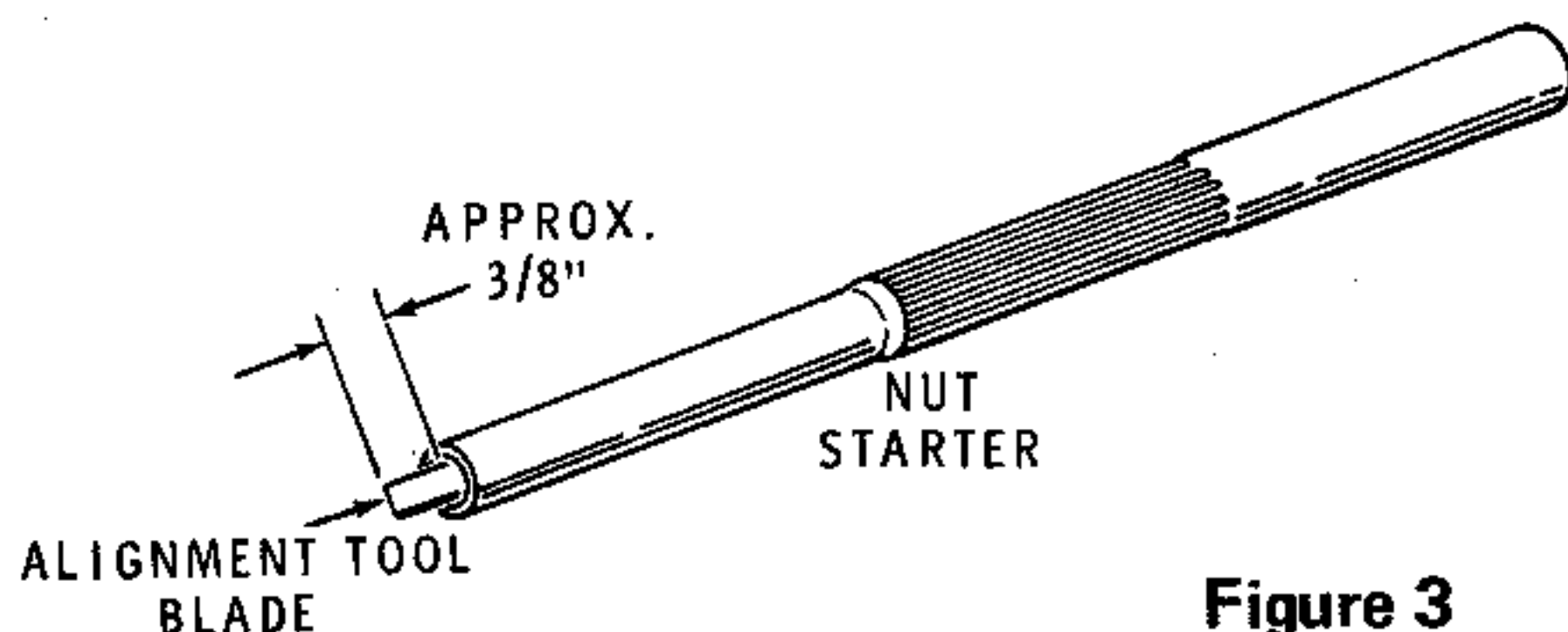


Figure 3

The accuracy of your Counter depends to a great extent upon the care and accuracy with which you perform the following steps. If at any time you do not obtain the results called for in a step, refer to the "In Case of Difficulty" section on Page 44 to correct the problem.

This section of the Manual contains two calibration procedures. If you have access to a reliable frequency counter and/or an accurate frequency generator, proceed to the "With Instruments" procedures on Page 41. If these instruments are not available, proceed to the following "Without Instruments" procedure.

Without Instruments

IMPORTANT: Most communications receivers and standard (AM) broadcast receivers, especially those with a built-in antenna coil, have sufficient sensitivity to produce the audible difference frequency called for in the following steps. However, if you are unable to hear the difference frequency, try another receiver and/or remove the cabinet shell from your Counter before you assume there is a difficulty.

- () Turn the Counter on and allow it to warm up for 30 minutes. This is **MOST IMPORTANT** for an accurate calibration.
- () Push the POWER/TIME BASE switch to the kHz position.
- () Push the MODE switch to TOL.

CLOCK OSCILLATOR

You will calibrate your Counter by using a radio receiver to compare the frequency of the Counter's 10 MHz clock oscillator with an accurate radio frequency. Signals from a radio station and from your Counter will be received simultaneously and adjustments will be made as described later. The radio station signal can be received by two different methods. Select one of the methods and calibrate the oscillator.

1. If you have a general coverage communications receiver, use its AM mode. For best accuracy, tune it to the highest WWV station frequency (25, 20, 15, 10, or 5 MHz) that you can receive at a satisfactory volume level in your area. Temporarily connect an insulated, unshielded wire to the receiver antenna connection (leave the outside antenna connected to the receiver) and lay the wire over the oscillator section of your Counter in the area shown in Figure 4 in the Illustration Booklet.

You should hear a tone. If you do not hear the tone, remove the cabinet shell from your Counter and place the insulated wire near IC26. This should make the signal easier to hear.

2. You can use a broadcast AM radio, by tuning in a station of medium volume and connecting a temporary additional antenna and laying it over the oscillator section of the Counter at the location shown in Figure 4 in Illustration Booklet. If you do not hear the tone of the Counter oscillator, remove the Counter cabinet shell and place the temporary antenna wire close to IC26. You can also use a portable AM Broadcast radio by holding it so its antenna is close to the Counter oscillator section.
- () Insert the end of the alignment tool in the screw slot of the trimmer. (See Figure 4.) Then turn the screw in the direction that produces a zero beat. Carefully withdraw the alignment tool.

With Instruments

NOTE: In the following steps, keep the cabinet shell on the Counter.

- () Turn the Counter on and allow it to warm up for 30 minutes. This is **MOST IMPORTANT** for an accurate calibration.

You will need precision equipment to calibrate the clock and the input sensitivity of your Counter in the following steps.

This calibration can be performed with either a frequency counter and a signal generator (capable of a 1-30 MHz, 250 mV output) or with a known, stable, laboratory standard frequency. Determine which of these methods you will use. Then complete the steps under the appropriate heading. If at any time you do not obtain the results called for in a step, refer to the "In Case of Difficulty" section on Page 44 to correct the problem.

CALIBRATION WITH A FREQUENCY COUNTER AND SIGNAL GENERATOR

Refer to Figure 5 in the Illustration Booklet for the following steps.

NOTE: The accuracy of your Counter, for this type of calibration, depends on the accuracy of the test frequency counter.

- () Connect the test leads of the test frequency counter to the output terminals of the signal generator.
- () Also connect the test leads of your Counter to the output terminals of the signal generator.
- () Press the POWER/TIME BASE switch to the kHz position for maximum resolution.

- () Set the signal generator to any convenient frequency between 1 MHz and 30 MHz at 250 mV to 500 mV output.
- () Use the alignment tool and adjust the OSC ADJ capacitor (see the inset drawing on Figure 5) until your Counter indicates exactly the same frequency as the test frequency counter.
- () Disconnect the test leads.

This completes the calibration of your Frequency Counter. Proceed to the "Operation" section.

CALIBRATION WITH A KNOWN LABORATORY STANDARD FREQUENCY

NOTE: It is essential that the known frequency source (frequency of your choice between 1-30 MHz) be absolutely stable. The accuracy of this type of calibration depends entirely on the accuracy of this known frequency.

- () Connect the known frequency to the test cable of the Counter.
- () Push the POWER/TIME BASE switch to the kHz position for maximum resolution. **NOTE:** If the frequency is 100 kHz or higher, the overrange lamp will be lighted.
- () Use the alignment tool and adjust the OSC ADJ capacitor until the known frequency is exactly indicated on your Counter.

This completes the calibration of your Frequency Counter. Proceed to the "Operation" section.

OPERATION

Refer to *Figure 6* in the Illustration Booklet for a description of the display, control, and adjustment.

CAUTION: Use ONLY the center conductor of the input lead of your Counter to check the frequency of an AC line voltage. Connecting the ground input lead to the "hot" (ungrounded) side of an AC line may result in a blown fuse and/or damage to your Counter.

When you connect your Counter to a transmission line, make sure that the line is properly terminated (low standing wave ratio) to avoid possible damage to the equipment under test and incorrect readings.

READING THE COUNTER

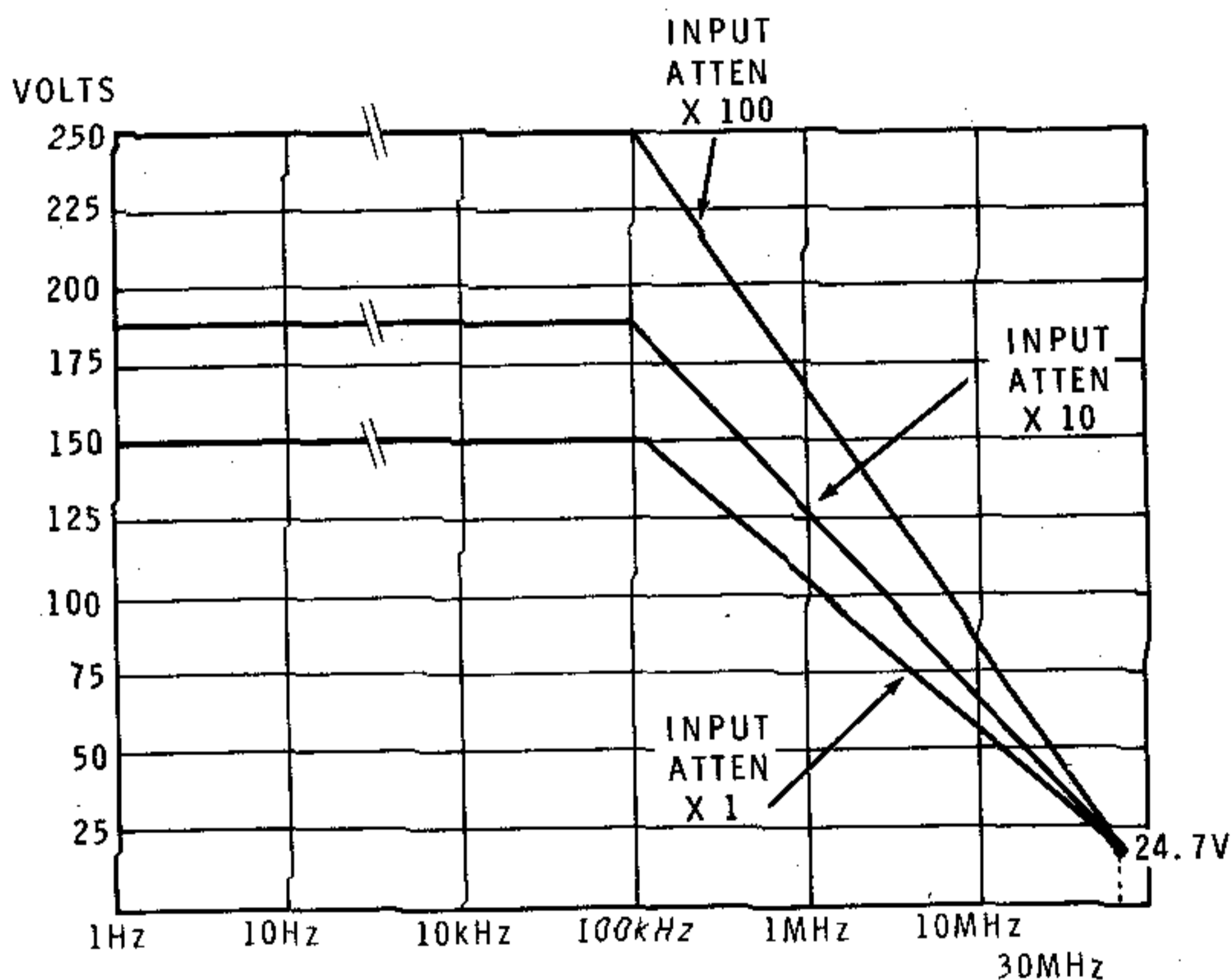
CAUTION: Avoid any excessive voltages that could damage your Counter. Refer to the "Maximum Input Voltage" for maximum safe input voltages at various frequencies.

INPUT PROBES AND CABLES

Any standard 10 megohm oscilloscope probe can be used with this Counter. Refer to *the Maximum Input Voltage* for the maximum AC voltage that can be applied to the INPUT of the Counter at various frequencies.

Maximum Input Voltage

Up to a frequency of 100 kHz, the maximum permissible input voltage is 250 volts rms. At frequencies above 100 kHz, the maximum input voltage must be derated according to the following graph.



MAXIMUM INPUT VOLTAGE DERATING CURVE

Unknown Frequencies

To measure an unknown frequency, push the POWER/TIME BASE switch to kHz. Then apply the unknown frequency to the counter input. If the OVERRANGE indicator lights up, the frequency is higher than 99.999 kHz and the POWER/TIME BASE switch should be pushed to MHz. If the display then constantly changes in a random manner, the frequency is higher than the Counter's capability, or the input level is too low.

The Display

Frequencies lower than 100 kHz can be read directly to a resolution of ± 1 Hz in the kHz position of the POWER/TIME BASE switch. Frequencies of 100 kHz and higher (within the range of the Counter) can be read to ± 1 Hz by using both time base positions. A frequency of 12,345,678 Hz would be displayed as follows:

POWER/TIME BASE Switch	Display	Ovrange Indicator
MHz	12.345	Off
kHz	45.678	On

ACCURATE LOW FREQUENCY MEASUREMENTS

Your Frequency Counter counts and displays low frequency signals. However, the display error will be ± 1 count because the clock in the Counter is not synchronized with the incoming signal. To measure a low frequency signal more accurately, position the POWER/TIME BASE switch to mS and the MODE switch to PER. Then solve for the equation $f = 1/\text{period}$.

Example: Accurately count a 10 Hz signal from a signal generator.

The period display is 99.991 mS.

Solve for $f = 1/\text{period} = 1/.099991 = \underline{10.0009}$ Hz.

NOTES:

- Noise on the input signal can cause large errors in this type of measurement as noise will make the Schmitt trigger switch either early or late.
- When possible, use fast rise-time signals (square waves instead of sine waves). Noise on square wave signals has less time to influence the Schmitt trigger and thus error is substantially reduced.

TOTALIZE MEASUREMENTS

In the TOL mode, the Counter adds up (totalizes) the input pulses until the:

- Input pulses stop.
- RESET button is pushed. (This clears the count to zero so the count will be 1 with the next input pulse.)
- Count is stopped by a logic 0 at the rear panel INPUT/OUTPUT connectors when the OSCILLATOR switch is in the EXT position.

12-VOLT OPERATION

The Counter will operate normally on DC power except the POWER/TIME BASE switch does not turn the Counter off. The Counter will remain on as long as the DC power is applied.

IN CASE OF DIFFICULTY

This three-part section gives suggestions for locating and resolving difficulties.

The first part, "General Troubleshooting Information," deals with problems that exist when you have just completed the assembly of your kit. This information primarily covers soldering and assembly problems.

The second part consists of a "Troubleshooting Chart," which gives difficulties and likely causes.

The third part, "Important Wave Shapes," contains significant waveforms.

If the checks under these three headings do not help you locate the problem, the difficulty may be a component. Read the "Circuit Description" (Pages 50 and 51) and refer to the Schematic Diagram in the Illustration Booklet to help you determine where the trouble is.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

GENERAL TROUBLESHOOTING INFORMATION

1. Make sure you have power at the transformer primary.
2. Make sure switch SW1 (120-240) is properly set.
3. Recheck the wiring. Trace each wire in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the kit builder.
4. Most problems result from poor connections and soldering. Use a magnifying glass and check all solder connections to be sure they are soldered as described in the "Soldering" section of the "Kit Builders Guide." Also check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring. Look for solder bridges between circuit board foils. Compare your foil pattern with the "X-Ray Views" on Page 51 and 52. Many troubles can be eliminated by reheating all connections to make sure they are soldered as described in the "Soldering" section of the "Kit Builders Guide."

5. Make sure that the proper transistor has been installed at each location and that each lead is in the proper hole.
6. Press each integrated circuit into its socket so that each pin will make a secure connection. Be sure that each IC pin is properly installed in its socket and not bent out or under the IC.
7. Check each IC to make sure its index mark matches the half-circle on the circuit board.
8. Check the values of the parts. Make sure the proper part has been wired into the circuit at each location. For example, a 150 Ω (brown-green-brown) resistor could easily be installed in place of a 510 Ω (green-brown-brown) resistor.
9. Check the continuity of the circuit board foils. If you find an open foil, bridge it through the circuit board with a jumper wire.
10. A review of the "Circuit Description" may help you to determine where the trouble is.

Substitution

Corresponding components of the circuitry for each display can be interchanged with the components of another. IC's 3 through 7 can be interchanged, for example.

If one display unit shows a digit incorrectly, interchange it with one of the other units to determine if the display or the circuit is faulty. If the circuit is faulty and there are no solder bridges on the associated foil, interchange the decoder/driver IC with one of the others. This method can be used with other single digit problems and can be extended to interchanging the decade counter integrated circuits.

Clock Circuit

Verify that the clock oscillator and divider circuits are operating properly by checking the voltage at pin 12 of IC19. The meter should alternately indicate less than 0.4 volt for one-half second and then greater than 2.4 volts for one-half second.

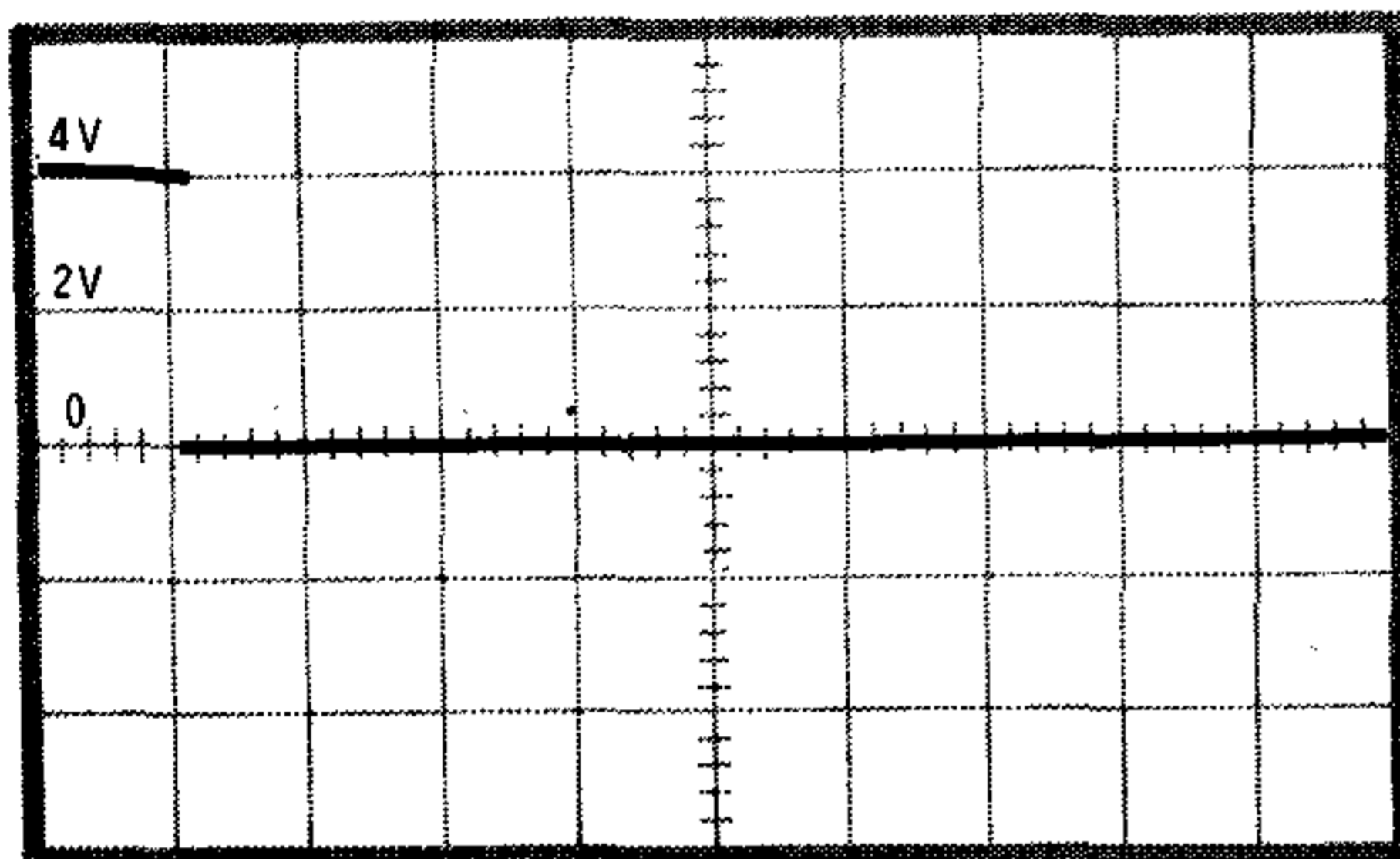
Troubleshooting Chart

CONDITION	POSSIBLE CAUSE
One readout does not reset to zero with the input shorted.	1. Check associated decade counter and decoder/driver IC's.
Readouts will not reset to zero in the kHz or MHz range.	1. Q6. 2. IC18. 3. IC22, IC23, IC24. 4. IC17.
Counter functions normal in MHz range but not in kHz range.	1. IC13. 2. Switch SW2. 3. IC19, IC20, IC21.
Display will not light.	1. Power supply. 2. IC27.
One or more display tubes will not light.	1. Check associated decoder/driver IC's (IC8 through IC12).
One display tube does not indicate correct numeral from known frequency source.	1. Check associated decade counter and decoder/driver IC's.
Counter resets to zero but will not count.	1. Range switch not firmly pressed to correct position. 2. Insufficient amplitude of input signal. 3. Transistors Q1 through Q4, IC1, IC2, IC15.
OVER (overrange) lamp does not function or is on continuously.	1. IC14. 2. IC13.
Counting sequence is displayed during gating.	1. Memory transfer line, Q6. 2. IC18.
Decimal point does not light.	1. Resistor R102. 2. Interchange D104 with another display.
Random count with input cable disconnected.	1. Scrape paint under BNC connector on back of panel.
+5 volt supply too high.	1. IC27.

IMPORTANT WAVE SHAPES

This section shows wave shapes that should be present at various points in your Frequency Counter. The wave shapes are line drawings of photographs of the graticule on an oscilloscope. A low capacitance X10 probe was used and the oscilloscope was set for .1 volt-per-division. The time base is indicated for each drawing. Use the MHz position of the POWER/TIME BASE switch. All wave shapes are approximately 3.5 to 4.5 volts. The bottom horizontal lines of the wave shapes represent approximately 0 to .4 volt.

IC3, 4, 5, 6, 7; Pin 2



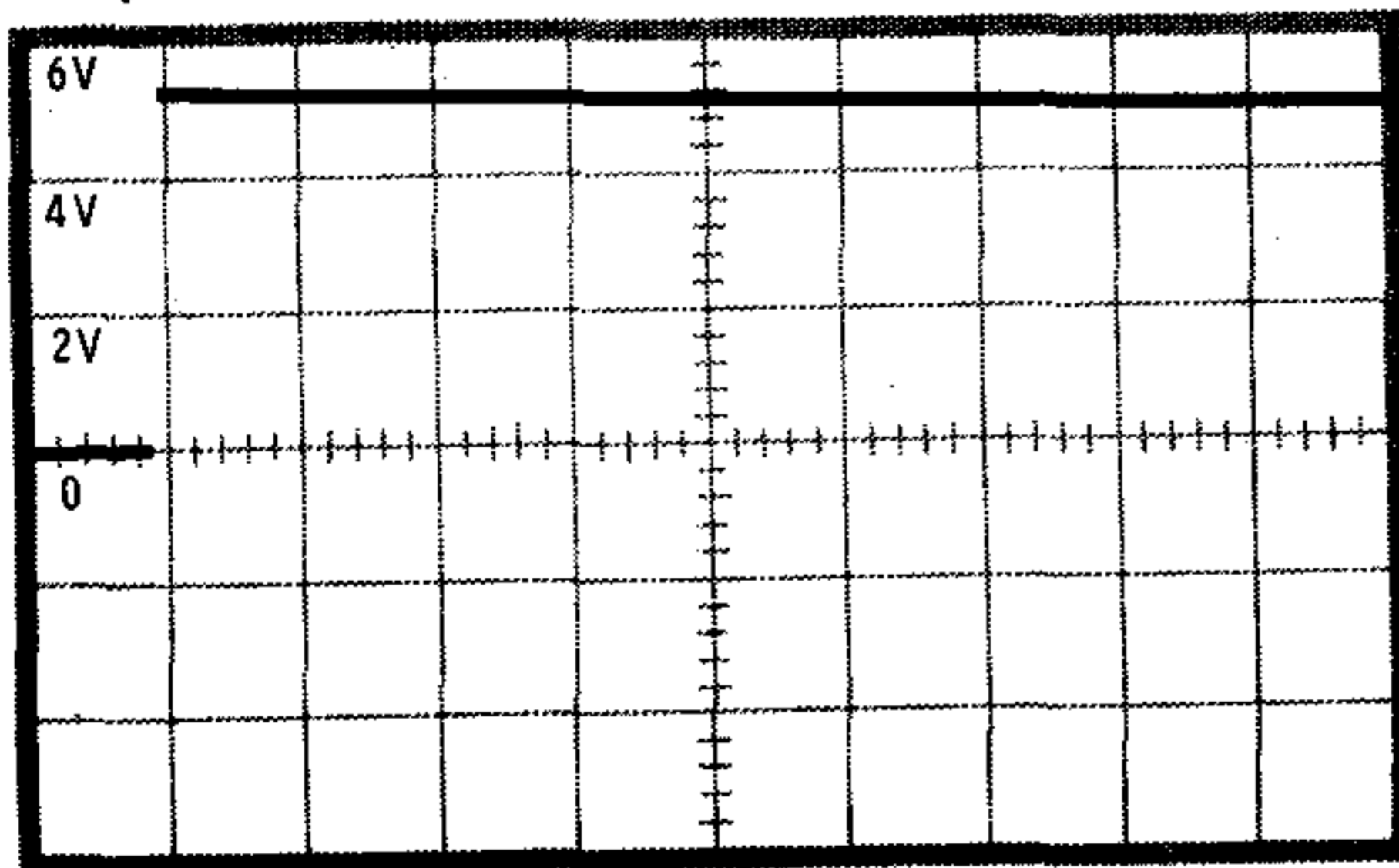
50 μ SEC/DIV
RESET PULSE

IC25; Pin 12



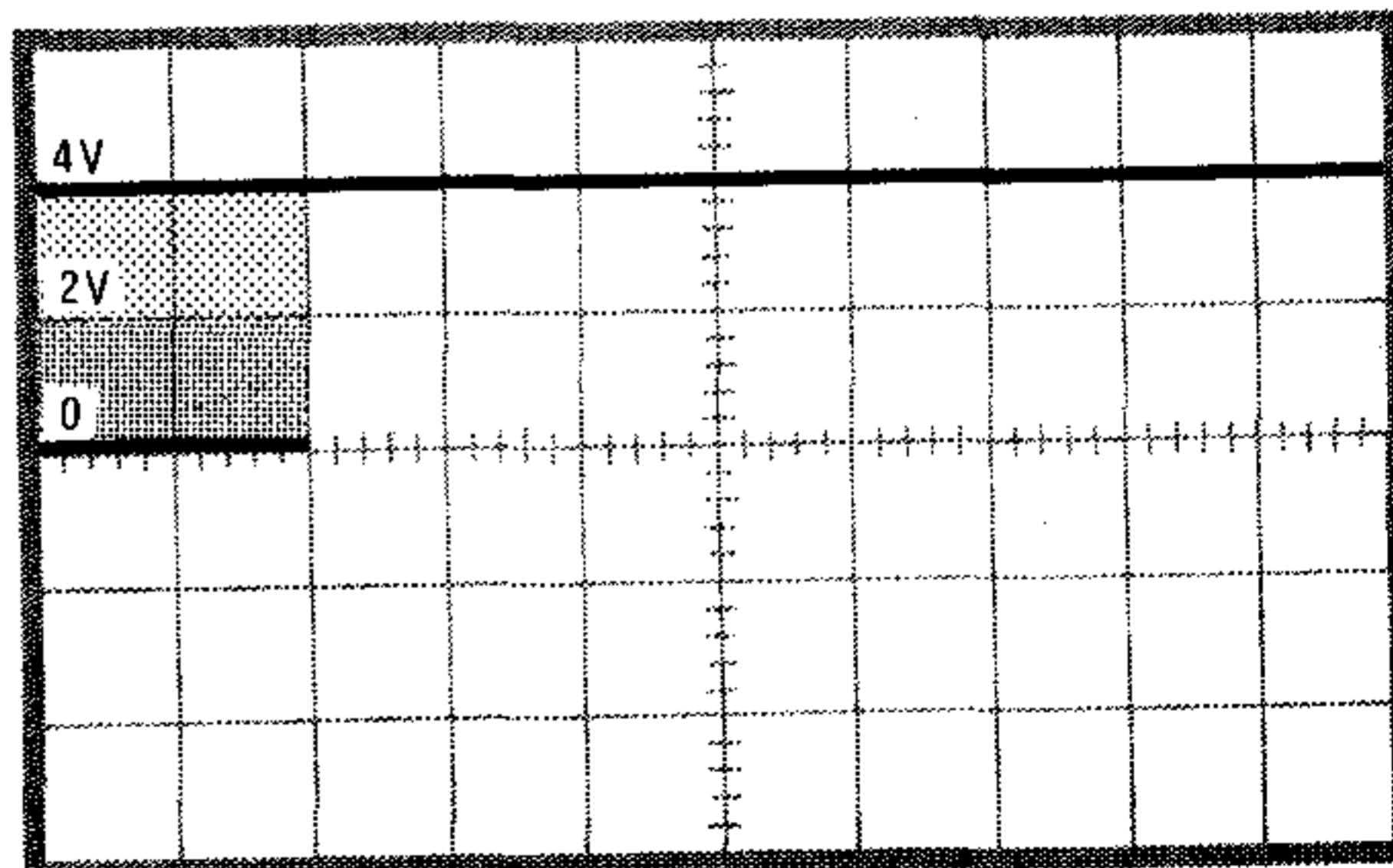
.5 μ SEC/DIV
OSCILLATOR

Q6; Collector



50 μ SEC/DIV
TRANSFER PULSE

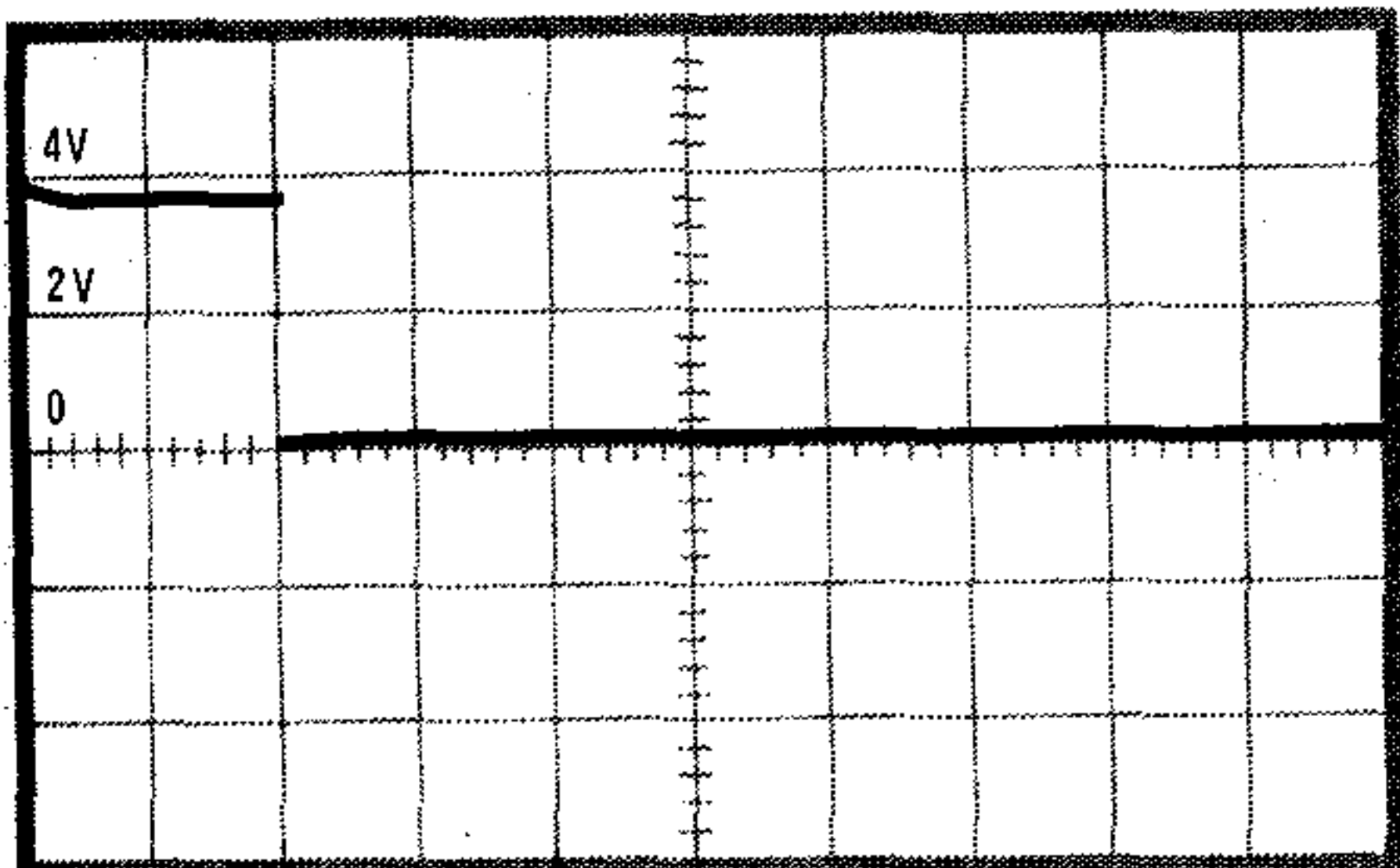
IC2; Pin 8



PIN 8
.5 mSEC/DIV
GATED SIGNAL

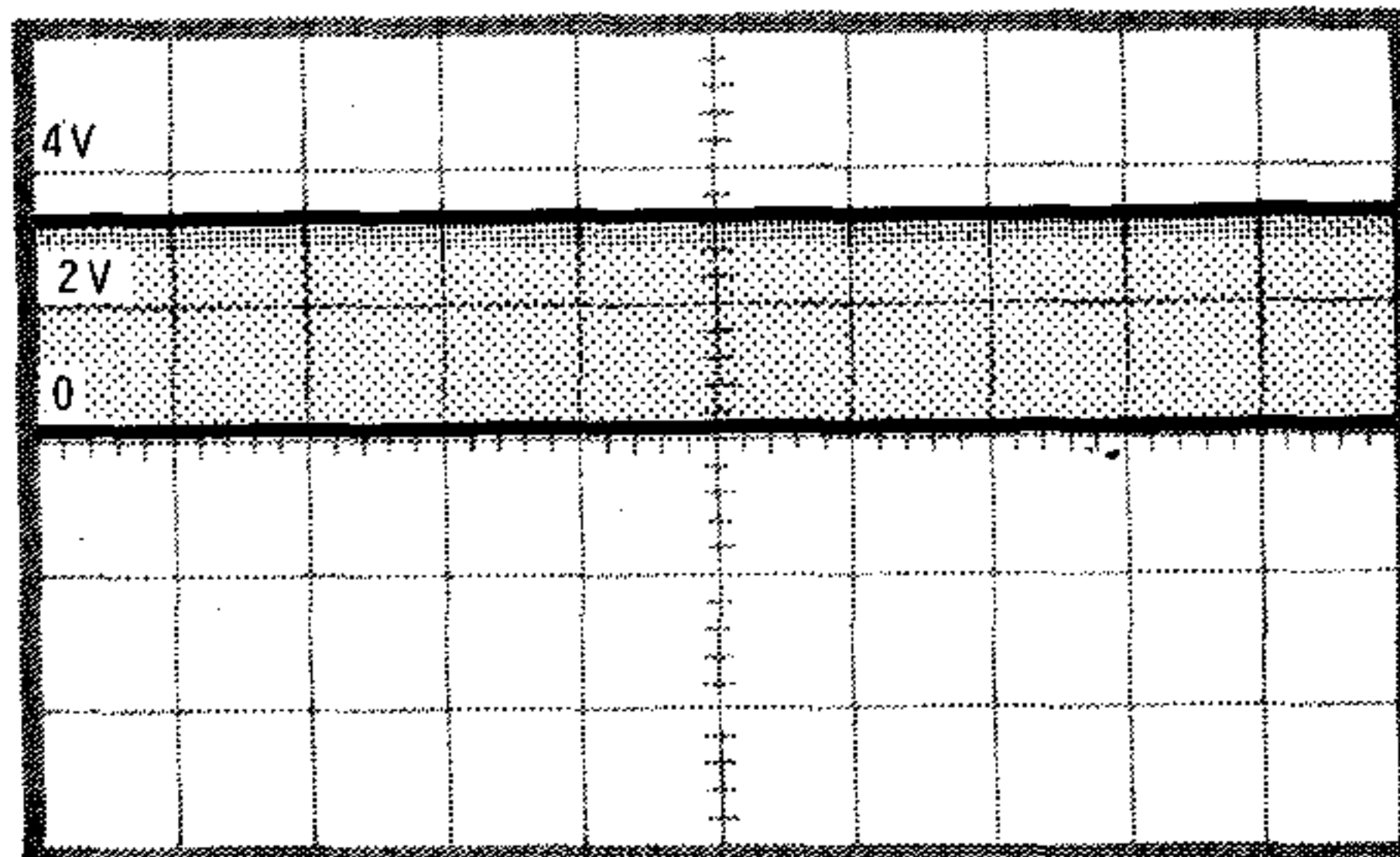


IC2; Pin 6



.5 mSEC/DIV
GATE

IC2; Pin 4



.5 mSEC/DIV
INPUT SIGNAL

SPECIFICATIONS

FUNCTIONS

Frequency	5 Hz to 30 MHz.
Period	1 μ sec resolution to 99.999 sec.
Totalize	1 - 99,999 events.

INPUT

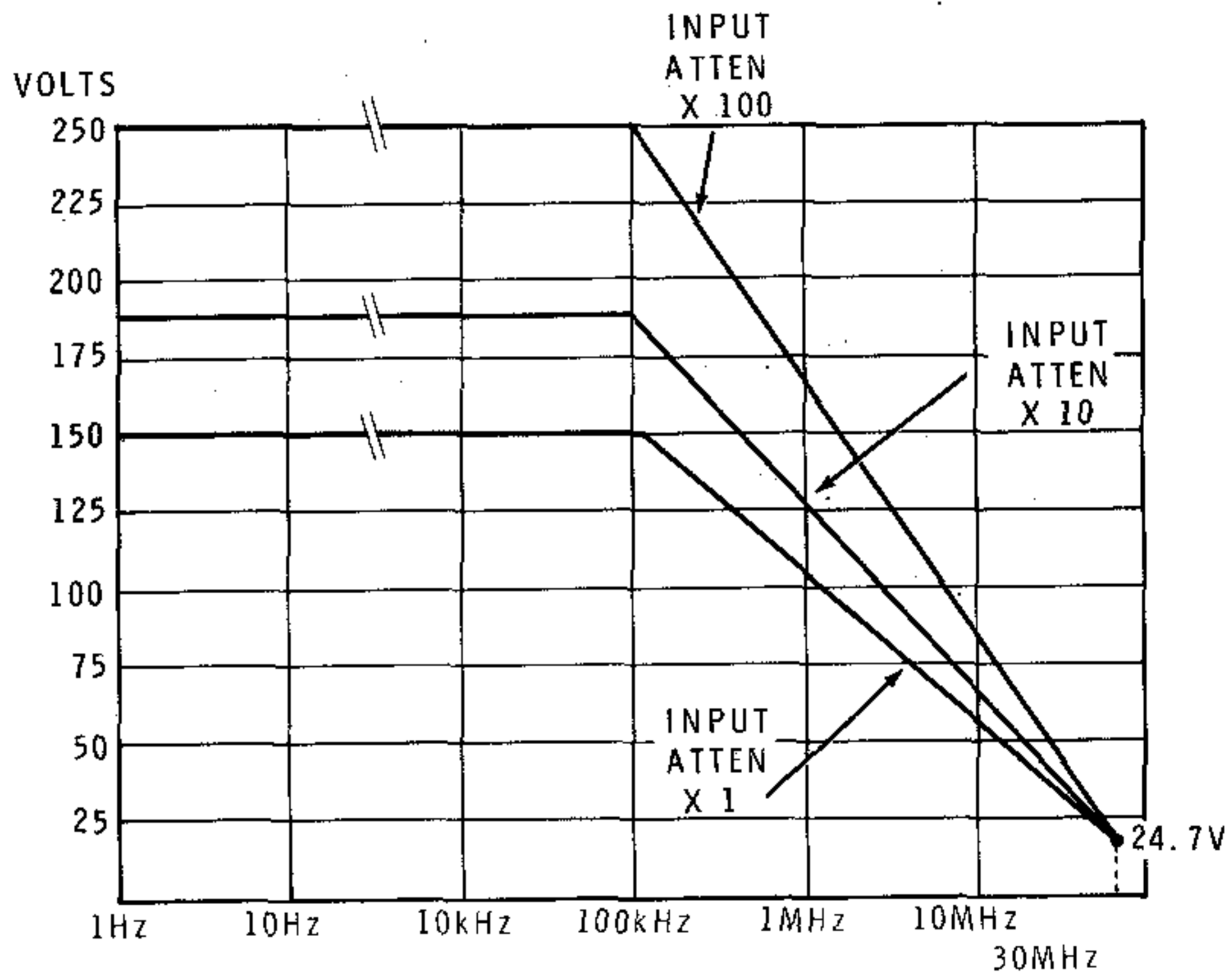
Frequency Range	5 Hz to 30 MHz minimum.
Sensitivity	15 mV rms (50 mV, 5 Hz to 50 Hz).
Period Pulse Width	25 nsec minimum.
Low Frequency Signal Risettime	1 msec for signals less than 10 Hz.
Input Impedance	1 M Ω shunted by less than 35 pF.
Protection	240 volts rms at 60 Hz. See the Input Derating curve.
Attenuator	X1, X10, X100 fixed compensation.

TIME BASE

Stability	±1 ppm.
Frequency	10 MHz.
Temperature Stability	±10 ppm, maximum 0° to 40° ambient.

OSCILLATOR CONNECTION

External Input Frequency	DC to 20 MHz.
External Input Sensitivity	TTL or 2.5 V rms from 50 Ω source.
Internal Output	TTL signal at 1 MHz.



MAXIMUM INPUT VOLTAGE DERATING CURVE

GENERAL

Gate Interval	kHz - 1 sec, MHz - 1 msec (indicated by gate light).
Manual Gate	DC control in events mode using external OSC input connector.
Display Time	200 msec plus gate interval.
Power Requirements	105 - 130 or 210 - 260 VAC (switch selected), 50 - 60 Hz, (at 25 watts.); or 9 - 14 VDC at 1.25 amperes.
Dimensions	7-1/4" wide, 10-1/2" deep, 2-3/4" high (less handle).
Weight	5 lbs.

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram and the Block Diagram while you read this "Circuit Description."

The following "Theory of Operation" contains a general description of the circuits. The remaining sections describe each circuit in detail.

THEORY OF OPERATION

The signal to be counted is applied, through the input attenuator and impedance converter to the Schmitt trigger. There the signal is "squared" and applied to the GATE. During the time the pulse from the time base scaler (GATE pulse) is also present at the GATE, the GATE is open and the frequency is counted by the following decade counters. After the GATE is closed, at the end of the GATE pulse, the "count" in the decade counters is transferred to the memories by the transfer pulse. At this time, proper segments of the display units turn on and the frequency is displayed. The reset pulse then clears the decade counters so they are ready for the next time the GATE is open. The duration of the GATE pulse is determined by the position of the POWER/TIME BASE switch. The pulse is of one-second duration in the kHz position and of one millisecond duration in the MHz position.

The input to IC13 converts either the time base or the input period to a GATE "ON" time, depending on the position of the Mode switch. By counting the input signal gated by the time base signal, frequency is displayed. By counting the time base signal gated by the input signal, period is displayed. In the totalize mode, the Counter simply counts the input signal without any gating.

INPUT CIRCUIT AND SCHMITT TRIGGER

The input signal is applied to an input circuit that consists of a switchable voltage divider (R1, R2, R3) that is frequency compensated by C1, C2, and C3. The signal is then coupled through C4 and R4 to D1 and D2, which provide over-voltage protection for Q1.

Transistors Q1 and Q2 are direct coupled with 100% negative feedback. These transistors provide wide bandwidth, high input impedance, low output impedance, and gain of one. IC1C and IC1A then amplify the signal to the input limits of IC1B, which is wired as a Schmitt trigger. IC1B drives Q3 and Q4, which translates the signal to TTL (Transistor-Transistor-Logic) levels and makes the signal compatible with the remaining logic circuitry.

10 MHz CLOCK AND SCALER

A 10 MHz crystal and gates B and C of IC26 form a TTL-compatible clock. Capacitors C7, C8, and C9 provide the proper capacitive load for the crystal, and C7 is variable to allow you to precisely calibrate the oscillator. Resistors R21, R22, and R23 assure efficient starting of the oscillator. Gate A of IC26 provides buffering action between the oscillator and the first decade divider (IC25) of the time base scaler. The 10 MHz clock signal is then further divided by IC's 19 through 24 to provide appropriate GATE times for the frequency mode and time pulses for the period mode.

GATING, MEMORY, RESET

Frequency Mode

The input signal at IC2B pin 4 is coupled through gates B and E of IC2 to the counters (IC3 through IC7) by the GATE pulse (one second or one millisecond) from pin 11 of IC13B. During this count time, Q5 and D106 (the GATE lamp) are turned on. At the end of the GATE pulse, pin 10 of IC13B goes high. This causes pin 11 of IC18D to pulse low, and pin 8 of IC18C to pulse high and turn on Q6 for an instant. During this instant, IC's 8 through 12 accept the count from the five decade counters and begin to display. The frequency is displayed until the end of the next GATE pulse when the display is updated.

If the display was in overrange, IC13A pin 15 would be high and this overrange condition would be entered in data latch IC14. The high at the output of IC14 would allow the overrange indicator to light. Under non-overrange conditions, IC14 keeps the indicator off.

The trailing edge of the pulse from pin 11 of IC18D triggers IC16 and produces a 200 millisecond output pulse. This pulse first turns on IC17D and clears IC13B. The pulse from pin 6 of IC16 also gates IC18A and IC18B, and resets the decade counters (IC3 through IC7) to zero. IC17C then changes state and clears IC13A. Any overrange information has already been entered into data latch IC14.

Period Mode

The input signal at IC15E pin 9 is coupled through IC15 gates E and F to IC13B, the GATE control flip-flop. The selected time base signal is applied to IC2 pin 11 and counted by the decade counters during the time IC2 is GATED on (which is the time of one period of the input signal).

Totalize Mode

IC2D pin 1 and IC15E pin 10 are held low by Mode switch SW3. This inhibits the GATE function of the Counter and the input signal at IC2A pin 3 is coupled through gates A and E to the counters.

Switch SW5 resets the Counter in all modes by grounding IC18B pin 5. If you reset the Counter with an external GATE pulse, the pulse is coupled through R33 and SW6 to IC17A pin 1. This creates a low at pin 6 of IC17B which turns off GATE IC2A so no signal can propagate through IC2 to the counters.

OVERRANGE DETECTION

If the count passes from 99.999 to 100.000, a pulse is produced at the D output (pin 11) of IC7. This spillover toggles IC13A, which is a standard JK flip-flop. The J input of this IC is tied to logic 1 (+5 volts). This causes the Q output to latch to a logic 1 condition whenever the CK input is toggled. The Q output remains in this condition until a logic 0 is applied to the C (clear) input.

IC14 is quadruple 2-input NAND gate package used as a data latch. The logic level at pin 1 of IC14 will be transferred to pin 6 when pin 2 and pin 13 are both at a logic 1. A logic 0 at these inputs will inhibit the transfer. The output of this latch is used to short out the overrange LED when no spillover has occurred. The overrange indicator lights whenever IC13 pin 15 is at a logic 1.

POWER SUPPLY

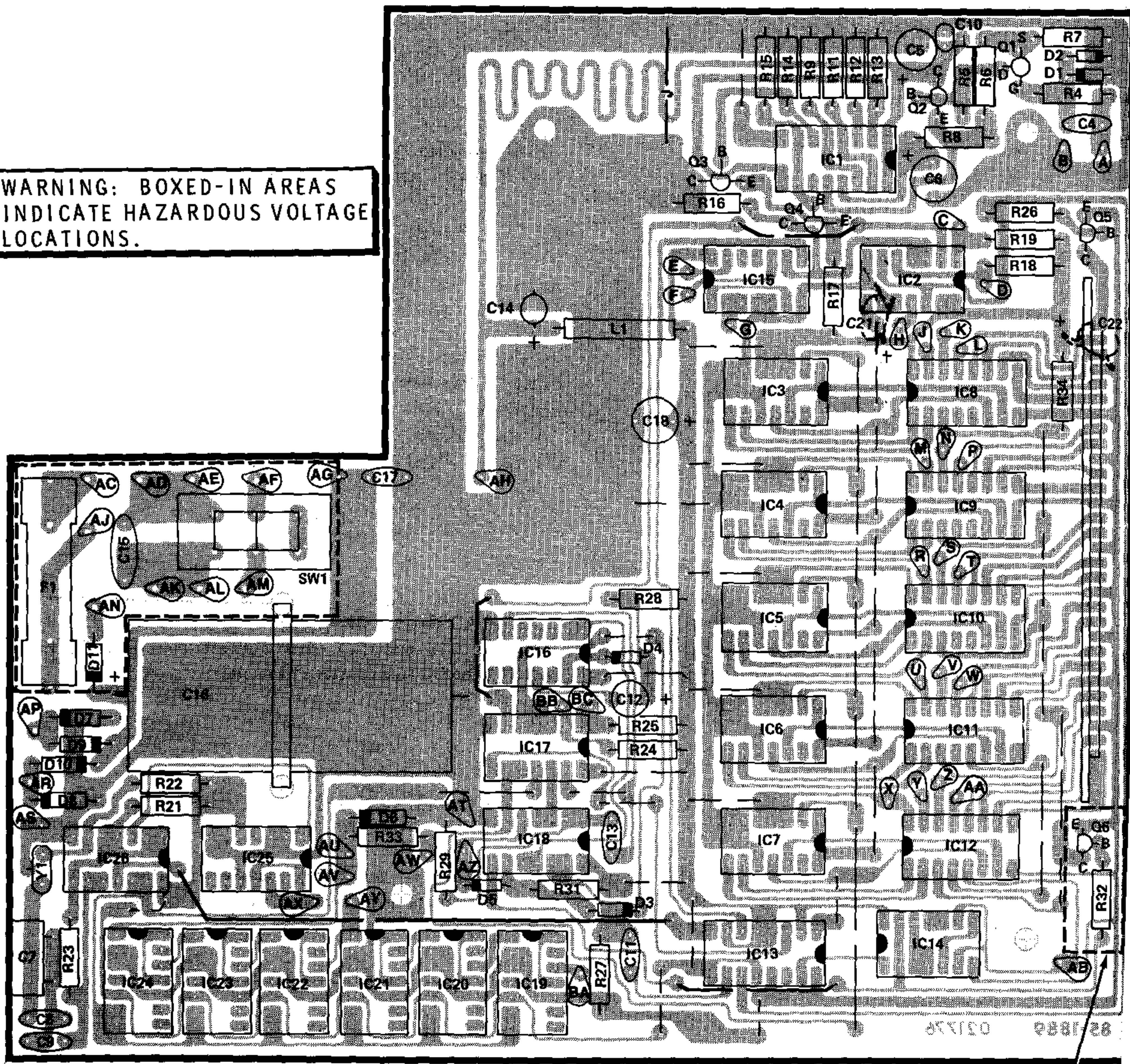
Transformer T1 steps down the line voltage to the proper value of AC. Diodes D7 through D10 rectify the AC and capacitors C16 and C17 filter out the pulsations. IC27 regulates the DC to a constant five volts.

CIRCUIT BOARD X-RAY VIEWS

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

- A. Find the circuit component number (R5, C3, etc.) on the X-Ray View.
- B. Locate this same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.
- C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.

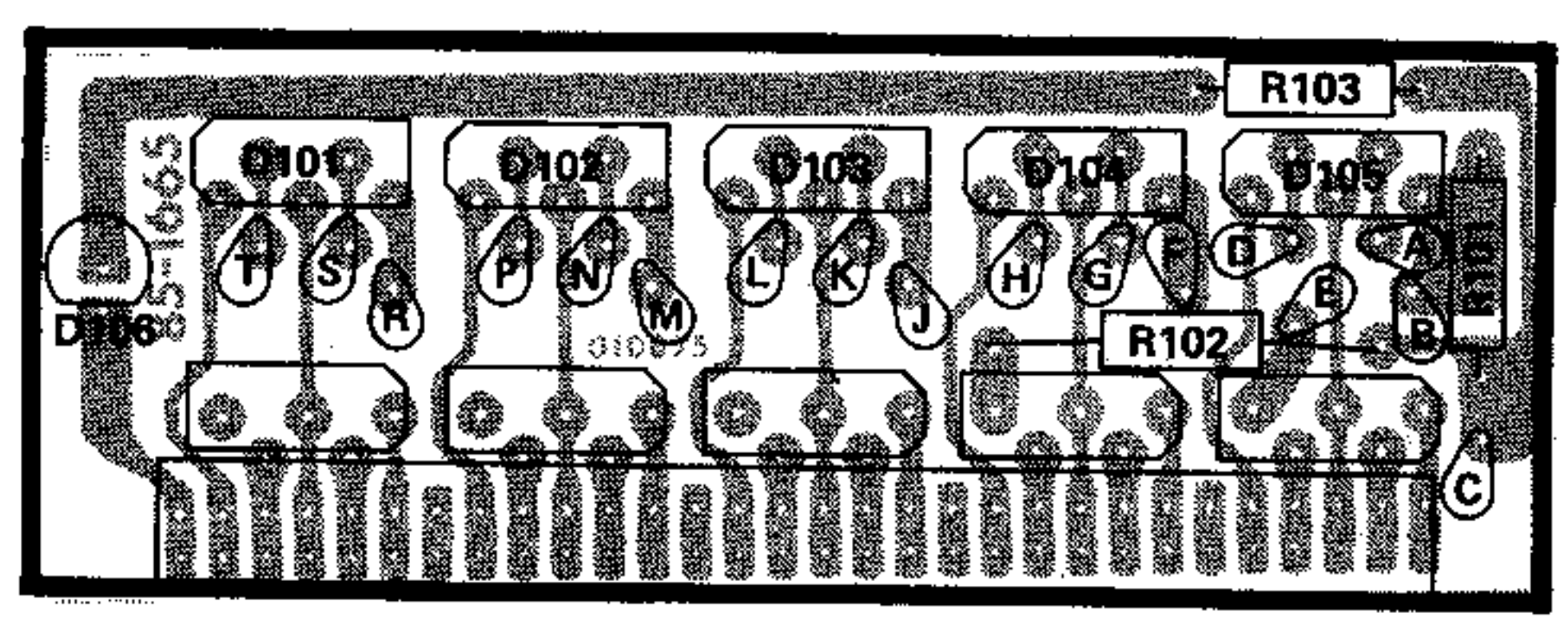
WARNING: BOXED-IN AREAS INDICATE HAZARDOUS VOLTAGE LOCATIONS.



MAIN CIRCUIT BOARD (VIEWED FROM COMPONENT SIDE)

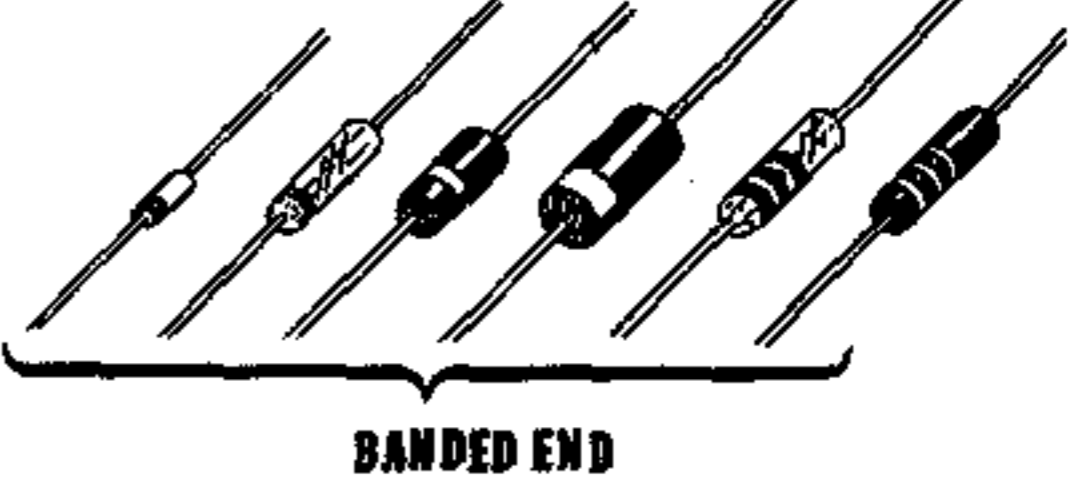
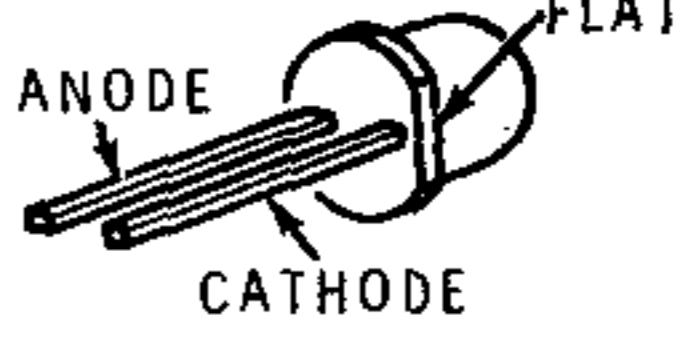
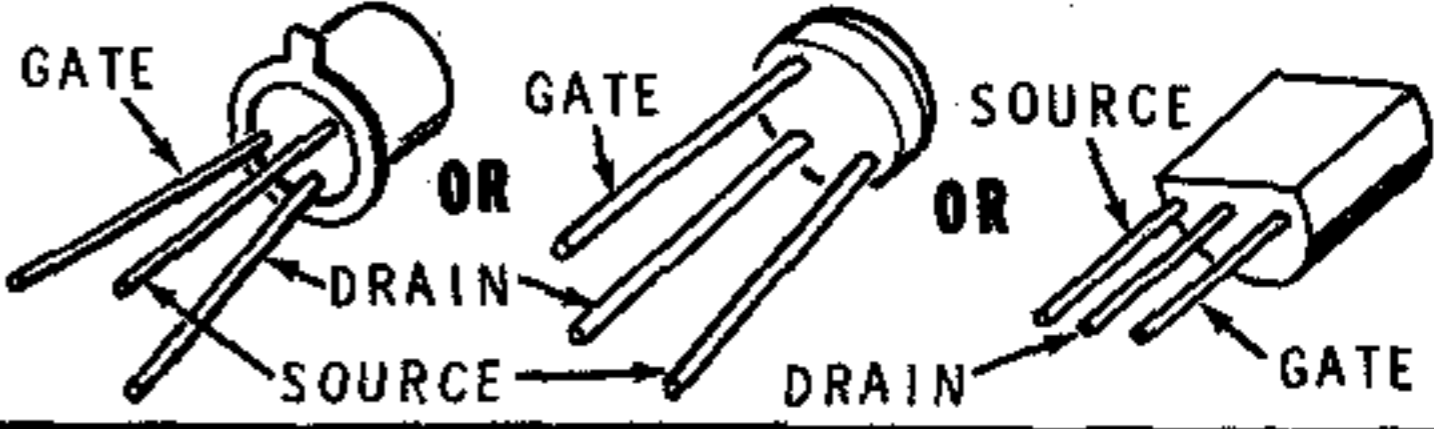
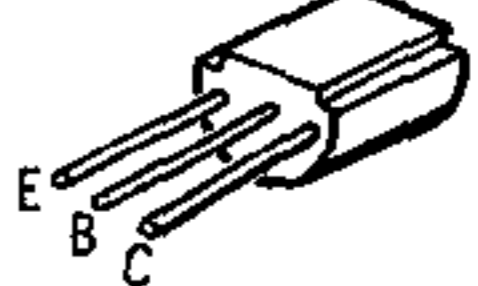
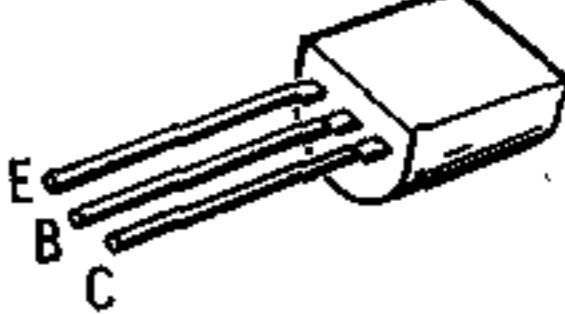
POWER SWITCH UNDER CIRCUIT BOARD

MAIN CIRCUIT BOARD (Viewed from component side)

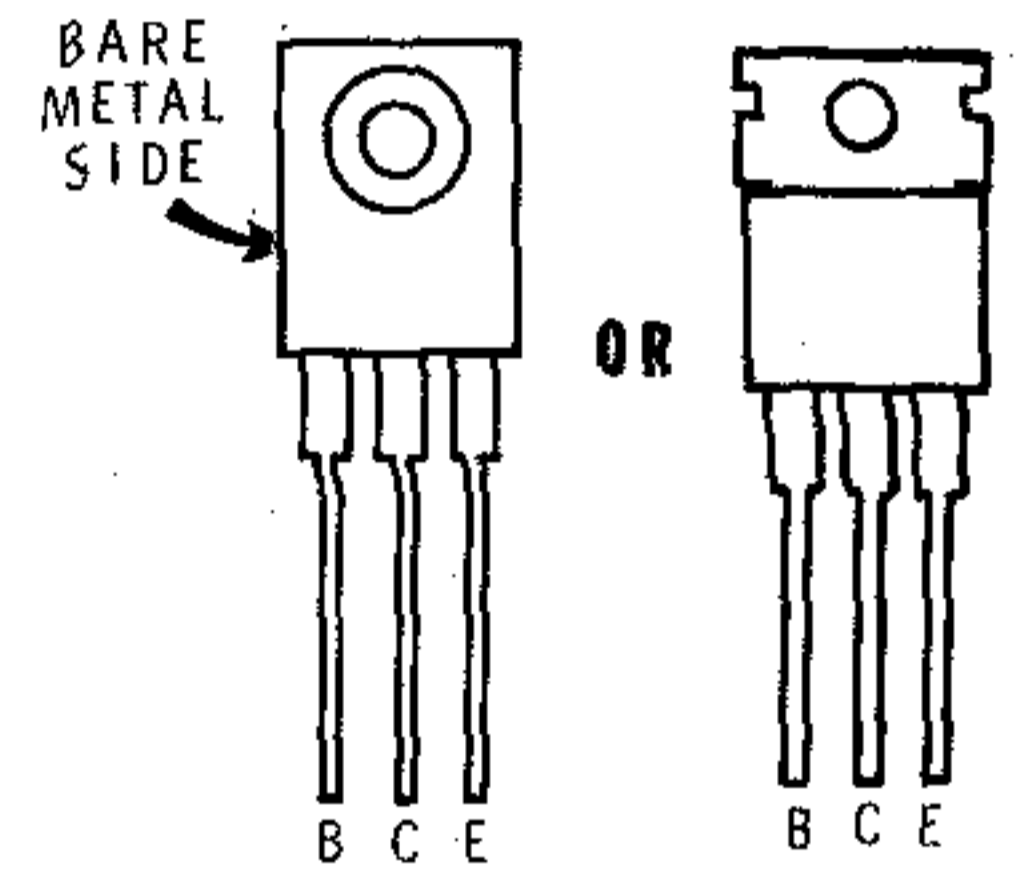
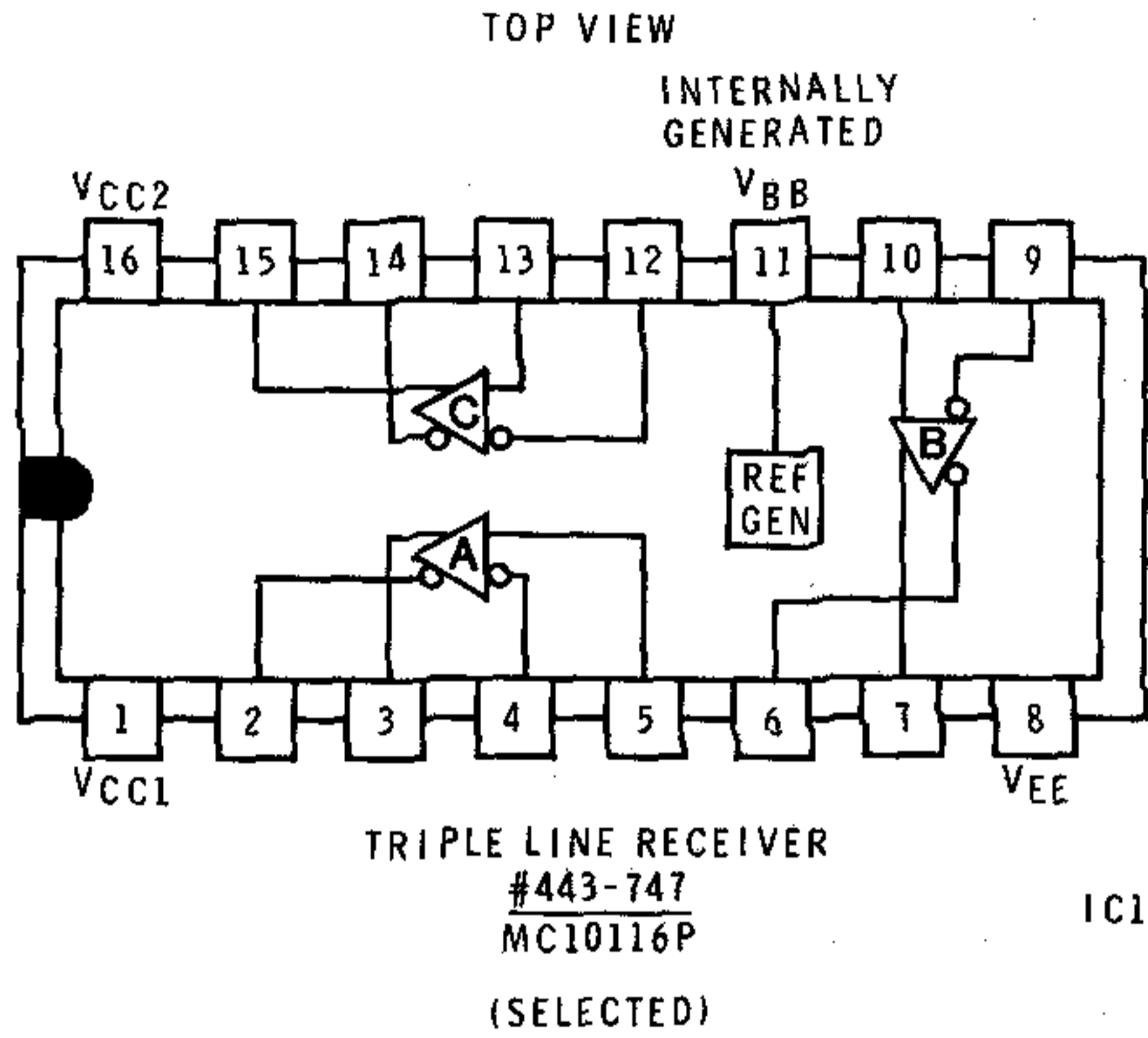


DISPLAY CIRCUIT BOARD
(Viewed from foil side)

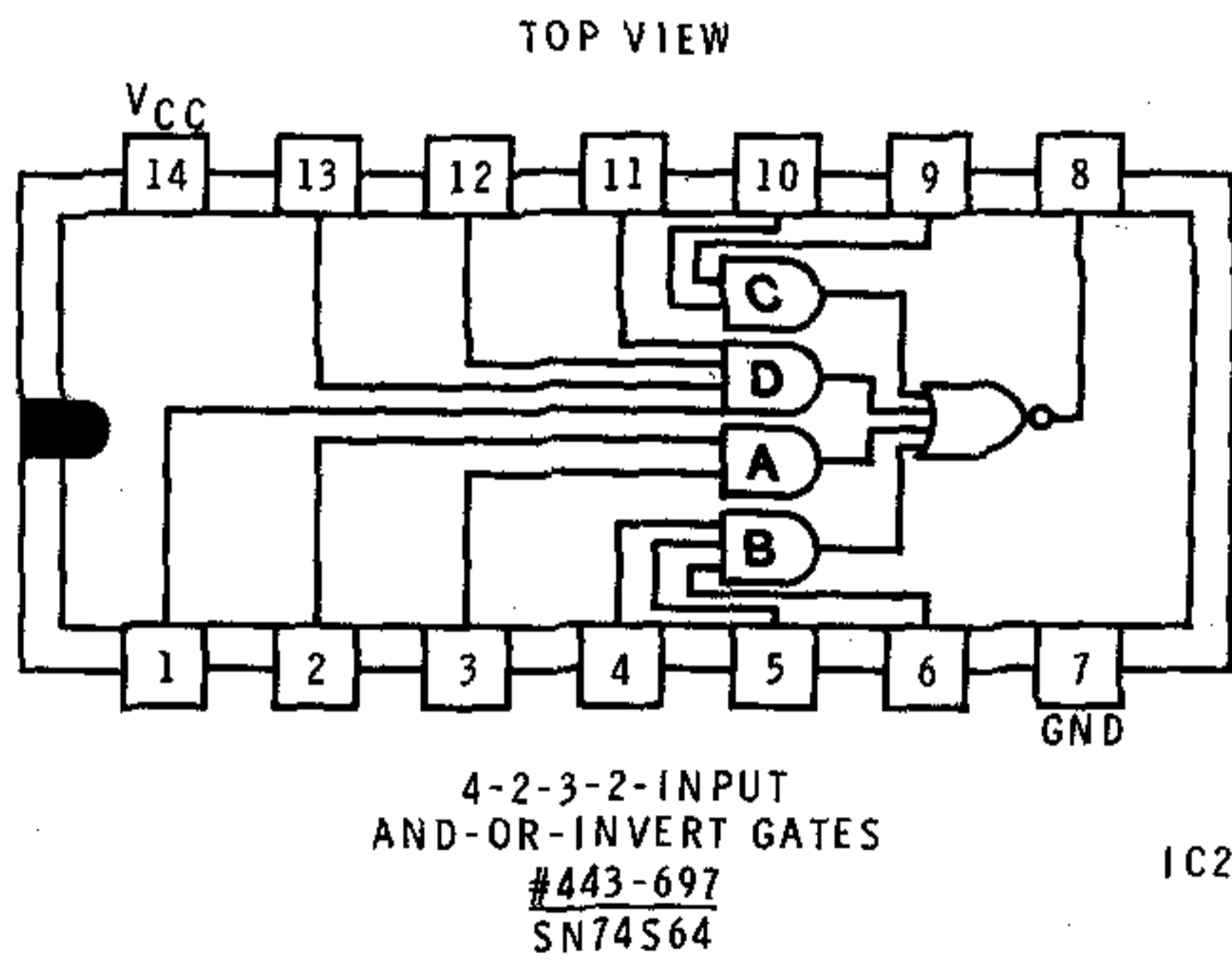
SEMICONDUCTOR IDENTIFICATION CHART

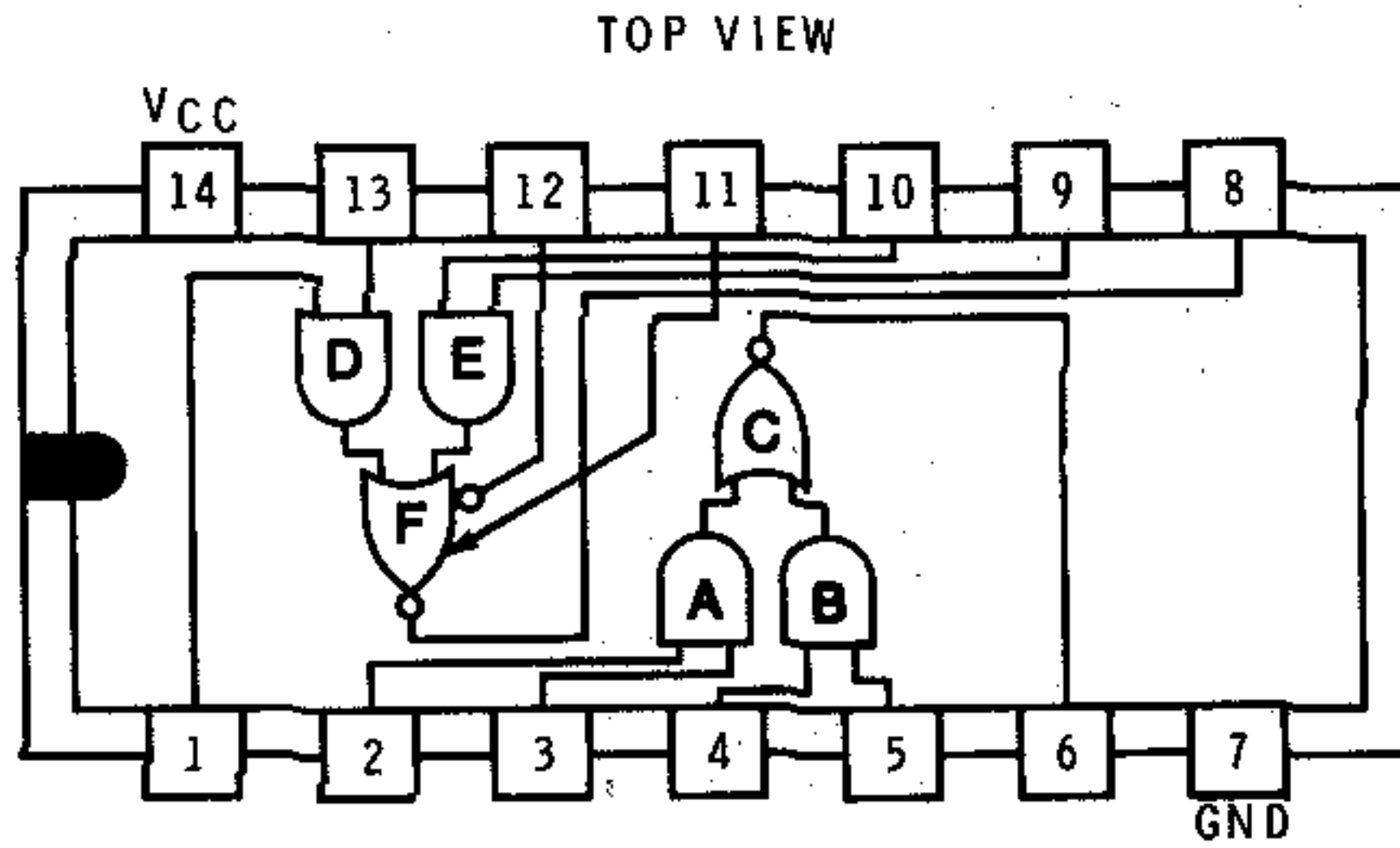
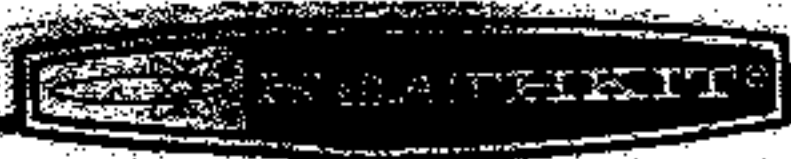
DIODES			
COMPONENT	HEATH PART NUMBER	MAY BE REPLACED WITH	IDENTIFICATION
D1, D2, D3, D4, D5	56-56	1N4149	<p>IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.</p>  <p style="text-align: center;">BANDED END</p>
D6	56-44	1N4653	
D7, D8, D9, D10, D11	57-65	1N4002	
D106	412-616	FLV117	
TRANSISTORS			
Q1	417-828	E-304	
Q2, Q3, Q4	417-292	2N5771	
Q5, Q6	417-801	MPSA20	

INTEGRATED CIRCUITS

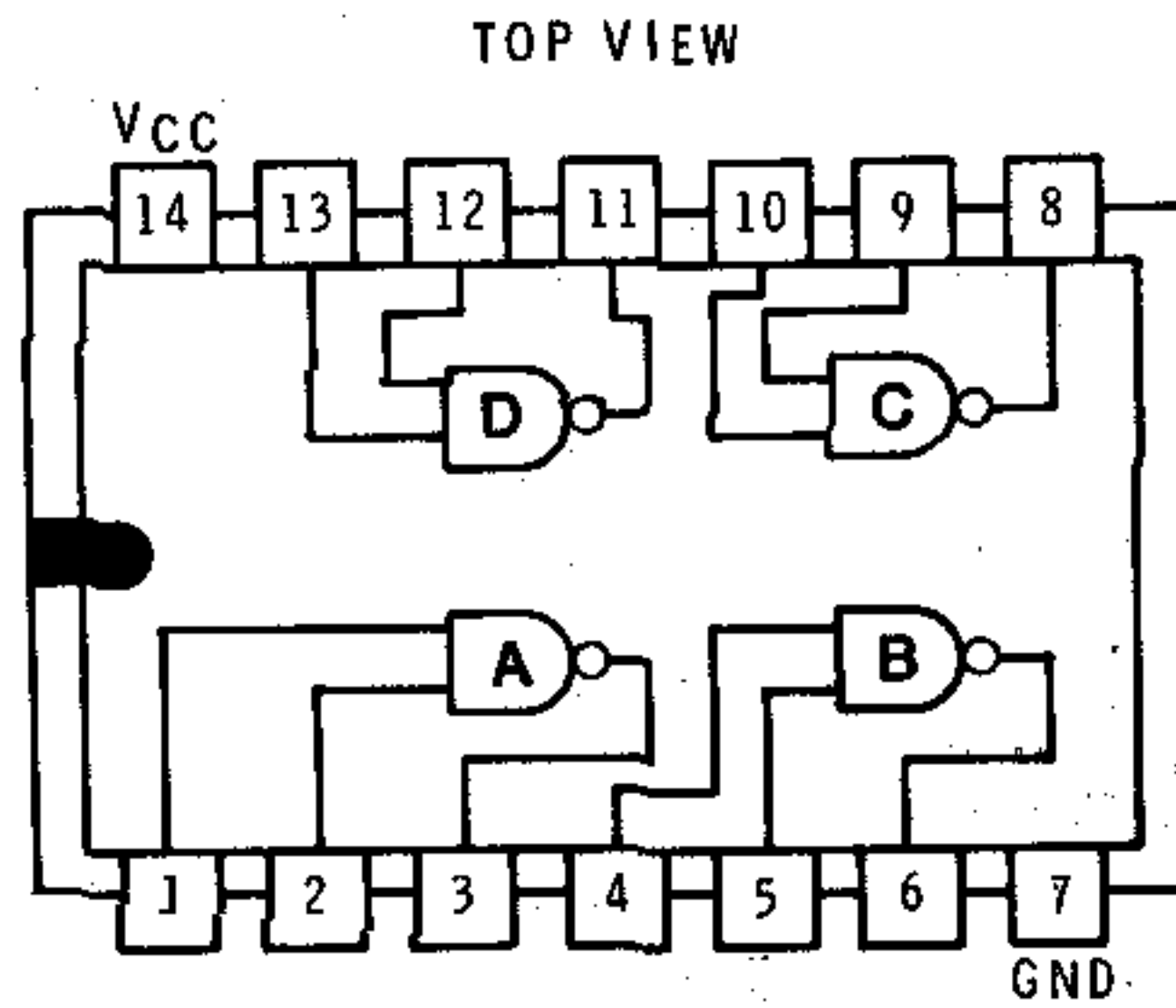


5-VOLT REGULATOR
#442-54
 μ A7805
IC27

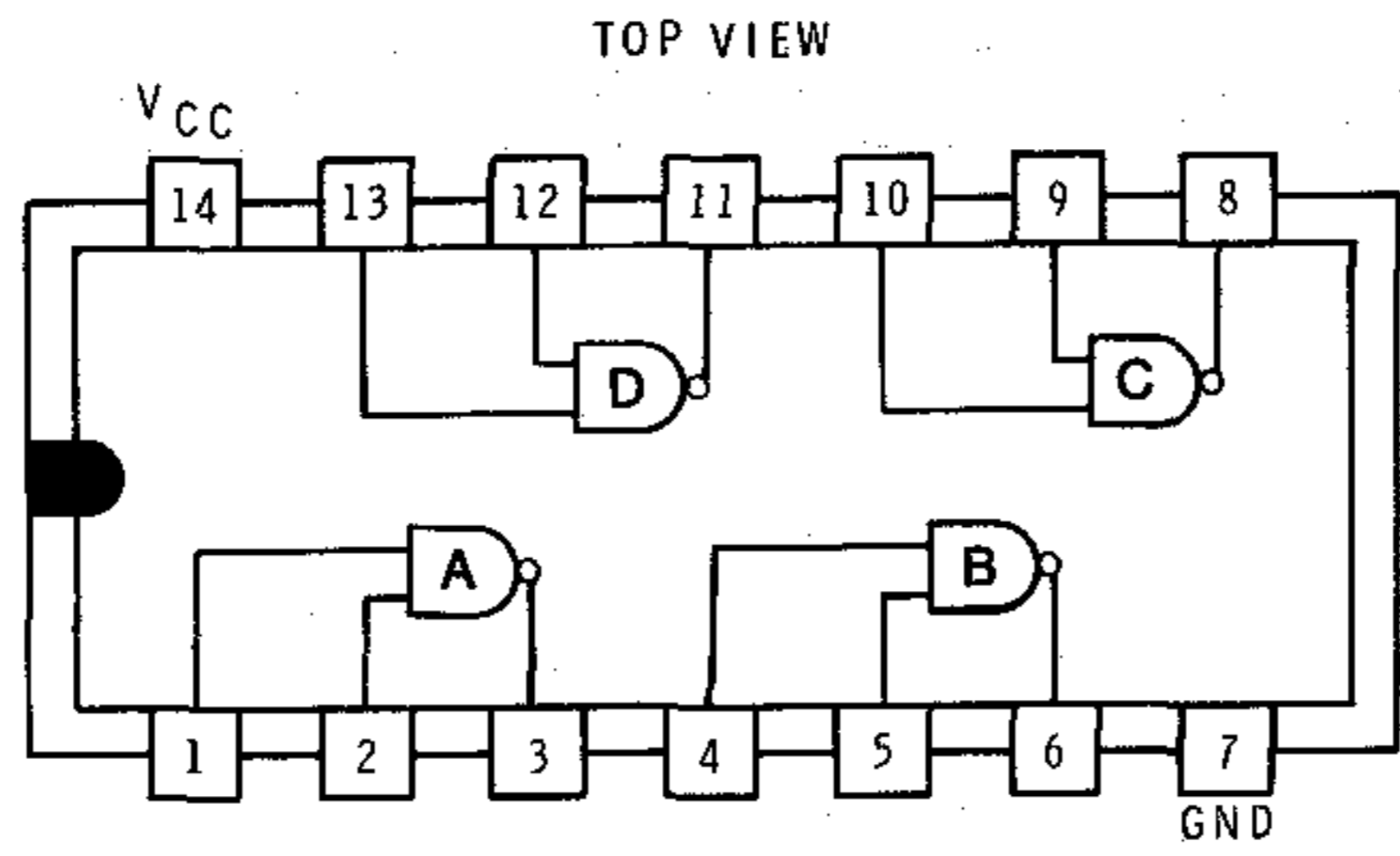




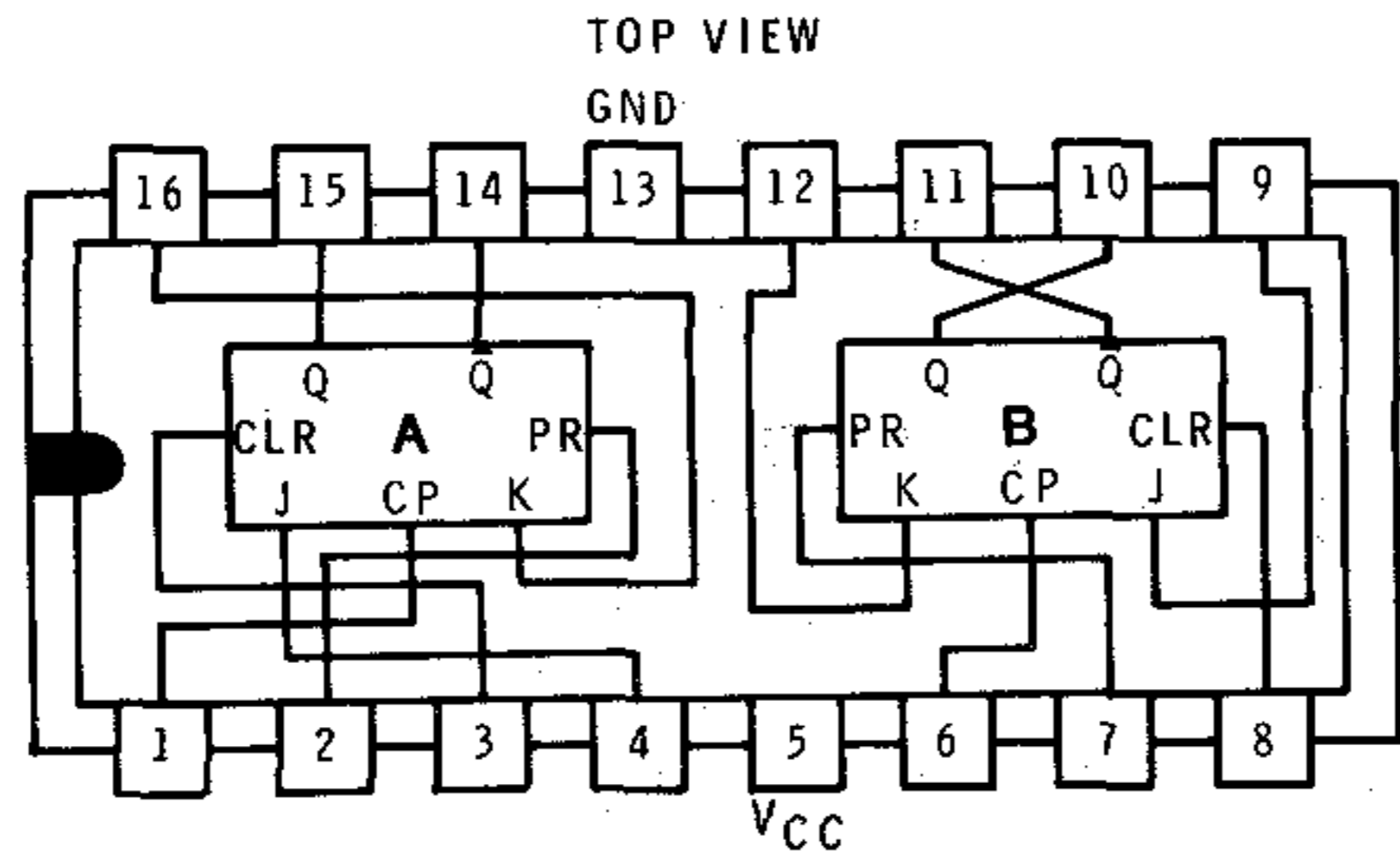
DUAL 2-WIDE 2-INPUT
AND-OR-INVERT GATES
(ONE GATE EXPANDABLE) IC15
#443-15
SN7450N



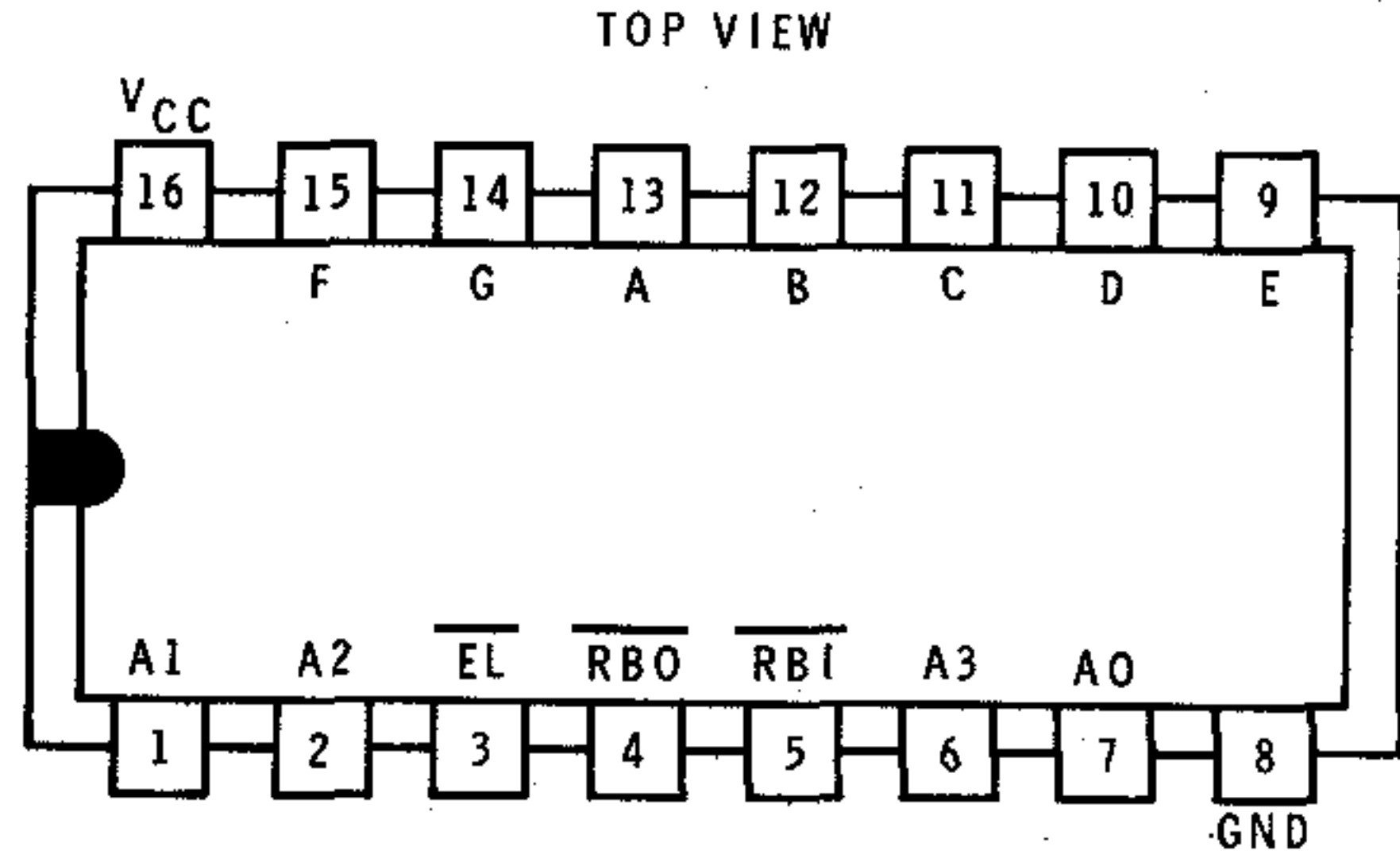
QUADRUPLE 2-INPUT
POSITIVE-NAND GATES IC14
#443-1 IC17
SN7400N IC26



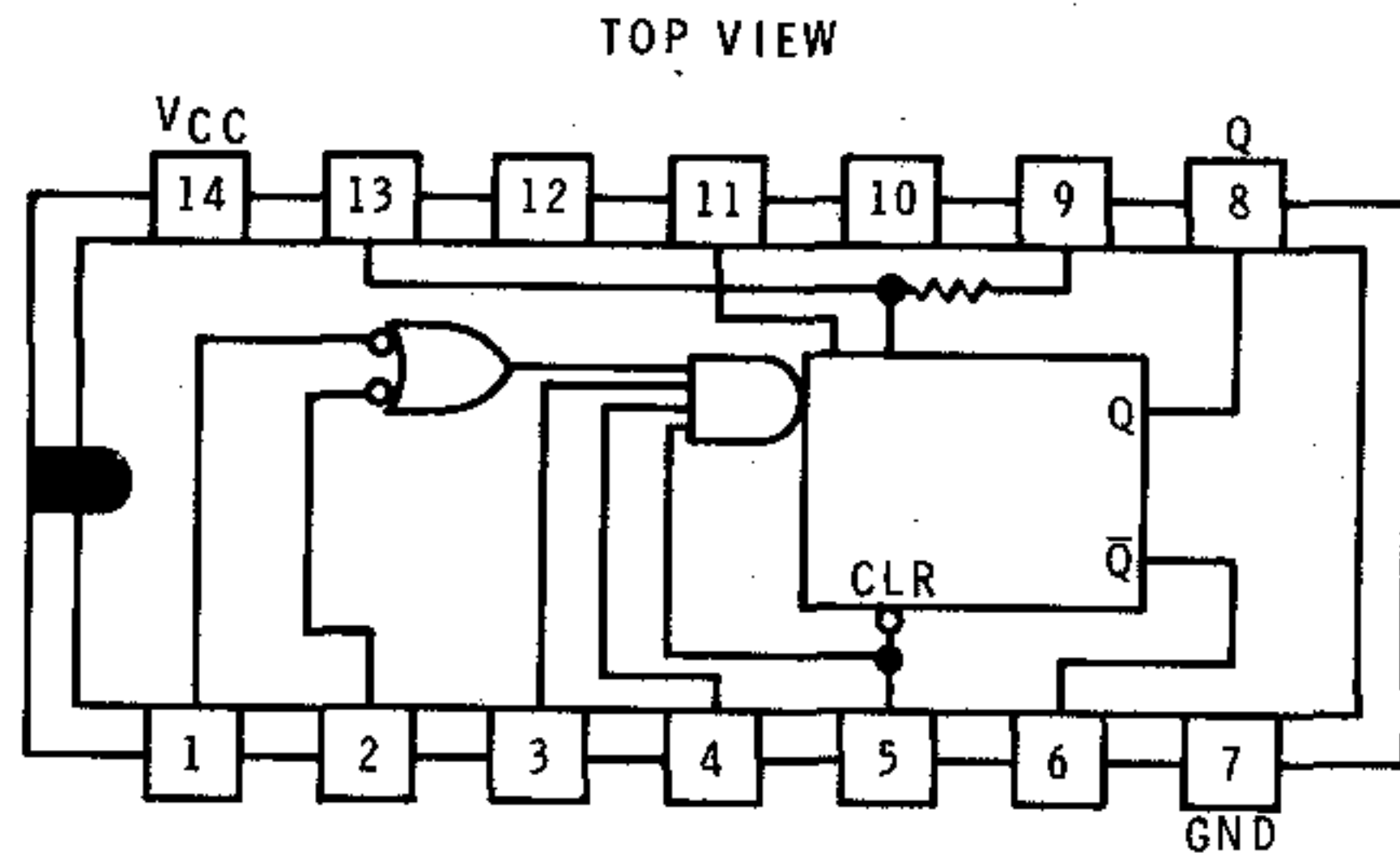
QUADRUPLE 2-INPUT
 POSITIVE-NAND
 SCHMITT TRIGGERS IC18
 #443-625
 SN74132N



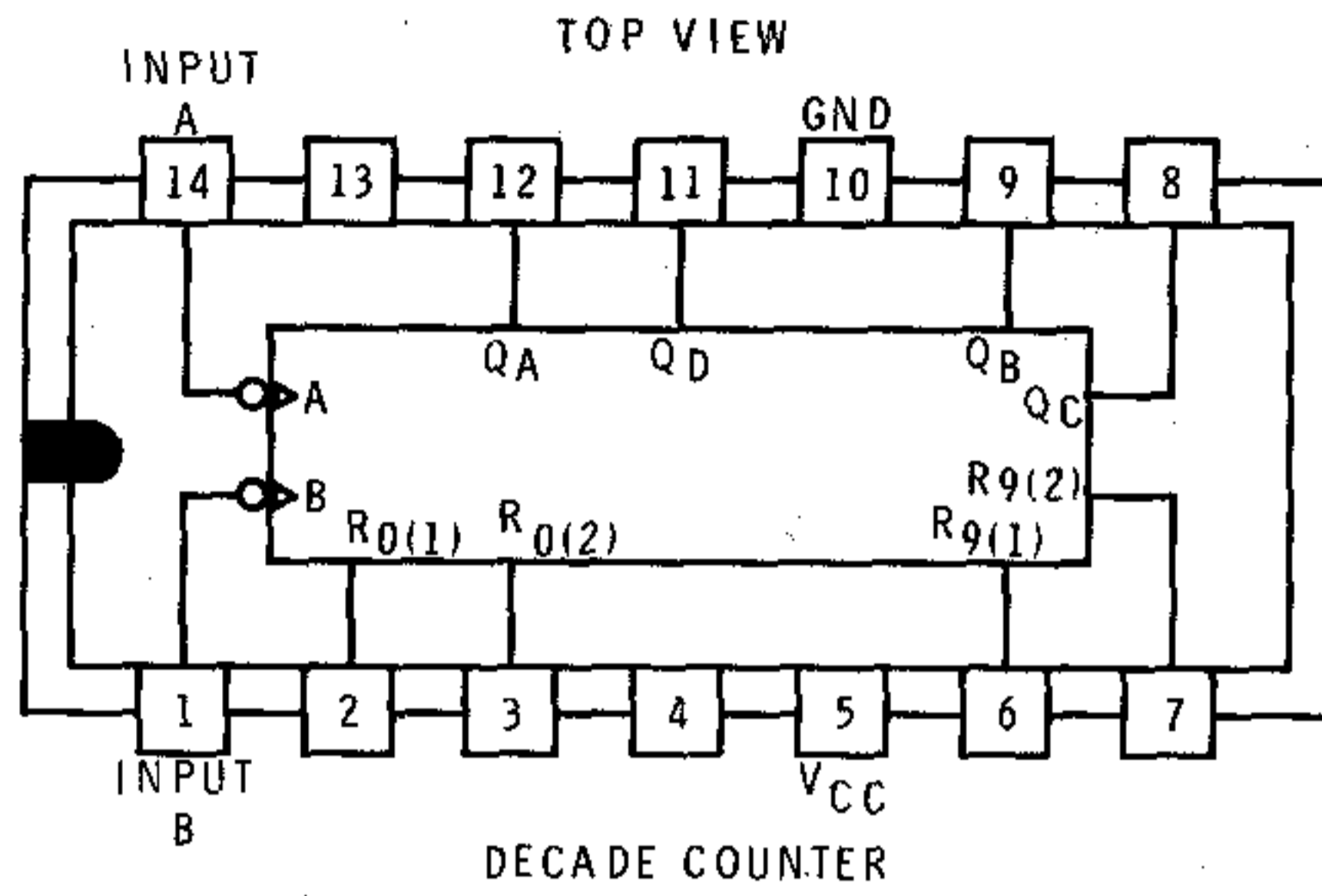
DUAL J-K FLIP-FLOP IC13
 #443-16
 SN7476N



7-SEGMENT
DECODER DRIVER IC8
#443-694 IC9
9368 IC10
 IC11
 IC12

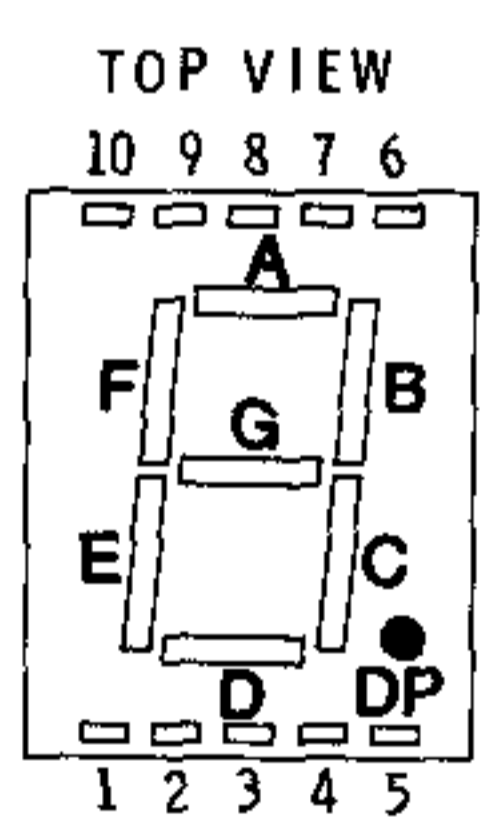


RETRIGGERABLE MONOSTABLE
MULTIVIBRATOR WITH CLEAR IC16
#443-23
SN74122N



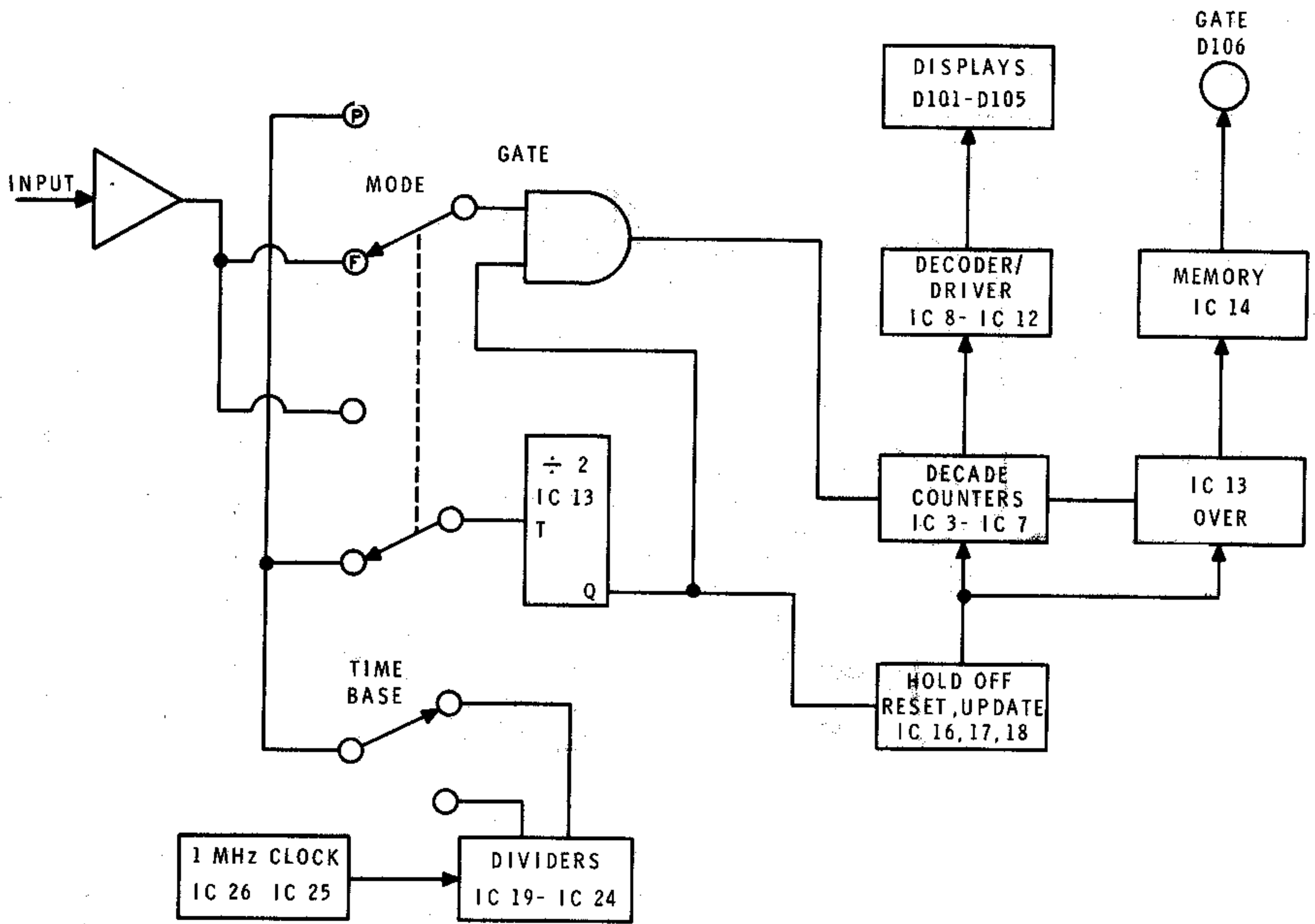
IC5	IC19	IC3
IC6	IC20	
IC7	IC21	
	IC22	
	IC23	
	IC24	
	IC25	

DISPLAY



- PIN
- 1..... Segment E
 - 2..... Segment D
 - 3..... Common Cathode
 - 4..... Segment C
 - 5..... DP
 - 6..... Segment B
 - 7..... Segment A
 - 8..... Common Cathode
 - 9..... Segment F
 - 10.... Segment G

#411-819
FND500



BLOCK DIAGRAM

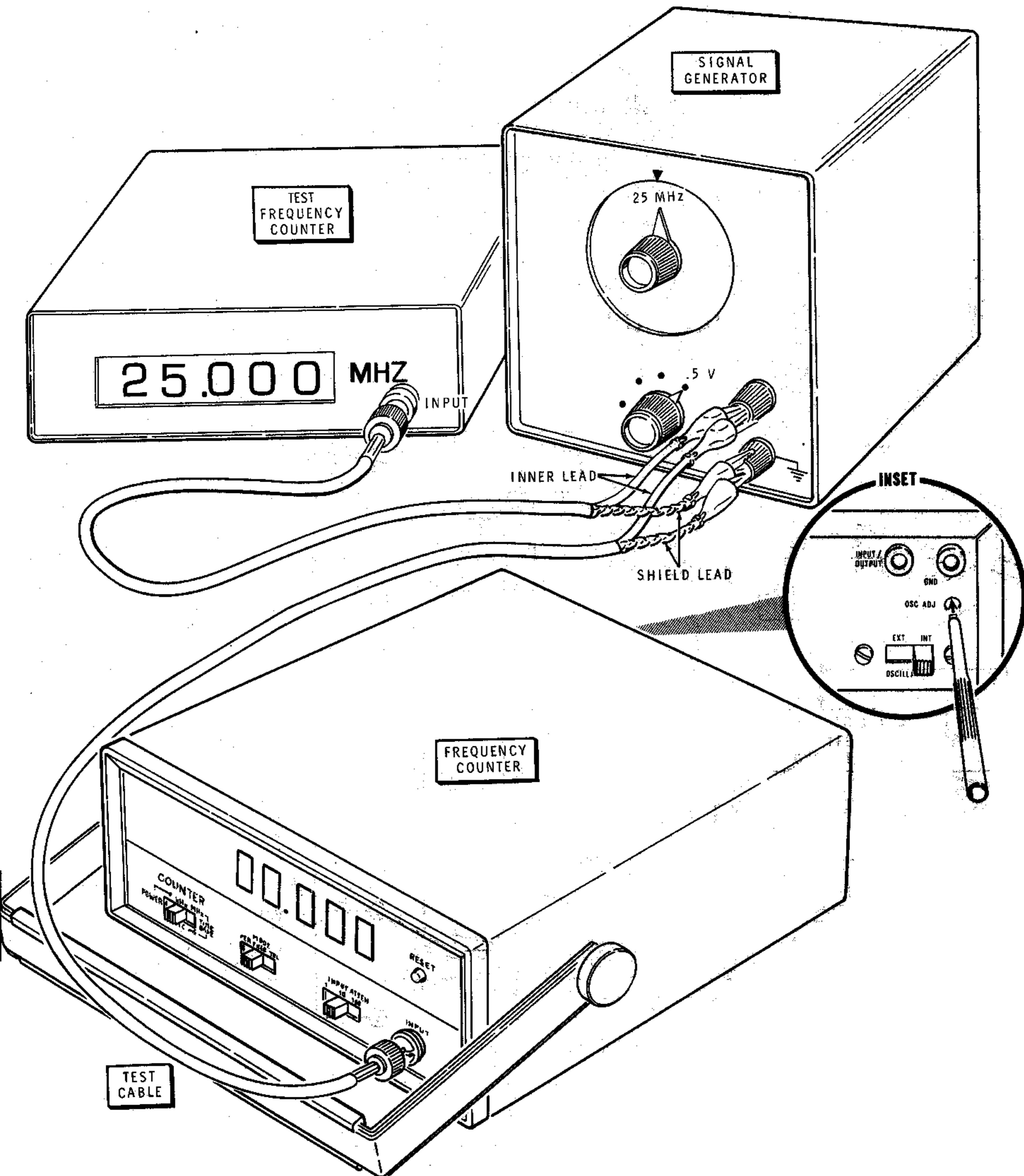


Figure 5

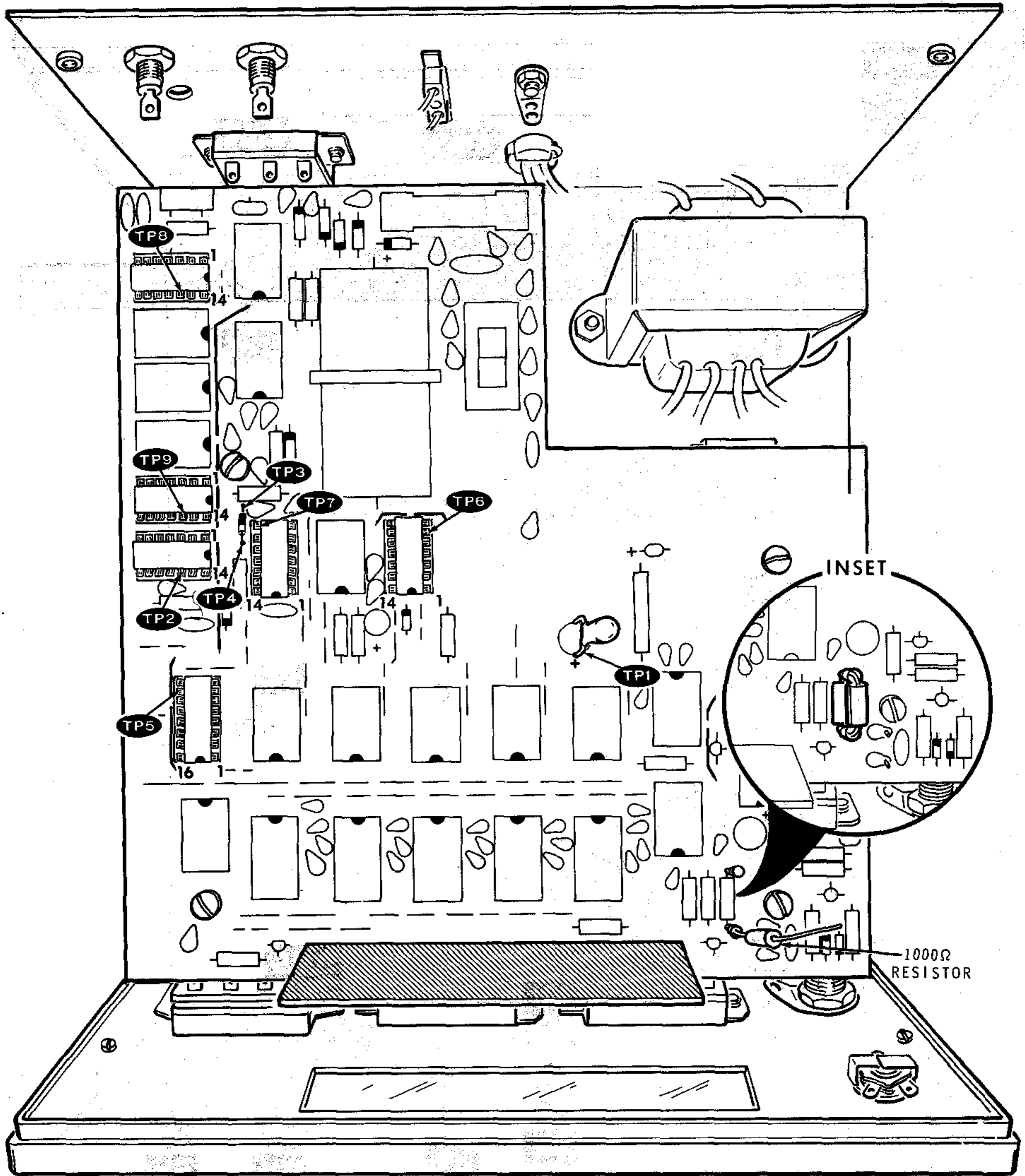
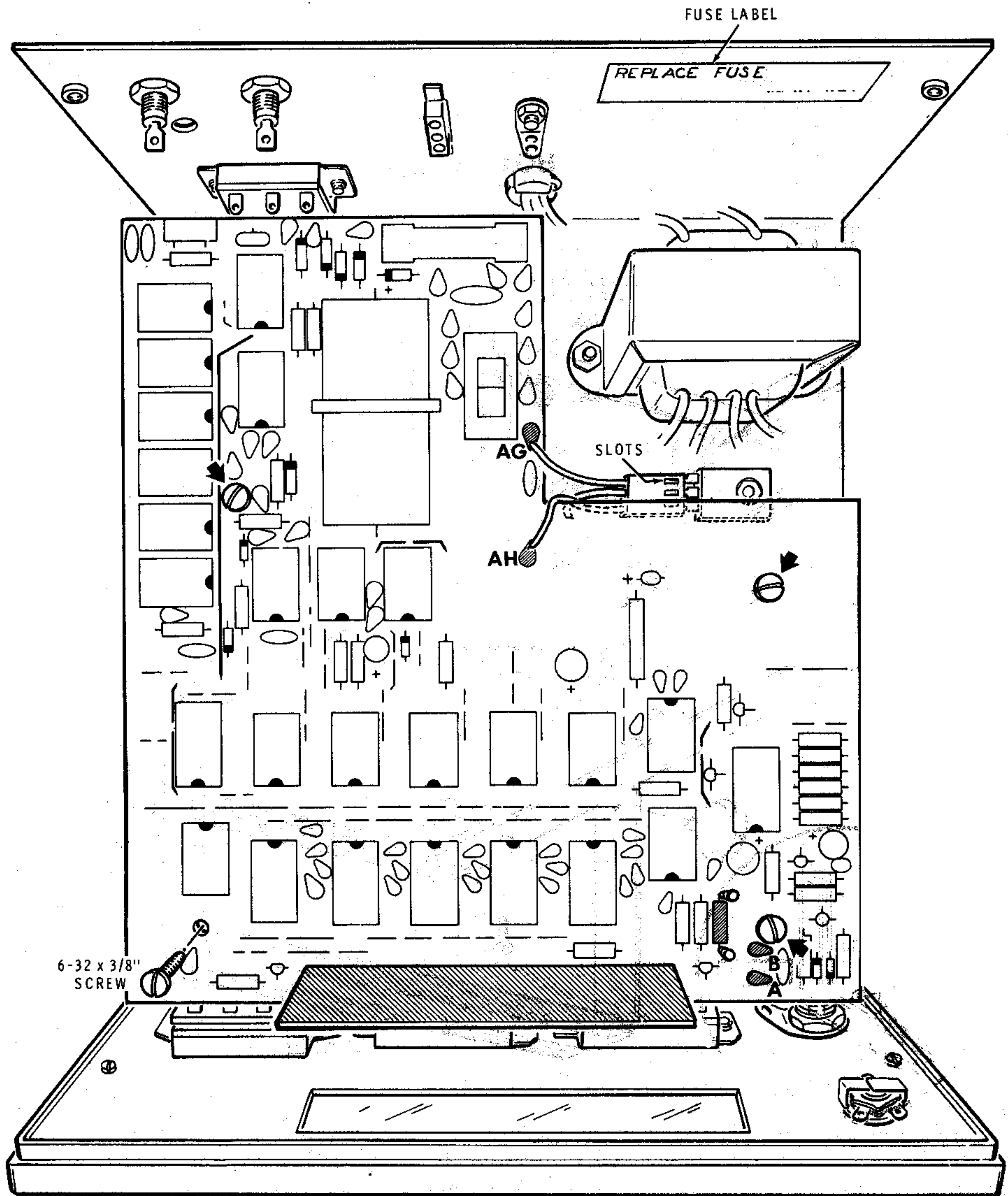


Figure 2

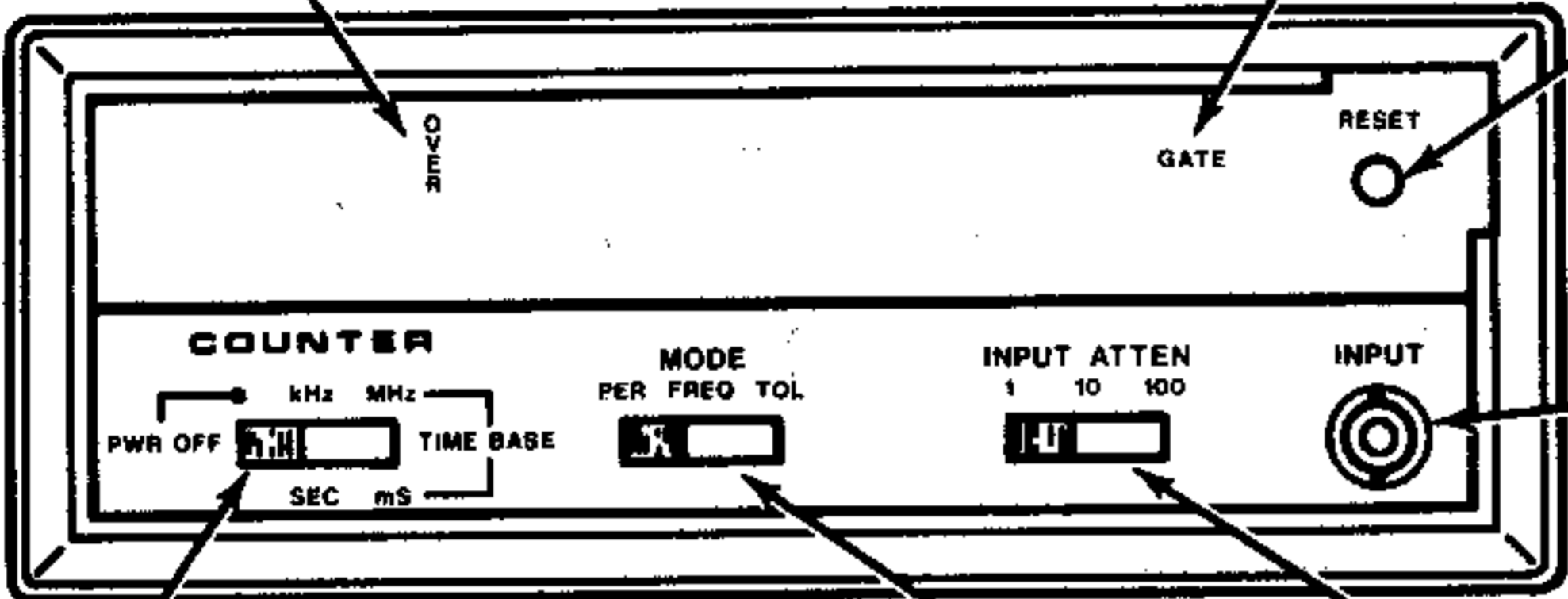


PICTORIAL 4-7

OVERRANGE indicator: Indicates when the number to be displayed is larger than the display can handle.

GATE lamp (D106): Flashes off and back on when the display is updated.

RESET switch (SW5): Resets the display to zero in any mode.



INPUT CONNECTOR

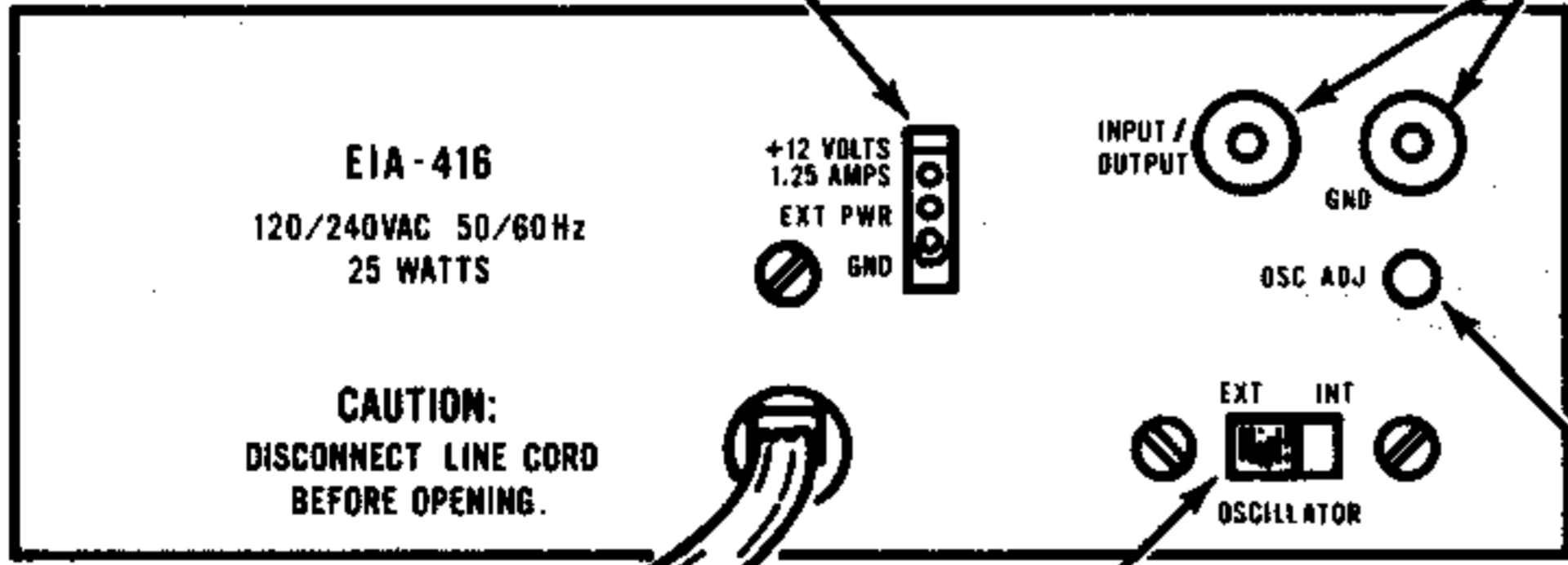
INPUT ATTEN switch (SW4): Divides the amplitude of the incoming signal by 1, 10, or 100.

POWER/TIME BASE switch (SW2): Turns the unit on and off, selects between kHz and MHz in the FREQ MODE, and selects between SEC and mS in the PER (period) MODE.

MODE switch (SW3): Selects the operating mode of the Counter — PER (period), FREQ (frequency), or TOL (totalize). TOL is an events count mode and can be gated by using the rear panel INPUT/OUTPUT jack and putting the EXT/INT switch in the EXT position.

EXT PWR connector: Accepts external DC power connector.

INPUT/OUTPUT connectors: Use as an input for an external time base signal, or as an output for the internal time base signal. You can also apply an inhibit signal to gate the totalize mode.



OSCILLATOR EXT INT switch: Selects either the internal time base or an external time base signal.

OSC ADJ capacitor (C7): Calibrates the time base frequency.

Figure 6

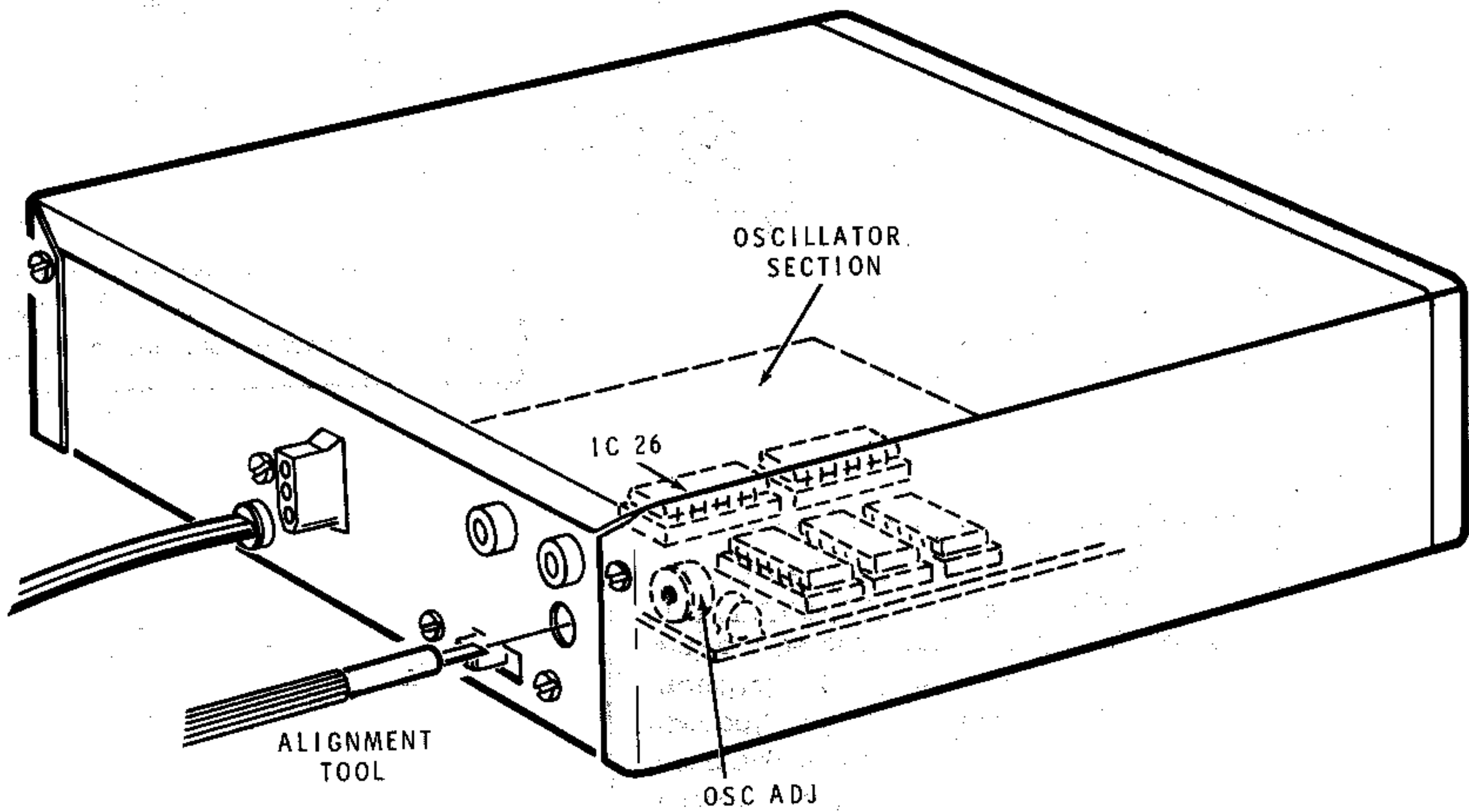
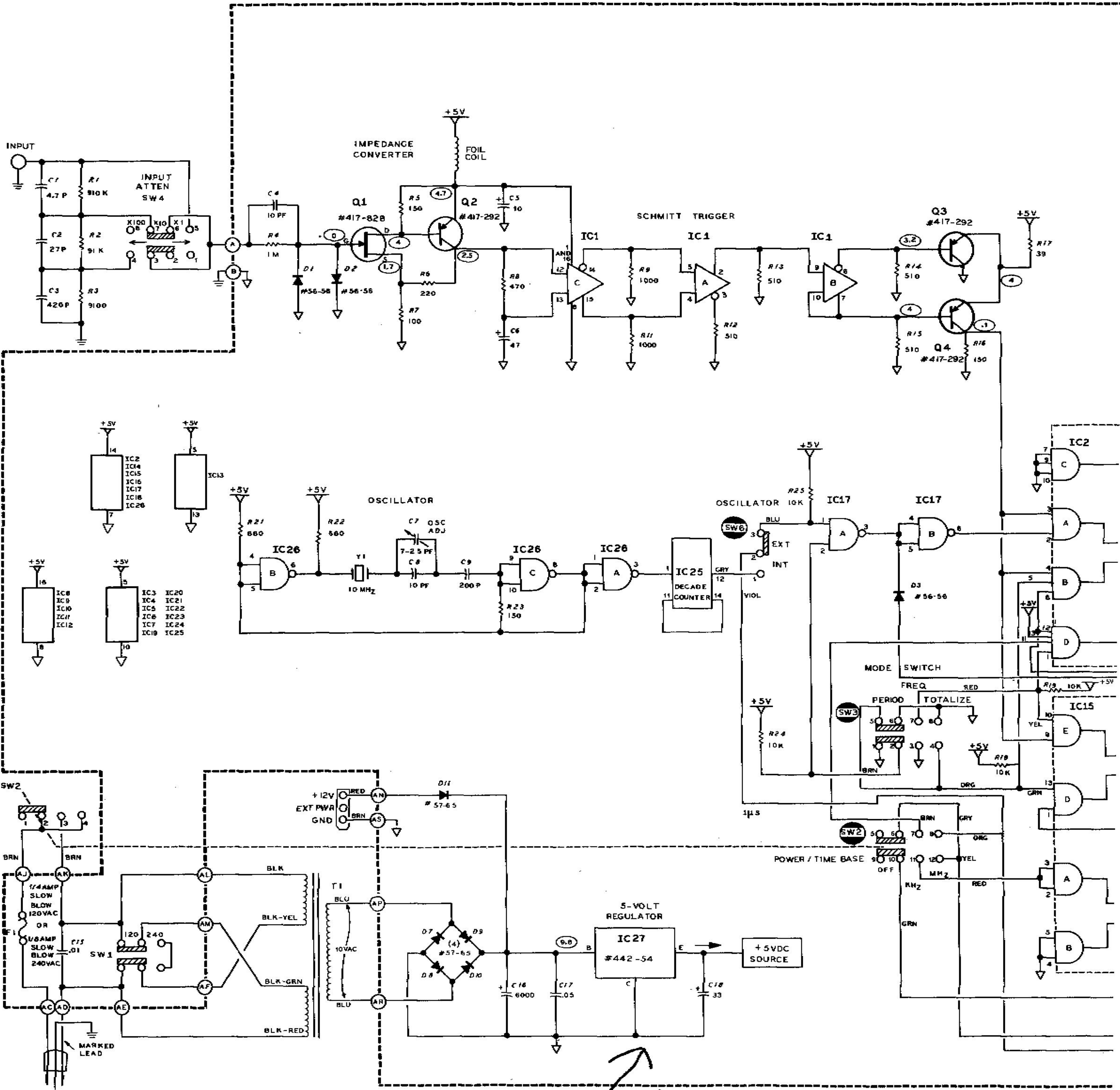


Figure 4



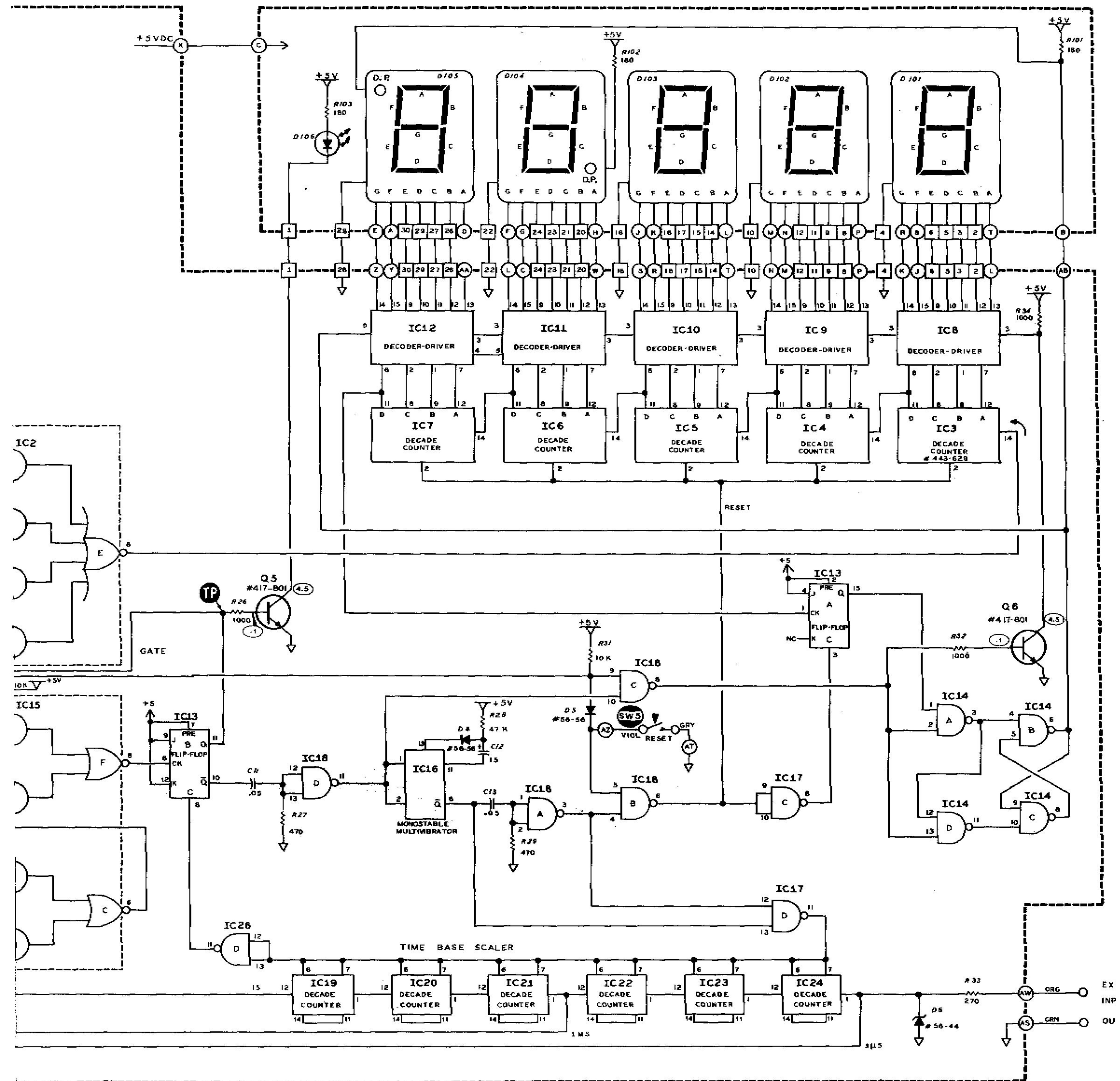
See attached page

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**SCHEMATIC OF THE
HEATH
MODEL IM-4100/SM-4100
FREQUENCY COUNTER**

**SCHEMATIC OF
MOTOROLA
MODEL S-1357A
FREQUENCY COUNTER**

- NOTES:
1. COMPO
 2. ALL RE
 3. ALL RE
 4. ALL CA NOTED.



S:

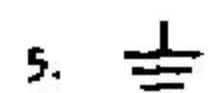



COMPONENT NUMBERS ARE IN THE FOLLOWING GROUPS:

- 1 - 99 PARTS MOUNTED ON THE CHASSIS AND MAIN CIRCUIT BOARD.
- 101 - 199 PARTS MOUNTED ON THE DISPLAY CIRCUIT BOARD.

ALL RESISTOR VALUES ARE IN OHMS: K-1,000; M-1,000,000.

ALL RESISTORS ARE 1/2 WATT, 5%.

ALL CAPACITOR VALUES ARE IN μF UNLESS OTHERWISE NOTED.

- 5.  THIS SYMBOL INDICATES CHASSIS GROUND.
- 6.  THIS SYMBOL INDICATES CIRCUIT BOARD GROUND.
- 7.  THIS SYMBOL INDICATES A PART MOUNTED ON THE CHASSIS BUT SHOWN ON THE CIRCUIT BOARD.
- 8.  THIS SYMBOL INDICATES A DC VOLTAGE TAKEN WITH A HIGH INPUT IMPEDANCE VOLTMETER BETWEEN THE POINT INDICATED AND GROUND WITH NO INPUT SIGNAL. VOLTAGES MAY VARY $\pm 20\%$.

June 1, 1976

IMPORTANT NOTICE

Please make the following changes in your Assembly Manual before you begin to assemble your kit.

Page 4 – Under "Tantalum."

Change:	A3 ()	1	10 μ F	25-220	C5
To:	A3 ()	<u>3</u>	10 μ F	25-220	C5, <u>C21, C22</u>

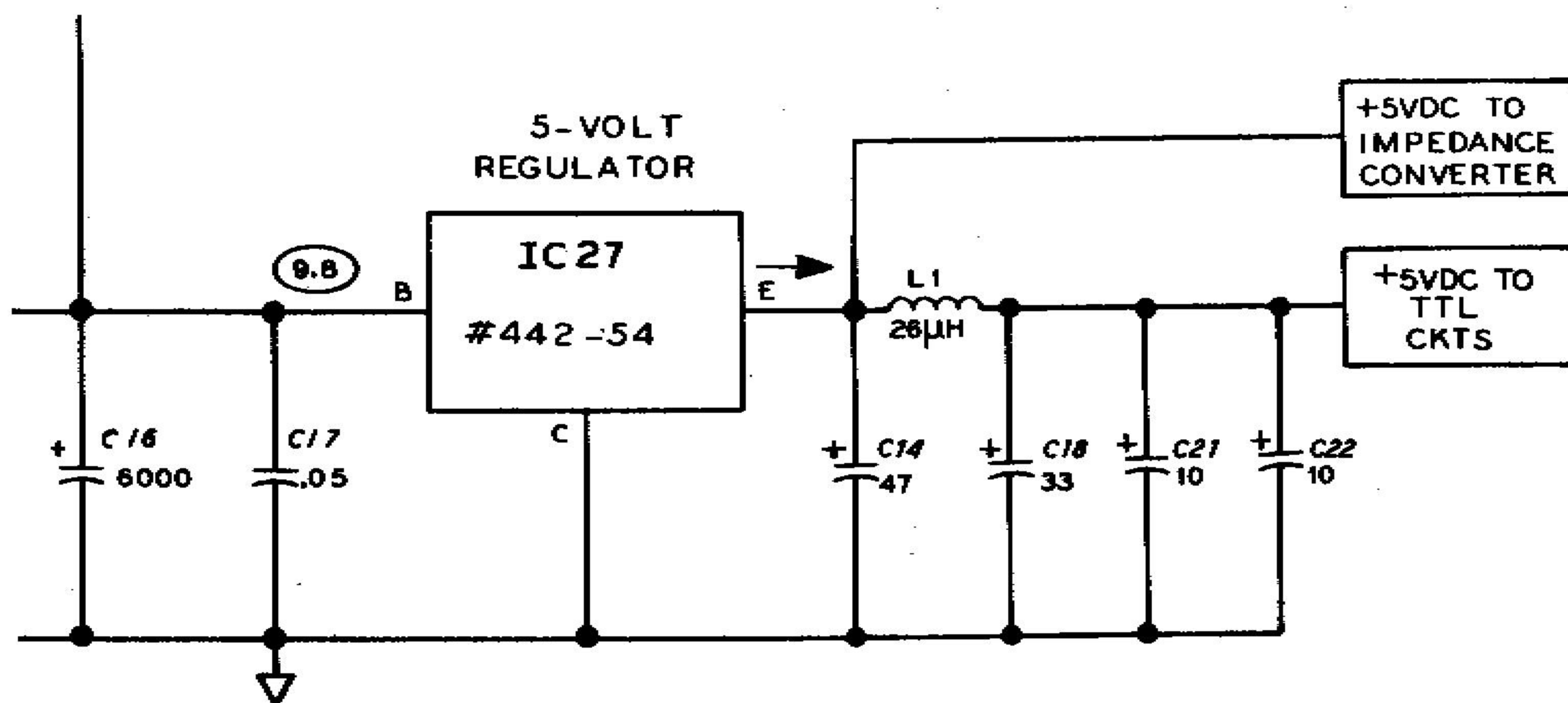
Page 24 – Remove Page 25A from this Notice and place it between Pages 24 and 25. Install the parts on this Page after you have completed Page 25 in your Manual.

Page 52 – Remove Page 52 from this Notice and tape it over Page 52 in your Manual.

Schematic Diagram – Correct the lower center section of your Schematic Diagram as shown in the Schematic Correction Diagram.

Thank you,

HEATH COMPANY

**SCHEMATIC CORRECTION DIAGRAM**