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## INTRODUCTION

The Elenco model F-100 is a 100MHz multiple-function counter that features a temperature control crystal oven for high accuracy readings. Other features include eight high brightness seven segment LED display, low power consumption circuit design and full input signal conditioning. The F-100 is also small in size and light weight for easy portability.

The model F-100 has four functions in one. It is a 100MHz frequency counter with drift of less than  $\frac{1}{3}$  Hz per million Hz per month. This accuracy is achieved because of the temperature control crystal oven. It also has a self-test function which will allow checking the output for proper operation. The third function is a period measurement which allows you to measure time interval between pulses. The fourth function is a totalizer counter which allows you to count pulses. All these functions are accomplished by a single LSI integrated circuit. The input signal is AC or DC coupled and can be conditioned by trigger level and attenuation of the signal.

The location of control, indicators, connectors and other information on this model is provided in this manual. It is recommended that you should read and understand all information in this manual before attempting to operate this instrument.

## SPECIFICATIONS:

### MEASURING MODE

#### FREQUENCY MEASUREMENTS

- Range:* 10Hz to 10MHz direct counter, 10MHz to 100MHz prescaled by 10.
- Resolution: Direct Counter:* 0.1, 1, 10, 100Hz switch selectable.  
*Prescaled:* 1, 10, 100, 1000Hz switch selectable.
- Gate Time:* 0.01S, 0.1S, 1S, 10S switch selectable.
- Accuracy:*  $\pm 1$  count  $\pm$  time base error.

#### PERIOD MEASUREMENTS

- Range:* .1sec. to .4 microsecond
- Resolution:* 100nS/N, N = 1,10,100,1000 switch selectable.
- Accuracy:*  $\pm 1$  count  $\pm$  time base error.

#### TOTALIZE MEASUREMENTS

- Range:* 10Hz to 10MHz.
- Resolution:*  $\pm 1$  count of input.

### INPUT CHARACTERISTICS

- Input Sensitivity:* 25mV RMS sine wave or 70mV p-p.
- Attenuation:*  $\times 1$ ,  $\times 20$  fixed.
- Trigger Level:* Continuously variable  $\pm 350$ mV times attenuator setting around average value of signal.
- Impedance:* Approx. 1M ohm less then 35pF.
- Maximum Voltage:* 250V (DC + AC rms). Exceeding this limit is not recommended.

### TIME BASE

- Frequency:* 10MHz Temperature Control Oven.
- Aging Rate:*  $\pm 3 \times 10^{-7}$ /month.
- Temperature:*  $\pm 1 \times 10^{-6}$ , 0°C to 40°C.
- Line Voltage:*  $\pm 1 \times 10^{-7}$  for 10% change.
- Warm-Up Time:* 20 minutes when cold started at 25°C.

### GENERAL

- Display:* 8 digits, 7mm red LED display with decimal point, overflow, KHz, MHz and uS indication.
- Check:* Counts internal 10MHz time base oscillator.
- Power Requirements: Line:* 115/230V  $\pm 15\%$ , 45Hz-70Hz.  
*Internal Battery:* Option.
- Temperature: Rated range of use:* - 5°C - + 50°C.

## OPERATION

### INTRODUCTION

This section provides complete operating information needed for the model F-100 multi-function counter. This includes a description of all front panel controls, connectors and indicators, operating instructions and operators maintenance.

### PREPARATION FOR USE

#### 1 Power Requirements

The F-100 requires a power source of 120 or 230VAC, 45 to 70Hz single phase. Power consumption is only 10 watts maximum.

#### 2 Line Voltage Selection

Line voltage selection is determined by the position of the line voltage selector switch located on the rear panel. Line voltage is preset at the factory for 120V (100-130V) and can be repositioned for 230V (180 to 250V) as required.

3 Wait about 20 minutes for more accurate measurement until the crystal oven oscillator gets stabilized in temperature.

### FRONT PANEL FEATURES

Figure 1 shows the front panel of the F-100.

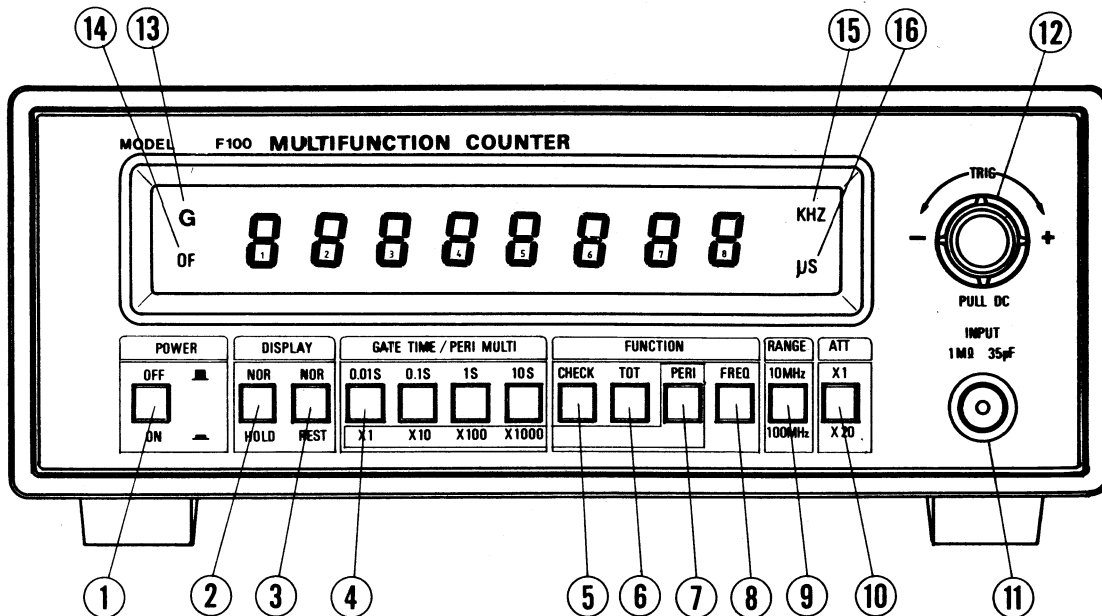


Figure 1

#### 1. POWER SWITCH

To turn on, depress push button. To turn off, depress push button.

#### 2. HOLD

In hold, switch IN, the measurement (except for totalize) in progress is stopped.

#### 3. RESET

When pressed, immediately resets the counter to begin a new measurement. Usually used in the totalize mode to begin a new measurement.

#### 4. GATE TIME/PERIOD MULTIPLIER

For frequency measurement, this switch is used to change the gate time. When in the period measurement mode, it is used to change the multiplier factors. Each range is as follows;

GATE TIME	10MHz RANGE	100MHz RANGE
0.01S	100Hz Resolution	1KHz Resolution
0.1S	10Hz Resolution	100Hz Resolution
1S	1Hz Resolution	10Hz Resolution
10S	0.1Hz Resolution	1Hz Resolution
PERIOD MULT	RESOLUTION	
× 1	10 <sup>-7</sup> Second	
× 10	10 <sup>-8</sup> Second	
× 100	10 <sup>-9</sup> Second	
× 1000	10 <sup>-10</sup> Second	

#### 5. CHECK

When pressed, counts the internal 10MHz time base oscillator.

#### 6. TOT

Use for totalizer measurement.

#### 7. PERI

With this switch in, the F-100 is placed in the period mode.

#### 8. FREQ

With this switch in, the F-100 is placed in frequency mode.

#### 9. FREQUENCY RANGE

Selector for 10MHz or 100MHz range.

#### 10. ATT

Input signal attenuator switch. When pressed the input signal is attenuated by a factor of 20.

#### 11. INPUT

BNC connector for the signal input.

#### 12. TRIG.

Trigger level control used in conjunction with the ATT switch to select the relative voltage at which triggering occurs.

#### 13. GATE INDICATOR

Displays the opened or closed state of the GATE. When GATE is open, indicator is lit.

#### 14. OVERFLOW INDICATOR

#### 15. KHz ANNUNCIATOR

#### 16. μS ANNUNCIATOR

### REAR VIEW

Figure 2 shows the rear panel of the F-100.

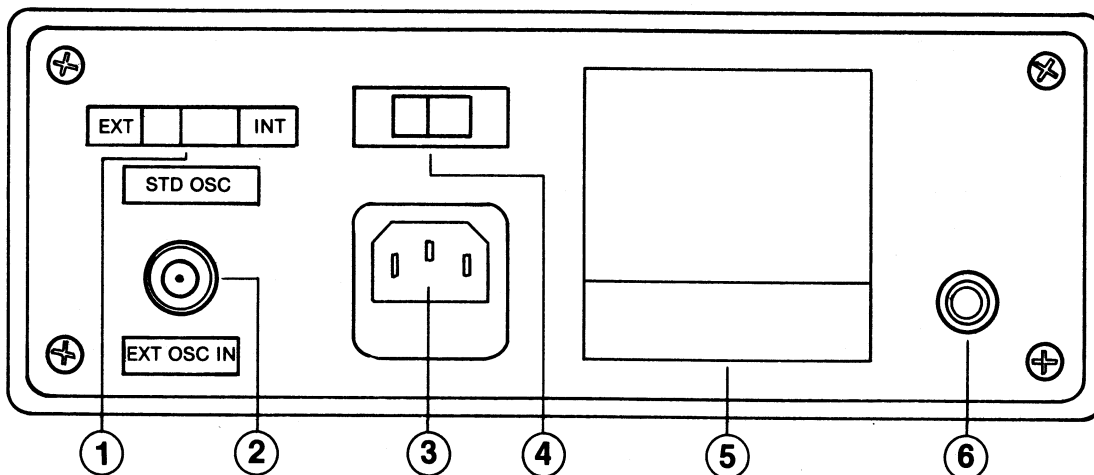


Figure 2

1. Standard oscillator selector switch
2. External oscillator input connector
3. AC Inlet for power connecting
4. Selecting switch for AC 115V/230V
5. Engraved caution
6. Ground terminal

## OPERATING CHARACTERISTICS

The following paragraphs describe the operating ranges and resolution for frequency, period, totalize and check function.

### Frequency Measurements

Perform frequency measurements as follows:

1. Press the POWER switch to the ON position.
2. Press the FREQUENCY function switch to select the frequency mode of operation.
3. Select the desired gate time.
4. Connect the input signal to the front panel BNC connector.
5. Set ATT and TRIG to desired position. If input signal level is greater than 300mV, depressing the ATT switch will decrease the trigger sensitivity of the input section by 20 times and reduce possible noise errors.
6. Read the frequency on display and observe the unit of measurement indication to the right of the display.

### Period Measurements

Perform period measurements as follows:

1. Press the POWER switch to the ON position.
2. Press the PERIOD function switch to select the period mode of operation.
3. Select the desired PERIOD MULTI  $\times 1$ ,  $\times 10$ ,  $\times 100$  or  $\times 1000$ .
4. Connect the input signal, to the front panel BNC connector.
5. Set ATT and TRIG to desired position. If input signal level is greater than 300mV, depressing the ATT switch will decrease the triggering sensitivity of the input section by 20 times and reduce possible noise errors.
6. Read the period time on display and observe the unit of measurement indication to the right of the display.

### Totalize Measurements

Perform totalize measurements as follows:

1. Press the POWER switch to the ON position.
2. Press the TOTAL function switch to select the totalize mode of operation and the RESET switch to initialize the counter.
3. Connect the input signal to the front panel BNC connector.
4. Set ATT and TRIG to desired position. If input signal level is greater than 300mV, depressing the ATT switch will decrease the triggering sensitivity of the input section by 20 times and reduce possible noise errors.
5. Read the accumulated total on display.
6. To freeze the accumulated total, press the HOLD switch in.

### Check Mode

The self check mode provides a means of verifying proper overall operation of the counter.

1. Press the POWER switch to the ON position.
2. Press the CHECK switch to select the self check mode.
3. Press the 10S GATE TIME selector; the display should read 10000.0000, with the instrument gating once every 10 second. The (1) is assumed (not visible).
4. Press the 1S GATE TIME selector; the display should read 10000.000, with the instrument gating once every second.
5. Press the 0.1S GATE TIME selector; the display should read 10000.00, with a 100 millisecond gate time.
6. Press the 0.01S GATE TIME selector; the display should read 10000.0, with a 10 millisecond gate time.

## **CALIBRATION INTRODUCTION**

Calibration of the model F-100 multi-function counter is limited to adjustment of the time base oscillator frequency. You will need a accurate 10MHz crystal oscillator of known frequency to perform this test. If one is not available, you will need another accurate counter to perform this test. If neither is available send the unit to Elenco service department for calibration.

The time base oscillator adjustment should be made whenever the oscillator is repaired or whenever it is determined that accuracy of the counter is not within the desired accuracy. Perform the time base oscillator adjustment in an environment having an ambient temperature of + 22° C to + 25° C (72° F to 77° F). Allow the instrument to warm up at least 30 minutes with the case on before adjusting the time base.

### **WARNING**

**Maintenance described herein is performed with power supplied to the instrument and protective covers removed. Such maintenance should be performed only by service trained personnel who are aware of the hazard of electrical shock.**

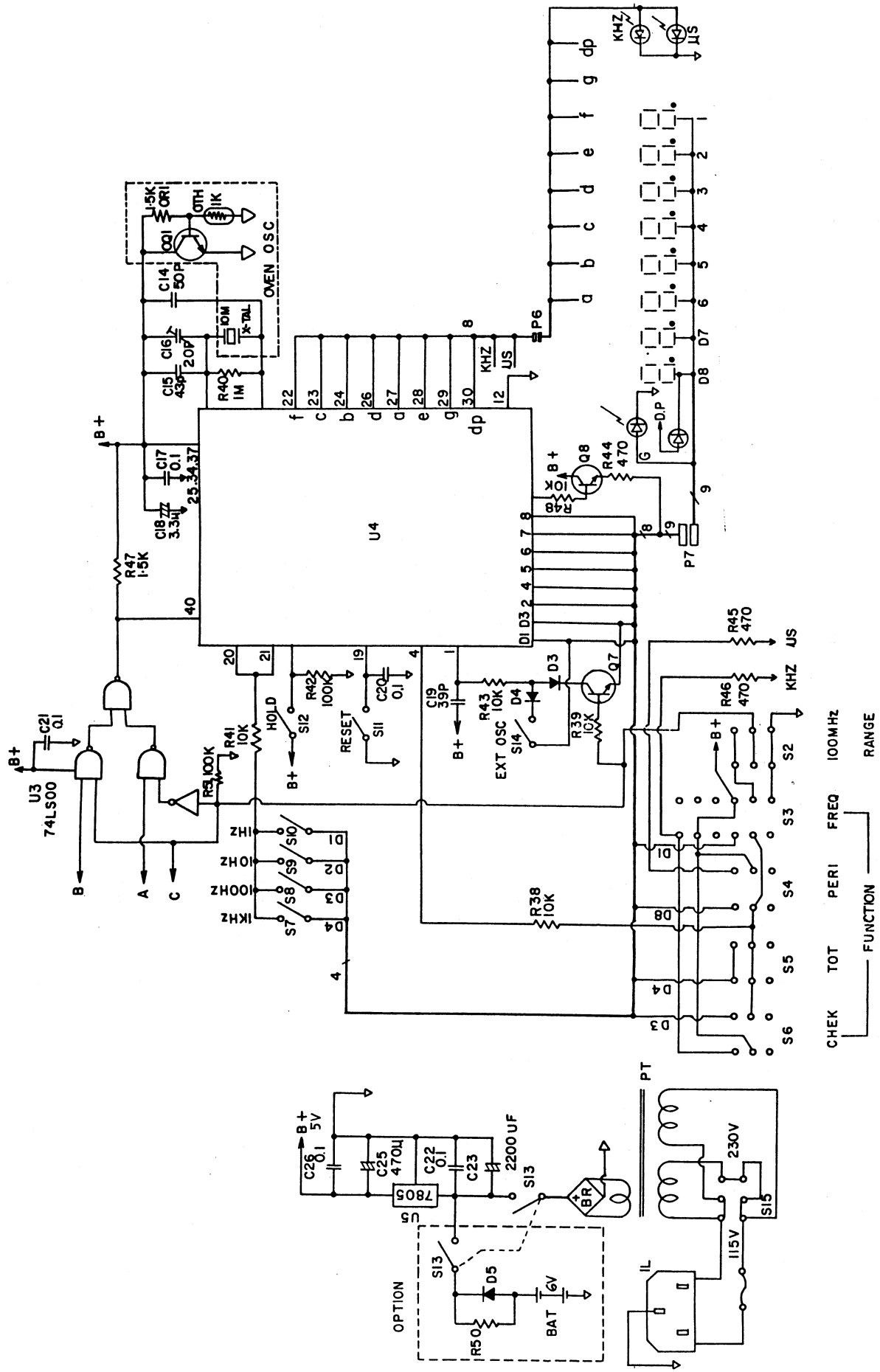
## **TIME BASE RADIO FREQUENCY ADJUSTMENT**

1. Be sure the AC plug is removed from power.
2. Remove the cover from the case.
3. Select a 10MHz standard frequency oscillator. Connect the 10MHz signal to the counter input. If you do not have a frequency standard available or a very accurate frequency counter, do not attempt to calibrate the unit. Send it to Elenco service department for calibration.
4. Set the F-100 front panel controls as follows:

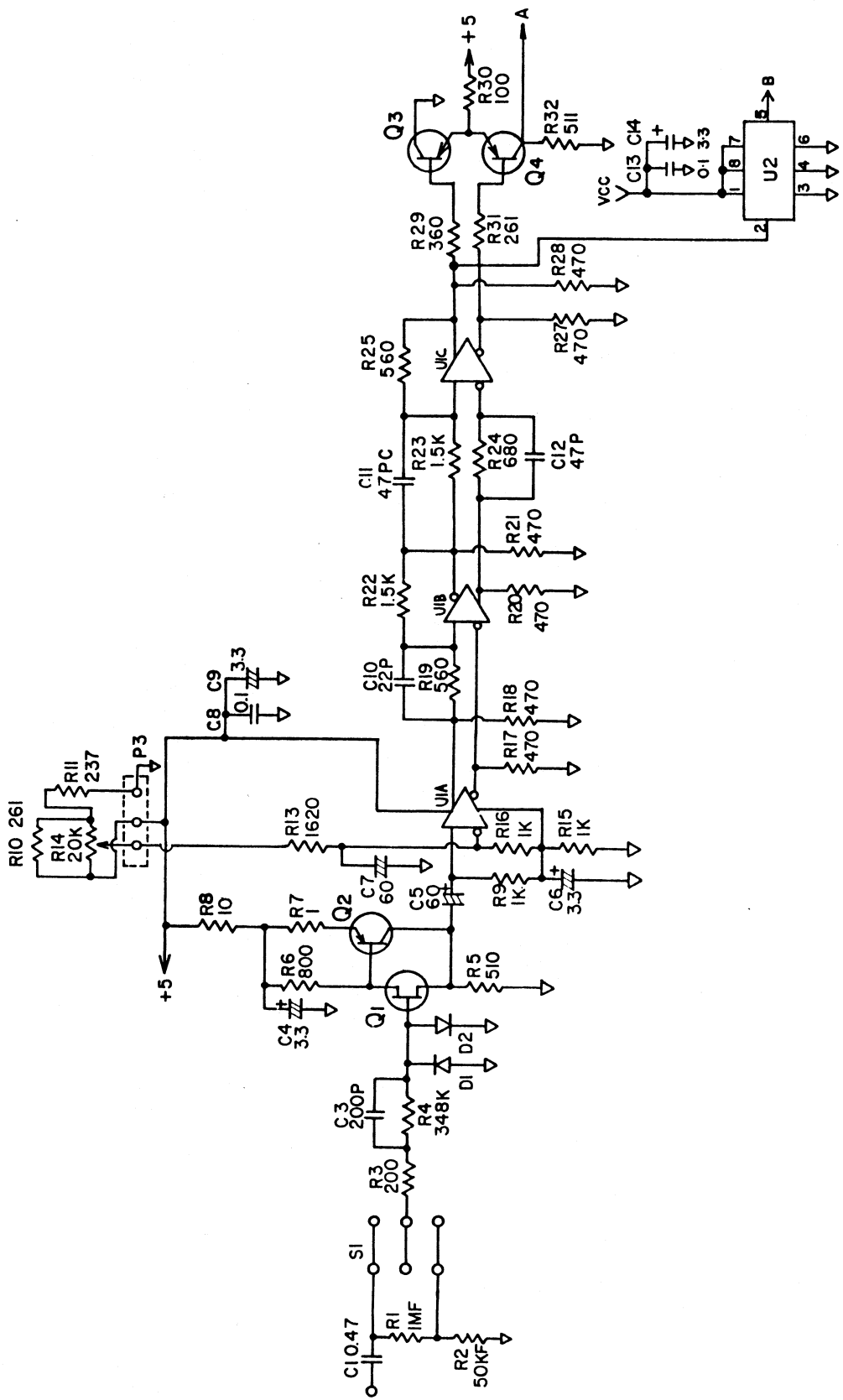
POWER \_\_\_\_\_ ON  
NOR/HOLD \_\_\_\_\_ NOR  
GATE TIME \_\_\_\_\_ 1S  
FUNCTION \_\_\_\_\_ FREQ  
RANGE \_\_\_\_\_ 10MHz  
ATT \_\_\_\_\_ x 1  
TRIG \_\_\_\_\_ CENTER POSITION

The approximate input frequency should be in the display with an update once a second.

5. While observing the counter display, adjust the time base oscillator control (C16 located on the PCB) to obtain a reading of 10000.000 ± 1 digit.



ELENCO F-100 POWER SUPPLY & DISPLAY CIRCUIT



ELESCO F-100 INPUT AMPLIFIER & PRE SCALER

# PARTS LIST

## SEMICONDUCTORS

SYMBOL	DESCRIPTION	PART NO.
Q3,4	Transistor, PNP. BC328	1001-00BC328
Q2	Transistor, PNP. BF509	1001-00BF509
Q7,8	Transistor, NPN. 2N2222	1002-02N2222
Q1	Transistor, NPN. TIP31C	1003-0BF256A
D3,4	Diode, 1N4148	1101-01N4148
D1,2	Diode, SW. 1N4152R	1101-1N4152R
BR	Diode, Bridge Rectifier W02	1105-0000W02
U4	IC, M7226B	1201-007226B
U3	IC, 74LS00	1203-074LS00
U2	IC, uPB551C	1204-uPB51C
U1	IC, MC10216P	1204-010216P
U5	IC, MC7805T	1205-007805T

## RESISTORS

OTH1	Thermistor, 1K TD5-C225D	1902-05C225D
R7	Resistor, 1 OHM 1/4 W	2001-001R0JB
R8	Resistor, 10 OHM 1/4 W	2001-010R0JB
R30	Resistor, 100 OHM 1/4 W	2001-00101JB
R9,15,16	Resistor, 1K OHM 1/4 W	2001-00102JB
R39,R41,R43,R48	Resistor, 10K OHM 1/4 W	2001-00103JB
R42,51	Resistor, 100K OHM 1/4 W	2001-00104JB
R40	Resistor, 1M OHM 1/4 W	2001-00105JB
R22,23,47,0R1	Resistor, 1.5K OHM 1/4 W	2001-00152JB
R3	Resistor, 200 OHM 1/4 W	2001-00201JB
R31	Resistor, 260 OHM 1/4 W	2001-00261JB
R29	Resistor, 360 OHM 1/4 W	2001-00361JB
R17,18,20,21,27,28	Resistor, 470 OHM 1/4 W	2001-00471JB
R5,32	Resistor, 510 OHM 1/4 W	2001-00511JB
R19,25	Resistor, 560 OHM 1/4 W	2001-00561JB
R24	Resistor, 680 OHM 1/4 W	2001-00681JB
R6	Resistor, 800 OHM 1/4 W	2001-00801JB
R1	Resistor, 1M OHM 1/2 W	2002-00105FC
R2	Resistor, 50K OHM 1/4 W	2002-00503FB
R4	Resistor, 348K OHM 1/2 W	2002-0348KFC
R13	Resistor, 1620 OHM 1/4 W	2002-1620RFB
R11	Resistor, 237 OHM 1/4 W	2002-237ROFB
R10	Resistor, 261 OHM 1/4 W	2002-261ROFB
R14	Resistor Variable, 20K	2008-000203B

## CAPACITORS

C3	Capacitor, Ceramic 200pf 100V	3000-000201D
C1	Capacitor, Ceramic 0.47uf 400V	3000-000474F
C10	Capacitor, Ceramic 22pf 50V	3000-0022ROC
C19	Capacitor, Ceramic 39pf 50V	3000-0039ROC
C11,12	Capacitor, Ceramic 47pf 50V	3000-0047ROC
C23	Capacitor, Electrolytic 2200uf 25V	3002-000228A
C4,6,9,14,18	Capacitor, Electrolytic 3.3uf 50V	3002-000335C
C25	Capacitor, Electrolytic 470uf 25V	3002-000477A
C7	Capacitor, Electrolytic 60uf 25V	3002-000606A
C5	Capacitor, Tantalum 60uf 25V	3003-000606A
C8,13,17,20,21,22,26	Capacitor, Met. Poly. MKS2	3004-000104C
C16	Capacitor, Trimmer 10pf	3007-00010R0
C15	Capacitor, Mica. 43pf 50V	3008-0043ROC
C14	Capacitor, Mica. 50pf 50V	3008-0050ROC

## MISCELLANEOUS

X-TAL	Crystal, 10MHz 20PPM	3500-0000106
PT	Transformer, Power	4001-000F100
LD1-LD8	LED Display, 7mm, D200PK	5001-0D200PK
L1,2,3,4	LED, Red CQY85N	5003-0CQY85N
S15	Voltage Selector SW, Sx2-40	6001-0000001
S14	Switch, Slide 3P2	6001-0000002
S1-S11	Switch Set	6002-0000011
J1,2	Connector, BNC	6503-0000001
J3	Binding Post, Metal	6504-0000001
2	Fuse, 250V 1A	7002-00F100C
1	Knob	9000-0101604
13	Push Switch with Knob	9000-6000216
1	Filter, Acryle (red)	9000-6000217

## **WARRANTY POLICY**

This instrument has been tested and conforms to our rigid requirements on performance and durability. It is guaranteed to be free of defects in workmanship, materials and construction for a period of 5 years. If this product should fail in normal use within the first 3 months from the date of purchase, Elenco will repair or replace the unit at no cost. For the remainder of the warranty period a nominal service charge is required to cover shipping and handling.

Direct all warranty inquiries to:

***Elenco Electronics Inc.***  
**150 W. Carpenter Ave.**

***Service Department***  
***Wheeling, IL 60090***