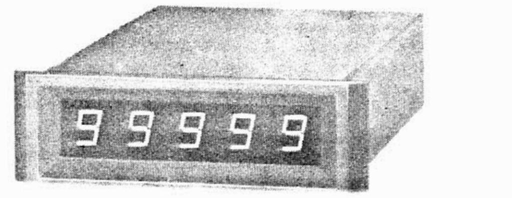
INSTRUCTIONS

PF-5 FREQUENCY COUNTERS



Introduction

The PF Series Frequency Counters are compact, panel mounted instruments for measuring frequencies from 0 to 1MHz. The PF-5 is a five-digit instrument. With a simple field modification the frequency range may be increased to 10MHz. The display consists of 0.3-inch-high digits illuminated by light-emitting diodes. The meters employ large-scale integrated circuitry for reliability and ease of maintenance.

Input amplitudes from 3V to 30V, peak-to-peak, may be accommodated. A simple field modification extends this amplitude to 700V peak-to-peak so that 115 or 230 VAC line frequencies may be monitored.

The inclusion of Schmitt triggers in the input signal-conditioning circuitry makes it possible to obtain accurate frequency measurements from inputs with slow-rising and slow-falling waveforms. For contact-closure inputs, a simple field modification provides an input filter to eliminate errors due to contact bounce.

Any one of four crystal-controlled time bases, 0.01 second, 0.1 second, 1 second or 10 seconds may be selected by external jumpering at the connector. Decimal point location, display test, display blanking and hold are also controllable by external jumpering at the connector.

The meter is designed to operate with a +5V 5% regulated power supply. See figure 1 for a typical +5V power supply circuit for operation from 115 VAC. An optional 5V power supply is available from your distributor; P/N 39-193-1 for operation from 115 VAC and 39-193-2 for operation from 230 VAC.

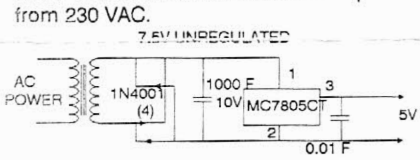


Figure 1. Typical Power Supply Schematic Diagram

Specifications

Frequency Range: 0 to 1 MHz (The range is extendable to 10 MHz with field modification.)

Frequency Accuracy: +/- (1 count + time base accuracy)

Time Base:

Crystal Frequency - 10 MHz
Time Bases - 0.01 sec
0.1 sec
1 sec
10 sec

Crystal Stability:
Aging: <10 ppm/yr
Temperature: <10 ppm 0° C to +50°C

Operating Temp: 0° C to +50° C

Digits: five

Display: 0.3" high LED

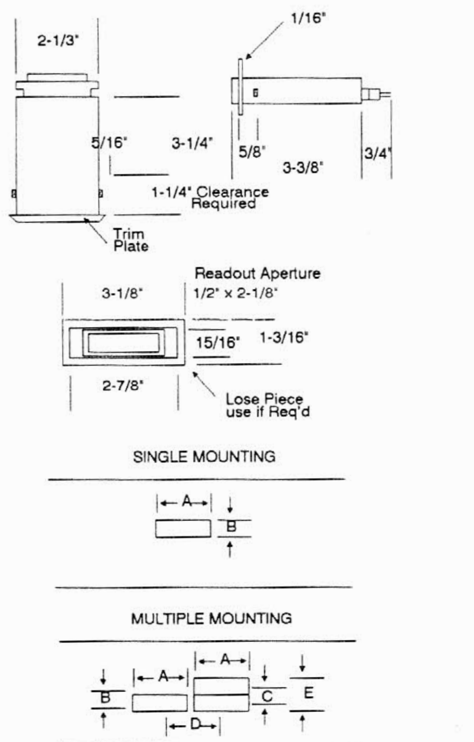
Input Signal Amplitude: 3V peak-to-peak to 30V peak-to-peak (extendable to 700V peak-to-peak with field modification).

Input Impedance: For signals within the levels of 0 and +5V: 75 kilohm. For signals outside the levels of 0 and +5V: 10 kilohm in parallel with 390 pF. (Input impedance will change with certain field modification).

Power Supply: +5V +/- 5% @ 150 mA, nominal.

Weight: Approx. 2.5 oz (71 grams)

Dimensions: See figure 2.



	Cutout w/Trim Plate	Center Line w/o Trim Plate	Center Line w/Trim Plate	Cutout For Multiple Mounting w/o Trim Plate
A	2-17/32			
B	31/32			
C		15/16	1-3/16 (min)	
D		3-1/8 (min)	3-1/8 (min)	
E				Unit No. x 15/16

Figures 2 and 3. Case Size and Mounting Data

Installation

1. Mount the meter as follows:

   a. Cut hole in panel (figures 2 and 3).

   b. Slide trim plate over housing, facing beveled edge of trim plate forward.

   c. Insert meter through cutout in panel from front of panel.

   d. Fit mounting clips (2) into slots located on top and bottom of meter. The foot clip should face forward.

   e. Thread screws (2) into clips & tighten screws against rear surface of panel.

2. Install a keying tab in the connector between contacts 1 and 2. The connector should be NLS part number 39-195 or equivalent. (See figure 4 for connector pin data.)

AC-Coupled Signal Input	A	1	DC-Coupled Signal Input
Signal COM	B	2	Signal COM
10^4 Decimal	C	3	Display Test
10^1 decimal 0.1 Sec Time Base	D	4	10^0 Decimal 0.01 Sec Time Base
HOLD	E	5	Signal COM
Decimal Pt. COM	F	6	COM for Display Test & Blanking
Display Blanking	H	7	Time Base COM
10^3 Decimal 10 Sec Time Base	J	8	10^2 Decimal 1 Sec Time Base
+5V COM	K	9	+5V Power
+5V COM	L	10	+5V Power

Figure 4. Connector Information

Operation

Power Supply. Connect the negative side of the 5 V power supply to pin K or L of the connector and the positive side to pin 9 or 10.

Signal. Connect signal common to pin 2, 5 or B. Connect SIGNAL HI to pin A for AC coupling, or pin 1 for DC coupling. DC coupling may be used if the input signal crosses the switching threshold, which is approximately two volts. Otherwise, AC coupling should be used.

The optimum input signal to the counter is 5V peak-to-peak. If DC coupled, this should go from 0 to +5 volts. However, signals up to 30V peak-to-peak can be accommodated. (For larger amplitudes see paragraphs on Field Modification.)

If the input is a 5-volt peak-to-peak sine wave, and AC coupling is used, the minimum input frequency should be 100 Hz to avoid excessive signal attenuation across C1, the 0.1 muF coupling capacitor. If it is necessary to measure lower frequencies using AC coupling, a larger capacitor, 1 muF for example, may be connected externally in series, with the input lead connected to pin 1.

The input circuitry has been designed so that simple field modifications can be made to accommodate a wide variety of signal input situations. These will be described under Field Modification.

Time Base Selection. For the counter to function, one of the four time bases must be selected. This is accomplished by jumpering pin 7 to pin 4, D, 8 or J as shown below.

Time Base in Seconds	Jumper Pin 7 to Pin
0.01	4
0.1	D
1	8
10	J

Decimal Point Selection. A decimal point, if desired, is obtained by jumpering pin F on the mating connector to pin 4, D, 8, J or C as shown below.

Decimal Location	X. X. X. X. X.
Pin Designation	C J 8 D 4

Choice of the decimal point location will depend upon the time base, the frequency unit, and whether scaling is required. If no scaling is involved, the decimal point should normally be located as shown in table I.

Table I. Decimal Point Locations

Time Base In Seconds	Decimal Point Location For Hz	Decimal Point Location For kHz	Decimal Point Location For MHz
0.01		XXXX.X	X.XXXX
0.1		XXX.XX	
1	XXXXX	XX.XXX	
10	XXXX.X	X.XXXX	

Hold. When the HOLD input, pin E, is jumpered to pin 9 or 10 (+5V), any measurement in progress is stopped and the counter reset. The latches which hold the counter data are not updated, so the result of the last complete measurement is displayed. When the jumper is removed, a new measurement is initiated.

Overflow. If the input frequency exceeds the capacity of the counter for the time base selected, all decimal points will be illuminated.

Display Test. to insure that there are no missing digit segments or decimal points, the display may be tested by jumpering pins 6 and 3 on the connector. The display should then appear as shown below.

8.8.8.8.8.

Display Blanking. The display cannot be blanked unless the counter is placed in HOLD. This is accomplished by jumpering pin E on the connector to pin 9 or 10 (+5V). With the counter in HOLD, the display is blanked by jumpering connector pins 6 and H.

To unblank the display, remove the jumper betwen pins 6 and H, and take the counter out of HOLD by removing the jumper between pin E and pin 9 or 10.

Field Modification

There are several minor modifications to the input circuitry which can be made by the user to "tailor" the counter to his specific needs. These modifications greatly enhance the versatility of the counter. In particular, the modifications enable the counter:

a. To operate at peak-to-peak voltages up to 700 volts for line-monitoring applications.

b. To operate at frequencies up to 10 megahertz.

c. To operate properly with bouncing contact closures.

d. To provide various input bias levels in the range from 0 to +5 volts.

To aid in the description of the modifications, a schematic diagram of the input circuit is shown in figure 5. A drawing showing the component layout is provided in figure 6.

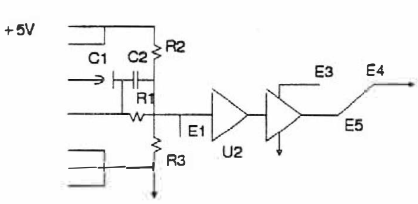


Figure 5. Schmitt Trigger Schematic Diagram

Component Access. All of the modifications are made on the counter P.C. board. To gain access to this board, insert the blade of a small screwdriver or pen knife between case and rear cover, midway on the case above printed circuit connector, and pry gently outward. Remove cover. Observe that red filter is now a loose piece which will have to be inserted into case prior to sliding in the P.C. board on reassembly.

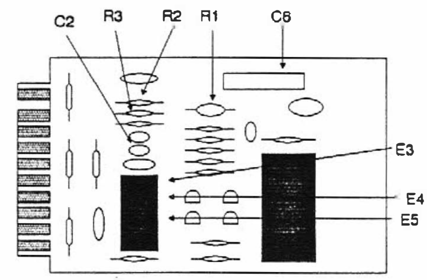


Figure 6. PC Board Compnent Layout

Modification for Operation with High-Voltage Signal Inputs

1. Remove C2 (390 pF).

2. For operation from 30 volts to 200 volts peak-to-peak change the value of R1 from 10 kilohm +/- 5%, 1/2 W, to 100 kilohm +/- 5%, 1/2 W. A carbon film or carbon composition resistor will be satisfactory.

3. For operation from 70 volts to 700 volts peak-to-peak change the value of R1 from 10 kilohm +/- 5%, 1/2 W, to 1 megohm +/- 5%, 1/2 W. A carbon film or carbon composition resistor will be satisfactory.

Modification for Operation at High-Frequencies

1. For frequencies up to one megahertz no modification should be necessary.

2. For frequencies up to 10 megahertz it is necessary to bypass the Schmitt triggers. This is accomplished by removing the jumper between pads E4 and E5 on the counter P.C. board, and inserting a jumper between pads E3 and E4.

   With this modification, sine wave inputs with frequencies down to 25 kHz can still be accommodated.

   Signal input amplitude should be limited to 5 volts peak-to-peak.

Modification for Operation with Contact Closures

For proper operation of the counter with contact-closure inputs, it is necessary to delay the arrival of the input signal at the Schmitt trigger input until the contact no longer bounces. This is accomplished with an RC input filter.

1. Remove C2 (390 pF).

2. Remove R3 (150 kilohm).

3. Change R1 from 10 kilohm +/- 5%, 1/2 W, to 100 kilohm +/- 5%, 1/4 W.

4. Change R2 from 150 kilohm +/- 5%, 1/4 W, to 300 kilohm +/- 5%, 1/4 W.

5. Insert a 0.1 mircoF capacitor (10V or more) between pads E1 and E2.

   The direct-coupled signal input should be used, and the contact-closure should connect this input (pin 1) to common (pin 2, 5 or B).
   If spurious extra counts due to contact bounce are stll observed, increase the value of the capacitor connected between E1 and E2.

   If the counter is not keeping up with the input frequency, decrease the value of the capacitance between E1 and E2.

Input Bias Level. The input bias voltage, appearing at the junction of R2 and R3, depends upon the relative values of these resistors. By varying these values, any bias voltage in the range from 0 to +5 volts may be obtained. For example, in the modification for contact-closure operation, R3 is removed causing the bias level to rise to +5 volts. This level is also suitable for direct-coupled TTL inputs.

Calibration

Calibration of the meter is performed as follows:

1. Remove counter assembly from case as described under Field Modification.

2. Select the 1-second time base by jumpering pin 7 to pin 8 on the mating connector.

3. Connect a frequency standard to the input terminals.

4. Set frequency standard to approximately 99990 Hz; the frequency setting is not critical.

5. Adjust capacitor C6 (figure 6) until display agrees with frequency standard input.

6. Remove inputs and reassemble meter.

Specifications Subject to Change without Notice

NON-LINEAR SYSTEMS

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