OPTOELECTRONICS
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OPTOELECTRONICS

OWNER'S MANUAL

HANDI-COUNTER™ SERIES 2210A & 2300

Your OEI Frequency Counter has been designed to give years of trouble-free service. This manual contains important information on it's use and care. Please take a few moments to familiarize yourself with the contents prior to using your counter.

⚠ Where this symbol appears on the counter, it means: "SEE EXPLANATION IN MANUAL"

"CAUTION" The use of this word in this manual is reserved for conditions or actions that may damage your counter.

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FEATURES OF THE 2210A & 2300

The 2210A and 2300 counters are truly general purpose instruments capable of making a variety of measurements from audio frequencies (2210A only) through microwave. You can check the clock in your computer or pick up a cellular phone, cordless phone, ham rig, marine or aircraft VHF transmitter. You can even pick up police, fire, or public service transmitters from up to several hundred feet away and then punch up and listen in with your scanner. Because of it's compact size, the 2210A is perfect for service work because it easily fits into a tool box or even a shirt pocket. It's easy to carry the 2210A or 2300 to remote transmitter sites or up towers when you need a counter on the spot. The 2210A and 2300 are even small enough to build into a piece of test equipment or console just like you would a panel meter.

With all the features packed into this palm sized instrument, you may be surprised to see how clean the 2210A and 2300 are inside. Surface mount components are used in a carefully considered mechanical design and parts layout. A large-scale integrated circuit is the functional heart of the counter. Compact-size LED displays, surface mount components, 1/8 watt resistors, monolithic capacitors and miniature aluminum electrolytic caps permit very efficient use of the printed circuit board area.

The models 2210A and 2300 are breakthrough high-technology products that make microwave frequency measurements, a low cost option. Both counters employ maximized sensitivity. This ensures that they will have the maximum amount of input amplifier gain that will result in increased RF pick-up distance using an antenna. Any additional gain would result in "Hard Self Oscillation" that reduces antenna pick-up distance.

SPECIFICATIONS

	INPUT "A" 2210A only	INPUT "B" 2210 & 2300
Frequency Range:	10Hz to 12MHz	10MHz to 2.4GHz
Input Impedance:	1 Megohm, 30pF	50 Ohm
Typical Sensitivity:	20mV @ 10Hz	< 5mV @ 10Mhz
	10mV @ 100Hz	< 1mV @ 30MHz
	10mV @ 1kHz	< 1mV @ 150MHz
	10mV @ 1MHz	< 3mV @ 450MHz
	10mV @ 10MHz	< 3mV @ 850MHz
Max. Power Input:	100V rms	+15 dBm

⚠ CAUTION

Damage may occur to the counter if the Maximum Power Input is exceeded. Damage occuring from input overload is not covered by your warranty. See warranty for details. Never direct couple a transmitter output to the counter input. When using an antenna, always hold the counter at least several feet away from transmitter's ouputting 5 watts or more. Transmitter's outputting over 10 watts should be read from even greater distances.

	INPUT "A" 2210 only	INPUT "B" 2210 & 2300
Timebase:		
Frequency:	10MHz	3.90625MHz
Stability:	+/- 1 part per million, 25-35C,	
Aging:	1 ppm per year, typical after first year	
Calibration Adjust:	Through front panel	
Accuracy:	+/- Timebase inaccuracy, +/- 1 count	
	2210A only	**2210 & 2300**
Gate Period:	1 or 1 Second selectable	.25 or 2.5 Seconds selectable
Resolution:	1Hz in 1 Second 10Hz in .1 Seconds	100Hz in 2.5 Seconds 1000Hz in .25 Seconds

Power: Internal NiCad Battery Pack (4 x NR-AA, 1.2V, 600mAh)
1, 5-3 Hour Discharge, 12-16 Hour Recharge cycle - typical
100VAC, 60Hz to 9VDC, 200-500mA nominal, Center-Positve, AC-Charger/Adapter included for AC operation.

Display: 8 LED Digits, .28" high

Size: 3.9" high x 3.5" wide x 1" deep **Weight:** 9 oz.

Construction: Aluminum cabinet with durable finish. NiCad batteries are soldered in and not field changeable. Manufactured in U.S.A. Specifications subject to change withoutnotice.

OPERATOR CONTROLS

PWR: Selects Battery "ON/OFF" or AC Operation/Battery Charge. Up in "ON" and down is "OFF". Battery charge and operation is automatic depending upon presence of external AC Charger/Adaptor.

GATE: Selects Signal Sample Period

FAST:

.1 second sample time, displays 10 Hz resolution, Range "A". (2210A only)

.25 second sample time, displays 1000 Hz resolution, Range "B".

(Use Fast Gate setting for FREQUENCY FINDING) (2210 & 2300)

SLOW:

1 second sample time, displays 1 Hz resolution, Range "A". (2210 only)

2.5 second sample time, displays 100 Hz resolution, Range "B". (2210 & 2300)

RANGE: Selects Frequency Range and Input Impedance

A: 10Hz to 12MHz Range, High Impedance Input. (2210 only)

B: 10MHz to 2.4GHz Range, 50 Ohm Input. (2210A & 2300)

INDICATORS

DISPLAY: 8 Red LED Digits of .28 inch height indicate frequency. Decimal point will be placed at the appropriate "MHz" position. The lead zeros are blanked above the frequency displayed.

GATE: Red LED illuminates during the gate or input signal sample period. The indicator is off during the time between sample period.

RECHARGEABLE BATTERY OPERATION

The counter can operate several hours from fully charged internal NiCad batteries. The batteries are charged when the unit is powered by the AC-Charger/Adapter. Full recharge will occur in 12 to 16 hours. The counter may be operated over prolonged periods by AC adapter operation with no harm to batteries as the charge current is regulated. It should take about 16 hours to full charge a discharged battery pack.

The batteries should be deep cycled occasionally by allowing them to completely discharge and fully charge several times to maintain maximum battery capacity.

CAUTION

The NiCad batteries should last over several years, however, it is recommended that the counter be checked inside after one year of operation for any sign of battery leakage or corrosion. Replace all batteries if any visible damage is observed.

To inspect the NiCad battery packs it is necessary to open the cabinet. This is accomplished by removing two machine screws from each end of the cabinet and removing the top cover.

CAUTION

110V AC and External DC Operation

A 110V AC, 60Hz TO 9V DC, 200-500mA, Center-Positive, AC-Charger/Adapter is specified for use and is supplied with the counter. This is a nominal specification and the adapter supplied with the counter will match the counter's requirement exactly. When using external power supplies make sure that the voltage under load does not exceed 9 VDC. When operating from an automotive electrical system, some means of reducing the voltage to the counter must be employed. Automotive voltages in excess of 13.8VDC are common and may damage the NiCad batteries. If the counter becomes excessively hot to the touch then remove it from the power supply immediately.

CALIBRATION

Calibration adjustment openings in the instrument top cover are labeled "CAL ADJ" "A" and "B" (Model 2300 has a single adjustment). These openings permit access to the trimmer capacitor which provides about a 60 parts per million adjustment range of the time base oscillators. Use the slow Gate Time for maximum resolution and read a stable signal of known frequency adjusting the trimmer for correct frequency display. Calibrate using a 10MHz reference on the "A" range and a higher frequency (150MHz) on the "B" range (2300). The higher the calibration frequency, the more accurately the instrument can be calibrated.

FACTORY CALIBRATION SERVICE

OPTOELECTRONICS' Service Department provides a calibration service at the factory. Counters may be shipped for this service using the Factory Service & Return Policy explained on the last page of this manual. The current charge is $40.00 ($35.00 + $5.00 Return Shipping). This price is subject to change without notice. Consult factory for current pricing at time this service is requested. *OPTOELECTRONICS* will provide a Certificate of Calibration at time of calibration service, upon request.

FACTORY SERVICE & RETURN POLICY

FACTORY SERVICE

Warranty: Products under warranty must be returned, transportation prepaid, to *OPTOELECTRONICS'* Ft. Lauderdale Service Center. All parts replaced and labor performed under warranty is at no charge to the customer.

Non-Warranty: Products not under warranty must be returned, transportation prepaid, to *OPTOELECTRONICS'* Ft. Lauderdale Service Center. Factory service will be performed on a time and materials basis at the service rate in effect at the time of repair. A repair estimate prior to commencement of service may be requested. Return shipping will be added to the service invoice and is to be paid by customer.

RETURN POLICY

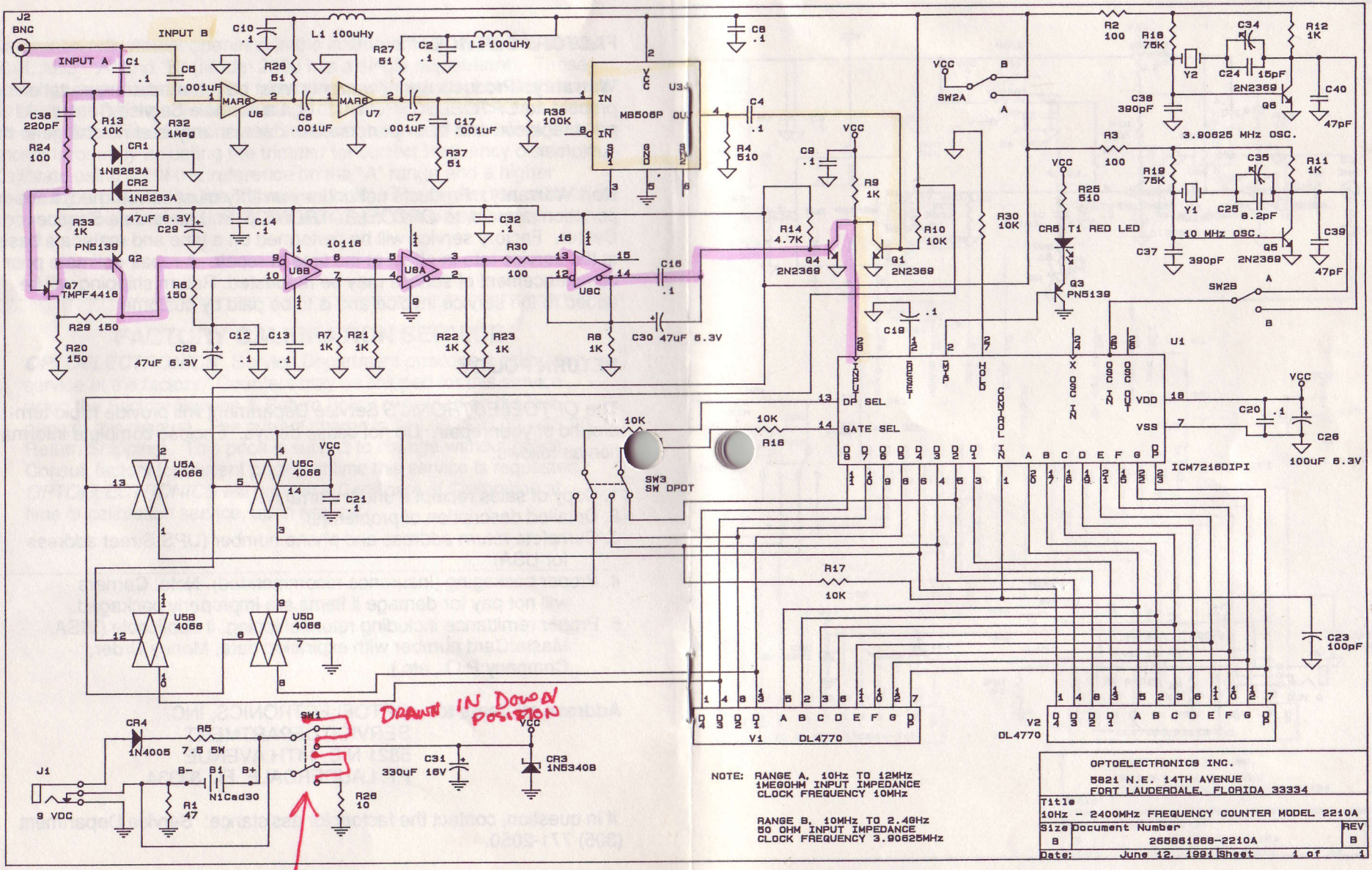
The *OPTOELECTRONICS* Service Department will provide rapid turnaround of your repair. Do not cause delays. Enclose complete information as follows:

1. Copy of sales receipt if under warranty.
2. Detailed description of problem(s).
3. Complete return address and phone number (UPS Street address for USA)
4. Proper packaging (insurance recommended). Note: Carriers will not pay for damage if items are improperly packaged.
5. Proper remittance including return shipping, if applicable (VISA, MasterCard number with expiration date, Money Order, Company P.O., etc.)

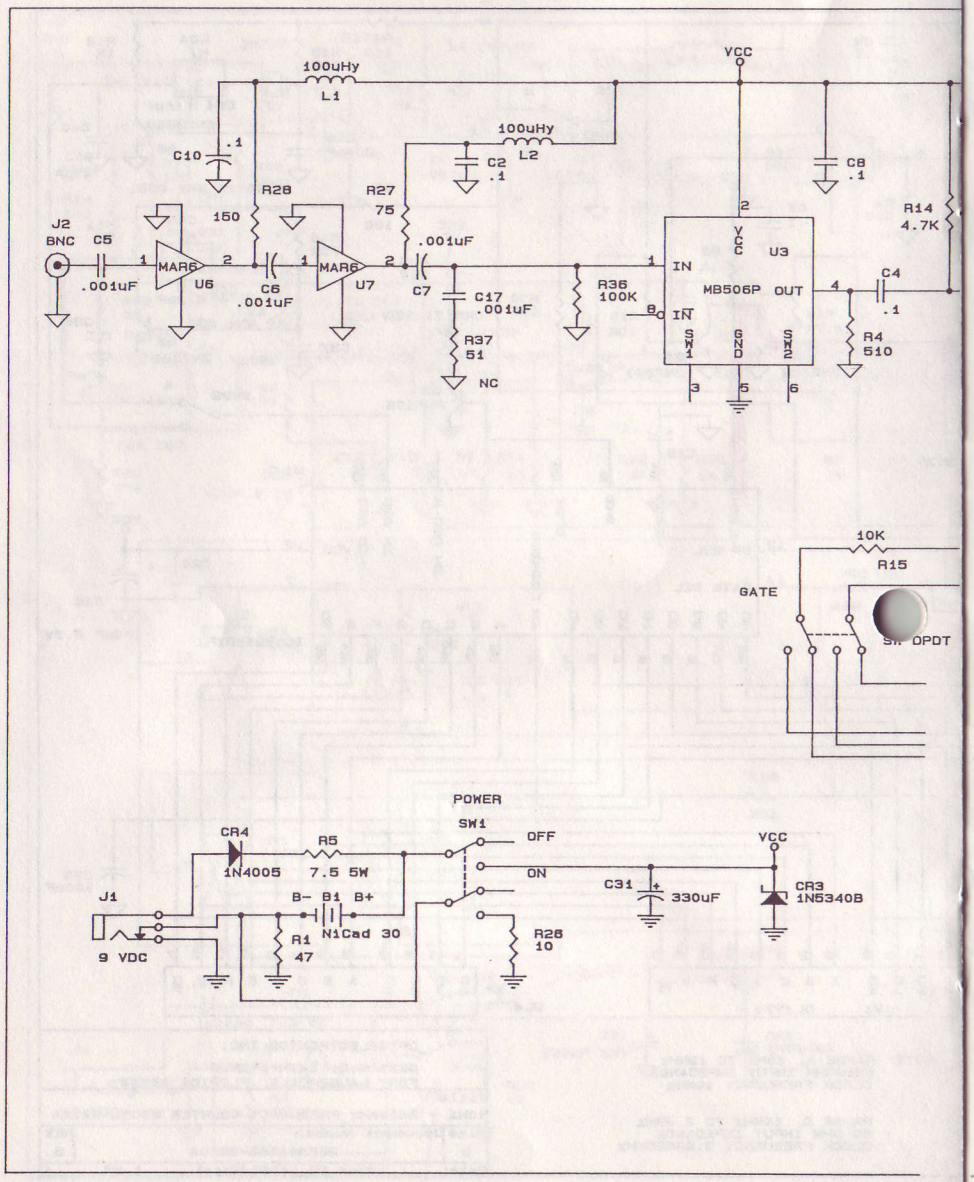
Address all items to: OPTOELECTRONICS, INC.
SERVICE DEPARTMENT
5821 N.E. 14TH AVENUE
FT. LAUDERDALE, FL 33334

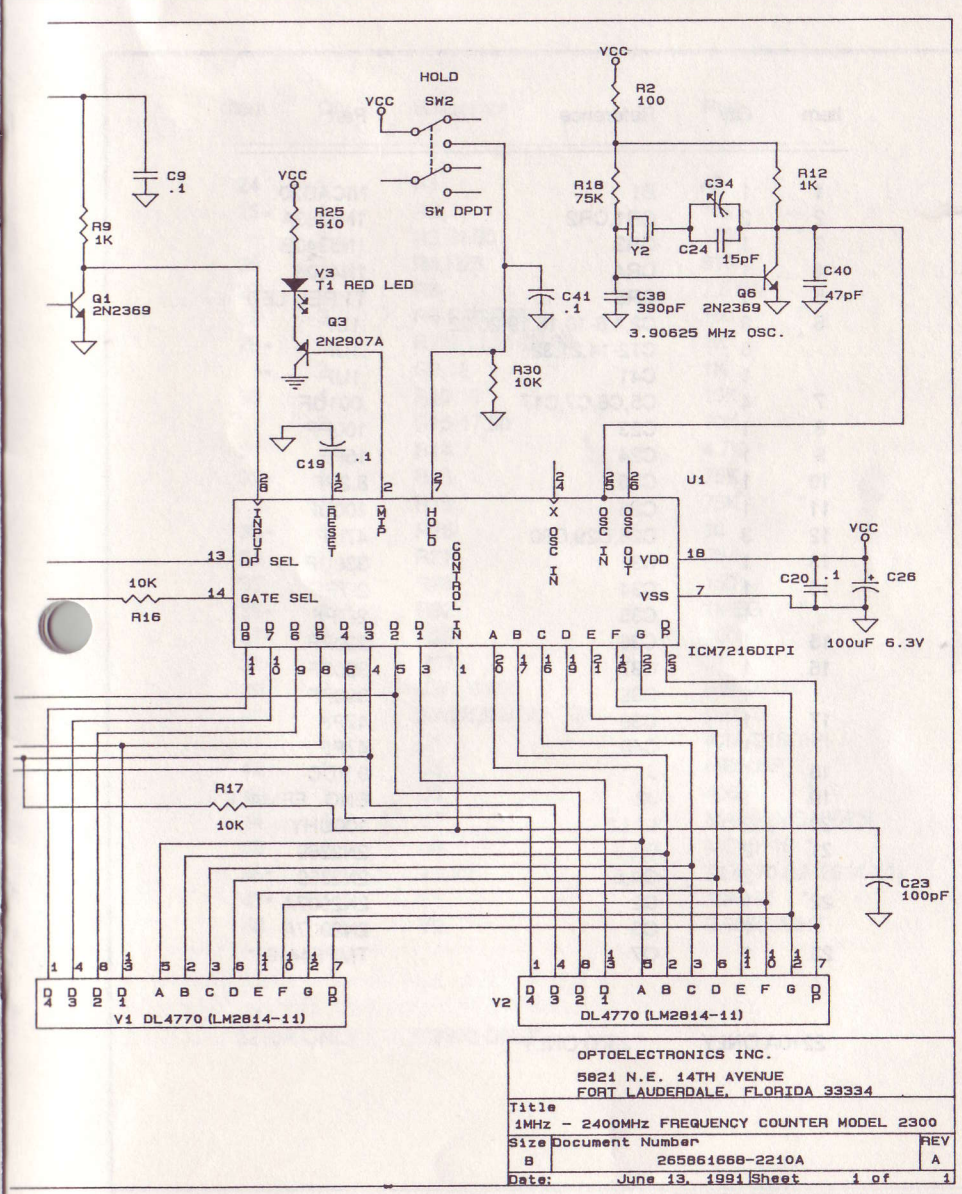
If in question, contact the factory for assistance: Service Department (305) 771-2050.

SCHEMATIC FOR MODEL 2210A



SCHEMATIC FOR MODEL 2300





PARTS LIST

Item	Qty	Reference	Part
1	1	B1	NICAD30
2	2	CR1,CR2	1N6263A *
3	1	CR3	1N5340B
4	1	CR4	1N4005
5	1	CR5	T1 RED LED
6	8	C2,4,8-10,16,19-20,32	.1UF
	6	C12-14,21,32	.1UF *
	1	C41	.1UF **
7	4	C5,C6,C7,C17	.001UF
8	1	C23	100PF
9	1	C24	15PF
10	1	C25	8.2PF *
11	1	C26	100UF
12	3	C28,C29,C30	47UF *
13	1	C31	330UF
14	1	C34	2-7PF
	1	C35	2-7PF *
15	1	C36	220PF *
16	1	C37	390PF *
	1	C38	390PF
17	1	C39	47PF *
	1	C40	47PF
18	1	J1	9 VDC
19	1	J2	BNC , FEMALE
20	2	L1,L2	100UHY
21	2	Q1,6	2N2369
	2	Q4,5	2N2369 *
22	1	Q2	2N2907A *
	1	Q3	2N2907A
23	1	Q7	TMPF4416 *

* 2210A ONLY **2300 ONLY

Item	Qty	Reference	Part
24	1	R1	47
25	1	R2,	100
	3	R3,24,30	100 *
26	2	R4,R25	510
27	1	R5	7.5 5W
28	3	R6,R20,R29	150 *
29	9	R7-8,11,21-23,33	1K *
	2	R9,12	1K
30	4	R10,13	10K *
	2	R15-17,30	10K
31	1	R14	4.7K
32	1	R18	75K
	1	R19	75K *
33	1	R26	10
34	3	R27	75
35	1	R28	150
36	1	R32	1MEG *
37	1	R36	100K
38	1	R37	51
39	2	SW1,SW3	SW DPDT
40	2	SW2B,SW2A	DPDT
41	1	U1	ICM7216DIPI
42	1	U3	MB506P
43	1	U5	4066 *
44	1	U7	MAR6 (MSA0685)
45	1	U8	MC10116 *
46	2	V1,V2	DL4770 (LM2814-11)
47	1	Y1	10MHZ *
48	1	Y2	3.90625MHZ

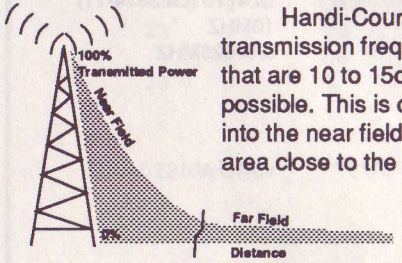
* 2210A ONLY **2300 ONLY

USING THE COUNTER

Low-cost Handi-Counters (Handheld Frequency Counters) such as the OPTOELECTRONICS Model 2210A and 2300 are now being used for both conventional laboratory bench measurements as well as to measure transmitted radio frequency signals from a wide variety of sources (Frequency Finding). This is possible because the input sensitivity of these counters are very high by test instrument standards. Until recently, input sensitivity of 10 millivolts was considered to be quite good. In fact many of the lab quality counters today that cost many times the price of the these units have sensitivity specified to 10 millivolts. The 2210A and 2300 use miniature surface mount wide band amplifier ICs to achieve sensitivities well below 10 millivolts over a large part of its range (below 2 millivolts from 27MHz through 450MHz). This makes the 2210A one of the worlds most sensitive frequency counters at any price!

Knowing the sensitivity of the counter does not answer the question "How close to the transmitter must one be to pick up the frequency?". Several factors will determine the distance question. The radiated power, type of antenna and radiation pattern, the frequency of the transmission, the background level of RF, atmospheric conditions, interference from other transmitters, position of buildings or structures, weather conditions, and sun spots will influence the distance which one can detect a transmission. As the relative amount of background RF increases, the maximum distance the counter can be from the source to be counted decreases. In unpopulated areas that have low background levels of RF, distances in excess of 200 feet have been reported using a 5 watt 2 meter transmitter. In large metropolitan areas, this distance may decrease to 50 feet or less. Due to this fact, it is impossible to predict exact distances for a given location or set of conditions.

When FREQUENCY FINDING, maximum distances may be attained by using the appropriate antenna. OEI offers a selection of antennas for this purpose that have been tested to give best results.



Handi-Counters™ are unique in their ability to find RF transmission frequencies. Immediate response to frequencies that are 10 to 15db greater than the background RF level is possible. This is done by simply moving the Hand-Counter™ into the near field of the radio transmitter. The near field is the area close to the antenna where the field strength is high but

falling off rapidly as distance increases. This is compared with the far field where the field strength is low but remains fairly constant over great distances. Handi-Counters™ work well at relatively close distances and can measure a transmission frequency rapidly without having to tune through the RF spectrum.

Frequency counters are not nearly as sensitive as radio receivers or scanners. This is not a flaw in the counter but it is due to its nature. A counter has a broadband response, that is it is sensitive to all frequencies at the same time without having to be tuned. A radio receiver can only be tuned to one frequency at a time. The radio must be re-tuned to receive a different frequency. The tuning, however, permits the radio to be very sensitive at the frequency that it is tuned to. Receiver sensitivities can be well below 1 microvolt. The counter must be close enough to the source of the radio frequency transmission to pick up enough signal to count. There will typically be only one strongest source of RF for the counter to count, even in the presence of two transmitters. The counter will not mix two signals together and display an incorrect count.

Counters that are very sensitive will give random unstable counts with no singal present. The sensitive input circuitry will tend to self- oscillate. The frequency displayed during self-oscillation has no practical significance. The presence of RF at sufficient amplitude will cause the counter to "lock up" and display the correct count. The counter can be forced to not self-oscillate by making it less sensitive. The counter operator can very quickly learn to differentiate between self-oscillation and reading a frequency.

Several types of RF transmissions cannot be counted by frequency counters. Suppressed carrier (single sideband) transmissions, pulse-modulated signals from garage door openers of remote control transmitters cannot be counted. The counter must have continuous RF carrier to count. Very low level transmitters with radiated power levels below 10 milliwatts (such as the Radio Shack wireless microphone) do not produce enough signal to be counted. Cordless telephones also have very low power levels but can be counted using an antenna held near the phone antenna.