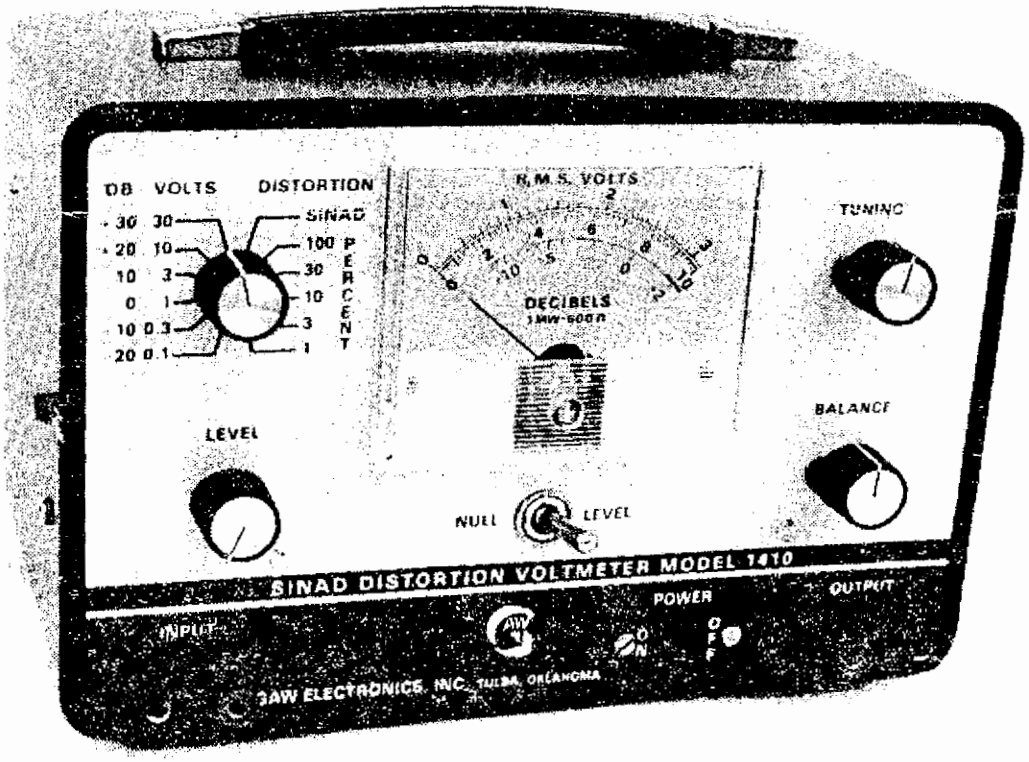
MODEL 1410

SINAD DISTORTION VOLTMETER



Sinad Measurement is straight forward with the Model 1410. Simply connect the receiver speaker terminals to the input of the Model 1410 and set the proper frequency and 1000 Hz deviation on the Signal Generator. Switch the LEVEL-NULL switch to NULL, place the TUNING and BALANCE controls in a vertical position as indicated by the panel markings, set the function switch to SINAD and read the 12 db Sinad sensitivity by adjusting the Signal Generator attenuator until the meter reading indicates "−10" on the lower scale of the Model 1410.

For a more detailed description as well as testing to EIA specs, see page two of the instruction manual.

Operating Manual

Sinad Distortion Voltmeter

The Model 1410

GAW ELECTRONICS, INC.
8266 EAST 41st STREET
TULSA, OKLAHOMA 74145
(918) 664-1012

INTRODUCTION

The Model 1410, Sinad-Distortion Meter, is a complete Wien Bridge 1000 Hz plus or minus 100 Hz distortion analyzer with which harmonic distortion may be measured down to one percent of full scale. In addition, it is an audio voltmeter of 100 millivolt rms full scale sensitivity. Full scale sensitivity of 3 millivolts rms may be achieved by calibrating the distortion ranges.

A Sinad measuring mode is provided which indicates the combined "noise and distortion" to "signal plus noise" ratio directly in decibels. The indication is independent of the normal change in signal level as carrier level is varied and eliminates the need for successive level adjustments normally associated with Sinad measurements.

SECTION 2

SPECIFICATIONS

A. NULL FREQUENCY: 1 KHz plus or minus 100 Hz. (may be preset to 1 KHz plus or minus 30 Hz for automatic leveling Sinad measurements.)

B. INPUT IMPEDANCE: Approximately 40K ohms.

C. DISTORTION RANGES: 1, 3, 10, 30, 100% full scale.

D. A. C. VOLTMETER RANGES: 0.1, 0.3, 1, 3, 10, 30V rms full scale.

E. DECIBEL RANGES: plus 2 db. to minus 12 db. 1 milliwatt 600 ohms.

F. MINIMUM INPUT VOLTAGE FOR DISTORTION MEASUREMENT: 0.3V rms.

G. MINIMUM INPUT VOLTAGE FOR SINAD MEASUREMENT: 0.003V rms.

H. INPUT VOLTAGE REQUIRED FOR AUTOMATIC SINAD LEVELING: Typically 50 mV rms to 4V rms.

I. OUTPUT VOLTAGE FOR MONITORING: 7Vpp at full scale reading

J. FREQUENCY RESPONSE: 20 Hz to 20 KHz plus or minus 1 db.

K. ACCURACY:
   Voltmeter-plus or minus 5% of full scale.
   Distortion-plus or minus 5% of full scale, plus 0.1%
   Sinad-plus or minus 1 db.

L. POWER REQUIREMENTS: 115 plus or minus 15 VAC, 50–60 Hz.

M. DIMENSIONS: 9" W. x 6-½" H. x 5" Deep, plus hardware. Transit cover optional

N. WEIGHT: 2-½ lbs.

SECTION 3

CIRCUIT DESCRIPTION:

The Sinad Distortion Meter uses six internally compensated integrated circuit operational amplifiers; one in a preamplifier, two in a Wien Bridge notch filter, one in an audio voltmeter, and two in an automatic voltage leveling circuit. Sufficient feedback is included in all circuits to assure stable, accurate performance. The power supplies are electronically regulated to provide maximum independence from A.C. power fluctuations.

SECTION 4

OPERATION:

A. VOLTMETER

The A. C. Voltmeter has six separate voltage ranges allowing measurements up to 30V rms.

By calibrating the distortion ranges a full scale sensitivity of 3 millivolts rms may be achieved.

To calibrate the distortion ranges connect an audio oscillator to the input terminals of the 1410. Place the function switch in the 0.3V rms range. Adjust audio oscillator's output to give a full scale reading. Rotate function switch to the 100% range and adjust LEVEL control to give a full scale reading. Disconnect the audio oscillator from the 1410. The ranges are now calibrated to read the following:

	0.3V rms	Full Scale
30%	0.1V rms	Full Scale
10%	0.03V rms	Full Scale
3%	0.01V rms	Full Scale
1%	0.003V rms	Full Scale

The distortion ranges may also be calibrated to give a full scale reading of 10 millivolts rms in the 1% range. This can be accomplished by substituting 1.0V rms for 0.3V rms in the preceding paragraph. The ranges will now be calibrated to read the following:

100%	1.0 V rms	Full Scale
30%	0.3 V rms	Full Scale
10%	0.1 V rms	Full Scale
3%	0.3 V rms	Full Scale
1%	0.01V rms	Full Scale

B. DISTORTION MEASUREMENT

1. Connect a 1 KHz plus or minus 100 Hz audio signal to the input of the Model 1410.
2. Set the NULL/LEVEL switch to LEVEL position and the function selector to 100 percent.
3. Adjust LEVEL control for full scale indication on the 100% scale.
4. Place NULL/LEVEL switch into NULL position.
5. Adjust TUNING control for minimum reading. Adjust BALANCE control for minimum reading.
6. Reset the function switch to a lower scale to provide a more readable indication.
7. Readjust TUNING and BALANCE for minimum reading.
8. Read the total harmonic distortion on the meter and function switch.

C. SINAD MEASUREMENT

1. Connect an FM Signal Generator such as the GAW Co. Model 1012 through a suitable r.f. cable and 6 db pad.
2. Modulate the Signal Generator using the internal 1000 Hz. Adjust deviation to 60% of the allowable receiver bandwidth.
3. Tune the Signal Generator to the proper carrier frequency and center using the discriminator test point if available.
4. Set the Signal Generator to approximately 1000 microvolts or until the receiver is completely quieted.
5. Connect the SD meter across the receiver speaker terminals.
6. Measure the audio voltage by setting the SD meter "SENSITIVITY" switch to one of the appropriate voltage measuring ranges. Note that the EIA spec. requires the Sinad Test to be performed at full receiver power output.
7. Switch the "LEVEL-NULL" switch to "LEVEL", center TUNING and BALANCE pots to the vertical panel marks, and set the "SENSITIVITY" switch to SINAD. If the input amplitude is between 50 mV and 4 VAC the meter will automatically level.
8. Switch the "LEVEL-NULL" switch to "NULL" and read the Sinad level in db as the Signal Generator attenuator is decreased. Note that a clean low noise and low distortion modulated 1 KHz signal will indicate a low reading on the scale. If the modulation frequency is outside of the required plus or minus 30 Hz the Tuning and Balance controls may be adjusted for minimum reading.

APPLICATION:

The Model 1410 Sinad Voltmeter is a useful and time saving tool for "Tweaking" receivers into peak performance.

After the receiver under test is aligned according to manufacturers specifications, connect the 1410 to the receiver and measure the 12 db sinad level. The front end tuning adjustments should now be adjusted slightly for the best 12 db sinad reading. (Lowest attenuator setting)

In this way a significant increase in receiver sensitivity is often obtained.

SECTION 5

MAINTENANCE

A. GENERAL

1. The purpose of this section is to acquaint operating and maintenance personnel with the procedures for making certian adjustments that may be necessary after critical parts are replaced.
2. It should be noted that most of the field replaceable parts are available through your local sales representative or direct from:

GAW ELECTRONICS, INC.
8266 EAST 41st STREET
TULSA, OKLAHOMA 74145
(918) 664-1012

The adjustment procedures outlined in this section should be carefully followed. When the described test equipment is not available, it would be advisable to return the Model 1410 for repair.

B. REMOVING THE INSTRUMENT FROM THE CASE

1. Remove the power cord.
2. Place the instrument panel down on a cushion or soft surface.
3. Remove three 6-32 phillips head screws from the rear and sides of the case.
4. Gently life case from the unit.

C. VOLTMETER CALIBRATION

1. Connect an accurate ohmmeter from chassis ground to the junction of R5 and R4.
2. Place function selector to Sinad mode.
3. Adjust R5 for a meter reading of exactly 10,000 ohms.
4. Connect an accurate A. C. voltage source of 30, 10, 3, or 1V rms to the input terminals of the Model 1410.
5. Place function switch in the appropriate range to give a full scale reading.
6. Adjust R-17 to give a full scale reading.

D. DISTORTION METER CALIBRATING

1. Connect the output from an audio generator to the input terminals of the Model 1410.
2. Set the audio generator's output frequency to exactly 1000 Hz with at least 0.3V output.
3. Set the function switch to the 100% range and the NULL/LEVEL switch to level.
4. Adjust LEVEL control to give a full scale meter reading.
5. Set TUNING and BALANCE controls to their mid positions.
6. Set the NULL/LEVEL switch to NULL.
7. Adjust trimmer pots R-32, and R-33 for minimum meter indication.
   NOTE: It may be necessary to turn the function switch to lower percentage values to show the minimum more clearly.
8. Now adjust trimmer Pot R-29 for minimum meter indication.
9. Repeat steps 7 and 8 until no further improvement is obtained.

E. SINAD CALIBRATION

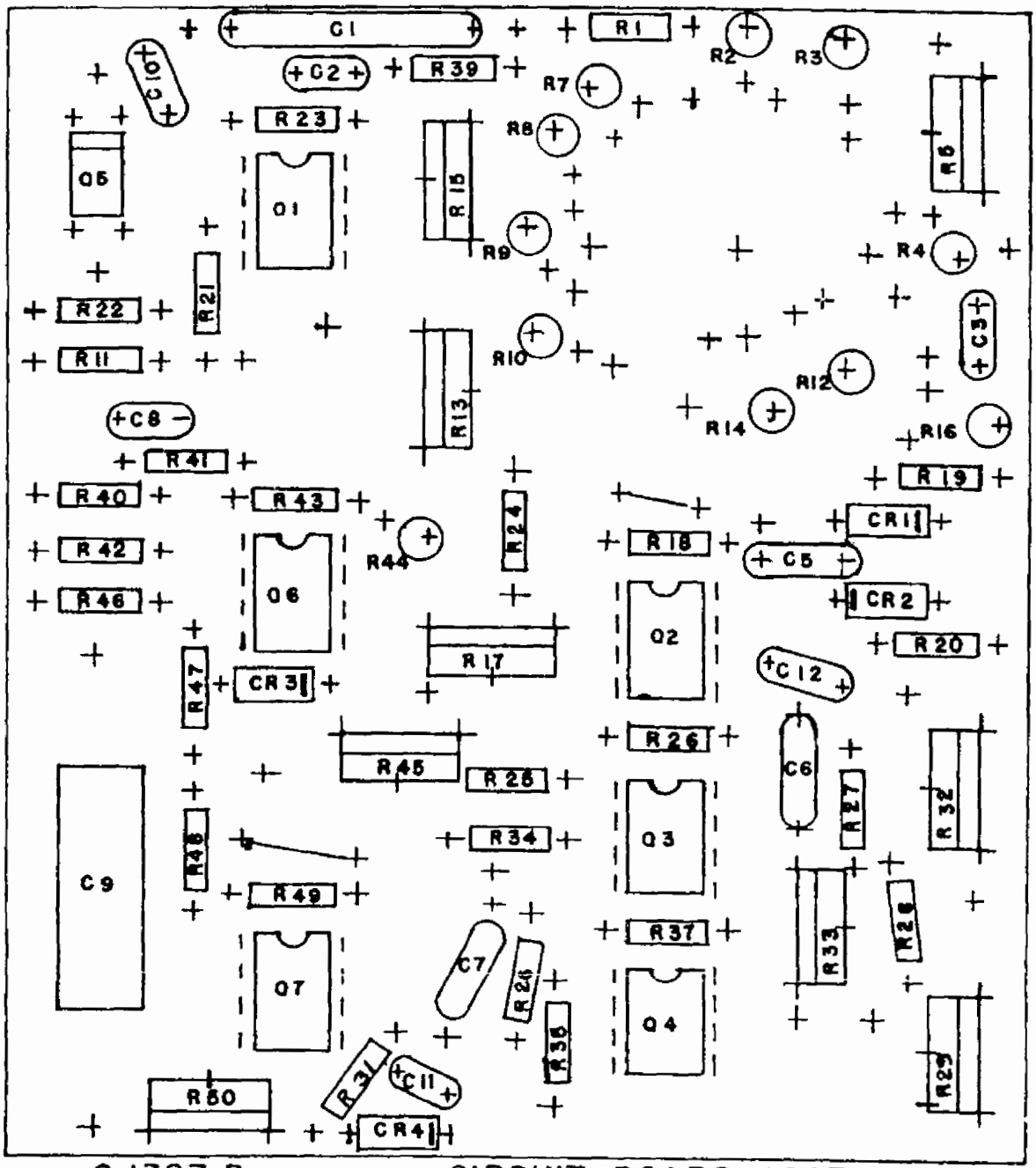
1. Place function selector into SINAD mode.
2. Using an accurate high impedance voltmeter, (20,000 ohms per volt or better) measure the DC voltage on pin 3 of Q7. Adjust trimmer pot R-50 to obtain a voltage reading of exactly 0.25 DCV.

3. Connect an audio oscillator to the input terminals of the 1410.
4. Place function selector into the 0.1Vrms range, set audio oscillator's output to read 50 millivolt.
5. Switch function to SINAD.
6. Adjust trimmer pot R-45 to position the meter needle into the lower end on black band on the decibel scale. This will insure automatic sinad leveling throughout the range of 50 Mv to 4 vrms.

SECTION 6

TABLE OF REPLACEABLE PARTS

REFERENCE SYMBOL	DESCRIPTION
	CAPACITORS
C-12	Disc 130 pf 1KV.
C-6, C-7	Mylar .001 mfd 600V.
C-1	Mylar 0.47 mfd. 600V.
C-8	Electrolytic 0.47 mfd. 30V.
C-2, C-3, C-5	Electrolytic 4.7 mfd 30V.
C-10, C-11	Electrolytic 10 mfd 30V.
C-102	Electrolytic 470 mfd 25V.
C-9	Electrolytic 1000 mfd 16V.
C-101	Electrolytic 1000 mfd 25 V.
	DIODES
CR-1, CR-2, CR-3	IN 60 Germanium Diode
CR-4	IN 5227 Zener Diode
CR-101, CR-102, CR-103, CR-104	IN 4001 Rectifiers
	FUSE
F-1	3 AG-1/4 Amp.
	CONNECTORS
J-1, J-2	Binding Post, Red
J-3, J-4	Binding Post, Black
P-101	AC Receptacle, Male
	INTEGRATED CIRCUITS
Q-1, 2, 3, 4, 6, 7	MC 1741 CP-1
Q-5	MC 3340
Q-101	78L12AWC
Q-102	79M12HC
	RESISTORS – FIXED
R-46	Comp. 1K ohm 10% 1/4W.
R-28	Comp. 24K ohm 10% 1/4W.
R-1, 21, 22, 24, 25, 27, 35, 38, 40, 41, 42, 47, 48	Comp. 10K ohm 10%1/4W.
R-34, 37	Comp. 100K ohm. 10% 1/4W.
R-39	Comp. 150K ohm 10% 1/4W.
R-43	Comp. 470K ohm 10% 1/4W.
R-49	Comp. 1 Meg ohm 10% 1/4W.
R-51	Comp. 3K ohm 5% 1/4W.
R-14	Comp. 4.3K ohm 5% 1/4W.
R-12	Comp. 6.2K ohm 5% 1/4W.
R-44	Comp. 20K ohm 5% 1/4W.
R-19, R-20	Comp. 39K ohm 5% 1/4W.
R-23, 18	Comp. 91K ohm 5% 1/4W.
R-26	Comp. 270K ohm 5% 1/4W.
R-16	Film 1K ohm 1% 1/8W.
R-10	Film 2.15K ohm 1% 1/8W.
R-9	Film 8.87K ohm 1% 1/8W.
R-4	Film 19.6K ohm 1% 1/8W.
R-8	Film 30.9K oh, 1% 1/8W.
R-1	Film 34.8K ohm 1/8W 1%
R-3	Film 80.6K ohm 1/8W 1%
R-7	Film 100K ohm 1/8W 1%
R-2	Film 274K ohm 1/8W 1%
	RESISTORS – VARIABLE
R-17, 13, 15	1K 20% 1/2W.
R-50, R-45	5K 20% 1/2W.
R-5, 29	10K 20% 1/2W.
R-32, R-33	250K 20% 1/2W.
R-30	1K 20% 2W.
R-31	50K Dual 20% 2W.
R-6	5K 20% 2W.
	SWITCHES
S-1	1 Pole 12 Pos. 2 Deck, N.S. Rotery, (Function)
S-2	SPST Toggle, (Null-Level)
S-101	DPDT Slide, (Power)
	TRANSFORMER
T-101	24 VAC C. T. 100 MA.
	MISCELLANEOUS
C-1327-B	P.C. Board Assy.
W-101	Cord, Power
	Cover, Transit



C 1327-B CIRCUIT BOARD ASSEMBLY

SINAD DISTORTION VOLTMETER
MODEL 1410
GAW CO., INC.

NOTES:
ALL CAPACITORS IN MICROFARADS, EXCEPT WHERE NOTED.
ALL RESISTORS IN OHMS ±10% EXCEPT WHERE NOTED.