TM-102848

INSTRUCTION MANUAL

NETWORK ANALYZER

MODEL 305-PA-3009

SEPTEMBER, 1976

This equipment is manufactured under U. S. Patent Number 3,725,781 - Dranetz Eng. Labs, Inc. 23207

DRANETZ
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SERIAL NUMBER EFFECTIVITY

Instruction Manual TM-102,848 provides maintenance and operating instructions for Plug-in Model 305-PA-3009 units determined by the foll following Serial No. codes:

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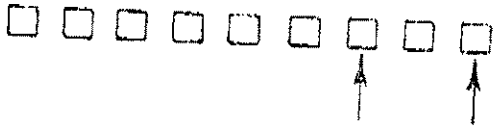
9 DIGIT EXAMPLE



Plug-in 305-PA-3009 Notes:

1. If last digit (9th digit) is 6 or greater and the 7th digit is 3 or greater; this manual applies.
2. If last digit (9th digit) is 7 or greater; this manual applies.

305-PA-3009 INSTRUCTION MANUAL

TABLE OF CONTENTS

SECTION 1

GENERAL INFORMATION

1.1 INTRODUCTION

This manual provides operating and service information for the Dranetz Model 305-PA-3009 Network Analyzer Plug-in manufactured by Dranetz Engineering Laboratories Incorporated, South Plainfield, New Jersey. This plug-in may be used in all Dranetz Series 305 phasemeter main frames.

1.2 PURPOSE

The purpose of this plug-in is to expand the usefulness of Dranetz Series 305 phasemeters by adding the ability to measure the voltage of both inputs in either volts or dB reference 1 Volt= 0 db. The ratio in dB of the "Signal" input with respect to the "Reference" is also measured.

1.3 CHARACTERISTICS

The detailed characteristics of the 305-PA-3009 when used in a series 305 phasemeter are specified by Table 1-1 which follows:

TABLE 1-1, 305-PA-3009 SPECIFICATIONS

INPUT LEVEL RANGE:

10 mV rms to 40 V rms both inputs.

INPUT IMPEDANCE:

1 Megohm plus 40 pf both inputs, usable with standard oscilloscope probes.

INPUT FREQUENCY RANGE:

2 Hz to 700 kHZ

FUNCTIONS:

Amplitude of reference input in volts or dB ref 1 volt,

TABLE 1-1 SPECIFICATIONS (cont.)

Amplitude of signal input in volts or dB ref 1 volt, Phase angle of signal input with respect to reference input, and Ratio of signal input to reference input in dB. The function to be displayed is selected by a switch on the front panel of the plug-in.

ANALOG OUTPUTS:

Four Outputs are simultaneously available at the rear of the phasemeter main frame. They are proportional to Reference input level (in either volts or db), Signal input level (in either volts or db), Phase Angle of Signal with respect to reference, and ratio of signal to Reference in db. The sensitivity of all db outputs is 10 mv/db. The sensitivity of the phase angle Output is 10 mv/ degrees (a positive output indicates that Signal leads Reference). The voltage amplitude outputs have one of 3 sensitivities depending on which voltage range is in use. Sensitivity is 10 volts/ volt in the mv x 1 range, 1 volt/volt in the mv x 10 range and 0.1 volt/volt in the volts ÷10 range.

VOLTAGE RANGE SELECTION

Fully automatic

VOLTAGE RANGE INDICATION:

By indicator lamps on front panel and by outputs on rear of main frame suitable for operation of 24 vdc, 8 ma drive reed relays.

ACCURACIES (analog outputs):

Phase: $\pm$ 0.1° from 40 mV to 40 V rms from 50 Hz to 50 kHz, typically $\pm$0.25° at all other levels from 5Hz to 500 kHz.

Voltage amplitude (Volts): $\pm$ 2% of reading from 40 mV to 40 V rms from 50 Hz to 50 kHz, $\pm$5% of reading typical down to 10 HZ and up to 500 kHz.

Voltage Amplitude (dB ref. 1 Volt): $\pm$0.3 db from - 28 dB to +32 dB from 50 Hz to 50 kHz, $\pm$ 0.6 db typical down to 10 Hz and up to 500 kHz.

Voltage Ratio (dB sig./ref): $\pm$0.5 dB from -28dB to +32 dB in each input from 50 HZ to 50 kHz, $\pm$ 1 dB typical down to 10 Hz and up to 500 kHz.

TABLE 1-1 SPECIFICATIONS (cont.)

For accuracies at the front panel readout, add the error of the DVM as specified in the main frame instruction manual TM-101378A.

LEVEL LIMIT INDICATION:

Indication lamps on front panel light for Signal input below 40 mv, Signal input above 40 volts, Reference input below 40 mv, and Reference input above 40 volts. A single TTL compatible line to a main frame rear connector changes state from "1" to "0" if any of the four out-of-limit indicators light.

SECTION 2

OPERATING INSTRUCTIONS

2.1 GENERAL

The 305-PA-3009 network analyzer plug-in is operated in a Dranetz series 305 phasemeter main frame. The instruction manual for the main frame (TM-10137A) should be referred to for much of the operating procedure. Only information directly concerned with the 305-PA-3009 plug-in is presented in these instructions.

2.2 CONNECTORS AND CONTROLS

The rear connector on the 305-PA-3009 is of no concern to the operator. Its function is to properly mate the plug-in to the main frame connecting power supplies, grounds and various signal leads. The operator is concerned; however, with all controls, connectors and indicators located on the 305-PA-3009 front panel. These are identified by figure 2-1 and described by Table 2-1 which follows.

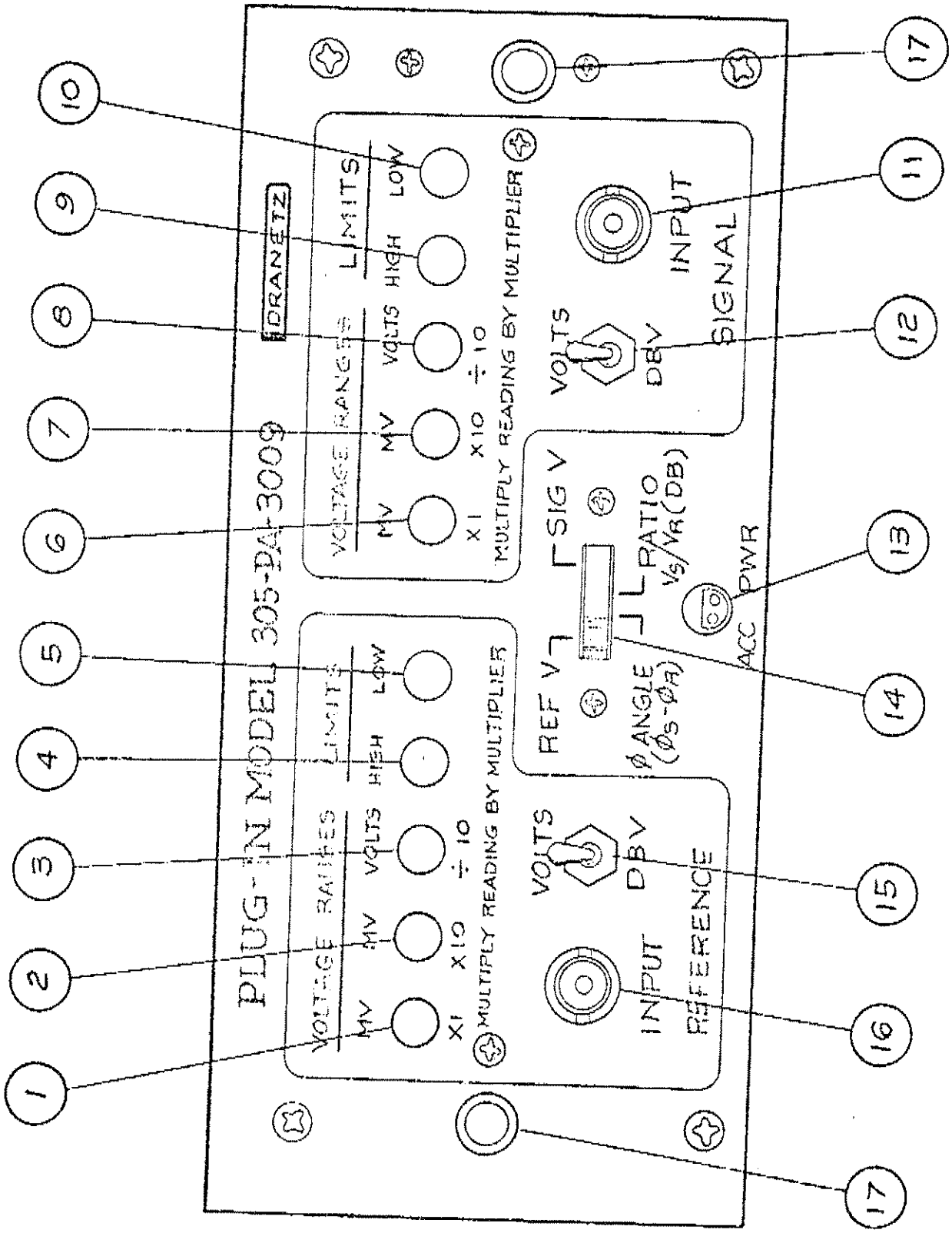


FIGURE 2-1, 305-PA-3009 FRONT PANEL

TABLE 2-1, FRONT PANEL COMPONENTS

INDEX NO.	COMPONENT AND DESCRIPTION
1.	Reference channel mV x 1 indicator lamp. When this lamp lights, Reference Voltage displayed on the main frame DPM is presented directly in mV rms. This lamp does not apply if voltage is being displayed in dBV.
2.	Reference channel mV x 10 indicator lamp. When this lamp lights, Reference Voltage displayed on the main frame DPM must be multiplied by 10 to read in mV rms. This lamp does not apply if voltage is being displayed in dBV.
3.	Reference channel Volts ÷10 indicator lamp. When this lamp lights, Reference Voltage displayed on the main frame DPM must be divided by 10 to read in Vrms. This lamp does not apply if voltage is being displayed in dBV.
4.	Reference channel high limit indicator lamp. This lamp lights when the input applied to the Reference channel approaches the 40 V rms upper limit. This lamp also blinks on when the plug-in auto ranges upward.
5.	Reference channel low limit indicator lamp. This lamp lights when the input applied to the Reference channel drops below 40 mV rms by more than approximately 10%. This lamp also blinks on when the plug-in auto ranges downward.

TABLE 2-1, FRONT PANEL COMPONENTS (CONT.)

6.	Signal channel mV x 1 indicator lamp. When this lamp lights, Signal voltage displayed on the main frame DPM is presented directly in mV rms. This lamp does not apply if voltage is being displayed in dBV.
7.	Signal channel mV x 10 indicator lamp. When this lamp lights, Signal voltage displayed on the main frame DPM must be multiplied by 10 to read in mV rms. This lamp does not apply if voltage is being displayed in dBV.
8.	Signal channel Volts ÷10 indicator lamp. When this lamp lights, Signal voltage displayed on the main frame DPM must be divided by 10 to read in V rms. This lamp does not apply if voltage is being displayed in dBV.
9.	Signal channel high limit indicator lamp. This lamp lights when the input applied to the Signal channel approaches the 40 V rms upper limit. This lamp also blinks on when the plug-in auto ranges upward.
10.	Signal channel low limit indicator lamp. This lamp lights when the input applied to the signal channel drops below 40 mV rms by more than approximately 10%. This lamp also blinks on when the plug-in auto ranges downward.
11.	Signal channel input connector (BNC).

TABLE 2-1, FRONT PANEL COMPONENTS (cont.)

12.	Signal channel VOLTS/ DBV switch. When this switch is in the VOLTS position, the Signal voltage is presented in 3 linear ranges from below 40 mV rms to 40 V rms. The range in use is designated by the Signal voltage range indicator lamps. When the switch is in the DBV position, the Signal voltage is presented in dB referenced to 1 volt = 0 dB. The voltage range indicator lamps are not relevent to dBV readings.
13.	Accessory Power Jack. This jack provides power for external isolation transformermers of the Dranetz 3100 series. Pin A provides + 24 VDC at 50 ma while pin B provides - 24 VDC at 50 ma.
14.	Function Selector Switch. This switch selects which of the four functions being measured is to be displayed by the main frame DPM. The four functions available are Reference voltage (in volts or dBV), Signal voltage (in volts or dBV), Ratio of Signal voltage with respect to Reference voltage in dB, and phase angle of Signal voltage with respect to Reference voltage in degrees.
15.	Reference channel VOLTS/DBV switch. When this switch is in the VOLTS position, the Reference voltage is presented in 3 linear ranges from below 40 mV rms to 40 V rms. The range in use is designated by the Reference voltage range indicator lamps. When the switch is in the DBV position, the Refcrence voltage is presented in dB referenced to 1 volt = 0 dB. The voltage range indicator lamps are not relevent to dBV readings.

16. Reference channel input connector (BNC).

17. Plug-in lock fasteners. To secure plug-in turn CW. To release plug-in turn CCW.

2.3 OPERATING PROCEDURE

2.3.1 The 305-PA-3009 must be installed in a Series 305 phasemeter prior to operation. This is accomplished by removal of the existing plug-in and substitution of the 305-PA-3009. Plug-ins are secured using 2 pawl type fasteners located at each end of the front panel.

2.3.2 An additional step is required before the 305-PA-3009 may be operated. Check the rear panel of the 305 main frame. If there is a toggle switch between the "MAIN FRAME" and "PLUG-IN" connectors, place it in the position marked "3009". If the main frame was manufactured before this switch was added one may either perform the steps which follow or may add the switch in accordance with the instructions in Section 6 of this manual. If the switch is not to be installed, remove the cover from the phasemeter main frame and cut the jumper wire between pins 6 and 7 of the MAIN FRAME" connector (J 3). After this jumper is cut the case is re-installed. The next step is installation of a jumper cable between the MAIN FRAME (J3) and PLUG-IN (J2) connectors on the 305 series main frame rear panel. The required jumper cable is supplied with each 305-PA-3009 plug-in. The two preparatory steps described here disconnect the DPM from the phasemeter mainframe and allow it to be fed from the function selector switch on the front panel of the plug-in. If the pre-wired jumper cable is lost a substitute may be constructed by making the following connections between two Cannon type DB 25P connectors:

J3 MAIN FRAME		J2 PLUG-IN
Pin 6	to	Pin 6
Pin 7	to	Pin 7

NOTE: If the main frame contains the Automatic Calibrator (Option 107), the jumper to be cut is between pin 6 and pin 8 of J3. Then, pin 8 of J3, instead of pin 7, is connected to pin 7 of J2.

2.3.3 After initial preparation operate the 305/305-PA-3009 combination as follows:

a. Turn unit on and allow a minimum of one minute for warm-up.

b. Connect inputs to both Reference and Signal input connectors.

c. Put main frame MEAS/CHECK switch in the MEAS position.

d. Select measurement desired using function selector switch on plug-in.

e. Select either voltage or DBV presentation for level measurements.

f. Allow panel meter to stabilize and read measured quantity. Angle, DB ratio and dBV are direct reading without any scale factors. Voltage readings must be modified by the scale factor shown by the Voltage Range indicator lamps.

NOTE: If main frame contains the Automatic Calibration feature (Option 107), the 305-PA-3009 function selector switch must be kept in the "Ø ANGLE" position during any automatic calibrations performed.

2.3.4 Additional operating information concerning the 305 main frames is contained in Instruction Manual TM-101378A supplied with each main frame.

2.3.5 Four simultaneous analog outputs are available at the PLUG-IN (J2) connector on the rear of the main frame. These are detailed in Table 2-2.

2.3.6 Six decimal point outputs are available at the PLUG-IN (J2) connector on the rear of the main frame. These outputs are identified by Table 2-2. Figure 2-2 shows a typical hook up illustrating the use of these decimal point outputs in conjunction with external DPM's.

TABLE 2-2, PIN DESIGNATIONS

"Plug-In" Connector (J^2) At Rear of Main Frame

Pin No.	Pin Function
1.	Level limits, "1" Normal, "0" out of limits.
2.	Ref. 10 Vdc out/Vrms in } Pin grounded
3.	Ref. 1 Vdc out/Vrms in } through PNP
4.	Ref. 0.1Vdc out/Vrms in } transistor on range in use.
5.	CKT. GND.
6.	SELECTED FUNCTION OUTPUT
7.	PHASE ANGLE INPUT, 10 mv/degree
8.	Ref. LEVEL OUTPUT, See Paragraph 2.3.7.6
9.	SIG. LEVEL OUTPUT See paragraph 2.3.7.7
10.	CKT. GND.
11.	Sig. 10Vdc out/Vrms in } Pin grounded
12.	Sig. 1 Vdc out/Vrms in } through PNP
13.	Sig.0.1 Vdc out/Vrms in } transistor on range in use
14.	RATIO OUTPUT, Vs/Vr in dB, 10 mv/dB
15.	CKT. GND.
16.	N.C.
17.	N.C.
18.	N.C.
19.	N.C.
20.	+ 24 Vdc
21.	N.C.
22.	N.C.
23.	N.C.
24.	N.C.
25.	- 24 Vdc

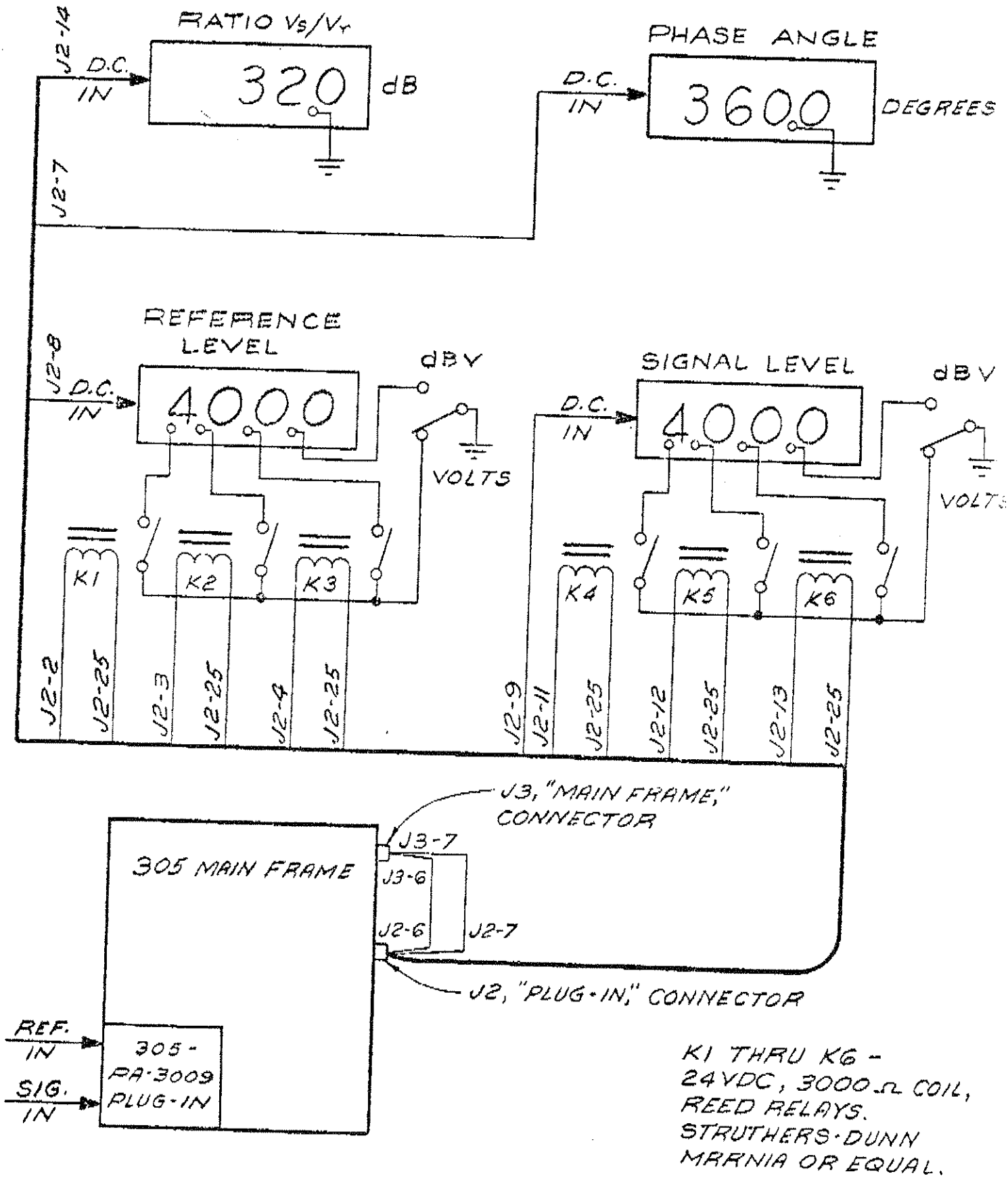


FIGURE 2-2, CONNECTION DIAG.
USING FOUR SIMULTAEOUS EXTERNAL DPMS

2.3.7 This paragraph lists in order and describes in detail the function of each of the 25 pins of the PLUG-IN CONNECTOR (J_2) on the rear of the main frame.

2.3.7.1 Pin 1 provides a TTL compatible (< 0.8 Vdc LOW, > + 2.4 Vdc HIGH) output which is high whenever both Signal and Reference inputs are within the high accuracy range of 40 mV rms to 40 V rms. This output goes low whenever either input is out of the specified limits.

2.3.7.2 Pin 2 provides a PNP transtor closure to ground when the <40 mV to 400 mV Reference input level range is in use. This pin can draw 8 ma dc from a 3 KΩ load connected to -24 Vdc (Pin 25). It is intended to operate a reed relay. Pins 3 and 4 provide identical outputs for the 400 mV to 4 V and 4 V to 40 Vrms input ranges.

2.3.7.3 Pins 5, 10 and 15 are circuit ground points.

2.3.7.4 Pin 6 outputs the function selected by the switch on the plug-in front panel. This is usually fed to J3 pin 6 which is the input to the 305 panel meter. It may be used to feed a remote DPM if the 305 main frame is without readout.

2.3.7.5 Pin 7 inputs the phase angle information to the selector switch. This information comes from pin 7 of main frame connector J3.

2.3.7.6 Pin 8 output is either a linear or dBV presentation of the Reference input voltage. Sensitivity in the dBV mode is 10 mV/dB referenced to 0 dB=1 Vrms. For sensitivities in the linear voltage mode see Table 2-2 and paragraph 1.3.

2.3.7.7 Pin 8 output is either a linear or dBV presentation of the Signal input voltage. Sensitivity in the dBV mode is 10 mV/dB referenced to 0 dB = 1 Vrms. For sensitivities in the linear voltage mode see Table 2-2 and paragraph 1.3.

2.3.7.8 Pin 11 provides a PNP transistor closure to ground when the 40 mV to 400 mV Signal input level range is in use. This pin can draw 8 ma dc from a 3 kΩ load connected to - 24 Vdc (Pin 25). It is intended to operate a reed relay. Pins 12 and 13 provide identical outputs for the 400 mV to 4V and 4 V to 40 Vrms input ranges.

2.3.7.9 Pin 14 provides an output proportional to the Ratio V sig/V ref.expressed in dB. The output is 0 Vdc for equal Signal and Reference inputs and may vary as much as ± 0.72 Vdc. Sensitivity is 10 mV/dB.

2.3.7.10 Pins 16, 17, 18, 19, 21, 22, 23 and 24 have no connection.

2.3.7.11 Pin 20 is + 24 Vdc output.

2.3.7.11 Pin 25 is - 24 Vdc output.

SECTION 3

THEORY OF OPERATION

3.1 GENERAL

The 305-PA-3009 plug-in has several functions. It generates two square wave output signals whose transitions correspond in time to the zero crossings of its two input sinewaves. It linearly detects each input signal and determines the correct input attennator to use in each channel. It converts the linearly detected information into dB form and it subtracts one dB output from the other to determine the dB level difference (ratio) between them.

3.2 BLOCK DIAGRAM DISCUSSION

3.2.1 The operation of the plug-in will be explained by reference to the block diagram of Figure 3-1. The Block diagram shows only one of the two identical channels (REFERENCE AND SIGNAL) contained in the plug-in. Since they are identical, discussion of one channel will be sufficient.

3.2.2 The input signal is applied through attennator Block 1. to input amplifier Block 2. The attenuator has 3 relay selected positions : ÷1,÷ 10 and÷100.

3.2.3 The output of amplifier Block 2 is applied to squaring circuit Block 3. and through gain control R3 to linear detector Block 4. The squaring circuit Outputs a square-wave to the main frame whose transistions correspond to the zero crossings of the input sinewaves.

3.2.4 The linear detector, Block 4., combined with the filter, Block 5 produce a d.c. output proportional to the amplitude of the A.C. input signal. This d.c. voltage is the "Voltage" output from the plug-in. It is also connected to the high and low limit detectors, Blocks 6 and 7.

3.2.5 If the input to limit detector Block 6 is greater than a preset value of approximately 3.8 volts, a negative output is produced. This output sets flip-flop Block 12 immediately. If this does not correct the high signal condition flip-flop Block 13 is also set after a time delay caused by delay Block 11.

3.2.6 If the input to limit detector Block 7 is less than a preset value of approximately 0.34 volts, a negative output is produced. This output resets flip-flop Block 13 immediately. If this does not correct the low signal condition flip-flop Block 12 is also reset after a time delay caused by delay Block 10.

3.2.7 Decoder Block 14 monitors the outputs of flip-flop blocks 12 and 13. If both flip-flops are set, the attenuator Block 1 is set at ÷100 and the V ÷10 range lamp is lit through driver Block 17. If both flip-flops are reset, the attenuator Block 1 is set at ÷1 and the MV x 1 lamp is lit through driver Block 15. If one flip-flop is set and the other is reset, the attenuator Block 1 is set at ÷10 and the MV x 10 lamp is lit through driver Block 16.

3.2.8 The output of filter Block 5, a dc voltage proportional to the amplitude of the ac input, is also connected to log convertor Block 18. The output of Block 18 is proportional to the log of its input and, when scaled properly, represents dB changes in the applied voltage. R41 adjusts the dc offset of the input stage of the Log Convertor in order to maintain accuracy at low input levels.

3.2.9 A composite analog output signal corresponding to the ac input to Block 1 is generated by log summing amplifier Block 19. This amplifier sums the output of the log convertor with 2 additional signals representing the level range in use. Since the input attenuator has 3 different positions differing by 20 dB (10:1) the amplitudes of the signals summed with the output of the log convertor are set to represent 20 dB. These signals are generated by transistor switch Blocks 20 and 21. The levels of these inputs are set by variable resistors R79 and R73 while the level of the signal from the log convertor itself is set by variable resistor R 80.

3.2.10 Switch Blocks 20 and 21 are controlled by the outputs of decoder Block 14. When the decoder selects the MVx 10 range, switch Block 20 is turned on and it feeds current from -6 volt reference Block 22 to log summing amplifier Block 19. When the decoder selects the V÷10 range, switch Blocks 20 and 21 are both turned on to supply current from the -6 volt reference to the log summing amplifier.

3.2.11 The output of log summing amplifier Block 19 represents dB referenced to 0 db = 1 Vrms input to Block 1. The zero point is adjusted using potentiometer R 82. The sensitivity of this output is 100 mV/dB. A resistive attenuator is used to reduce this sensitivity to 10 mV/db to comply with the input requirements of the 305 main frame panel meter.

3.2.12 The output of the log summing amplifier is also connected to the positive input of ratio summing amplifier Block 23. The negative input of the ratio summing amplifier is connected to the 100 mV/dB log output from the opposite channel. The output of the ratio summing amplifier is then the ratio of the plug-in's two input levels expressed in dB.

SECTION 4

PERFORMANCE CHECK

4.1 GENERAL

The performance check procedures enable the operator to determine if the 305-PA-3009 Plug-in is operating properly. This check can be performed either after setting up new equipment or after a unit has been repaired. A thirty minute equipment warm-up period followed by Main Frame Calibration in accordance with paragraph 3-5 of the main frame instruction manual (TM-1013/8A) must precede the performance check.

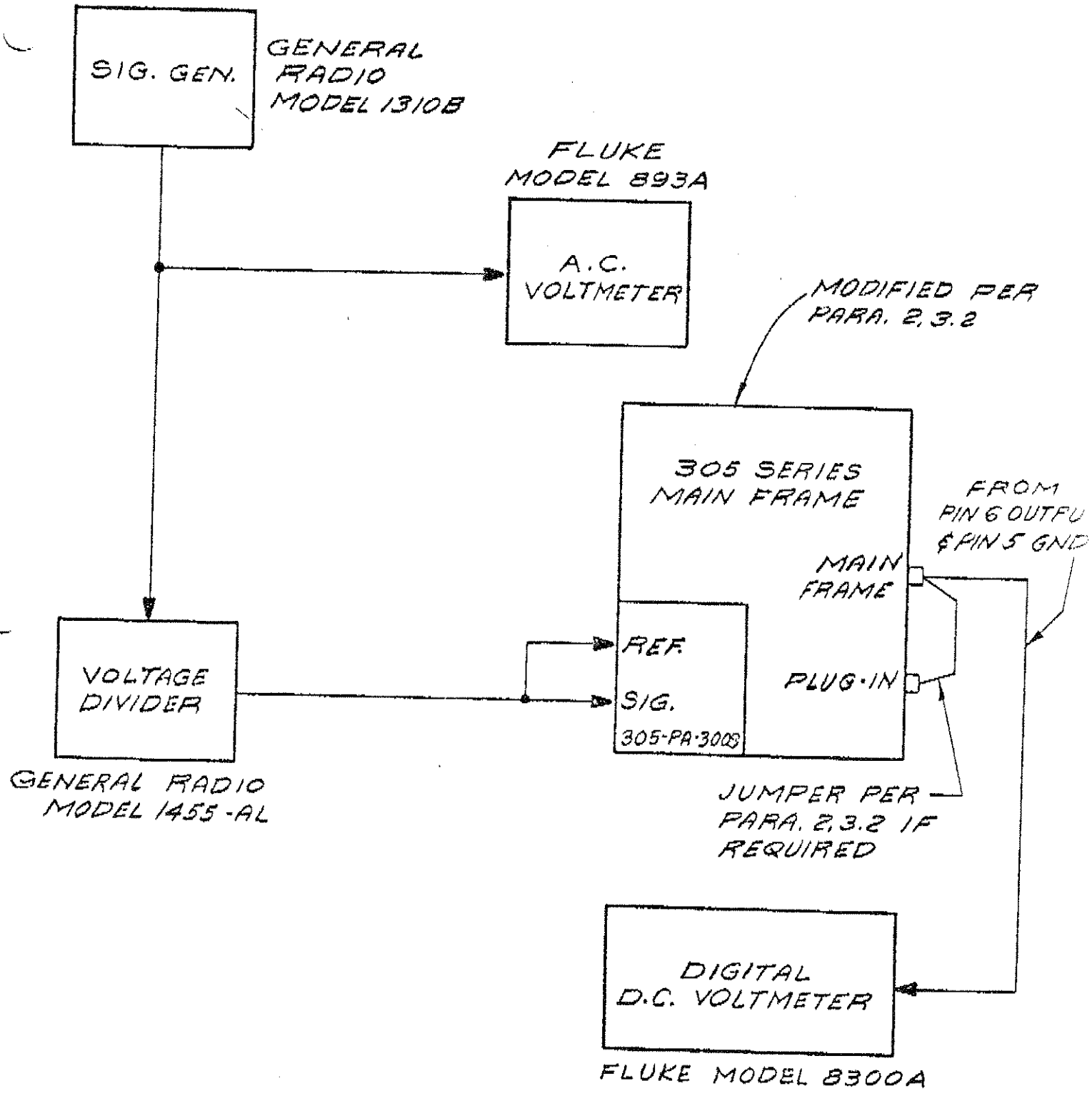


FIGURE 4-1
LINEARITY TEST CIRCUIT

4.2 TEST PROCEDURE

4.2.1 The 305-PA-3009 is tested in a series 305 main frame. Testing falls into four categories. They are level ranging, phase angle measurement, input level measurement, and ratio measurement.

4.2.2. To evaluate level ranging and phase angle measurement, conduct the test detailed by paragraphs 3-6 through 3-10 in the main frame instruction manual TM-101378A. The 305-PA-3009 should be tested as if it were a 305-PA-3001 for level ranging and phase accuracy. The 305-PA-3009 function selector switch must be in the Ø ANGLE position.

4.2.3 To evaluate input level measurement accuracy, both linearity and frequency response tests are required. Readings should be recorded in Voltage and dBV modes for both Reference and Signal Channels.

4.2.4 To measure Signal channel linearity connect the equipment as per Figure 4-1 which follows. Set the 305-PA-3009 function selector switch to the "Sig.V" position.

4.2.5 Set the signal generator output level to 10.0 Vrms at a frequency of 1.0 kHz. Maintain this voltage throughout the linearity test.

4.2.6 By varying the settings of the voltage divider, check the test points specified in the data seet of Table 4-1. Record outputs in both the Voltage and dBV modes by operating the switch on the 305-PA-3009 front panel.

TABLE 4-1

LEVEL MEASUREMENT LINEARITY DATA SHEET

Attenuator Setting V out/V in	Voltage Range	Voltage Output (Volts)	Voltage Output Limits Min,	Max,	DBV Output (Volts)	DBV Output Limits Min,	Max.
1.0000	V÷10		0.98	1.02	.197	.203	
.5000	V÷10		0.49	0.51	.137	.143	
.2000	mVx10		1.96	2.04	.057	.063	
.1000	mVx10		0.98	1.02	-.003	+.003	
.0500	mVx10		0.49	0.51	-.063	-.057	
.0200	mVx 1		1.96	2.04	-.143	-.137	
.0100	mVx 1		0.98	1.02	-.203	-.197	
.0050	mVx 1		0.49	0.51	-.263	-.257	
.0020	mVx 1		0.19	0.21	-.346	-.334	
.0010	mVx 1		.090	.110	-.410	-.390	

4.2.7 To measure Reference channel linearity all connections remain as in Figure 4-1. Set the 305-PA-3009 function selector switch to the "REF.V" position. Continue to maintain the 1.0 kHz signal generator output voltage at 10.0 Vrms during the balance of the linearity testing.

4.2.8 Check Reference channel linearity by again varying the settings of the voltage divider as detailed by Table 4-1. Record outputs in both Voltage and dBV modes by operating the switch on the 305-PA-3009 front panel.

4.2.9 To check level measurement frequency response connect test equipment as detailed by Figure 4-2.

4.2.10 An input level of 1 Vrms must be maintaned constant at all frequencies using the Ballantine A.C. voltmeter. Data should be recorded for both Reference and Signal channels at each frequency specified in the data sheet of Table 4-2. The VOLTS/DBV switches are kept in the VOLTS position during the entire test while the function selector switch is moved between the REF V and SIG. V positions at each frequency in order to test both channels. The error limits specified include the tolerance of the Ballantine A.C. voltmeter.

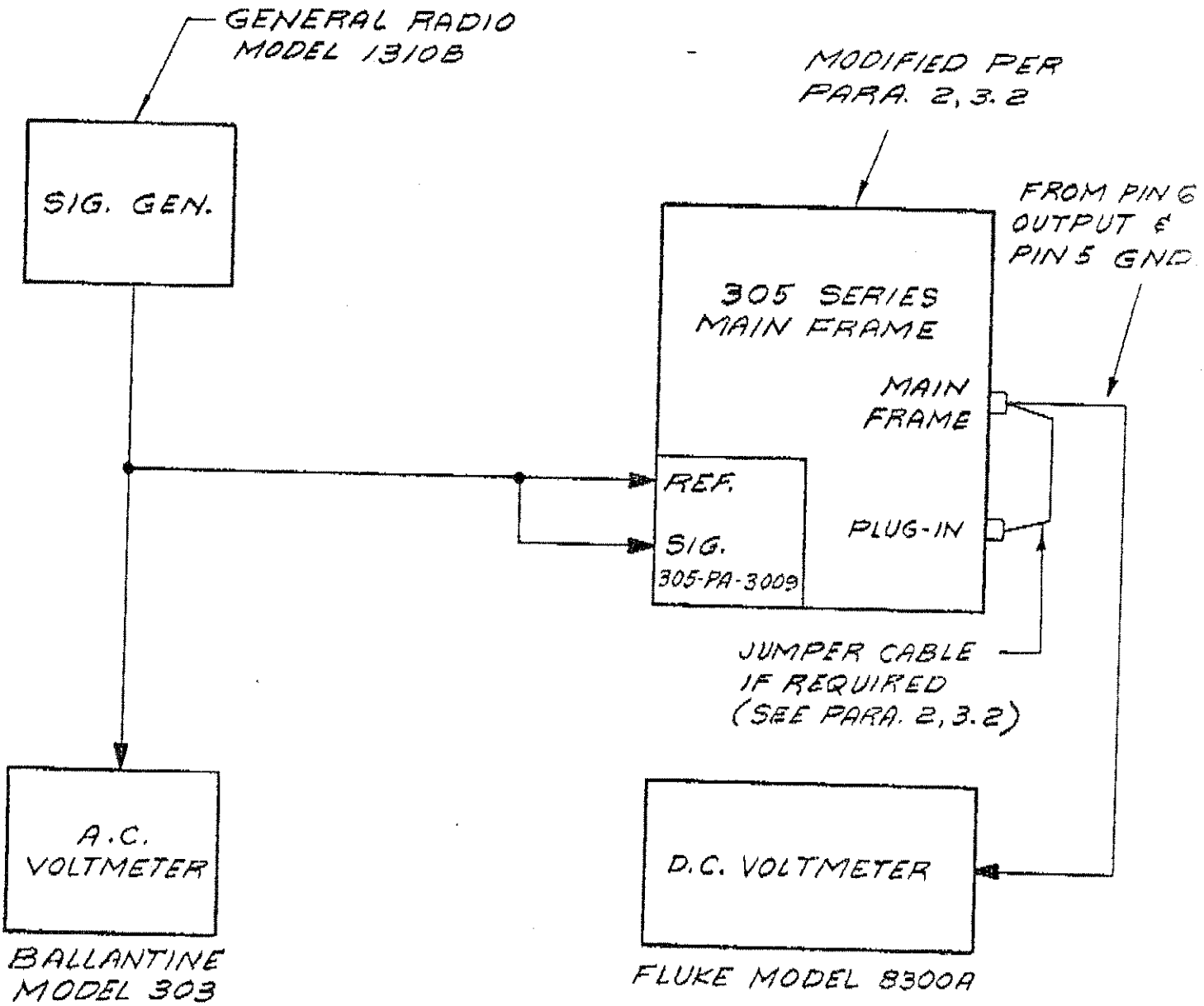


FIGURE 4-2
FREQUENCY RESPONSE TEST CIRCUIT

TABLE 4-2

FREQUENCY RESPONSE DATA SHEET

(LEVEL MEASUREMENT)

Frequency HZ	Input Level Vrms	Ref V Output V dc	Sig V Output V dc	Output Limits V dc MIN.	MAX.
10	1.00			0.92	1.08
50	1.00			0.97	1.03
100	1.00			0.97	1.03
500	1.00			0.97	1.03
1K	1.00			0.97	1.03
5K	1.00			0.97	1.03
10K	1.00			0.97	1.03
50K	1.00			0.97	1.03
100K	1.00			0.93	1.07
500K	1.00			0.90	1.10

SECTION 5

MAINTENANCE

5.1 GENERAL

No routine scheduled maintenance is required by the 305-PA-3009 plug-in. If it is desired at any time to verify the performance of the plug-in, a test may be run in accordance with paragraph 4.2. If any out of tolerance operation is noted, adjustment should be performed in accordance with paragraph 5.2. If adjustment is not adequate to correct the problem, repair may be made using the schematic diagrams along with the information contained in Section 3 and paragraph 5.3.

5.2 ADJUSTMENT PROCEDURE

5.2.1 There are twelve internal adjustments concerned with phase angle measurement in each 305-PA-3009 plug-in. These must be set correctly before adjustments concerned with level measurement are made. 5 adjustments are used to match each set of input attenuators and 1 adjustment is used to adjust each squaring circuit for minimum level sensitivity.

5.2.2 The input attenuators and the squaring circuits used in the 305-PA-3009 are nearly identical to those used in the 305-PA-3001. Adjustment procedures applicable to the 305-PA-3001 are also correct for the 305-PA-3009. These procedures are detailed in Section VI of the main frame instruction manual TM-101378A. The 305-PA-3009 function selector switch must be in the Ø ANGLE position during all adjustments concerned with phase angle measurement.

5.2.3 There are twelve internal adjustments in the 305-PA-3009 which are concerned with input level measurements. Six potentiometers on Card 4 (Bottom Card) are for the Signal input and the six potentiomets on Card 3 (2nd from bottom) are for the Reference input. The pots are all screwdrive adjustment types and are accessable from the sides of the plug-in. Refer to P.C. Board Assembly, drawing number 102, 253 to locate the various pots. Since access to the sides of the plug-in is required, it must be operated on the plug-in extender cable during this portion of the adjustment procedure. This extender is supplied with each Series 305 main frame.

5.2.4 Connect the equipment as detailed by Figure 5-1. Energize all equipment and allow a 15 minute minimum warm-up before proceeding.

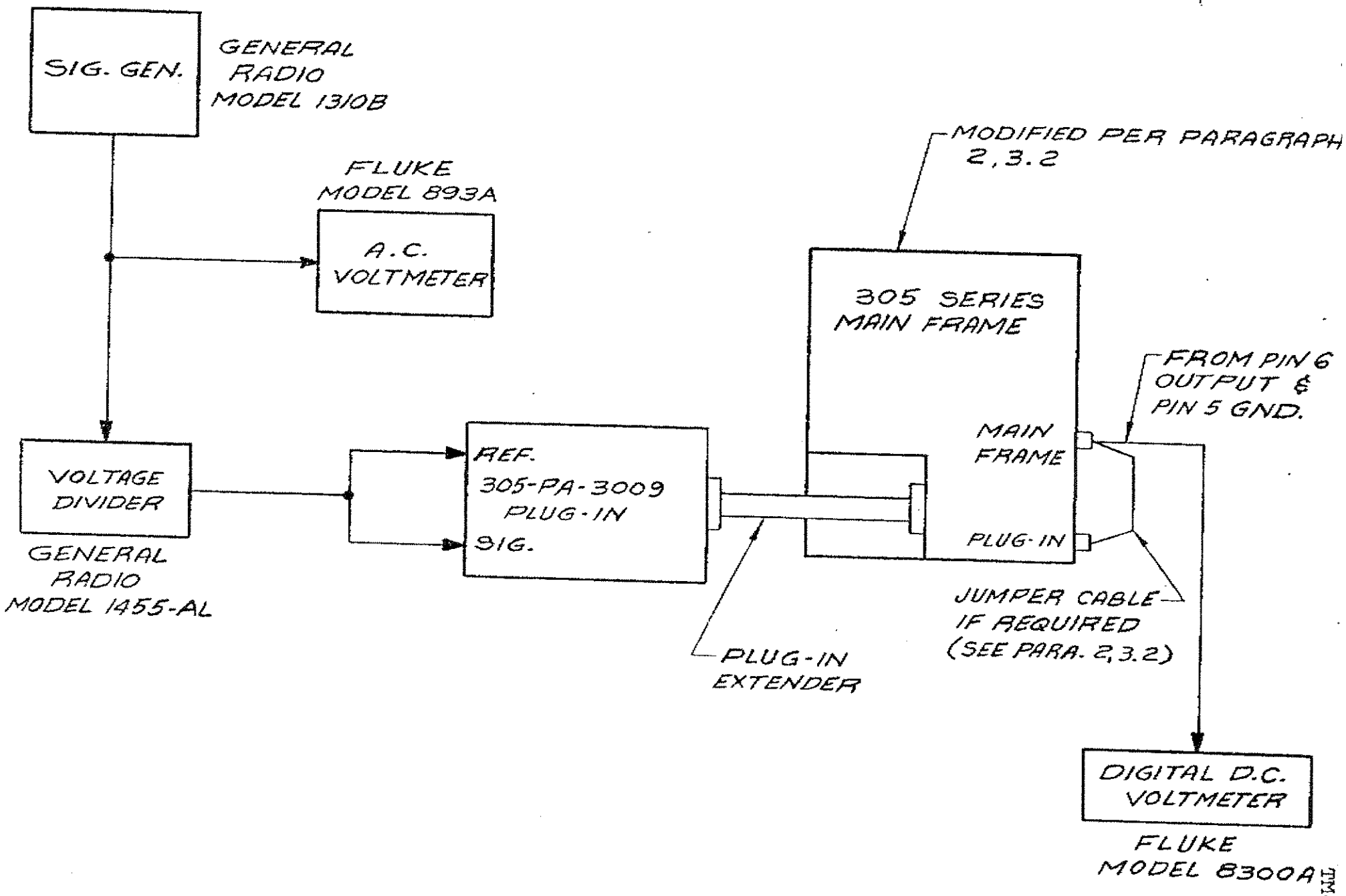


FIGURE 5-1 TEST CIRCUIT

5.2.5 Adjust the Reference Channel level measurement circuits as follows using the potentiometers located on Card 3 (2nd card from bottom).

a. Set signal generator output level to 10.00 Vrms at 1 kHz. Maintain this level constant during the entire procedure.

b. Set the 305-PA-3009 function selector switch to the "REF V" position.

c. Set the VOLTS/DBV switch to the VOLTS position.

d. Set the voltage divider to .0300 (0.3 Vrms. Output).

e. Adjust R3 for a reading of 3.00 Vdc on the D.C. voltmeter.

f. Move the VOLTS/DBV switch to the DBV position.

g. Switch the voltage divider between .0090 and .0900 (0.09 and 0.90 Vrms outputs) and note the reading of the D.C. voltmeter at both settings. Adjust R79 until a difference of 200 mv (20db) between the two readings is obtained. Clockwise rotation increases difference.

h. Switch the voltage divider between .0090 and .9000 (0.09 and 9.0 Vrms outputs) and note the reading of the D.C. voltmeter at both settings. Adjust R73 until a difference of 400 mv (40db) between the two readings is obtained. Clockwise rotation increases difference.

i. Switch the voltage divider between .2000 and .2518 (2,000 and 2,518 Vrms outputs) and note the reading of the D.C. voltmeter at both settings. Adjust R80 until a difference of 20 mv (2db) between the two outputs is obtained. Clockwise rotation increases difference.

j. Set the voltage divider to .0100 (0.100 Vrms out). Adjust R82 for a reading of -0.200 Volts (-20dBV) the D.C. voltmeter.

k. Set the voltage divider to .0010 (10 mv rms out) Adjust R41 for a reading of -0.400 Volts (-40 dB on the D.C. voltmeter.

l. Repeat steps j. and k. until both readings are correct without further adjustment of the potentiometers.

m. Make the voltage divider settings in Table 5-1 and read the D.C. output at each input. If the output voltages do not fall within the specified limits, repeat from step a. once. If the voltages still are out of limits repair is required.

TABLE 5-1
DBV OUTPUT CHECK

Voltage Divider Settings	Required output Millivolts
.999X	+200 ± 3
.3162	+100 ± 3
.1000	0 ± 3
.0316	-100 ± 3
.0100	-200 ± 3
.0050	-260 ± 3
.0010	-400 ± 4

5.2.6 Adjust the Signal Channel level measurement circuits, using the potentiometers on Card 4 (bottom card). The procedure is identical to that used for the Reference Channel (Paragraph 5.2.5) except the function selector switch must be kept in the "SIG V" position during the adjustments.

5.3. REPAIR PROCEDURE

5.3.1 When a problem develops that cannot be corrected by adjustment, repair is necessary. If adequate facilities or trained personnel are not available, the plug-in should be returned to Dranetz Engineering Laboratories Incorporated, 2385 South Clinton Ave., South Plainfield, New Jersey, 07080 for repair. Detailed information as to the nature of the problem as well as the name of the person to contact in case of questions should be included with the unit when it is returned.

5.3.2 Where the user elects to do his own repair, a signal tracing trouble shooting technique is recommended. The block diagram and theory of operation in Section 3 give the repairman an overall view of the plug-in's operation. Details are supplied by the schematic diagrams and assembly drawings included in Section 6 of this manual and in the main frame manual TM-101378A.

5.3.3 It is sometimes necessary to perform the adjustment procedure of paragraph 5.2 following a repair since component changes may influence the settings of various adjustment capacitors and potentiometers.

SECTION 6

MAIN FRAME MODIFICATION

6.1 PURPOSE

The purpose of this section is to detail a modification which may be made to existing Dranetz Series 305 main frames to provide for more convenient use with the model 305-PA-3009 plug-in. This modification will become a standard feature of newer series 305 main frames. This modification adds a switch which will allow the use of either a 305-PA-3009 or another plug-in without changing jumper wires between rear panel connectors. The change is not necessary unless plug-in types are to be changed. If only a 305-PA-3009 is to be used in the main frame, the procedure described in paragraph 2.3.2 would probably be most convenient.

6.2 MODIFICATION PROCEDURE

6.2.1 The following steps describe in detail the operations necessary to install the toggle switch supplied (C&K type 7201 or equal) in the rear panel of a Dranetz series 305 main frame.

6.2.2 Remove the cover from the unit (2 screws at lower rear).

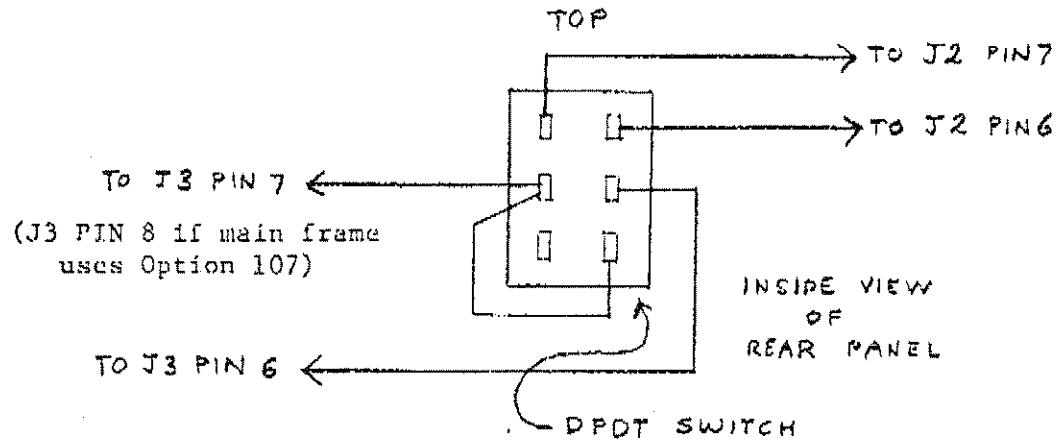
6.2.3 Keeping the unit horizontal, carefully drill a ¼" diameter hole in the rear panel. The hole should be mid-way between the"PLUG-IN" and "MAIN FRAME" connectors and approximately 1½ inches from the top of the panel. Care should be taken to keep the instrument free from chips which could cause short circuits.

6.2.4 Install the switch in the hole so the toggle operates up and down.Identify the toggle up position as "NORMAL" and the toggle down position as "3009".

6.2.5 Remove the jumper wire between pins 6 and 7 of the MAIN FRAME connector (j3). (Between pins 6 and 8 if main frame has Option 107.)

6.2.6 Wire the switch as illustrated in Figure 6-1 which follows:

FIGURE 6-1
SWITCH WIRING DIAGRAM



6.2.7 Re-install 305 main frame cover using 2 screws at lower rear.

6.2.8 The unit is now ready to operate with either a 305-PA-3009 or other plug-ins. When using a 305-PA-3009, lower the toggle to the "3009" position. When using a different plug-in, raise the toggle to the "NORMAL" position.