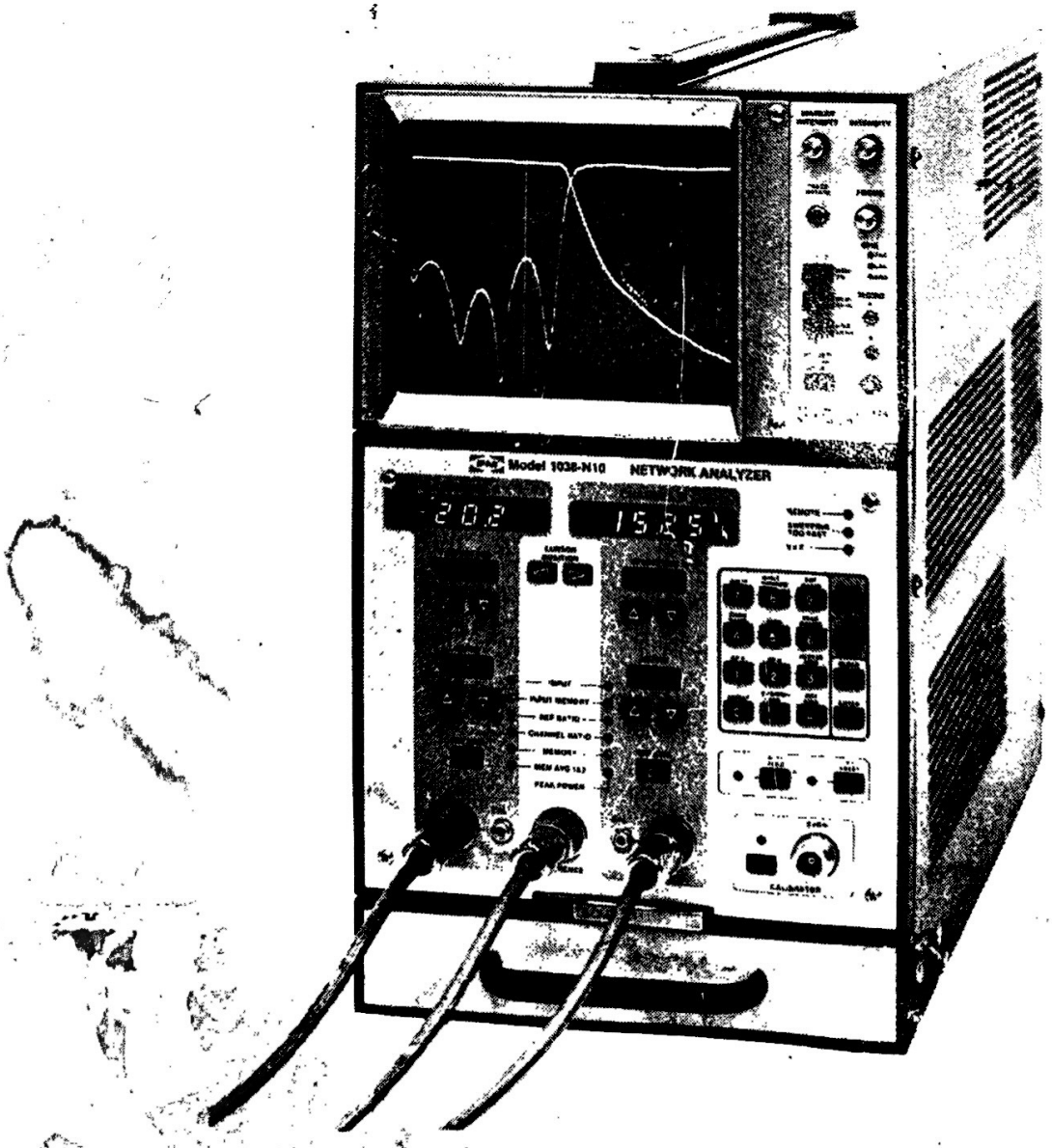
WAVETEK

Pacific Measurements Model 1038-N10 Network Analyzer

OPERATIONAL HANDBOOK



P/N 15373

ADDENDUM TO THE MODEL 1038-N10
OPERATIONAL HANDBOOK

The following changes must be made in the N10 Operational Handbook when an N10 Plug-In unit conforming to code 12 or higher is used in either a Model 1038-D14A or D14 Mainframe. All references to "D14" in the Handbook should be changed to read, "Model 1038-D14A or D14".

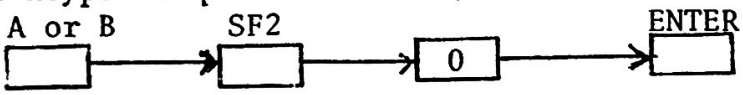
Page 3 - Sec. 1.3 Add 20 dB/DIV to the Channel A and B listing of available sensitivity settings.

Page 11 - Sec. 4.13.2 "1" Change to read: "Selects vertical sensitivity. Nine settings are available (0 through 8) to select -------" (rest the same)
Add "8" to the bottom of the Key Number column
Add "20.0" to the bottom of the dB/DIV column

Page 14 - Sec. 4.14 SF2 Change to read: Special Function Two initiates two sub-functions. These consist of the following:

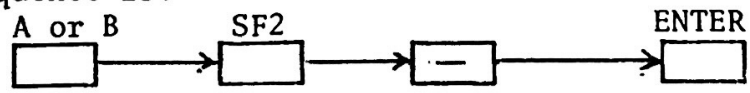
4.14.1 "0"

Used to toggle the cursor. SF2-0 will either cause the cursor to appear on the display screen if it is not already there, or to disappear if it is present. The keypad sequence is:



4.14.2 "—"

The "minus" function is used when it is desired to reset the N10 to the "power on" status. The keypad sequence is:



Page 14 - Sec. 5 GPIB Operation and Summary of Commands
Change to read: (See Section 7 of the Model D14A or D14 Operating and Maintenance Manual and Pacific Measurements Application Note AN21, "Programming the Model D14A/N10 Swept Frequency Measurement System" for general information regarding GPIB programming. These -----. (rest the same)
Change the second paragraph starting with, "The bus commands for the N10 ----" and ending with "---- would be sent over the bus." In place of this paragraph, add the following:

5.1 N10 Bus Commands used with a D14A Mainframe
The bus commands for the N10 are passed through the D14A by using a "minor" address which is one plus the D14A address. If the D14A address were 4, then the N10 address would be 5. *This means that the 1038-D14A/N10 system has two (2) addresses.* The minor address is not preceded by a "P" as with the D14 (no suffix).

5.2 N10 Bus Commands used with a D14 Mainframe
(use the existing second paragraph at this point)

Page 15 - Table A. N10 Bus Commands Add to the bottom of the Sensitivity listing: 8 = 20.0 dB/DIV

OPERATIONAL HANDBOOK – FORWARD

This Handbook is designed only to give the user the basic knowledge required to operate the N10, and is not meant to present a complete familiarization of the unit. The Model 1038-N10 Network Analyzer Instruction Manual should be referred to for any in-depth analysis of functional theory, performance evaluation, and maintenance procedures.

Sections 11, 12 and 13 of this Handbook offer specific methods of performing return loss and insertion loss/gain measurements with the N10. For an analysis of the various parameters involved in these and other measurements, see Application Note 20, "Swept-Frequency Return and Insertion Loss Measurements, and Improved Reflectometer Accuracy, Using the Model 1038 Measurement System with AUTOMEMORY®".

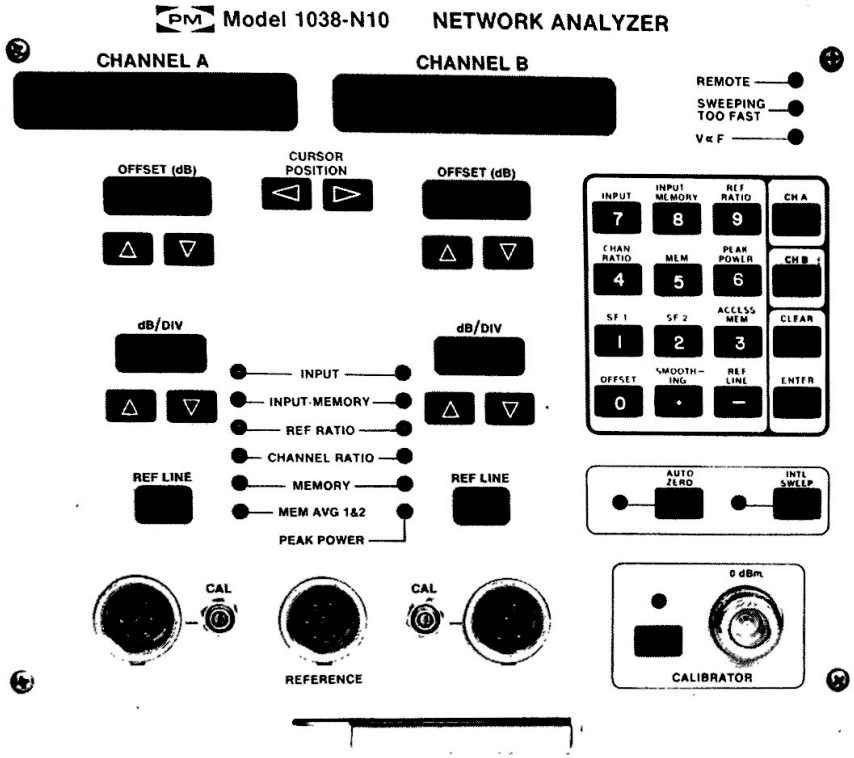


Fig. 1 Front View of Network Analyzer Plug-In

We believe you will enjoy working with your 1038-N10 unit, and that you will find it easy to use with the instructions we have provided.

However, we are not infallible and you may find something not completely covered to your satisfaction. If such is the case, don't despair (or ship it back), simply give us a call and we can probably solve the problem over the phone.

For operating advice, please call the sales department (x230) or, for repair advice, please call our Customer Service Department (x260). Our plant number is (408) 734-5780.

Thank you

N10 OPERATORS HANDBOOK TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

INTRODUCTION

The purpose of this Handbook is to instruct the operator in the correct usage and interpretation of the functions and features of the Model 1038-N10 Network Analyzer Plug-In. It is assumed that familiarization with the Model 1038-D14A Mainframe has been accomplished, so this Handbook will cover only the N10 functions.

The various front panel displays of the N10 are designed to provide information at a glance as to instrument status, as well as clear, precise readout of measurement data. If all displays for a particular channel are out, it means that that channel is turned off. When any displays are flashing, the N10 is telling the operator that further action is required to complete a command sequence. If a single indicator is flashing (such as "MEM AVG 1&2"), it means that a particular function is in progress and requires operator action (such as changing from a short to an open condition when calibrating a test set-up) to complete the function. The N10 will also tell the operator if an improper or out of sequence entry has been made by displaying an ERROR indication in the appropriate LED display window.

Use of the keypad allows the operator to quickly and precisely select and control almost all of the N10 functions. This is largely due to the fact that a logical progression is followed when entering a command sequence. First the desired channel is selected, then the desired function, then any numbers that may be required to be used with the function, and finally the ENTER command to activate the selected function. As previously mentioned, the N10 keeps the operator informed at each intermediate step of the command sequence that further action is required (flashing displays) or that a command has been improperly entered (ERROR indication). Though most of the keys are multi-functional. no "second function" keys are required due to the manner in which the N10 is programmed.

Note: Before turning on the N10 unit, see Sections 4.7 and 6 regarding internal switch settings required for certain measurements. The N10 must be removed from the 1038-D14A Mainframe to adjust these switches.

WARNING: Always be sure the 1038-D14A Mainframe is turned OFF before removing or replacing the N10 Plug-In.

Note: Figure 1 is located just preceding the Table of Contents and Figure 2 is the last page in this Handbook. Both Figures are fold-outs.

SECTION 1. FRONT PANEL CONTROLS (See Figure 1)

1.1 Cursor Position

The Cursor apppears as a full-screen-height vertical line on the CRT display. Use buttons (◁ ▷) or keypad as described in Section 4.13 to move the Cursor to wherever it is desired to take a reading. The power at that point is indicated (in dB or dBm) on the channel LED readout.

1.2 Offset

The input signal can be offset to the reference line (or wherever desired). Control buttons (△ ▽) move the selected channel A or B signal trace in 0.1 dB increments. Holding the button down causes the trace to move toward the selected location with increasing speed. The amount of offset is shown (in dB) on the LED readout. Offset can also be selected by using the keypad, as is described in Section 4.4.

1.3 dB/DIV

LED readouts indicate A and B channel vertical sensitivity (per major division on the CRT graticule). Increment/decrement but-

tons (△ ▽) will select settings as follows:

Channel A – 20, 10, 5, 2, 1, 0.5, 0.2, 0.1 dB/DIV

Channel B – 20, 10, 5, 2, 1, 0.5, 0.2, 0.1, and 0.05 dB/DIV

The keypad can also be used, as described in Section 4.13.2.

1.4 Ref Line

The Reference Line is moved through use of the keypad as described in Section 4.5. The REF LINE LED readout shows which major CRT graticule (on, above, or below the center line) has been chosen as the "0" dB Reference Line. If the Reference Line is on the center line, "CL" will be shown on the LED display.

1.5 Auto Zero

This button is used to command the N10 to re-zero itself whenever desired. It should be used frequently when working at low signal levels (< -40 dBm) to prevent possible errors appearing on the display. See Section 6 for further description.

1.6 Intl Sweep

The Internal Sweep should be turned ON when no sweep signal is being received from an external source. It can thus be used when the input signal is CW and the N10 is being used as a power meter.

SECTION 2. FRONT PANEL INDICATORS (See Figure 1)

(When lit, indicate the following):

2.1 Input

Data from the associated detector is being received by the channel (A or B) on whichever side the light is illuminated. The display is in dBm if no other light is on. This is the power meter mode.

2.2 Input-Memory

Memory is being subtracted (in dB) from the input signal of the channel where the light is illuminated.

2.3 Ref Ratio

The light is illuminated by the channel being ratioed with the reference. (i.e., dB = 10 log A/R or 10 log B/R.)

2.4 Channel Ratio

The indicator shows that the ratio of A/B or B/A is being performed. If the "A" light is on, then channel A is the controlling channel. (i.e., dB/DIV, etc. is selected in A channel and the B controls do not affect the reading.)

2.5 Memory

When "Memory" is the only light on, it indicates that the contents of the memory of whichever channel is illuminated are being displayed on the CRT. When the Access Memory function is in progress, the Memory light will flash to indicate the need to ENTER the memorized data. After entering, the Memory light will go out and the Input-Memory light will come on.

2.6 Mem Avg 1&2

Channel A only. Shows that the channel is ready to memorize the average of the previously memorized signal level and the current signal level. During a return loss calibration routine, the flashing light indicates that the operator must press the ENTER button again after changing from a short to an open condition to complete the sequence.

2.7 Peak Power

Channel B only. The light indicates that the Peak Power mode has been selected on the keypad. See Section 4.7 for the method of utilizing the Peak Power function.

2.8 Remote

Shows that the 1038-N10 unit is under the control of the IEEE Bus (GPIB).

2.9 Sweeping Too Fast

Indicates that the incoming sweep speed is beyond the maximum allowable speed for the instrument and will cause distortion of the displayed signal. The light will also flash if attempting to memorize a signal that is sweeping too fast for the memorizing circuit to follow. The operator must press the CLEAR button in this case. However, if the sweep is slowed down (light goes out), the panel will again become active and the sequence can be completed.

2.10 V ∝ F

Indicates that the voltage proportional to frequency mode is active. See Section 6 for the method of utilizing the V ∝ F function.

SECTION 3. FRONT PANEL REFERENCE AND CALIBRATION FUNCTIONS (See Figure 1)

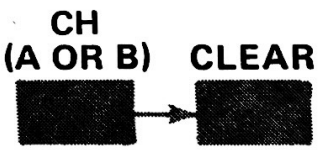
3.1 The REFERENCE detector is connected to a coupler or some other system reference point, and will sense any variation in power at that point. This causes the N10 to correct for level variations coming before the reference point and causes the display of only the difference between the reference signal and the input signal.

3.2 The CALIBRATOR connection is used to calibrate detectors associated with each active channel. It provides an accurate 0 dBm at 50 MHz output. *It should always be turned OFF when not in use.* See Section 8 of this Handbook for detector calibration procedure.

SECTION 4. FRONT PANEL KEYPAD FUNCTIONS AND OPERATION (See Figure 2)

4.1 CLEAR

Used to stop any function that is in progress when it is desired to terminate the command sequence. It is also used as an "Off" button when only one channel is used. When the unused channel has no detector attached, the channel *must* be turned OFF to allow the N10 to properly Auto Zero itself. Keypad sequence is:



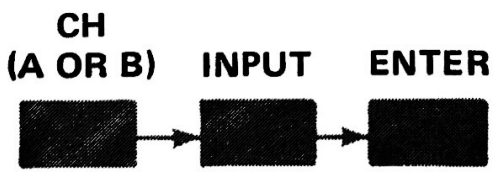
(The ENTER command is not necessary)

4.2 ENTER

Used as a final action to actuate any keypad command other than CLEAR, REF LINE, and SF2.

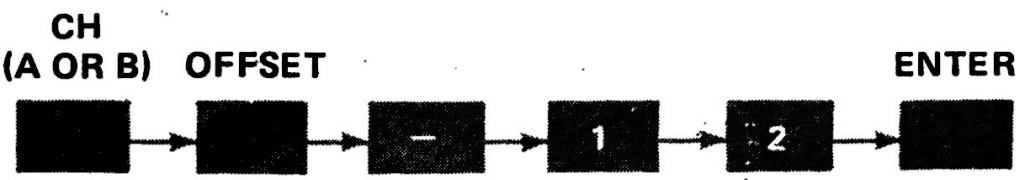
4.3 INPUT

Causes the display (in dBm) of the incoming signal for the selected channel. The keypad sequence is:



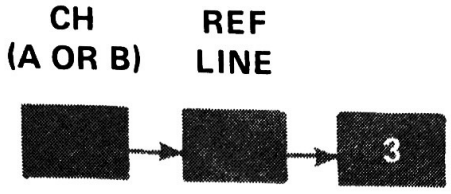
4.4 OFFSET

(See Section 1.2 for description.) If it were desired to Offset the signal to -12 dB, the keypad sequence would be:



4.5 REF LINE

(See Section 1.4.) To re-position the Ref Line upward (positive) three divisions, the keypad sequence would be:

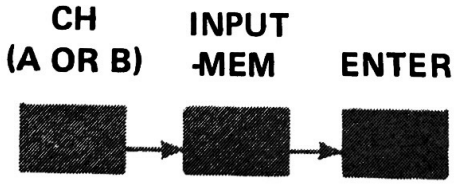


To move the line down (negative):

(It is not necessary to use the ENTER command.)

4.6 INPUT-MEMORY

Causes the display of the input signal (from the selected channel) with the contents of the memory subtracted (in dB). Keypad sequence is:

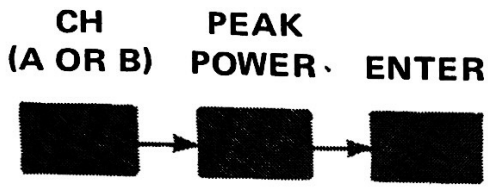


4.7 PEAK POWER

Channel B only. Allows the output of a Model 1018B Peak Power Meter to be used instead of the front panel detector input of channel B. The signal can be memorized or ratioed like any other input, and swept peak power measurements can be made.

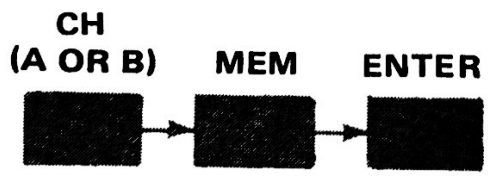
Note: Peak Power can be substituted for the input in both the REF RATIO and CHAN RATIO functions.

To use the Peak Power mode, output from the power meter is connected to the Aux 3 connection at the rear of the 1038-D14A Mainframe. A switch inside the top rear of the N10 housing must be adjusted to the desired mV/dB sensitivity. This switch is labeled "Peak Power Sensitivity" and can be adjusted to 10 or 100 mV/dB. Switch position "0" selects 10 mV/dB (standard for 1018B) and switch position "4" selects 100 mV/dB. Adjust "B CHAN" only. "A CHAN" is used only for certain internal calibration procedures (switch must be at "0"). Sequence is:



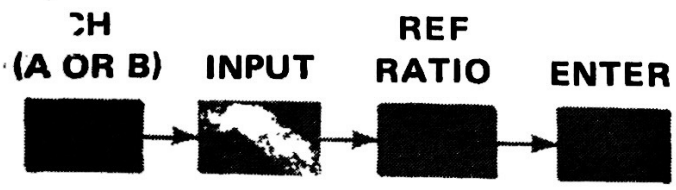
4.8 MEM

Causes the display of the contents of the memory of the selected channel. The displayed signal is dependent upon the dB/DIV sensitivity setting. Sequence is:



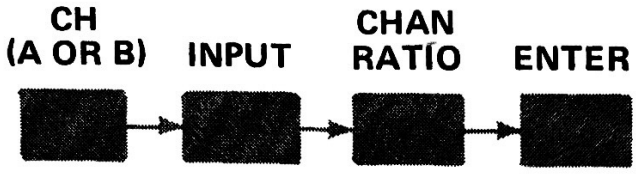
4.9 REF RATIO

Used when the reference signal level is above -30 dBm to cause the reference detector input to be ratioed with the signal of the desired channel. Sequence is:



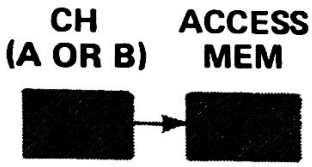
4.10 CHAN RATIO

Similar to the Ref Ratio function except that channels A or B can be ratioed to each other (i.e., display in dB = 10 log B/A or 10 log A/B). Channels A and B have more sensitivity than the reference channel (-60 dBm versus -30 dBm), so this is a useful function at low reference signal levels. Sequence is:



4.11 ACCESS MEM

Prepares the N10 for storing an input signal in the memory of the selected channel. To prepare to memorize, the keypad sequence is:

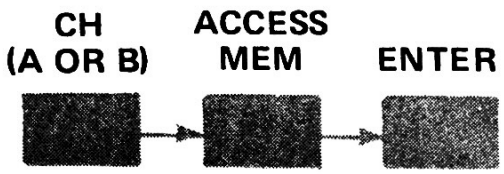


The "Memory" LED will start flashing at this point.

Note: If one channel is turned off (no detector attached), the reading will momentarily appear on that channel. This is normal, and the reading will disappear as soon as the memorizing is completed.

Pressing ENTER will cause the instrument to memorize during the next *full* sweep. When the information is memorized, the flashing "Memory" LED will go out and the "Input-Memory" LED will light. When calibrating channel A, the "Mem Avg 1&2" light will flash the first time ENTER is pressed. After changing from the short to the open condition, ENTER is pressed again and "Input-Memory" will stay lighted. This indicates that the CRT is displaying the input, with the average of the two memory calibrations subtracted out.

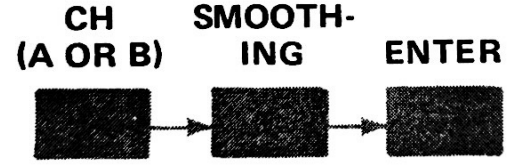
When performing the REF RATIO or CHAN RATIO functions, follow the command sequence as given in paragraph 4.9 or 4.10 and then execute the following:



The "Ref Ratio" or "Chan Ratio" and "Input-Memory" lights will turn on to indicate that the Reference Ratio or Channel Ratio (after subtracting the contents of the memory) is being displayed on the CRT.

4.12 SMOOTHING

Causes a reduction in bandwidth of the N10 log amplifier on all dB/DIV settings at signal levels of -30 dBm or below. If the "Sweeping Too Fast" light comes on, the sweep speed must be reduced to prevent signal distortion. The keypad sequence required to activate the smoothing function is:



To terminate the smoothing function, press "CH (A or B)", then "SMOOTHING", then "CLEAR".

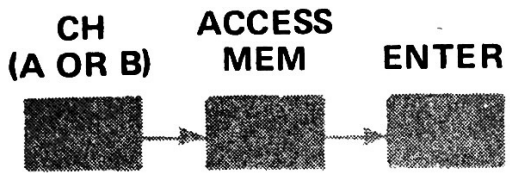
4.13 SF1

Special Function One is composed of ten different sub-functions. These consist of the following key numbers (pressed after pressing "CH (A or B)" and "SF1"):

4.13.1 "0"

Used to set a specific cursor position. For example, pressing 6.5 after pressing "SF1" and "0" will move the cursor 6.5 divisions to the right from the left side of the CRT graticule. The keypad sequence would be:

When performing the REF RATIO or CHAN RATIO functions, follow the command sequence as given in paragraph 4.9 or 4.10 and then execute the following:



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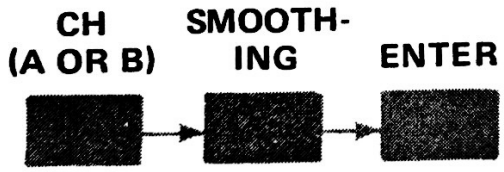

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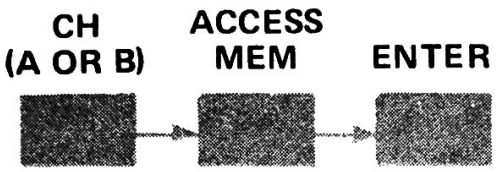

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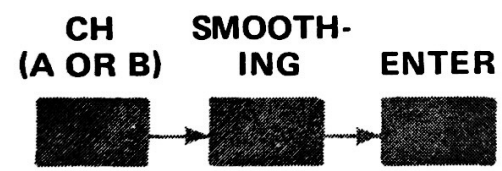

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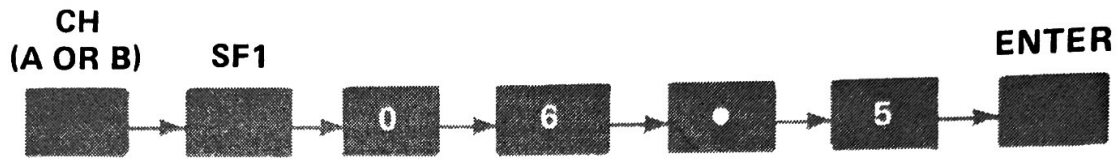
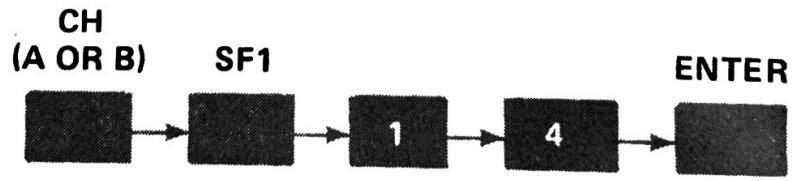


4.13.2 "1"

Selects vertical sensitivity. Nine settings are available (0 through 8) to select the desired dB/DIV increment of channels A and B. Settings correspond to the following key numbers:

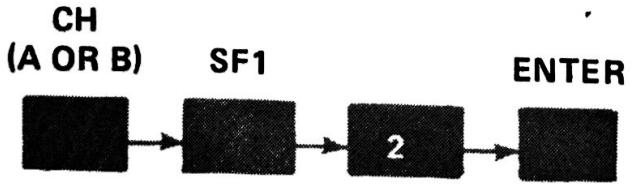
Key Number	dB/DIV
0	0.05
1	0.1
2	0.2
3	0.5
4	1.0
5	2.0
6	5.0
7	10.0
8	20.0

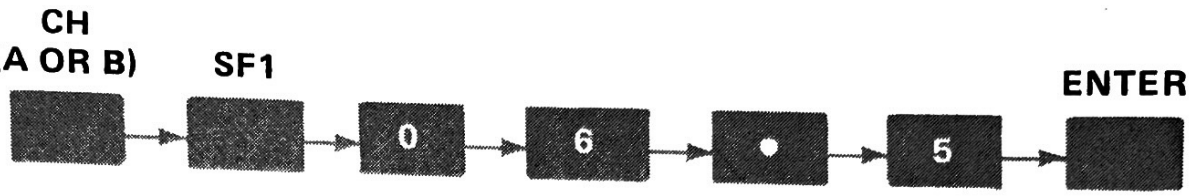
For example, if 1 dB/DIV sensitivity were desired, the keypad sequence would be:



4.13.3 "2"

Initiates a self-test function within the 1038-N10 unit. This self-tests the general condition of the analog circuitry associated with the particular channel. A healthy condition is indicated by a reading of 3 to 9 dB on the channel LED display. Both channels must be in the "Input" mode as described in Section 4.3. The keypad sequence is:





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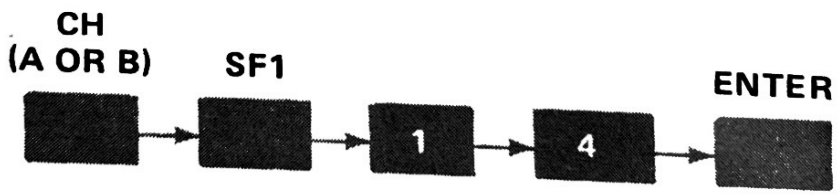
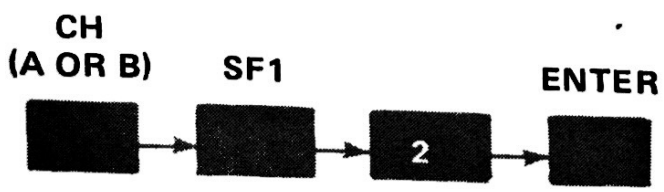
Key Number	dB/DIV
0	0.05
1	0.1
2	0.2
3	0.5
4	1.0
5	2.0
6	5.0
7	10.0
8	20.0

For example, if 1 dB/DIV sensitivity were desired, the keypad sequence would be:



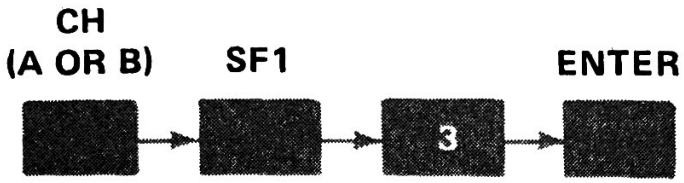
4.13.3 "2"

Initiates a self-test function within the 1038-N10 unit. This self-tests the general condition of the analog circuitry associated with the particular channel. A healthy condition is indicated by a reading of 3 to 9 dB on the channel LED display. Both channels must be in the "Input" mode as described in Section 4.3. The keypad sequence is:



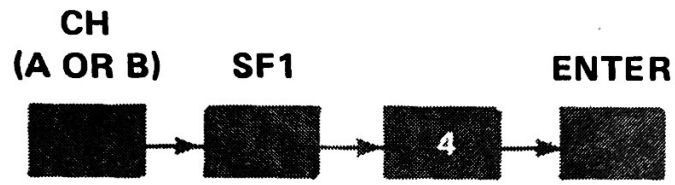
4.13.4 "3"

Used to terminate the self-test function. Sequence is:



4.13.5 "4"

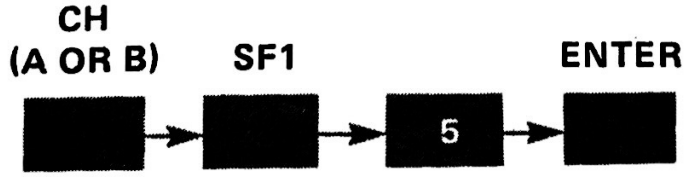
Causes the display of whatever data is currently on the GPIB. Disconnects all other inputs to the 1038-N10 unit. If there is no GPIB connection, the input will be from the external ratio signal (A/X or B/X) coming from the rear panel I/O connection. The sequence is:



4.13.6 "5"

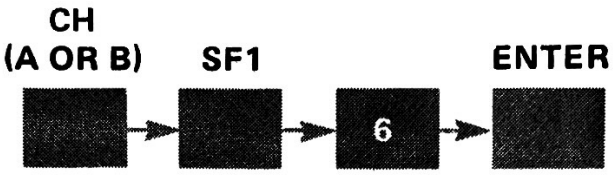
Used to enable the manual sweep mode. Disables the automatic external horizontal sweep scaling function and freezes the width. It is to be used only after the sweep width has become stable, and can be used for a period of several minutes of testing before re-enabling.

This capability of switching to a manually controlled sweep allows the user to determine the exact frequency where a power reading changes or, conversely, to look at the specific power output at some desired frequency. The keypad sequence is:



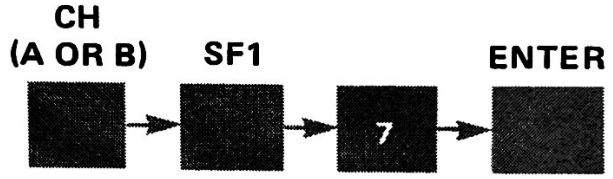
4.13.7 "6"

Re-enables the automatic sweep scaling circuitry. The keypad sequence is:



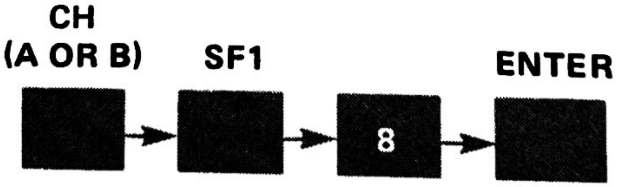
4.13.8 "7"

Used essentially as the opposite of SF1 — 4 in that it disables the input from the GPIB interface or from external ratio inputs and enables all other inputs. The keypad sequence is:



4.13.9 "8"

Causes the disconnection of all inputs from the display circuits. It also allows the selection of any combination of inputs. The keypad sequence is:

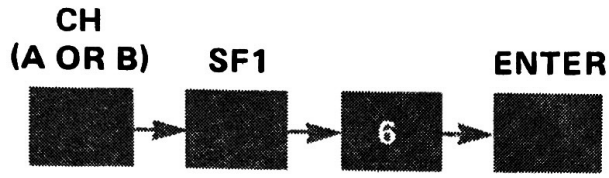


4.13.10 "9"

Sub-function Nine will cause the manual lockout of all front panel controls with the exception of the cursor controls and numbers 0 through 9 on the keypad. When "CH (A or B)" then "SF1" then "9" are pressed, any 0 through 9 digit pressed after that will go through the GPIB, signal for an SRQ, and tell the operator to set up the predetermined test conditions for the entire ATE system. SF1-9 can be used when the N10 is connect-

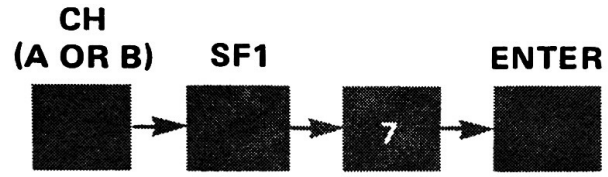
4.13.7 "6"

Re-enables the automatic sweep scaling circuitry. The keypad sequence is:



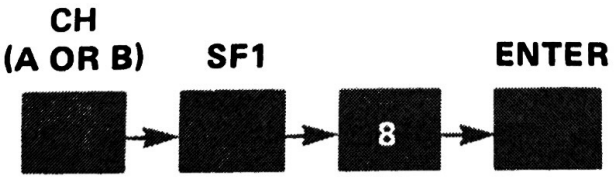
4.13.8 "7"

Used essentially as the opposite of SF1 – 4 in that it disables the input from the GPIB interface or from external ratio inputs and enables all other inputs. The keypad sequence is:



4.13.9 "8"

Causes the disconnection of all inputs from the display circuits. It also allows the selection of any combination of inputs. The keypad sequence is:



4.13.10 "9"

Sub-function Nine will cause the manual lockout of all front panel controls with the exception of the cursor controls and numbers 0 through 9 on the keypad. When "CH (A or B)" then "SF1" then "9" are pressed, any 0 through 9 digit pressed after that will go through the GPIB, signal for an SRQ, and tell the operator to set up the predetermined test conditions for the entire ATE system. SF1-9 can be used when the N10 is connect-

ed to the GPIB or when it is desired to lock out the front panel in a production application.

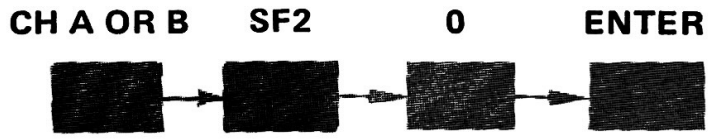
To terminate the SF1-9 function and return to a normal operating mode, it is necessary to either turn OFF the instrument for at least 10 seconds or send a system reset command through the bus (bus command "PD").

4.14 SF2

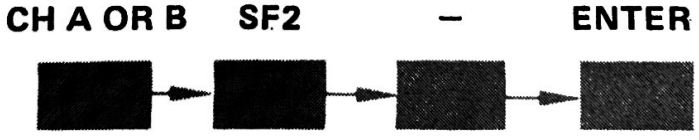
Special Function Two initiates two sub-functions. These consist of the following:

4.14.1 "0"

Used to toggle the cursor. SF2-0 will either cause the cursor to appear on the display screen if it is not already there, or to disappear if it is present. The keypad sequence is:



4.14.2 "–" The "minus" function is used when it is desired to reset the N10 to the "power on" status. The keypad sequence is:



Note: It should be remembered that there can be no RF input for the Auto Zero function to operate properly when the instrument is reset.

SECTION 5 GPIB OPERATION AND SUMMARY OF COMMANDS

(See Section 7 of the Model D14A or D14 Operating and Maintenance Manual and Wavetek Pacific Measurements Application Note AN21, "Programming the Model D14A/N10 Swept Frequency Measurement System" for general information regarding GPIB programming. These publications offer instructions for establishing programming routines, as well as command listings and samples programs, that are beyond the scope of this Handbook.)

5.1 N10 Bus Commands Used with a D14A Mainframe

The bus commands for the N10 are passed through the D14A by using a "minor" address which is one plus the D14A address. If the D14A address were 4, then the N10 address would be 5. *This means that the 1038-D14A/N10 system has two (2) addresses.* The minor address is not preceded by a "P" as with the D14 (no suffix).

5.2 N10 Bus Commands Used with a D14 Mainframe

The bus commands for the N10 are passed through the D14 Mainframe by prefixing a "P" (for plug-in) in front of the commands. For example, to access channel A, a "PA" command would be sent over the bus to the D14. To turn off channel B, a "PBC" command would be sent over the bus.

The commands for the N10 follow the keystrokes almost one for one, so learning to program the unit should be a comparatively simple procedure. Table A identifies the keyboard command and indicates the bus command that remotely activates the same function.

Table A. N10 Bus Commands

Channel A	A
Channel B	B
Enter	E
Clear	C
Auto Zero	Z
Internal Sweep	I
External Sweep	X
Calibrator ON	K
Calibrator OFF	J

Secondary Functions (etched above each keypad button)

Offset	0
SF1	1– (Followed by 0 through 9 for the specific function).
SF2	2– (Followed by 0 or – for specific function).
Access Memory	3
Channel Ratio	4
Memory	5
Peak Power	6
Input	7
Input-Memory	8
Reference Ratio	9
Smoothing	•
Reference Line	–

Indirect Functions

Sensitivity	S (followed by number from 0 - 8)

0 = 0.05 dB/DIV
1 = 0.1
2 = 0.2
3 = 0.5
4 = 1.0
5 = 2.0
6 = 5.0
7 = 10.0 dB/DIV
8 = 20.0 dB/DIV

Table A. N10 Bus Commands

Channel A	A
Channel B	B
Enter	E
Clear	C
Auto Zero	Z
Internal Sweep	I
External Sweep	X
Calibrator ON	K
Calibrator OFF	J

Secondary Functions (etched above each keypad button)

Offset	0
SF1	1— (Followed by 0 through 9 for the specific function).
SF2	2— (Followed by 0 or — for specific function).
Access Memory	3
Channel Ratio	4
Memory	5
Peak Power	6
Input	7
Input-Memory	8
Reference Ratio	9
Smoothing	•
Reference Line	—

Indirect Functions

Sensitivity . . . . . S (followed by number from 0 - 8)

0 = 0.05 dB/DIV
1 = 0.1
2 = 0.2
3 = 0.5
4 = 1.0
5 = 2.0
6 = 5.0
7 = 10.0 dB/DIV
8 = 20.0 dB/DIV

SECTION 6. VOLTAGE PROPORTIONAL TO FREQUENCY AND AUTO ZERO FUNCTION

6.1 Voltage Proportional to Frequency

The voltage proportional to frequency (V ∝ F) function can be used when a sweep generator is available that has a V ∝ F capability. The V ∝ F function allows the operator to "zoom in" on a narrow segment of a broad band of frequencies. Sweep end points can be changed at will and still preserve memory correction calibration.

To use the V ∝ F function, connect the V ∝ F output (labeled "1V/GHz" or "Frequency Reference") from the sweeper to the Aux 2 connection at the rear of the D14A Mainframe and change the internal switch to positions 0 to 1 as shown in Table B below. The "V ∝ F" light will turn on to indicate that the function is available for use. This means that the horizontal memory address of the instrument is now proportional to the input signal rather than the 0 to 10V ramp that is usually used. This, in turn, means that sweeper start and stop frequencies can be changed whenever desired without requiring any re-calibration.

6.2 Auto Zero Function

The purpose of the Auto Zero function is to remove offsets caused by thermal EMF's external to the N10. The unit contains both an internal and external automatic zeroing capability. The internal zeroing is always active, regardless of switch position (Table B), and helps to assure that the instrument's signal conditioning circuitry is staying within specifications. The external zeroing function places the detectors in the Auto Zero circuit loop.

Automatic zeroing is accomplished in two ways. If the sweep generator turns the RF power completely off (zero power) during the retrace period, zeroing is automatically activated during every retrace cycle. If the sweep generator does not turn the RF power off during retrace, the sweeper can be turned off and the AUTO

ZERO button pressed periodically to assure that the instrument is zeroed. If balanced detectors are used, the thermal drift due to the detectors is minimized, thus requiring less periodic zeroing.*

A switch inside the N10 housing must be set to enable the instrument to accept the V ∝ F sweeper input and turn the Auto Zero function on and off. Access to this switch is through the indicated vent hole on the top rear of the housing. Turning the switch to the "0" setting will turn ON the V ∝ F and leave ON the Auto Zero. Turning the switch to the "2" setting will turn OFF the V ∝ F and leave ON the Auto Zero. The V ∝ F should be turned OFF whenever the function is not being used. Available switch positions for turning both the V ∝ F and external Auto Zero functions ON or OFF are given in Table B.

Function	Switch Position
External Auto Zero and V ∝ F ON	0
External Auto Zero and V ∝ F OFF	3
External Auto Zero ON and V ∝ F OFF	2 — Normal Position
External Auto Zero OFF and V ∝ F ON	1

Table B. V ∝ F and Auto Zero Switch Settings

*If the signal level is *always above -30 dBm,* then the Auto Zero function need *never* be used.

SECTION 7. INITIAL TURN-ON PROCEDURE (See Sections 11, 12, and 13 for typical set-ups.)

7.1 Connect detector(s). Channel A is usually used for return loss measurements. Channel B is usually used for insertion loss/gain measurements.

7.2 Be sure that there is no RF power applied to the N10.

7.3 Turn Mainframe power ON.

7.4 If only one channel is to be used and the other channel has no detector attached, turn OFF the unused channel (press the channel letter and then the "Clear" button on the keypad).

7.5 After warm-up (Auto Zero light off), with no RF applied, the channel LED readout(s) should display:

CH A and/or B . . . . . -65 to -80 dB
OFFSET 0.0
dB/DIV 10.0
REF LINE CL

If channel A and/or B does not read -65 to -80 dB, press the AUTO ZERO button again after about 5 minutes. The instrument may not be completely warmed up.

SECTION 8. DETECTOR CALIBRATION

8.1 Allow at least 10 minutes warm-up time. Longer (at least 20 minutes) if the instrument has been stored in a cold place.

8.2 Connect the detector to be calibrated to the CALIBRATOR input on the front panel.

8.3 Turn ON the CALIBRATOR and the INTL SWEEP (above the Calibrator).

8.4 Set the Cursor to the center of the screen.

8.5 Set the OFFSET to 00.0, dB/DIV to 0.1 dB, and the REF LINE to CL.

8.6 Press "CH (A or B)", then "INPUT", then "ENTER" buttons on the keypad.

8.7 The trace should be in the middle of the CRT screen and the channel readout should read 0.0.

8.8 If the readout is anything other than 0.0, adjust the CAL pot next to the detector input until 0.0 is obtained.

SECTION 9. ABSOLUTE POWER DISPLAY

> *Note: If a Hewlett-Packard Model 8350 Sweep Generator is used as the swept source, the sweeper ramp can change form at about 1 sweep per second. This higher speed ramp form can cause display problems on the N10. If display anomalies are noted, slow the sweep speed to below 1 sweep per second.*

9.1 If power is to be displayed against another variable (frequency), connect the horizontal ramp from the sweep generator to Aux 1 at the rear of the D14A Mainframe.

9.2 Set the sweep generator to repetitive sweep. *(Note: Horizontal position and width are automatically adjusted for correct location and size.)*

9.3 Connect the detector to the device under test and be sure the OFFSET display LED reads 00.0, REF LINE is set to CL, and the dB/DIV is adjusted to read 10 dB/DIV.

9.4 Press "CH (A or B)", then "INPUT", and then the "ENTER" buttons on the keypad. The signal trace should appear on the CRT display.

9.5 Set the REF LINE, OFFSET, and dB/DIV to the desired positions and take the reading.

9.6 To use the SMOOTHING feature, press the channel of interest, then "SMOOTHING", then the "ENTER" buttons.

9.6.1 If there is any distortion of the signal waveform, slow the sweep until the signal appears normal.

9.7 For greater sensitivity (to see small signal variations across a given band of frequencies):

9.7.1 Move the portion of interest of the displayed signal to the reference line using the OFFSET adjustment.

9.7.2 Increase the sensitivity as required.

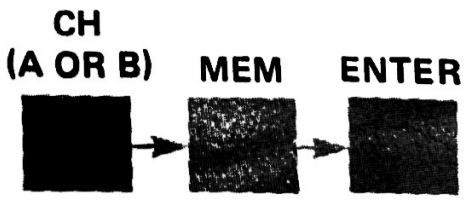
9.7.3 The reading on the OFFSET LED display is the power (in dBm) at the point where the trace crosses the reference line. The channel readout will show the power reading wherever the cursor is positioned.

SECTION 10. USE OF THE MEMORY

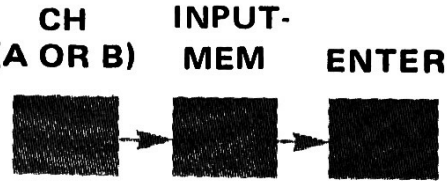
> *Caution: The sweep cannot be too fast while memorizing or errors will be generated due to bits of information being lost. If the sweep is too fast, this will be indicated by the instrument through the flashing of the Sweeping Too Fast error light, audible beeping, and a lock-up of all the instrument's functions (except CLEAR) until the sweep generator is slowed down sufficiently to allow accurate recording. See Section 2.9.*

10.1 Single Reference

To store any single reference signal in the memory of either channel, the ACCESS MEM function is used as described in Section 4.11 of this Handbook. To check the contents of the memory of either channel, press



When the INPUT-MEM function is used to display the input signal (from the selected channel) with the contents of the mem-

ory subtracted (in dB), press 

When this is done, a straight line should result. This is because the calibration curve just recorded is subtracted in (dB) from the input calibration curve. When subsequent measurements are made, the data displayed will be just the characteristics of the RF device. This is because the apparent calibration curve is a straight line corresponding to the reference line.

10.2 Average of Two References

To avoid errors due to coupler or bridge test port mismatch during calibration for return loss measurements, two reference curves can be averaged. The first curve is made using an open circuit on the test port, and the second curve is made by replacing the open with a short. Since the two reflected signals are 180 degrees out of phase, the resultant curves will have equal and opposite errors. By averaging the curves, the final calibration curve will be correct. This removes the test port as a source of uncertainty in the measurement.

The N10 accomplishes the above on channel A, through use of the MEMORY function and the MEM AVG 1&2 indication, as described in Section 2.6. After ENTER is depressed, the characteristic of the open condition is averaged with the characteristic of the short condition. The result is placed in memory. Unlike the straight line obtained with a single reference, the memorized average typically is not a straight line.

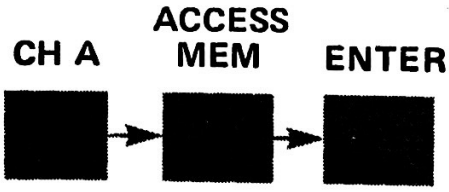
SECTION 11. INDIVIDUAL RETURN AND LOSS INSERTION LOSS/GAIN MEASUREMENT PROCEDURES

11.1 Return Loss Procedure (See Fig. 3 for typical test setup)

11.1.1 Prior to return loss testing, the sweep generator should be ad-

justed to the desired frequency range, sweep speed, and power level.

11.1.2 Connect a calibrated short to the bridge test port.

11.1.3 Press 

Note that the LED indicating Memory Average 1&2 is blinking when this step of the normalizing is completed.

11.1.4 Replace the calibrated short with the calibrated open on the test port.

Press 

11.1.5 The channel A Input-Minus-Memory LED will be lit and the channel A cursor display will read in dB.

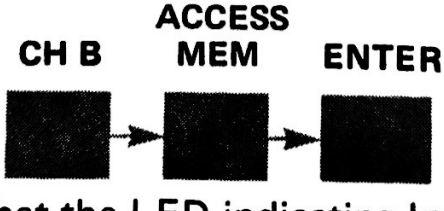
11.1.6 Connect DUT as shown in Fig. 3.

11.1.7 Return loss readings can now be taken by moving the cursor to any desired location.

11.2 Insertion Loss/Gain Procedure (See Fig. 4 for typical test setup)

11.2.1 Prior to insertion loss/gain testing, the sweep generator should be adjusted to the desired frequency range, sweep speed, and power level.

11.2.2 Connect the channel B detector to the output port of the attenuator.

11.2.3 Press 

Note that the LED indicating Input-Minus-Memory is lit and the channel B cursor display readout window is reading in dB.

11.2.4 Insert DUT as shown in Fig. 4.

11.2.5 Insertion loss/gain readings can now be made by moving the cursor to any desired location.

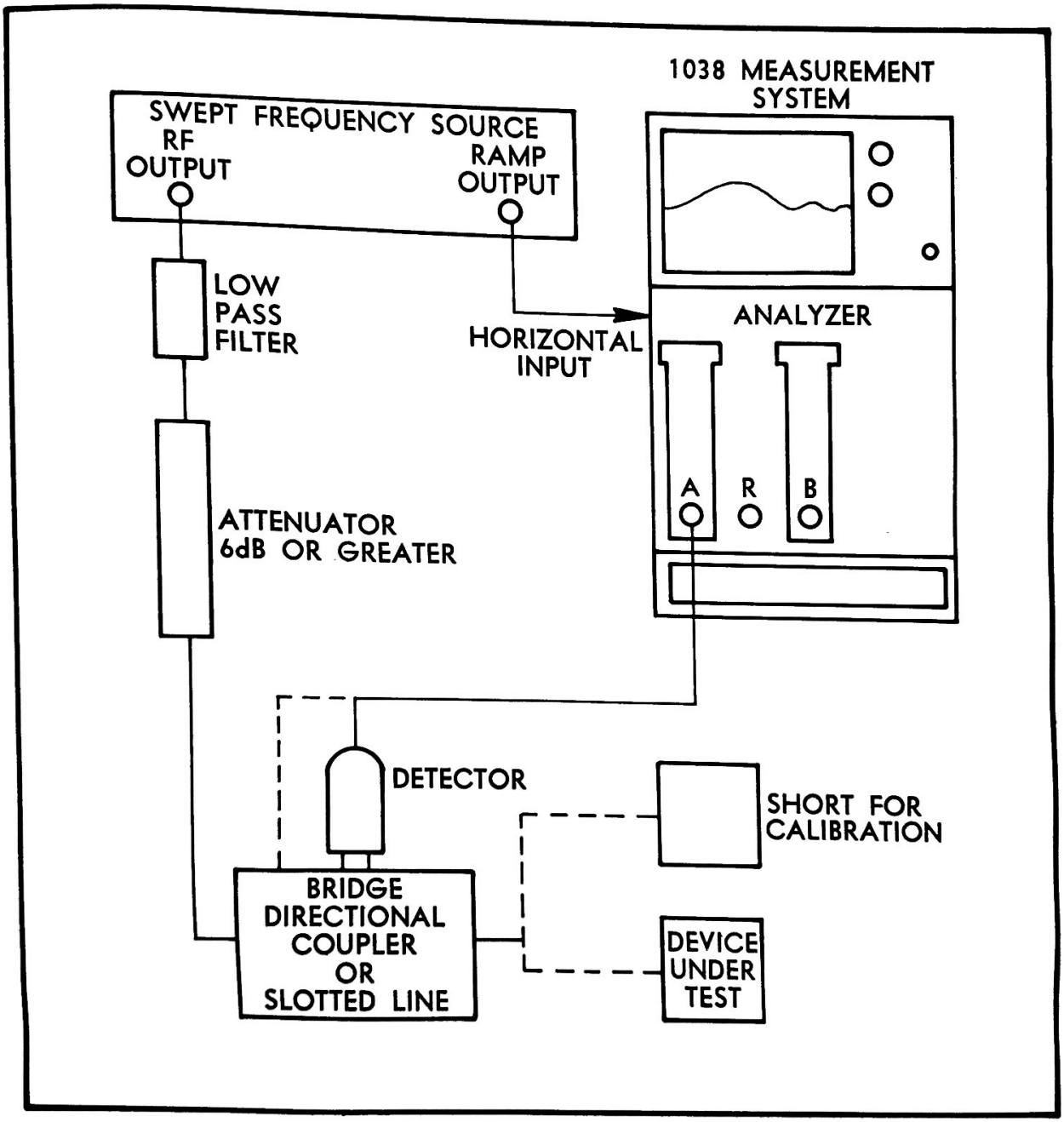


Figure 3. Return loss measurement test system using an attentuator to guarantee a good source match.

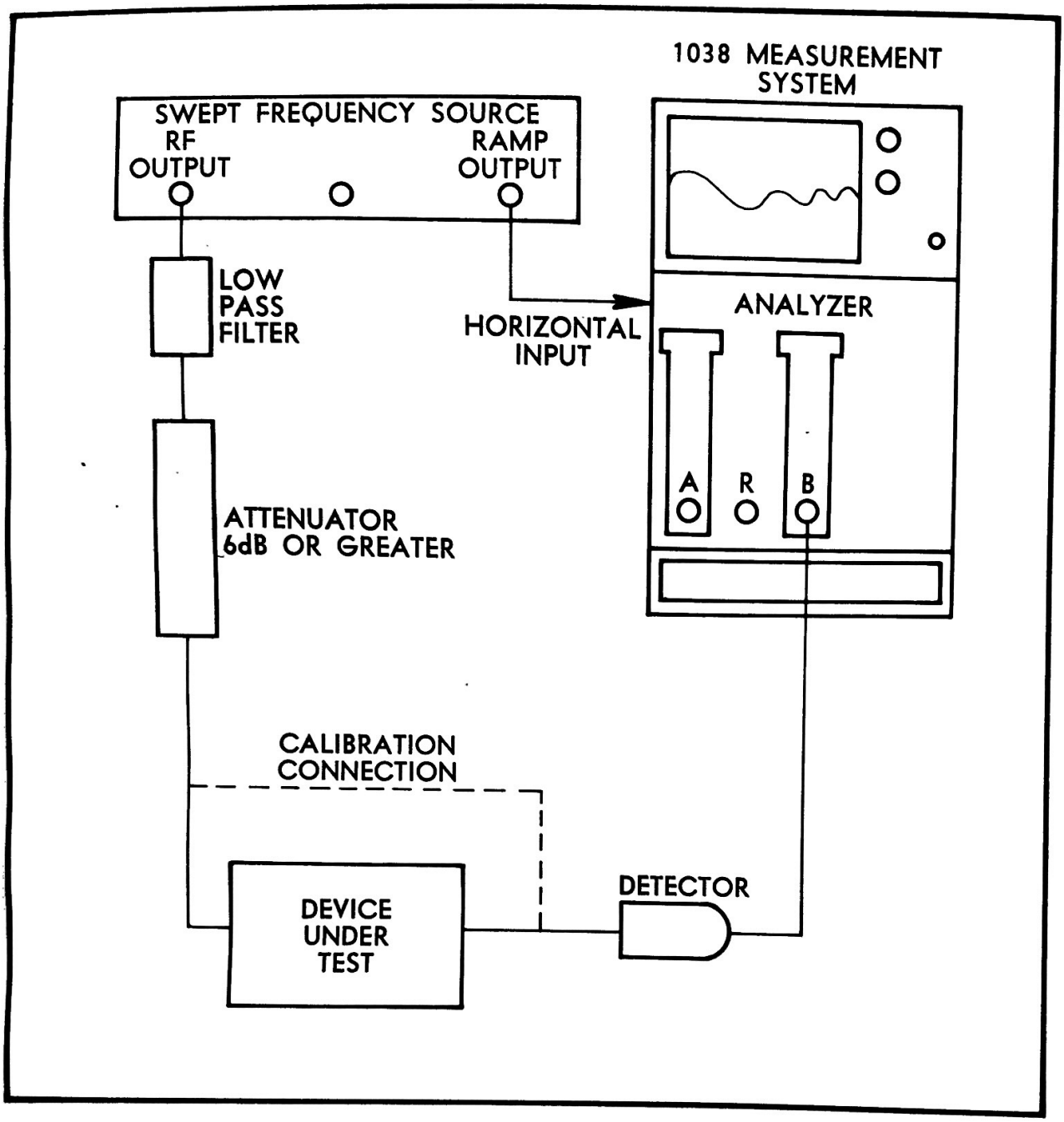


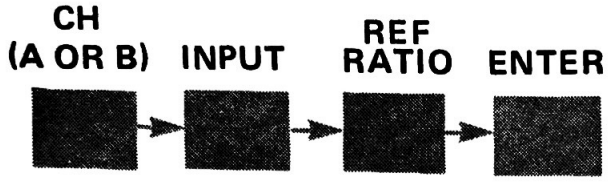
Figure 4. Insertion loss measurement test system using an attentuator to guarantee a good source match.

SECTION 12. RATIO MEASUREMENTS (See Figs. 5 & 6 for typical return and insertion loss test setups)

12.1 Reference Ratio

At reference signals higher than -30 dBm, the reference detector can be used to correct for sweeper drift and other undesirable characteristics that might distort the readings while performing

a calibration routine. The setup is made as shown in Fig. 5 for return loss or Fig. 6 for insertion loss, using a directional coupler instead of an attenuator.



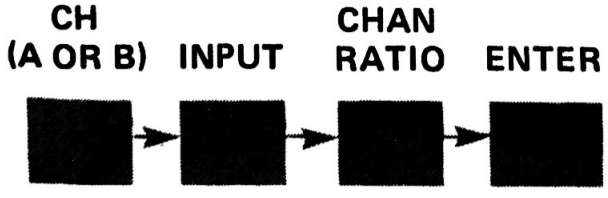
12.1.1 Press

(Channel A is pressed if the second detector is attached to channel A; channel B if other detector is connected to channel B — See Section 2.3).

12.1.2 Continue as described in Sections 11.1.3 through 11.1.7 if making a return loss measurement, or as given in Sections 11.2.3 through 11.2.5 if making an insertion loss/gain measurement.

12.2 Channel Ratio

The Channel Ratio function is similar and can be used like the Reference Ratio function except that channels A & B can be ratioed to each other rather than the reference channel. Since channels A & B have greater sensitivity than the reference channel (-60 dBm versus -30 dBm) this function is useful at low signal levels. An added advantage of this mode is that the reference channel (A or B) is in the INPUT mode and thus is measuring the power level (dBm). This means that a power meter is not required to set input or output power levels. To activate the Channel Ratio function, select which channel (A or B) is to be ratioed to the other and perform the following sequence:



Press

12.2.1 Continue as described in Sections 11.1.3 through 11.1.7 if making a return loss measurement, or as given in Sections 11.2.3 through 11.2.5 if making an insertion loss/gain measurement.

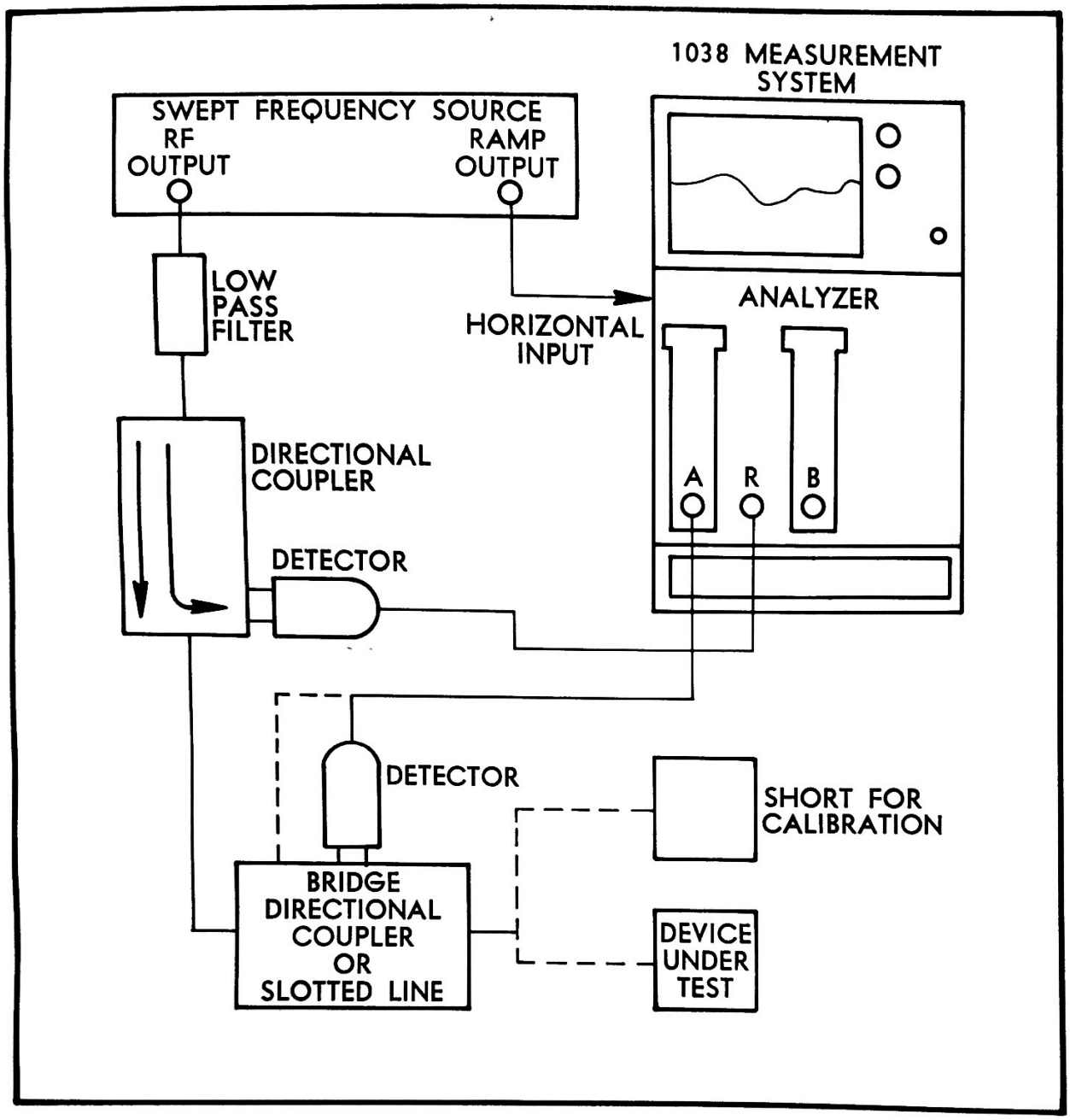


Figure 5. Return loss measurement test system using the ratio input of the Model 1038 to take into consideration incident wave variations.

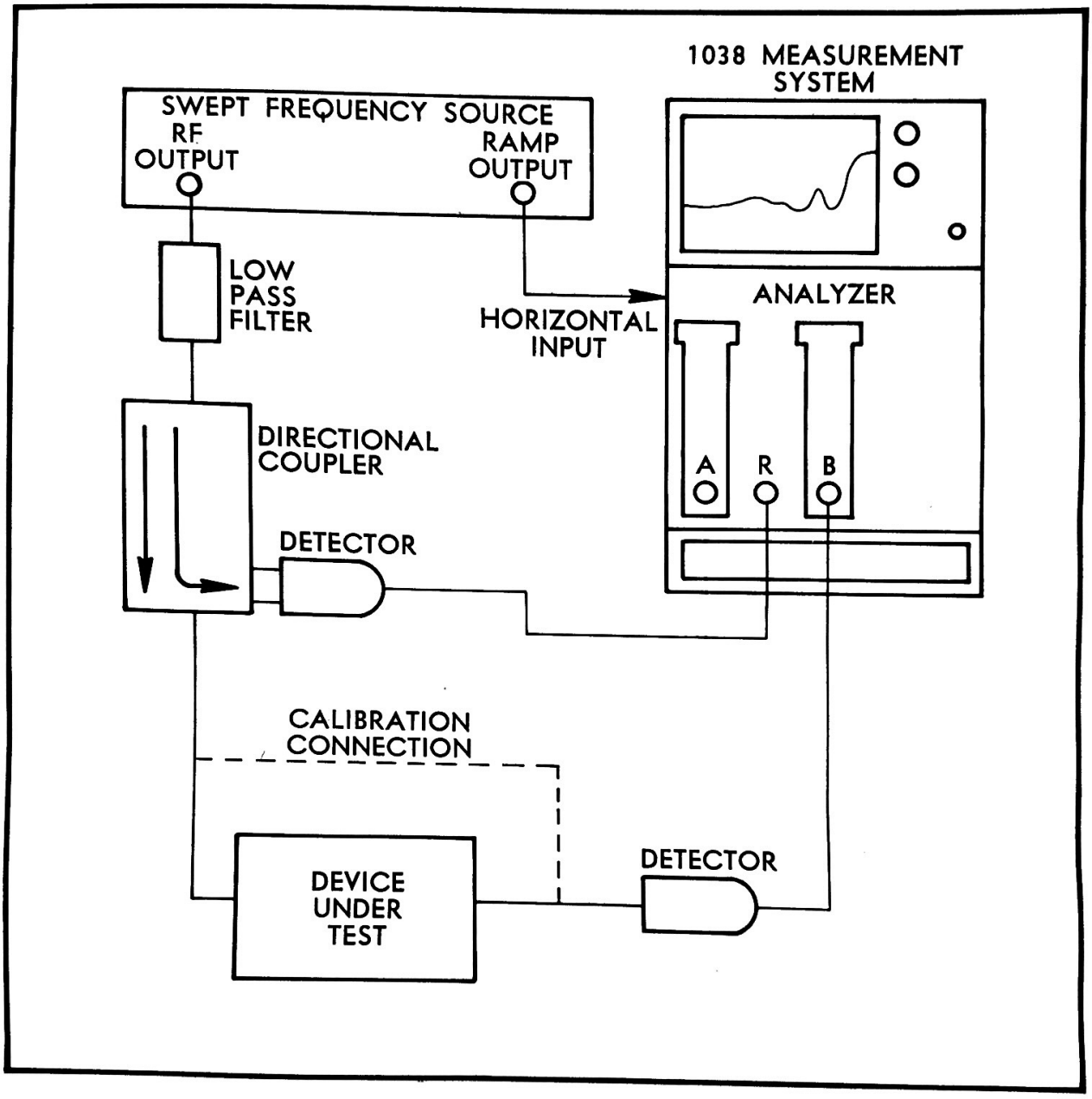


Figure 6. Insertion loss measurement test system using the ratio inputs of the Model 1038 to take into consideration incident wave variations.

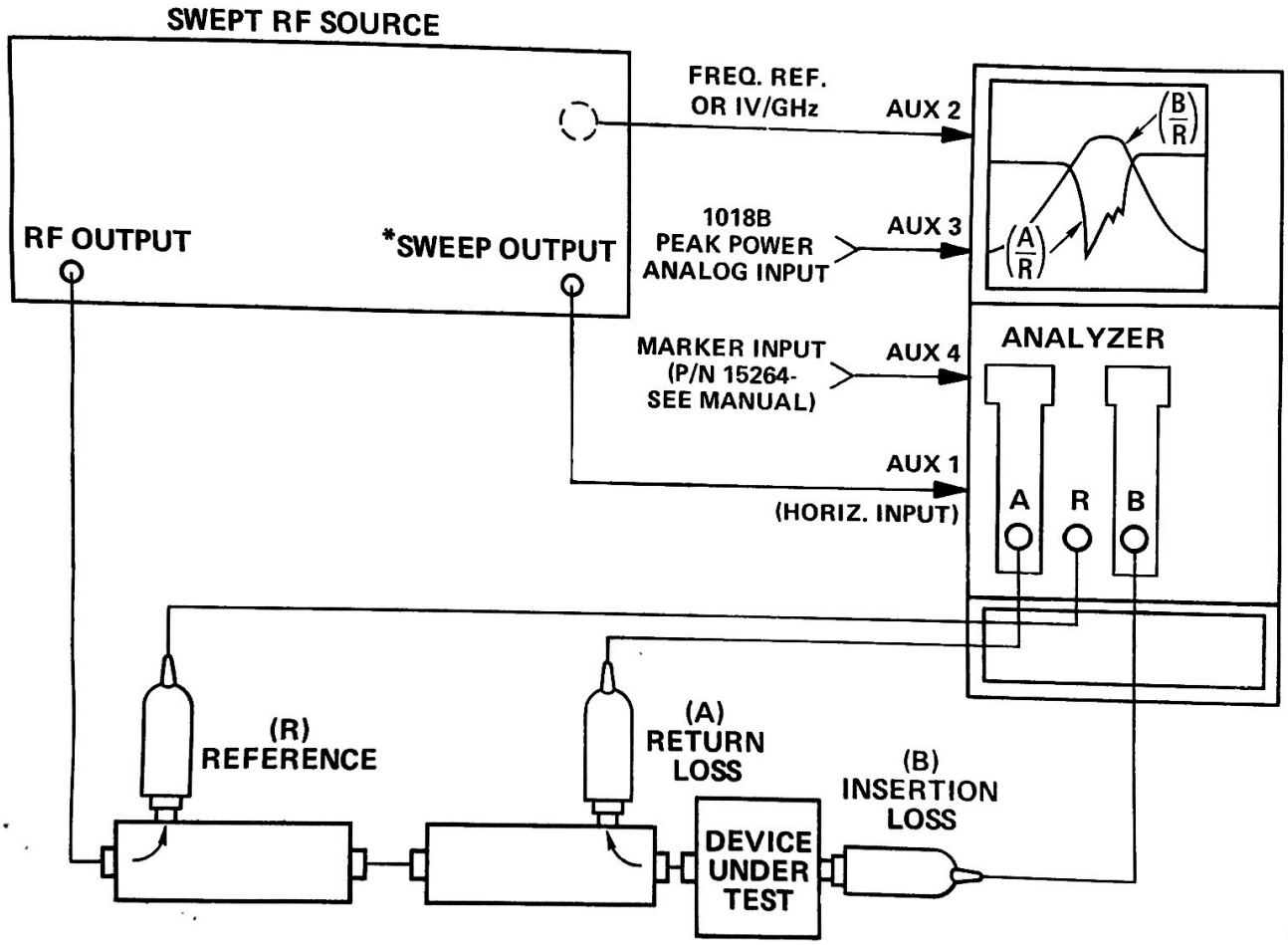
SECTION 13. SIMULTANEOUS RETURN LOSS AND INSERTION LOSS/GAIN MEASUREMENT PROCEDURES (See Fig. 7 for typical test setup).

13.1 After setting up the test system similar to Fig. 7, calibrate for return and insertion loss as given in Sections 11 and 12.

13.2 Set the REF LINE, OFFSET, and dB/DIV to the desired posi-

tions.

13.3 The reading on the OFFSET LED display is the power (in dB) at the point where the trace crosses the reference line. By moving the cursor to any desired location on the trace, the channel A LED display will show the return loss and the channel B LED display will show the insertion loss/gain at that point.



* Sweep retrace time must be > 5 ms.
Sweep forward time must be > 20 ms.

Figure 7. Typical N10 System Return Loss and Insertion Loss/Gain Set-Up

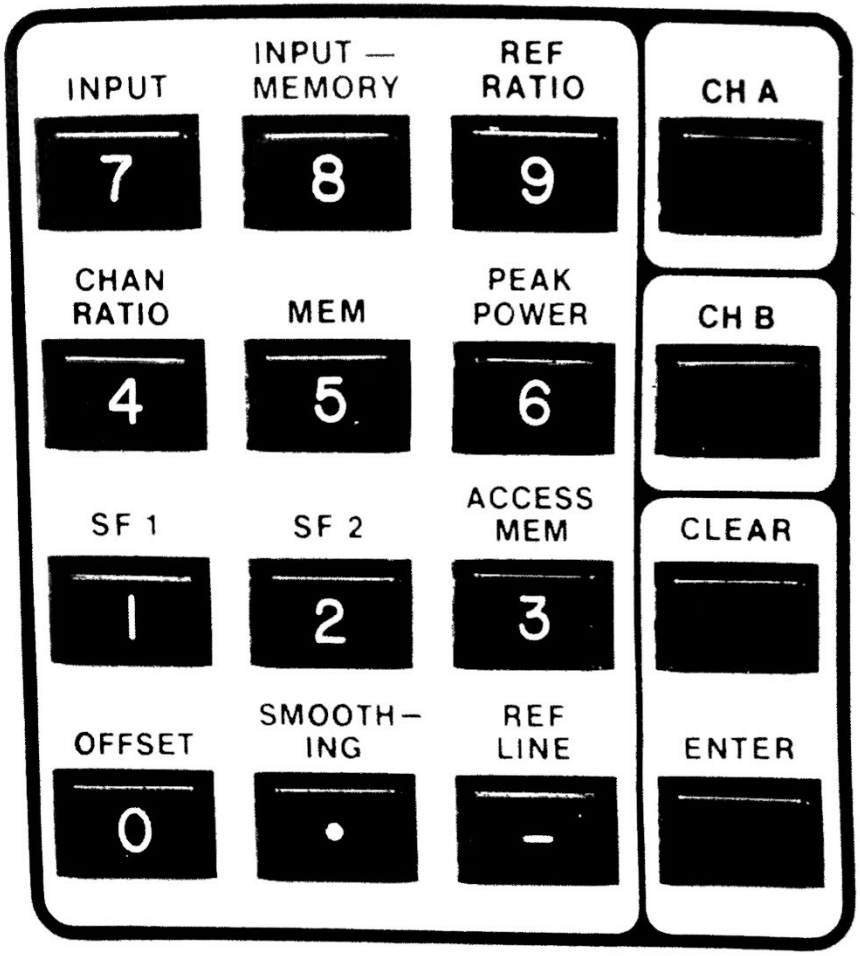


Fig. 2 N10 Keypad

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