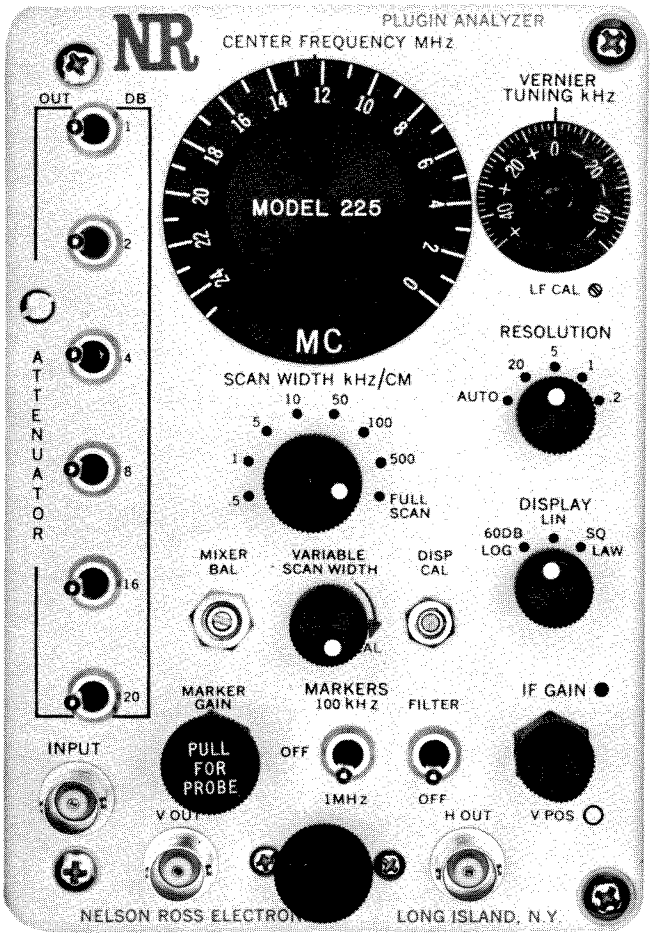


KFI

MODEL

PSA 225

THIS MANUAL ISSUED WITH

SERIAL NUMBER 228

TABLE OF CONTENTS

SECTION 1

GENERAL INFORMATION

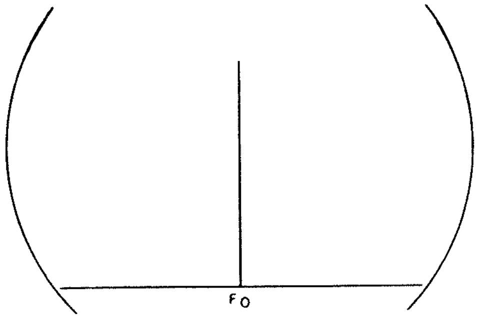
Before operating a NELSON-ROSS wideband Plugin Spectrum Analyzer it is important to have a clear understanding of the nature of spectral displays and the data they can provide. Used conventionally, the purpose of an oscilloscope is to provide a visual display of an electrical signal, presenting the amplitude with respect to time. In such a presentation, the horizontal axis of the CRT tube represents time and the vertical axis represents instantaneous amplitude. An equally meaningful display, commonly called a spectral display, is one in which the horizontal axis represents frequency and the vertical axis represents RMS amplitude. This is the type of display provided by NELSON-ROSS Plugin Spectrum analyzers.

SPECTRAL DISPLAYS

The nature of the spectral display can be understood with the aid of the following illustrative examples:

Single Frequency, Idealized

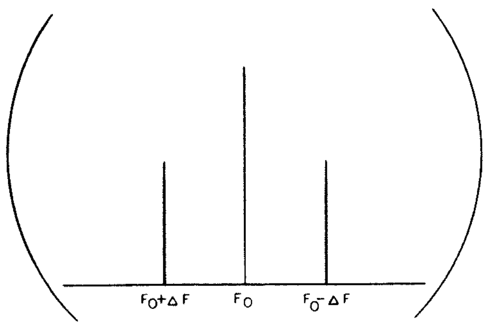
An ideal spectrum analyzer will display a signal containing energy at only one frequency as a single vertical line:



C W SIGNAL AS SEEN ON IDEAL SPECTRUM ANALYZER

Multiple Frequencies, Idealized

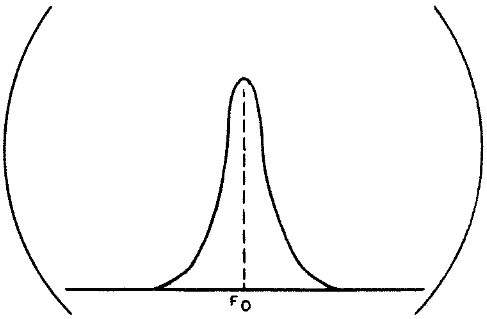
Multiple signals would appear as multiple vertical lines however close in frequency they may be. A carrier modulated by sidebands at plus and minus a small frequency increment would thus appear as shown:



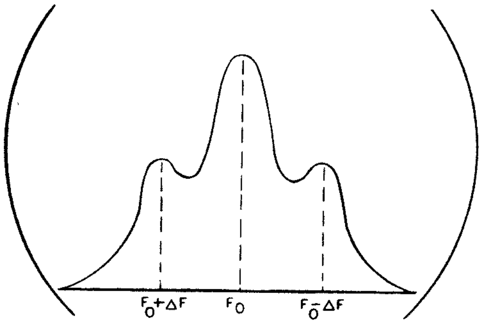
MODULATED SIGNAL ON IDEAL ANALYZER

Single and Multiple Frequency Displays

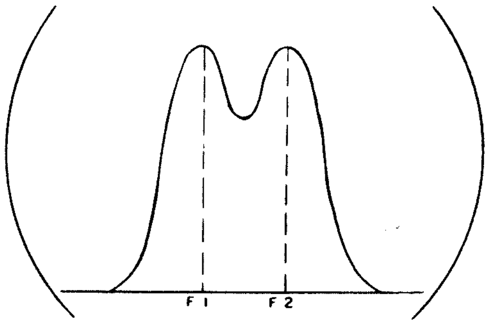
An actual spectrum analyzer, however, cannot present an infinitely narrow vertical line. Instead the signal is broadened into a pulse. Similarly, multiple signals, closer together than the width of the pulse, will tend to blend. This illustrates resolution, a basic spectrum analyzer parameter which must be considered. The smaller the frequency difference which can be discerned, the better the resolution of the analyzer. Two equal amplitude signals are considered resolved when they are far enough apart to cause a 3 db dip to appear between them:



C W SIGNAL AS SEEN ON REAL ANALYZER



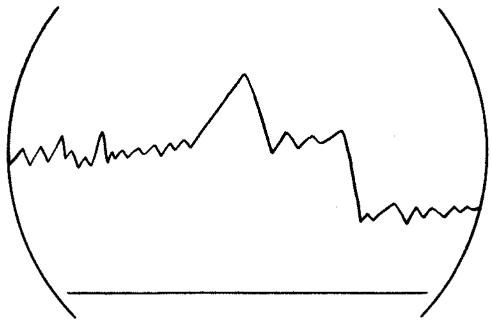
MODULATED SIGNAL ILLUSTRATING EFFECT OF RESOLUTION



TWO EQUAL SIGNALS JUST RESOLVED

Continuous Spectrum

Signals containing frequency components spaced closer than the resolution of the analyzer generate a continuous spectrum:



CONTINUOUS SPECTRUM

PARAMETERS

There are three basic parameters of a spectrum analyzer display:

Resolution - Defined in the previous paragraphs as the proximity of two adjacent frequencies which can be separated (by a 3 db dip) in the display.

Scan Width - The width of the display (in kHz/cm or MHz/cm) on the cathode-ray tube

Scan Time - The amount of time taken to scan the scan width mentioned above

Since these three parameters are interrelated, it is important to understand the manner in which they effect one another. Scan time and scan width may be combined to produce a factor called sweep rate (cycles per second per second) which may not be exceeded for any given resolution. Expressed mathematically:

$$\frac{\text{Scan Width}}{\text{Scan Time}} = (\text{Resolution})^2$$

If this relationship is violated, either by reducing the scan time (increasing sweep speed) or by increasing the scan width, the signal will smear and lose amplitude.

This is an important point to remember - contrary to conventional oscilloscope operation, with spectrum analyzers slower sweep speeds produce better displays. Since NELSON-ROSS Plugin Spectrum Analyzers fit oscilloscopes with high sweep speed capabilities, the operator must remember to reduce the sweep speed sufficiently to obtain a good display. For operator convenience, NELSON-ROSS Wideband Plugin Analyzers are provided with automatic resolution. In this mode of operation the resolution is programmed with the scan width so that a constant optimum scan rate may be maintained. This scan rate is automatically provided in instruments with internal scan rate generators. For instruments which utilize the oscilloscope sweep generator, the correct setting of the sweep time controls is in the technical specifications of the instrument (see section 2 of this manual).

SECTION 2

CHARACTERISTICS

The NELSON-ROSS Plugin Spectrum Analyzer, Model PSA-225 is designed so that it may be conveniently plugged into any Tektronix 560 series Oscilloscope. Installation of the plugin immediately converts the oscilloscope into a complete spectrum analyzer. All voltages and power are automatically obtained from the oscilloscope when the analyzer is inserted.

The all solid state Model PSA-225 covers the frequency range of 1 kHz to 25 MHz. A wide range of dispersions from 500 Hz/cm to 500 kHz/cm are provided as well as a Full Scan of 25 MHz. IF Bandwidths from 200 Hz to 20 kHz are readily selectable from a front panel switch. High sensitivity (-90 dbm), flat response (± 1 db), high stability and high spurious rejection are inherently characteristic of the PSA-225 which features complete solid state construction including the swept local oscillator. This model also possesses such other features as: linear, 60 db log and 13 db square law displays, 51 db input attenuator; 40 db IF gain; frequency markers, video filtering and horizontal and vertical outputs.

TECHNICAL SPECIFICATIONS

SPECIFICATION:	PSA-225
COMPATIBLE OSCILLOSCOPES:	Tektronix 560 series or equiv.
CENTER FREQUENCY RANGE:	1 kHz to 25 MHz
CALIBRATED TUNING DIAL RANGE	Center: 0 to 25 MHz Vernier: ± 50 kHz
TUNING DIAL ACCURACY:	± 5%
DISPERSION/SCAN WIDTH:	Eight positions selectable with front panel switch. 1. 500 Hz/cm 5. 50 kHz/cm 2. 1 kHz/cm 6. 100 kHz/cm 3. 5 kHz/cm 7. 500 kHz/cm 4. 10 kHz/cm 8. Full Scan: 2.5 MHz/cm Dispersion continuously adjustable between fixed position settings with front panel control.
SCAN WIDTH ACCURACY:	± 10%
RESOLUTION/IF BANDWIDTH:	Automatically programmed with Dispersion Uncoupled: 200 Hz, 1, 5 and 20 kHz Selectable with front panel switch.
VERTICAL DISPLAYS:	Linear, 60 db Log and 13 db Square Law Selectable with front panel switch
SENSITIVITY:	At maximum gain: Linear Display 100 μ Full Scale (nominal). Square Law Display 30 μ Full Scale (nominal). Log Display -30 dbm Full Scale (nominal). Minimum Discernable Signal -90 dbm (-85 dbm for 75Ω input).

DISPLAY FLATNESS:	± 1 db
DISTORTION DYNAMIC RANGE:	Display: 60 db Distortion: Harmonic and IM products at least 50 db down from two equal full screen signals.
INPUT IMPEDANCE:	50 or 75 ohms (specify) BNC type connector on front panel.
INPUT ATTENUATOR:	51 db range in 1 db steps; ± 0.1 db/db.
INPUT SIGNAL LEVEL:	-30 dbm (maximum)
IF GAIN:	40 db (nominal) Continuously variable with front panel control.
SCAN RATE:	From oscilloscope 10 sec/scan to 20 scans/sec. Should be set at 10 scans/sec (10 millisec/cm) with RESOLUTION in AUTO position.
INTERNAL MARKERS:	100 kHz and 1 MHz and their harmonics Selectable with front panel switch.
MARKER GAIN:	Continuously variable with front panel control.
VIDEO FILTER:	10 milliseconds Selectable with front panel switch.
IF FREQUENCIES:	First IF: 65 MHz (nominal) Second IF: 10.7 MHz Third IF: 1.5 MHz
VERTICAL OUTPUT:	0.2 volts from 100 Ω DC coupled at ground; BNC type connector on front panel.
HORIZONTAL OUTPUTS:	-1 to +1 volt from 1000 ohms, DC coupled at ground. BNC type connectors on front panel.
POWER REQUIREMENTS:	All power and voltages from oscilloscope.

SECTION 3

OPERATING INSTRUCTIONS

UNPACKING AND INSPECTION

It is important that a careful inspection be made of the unit immediately after it is unpacked. Look for obvious indications of any physical damage which may have been sustained during shipping. All crystals should be firmly seated and connectors tightly mated.

NOTE: All new Tektronix Time Base plugins provide the sawtooth drive required for the Nelson-Ross analyzers at the interconnecting plug, except for oscilloscope Model 565 where an external cable is required. Older Time Base models will have to be inspected and modified to provide the sawtooth drive if necessary.

Modification instructions are included in the rear of this manual.

SWEEP SWITCH POSITIONING INSTRUCTIONS

Place the SWEEP switch to the "INT" position when using Tektronix Time Base types 67, 2B67, 3B1, 3B4 and 3B3. When using the Dual Beam oscilloscope, the switch must be placed to the "EXT" position.

INSTALLATION OF THE PLUGIN

Insert the plugin analyzer into the vertical compartment of the scope. When using dual beam oscilloscopes, use the upper beam compartment. Turn the lock knob fully clockwise to secure the unit. Dual beam oscilloscopes require the use of an external coaxial cable which must be connected between the SWEEP jack on the plugin analyzer and the UPPER HORIZONTAL SIGNAL OUTPUT jack on the rear of the scope. Turn the oscilloscope power on and allow the instrument to warm up. (The complete solid state plugin analyzer requires no warm-up, but the oscilloscope requires about 15 minutes).

INITIAL ADJUSTMENTS

Certain initial adjustments must be performed when installing the plugin analyzer for the first time. The initial adjustments must be made so that true representations of control functions will be possible. The sweep controls on the oscilloscope must be set to produce a free-running display at the proper sweep speed. To obtain a free-running display, set the oscilloscope controls as follows (use time base A on dual time base units):

TRIGGER LEVEL	AUTOMATIC
TRIGGER SLOPE	+
COUPLING	AC FAST
SOURCE	LINE
MODE	NORMAL
POSITION	TRACE CENTERED
TIME/DIV	10 MILLISECONDS

Set the Plugin Spectrum Analyzer as follows:

CENTER FREQUENCY	0 MHz
DISPLAY	LOG
FILTER	OFF
VERNIER TUNING	CENTER
INPUT ATTENUATOR	OUT (0 DB)
IF GAIN	CW
LF CAL	CENTER
MARKERS	OFF
MARKER GAIN	CW
MIXER BAL	CENTER
RESOLUTION	AUTO
SCAN WIDTH	FULL SCAN
VARIABLE SCAN WIDTH	CW
V POS	CENTER

It will now be possible to obtain a horizontal trace along the bottom graticule line on the oscilloscope screen by adjustment of the V POS control on the analyzer.

NOTE: The TIME BASE plugin must be properly calibrated to insure correct operation of the Spectrum Analyzer.

A trace which is not parallel to the graticule may be rotated into a proper position by use of the TRACE ALIGN control, on the oscilloscope.

Adjust the H POS to center the trace on the base line. A vertical pip representing the internally generated zero frequency signal will appear at the left of the trace. After adjustment the zero signal should coincide with the leftmost mark on the CRT graticule and the trace should extend 10 cm along the base line.

NOTE: DUAL BEAM TYPE 565 SCOPE ONLY

For proper calibration of the plugin analyzer, the sawtooth signal must start at zero volts DC. A "DC LEVEL" control is provided for this adjustment and is accessible by removing the left side of the scope frame. Adjust the control until the Zero Frequency signal is at the left most graticule line.

LF CAL ADJUSTMENT

Since the voltages supplied to the analyzer may vary from oscilloscope to oscilloscope, an initial adjustment is required to bring the CENTER FREQUENCY dial to the specified accuracy. With the CENTER FREQUENCY dial at 0 MHz, set the SCAN WIDTH control to 500 kHz/cm. The zero signal will appear on the screen. Using a screwdriver, adjust the LF CAL potentiometer (concentric with the VERNIER TUNING control) to position the signal directly on the graticule center line. Calibration of the CENTER

FREQUENCY dial at higher levels of RESOLUTION and narrower SCAN WIDTHS may be performed in the same manner.

DISPERSION CALIBRATE ADJUSTMENT

Rotate the SCAN WIDTH switch to FULL SCAN and place the MARKER SWITCH in the 1 MHz position. The zero signal will appear on the left side of the trace and several 1 MHz marker pulses will be present on the display. Starting with the first marker pulse (do not count the zero signal) on the left side of the display, count the total number of markers present. There should be exactly 25 markers present. If more or less than 25 markers are present, turn the DISP. CAL adjustment until exactly 25 markers appear. If difficulty is encounted in trying to select the first marker, position the MARKER switch to "OFF" and carefully note the location of the zero signal.

FUNCTION AND OPERATION OF PANEL CONTROLS

In order to obtain the most efficient and accurate performance from any of the Nelson-Ross Plugin Spectrum Analyzers, it is essential that the function and marking of each of the controls be fully understood. The Model PSA-225 Plugin Spectrum Analyzer may be used in any application where the necessity exists to visually observe signals whose components fall within its frequency range of 1 kHz to 25 MHz. With this instrument, it is possible to measure the relative amplitudes as well as the absolute values of each of the various components which make up a complex signal.

The spectrum analyzer is designed so that its basic operating characteristics may be adjusted to provide the parameters required for analysis of the desired signals. These parameters are adjusted through the use of the panel controls, which are shown in photo on Title Page of this Manual.

CENTER FREQUENCY AND VERNIER TUNING

Adjustment of these controls centers the signal being observed on the oscilloscope screen. Please note that the Center Frequency control is operative for all positions of DISPERSION except FULL SCAN (2.5 MHz/cm). The CENTER FREQUENCY control is calibrated from 0 to 25 MHz at 1 MHz increments. The VERNIER TUNING control provides a calibrated vernier from -50 to +50 kHz.

SCAN WIDTH

The position of this control adjusts the Scan Width of the screen display. This eight position switch, located below the CENTER FREQUENCY control, provides dispersions of .5 kHz/cm, 1 kHz/cm, 5 kHz/cm, 10 kHz/cm, 50 kHz/cm, 100 kHz/cm, 500 kHz/cm, and FULL SCAN (2.5 MHz/cm). In the FULL SCAN position, the CENTER FREQUENCY control is inoperative and the entire frequency band of the analyzer, 0 to 25 MHz is displayed.

RESOLUTION

This switch, located on the right side of the panel, provides four values of resolution; namely: 0.2, 1, 5, and 20 kHz. A fifth position, AUTO, automatically selects the correct resolution for all settings of the Scan Width switch. Resolution is provided by an adjustable bandwidth RF filter in the last IF amplifier. Resolution is defined as the ability of the instrument to distinguish between two adjacent signals. Two such signals (of equal amplitude) are considered resolved if a 3 db dip appears between them. In use, the appearance of the display determines the setting of this switch. Too high a resolution will cause a great loss in sensitivity, while too low a value will result in a smeared display with beat-modulation riding on the trace. The scan time should be adjusted to 10 milliseconds per cm when using the AUTO resolution.

DISPLAY

This switch, located below the RESOLUTION switch, provides three vertical scale functions:

60 db LOG — In this display mode the vertical scale of the instrument is logarithmic. Relative to a full scale signal (0 db), each 1/6 of the vertical scale is approximately 10 db. Thus a signal 30 db down from full scale will be $\frac{1}{2}$ scale. A signal 60 db down is just visible as a small (1/6 cm) deflection on the baseline.

LIN — In this display mode the vertical deflection produced by the signal is directly proportional to the input voltage (the bottom $\frac{1}{4}$ of this scale will be non-linear due to the extremely low levels encountered).

SQUARE LAW — In this display mode the vertical deflection produced by the signal is directly proportional to the input power. Thus, two signals differing by 3 db will appear 2:1 in amplitude on the screen.

VIDEO FILTER

Located on the lower left corner of the panel, this switch permits the operator to insert a low-pass filter into the vertical deflection amplifier to filter out noise, etc.

INPUT ATTENUATOR

This six switch step attenuator provides 51 db of attenuation in 1 db steps. This attenuator is useful for making relative amplitude measurements.

IF GAIN

This variable control located concentric to the V POS control, provides nominally 40 db IF gain so that full screen signals can be set up and relative amplitude measurements carried out.

MARKERS

This three position switch on the lower center of the panel, inserts frequency markers that appear as positive going signals at the following frequencies:

When switched to the lower position, markers at 1 MHz intervals are displayed. When switched to the upper position, interpolation markers at 100 kHz intervals are displayed between the 1 MHz markers. When in the center position, no markers are displayed.

MARKER GAIN

This control on the left of the MARKER switch, adjusts the height of the markers when either marker frequency is used.

MIXER BAL

This control is used to null IM products and zero signal.

INPUT JACK

The SIGNAL INPUT jack is a BNC type connector. Input impedance is 50 ohms, except for 75 ohm instruments which have a 75-50 ohm pad built in.

V OUT

This front panel OUTPUT jack may be used for external monitoring of the spectral display by meters, X-Y recorders or similar devices. It is not recommended that loads of less than 10,000 ohms be connected to this terminal.

SWEEP

This jack is used either for X-Y recorder connector or for the horizontal sweep input which is required when the Dual Beam 565 scope is used.

SECTION 4

EQUIPMENT DESCRIPTION

GENERAL

The solid state Model PSA-225 Plugin Spectrum Analyzer covers the range from 1 kHz to 25 MHz. The analyzer contains a balanced mixer which heterodynes the input signal with the internal local oscillator, producing an IF signal at 65 MHz. A 65 MHz IF system with subsequent amplifiers at 10.7 MHz and 1.5 MHz, provides gain, while a crystal filter acts as the resolution element. Linear, logarithmic, and square law amplifiers provide vertical deflection for the oscilloscope while the oscilloscope's sawtooth output to the internal local oscillator provides the horizontal sweep. As a result, the oscilloscope displays the spectrum of the input signal. The relatively high frequency of the first IF allows dispersion or scanwidths up to 25 MHz.

Figure 4-1 is a block diagram of the Model PSA-225 analyzer. This unit consists of an instrument frame and seven modular electronic subassemblies. Blocks representing the seven modules are shaded. All other elements shown are considered part of the instrument frame.

Schematic drawings and maintenance information for the frame, printed circuit boards and modules will be found in Section 6, of this manual.

INSTRUMENT FRAME

The following elements are mounted on the instrument frame:

1. PANEL CONTROLS
2. INPUT CONNECTOR
3. HORIZONTAL & VERTICAL OUTPUT CONNECTORS
4. CENTER FREQUENCY & VERNIER TUNING CIRCUITRY
5. SCAN WIDTH CIRCUITRY
6. VIDEO FILTER CIRCUITRY
7. VERTICAL DEFLECTION AMPLIFIER
8. INPUT ATTENUATOR
9. POWER SUPPLY LOADS

The instrument frame also houses the following modules:

1. FIRST IF MODULE
2. VARIABLE BANDWIDTH IF MODULE
3. LOG-LIN SQUARE LAW MODULE
4. TRACKING MODULE
5. OSCILLATOR MODULE
6. MARKER MODULE
7. MIXER MODULE

CIRCUIT DESCRIPTION

The input signal is impressed at the SIGNAL INPUT jack, which is a BNC connector on the front panel.

This is connected, via the Input Attenuator to the MIXER MODULE. The local oscillator signal for this mixer is derived from the SWEPT OSCILLATOR MODULE, which provides a swept signal from 65 MHz to 90 MHz. Since the FIRST IF MODULE only responds to 65 MHz which must be the difference between the Local Oscillator and input frequencies, this results in a tuning range of 0 to 25 MHz.

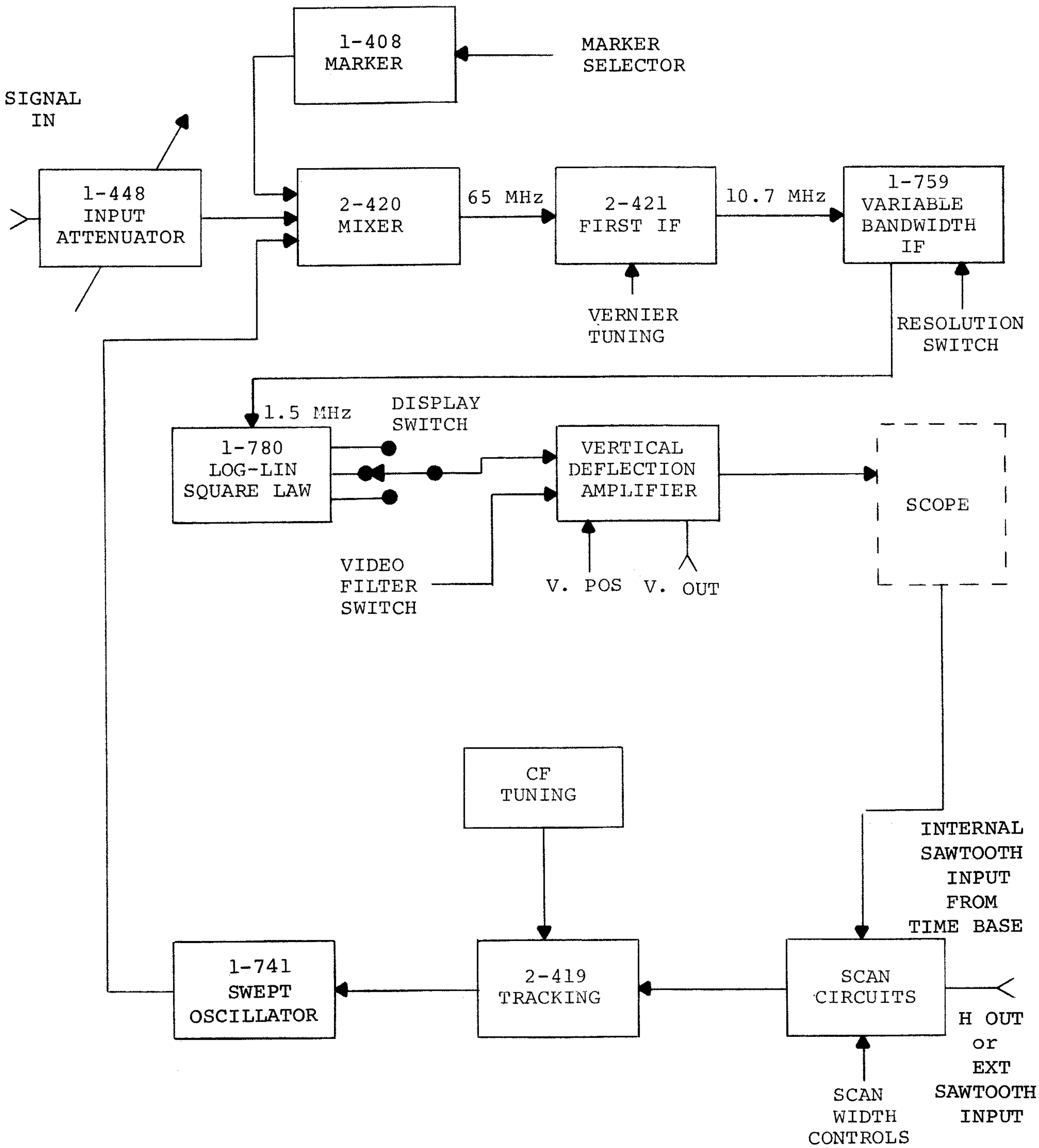
The SWEPT OSCILLATOR MODULE is voltage tuned, producing a signal whose frequency is proportional to the voltage impressed on the tuning control terminal. Since the voltage vs. frequency curve is non-linear, the TRACKING MODULE is provided to linearize the oscillator curve. At the inputs to the tracking chassis the voltage vs. frequency curve is therefore linear.

The instrument is tuned by introducing a DC voltage into the tracking chassis by means of the CENTER FREQUENCY potentiometer. The sawtooth output of the sweep generator is injected into the tracking chassis via the SCAN WIDTH switch to provide the sweeping action. The SCAN WIDTH switch is essentially a calibrated attenuator which controls the sawtooth level to provide the various specified scan widths. In the FULL SCAN position of the SCAN WIDTH switch the CENTER FREQUENCY control is disconnected and a fixed voltage corresponding to mid-band is applied, resulting in a full scan display. In narrow scan width settings, the swept local oscillator is kept at a fixed frequency and the oscillator in the FIRST IF MODULE is swept. This arrangement provides increased stability. The sawtooth drive obtained from the TIME BASE, is amplified and conditioned for the scan circuitry.

The output of the MIXER MODULE is fed into the FIRST IF MODULE. The FIRST IF MODULE provides gain and converts the 65 MHz signal to 10.7 MHz.

The output of the FIRST IF MODULE is then brought to the VARIABLE BANDWIDTH IF MODULE where it is converted down to 1.5 MHz and passed through an adjustable bandwidth crystal filter to provide the resolution characteristics of the analyzer.

The 1.5 MHz signal from the VARIABLE BANDWIDTH IF MODULE is impressed upon the input of the LOG-LIN SQUARE LAW MODULE. This module generates logarithmic, linear or square law video. The operator may select the desired video signal by positioning the DISPLAY SWITCH in the appropriate position. The output of this switch is then routed to the Vertical Deflection Amplifier shunted by the VIDEO FILTER. The VIDEO FILTER switch connects a capacitor to the Vertical Deflection Amplifier to provide low pass filtering. Frequency markers are generated by the MARKER MODULE, which contains two synchronized oscillators. Each oscillator drives an avalanche transistor pulse generator, which generates narrow pulses having energy over the entire range of the instrument. The marker output is coupled to the instrument via a special input on the MIXER MODULE.



MODEL PSA-225
BLOCK DIAGRAM

FIGURE 4-1

SECTION 5

MAINTENANCE AND REPAIR

NELSON-ROSS Plugin Spectrum Analyzers are designed and manufactured to high standards of reliability and quality control. The use of fully transistorized circuitry has eliminated the need for periodic maintenance (except for routine calibration). In normal service, it is unlikely that your plugin analyzer will require repair. Should a failure occur, however, this section will provide you with a general sequential procedure for locating the fault and repairing the unit.

VISUAL INSPECTIONS

Plugin units are generally subject to considerable handling and could be accidentally damaged during storage or transfer. Accordingly, you should visually inspect the plugin unit periodically for obvious damage. Look for loose or frayed wires, damaged components, broken component boards, etc. Burn marks on a component could disclose an impending circuit failure, a short circuit, or overload conditions, any of which requires futher investigation.

GENERAL SOLDERING CONSIDERATIONS

Many components in your plugin analyzer are mounted on printed circuit boards. The use of a 40 watt soldering iron is suggested for soldering of any components. Only high tin content solder is recommended.

GENERAL TROUBLE SHOOTING

Should you suspect a malfuntion in your plugin spectrum analyzer, the following six general steps are recommended as a sequential procedure to correct the problem.

1. Confirm that a malfunction actually does exist
2. Isolate the trouble to either the Plugin Spectrum Analyzer or the oscilloscope
3. Localize the problem to the analyzer main frame or a circuit module
4. Trouble-shoot the faulty element to determine the exact source of trouble
5. Repair the malfunction
6. Test the repaired analyzer and realign (if necessary)

CONFIRMATION

It has been found through experience that many indications which are presumed to be caused by a malfunction in the equipment actually result from incorrect settings. All controls should be checked for correct settings. You should also check the input cable connections and accessories. Once a determination is made that an actual equipment malfunction does exist, it must be ascertained whether it is located in the plugin unit or the oscilloscope.

ISOLATION

Isolation of the trouble to either the oscilloscope or the plugin unit may be accomplished by either of two possible methods. In the first and simplest method, the plugin unit is removed and replaced with a spare plugin. The second method requires verification of input signals voltages, and analysis of the screen display.

CAUTION

Before plugging in the spare unit, it is essential that a careful inspection be made of the suspected original unit, for evidence of charred components or burned wiring. Any indications of such damage could be the result of excessive oscilloscope supply voltages. In such cases it is absolutely necessary to make complete voltage checks prior to installing a spare. If this precaution is not taken, the spare unit may become damaged.

If, after a spare unit (known to be functioning properly) is substituted and the system does not work properly, the fault exists in the oscilloscope. Refer to the oscilloscope instruction manual for the correct maintenance procedures. If a spare unit is not available for substitution further testing must be performed. A plugin extension cable (avialable from the oscilloscope manufacturer) may be used to facilitate the required testing, or the top and bottom covers may be removed from the oscilloscope, and the unit stood on its side. First, check all voltages supplied by the oscilloscope to the plugin unit.

The voltages supplied by the oscilloscope to the plugin analyzer are identified on the schematic drawing of the analyzer frame. All schematics and parts lists may be found in Section 6 of this manual. If the voltages measure incorrectly, remove the plugin spectrum analyzer and recheck the voltages. At this point, if the voltages check correctly with the spectrum analyzer removed, the trouble may be assumed to be in the plugin unit.

TROUBLE SHOOTING THE SPECTRUM ANALYZER

When it has been definitely established that the malfunction exists in the spectrum analyzer plugin unit the following trouble-shooting procedures are recommended. Much time and effort will be conserved by first performing a very thorough visual inspection of the plugin unit. Carefully scrutinize the unit for evidence of burned or broken wires, loose coaxial cables, defective switches, overheated or discolored components, and loose or improperly seated crystals. In the event that a burned or discolored component is discovered, it is essential that the direct cause of the trouble be located, and corrected before replacing the component. If no defects are detected by visual inspection, then the following sequential procedure should be used to localize the fault.

Supply power to the plugin analyzer through an extension cable from the oscilloscope (available from the oscilloscope manufacturer), or turn the oscilloscope on its side and remove the top and bottom covers.

If there is no display on the oscilloscope screen the trouble may lie within the analyzer instrument frame. The frame electronics may be checked on a D.C. basis, using any volt-ohm-meter (20,000 Ω/volt). Voltages to be found at many terminals are indicated on the frame schematic. This check should include voltages at the power resistors, the vertical and horizontal amplifier, sawtooth and tuning voltages (where applicable).

If the instrument frame is operating properly, then the malfunction must be localized to the faulty modular unit. This may be accomplished by applying signals to the modules, one module at a time, starting with the last module (on the block diagram) and working back toward the analyzer input. Proper input frequencies for each module are indicated on the block diagram and may be supplied by any standard signal generator. A faulty module is indicated when the test signal will not pass and there is no deflection on the oscilloscope screen. The faulty module should then be inspected and tested in accordance with the procedure specified in the individual module description, contained in Section 6 of this manual.

The instrument frame of the analyzer has been designed to permit service of the individual modules and printed circuit boards without removal from the frame. Each module is mounted to the analyzer frame on a flexible harness to permit testing and trouble shooting without the use of patch cords or jumpers. Printed circuit boards may be unscrewed and swung out on their wires for service.

SECTION 6

SCHEMATICS, PARTS LIST, AND SERVICE INFORMATION

This section consists of several sub-sections, each containing the complete information for a module or similar sub-assembly of the instrument covered by this manual. Each sub-section is a complete package containing schematics, repair information, alignment procedures and replacement parts lists for the item covered.

CONTENTS

INSTRUMENT FRAME

ALIGNMENT PROCEDURES

Equipment Required

Oscilloscope: DC-100 kHz response (minimum 1V/CM) sensitivity (minimum).

Signal Generator: -30 dbm minimum 0 to 25 MHz output.

Multimeter: 20, 000 Ω/V.

1. Plug in Analyzer and allow to warm up. Use a test fixture or extension cord, if necessary, to allow access to all adjustments.

   Center the horizontal trace on the screen.

2. Adjust the vertical scale controls as follows:

   A. V POSITION RANGE: Set to provide zero volts dc V OUT jack with no signal on screen.

   B. IF gain CCW and trace properly positioned.

   C. V GAIN: Set 8 cm signal on screen in SQ. LAW to provide 0.2V signal on V OUT jack (use oscilloscope to measure).

   D. GAIN LIN: Set to provide smooth increase in gain when IF GAIN control is rotated.

   E. NOISE: Adjust for 100 uv full scale signal in LIN at maximum gain.

   F. LOG GAIN: Adjust for -30 dbm to -35 dbm full scale in LOG at maximum gain.

3. The following procedure should be used to align the CENTER FREQUENCY and SCAN WIDTH controls. Set the CENTER FREQUENCY dial to the exact center of the frequency range. Connect the multimeter between the arm of the CENTER FREQUENCY potentiometer and ground. Adjust the LF CAL (screwdriver adjust) for zero voltage (± ½ volt). Set the panel SCAN WIDTH control to FULL SCAN. On the Tracking Module, turn all CUT controls fully CCW.

   The extremes of the SAWTOOTH come from the scope but must be adjusted so that the sawtooth output of the Tracking Module in FULL SCAN covers the same range that the DC output covers, when the CENTER FREQUENCY is tuned from minimum to maximum at the lowest setting of the SCAN WIDTH control. This insures that the FULL SCAN display will agree with the CENTER FREQUENCY dial range.

   This is accomplished by adjusting SWEEP ± LIMIT, DC LEVEL (PC Board) and DISPERSION CAL (Panel) controls on the frame. In minimum SCAN WIDTH, the DC output of the Tracking Module at the 0 and 25 MHz marks on the dial, should agree with the sawtooth extremes in FULL SCAN. The DISPERSION CAL control only effects the upper frequencies and FULL SCAN, while the SWEEP ± LIMIT operates on both ends equally. The DC LEVEL adjustment is required only when the Tektronix 565 frame is used.

SWEEP SWITCH position

Position the SWEEP SWITCH on the main PC Board to "INT" when using any scope except Tektronix 565. Switch to "EXT" when using the Tektronix 565 scope.

Connect the test oscilloscope to "TP1" located on the main PC Board and monitor the sawtooth output.

SAWTOOTH ADJUSTMENT PROCEDURE

1. For all scopes except Tektronix 565
   - A. Adjust the DISP CAL control to balance the sawtooth above and below 0 VDC.
   - B. Use the SWEEP ± LIMIT control to provide a 40 volt P-P sawtooth.
2. For Tektronix 565 only
   - A. Adjust the SWEEP ± LIMIT control 3/4 maximum clockwise.
   - B. Use the DISP CAL and DC LEVEL controls to provide a 40 volt P-P sawtooth balanced above and below 0 VDC.

CF DIAL, FULL SCAN AGREEMENT ADJUSTMENT

1. Connect a signal generator (adjusted to 25 MHz at -30 dbm) to the INPUT of the analyzer.
2. Adjust the analyzer controls to observe a 25 MHz at a SCAN WIDTH of 500 kHz per cm.
3. Tune the signal generator frequency until the signal pulse is in the exact center of the graticule.
4. Adjust the SCAN WIDTH switch to FULL SCAN.
5. Adjust the SWEEP ± LIMIT control (on the PC Board) until the signal pulse is on line with the graticule on the right side of the screen.
6. Repeat steps 2 thru 5 to check adjustment.

CENTER FREQUENCY dial adjustment

A) The curve of the tuning dial is set by means of potentiometers located on the Tracking Module. Nine of the potentiometers control the spacing between points on the dial (slope potentiometers). Each SLOPE potentiometer operates only over the section of the dial controlled by its associated voltage bias. An additional control is provided to set the lower end of the curve.

B) Each SLOPE adjustment effects the rate of change of frequency with rotation of the CENTER FREQUENCY control from the point at which it enters the circuit and downward in frequency over the rest of the dial. The effects are additive. It is therefore necessary to start adjustment of the tuning curve from the top of the dial and work toward the lower end. The upper end of the dial has no potentiometer associated with it, so the last 2 dial marks are set by adjusting the tuning adjustment on the SWEPT OSCILLATOR MODULE. SLOPE adjustments are then introduced progressively, to linearize the rest of the dial. The procedure is as follows:

C) Place the instrument in FULL SCAN.

D) Set the slope controls fully CW and inject a 25 MHz signal at -40 dbm. Adjust the SWEPT OSCILLATOR tuning to place this signal on the 11th graticule line (extreme edge). Rotate the CUT potentiometer until the zero signal (which will be visible somewhere around mid screen) just begins to be affected. This insures that the diode string covers the full range of the dial.

E) Reduce the signal generator frequency to 2.5 MHz steps. For each adjustment the signal should move 1 cm to the left. When a step is found out of tolerance rotate the lowest SLOPE control which will affect the mark or until the mark is seen to move. Adjust the SLOPE control for the best fit of the next few marks to the dial.

F) Repeat the above procedure for succeedingly lower sections of the dial with progressively higher numbered SLOPE controls in numerical order until the entire dial fits within the specified accuracy.

G) Recheck and readjust the tracking adjustments against the dial, readjusting as necessary to provide the specified dial accuracy.

4. SMALL SCAN: Switch the SCAN WIDTH control to 10 kHz/cm. At any convenient frequency, AM modulate the signal generator with a 50 kHz signal. Tune to the signal and adjust the SMALL SCAN SET control to provide sidebands on the diaplay, at ± 5 cm from the center. Check the dispersion at .5, 1, 5, 10 kHz/cm using a modulated signal as above. Adjust the SMALL SCAN control for best fit. This completes the adjustment.

5. Refer to the MIXER MODULE section for MIXER BAL adjustment procedure.

PARTS LIST

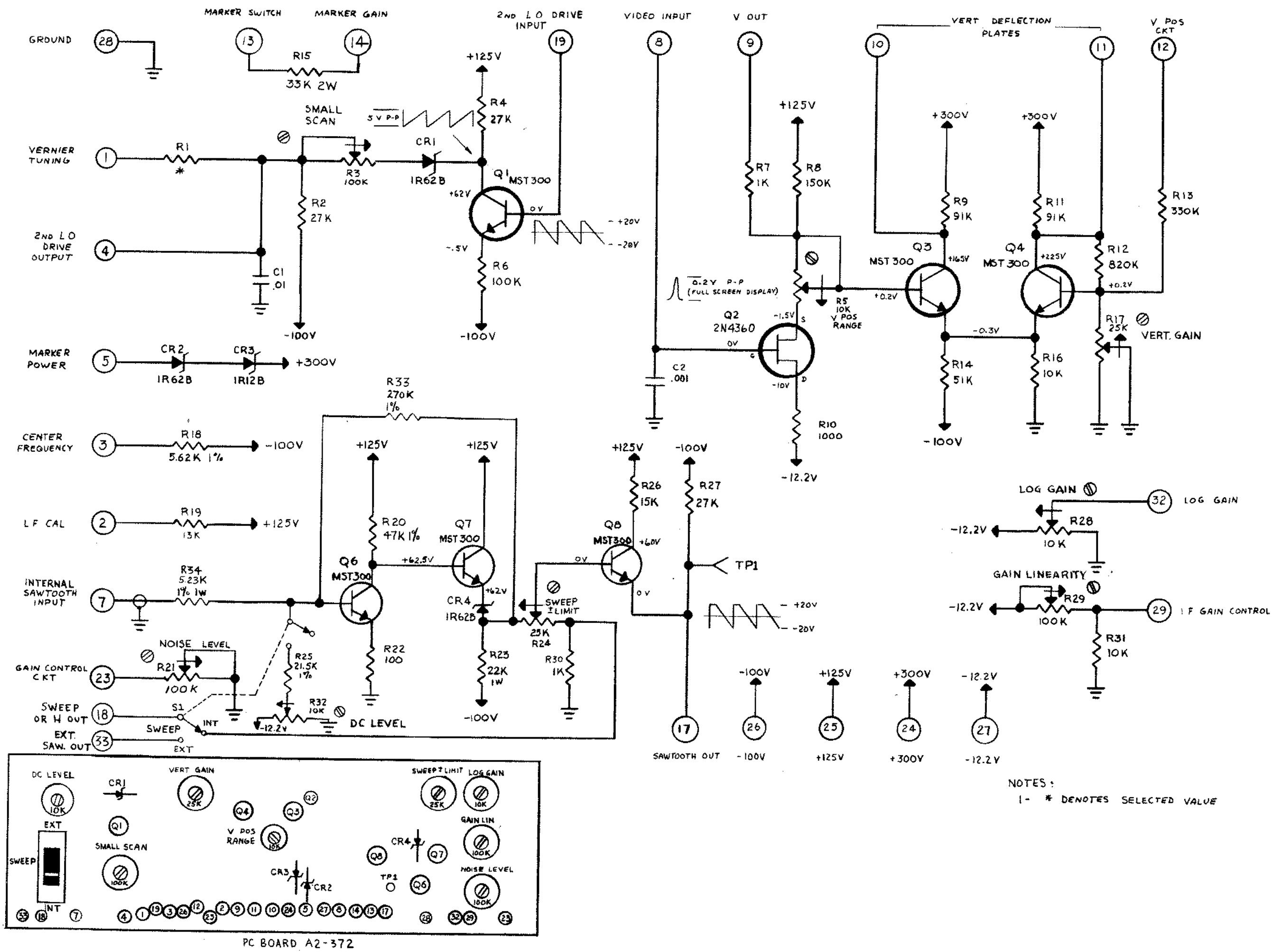
C1	Capacitor Electrolytic 50 uf @12V Sprague TE1133
C2	Capacitor Paper .01 @ 200V Amperex 296AB/A100K
C3	Capacitor Electrolytic 10 uf @ 150V Sprague TE1057
J1	Connector, Coaxial UG 625B
J2	Same as J1
J3	Same as J1
P1	Connector Mating Amphenol 26-159-24
R1	Resistor Composition $\frac{1}{2}$W 5% 1K IRC GBT$\frac{1}{2}$
R2	Potentiometer Dual 1000-154-28 25K Front 10K Rear
R3	Resistor Film $\frac{1}{4}$W 1% 2.49K Dale MFF$\frac{1}{2}$ T1
R4	Resistor Film $\frac{1}{4}$W 1% 499Ω Dale MFF$\frac{1}{4}$ T1
R5	Resistor Film $\frac{1}{4}$W 1% 47.5K Dale MFF$\frac{1}{4}$ T1
R6	Resistor Film $\frac{1}{4}$W 1% 20.5K Dale MFF$\frac{1}{4}$ T1
R7	Resistor Film $\frac{1}{4}$W 1% 24.9K Dale MFF$\frac{1}{4}$ T1
R8	Resistor Film $\frac{1}{4}$W 1% 1K Dale MFF$\frac{1}{4}$ T1
R9	Same as R8
R10	Wire Wound 3500 5XM WL
R11	Resistor Film $\frac{1}{4}$W 1% 8060 Ω Dale MFF$\frac{1}{4}$ T1
R12	Resistor Film $\frac{1}{4}$W 1% 40.2 Ω Dale MFF$\frac{1}{4}$ T1
R13	Resistor Composition $\frac{1}{2}$W 5% 22K IRC GBT$\frac{1}{2}$
R14	Potentiometer 100K 1000-154-51
R15	Not Used
R16	Potentiometer Switch 1K Mallory PP-13R
R17	Potentiometer 1000-154-59 50K
R18	Potentiometer 1000-154-27 100K
R19	Not Used
R20	Not Used
R21	Same as R17
R22	Selected at Test
R23	Potentiometer Dual 250K Front 20K Rear 1000-154-43

R24	Not Used
R25	Not Used
R26	Resistor Composition $\frac{1}{2}$W 5% 91K IRC GBT$\frac{1}{2}$
R27	Resistor Composition $\frac{1}{2}$W 5% 68K IRC GBT$\frac{1}{2}$
R28	Resistor Composition $\frac{1}{2}$W 5% 47K IRC GBT$\frac{1}{2}$
R29	Resistor Wire Wound 5W 5% 5XM 560 Ω
R30	Not Used
R31	Resistor Wire Wound 3W 5% 3X 82 Ω
S1	PP Switch Part of R16
S2	Switch Rotary NR 19997-5
S3	Switch Rotary Alco MRA-1-108
S4	Switch Toggle C & K 7201
S5	Switch Toggle C & K 7203
S6	Switch Rotary Alco MRA-2-5S

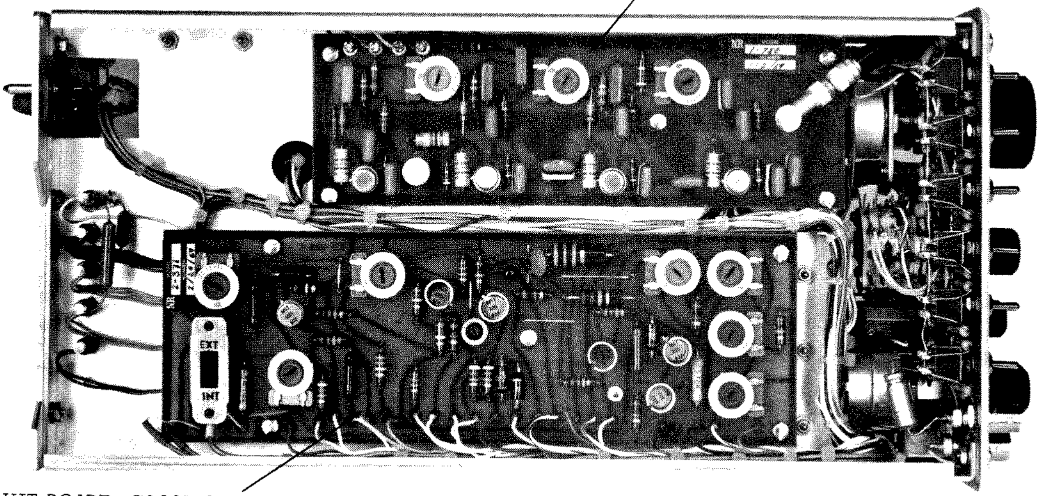
PRINTED CIRCUIT BOARD C1001-371

C1	Capacitor Disc .01 CRLDD6-103
C2	Capacitor Disc .001 @ 1000V CRLDD-102
CR1	Diode Zener Solitron 1R62B
CR2	Same as CR1
CR3	Diode Zener Solitron 1R12B
CR4	Same as CR1
Q1	Transistor MST 300 MS Transistor
Q2	Transistor 2N4360
Q3	Same as Q1
Q4	Same as Q1
Q5	Not Used
Q6	Same as Q1
Q7	Same as Q1
Q8	Same as Q1
R1	Resistor Composition $\frac{1}{2}$W 5% Selected Value IRC GBT$\frac{1}{2}$
R2	Resistor Composition $\frac{1}{2}$W 5% 27K IRC GBT$\frac{1}{2}$
R3	Resistor Potentiometer 100K CTS U201 R104B
R4	Resistor Composition $\frac{1}{2}$W 5% 27K IRC GBT$\frac{1}{2}$
R5	Resistor Potentiometer 10K 53-1-103 10K Spectrol
R6	Resistor Composition $\frac{1}{2}$W 5% 100K IRC GBT$\frac{1}{2}$
R7	Resistor Composition $\frac{1}{2}$W 5% 1K IRC GBT$\frac{1}{2}$
R8	Resistor Composition $\frac{1}{2}$W 5% 150K IRC GBT$\frac{1}{2}$
R9	Resistor Composition $\frac{1}{2}$W 5% 91K IRC GBT$\frac{1}{2}$
R10	Same as R7
R11	Same as R9
R12	Resistor Composition $\frac{1}{2}$W 5% 820K IRC GBT$\frac{1}{2}$
R13	Resistor Composition $\frac{1}{2}$W 5% 330K IRC GBT$\frac{1}{2}$
R14	Resistor Composition $\frac{1}{2}$W 5% 51K IRC GBT$\frac{1}{2}$
R15	Resistor Composition 2W 5% 33K IRC GBT2
R16	Resistor Composition $\frac{1}{2}$W 5% 10K IRC GBT$\frac{1}{2}$
R17	Resistor Potentiometer 25K CTS U201R253B
R18	Resistor Film $\frac{1}{2}$W 1% 5.62K
R19	Resistor Composition $\frac{1}{2}$W 5% 13K IRC GBT $\frac{1}{2}$
R20	Resistor Film $\frac{1}{2}$W 1% 47K Dale MFF $\frac{1}{2}$ T1
R21	Same as R3
R22	Resistor Composition $\frac{1}{2}$W 5% 100Ω IRC GBT$\frac{1}{2}$
R23	Resistor Composition 1W 5% 22K IRC GBT1
R24	Same as R17
R25	Resistor Film $\frac{1}{2}$W 1% 21.5K Dale MFF $\frac{1}{2}$ T1

R26	Resistor Composition $\frac{1}{2}$W 5% 15K Dale MFF $\frac{1}{2}$ T1
R27	Same as R2
R28	Resistor Potentiometer 10K CTS U201R103B
R29	Same as R3
R30	Same as R7
R31	Same as R16
R32	Same as R28
R33	Resistor Composition $\frac{1}{2}$W 1% 270K IRC GBT$\frac{1}{2}$
R34	Resistor Composition $\frac{1}{2}$W 1% 5.23K IRC GBT$\frac{1}{2}$
S1	Switch Slide DPDT Switchcraft 46206LF



LOG - LIN SQUARE LAW MODULE 1-780



PRINTED CIRCUIT BOARD C1001-371

PSA 225 LEFT SIDE

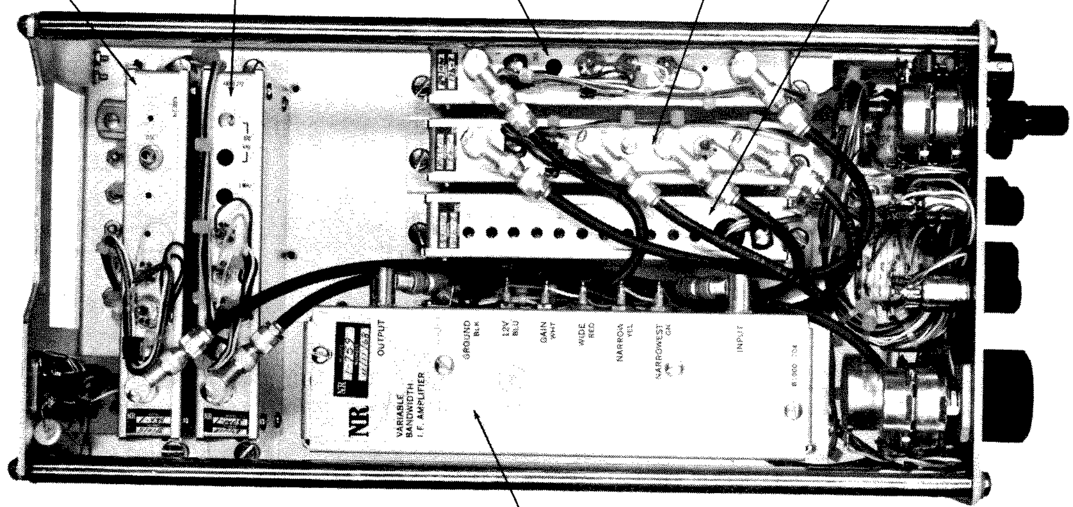
MARKER MODULE 1-408

MIXER MODULE 2-420

SWEPT OSCILLATOR 1-939

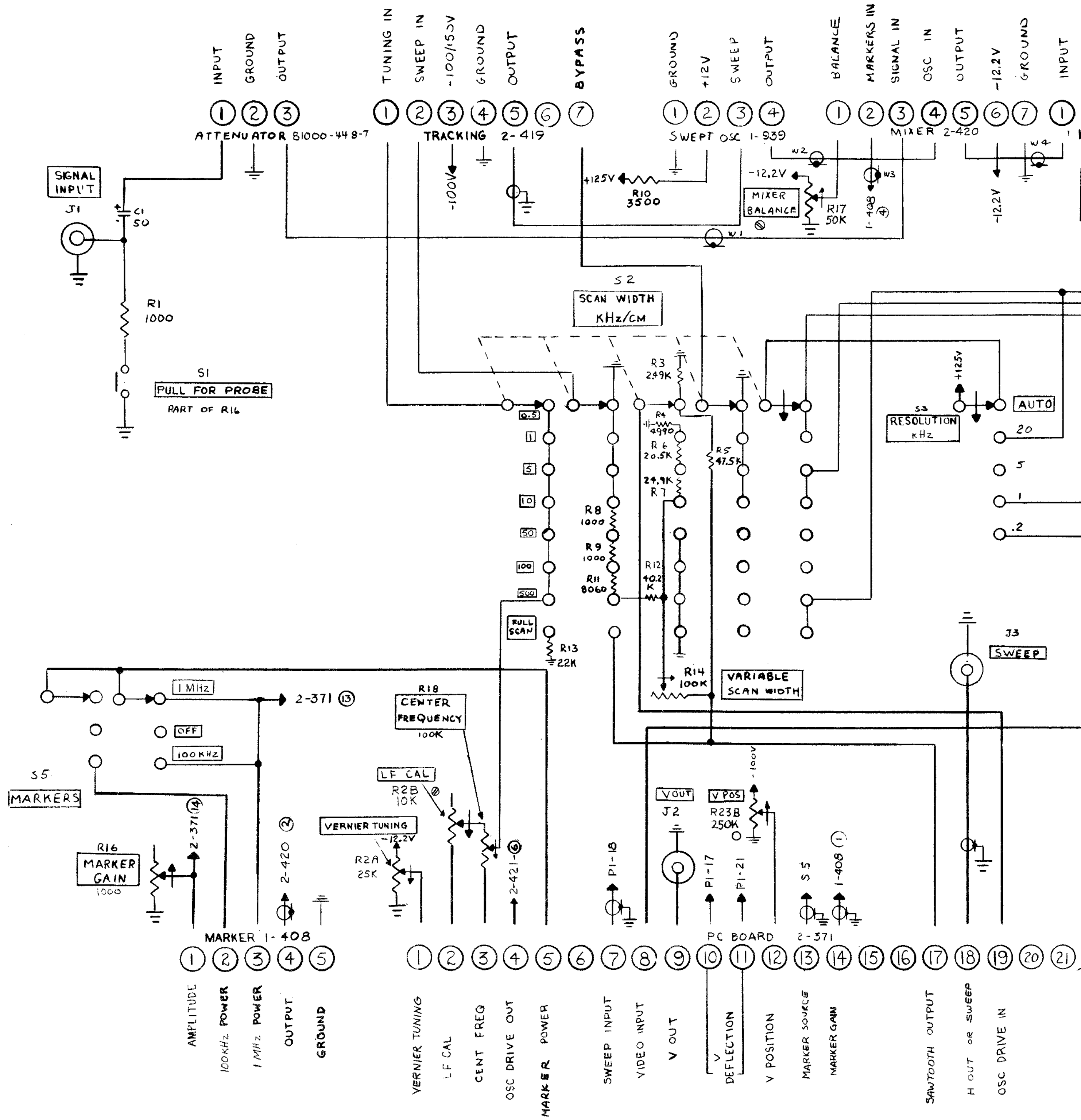
FIRST IF MODULE 2-421

TRACKING MODULE 2-419

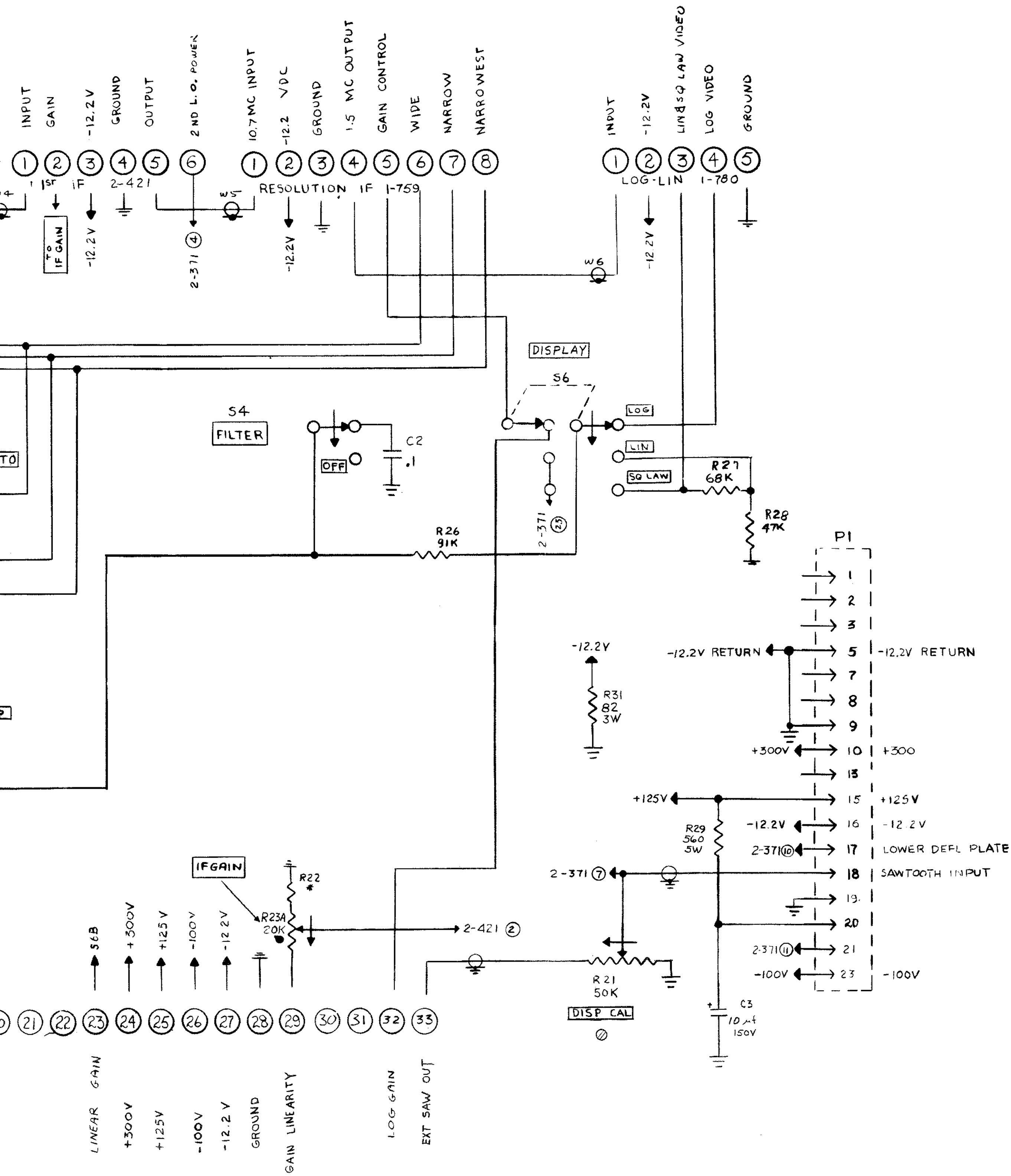


VARIABLE BANDWIDTH IF MODULE 1-759

PSA 225 RIGHT SIDE



INPUT
GROUND
OUTPUT
ATTENUATOR B1000-448-7
TUNING IN
SWEEP IN
-100/155V
GROUND
OUTPUT
BYPASS
TRACKING 2-419
GROUND
+12V
SWEEP
OUTPUT
SWEPT OSC 1-939
BALANCE
MARKERS IN
SIGNAL IN
OSC IN
OUTPUT
-12.2V
GROUND
INPUT
MIXER 2-420
SIGNAL INPUT
J1
C1 50
R1 1000
S1
PULL FOR PROBE
PART OF R16
-100V
+125V
R10 3500
-12.2V
MIXER BALANCE
R17 50K
1-408 (4)
W1
W2
W3
W4
-12.2V
S2
SCAN WIDTH KHz/CM
R3 249K
R4 4990
R6 20.5K
R5 47.5K
24.9K R7
R8 1000
R9 1000
R11 8060
R12 40.2K
R13 22K
R14 100K
VARIABLE SCAN WIDTH
FULL SCAN
0.5
1
5
10
50
100
500
+125V
S3
RESOLUTION KHz
AUTO
20
5
1
.2
J3
SWEEP
1 MHz
OFF
100 KHz
2-371 (13)
S5
MARKERS
R16
MARKER GAIN
1000
2-371 (14)
2-420 (2)
R18
CENTER FREQUENCY
100K
LF CAL
R2B 10K
VERNIER TUNING
-12.2V
R2A 25K
2-421-(6)
P1-18
VOUT
J2
P1-17
P1-21
V POS
R23B 250K
-100V
S5
1-408 (1)
MARKER 1-408
AMPLITUDE
100KHz POWER
1MHz POWER
OUTPUT
GROUND
PC BOARD 2-371
VERNIER TUNING
LF CAL
CENT FREQ
OSC DRIVE OUT
MARKER POWER
SWEEP INPUT
VIDEO INPUT
V OUT
V DEFLECTION
V POSITION
MARKER SOURCE
MARKER GAIN
SAWTOOTH OUTPUT
H OUT OR SWEEP
OSC DRIVE IN



INPUT
GAIN
-12.2V
GROUND
OUTPUT
2ND L.O. POWER
1ST IF 2-421
TO IF GAIN
2-371 ④
W5
10.7MC INPUT
-12.2 VDC
GROUND
1.5 MC OUTPUT
GAIN CONTROL
WIDE
NARROW
NARROWEST
RESOLUTION IF 1-759
W6
INPUT
-12.2V
LIN & SQ LAW VIDEO
LOG VIDEO
GROUND
LOG-LIN 1-780
DISPLAY
S6
LOG
LIN
SQ LAW
R27 68K
R28 47K
S4
FILTER
OFF
C2 .1
R26 91K
2-371 ㉓
P1
-12.2V RETURN
-12.2V RETURN
+300V
+300
+125V
+125V
-12.2V
-12.2V
2-371⑩
LOWER DEFL PLATE
2-371 ⑦
SAWTOOTH INPUT
2-371⑪
-100V
-100V
-12.2V
R31 82 3W
R29 560 5W
C3 10μf 150V
IFGAIN
R22 *
R23A 20K
2-421 ②
R21 50K
DISP CAL
S6B
+300V
+125V
-100V
-12.2V
LINEAR GAIN
+300V
+125V
-100V
-12.2V
GROUND
GAIN LINEARITY
LOG GAIN
EXT SAW OUT

MARKER GENERATOR MODULE (1-408)

The function of this module is to generate 1 MC marks and 100 KHz interpolation marks over the region from 0 to 25 MHz. This is accomplished as follows:

The master 1 MHz frequency is generated by an integrated circuit crystal oscillator. The output of this oscillator triggers an avalanche transistor, which breaks down to discharge a small capacitor in its collector circuit through a small resistor in its emitter circuit. The result is a narrow pulse with spectral energy over the entire 0 to 25 MHz range. The harmonics of the repetition rate appear at 1 MHz intervals across the band.

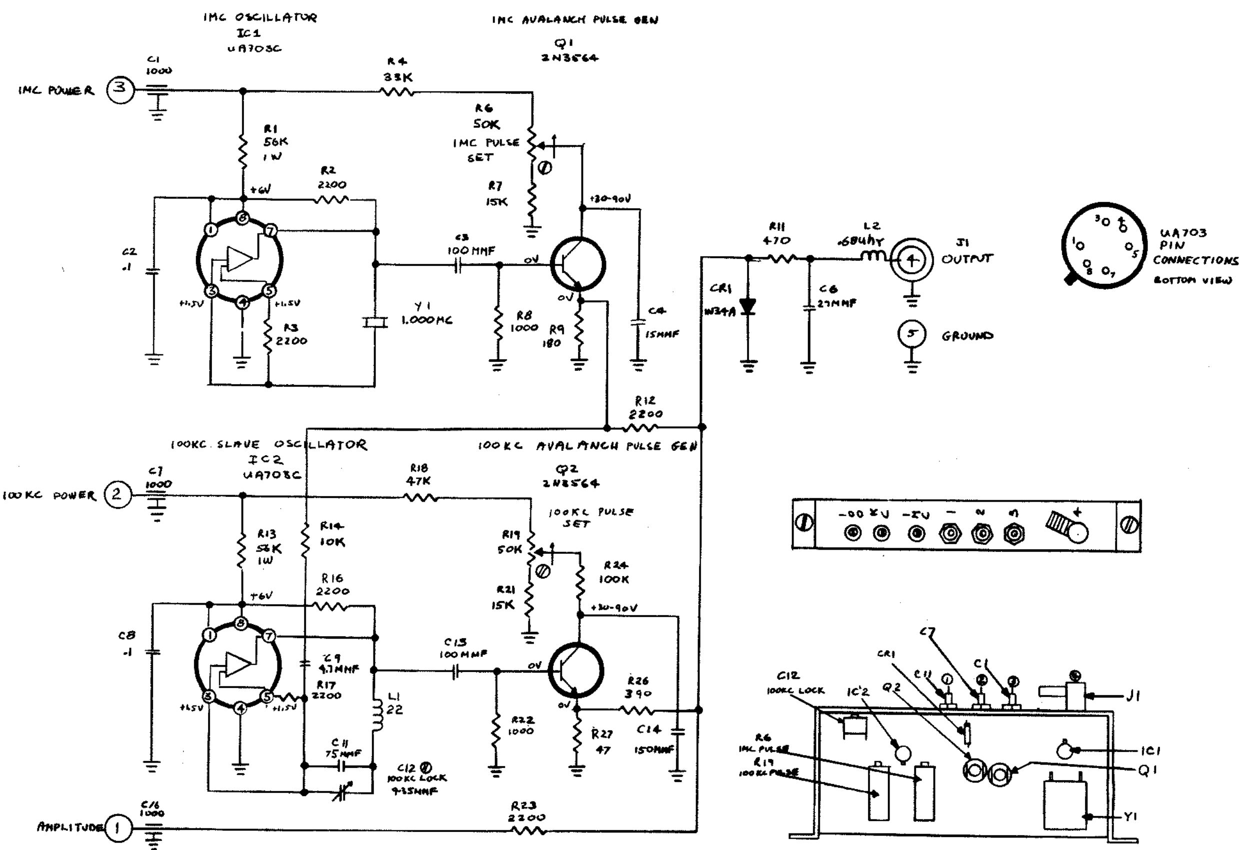
When 100 KHz interpolation marks are required, a second integrated circuit oscillator is energized. This oscillator is locked to the 1 MHz pulse train, and drives a similar avalanche transistor to produce 100 KHz pulses.

Alignment of the module is straight forward. With only the 1 MHz markers on and the instrument in FULL SCAN the 1 MHz PULSE SET control is adjusted to provide a clean, uniform array of markers across the band. The 100 KHz marks are then turned on and the 100 KHz PULSE SET control adjusted until small, noisy markers appear between the 1 MHz marks. The 100 KHz LOCK capacitor are then alternately adjusted for best display. The avalanche transistors are mounted in sockets, so that they may be selected for best performance (not every transistor will be satisfactory).

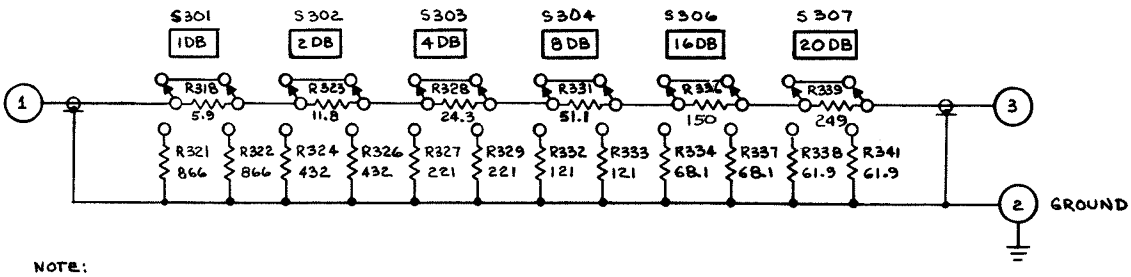
PARTS LIST

R1	Resistor 1W 5% 56K
R2	Resistor ¼W 5% 2.2K
R3	Same as R2
R4	Resistor ¼W 5% 33K
R5	Not Used
R6	Potentiometer 50K Bourns 77PR50K
R7	Resistor ¼W 5% 15K
R8	Resistor ¼W 5% 1K
R9	Resistor ¼W 5% 180 Ω
R10	Not Used
R11	Resistor ¼W 5% 470 Ω
R12	Same as R2
R13	Same as R1
R14	Resistor ¼W 5% 10K
R15	Not Used
R16	Same as R2
R17	Same as R2
R18	Resistor ¼W 5% 47K
R19	Same as R6
R20	Not Used
R21	Same as R7
R22	Same as R8
R23	Same as R2
R24	Resistor ¼W 5% 100K

R26	Resistor ¼W 5% 390 Ω
R27	Resistor ¼W 5% 47 Ω
C1	Feedthrough Capacitor 1000 uuf Erie 321-000-X5V0-102M
C2	Paper Capacitor .1 @ 200V Amperex C280AE/A100K
C3	Mica Capacitor 100 uuf CM15E101J
C4	Mica Capacitor 15 uuf CM15E150J
C5	Not Used
C6	Mica Capacitor 27 uuf CM15E270J
C7	Same as C1
C8	Same as C2
C9	Capacitor 4.7 uuf Stackpole
C10	Not Used
C11	Mica Capacitor 75 uuf CM15E750J
C12	Trimmer Capacitor 9-35 mmf Erie 538-000-94R
C13	Same as C3
C14	Mica Capacitor 150 uuf CM15E151J
C15	Not Used
C16	Same as C1
J1	Connector UG694/U
CR1	Diode 1N34A
L1	Choke 22 uhy J.W. Miller 70F222A1
L2	Choke .68 uhy J.W. Miller 9320-08
Y1	Crystal CK1000-146-4
1C1	Integrated Circuit Fairchild UA703C
1C2	Same as 1C1
Q1	Transistor Fairchild 2N3564
Q2	Same as Q1



50Ω 51db ATTENUATOR



NOTE:
1. ALL RESISTORS IN OHMS.
2. THIS SCHEMATIC VALID FOR ALL DASH NO'S

PARTS LIST

S301	Switch C & K Components 7201
S302	Same as S301
S303	Same as S301
S304	Same as S301
S305	Not Used
S306	Same as S301
S307	Same as S301
R318	Resistor ½W 1% 5.9 Ω
R319	Not Used
R320	Not Used
R321	Resistor ½W 1% 866 Ω
R322	Same as R321
R323	Resistor ½W 1% 11.8 Ω
R324	Resistor ½W 1% 432 Ω
R325	Not Used
R326	Same as R324
R327	Resistor ½W 1% 221 Ω
R328	Resistor ½W 1% 24.3 Ω
R329	Same as R327
R330	Not Used
R331	Resistor ½W 1% 51.1 Ω
R332	Resistor ½W 1% 121 Ω
R333	Same as R332
R334	Resistor ½W 1% 68.1 Ω
R335	Not Used
R336	Resistor ½W 1% 150 Ω
R337	Same as R334
R338	Resistor ½W 1% 61.9 Ω
R339	Resistor ½W 1% 249 Ω
R340	Not Used
R341	Same as R338

VARIABLE BANDWIDTH IF MODULE (1-759)

FUNCTION

The function of this module is to accept a signal at a 10.7 MHz input frequency and deliver an amplified signal at 1.5 MHz. The IF module provides both gain and frequency conversion. A two pole crystal filter in the 1.5 MHz section provides various resolution bandwidths. The input is 50 ohms while the high impedance output is specifically designed to drive the next module within the analyzer. An outline drawing of this module is provided along with an interconnection schematic for the boards within the module.

CIRCUIT DESCRIPTION

The input signal is impressed upon the base of the mixer transistor, Q1. A crystal controlled local oscillator comprised of Q2 and its associated circuitry provides a 12.2 MHz signal which is applied to the emitter of Q1. The output of Q1 is a 1.5 MHz signal, which is initially filtered by a tuned circuit consisting of Z1, and C1. The signal is then fed through the two crystal filters on the crystal filter board. Bandwidth selection is accomplished remotely by diode switching via diode pairs which are normally reversed biased. Forward biasing each pair of diodes provides a different bandwidth position. In the first switch position (widest) the filter is disconnected, providing a wide band position. In the second position the bandwidth is fixed and is a function of the crystal frequency. This position is obtained by reverse biasing all diode pairs. In the third and fourth positions, the crystal filter is inserted at progressively narrower bandwidths. Resistors R8, R12, R34, and R38, and capacitors C8, C13, and C28, are selected at assembly to suit the crystal characteristics and bandwidths for each analyzer model. Gain and gain adjustment is achieved by a 1.5 MHz output amplifier comprised of Integrated Circuit IC1 on the input-output board.

MAINTENANCE AND REPAIR

When a malfunction has been localized to this module, the module should be removed from the instrument frame, and supplied power from the frame by its harness. The following sequential procedure should then be used to trouble-shoot the module.

Perform a D.C. check of voltages on the emitter, base and collector of each transistor stage. Nominal voltages are indicated on the module schematic. If voltage readings are satisfactory, the module must be checked stage by stage. With the module output connected to the next chassis in the frame, apply a signal input to each stage, starting with the last stage in the module and working back to the module input. Any standard signal generator may be used to supply the stage inputs (indicated on the module schematic).

Once a particular stage is found to be inoperative, individual components may be replaced until satisfactory operation is attained.

ALIGNMENT

Test Equipment Required: Signal Generator with output at 10.7 MHz and 1.5 MHz over the range of levels from -100 through -10 dbm.

The Variable Bandwidth IF Module contains three basic circuits which require alignment: the Oscillator-Mixer, the Crystal Filter and the Output Amplifier. The module must be removed to gain access to some of the alignment controls.

During alignment, the module should be connected to the working Plugin Spectrum Analyzer so that the oscilloscope display may be used to observe the shape of bandpass filter in the Variable Bandwidth IF Module.

1. Set the DISPLAY switch on the analyzer panel to LIN
2. For initial alignment, a -10 dbm signal at 1.5 MHz should be applied to the input connector, J. (1)
3. The Resolution switch on the analyzer should be placed in the minimum resolution position, (this position removes the crystal bandpass filter from the circuit)
4. Trimmer C14 and Transformer Z1 on the input-output board should then be tuned for maximum deflection on the oscilloscope screen
5. The signal generator output level should then be reduced to the order of -50 dbm and the frequency readjusted to 10.7 MHz
6. The oscillator tuning capacitor, C6 on the input-output board may then be

adjusted to produce a local oscillator signal. When properly adjusted the mixture of the local oscillator signal with the 10.7 MHz input will produce a 1.5 MHz signal, which will cause deflection on the oscilloscope screen

7. This capacitor, C6 must be adjusted for reliable operation of the local oscillator, a setting which may not coincide with the position for maximum deflection on the CRT screen. It must be adjusted to permit the local oscillator to self-start

8. This setting should be checked by applying and removing power to the spectrum analyzer a few times

9. The crystal filter is aligned with the input connectors, J1 connected normally to the 10.7 MHz output of the previous module. Any attenuator should, however, be switched out of the circuit by the front panel controls.

10. A signal should be provided to the input of the spectrum analyzer so that a component line is displayed on the CRT screen. The shape of this line, is the shape of the bandpass, of the crystal filter which is to be aligned

11. Place the RESOLUTION switch in the position in which all diode pairs are reverse biased, which is the position of maximum crystal filter bandwidth and the position in which the tuning of components is most sensitive

12. Trimmer capacitors C6 and C21 on the crystal filter board should be tuned alternately, for the broadest, smoothest, response obtainable. Do not tune for maximum transmission, but rather for a minimum point at which the transmission, is broad and the shape of the bandpass is smooth and even

13. Capacitors C4 and C19, on the crystal filter board should then be alternately be adjusted to minimize skirt leakage of the signal. Since these capacitors affect the tuning of C6 and C21 (of the previous step) they should be alternately readjusted until the shape of the bandpass is smooth and leakage around the skirts of the signal is minimized

14. Switch the analyzer DISPLAY switch to LOG and increase the signal level until a full screen signal is observed. This greatly expands the skirts to facilitate adjustment of C4 and C19 for the most symmetrical bandpass characteristics

15. Return the DISPLAY switch to the LIN position

16. Retrim Z1 and C14 for maximum transmission. The step assures that the center frequency of the various tuned circuits is precisely the same as the center frequency of the filter, in its narrowest position

---

PARTS LIST

VARIABLE BANDWIDTH I.F. (1-759)

Frame C1000-759
Crystal Filter C1000-785
Input-Output Circuit C1000-786

FRAME B1000-759

C1	Capacitor, Feedthru 1000 mmf Erie X5V321-1000 mmf
C2	Same as C1
C3	Same as C1
C4	Same as C1
C5	Same as C1
J1	Connector UG694/U
J2	Same as J1

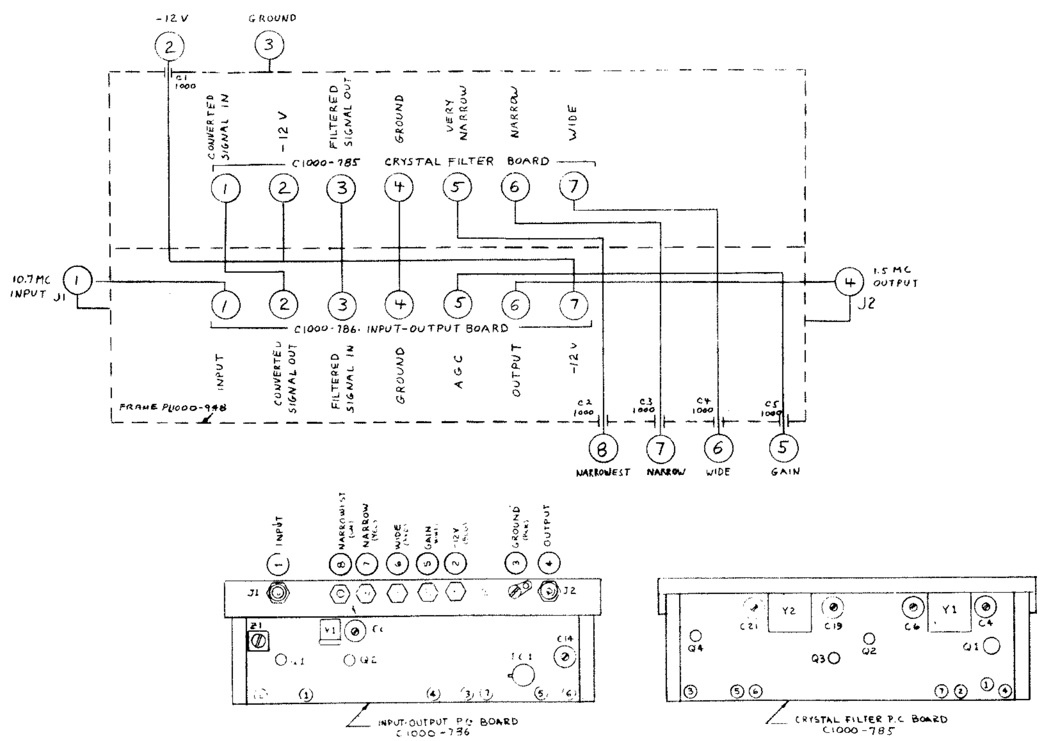
CRYSTAL FILTER C1000-785

R1	Resistor ¼W 5% 47K
R2	Same as R1
R3	Resistor ¼W 5% 1200 Ω
R4	Resistor ¼W 5% 220 Ω
R5	Not Used
R6	Same as R4
R7	Resistor ¼W 5% 100K
R8	Selected At Test
R9	Same as R1
R10	Not Used
R11	Same as R7
R12	Selected At Test
R13	Same as R1
R14	Same as R7
R15	Not Used
R16	Selected At Test
R17	Same as R1
R18	Resistor ¼W 5% 330K
R19	Same as R18
R20	Not Used
R21	Same as R4
R22	Same as R4
R23	Resistor ¼W 5% 4700 Ω
R24	Same as R1
R25	Not Used
R26	Same as R1
R27	Same as R23
R28	Same as R23
R29	Same as R3
R30	Not Used
R31	Same as R4
R32	Same as R4
R33	Same as R7
R34	Selected At Test
R35	Not Used
R36	Same as R1
R37	Same as R7
R38	Selected At Test
R39	Same as R1
R40	Not Used
R41	Same as R7
R42	Selected At Test
R43	Same as R1
R44	Same as R18
R45	Not Used
R46	Same as R18
R47	Same as R23
C1	Capacitor, Disc .001 @ 600V Centralab DD-102
C2	Capacitor Mylar .1 @ 200V Amperex C280AE/A100K
C3	Same as C1
C4	Capacitor, Trimmer 2.5-11mmf Erie 538-000-90R
C5	Not Used
C6	Capacitor, Trimmer 9-35mmf Erie 538-000-94R
C7	Same as C1
C8	Selected At Test
C9	Same as C1
C10	Not Used
C11	Same as C1
C12	Same as C1
C13	Selected At Test
C14	Same as C1
C15	Not Used
C16	Same as C1
C17	Same as C7
C18	Same as C1
C19	Same as C4
C20	Not Used
C21	Same as C6
C22	Same as C7
C23	Selected At Test
C24	Same as C1
C25	Not Used
C26	Same as C1
C27	Same as C1
C28	Selected At Test
C29	Same as C1
C30	Not Used
C31	Same as C1
Y1	Crystal 1.5 MHz A1000-007-3
Y2	Same as Y1

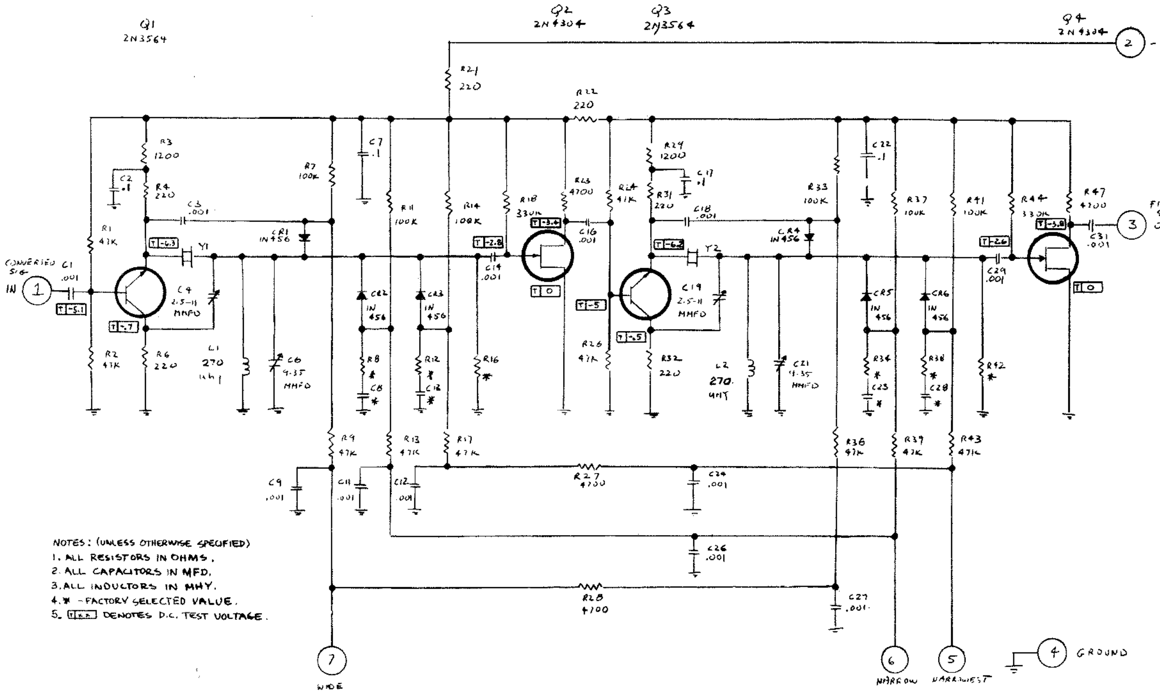
L1	Choke 270 uhy Delevan 2500-00
L2	Same as L1
CR1	Diode 1N456
CR2	Same as CR1
CR3	Same as CR1
CR4	Same as CR1
CR5	Same as CR1
CR6	Same as CR1
Q1	Transistor 2N3566 Fairchild
Q2	Transistor, FET Amelco 2N4304
Q3	Transistor 2N4304
Q4	Same as Q2

INPUT-OUTPUT CIRCUIT C1000-786

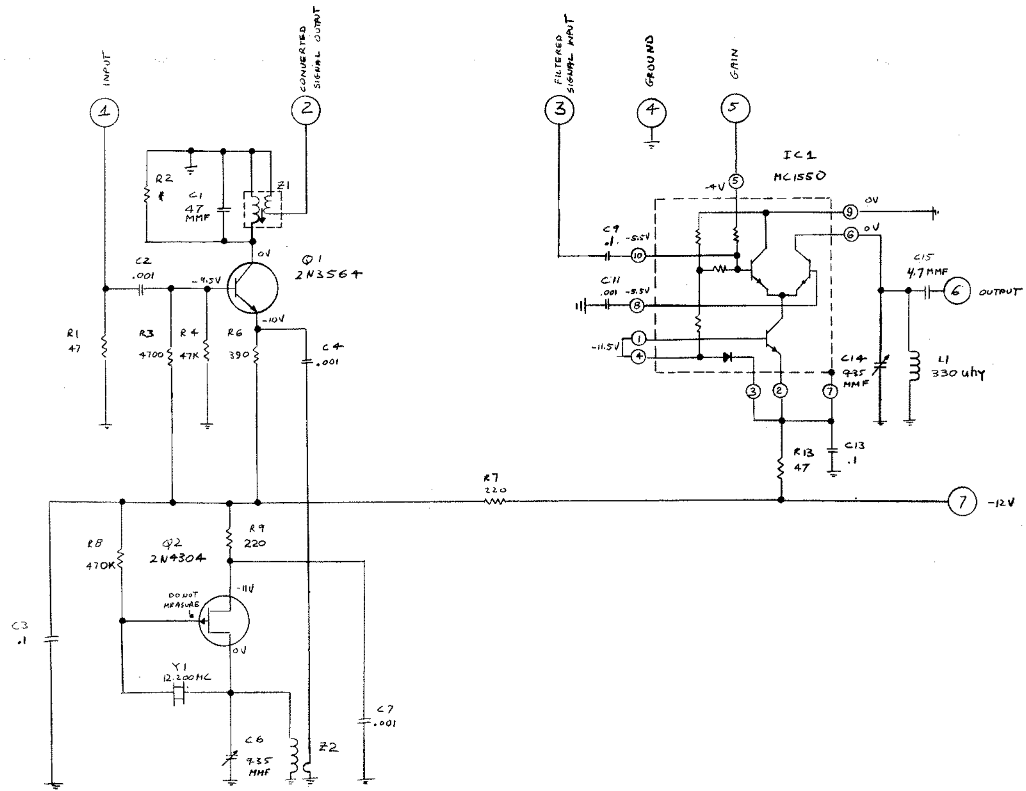
R1	Resistor $\frac{1}{4}$W 5% 47 Ω
R2	Selected At Test
R3	Resistor $\frac{1}{4}$W 5% 4700 Ω
R4	Resistor $\frac{1}{4}$W 5% 47K
R5	Not Used
R6	Resistor $\frac{1}{4}$W 5% 390 Ω
R7	Resistor $\frac{1}{4}$W 5% 220 Ω
R8	Resistor $\frac{1}{4}$W 5% 470K
R9	Same as R7
R10	Not Used
R11	Not Used
R12	Not Used
R13	Same as R1
R14	Not Used
C1	Capacitor, Mica 47 mmf CM15E470J
C2	Capacitor, Disc .001 @ 600V Centralab DD-102
C3	Capacitor .1 @ 200V Amperex C280AE/A100K
C4	Same as C2
C5	Not Used
C6	Capacitor Trimmer 9-35 mmf Erie 538-000-94R
C7	Same as C2
C8	Not Used
C9	Same as C3
C10	Not Used
C11	Same as C2
C12	Not Used
C13	Same as C3
C14	Same as C6
C15	Capacitor, Ceramic 4.7 mmf Stackpole Type GA
C16	Not Used
Q1	Transistor 2N3564 Fairchild
Q2	Transistor, FET Amelco 2N4304
IC1	Integrated Circuit Motorola MC1550
Y1	Crystal 12.2 MHz C1000-007-9
L1	Choke 330 uhy Delevan 2500-04
Z1	Transformer B1000-345-1
Z2	Transformer B1000-709-6



FRAME C1000-759



CRYSTAL FILTER C1000-785



INPUT-OUT CIRCUIT C1000-786

LOG-LIN SQUARE LAW MODULE

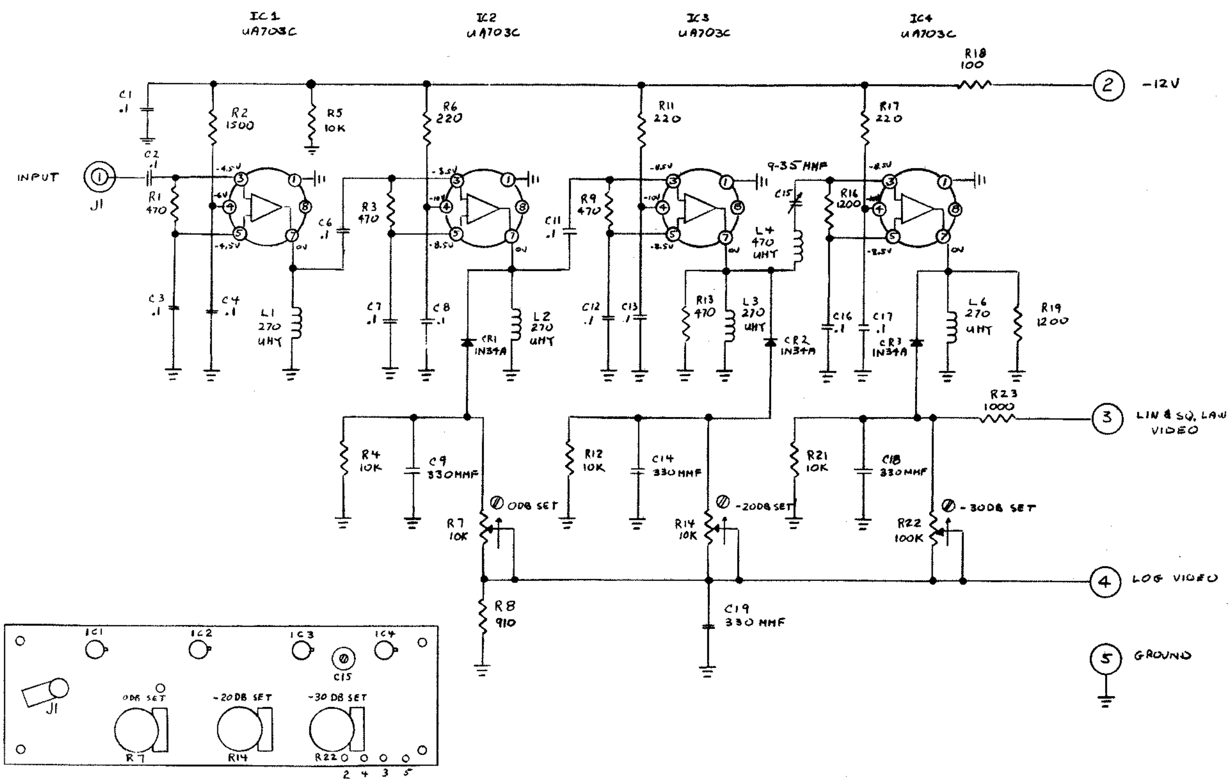
This module provides the essential functions of detection and vertical scale shapping. Four identical integrated circuit RC coupled amplifiers provide gain. A tuned circuit at the input to the last amplifier rejects noise. The three final amplifiers each drive a detector, the outputs of which are summed up to provide the logarithmic characteristic required for the LOG display function of the instrument. Potentiometers are provided for adjusting the ratios in which the detectors are summed up so that the shape of the LOG display may be set up as required.

For LINEAR and SQUARE LAW operation, only the last detector is used. An attenuator on the DISPLAY switch on the main frame adjusts the gain of the vertical amplifier so that either the linear or square law detection region of the last detector is used, as required. The alignment of this module consists of adjusting the trimmer condenser on the tuned circuit for maximum signal with the instrument in LIN, and adjusting the vertical display curve with the instrument in LOG. R22 (-30 db set) is used to set the mid point of the log scale. The -20 db set and 0 db set controls - which interact - set the scale between 0 db and -30 db. The curve from -30 db to -60 db is preset and cannot be adjusted. Full scale (6 cm) is the reference level. The shape of the curve should be adjusted to provide the following fits: 0 db = 6 cm, -10 db = 5 cm, -20 db = 4 cm, -30 db = 3 cm. -40 db will then fall at 2 cm, -50 db at 0.8 cm and -60 db will be barely visible as a 1/10 cm deflection.

PARTS LIST

R1	Resistor ½W 5% 470 Ω
R2	Resistor ½W 5% 1.5K
R3	Same as R1
R4	Resistor ½W 5% 10K
R5	Not Used
R6	Resistor ½W 5% 220 Ω
R7	Potentiometer 10K CTS U201R103B
R8	Resistor ½W 5% 910 Ω
R9	Same as R1
R10	Not Used
R11	Same as R6
R12	Same as R4
R13	Same as R1
R14	Same as R7
R15	Not Used
R16	Resistor ½W 5% 1.2K
R17	Same as R6
R18	Resistor ½W 5% 100 Ω
R19	Same as R16
R20	Not Used
R21	Same as R4
R22	Potentiometer 100K CTS U201R104B
R23	Resistor ½W 5% 1K
C1	Paper Capacitor .1 @ 200V Amperex C280AE/A100K
C2	Same as C1
C3	Same as C1
C4	Same as C1
C5	Not Used

C6	Same as C1
C7	Same as C1
C8	Same as C1
C9	Mica Capacitor 330 uuf CM15E331J
C10	Not Used
C11	Same as C1
C12	Same as C1
C13	Same as C1
C14	Same as C9
C15	Trimmer Capacitor 9-35uuf Erie 538-000-94R
C16	Same as C1
C17	Same as C1
C18	Same as C9
1C1	Integrated Circuit Fairchild UA703C



SWEPT OSCILLATOR MODULE (1-741) (1-939)

This module consists of an oscillator, which is tuned by a varactor, followed by a buffer amplifier. The oscillator utilizes an integrated circuit amplifier driving a high Q tuned circuit. A capacitor between input and output provides feedback. A low impedance secondary winding on the tuned circuit provides drive for the buffer amplifier, which is an integrated circuit wideband amplifier.

The oscillator frequency is controlled by a varactor diode across the tuned circuit. The capacity of the diode is controlled by means of an external voltage introduced via the TUNING V IN jack. Since there are no adjustments, there is no alignment procedure. The module may be shown to be working by observing the output on a power meter (approx.-20 dbm) or a spectrum analyzer.

Modules 1-741 and 1-939 are identical except for polarity of varactor CR1.

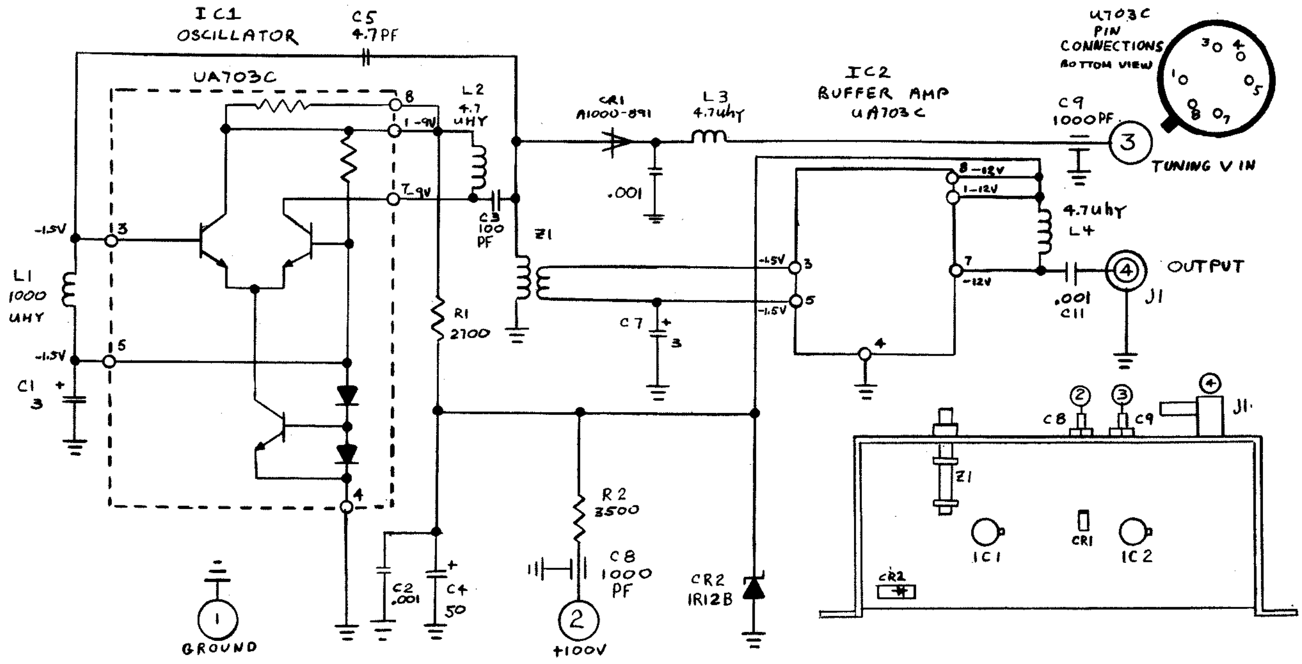
PARTS LIST

SWEPT OSCILLATOR MODULE 1-741

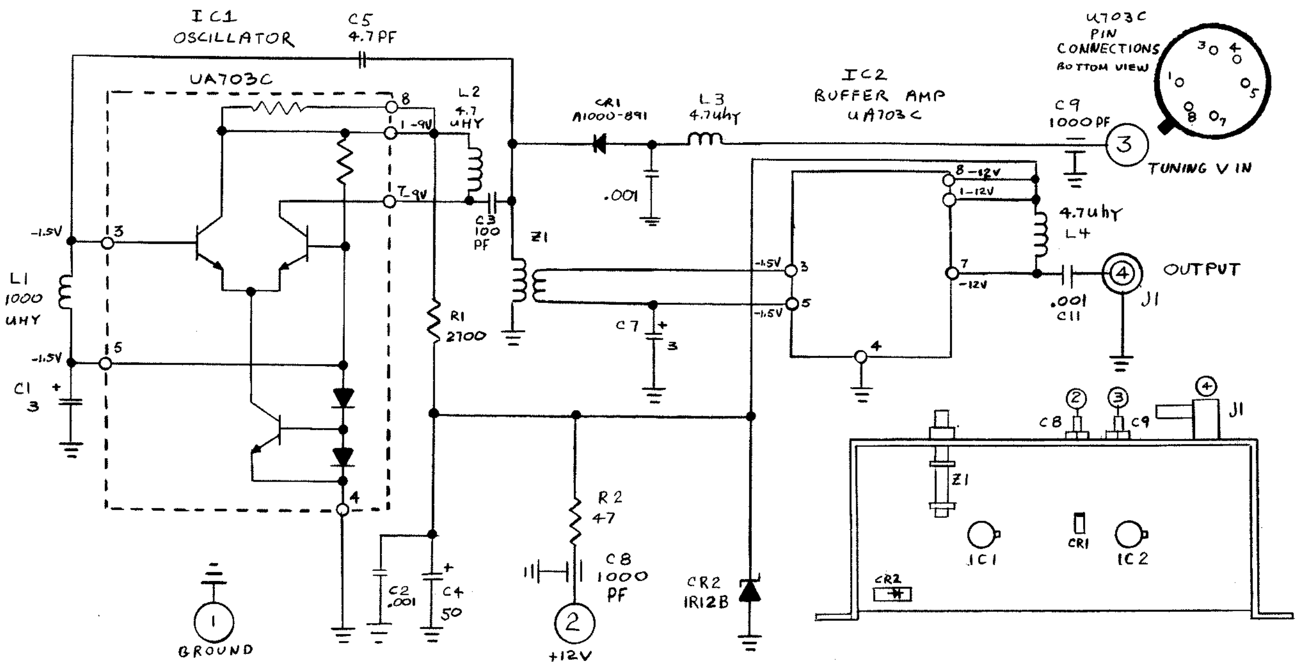
R1	Resistor ½W 5% 2.7K
R2	Resistor WW Axial 5W 3.5K
C1	Electrolytic Capacitor 3ufd @ 6V Sprague TE 1082
C2	Disc Capacitor .001 @ 600V CRl DD 102
C3	Mica Capacitor 100 uuf CM15E101J
C4	Electrolytic Capacitor 50 @ 12 Sprague TE 1133
C5	Ceramic Capacitor 4.7 uuf
C6	Same as C2
C7	Same as C1
C8	Feedthrough 1000 uuf Erie 321-000-X5V102P
C9	Same as C8
C10	Not Used
C11	Same as C2
1C1	Integrated Circuit Fairchild UA703C
1C2	Same as 1C1
L1	Coil 1000 uhy Delevan 2500-28
L2	Coil 4.7 uhy Delevan 1537-28
L3	Same as L2
L4	Same as L2
CR1	Varactor A1000-891
CR2	Diode 1R12R
Z1	Transformer A1000-985

SWEPT OSCILLATOR 1-939

PARTS IDENTICAL TO 1-741


IC1
OSCILLATOR
C5
4.7PF
UA703C
L2
4.7
UHY
CR1
A1000-891
L3
4.7uhy
IC2
BUFFER AMP
UA703C
U703C
PIN
CONNECTIONS
BOTTOM VIEW
C9
1000PF
TUNING V IN
C3
100
PF
Z1
.001
4.7uhy
L4
OUTPUT
L1
1000
UHY
.001
C11
J1
R1
2700
C7
3
C1
3
R2
3500
C8
1000
PF
CR2
IR12B
C2
.001
C4
50
GROUND
+100V
C8
C9
J1
Z1
CR1
IC1
IC2
CR2

1-741


IC1
OSCILLATOR
C5
4.7PF
UA703C
L2
4.7
UHY
CR1
A1000-891
L3
4.7uhy
IC2
BUFFER AMP
UA703C
U703C
PIN
CONNECTIONS
BOTTOM VIEW
C9
1000PF
TUNING V IN
C3
100
PF
Z1
.001
4.7uhy
L4
OUTPUT
L1
1000
UHY
.001
C11
J1
R1
2700
C7
3
C1
3
R2
47
C8
1000
PF
CR2
IR12B
C2
.001
C4
50
GROUND
+12V
C8
C9
J1
Z1
CR1
IC1
IC2
CR2

1-939

TRACKING MODULE

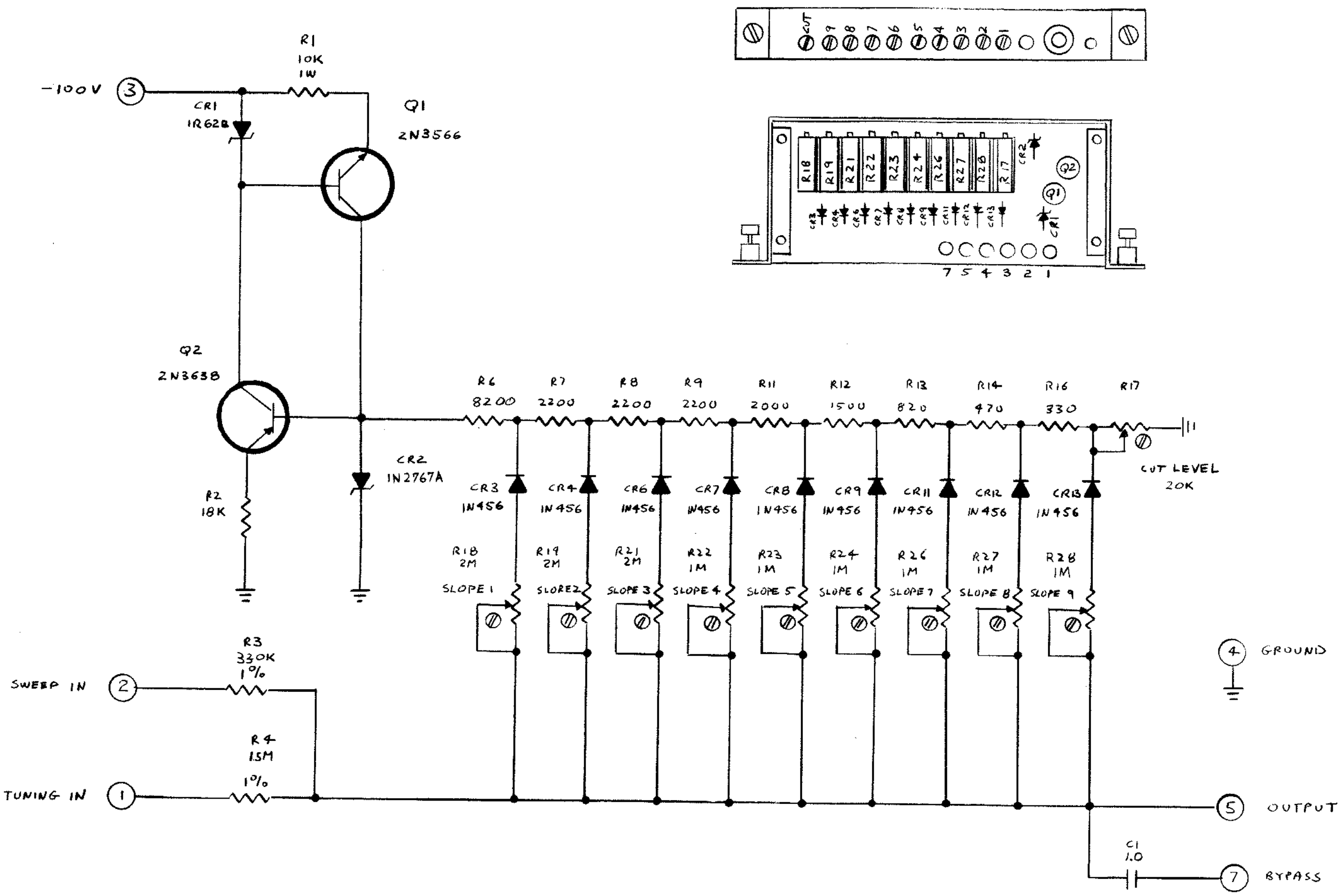
Since the voltage-vs-frequency curve of the swept oscillator module is non-linear and the tuning dial of the instrument is linear, it is the function of the tracking module to provide the non-linear transfer function which links the dial with the swept oscillator module. The sawtooth sweep voltage and the vernier tuning voltage (if required) are also processed by this module. The non-linear characteristics are obtained by means of a network of diodes and resistors. The diodes are biased at various voltages (cut points) so as to come into the circuit at different input voltages. Each diode has a resistor associated with it which modifies the output-input slope. The result is a non-linear characteristic, which may be controlled by means of adjustment potentiometers. These potentiometers are utilized to track the tuning curve with the dial calibration-hence the name "Tracking Module". The tuning voltage from the CENTER FREQUENCY potentiometer and the sweep voltage from the SCAN WIDTH control are summed up at the input to the non-linear network in proportion to their required outputs, by means of precision resistors.

Since the alignment of this module would be meaningless without the rest of the instrument, the procedure is given as "CENTER FREQUENCY dial adjustment", elsewhere in this manual.

PARTS LIST

C1	Capacitor, Paper 1.0 MFD @ 200V Goodall X663F
CR1	Diode 1R62B
CR2	Diode 1N2767A
CR3	Diode 1N456
CR4	Same as CR3
CR5	Not Used
CR6	Same as CR3
CR7	Same as CR3
CR8	Same as CR3
CR9	Same as CR3
CR10	Not Used
CR11	Same as CR3
CR12	Same as CR3
CR13	Same as CR3
Q1	Transistor 2N3566
Q2	Transistor 2N3638
R1	Resistor Composition 1W 5% 10K IRC GBT1
R2	Resistor Composition $\frac{1}{2}$W 5% 18K IRC GBT$\frac{1}{2}$
R3	Resistor Film $\frac{1}{2}$W 1% 330K Dale MFF $\frac{1}{2}$ T1
R4	Resistor Film $\frac{1}{2}$W 1% 1.5M Dale MFF $\frac{1}{2}$ T1
R5	Not Used
R6	Resistor Composition $\frac{1}{2}$W 5% 8200 Ω IRC GBT$\frac{1}{2}$
R7	Resistor Composition $\frac{1}{2}$W 5% 2200 Ω IRC GBT$\frac{1}{2}$
R8	Same as R7
R9	Same as R7
R10	Not Used
R11	Resistor Composition $\frac{1}{2}$W 5% 2000 Ω IRC GBT$\frac{1}{2}$
R12	Resistor Composition $\frac{1}{2}$W 5% 1500 Ω IRC GBT$\frac{1}{2}$
R13	Resistor Composition $\frac{1}{2}$W 5% 820 Ω IRC GBT$\frac{1}{2}$
R14	Resistor Composition $\frac{1}{2}$W 5% 470 Ω IRC GBT$\frac{1}{2}$
R15	Not Used
R16	Resistor Composition $\frac{1}{2}$W 5% 330 Ω IRC GBT$\frac{1}{2}$
R17	Potentiometer 20K Helipot 77PR20K

R18	Potentiometer 2M Helipot 77PR2M
R19	Same as R18
R20	Not Used
R21	Same as R18
R22	Potentiometer 1M Helipot 77PR1M
R23	Same as R22
R24	Same as R22
R25	Not Used
R26	Same as R22
R27	Same as R22
R28	Same as R22



MIXER MODULE

The mixer consists of a four diode ring modulator, balanced for three separate inputs. These inputs are: local oscillator, signal and marker. All three inputs are terminated in 50 ohms, and balanced so as to minimize transmission from input to output. The output drives a 65 MHz filter consisting of two link-coupled high Q tuned circuits.

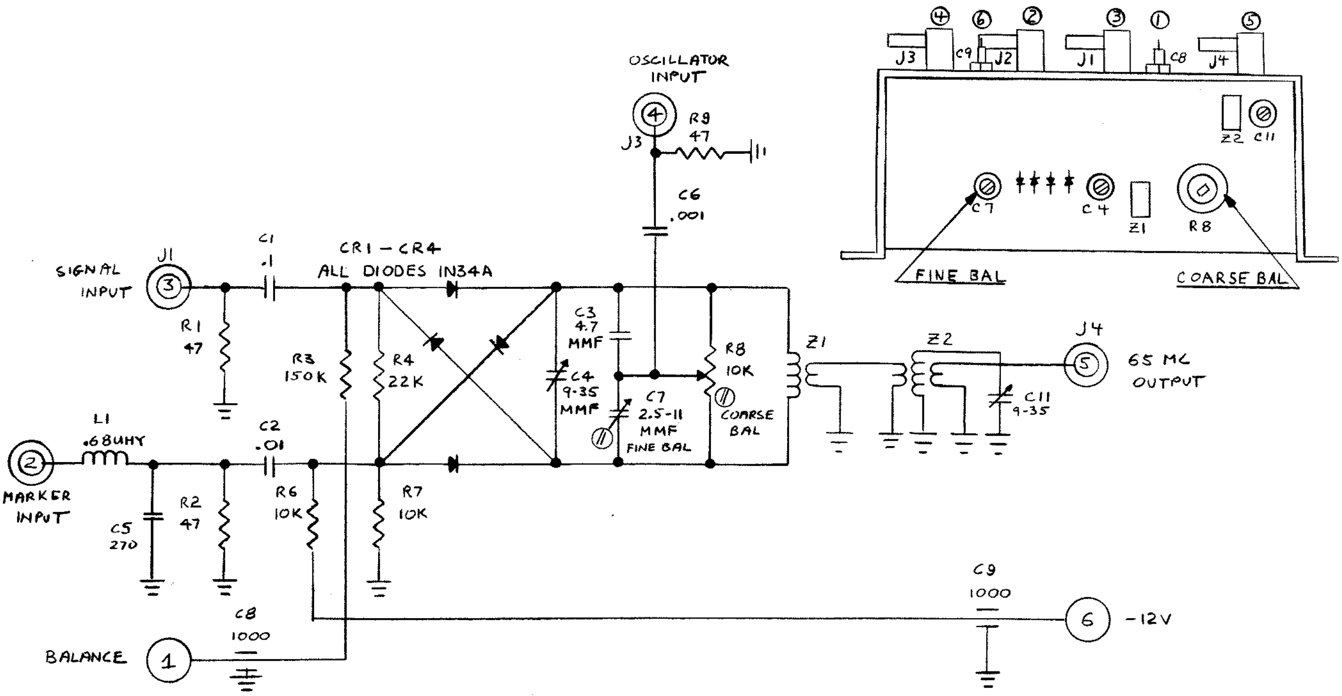
The balance is adjustable only for the oscillator input, and consists of three individual controls: a potentiometer for amplitude, a capacitor for phase and an external voltage input for diode characteristics. To obtain the specified performance from the instrument the mixer must be correctly balanced. This must be done on a complete, properly functioning instrument:

1. By means of a BNC tee connector, connect two signal generators in parallel to the input of the instrument (a suitable two-tone generator may be used). With the instrument in LOG, inject two equal signals of full scale amplitude into the instrument. These signals should be spaced close together so that the IM distortion products are visible just above and below the two signals.
2. Place the instrument in FULL SCAN so that the zero signal is visible.
3. Carefully adjust the amplitude and phase balance for minimum IM. This is not the point of minimum zero signal. After each adjustment, vary the MIXER BALANCE control on the panel to find a minimum for the zero signal. The correct adjustment is the point where minimum IM and a minimum of the zero signal occur simultaneously when varying the MIXER BALANCE control. The null in the zero signal at this point is not necessarily the best null. This is unimportant since the IM is really what is nulled with the MIXER BALANCE. The zero signal is only an indicator.

PARTS LIST

C1	Capacitor Paper .1 @ 200V
C2	Same as C1
C3	Ceramic Capacitor 4.7 uuf
C4	Trimmer Capacitor 9-35 uuf Erie 538-000-90R
C5	Not Used
C6	Disc Capacitor .001
C7	Trimmer Capacitor 2.5-11uuf Erie 538-000-90R
C8	Feedthrough 1000 uuf Erie 321-000-X5V0-102M
C9	Same as C8
C10	Not Used
C11	Same as C4
CR1	Diode 1N34A
CR2	Same as CR1
CR3	Same as CR1
CR4	Same as CR1
J1	Connector UG624/U
J2	Same as J1
J3	Same as J1
J4	Same as J1
R1	Resistor Composition $\frac{1}{4}$W 5% 47Ω IRC GBT$\frac{1}{4}$
R2	Same as R1
R3	Resistor Composition $\frac{1}{4}$W 5% 150K IRC GBT$\frac{1}{4}$
R4	Resistor Composition $\frac{1}{4}$W 5% 22K IRC GBT$\frac{1}{4}$
R5	Not Used
R6	Resistor Composition $\frac{1}{4}$W 5% 10K IRC GBT$\frac{1}{4}$
R7	Same as R6
R8	Potentiometer 10K CTS U201R102B

R9	Same as R1
Z1	Transformer B1000-709-9
Z2	Transformer B1000-709-13



FIRST IF MODULE

This module filters and amplifies the 65 MHz signal from the mixer and converts it to 10.7 MHz. Additional selectivity is provided at 10.7 MHz, and gain control is provided in the 65 MHz amplifier.

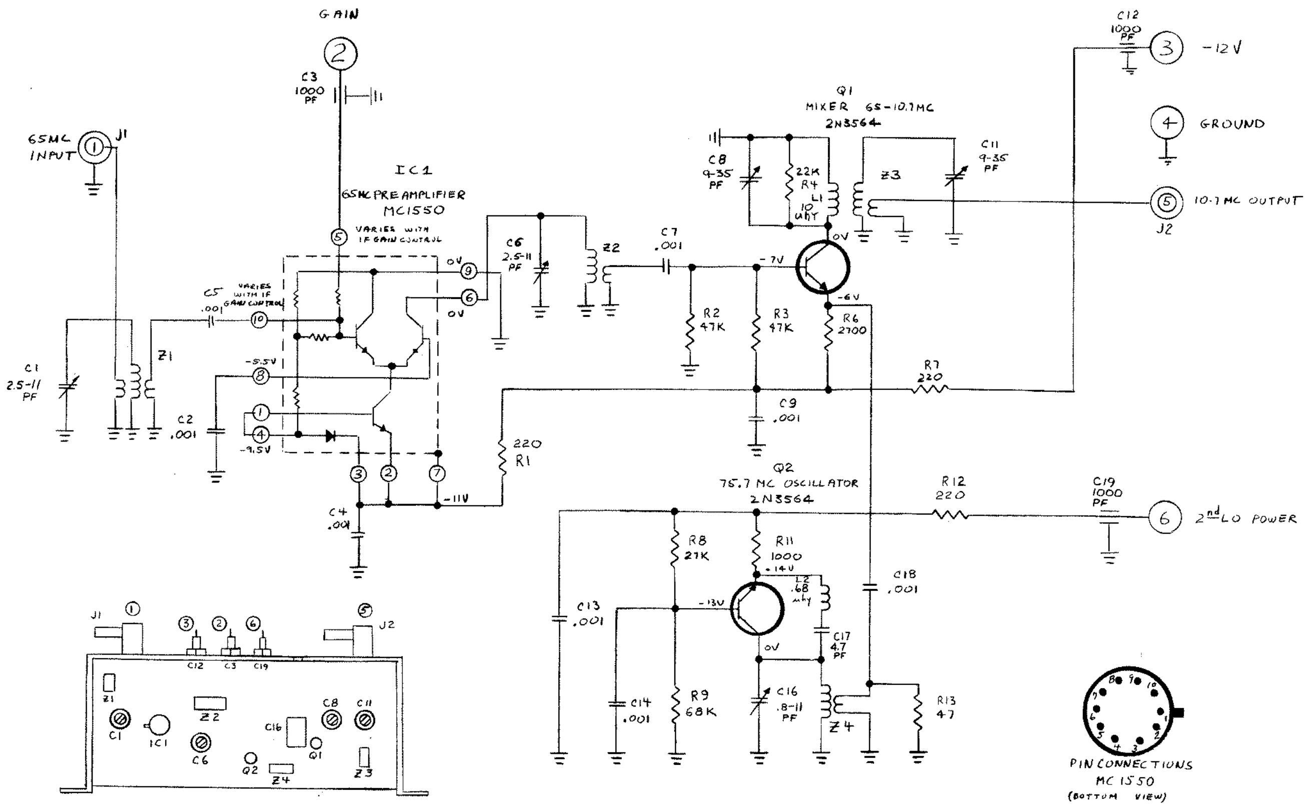
The input signal drives the amplifier, which is an integrated circuit, through a 65 MHz filter. This filter consists of two low impedance coils coupled via a high Q tank circuit which produces tight coupling at 65 MHz and very loose coupling at other frequencies. The output of the amplifier drives another high Q 65 MHz circuit with a low impedance secondary. The secondary drives a bipolar transistor mixer. The local oscillator for this mixer is an L-C tuned 75.7 MHz FET oscillator. The output difference frequency of the mixer is 10.7 MHz, which is passed through a double-tuned transformer with a 50 ohm output winding which drives the output. Power for the 54.3 MHz local oscillator is derived from a constant current resistor from + 100 volts. When the instrument is in the smaller dispersion settings this oscillator is swept by varying its supply current. Gain control is applied to the integrated circuit amplifier from the front panel IF GAIN control.

Alignment of this module should be done in a working instrument with correctly adjusted modules in all following signal circuits. Connect a signal generator to the input and tune to 10.7 MHz. Apply a very large signal (0 dbm) and rock the generator back and forth to find a small deflection on the screen. Modulating the generator will help, as the modulation will be visible on the baseline of the display. When a signal is seen, tune first C8 and then C11 for maximum. Next tune the generator to 65 MHz and switch the analyzer SCAN WIDTH control to a position in which the local oscillator is swept. Adjust C16 to locate and center the signal. Adjust C1 and C6 for maximum signal deflection.

PARTS LIST

C1	Capacitor Trimmer 2.5-11 uuf Erie 538-000-90R
C2	Capacitor Disc .001 @ 600V
C3	Feedthrough 1000 uuf Erie 321-000-X5V0-102P
C4	Same as C2
C5	Same as C2
C6	Same as C1
C7	Same as C2
C8	Trimmer Capacitor 9-35 uuf Erie 538-000-94R
C9	Same as C2
C10	Not Used
C11	Same as C8
C12	Same as C3
C13	Same as C2
C14	Same as C2
C15	Not Used
C16	Capacitor Trimmer .8-11 uuf Erie 523-000
C17	Capacitor Axial 4.7 uuf
C18	Same as C2
C19	Same as C3
IC1	Integrated Circuit Motorola MC1550
J1	Connector UG694/U
J2	Same as J1
L1	Choke 10 uhy Delevan 1537-36
L2	Choke .68 uhy Miller 9320-08
R1	Resistor Composition $\frac{1}{4}$W 5% 220 Ω IRC GBT$\frac{1}{4}$
R2	Resistor Composition $\frac{1}{4}$W 5% 47K IRC GBT$\frac{1}{4}$

R3	Same as R2
R4	Resistor Composition $\frac{1}{4}$W 5% 22K IRC GBT$\frac{1}{4}$
R5	Not Used
R6	Resistor Composition $\frac{1}{4}$W 5% 2.7K IRC GBT$\frac{1}{4}$
R7	Same as R1
R8	Resistor Composition $\frac{1}{4}$W 5% 27K IRC GBT$\frac{1}{4}$
R9	Resistor Composition $\frac{1}{4}$W 5% 68K IRC GBT$\frac{1}{4}$
R10	Not Used
R11	Resistor Composition $\frac{1}{2}$W 5% 1K IRC GBT$\frac{1}{2}$
R12	Same as R1
R13	Resistor $\frac{1}{4}$W 5% 47Ω IRC GBT$\frac{1}{4}$
Z1	Transformer B1000-709-10
Z2	Transformer B1000-709-1
Z3	Transformer B1000-709-6
Z4	Transformer B1000-709-9



SECTION 7

ACCESSORIES AND NOTES

SECTION 7

ACCESSORIES

Two accessory kits are available. They are the Model P2 probe kit and the Model P3 probe kit. The P2 probe kit is an active probe with unity transmission factor and high input impedance for observing low level signals, while the P3 probe kit is a passive high impedance attenuator probe for observing voltages up to 1200v p/p.

Model P2 probe kit consists of the Model P2 probe, coaxial cable, removable alligator clip and modification kit consisting of potentiometer C1000-154-30 and knob A1000-410 (PULL FOR PROBE). The required power for the probe is obtained from the analyzer via the center conductor of the input coaxial cable. This supply is energized when the IF GAIN control knob is pulled out. Units which are not ordered with the P2 probe will be shipped without this switch. The supply circuitry and the wires are in the unit and may be put into service by substituting a new IF GAIN control assembly (C1000-154-30) and knob (A1000-410) for the existing one. The wires for the switch will be found dressed against the cable near the control, and should be connected to the switch terminals. All probe kits are shipped complete with cable, knob and control. Analyzers ordered with probes will have the modification factory installed.

The probe consists of a field effect transistor connected as a source follower driving a transistor emitter follower. See Figure 7-1 for specifications and service information.

Model P3 probe kit: The P3 probe is a passive voltage divider probe and may be used on any 50Ω system to provide high impedance high voltage capabilities. The kit consists of the P3 probe, a coaxial cable and two range extenders A1000-896. The range extenders may be attached between the probe and the cable to provide 10:1 and 100:1 loss, thus extending the instrument capabilities to 1200 v p/p. No modifications of the analyzer are required. See Figure 7-2 for specifications and service information.

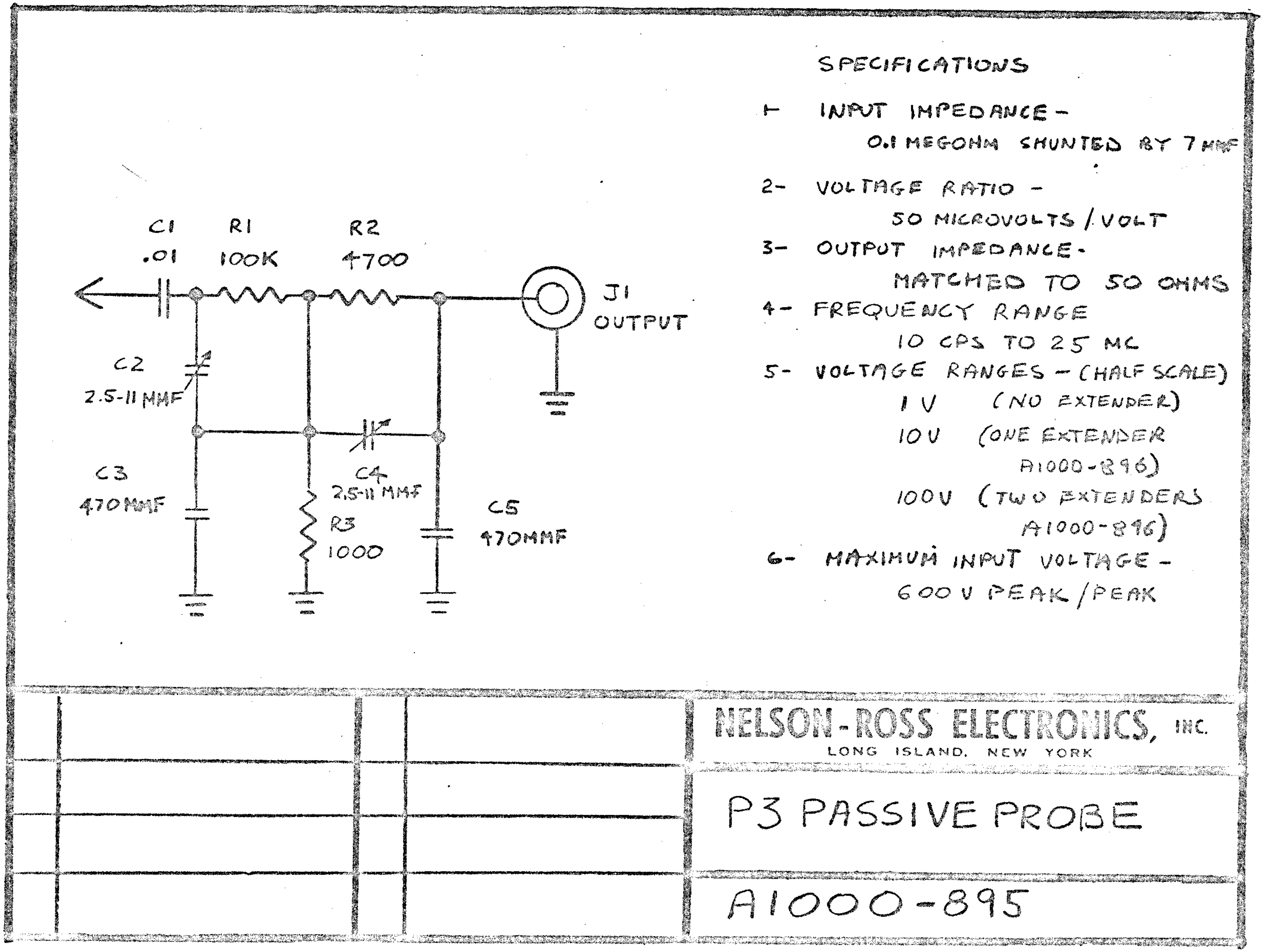
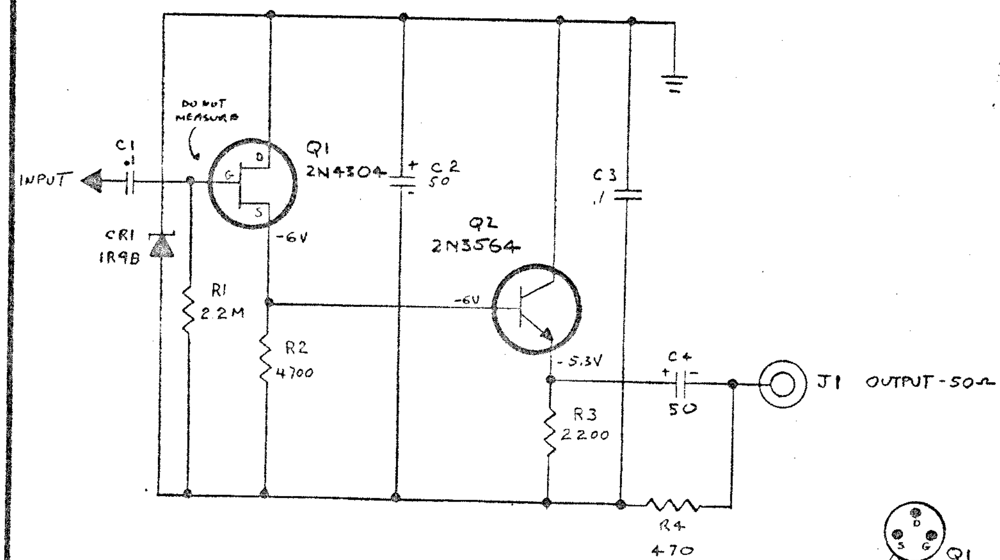
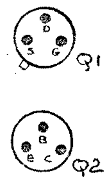

C1
.01
R1
100K
R2
4700
J1
OUTPUT
C2
2.5-11 MMF
C3
470 MMF
C4
2.5-11 MMF
R3
1000
C5
470 MMF
SPECIFICATIONS
1- INPUT IMPEDANCE -
0.1 MEGOHM SHUNTED BY 7 MMF
2- VOLTAGE RATIO -
50 MICROVOLTS / VOLT
3- OUTPUT IMPEDANCE -
MATCHED TO 50 OHMS
4- FREQUENCY RANGE
10 CPS TO 25 MC
5- VOLTAGE RANGES - (HALF SCALE)
1 V (NO EXTENDER)
10 V (ONE EXTENDER A1000-896)
100 V (TWO EXTENDERS A1000-896)
6- MAXIMUM INPUT VOLTAGE -
600 V PEAK / PEAK
NELSON-ROSS ELECTRONICS, INC.
LONG ISLAND, NEW YORK
P3 PASSIVE PROBE
A1000-895

FIGURE 7-2





SPECIFICATIONS

1- INPUT IMPEDANCE 2 MEG -15MMFD
2- MAXIMUM SIGNAL LEVEL 100MILLIVOLTS
3- MAXIMUM DC VOLTAGE. 200V
4- FREQUENCY RANGE 10 CPS -25MC

INSTRUCTIONS

1- MODIFY PLUG-IN ANALYZER TO PROVIDE PROBE POWER TO INPUT JACK CENTER PIN AS FOLLOWS
   A) DISCONNECT & REMOVE EXISTING I.F. GAIN CONTROL KNOB
   B) REPLACE WITH PART C1000-154-30 & KNOB A1000-410 [SUPPLIED WITH PROBE KIT]
   C) RECONNECT WIRING
   D) FIND 2 WIRE ENDS TIED TO CABLE NEAR THE CONTROL, STRIP & CONNECT TO SWITCH TERMINALS
2- CONNECT PROBE TO UNIT WITH 50Ω BNC-BNC COAXIAL CABLE A1000-352-2 SUPPLIED [ANY CABLE UP TO 20' MAY BE USED]
3- BE SURE TO CONNECT GROUND CLIP WHEN USING PROBE

P2 PROBE KIT CONSISTS OF:

1 PROBE -P2 - B1000-894
1 CABLE-BNC - A1000-352-2
1 CLIP -ALLIGATOR
1 KNOB-PULL A1000-410
1 CONTROL C1000-154-30
1 INSTRUCTIONS B1000-902

NELSON-ROSS ELECTRONICS, INC.
LONG ISLAND, NEW YORK

P2 PROBE
OPERATING INSTRUCTIONS

B1000-902 REV

FIGURE 7-1

MODIFICATION

TEKTRONIX TIME BASE PLUG-INS

The Time Base Plug-ins listed below must be modified for use with Nelson-Ross Spectrum Analyzer Plugins. The Modification Kit is included in a separate envelope and is packed with the analyzer.

MODEL	SERIAL NUMBERS
67	101-5000
2B67	5001-15179
3B1	101-4039
3B3	100-4269
3B4	100-739

MODIFICATION PARTS LIST

QTY.	DESCRIPTION	PART NO.
1	RESISTOR, FILM	95.3K ½W 1%
1	RESISTOR, FILM	102K ½W 1%
1	RESISTOR, FILM	221K ½W 1%
1	CABLE, COAX	50 Ω 4"
1	CABLE, COAX	50 Ω 10"
1	CABLE, COAX	50 Ω 12"
1	WIRE, UNINSULATED	#22 SOLID 2"

NOTE: Use silver-bearing solder supplied with scope when soldering to ceramic terminal strips.

INSTRUCTIONS:

A. Type 67 Plug-ins

Parts Required: Resistor, Film 221K ½W 1%
Coax Cable, 10 inches long.
Wire, Uninsulated #22 Solid 2 inches long.

1. Locate the ceramic strip notch to which is soldered a wire from pin 8 of V161 and a B161 neon bulb lead. This is CSD-16.
   Unsolder the B161 bulb tip holder from the opposite ceramic strip notch (CSC-16). Save holder for later use.
2. Solder the longer stripped center conductor of the coax to CSC-16.
3. Solder the coax shield to the vacant end notch on the adjacent strip (CSC-15).
4. Solder the bare wire from grounded terminal of C321 (located near R176) to CSC-15.
5. Solder the resistor between CSC-16 and CSD-16.
6. Replace the B161 tip holder at CSC-16.
7. Dress the coax along the cable to the plug-in rear connector.
   Solder the coax center conductor to connector pin 18 and the shield to pin 19.

B. Type 2B67 Plug-ins

Parts Required: Resistor, Film 221K $\frac{1}{2}$W 1%

Coax Cable, 12 inches long.

1. Locate the front neon bulb (B161) on the ceramic strip near V161 socket.
   Unsolder the B161 Bulb tip holder (from ceramic strip notch CSC-23). Save the holder for later use.
2. Solder the longer stripped center conductor of the coax to CSC-23.
   Solder the shield to a ground lug on the V161 socket, dressing it beneath the ceramic strip.
3. Solder the resistor between CSC-23 and the opposite strip notch (to which is soldered a B161 lead and a white-yellow wire).
4. Replace the B161 tip holder at CSC-23.
5. Dress the coax along the cable to the plug-in rear connector.
   Solder the coax center conductor to connector pin 18 and the shield to pin 19.

C. Type 3B1 Plug-ins

Parts Required: Resistor, Film 95.3K $\frac{1}{2}$W 1%

Coax Cable, 10 inches long.

1. Locate the neon bulb (B164) on the ceramic strips near V161 socket.
   Unsolder the B164 bulb tip holder (from ceramic strip notch CSM-23). Save the holder for later use.
2. Solder the longer stripped center conductor of the coax to CSM-23.
   Solder the shield to a ground lug on the V161 socket.
3. Solder the resistor between CSM-23 and the opposite ceramic strip notch (to which is soldered a B164 lead and a white-black-violet wire).
4. Replace the B164 tip holder at CSM-23.
5. Dress the coax along the cable to the plug-in rear connector.
   Solder the coax center conductor to connector pin 18 and the shield to pin 19.

D. Type 3B3 Plug-ins

Parts Required: Resistor, Film 102K $\frac{1}{2}$W 1%

Coax Cable, 10 inches long.

1. Locate the neon bulb (B164) on the ceramic strips near V161 socket.
   Unsolder the B164 bulb tip holder (from ceramic strip notch CSN-19). Save holder for later use.
2. Solder the longer stripped center conductor of the coax to CSN-19.
   Solder the shield to a ground lug on the V161 socket.
3. Solder the resistor between CSN-19 and the opposite ceramic strip notch (to which is soldered a B164 lead and a white-black-violet wire).
4. Replace the B164 tip holder at CSN-19.
5. Dress the coax along the cable to the plug-in rear connector.

Solder the coax center conductor to connector pin 18 and the shield to pin 19.

Type 3B4 Plug-ins

Parts Required: Resistor, Film 102K $\frac{1}{2}$W 1%

Coax Cable, 4 inches long.

1. Locate the ceramic strip notch (CSF-6) to which is connected the bare wire from pin 3 of V173 and the opposite vacant notch (CSE-6) near pin 7 of V173.
2. Solder the longer stripped end of the coax to CSE-6.

   Solder the shield to a ground lug on the V173 socket.
3. Solder the resistor between CSE-6 and CSF-6.
4. Dress the coax along the cable to the plug-in rear connector.

   Solder the coax center conductor to connector pin 18 and the shield to pin 19.