Contents

WARRANTY

We warrant that each new instrument manufactured and sold by us is free from defects in material and workmanship and that, properly used, it will perform in full accordance with applicable specifications for a period of two years after original shipment. Any instrument or component that is found within the two-year period not to meet these standards after examination by our factory, District Office, or authorized repair agency personnel will be repaired or, at our option, replaced without charge, except for tubes or batteries that have given normal service.

Type 1236 I-F Amplifier

B

West Concord, Massachusetts, U.S.A. 01781
Form 1236-0100-B
September, 1969
ID-8738

Specifications

Center Frequency: 30 MHz.

Bandwidth: Wide band, approx 4 MHz; narrow band, approx 0.5 MHz, selectable by panel switch.

Noise Figure: Typically 2 dB.

Sensitivity: From a 400-Ω source, for a 3-dB increase in meter deflection, < 9 μV (wide band) or < 3.5 μV (narrow band).

Meter Characteristics

Normal Scale: −2 to 10 dB. Linearity ±0.2 dB over 0 to 10-dB range.

Expanded Scale: 1-dB full scale. Linearity ±0.03 dB.

Compressed Scale: 40-dB min range.

Attenuator

Range: 0 to 70 dB in 10-dB steps.

Accuracy: ± (0.1 dB + 0.1 dB/10 dB) at 30 MHz.

Continuous Gain Control: 10-dB min range.

Video Output (Modulation): 1.5 V max; 1-MHz bandwidth.

I-F Output: 0.5 V max into 50 Ω.

Power-Supply Output: 150 to 300 V dc, adjustable, at 30 mA, regulated; 6.3 V ac at 1 A.

Power Required: 105 to 125, 195 to 235, or 210 to 250 V, 50 to 60 Hz, 22 W (without oscillator).

Accessories Supplied: Power cord.

Accessories Available: As local oscillator, GR 1208, 1209-C, 1209-CL, 1215, 1218, and 1361; 874-MRAL Mixer; GR874 low-pass filters, attenuators, adaptors, etc.

Mounting: Convertible-bench cabinet.

Dimensions (width x height x depth): 8 by 7⅜ by 8 in. (205 x 190 x 205 mm).

Weight: Net, 12½ lb (6 kg); **shipping,** 14¾ lb (7 kg).

General Radio Experimenter, reference: Vol 41, No. 7 and 8, July-August, 1967

Table of Contents

SECTION 1

INTRODUCTION

1.1 PURPOSE.

The 1236 I-F Amplifier is a sensitive, low-noise tuned amplifier. This instrument operates at a frequency of 30 MHz with two bandwidths: a wide band of 4 MHz and a narrow band of 0.5 MHz.

In conjunction with appropriate accessory equipment, the 1236 is used to form a sensitive VHF/UHF heterodyne detector. In general, this system can be used as a null detector or as an indicator of relative voltage levels. Specific applications within these broad areas, such as noise-figure, attenuation, and VSWR measurements, are many and varied.

1.2 DESCRIPTION.

Solid-state components are used throughout the amplifier, except for three Nuvistors in the preamplifier and one series regulating tube in the local-oscillator power supply.

Relative signal levels are indicated on a taut-band, 6-inch meter that has linear and decibel scales. The top 10 percent of the scale can be expanded to allow high-resolution readout of 1 dB over the full scale. An accurate ladder attenuator is provided for relative signal-level measurements that are beyond the range of the meter.

Output connectors for the 30-MHz signal and the modulation are available at the rear of the instrument. All operating controls are located on the front panel. A single knob permits both coarse and fine adjustments of the gain to obtain the desired output level.

The automatic-gain-control circuit is capable of compressing the meter-scale range to approximately 50 dB.

The 1236 I-F Amplifier can be divided into five parts as indicated in the block diagram of Figure 1-2. Refer to the following paragraphs for a brief description of these circuits, and to Figures 5-11 through 5-15 for complete schematic diagrams.

1.2.1 PREAMPLIFIER.

The first stage of amplification in the preamplifier consists of two Nuvistors in a cascode circuit, preceded by a double-tuned bandpass filter. The impedance transformation in this filter is selected for minimum noise figure with a source impedance of 400 Ω in parallel with 7 pF. (This is the average i-f impedance of the Type 874-MRAL Mixer that is recommended for use in the detector system mentioned in paragraph 1.1.)

A second bandpass filter, following the first amplifier stage, has either a wide or narrow band, depending on the setting of the BANDWIDTH switch.

A third Nuvistor tube is used in the output stage of the preamplifier. The output impedance of this stage is matched to the attenuator input.

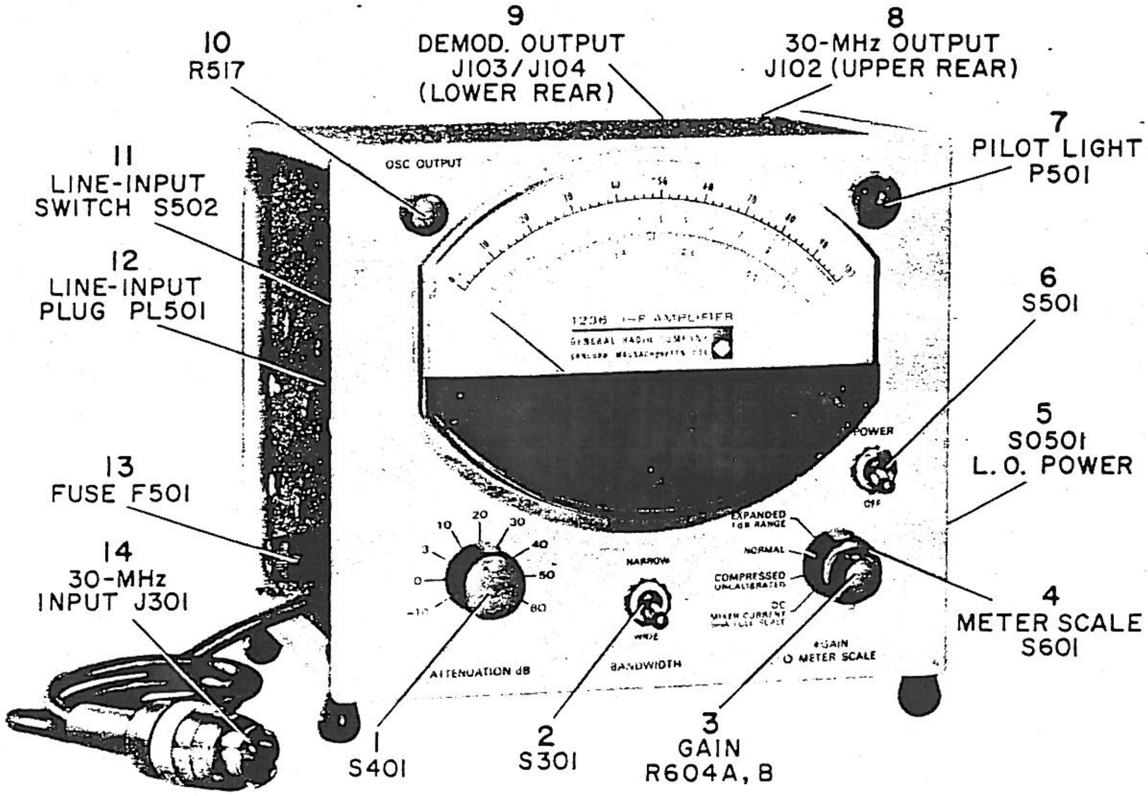


Figure 1-1. 1236 I-F Amplifier showing controls and connectors.

1.2.2 ATTENUATOR.

The ladder-type step attenuator covers a range of 70 dB in 10-dB steps. Interpolation between steps is made using the meter with its linear and dB scales.

1.2.3 POSTAMPLIFIER.

The postamplifier consists of one untuned and three tuned stages. The gain of the untuned stage is adjustable over a minimum range of 10 dB, using the GAIN control.

The METER SCALE switch, in the COMPRESSED position, closes the agc (automatic gain control) loop. The agc signal controls the gain of two of the tuned postamplifier stages. The output of the last stage (at the detector) is approximately 2 V, rms, maximum. To reduce the nonlinear response of the detector diode, a temperature-stabilized, linearizing network is incorporated in the detector circuit. A third winding on the output transformer supplies the 30-MHz output signal to the GR874 connector at the rear of the instrument. The modulation signal passes through a video amplifier to the output terminals, also located at the rear of the amplifier.

1.2.4 AGC AND EXPANSION AMPLIFIER.

The rectified output voltage of the postamplifier is fed to the meter circuit and to a differential amplifier. With the METER SCALE switch in the COMPRESSED position, the output of this amplifier controls the gain of two stages in the postamplifier. In the EXPANDED position, the meter is connected to the output of the differential amplifier.

1.2.5 POWER SUPPLY.

The power supply consists of three supply circuits:

a. Nuvistor plate supply.
b. Transistor and Nuvistor-filament supply.
c. Local oscillator supply.

All supply voltages are regulated, except the oscillator filament voltage. The local oscillator plate voltage is adjustable from 150 to 300 V by means of the OSC OUTPUT control.

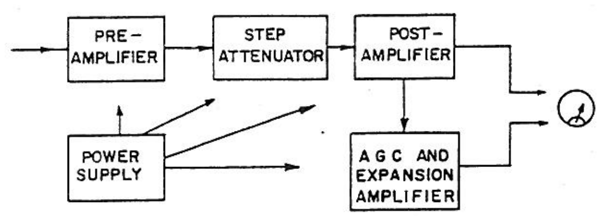


Figure 1-2. Block diagram of the 1236 I-F Amplifier.

1.3 CONTROLS AND CONNECTORS.

Table 1-1 lists and describes the 1236 controls and connectors:

TABLE 1-1
1236 CONTROLS AND CONNECTORS
(Refer to Figure 1-1)

Fig. 1-1 Ref. No. and Location	*Name and Description*	*Function*
1 Front panel	ATTENUATION dB Rotary switch.	Decreases the output level by the amount (in dB) indicated.
2 Front panel	BANDWIDTH Toggle switch.	Selects one of two available bandwidths: • WIDE. Approximately 4 MHz. • NARROW. Approximately 0.5 MHz.
3 Front panel	GAIN Dual potentiometer.	Continuous coarse and fine adjustment of gain, with a single knob.
4 Front panel	METER SCALE Rotary switch.	Selects one of four available meter functions: • EXPANDED 1-dB RANGE. Expands the upper portion of the NORMAL scales to a 1 dB, full-scale range. Read the lower (red) dB scale. • NORMAL. Meter indicates the relative signal level on the linear (black) scale or the upper (red) dB scale. • COMPRESSED UNCALIBRATED. Automatic gain control operation. Compresses meter range to about 50 dB. • DC MIXER CURRENT 5 mA FULL SCALE. Monitors the rectified mixer-crystal current. Read the linear (black) scale.
5 Right-hand side panel	Local Osc supply, Jones connector.	Output connector for 150 to 300 Vdc (35 mA max.) and 6.3 Vac (1 A max.) supply to local oscillator.
6 Front panel	POWER Toggle switch.	Turns power on and off.
7 Front panel	Pilot light.	Indicates power is supplied to the instrument when lamp glows.
8 Rear of amplifier	30 MHz OUTPUT GR874 connector	Connector for 30-MHz amplified output. Signal level approximately 0.5 V over 50-Ω load when meter indicates full scale.
9 Rear of amplifier	DEMOD OUTPUT Binding posts.	Output terminals for modulation signal at a level of 1.5 V maximum behind 600 Ω when the modulation depth is 100%.
10 Front panel	OSC OUTPUT Knob, continuous adjustment.	Adjusts the output of the associated oscillator.
11 Left-hand side panel	Line input switch.	Changes line input connections to input transformer for either 105- to 125-V or 195- to 235-V line input.
12 Left-hand side panel	Line input plug.	Terminals for 105- to 125-V or 195- to 235-V line input.
13 Left-hand side panel	Fuse, 0.5 amp.	Overload protection.
14 End of input cable	Input signal, GR874 connector.	Input terminals for 30-MHz input signal. The source impedance for optimum noise figure is 400 Ω in parallel with 7 pF.

1.4 ACCESSORIES.

Accessories supplied with the 1236 are listed in Table 1-2.

TABLE 1-2
1236 ACCESSORIES SUPPLIED

Part Number	*Description*	*Quantity*
4200-9622	Power Cord	1
0480-3070	Hardware Set (Refer to Table 2-1)	1

General Radio instruments that are available for use with the 1236 I-F Amplifier in setting up a basic heterodyne detector are listed in Table 1-3. The first 3 oscillators in the table are recommended as a set to cover the frequency range 40-2030 MHz. With these, the 1236 becomes a sensitive null detector for bridges or a standing-wave indicator for slotted lines. With suitable filters, the frequency range can be extended above 8 GHz; for details, refer to the GR catalog description of the 1241 Heterodyne Detector.

Refer to the GR catalog for a complete listing of other available accessories. These include filters, attenuators, adaptors, patch cords, power-dividing tees, dc-blocking capacitors, and bias-insertion tees.

TABLE 1-3
1236 ACCESSORIES AVAILABLE

Type	*Description*
1363	Oscillator, 56-500 MHz range.
1362	Oscillator, 220-920 MHz range.
1218	Oscillator, 900-2000 MHz range.
1215	Oscillator, 50-250 MHz range.
1361	Oscillator, 450-1050 MHz range.
874-MRAL	Mixer, for signal detection when used with a local oscillator and indicating amplifier.
481-P416	Rack-adaptor set for installation of amplifier/oscillator combination in a relay rack. (Can be used with all oscillators listed, except the Type 1218.)

SECTION 2

INSTALLATION

2.1 GENERAL.

The 1236 I-F Amplifier is primarily a portable instrument for bench use. It can also be attached to an oscillator, using the hardware set supplied. The amplifier/oscillator assembly can be used on the bench or it can be installed in a relay rack.

See Figure 2-1 for approximate dimensions and space required for the amplifier when used as a bench instrument.

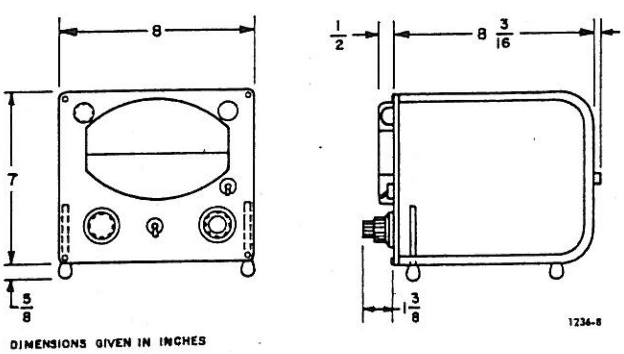


Figure 2-1. Approximate dimensions of the 1236 I-F Amplifier.

2.2 ASSEMBLY WITH AN OSCILLATOR.

The hardware set listed in Table 2-1 is supplied with the amplifier. With this set, the 1236 can be attached to one of the available oscillators recommended in Table 1-3.

TABLE 2-1
HARDWARE SET FOR AMPLIFIER/ OSCILLATOR ASSEMBLY
(Part Number 0480-3070)

Quantity	*Description*	*Part Number*
2	Clip	0480-8070
4	Nut, hex, 10-32	5810-3300
2	Screw, 10-32, 1 1/4 in.	7080-1000
2	Screw, 10-32, 1/2 in.	7098-0161
4	Washer, lock, No. 10.	8040-2400

NOTE

Instructions (Form 0481-0130-A) for assembly of amplifier and oscillator, and for installation of the assembly in a relay rack, are provided with the oscillator and rack-adaptor set. When using the instructions, substitute the 1236 amplifier for the power supply described in the instructions.

2.3 RELAY-RACK INSTALLATION.

Use the rack-adaptor set listed in Table 2-2 to install a 1236/oscillator assembly in a standard 19-inch relay rack.

This rack adaptor set can be used with oscillator Types 1363, 1362, 1215, and 1361. The width of the 1236/1218 (oscillator) assembly exceeds the width of a relay rack and this combination cannot be installed side-by-side in a standard 19-inch rack.

TABLE 2-2
AVAILABLE RACK-ADAPTOR SET FOR RELAY-RACK INSTALLATION OF 1236/OSCILLATOR ASSEMBLY (Part Number 0481-9646)

Quantity	*Description*	*Part Number*
1	Adaptor plate, solid, 7 x 1 in.	0480-8842
1	Adaptor plate, with cutout, 7 x 2 in.	0481-8460
1	Hardware set	0481-3100
1	Hardware set	0480-3210

2.4 POWER REQUIREMENTS.

The 1236 amplifier normally operates on a 105- to 125-V or 195- to 235-V, 50- to 60-Hz line. A line switch on the left-hand side panel allows easy conversion for either line input.

If operation on a 210- to 250-V line is desired, internal connections to the primary of the power transformer can be modified. Disconnect the white-orange-green lead from terminal 2L (see Figure 5-3) and solder it to terminal 2. For the complete schematic diagram, see Figure 5-11.

SECTION 3

OPERATING PROCEDURE

3.1 PRELIMINARY CHECKS.

The following steps should be checked, and the necessary adjustments made, before operating the 1236 I-F Amplifier.

a. Make certain the line-switch setting corresponds to the available line input (refer to paragraph 2.4). If operation on a 210- to 250-V line is desired, the power-transformer connections must be modified.

b. Observe the meter zero with the instrument turned off. Turn the screw on the meter cover (lower center) to adjust the meter to zero.

c. Connect the amplifier to appropriate accessory equipment and apply power to the instrument, using the POWER switch on the front panel. The pilot light should glow.

3.2 GENERAL OPERATION.

The following paragraphs refer to general use of the amplifier in the basic detector circuit.

3.2.1 ATTENUATION SWITCH.

This control decreases the output level by the amount (in dB) indicated by the setting. The attenuator covers a range of 70 dB in 10-dB steps. The meter, with its linear and dB scales, is used to interpolate between steps.

The -10-dB and 60-dB positions on the ATTENUATION control are marked in red to alert the user to possible errors when operating with the switch in these positions. These errors, which can be caused by residual noise at the -10-dB setting and by nonlinearity of the preamplifier at the 60-dB setting, are discussed further in paragraph 3.3.3 and 3.3.4.

3.2.2 METER SCALES.

The upper (black) scale is the linear scale, graduated in 100 equal divisions. The middle (red) scale has a range of -2 dB to 10 dB and provides the means to interpolate between the 10-dB steps of the ATTENUATION switch. These two scales are used with the METER SCALE switch in the NORMAL position.

The lower (red) scale expands the upper portion of the NORMAL scales to a 1-dB full-scale range, with the METER SCALE switch in the EXPANDED 1 dB RANGE position. To obtain an on-scale reading on the lower dB scale, the meter indication must first be set between 9- and 10-dB on the middle dB scale (indicated by the thick, red portion of the scale), with the METER SCALE switch in the NORMAL position.

3.2.3 METER SCALE SWITCH.

The METER SCALE switch selects one of four possible positions depending on the function desired. The lower (expanded) scale on the meter is used when the switch is in the EXPANDED 1 dB RANGE position, and both upper scales can be used when the switch is in the NORMAL position (refer to paragraph 3.2.2.)

In the COMPRESSED UNCALIBRATED position, the switch connects an automatic gain control loop into the circuit. The agc loop compresses the meter range to about 50 dB (refer to paragraph 3.3.5). This feature is particularly useful when the amplifier is used as a null detector in a bridge measuring setup. In this application, the agc function makes it possible to achieve final balance of the bridge without readjusting the sensitivity of the amplifier.

When the switch is turned to the DC MIXER CURRENT position, the rectified mixer-crystal current is indicated on the linear (black) scale. Full-scale meter deflection corresponds to 5 mA. When the amplifier is used in a heterodyne-detector system, the local-oscillator output level must be adjusted to obtain a compromise between noise level and conversion loss. A high local-oscillator output will reduce the conversion loss, but increase the noise level generated in the mixer diode. Conversely, a low local-oscillator output will reduce the noise level, but increase the conversion loss. In both cases, the overall noise figure is higher than the optimum value. A correct local-oscillator drive level is obtained when the rectified mixer-diode current is between 0.5 and 1 mA (between 10 and 20 percent of full scale on the upper, black scale).

3.2.4 GAIN CONTROL.

The GAIN control is a dual potentiometer with a single shaft. The front section of the potentiometer is the fine control and its wiper arm is connected directly to the shaft. The rear section is the coarse control and its wiper arm is driven by the same shaft, but with 30° of backlash built into the connection. With this type of control, fine adjustment of the gain can be made over 30° of knob rotation without changing the coarse-control setting.

When operating the GAIN control, turn the knob to overshoot the desired position slightly, then turn the knob in the opposite direction for fine adjustment.

3.2.5 BANDWIDTH SWITCH.

This switch gives the user a choice of a NARROW band of 0.5 MHz or a WIDE band of 4 MHz. Typically, the NARROW band is used for operation at lower frequencies, and the WIDE band is practical for use at higher local-oscillator frequencies where frequency stability often becomes a problem. The NARROW-band and WIDE-band response characteristics are shown in Figure 3-1.

3.2.6 30 MHz OUTPUT.

A GR874 connector at the top rear of the instrument provides the means to connect an i-f output of approximately 0.5 V to a 50 Ω load when the meter indicates full scale. Some possible uses of the 30 MHz output are:

a. i-f signal for afc (automatic frequency-control) loop.

b. connection to a second heterodyne detector (communications receiver) for increased sensitivity. A very stable local oscillator, or tight afc loop, is required in this case.

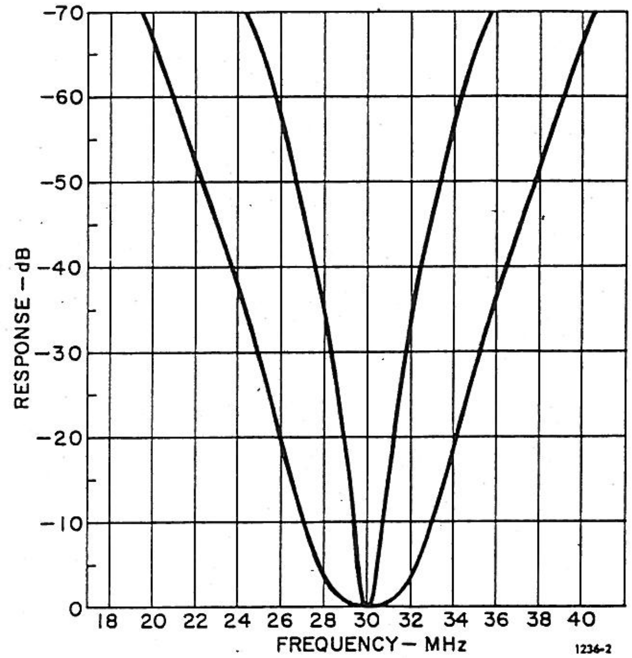


Figure 3-1. Typical narrow- and wide-band response characteristics of the 1236.

3.2.7 DEMODULATED OUTPUT.

Binding posts at the lower rear of the amplifier provide a video output (modulation) signal of 1.5 V maximum, behind 600 Ω, when the modulation depth is 100 percent. Two suggested uses for this output are:

a. level recording; Figure 3-5 shows the relationship between the modulation-output level (input to the recorder) and the i-f signal level.

b. connect to narrow-band, low-frequency amplifier (GR1232 or equivalent) for higher sensitivity.

3.2.8 OSC OUTPUT.

The OSC OUTPUT knob on the front panel of the amplifier is used to control the output level of the local oscillator (when it draws its power from the 1236 power supply) by adjusting the oscillator plate voltage between 150 V and 300 V.

3.3 INSTRUMENT CHARACTERISTICS.

3.3.1 SOURCE IMPEDANCE REQUIREMENTS.

The input circuit of the 1236 I-F Amplifier is designed to operate from a source impedance of 400 Ω in parallel with 7 pF (average i-f impedance of the GR Type 874-MRAL MIXER). The source impedance may vary from 200 to 600 Ω, with a small increase in the noise figure at the extreme values.

In wide-band operation, a decrease in source resistance will cause a decrease in bandwidth. For example, a 50-Ω source resistance will decrease the WIDE bandwidth to approximately 1.3 MHz and increase the noise figure to about 4 dB.

A large deviation of the source susceptance (from 1.4 mmho) will cause a serious detuning of the input filter, resulting in a lopsided wide-band response.

3.3.2 METER LINEARITY.

Linearity of the meter is determined by the tracking error of the meter movement and by the linearity of the detector circuit. A compensating network is used to partially offset the nonlinearity of the detector and meter-movement error. The resulting tracking error is shown in Figure 3-2. This curve is obtained with the ATTENUATION and GAIN controls set to limit residual meter deflection (due to noise) to less than 2% of full scale.

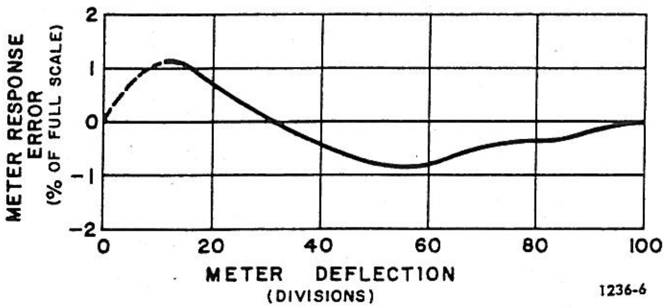


Figure 3-2. Typical tracking error of a 1236 meter. Error shown here is due to detector nonlinearity and meter-movement error.

3.3.3 METER ERROR DUE TO RESIDUAL NOISE.

When the ATTENUATION control is set at -10 dB, residual meter deflection (due to noise) will result. The noise level depends upon the setting of the GAIN control and on the source impedance. If signal levels are to be measured at the -10 dB ATTENUATION setting, the meter readings must be corrected for residual noise. As the plot in Figure 3-3 shows, the error increases with either a decrease in signal level or an increase in residual noise. Correct the meter reading as follows:

a. Read the upper dB scale on the meter and record this measurement as X.

b. Reduce the input signal to zero without changing the impedance presented to the amplifier input (replace the signal source with an impedance of the same value as the source impedance). Observe the residual-noise deflection.

c. Record the error (Δ dB) taken from Figure 3-3.

d. Calculate the corrected meter reading:

X-Δ = corrected reading in dB.

3.3.4 ERRORS AT 60-dB ATTENUATION SETTING.

The preamplifier output stage becomes somewhat nonlinear at the highest (60 dB) attenuator setting. This effect is noticeable when the gain control is set close to minimum gain. The resulting error for a 10-dB step will not exceed 1 dB, and will typically be less than 0.5 dB. The signal level at which the preamplifier output stage saturates is approximately 3 dB above the level required for full-scale meter deflection at minimum gain.

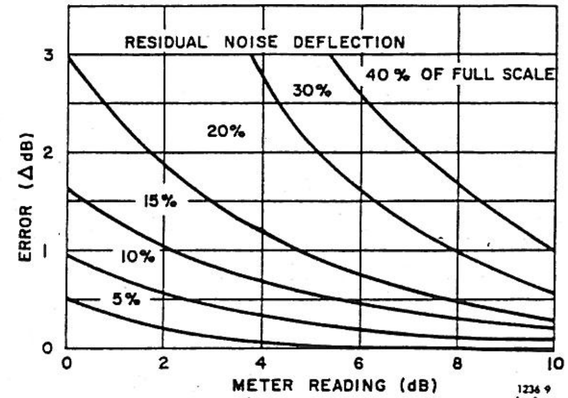


Figure 3-3. Curves showing meter error caused by residual meter deflection due to noise. Corrected reading = meter reading—ΔdB.

3.3.5 COMPRESSED-SCALE RESPONSE.

COMPRESSED scale operation is obtained by an automatic-gain-control loop which operates when the meter deflection is about 35% of full scale. The response is plotted in Figure 3-4.

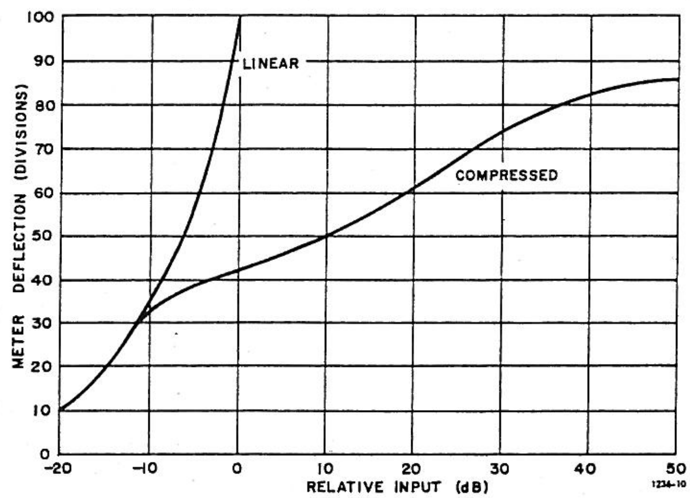


Figure 3-4. Curves showing typical linear and compressed scale response.

3.3.6 LINEARITY OF THE MODULATION OUTPUT.

The modulation (video output, 1-MHz bandwidth) signal is available at the binding posts at the rear of the instrument. The output resistance is approximately 600 Ω. The open-circuit output level is 1.5 V rms, for a 100% modulated i-f signal and full-scale meter deflection. Figure 3-5 shows the open-circuit output voltage as a function of the relative input-signal level, with the gain control set at minimum.

3.3.7 METER RESPONSE TO PULSED SIGNALS.

The detector in the output circuit of the postamplifier is a quasipeak device. Thus, the meter deflection is dependent upon frequency and duty cycle

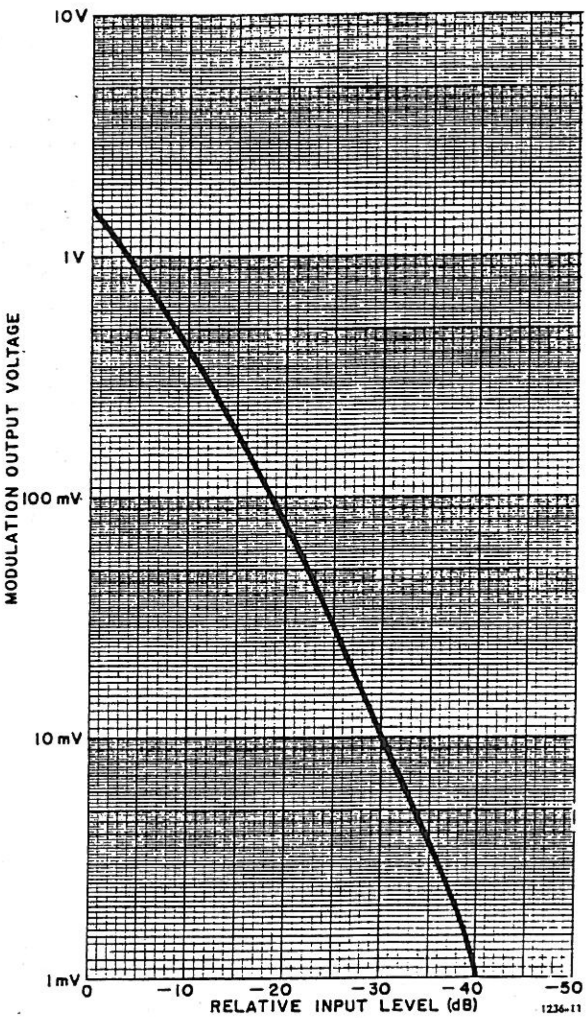


Figure 3-5. Typical modulation output voltage of a 1236 amplifier. Gain control is set at minimum.

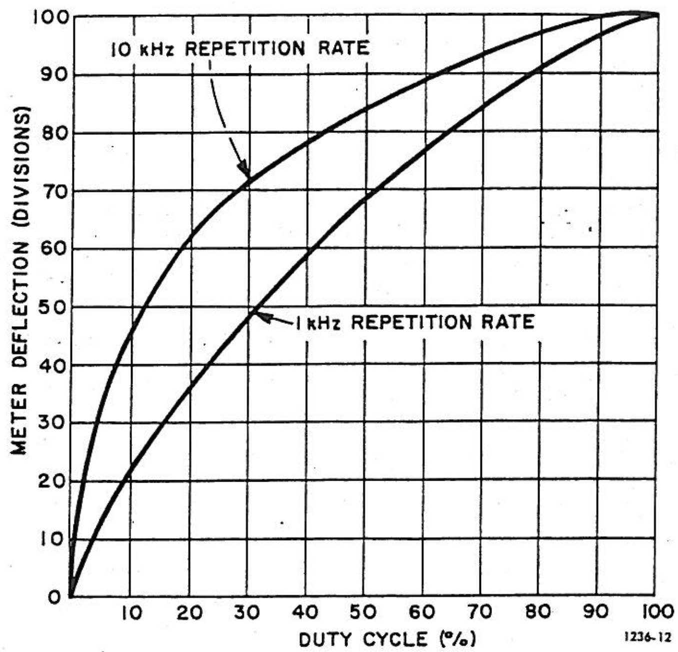


Figure 3-6. Typical 1236 meter response as a function of pulse duty cycle and repetition rate.

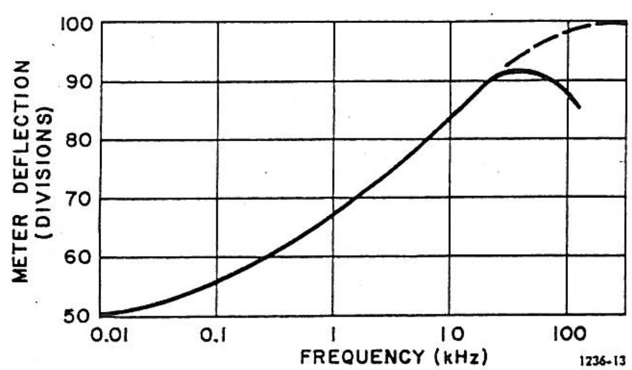


Figure 3-7. Typical 1236 meter response for square-wave modulation.

as well as the peak level of the input signal. The curves in Figure 3-6 show the meter response as a function of pulse duty cycle and repetition rate.

Figure 3-7 shows the meter response for square-wave modulation, with varying frequency. Meter deflection peaks at approximately 40 kHz and then drops off. This is caused by the charge time constant (about 20 μs) of the detector. The dotted portion of the curve indicates the meter response without the charge time constant limitation.

3.4 THE HETERODYNE DETECTOR.

The heterodyne detector is a basic detector system consisting of an assembly of the 1236 I-F Amplifier, the GR 874-MRAL Mixer, a GR local oscillator, and connecting hardware. See Figure 3-8. This assembly forms a sensitive, well shielded, wide-frequency-range receiver for relative signal-level measurements.

An input signal, and the local-oscillator signal set to a frequency 30 MHz above or below the signal frequency, are fed into the mixer. The 30 MHz difference-frequency output, which is in direct proportion to the input signal level, is amplified and detected in the amplifier.

The frequency range can be extended by heterodyning the signal with a harmonic of the oscillator. Sensitivity and dynamic range are reduced in this case. The upper signal-frequency limit is approximately 9 GHz.

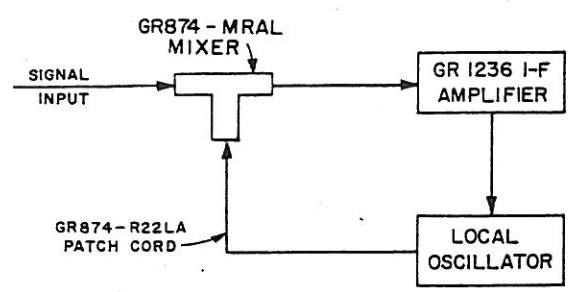


Figure 3-8. Block diagram of the basic heterodyne detector using a 1236, a GR 874-MRAL Mixer, and a suitable local oscillator.

The 1236 amplifier contains a power supply for the oscillator and the output of the oscillator is adjusted by varying the oscillator-plate-supply voltage with a control on the front panel of the amplifier.

3.4.1 GR 874-MRAL MIXER.

Description. The GR 874-MRAL Mixer, see Figures 3-9 and 3-10, consists of a short section of coaxial line terminated with a mixer diode. The local-oscillator input is coupled to the diode through a 50-Ω resistor via a third coaxial arm. The low-frequency end of the diode is bypassed to ground by a 7-pF capacitor and is routed to the (I-F) output connector through a small inductor. Locking GR874 connectors are used at all three arms to provide optimum shielding and to keep leakage at a minimum. Typical VSWR performance and sensitivity of the GR 874-MRAL, with the 1236 operating in the NARROW band, are shown in Figure 3-11.

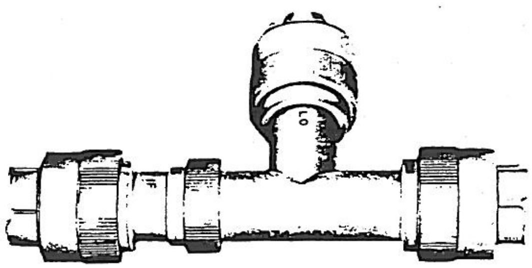


Figure 3-9. Type 874-MRAL Mixer.

Connections. In some instances, a poor match between the signal source and the mixer diode may cause low sensitivity. The match can usually be improved by the insertion of a short air line (such as the GR 874-L10L or 874-ELL), an adjustable-length line (such as the GR 874-LAL and -LK), and/or a tuning stub between the signal source and the mixer. The GR 874-TL used

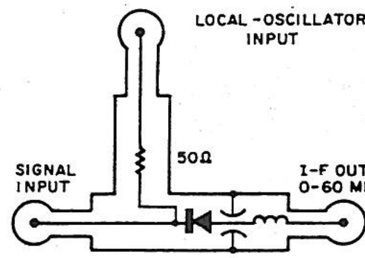


Figure 3-10. Schematic of Type 874-MRAL.

with either a GR 874-D20L or -D50L (depending on frequency) can be employed as the tuning-stub assembly.

The VSWR below 5 GHz can be reduced by installation of a GR 874-G6L or -G10L attenuator pad between mixer and source. The pad also tends to make the local-oscillator voltage across the diode junction less dependent on the source impedance.

Always connect the input of the 1236 directly to the mixer end marked I-F. Connect the signal source to the arm at the opposite end of the mixer and

VSWR performance (typical).

Mixer sensitivity (typical).

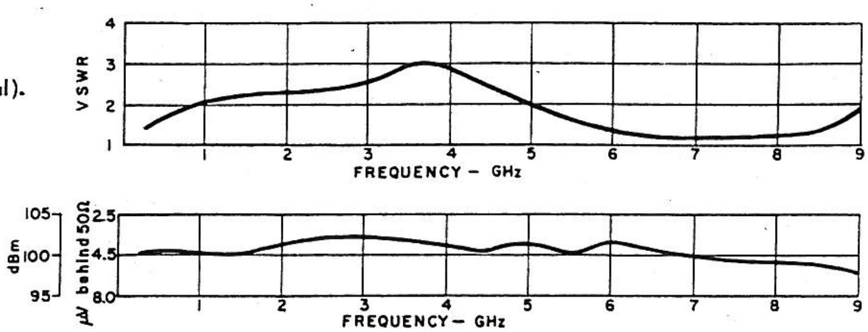


Figure 3-11. Graphs of VSWR performance and sensitivity for the GR 874-MRAL Mixer when used with GR 1236 in narrow-band operation.

the local oscillator to the branch end of the mixer, marked LO. For the best possible shielding, the mixer should be connected directly to the signal source. A length of double-shielded coaxial cable can be used where less than maximum shielding is acceptable.

3.4.2 APPLICATIONS.

The heterodyne detector has many uses, some of which are (see Figure 3-12):

a. A null detector for bridges such as the GR 1602 and GR 1609 UHF Admittance Meter, and the GR1607 Transfer-Function and Admittance Bridge.

b. An indicator of relative signal levels for:

- VSWR measurements with GR 874-LBB and GR 900-LB Coaxial Slotted Lines.
- VSWR measurements with hybrids and directional couplers.
- Attenuation measurements
- Filter characteristics measurements.
- Measurement of antenna patterns and antenna gain.

c. When calibrated at one level with a signal generator, power meter, or voltmeter; the detector can be used as:

- A VHF/UHF low-level tuned voltmeter.
- A VHF/UHF wave analyzer.
- A field-strength measuring receiver.

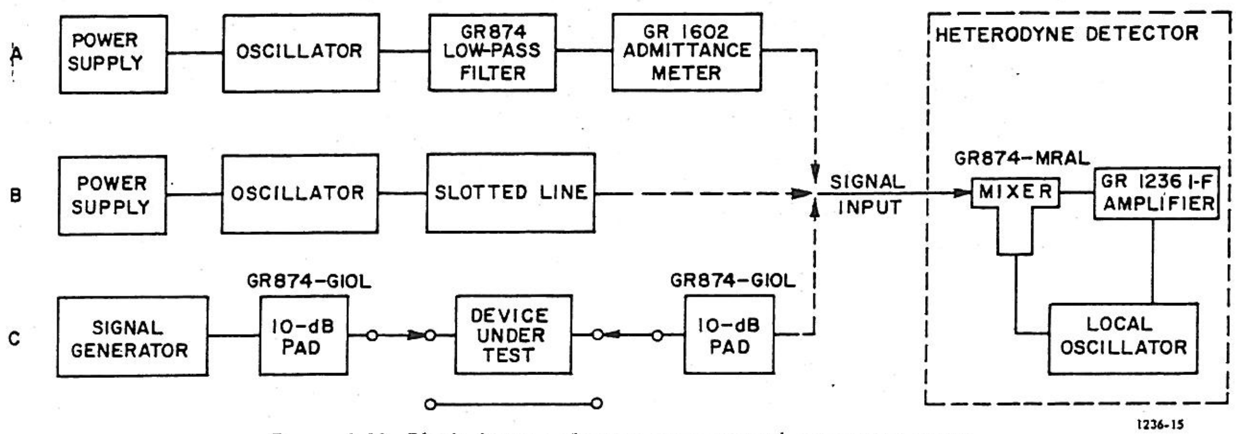


Figure 3-12. Block diagram showing some typical measuring setups using the basic heterodyne-detector system.
A - Null detector, using the GR 1602 Admittance Meter.
B - Relative-signal-level indicator, using the Slotted Line for VSWR measurements.
C - Typical test setup, using the series substitution method, for attenuation or filter-characteristics measurements.

Feedback capacitors C107 and C113 are adjusted for a predetermined sensitivity of the postamplifier, and for a symmetrical response around 30 MHz.

The GAIN control affects the collector impedance of Q101 and the tuning of the second stage. As a result, some variation will occur in the bandwidth and the peak frequency as the GAIN control setting is changed. The effect is small enough to be negligible in the overall performance of the instrument.

The meter circuit contains a linearizing network (see Figure 4-1) that partially compensates for non-linearity of the detector. In this network, V1 is adjusted for a linear response in the upper part of the meter scale and V2 is adjusted to optimize the lower part. Thus, two points on the meter can be adjusted for zero error with the full-scale position as a reference. In the 1236, the points selected are the 0-dB and zero-deflection positions.

Residual noise, which is dependent on the GAIN control setting, will cause a small error in the meter reading. At maximum gain, the meter deflection will be 1 to 1.5 small divisions. To compensate for this error, resistor R139 modifies the linearizing bias current of detector diode CR103 by a small amount, which varies with the GAIN control setting.

4.3 AGC AND EXPANSION AMPLIFIER.

See schematic diagram Figure 5-12. A stable differential amplifier is used for both the meter-scale expansion and agc amplifier. In the EXPANDED position of the meter-scale switch, the meter (with R203 in series) is connected between the collectors of transistors Q202 and Q204. In the COMPRESSED and MIXER CURRENT positions, the collector of Q202 is connected to the base of the regulating transistor Q105 in the postamplifier by resistor R203.

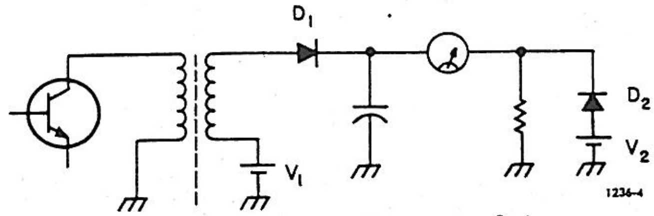


Figure 4-1. Elementary diagram of the detector linearizing network.

4.4 POWER SUPPLIES.

See schematic diagram 5-11. The 1236 I-F Amplifier contains three regulated power supplies: a Nuvistor plate supply of 66 V, a transistor and Nuvistor-filament supply of 12.6 V, and an oscillator supply of 150-300 V (adjustable) regulated plate voltage and 6.3 V ac unregulated filament voltage.

The 66-V supply has a Zener diode, CR507, in its ground-return loop, which provides -6.8 V with respect to ground. If the 66-V terminal is accidentally shorted to ground, the full short-circuit current will flow through diode CR507, which must then be replaced. The bias current of the 12.6-V supply reference-diode, CR512, is derived from the -6.8-V source.

SECTION 5

SERVICE AND MAINTENANCE

5.1 WARRANTY.

We warrant that each new instrument manufactured and sold by us is free from defects in material and workmanship, and that, properly used, it will perform in full accordance with applicable specifications for a period of two years after original shipment. Any instrument or component that is found within the two-year period not to meet these standards after examination by our factory, District Office, or authorized repair agency personnel will be repaired or, at our option, replaced without charge, except for tubes or batteries that have given normal service.

5.2 SERVICE.

The two-year warranty stated above attests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible. If the difficulty cannot be eliminated by use of the following service instructions, please write or phone our Service Department (see rear cover), giving full information of the trouble and of steps taken to remedy it. Be sure to mention the type and serial numbers of the instrument.

Before returning an instrument to General Radio for service, please write to our Service Department or nearest District Office, requesting a Returned Material Tag. Use of this tag will ensure proper handling and identification. For instruments not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay.

5.3 ACCESS TO COMPONENTS.

To remove the dust cover and gain access to the inside of the 1236, loosen the two thumbscrews at the rear of the instrument and pull the cover straight back.

Refer to the following paragraphs for information on how to gain access to components and etched boards that are not accessible when the dust cover is removed.

5.3.1 POWER SUPPLY.

Components mounted on the power-supply etched board are accessible at the top of the instrument. See Figure 5-3. For access to the underside of the board, remove the two No. 6-32 screws (A) and lockwashers at the rear of the board. Then, pivot the board to an upright position, as shown in Figure 5-4.

5.3.2 POSTAMPLIFIER.

The postamplifier box (see Figure 5-4) has clearly marked access holes for commonly used adjustments in the top cover and rear panel. To gain access to components in the postamplifier box, remove the twenty four No. 4-40 screws (B) and lockwashers, and remove the cover.

For access to the underside of the postamplifier etched board:

a. Remove the four No. 6-32 screws (C) and lockwashers: two from the bottom cover and two from the J102 support bracket.

b. Disconnect the input cable from J101 and pivot the postamplifier box upward as shown in Figure 5-5.

c. Remove the seventeen No. 4-40 screws (D) and lockwashers (see CAUTION on page 16). Remove the bottom cover.

CAUTION

Do not remove the two (paint sealed) screws (E, Figure 5-5).

5.3.3 PREAMPLIFIER AND ATTENUATOR.

To remove the preamplifier-attenuator cover (see Figure 5-6), turn the instrument upside down and remove the eighteen No. 4-40 screws (F) and lockwashers.

NOTE

Limited access to the attenuator is obtained by removing the cover of the preamplifier-attenuator box. To obtain full access to the attenuator, it is necessary to remove the preamplifier-attenuator assembly from the instrument. This involves extensive disassembly work and should be avoided if possible.

To remove the preamplifier-attenuator assembly:

a. Remove the four screws (G, Figure 5-6) that secure the front panel to the aluminum end frames. Pull the left-hand end frame back, remove the input cable from the side panel of the instrument, and slide the end frame back into position.

b. Swing the front panel of the instrument out.

c. Disconnect six wires (extending from the cable) from the top of the preamplifier-attenuator box (see CABLE, Figure 5-5). Remove the ATTENUATION knob. Remove the ATTENUATION and BANDWIDTH locking nuts from the front panel.

d. Remove the preamplifier-attenuator box from the instrument.

e. Disconnect the single wire connecting the preamplifier and attenuator. Detach the attenuator box from the preamplifier box. Remove the U-shaped attenuator cover.

Full access to the attenuator is now available. To reassemble the preamplifier-attenuator, start with step e above, and reverse the procedure.

TABLE 5-1

GR 1236 MINIMUM PERFORMANCE STANDARDS

Check	*Attenuation*	*Meter Function*	*Bandwidth*	*Gain control position*	*Specifications*
Center frequency	30 dB	NORMAL	NARROW	Mid range	30 ±0.2 MHz.
Center frequency	30 dB	NORMAL	WIDE	Mid range	30 ±0.4 MHz.
Bandwidth	30 dB	NORMAL	NARROW	Mid range	0.5 ±0.2 MHz.
Bandwidth	30 dB	NORMAL	WIDE	Mid range	4 ±1 MHz.
Gain	-10 dB	NORMAL	WIDE	fully cw	residual noise deflection between 25% and 60% of full scale.
Sensitivity*	0 to 3 dB	NORMAL	NARROW	fully cw	3.5 μV maximum.
Sensitivity*	0 to 3 dB	NORMAL	WIDE	fully cw	9 μV maximum.
Meter accuracy	30 dB	NORMAL	NARROW	Mid range	±0.2 dB from 0 - 10 dB.
Meter accuracy	30 dB	EXPANDED	NARROW	Mid range	±0.03 dB.
Attenuator accuracy	-10 to 0 dB	NORMAL	NARROW	fully ccw	±0.2 dB.**
Attenuator accuracy	0 to 40 dB	EXPANDED	NARROW	fully ccw	± (0.1 dB +0.1 dB/10 dB).
Attenuator accuracy	40 to 60 dB	EXPANDED	NARROW	fully cw	± (0.1 dB +0.1 dB/10 dB).
Meter response at 60 dB	60 dB	NORMAL	NARROW	fully ccw	Maximum 1-dB error for 10-dB step.
Compressed scale	50 to 0 dB	COMPRESSED	NARROW	any	Signal should increase as attenuation is decreased.
30-MHz output	30 dB	NORMAL	NARROW	any	0.5 V over 50 Ω load when meter reads full scale.
Demodulated output	30 dB	NORMAL	NARROW	any	1.2 V rms minimum, with 100 % modulation and full-scale meter reading.
Power Supply regulation	30 dB	EXPANDED	NARROW	any	When line voltage is varied from 105 to 125 V, meter reading should not change more than 0.2 dB.

*Open circuit voltage from a 400 Ω source for a 3-dB increase of the output over the residual noise level.
**Check on 1236 meter.

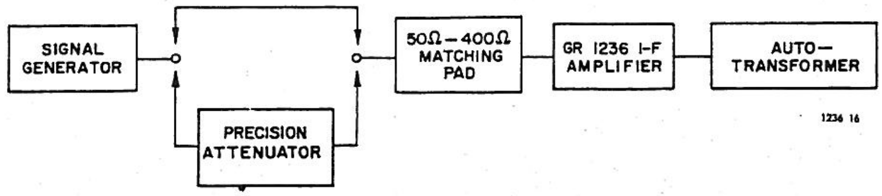


Figure 5-1. Test and calibration setup for 1236 I-F Amplifier.

5.4 MINIMUM PERFORMANCE STANDARDS.

The following procedure for checking the 1236 specifications is recommended for incoming inspection or periodic operational testing.

NOTE

A knowledge of detailed calibration and test procedures in paragraph 5.5 and 5.6 will be helpful in checking the specifications outlined in Table 5-1.

5.4.1 TEST SETUP.

The equipment required for test and calibration of the 1236 I-F Amplifier is listed in paragraph 5.5.1. The general test circuit for checking MINIMUM STANDARDS is shown in Figure 5-1. This setup, with additional equipment such as an oscilloscope, is also used for calibration and trouble-shooting procedures. Observe the preliminary steps described in paragraph 5.5.2 before proceeding with this test.

CAUTION

If the precision attenuator (see Figure 5-1) used in this test setup is a waveguide-below-cutoff type, do not use it in the circuit when making the first four tests listed in Table 5-1 because its frequency response can affect measurement results.

5.5 CALIBRATION AND ADJUSTMENT.

The following procedure is recommended for complete calibration and adjustment of the 1236 I-F Amplifier.

NOTE

Portions of the calibration procedure are also applicable to the sections covering MINIMUM PERFORMANCE STANDARDS (paragraph 5.4) and TROUBLE-SHOOTING PROCEDURE (paragraph 5.6).

5.5.1 EQUIPMENT REQUIRED.

The equipment specifications given are minimum requirements and not necessarily complete specifications. Equivalent equipment may be substituted for the models recommended.

1 Sweep-frequency oscillator.
  Frequency range: 25 MHz to 35 MHz.
  Output: adjustable from 100 µV to 100 mV, behind 50 Ω.
  Model: GR 1025 Standard Sweep-Frequency Generator.*

1 Signal generator.
  Frequency: 30 MHz.
  Output: calibrated, 5 µV to 250 µV.
  Model: GR 1025 Standard Sweep-Frequency Generator.*

1 Precision attenuator.
  Range: 70 dB in 10-dB steps.
  Accuracy: 0.05 dB per 10-dB step.
  Model: GR 1025 Standard Sweep-Frequency Generator.*

1 AC/DC voltmeter.
  Range: 1.5 V to 300 V.
  Accuracy: ±2% of indicated reading.
  Input impedance: 20,000 Ω/V
  Model: GR 1806 Electronic Voltmeter.

1 Metered adjustable autotransformer.
  a. For 1236 operating on 105 V to 125 V.
    Output: 105 V to 125 V, 30 W.
    Meter accuracy: ±3% of full scale.
    Model: GR W5MT3W Metered Variac® Autotransformer.
  b. For 1236 operating on 195 V to 235 V or 210 V to 250 V.
    Output: 195 V to 250 V, 30 W.
    Meter accuracy: ±5% of full scale.
    Model: GR W20HMT3A Metered Variac® Autotransformer.

1 Oscilloscope
  Bandwidth: DC to 500 kHz.
  Sensitivity: 50 mV/cm.
  Model: Tektronix Type 503 or 504.

1 50 Ω - 400 Ω matching pad.
  (See Figure 5-2a for diagram and parts required.)

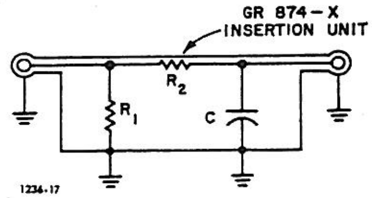


Figure 5-2a. Matching pad (50 Ω - 400 Ω).

R_1 – 390Ω 1/4 W, 62Ω, 1/4 W connected in parallel.

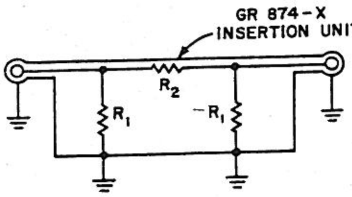
R_2 – 750Ω, 1/2 W, 750Ω, 1/2 W connected in parallel.

NOTE: Use composition-type resistors and mount R_1 with less than 3/16-inch lead length. Resistor values are nominal.

*The 1025 can be used as a sweep generator, a standard signal generator, and it also contains a precision attenuator.

1 1-dB attenuator pad.
Accuracy: ±0.01 dB.
(See Figure 5-2b for diagram and parts required).

Figure 5-2b. Attenuator pad (1 dB).



Use precision (low inductance) resistors if they are available. If not, use 5 % carbon-composition resistors connected as follows:

R_1 – 910Ω, 1/4 W; 20 kΩ, 1/4 W connected in parallel.

R_2 – 22Ω, 1/2 W resistors; 22Ω, 1/2 W resistors; 24Ω, 1/2 W resistors; 24Ω, 1/2 W resistors connected in parallel.

NOTE: Resistor values are nominal. Measure on a low-frequency bridge and select resistors so that R_1 and R_2 are within ±1% tolerance. Mount R_1 resistors with no more than 3/16 inch lead lengths. Avoid overheating the resistors when soldering. The completed assembly should be checked against an appropriate standard at a frequency of 30 MHz to verify the 1 dB ±0.01 dB accuracy specified.

1 Resistor, 10 kΩ ±10%, 10 W
1 Resistor, 100 Ω ±10%, 1/4 W
1 Adaptor, GR874/BNC Type, GR874-QBPL

5.5.2 PRELIMINARY STEPS.

a. Observe the zero position of the meter pointer with the amplifier turned off. If necessary, set the pointer to zero by adjusting the screw at the lower center of the meter cover.

b. Make certain that no static charge is present on the meter cover. Hold a 1/16 x 3-inch strip of paper by one end and move the other end over the meter cover. A static charge is present if the paper sticks to the cover. Wet the meter cover with any available anti-static solution to remove the charge.

c. Apply power to the amplifier and allow a 1/2-hour warmup time before calibration.

NOTE

Keep the amplifier in its upright position when reading the meter. Refer to paragraph 5.3 for instructions on how to gain access to the inside of the amplifier.

5.5.3 POWER SUPPLIES.

To test and adjust the power supplies in the 1236, proceed as follows:

a. Remove the amplifier dust cover. Remove the two screws at the rear of the power-supply etched board and the four screws at the rear of the post-amplifier box.

b. Connect the autotransformer to the line input plug at the left-hand side of the amplifier. Set the autotransformer to 115 Vac and turn the amplifier on.

c. Using the voltmeter, make the following measurements (see Figure 5-3).

AT (terminal) 512 to ground: 12.6 ±0.3 Vdc (adjustable with R511).
AT507 to ground: 66 ±5 Vdc.
AT505 to ground: -6.8 ±0.5 Vdc.
SO501 (see Figure 5-11).
#15 to #16: 150 Vdc min, 285 V to 300 Vdc max. (controlled by OSC OUTPUT knob).
#13 to #14: 6.5 ±0.5 Vac.

5.5.4 POST AMPLIFIER.

5.5.4.1 PERFORMANCE CHECK.

a. Disconnect the attenuator from the postamplifier input, J101, Figure 5-4 (BNC connector at the rear of the postamplifier box). Connect the signal generator to the postamplifier input using the GR874/BNC Adaptor. Set the generator frequency to 30 MHz.

b. Set the METER SCALE switch on the amplifier to NORMAL. Set the GAIN control fully clockwise. Then, adjust the generator output for a full-scale meter reading on the amplifier. The generator output must be between 140 μV and 160 μV OPEN-CIRCUIT VOLTAGE.

c. Observe the two frequencies at which the response is down 3 dB. The difference (3-dB bandwidth) should be approximately 5 MHz.

5.5.4.2 ALIGNMENT.

a. Swing the power-supply etched board to its vertical position. Connect the sweep generator to J101 (see Figure 5-4) at the rear of the postamplifier box. Set the 1236 METER SCALE switch to NORMAL. Adjust the frequency to 29 MHz and increase the generator output until an upscale reading on the amplifier is obtained. Adjust T103 for a maximum meter deflection (use slotted alignment tool*).

b. Set the amplifier GAIN control fully clockwise. Adjust the generator frequency to 30 MHz and the output for a full-scale reading on the amplifier. Back off the amplifier GAIN control until the meter reads 7 dB. Increase the generator output until the amplifier reads full scale again.

c. Connect C129 (feedthrough capacitor at AT105 in the postamplifier box, see Figure 5-7) to the oscilloscope input. (Connect C129 to the EXTERNAL RESPONSE DETECTOR jack on the generator if the GR 1025 Standard Sweep Generator is used.) Adjust the oscilloscope sensitivity so that full-scale spot deflection on the screen corresponds to full-scale deflection on the amplifier meter. Set the generator output to 200 μV OPEN-CIRCUIT VOLTAGE and switch to the sweep mode. The bandpass curve on the oscilloscope should have a 5-MHz bandwidth at the 3-dB points, centered around 30 MHz, and a full-scale vertical deflection at 30 MHz.

d. Align the response with T101, T102, C107, and C113, (see Figure 5-4) if necessary. C107 and C113 determine the Q's of the two tuned circuits and the gain of both stages. T101 and C107 affect the res-

*JFD #5284 or equivalent. (JFD Electronics Corp., Brooklyn, N.Y.)

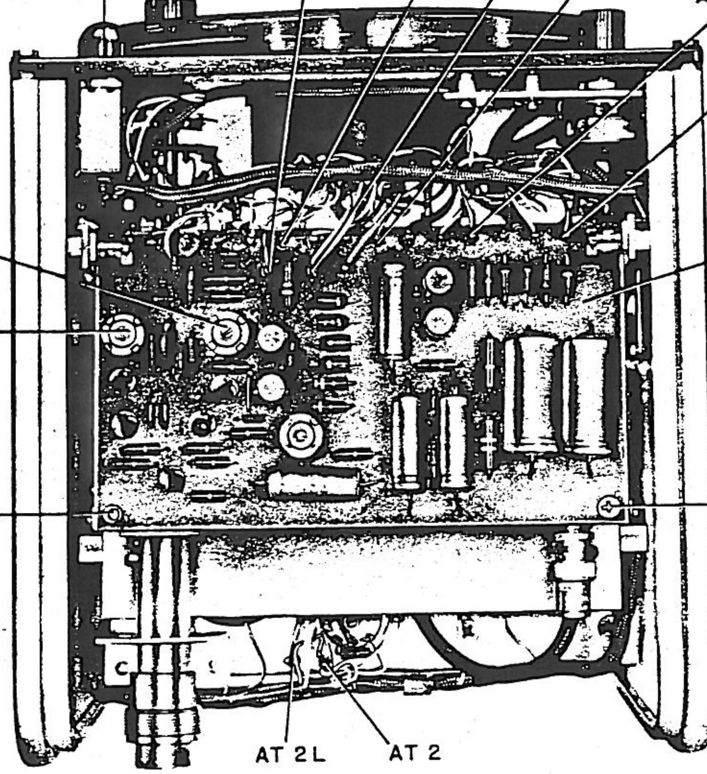


Figure 5-3. Top view of 1236 with dust cover removed. The etched-board assembly supports power-supply and expansion-amplifier components.

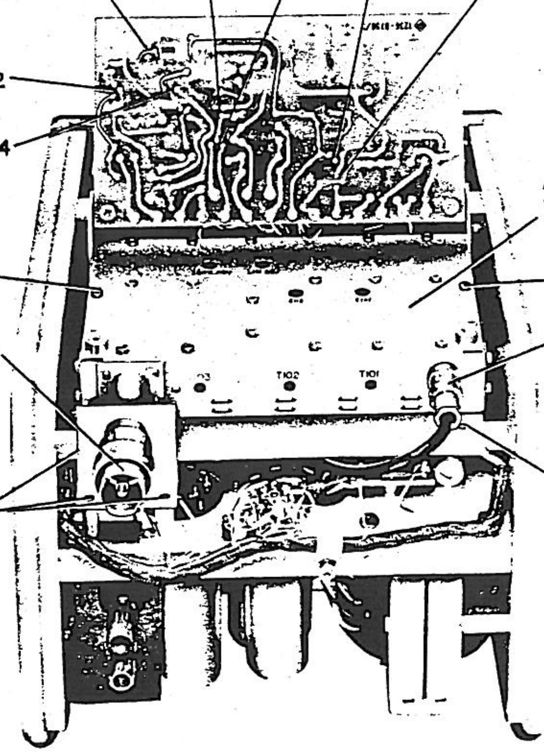


Figure 5-4. Rear view of 1236 with dust cover removed and the power-supply etched-board pivoted to a vertical position.

ponse below 30 MHz; T102 and C113 affect the response above 30 MHz. Because of interaction between these four adjustments, a correct response curve is obtained by gradual and careful adjustment.

e. If the circuits are detuned by a considerable amount, adjust C107 and C113 for minimum output. Set T101 to its maximum inductance (lowest resonant frequency) and T102 to its minimum inductance (highest resonant frequency). Then adjust T101-C107, and T102-C113 for a broad, symmetrical response around 30 MHz. Once the broad response is obtained, gradually vary both sets of adjustments to get a correct response curve as described in step c.

f. Turn the generator sweep control off and set the frequency to 30 MHz. Set the 1236 GAIN control fully clockwise and adjust the generator output for a full-scale reading on the amplifier. The generator output must be between 140 μV and 160 μV OPEN-CIRCUIT VOLTAGE. Adjust the frequency for maximum deflection on the amplifier meter. Set the GAIN control fully counterclockwise and adjust the frequency for maximum meter deflection once again. Both frequencies must be within 30 ±0.6 MHz.

5.5.4.3 METER LINEARITY AND ZERO ADJUSTMENT.

a. Remove the oscilloscope connection and set the generator frequency to 30 MHz. Turn the amplifier GAIN control fully counterclockwise and set the generator output to zero. Set the amplifier meter to zero, using the ZERO ADJ control (R120, Figure 5-4).

b. Increase the generator output to obtain a full-scale reading on the amplifier. Reduce the output by 10 dB. Set the LIN ADJ control (R122, Figure 5-4) for a 0-dB meter reading on the amplifier. Increase the signal level by 10 dB and readjust the generator output for a full-scale reading on the amplifier. Observe the 0-dB position again and repeat the LIN ADJ adjustment until the 0-dB reading indicates no visible error.

c. Set the generator output back to zero and adjust the ZERO ADJ control for a zero meter reading. Set the gain control fully clockwise and adjust the generator output for full-scale meter reading on the 1236. Reduce the generator output by 10 dB, and observe the 0-dB reading again. The error should not exceed 0.2 dB.

NOTE

If this adjustment is made separately (not as part of the complete calibration), connect the generator to the 1236 I-F Amplifier input and set the controls as follows:

ATTENUATOR: 30 dB.
BANDWIDTH: either position.
METER SCALE: NORMAL
GAIN: fully counterclockwise.

Then proceed with steps a through c.

5.5.5 EXPANSION AMPLIFIER.

5.5.5.1 PERFORMANCE CHECK.

a. Connect the signal generator to the post-amplifier input (J101, Figure 5-4). Set the amplifier METER SCALE switch to NORMAL. Set the generator frequency to 30 MHz and increase the generator output to obtain a 9.5-dB reading on the amplifier. Switch to the EXPANDED position. The amplifier meter must read between 0.3 dB and 0.7 dB on the lower (expanded scale.

b. Set the METER SCALE switch to the COMPRESSED position and increase the generator output by 40 dB, in 10-dB steps. The reading on the amplifier should increase with each step and not exceed full scale.

5.5.5.2 ADJUSTMENT.

a. Insert the 1-dB attenuator pad between the signal generator and the 1236 postamplifier. Set the METER SCALE switch to NORMAL and the GAIN control at the middle of its adjustment range.

b. Set the signal-generator frequency to 30 MHz and adjust the generator output for a 9-dB reading on the amplifier.

Switch the METER SCALE switch to EXPANDED and adjust the meter pointer to zero, using R211 (on power-supply etched board, see Figure 5-3). Remove the 1-dB pad and adjust R203 (see Figure 5-3) for full-scale meter deflection.

c. Set the METER SCALE switch back to NORMAL and repeat steps a and b to check the adjustment.

NOTE

If this adjustment is made separately (not as part of the complete calibration), connect the signal generator, via the 1-dB attenuator pad, to the 1236 input and set the controls as follows:

ATTENUATOR: 30 dB.
BANDWIDTH: either position.
METER SCALE: NORMAL.
GAIN: middle of the adjustment range.

Then proceed with steps b and c.

5.5.6 PREAMPLIFIER.

5.5.6.1 PERFORMANCE CHECK.

a. Connect the attenuator cable to the BNC jack (J101, Figure 5-4) at the rear of the postamplifier box. Connect the signal generator to the 50-Ω side of the 50 Ω - 400 Ω matching pad. Connect the 400-Ω side of the pad to the input of the 1236.

b. Set the signal-generator output to zero, the ATTENUATION switch to -10 dB, the BANDWIDTH switch to WIDE, the METER SCALE switch to NORMAL, and the GAIN control fully clockwise. The meter deflection must be between 25 and 60 percent of full scale.

c. Set the ATTENUATION to 30 dB, the GAIN control to the middle of its adjustment range, and measure the 3-dB bandwidths. The WIDE bandwidth must be 4 ±1 MHz and the NARROW bandwidth 0.5 ±0.2 MHz.

5.5.6.2 ALIGNMENT.

a. Turn the amplifier upside down and remove the cover on the preamplifier-attenuator box. Connect the attenuator cable to the postamplifier. Measure the dc voltage from C320 (see Figure 5-8) to ground. If this voltage is greater than 6.3 Vdc, interchange V301 and V302 (see Figure 5-5).

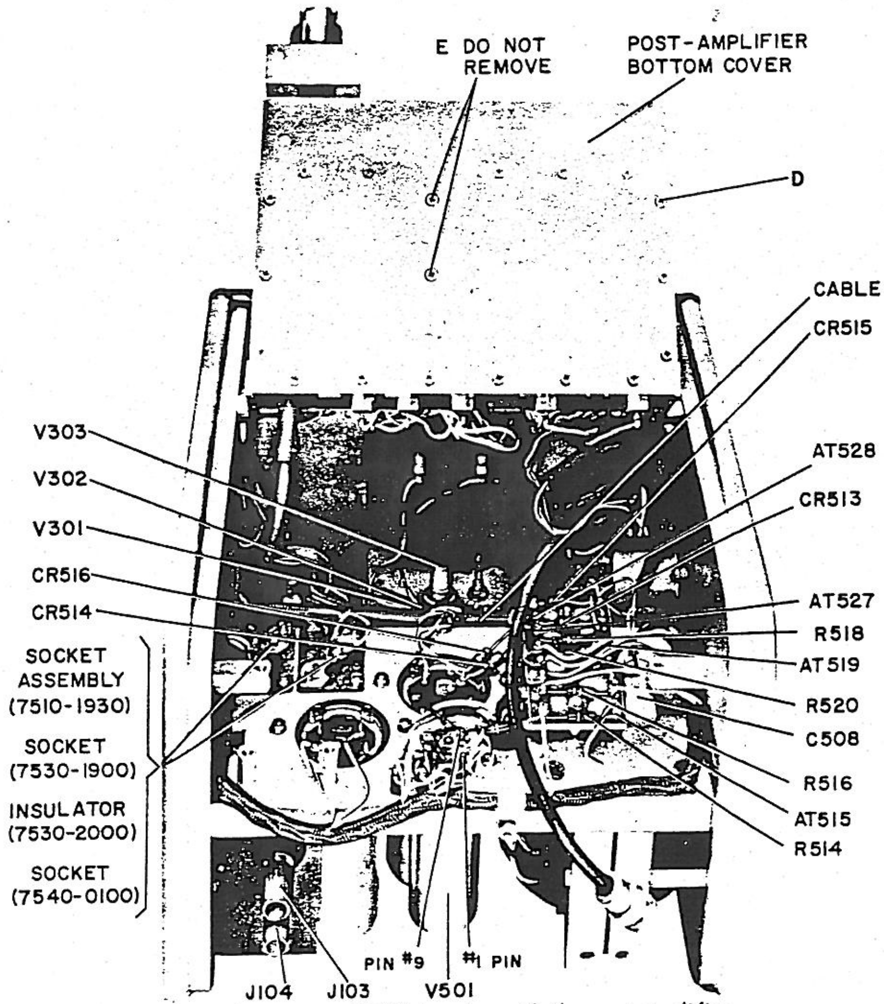


Figure 5-5. Rear view of 1236 interior with the post-amplifier box raised to its vertical position.

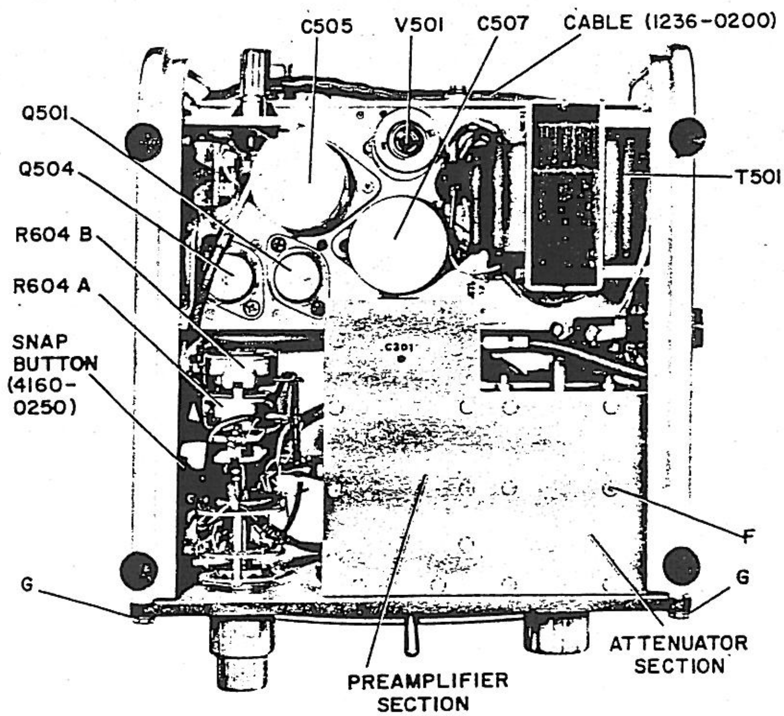


Figure 5-6. Bottom view of 1236 interior.

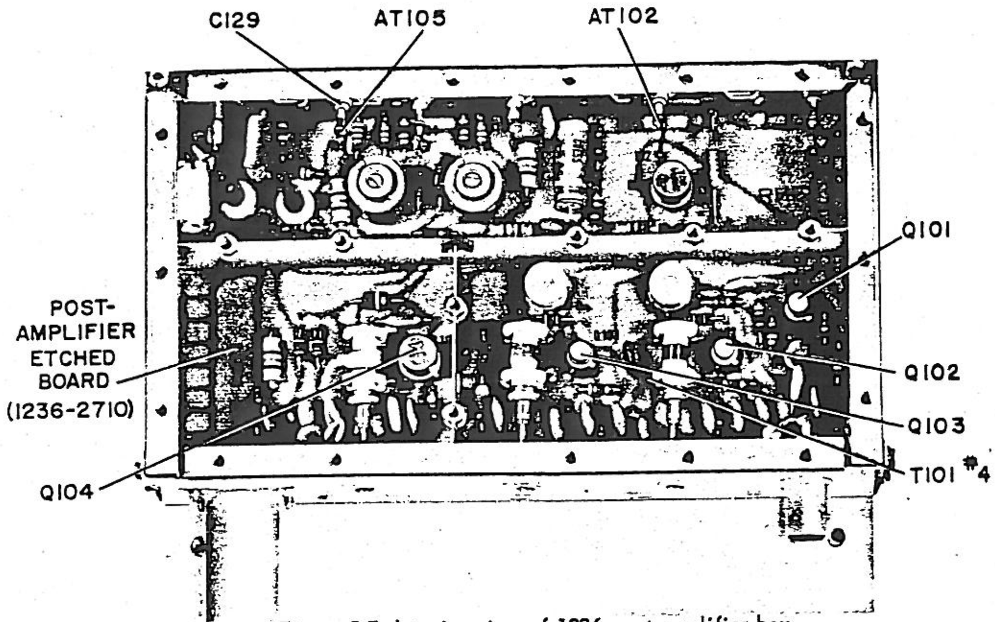


Figure 5-7. Interior view of 1236 post-amplifier box.

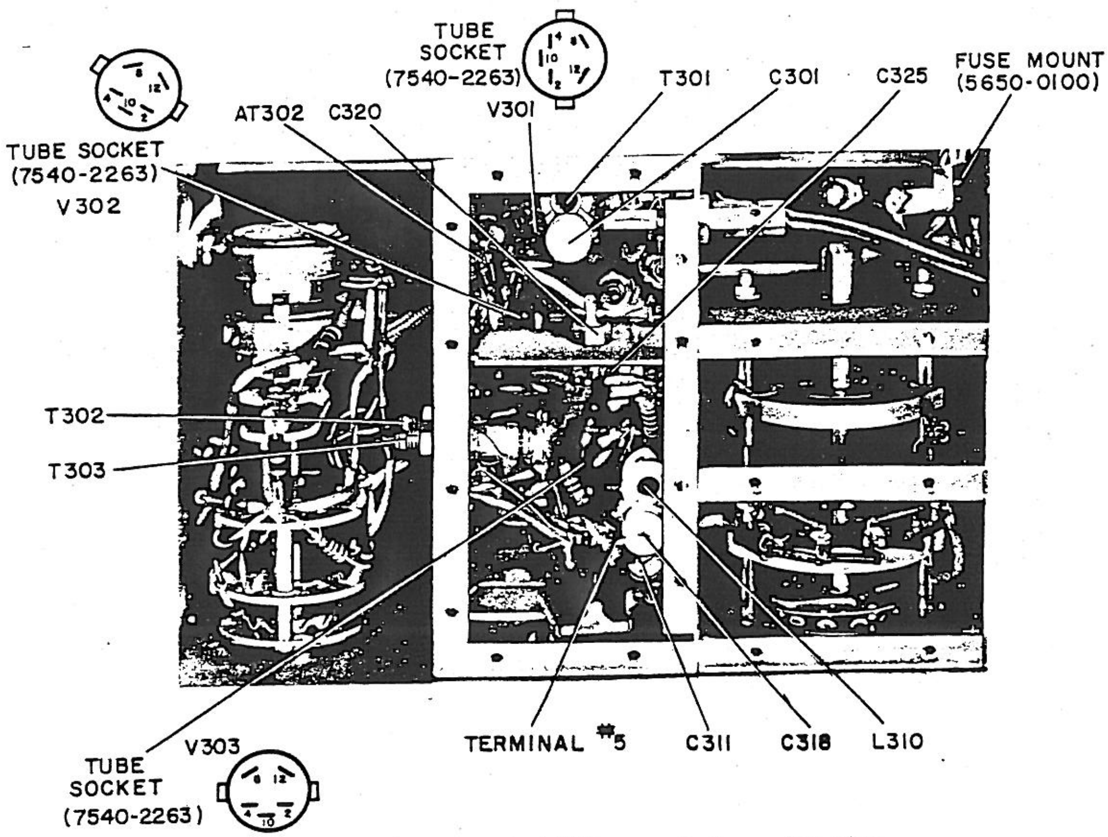


Figure 5-8. Interior view of 1236 attenuator/preamplifier box.

b. Connect the sweep generator to the amplifier input via the 50 Ω - 400 Ω matching pad as described in step a of the preamplifier performance check. Make certain to connect the 400-Ω side of the pad directly to the amplifier. Connect the input of the oscilloscope to AT302 (see Figure 5-8), using the detector probe. (If the GR 1025 is used, connect the EXTERNAL RESPONSE DETECTOR to AT302 via the detector probe.)

Connect a 100-Ω resistor between terminal #5 (see Figure 5-8) on the bandwidth switch, and ground.

c. Set the 1236 bandwidth switch to WIDE, the ATTENUATION to 60 dB, the METER SCALE switch to COMPRESSED, and the GAIN control to the middle of its adjustment range.

d. Switch the generator to the SWEEP mode and increase the generator output until the bandpass curve is displayed on the oscilloscope (vertical deflection, maximum 50 mV/cm). Adjust C301 and T301 (see Figure 5-8) for a maximally flat bandpass curve centered around 30 MHz. See Figure 5-9. (Start the T301 adjustment with the tuning slug screwed all the way in toward the threaded end of the coil form.)

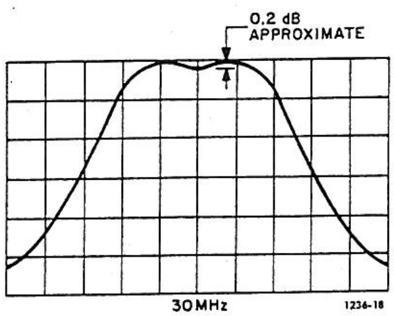


Figure 5-9. 1236 bandpass curve centered around 30 MHz.

e. Remove the signal-generator detector probe. Remove the 100-Ω resistor. Reduce the generator output.

f. Set the amplifier METER SCALE switch to NORMAL and the ATTENUATION to 30 dB. Shut off the generator SWEEP mode and set the frequency to 30 MHz. Adjust T302, L310, and C318 (see Figure 5-8) for maximum amplifier-meter deflection. After initial adjustment, do not touch T301, and repeat L310 and C318 adjustment for maximum meter deflection.

Set bandwidth switch to NARROW and adjust T303 and C311 (see Figure 5-8) for maximum meter deflection. Switch to WIDE bandwidth.

g. Connect C129 (see Figure 5-7) to the oscilloscope input. If the 1025 is used, connect C129 to the EXTERNAL RESPONSE DETECTOR jack on the sweep generator. Set the sweep generator to SWEEP and adjust T302, if necessary, (see Figure 5-8) to obtain a symmetrical curve around 30 MHz. Switch to the NARROW bandwidth. Again, the response curve should be symmetrical around 30 MHz. Readjust T303 and C311 if necessary.

h. Switch to the WIDE bandwidth and shut off the generator SWEEP control. Set the frequency to 30 MHz. Switch the ATTENUATION to 0 dB and adjust the generator output for a 0-dB reading on the amplifier meter. Switch the ATTENUATION to -10 dB. The meter should read 10 ±0.2 dB. If the reading is too low, turn the SWEEP back on and adjust L310 (see Figure 5-8) so that the peak of the curve moves slightly to the right of 30 MHz. Bring the peak back to 30 MHz by adjusting C318.

If the meter reading is too high, shift the peak to the left of the 30-MHz position with L310 and bring it back by adjusting C318.

Check the ATTENUATION 0 dB to -10 dB step again. Repeat the adjustment procedure if necessary.

5.6 TROUBLE-SHOOTING.

The 1236 I-F Amplifier can be divided into four sections. The calibration procedure (paragraph 5.5) checks these sections in the following order:

a. Power supplies.
b. Postamplifier.
c. Expansion amplifier.
d. Preamplifier.

Because the operation of each of these sections depends on the proper operation of the sections preceding it, a fault can be easily localized to one section by going through portions of the calibration procedure in the correct order. Starting with paragraph 5.5.2, proceed through paragraph 5.5.3, 5.5.4.1, 5.5.5.1, and 5.5.6.1. If one of the sections fails to check out properly, localize the trouble in that section by measuring the voltages listed in the tables of test voltages.

NOTE

The voltages given are nominal values; where no tolerance is given, a deviation of 10 percent is not necessarily abnormal. All voltages given are dc unless otherwise specified. The figure reference (right-hand column) is provided for easy location of the test points.

TABLE 5-2
POWER SUPPLY TEST VOLTAGES

Test Points	*Voltage*	*Fig. Ref.*
66-V Supply:		
AT507 - ground	66 ±5 V	5-3
AT507 - AT503	90 V	5-3
AT507 - Q502 base	66 V	5-3, 5-4
Q502 emitter - ground	0.2 V	5-4
AT505 - ground	-6.8 ±0.5 V	5-3
12.6-V Supply:		
AT512 - ground	12.6 ±0.3 V	5-3
AT512 - AT508	17 V	5-3
AT512 - Q506 emitter	6 V	5-3, 5-4
Q506 emitter - Q506 base	0.2 V	5-4
AT509 - ground	-0.25 V	5-3
Q505 base - ground	-0.4 V	5-4
Osc. Supply*:		
AT528 - AT515	150-300 V	5-5
AT528 - V501 pin #1	400 V	5-5
AT528 - V501 pin #8	100 V	5-5
AT528 - V501 pin #7	98 V	5-5
V501 pin #4 - V501 pin #5	6.5 ±0.5 Vac	5-5

*Connect a 10 kΩ, 10 W, resistor between AT528 and AT515, or between terminals #15 and #16 of SO501.

TABLE 5-3
1236 POST AMPLIFIER TEST VOLTAGES*

Test Points	*Voltage*	*Fig. Ref.*
Q101 emitter - ground	2.5 V	5-7
Q101 collector - ground	8 V	5-7
Q102 emitter - ground	4.7 V	5-7
Q103 emitter - ground	4.7 V	5-7
Q104 emitter - ground	1.3 V	5-7
T101 #4 - ground	3.9 V	5-7
C131 (AT102) - ground	12.3 V	5-7

*METER SCALE switch set to NORMAL.

TABLE 5-4
1236 EXPANSION AMPLIFIER TEST VOLTAGES*

Test Points	*Voltage*	*Fig. Ref.*
Q205 emitter - ground	-3.5 V	5-4
Q205 collector - ground	0.25 V	5-4
Q202 collector - ground	5.2 V	5-4
Q204 collector - ground	5.3 V	5-4

*METER SCALE switch set to NORMAL. Apply 30 MHz signal to obtain meter reading between 92 and 98 percent of full scale.

TABLE 5-5
1236 PREAMPLIFIER TEST VOLTAGES

Test Points	*Voltage*	*Fig. Ref.*
C320 - ground	6.2 V	5-8
C325 - ground	8 V	5-8
V301 pin #8 - ground	0.9 V	5-8
V302 pin #8 - ground	0.9 V	5-8
V303 pin #8 - ground	1.9 V	5-8

PARTS LIST

FEDERAL MANUFACTURER'S CODE

From Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) as supplemented through August, 1968.

Code	Manufacturer
00192	Jones Mfg. Co. Chicago, Illinois
00194	Walsco Electronics Corp, L.A., Calif.
00434	Schweber Electronics, Westburg, L.I., N.Y.
00656	Aerovox Corp, New Bedford, Mass.
01009	Alden Products Co, Brockton, Mass.
01121	Allen-Bradley, Co, Milwaukee, Wisc.
01295	Texas Instruments, Inc, Dallas, Texas
02114	Ferroxcube Corp, Saugerties, N.Y. 12477
02606	Fenwal Lab Inc, Morton Grove, Ill.
02660	Amphenol Electron Corp, Broadview, Ill.
02768	Fastex, Des Plaines, Ill. 60016
03508	G.E. Semicon Prod, Syracuse, N.Y. 13201
03636	Grayburne, Yonkers, N.Y. 10701
03888	Pyrofilm Resistor Co, Cedar Knolls, N.J.
03911	Clairex Corp, New York, N.Y. 10001
04009	Arrow-Hart & Hegeman, Hartford, Conn. 06106
04713	Motorola, Phoenix, Ariz. 85008
05170	Engr'd Electronics, Santa Ana, Calif. 92702
05624	Barber-Colman Co, Rockford, Ill. 61101
05820	Wakefield Eng, Inc, Wakefield, Mass. 01880
07126	Digitron Co, Pasadena, Calif.
07127	Eagle Signal (E.W. Bliss Co), Baraboo, Wisc.
07261	Avnet Corp, Culver City, Calif. 90230
07263	Fairchild Camera, Mountain View, Calif.
07387	Birtcher Corp, No. Los Angeles, Calif.
07595	Amer Semicond, Arlington Hts, Ill. 60004
07828	Bodine Corp, Bridgeport, Conn. 06605
07829	Bodine Electric Co, Chicago, Ill. 60618
07910	Cont Device Corp, Hawthorne, Calif.
07983	State Labs Inc, N.Y., N.Y. 10003
07999	Borg Inst., Delavan, Wisc. 53115
08730	Vemaline Prod Co, Franklin Lakes, N.J.
09213	G.E. Semiconductor, Buffalo, N.Y.
09408	Star-Tronics Inc, Georgetown, Mass. 01830
09823	Burgess Battery Co, Freeport, Ill.
09922	Burndy Corp, Norwalk, Conn. 06852
11236	C.T.S. of Berne, Inc, Berne, Ind. 46711
11599	Chandler Evans Corp, W. Hartford, Conn.
12040	National Semiconductor, Danbury, Conn.
12498	Crystalonics, Cambridge, Mass. 02140
12672	RCA, Woodbridge, N.J.
12697	Clarostat Mfg Co, Inc, Dover, N.H. 03820
12954	Dickson Electronics, Scottsdale, Ariz.
13327	Solitron Devices, Tappan, N.Y. 10983
14433	ITT Semicondictors, W.Palm Beach, Fla.
14655	Cornell-Dubilier Electric Co, Newark, N.J.
14674	Corning Glass Works, Corning, N.Y.
14936	General Instrument Corp, Hicksville, N.Y.
15238	ITT, Semiconductor Div, Lawrence, Mass.
15605	Cutler-Hammer Inc, Milwaukee, Wisc. 53233
16037	Spruce Pine Mica Co, Spruce Pine, N.C.
17771	Singer Co, Diehl Div, Somerville, N.J.
19396	Illinois Tool Works, Pakton Div, Chicago, Ill.
19644	LRC Electronics, Horseheads, N.Y.
19701	Electra Mfg Co, Independence, Kansas 67301
21335	Fafnir Bearing Co, New Briton, Conn.
22753	UID Electronics Corp, Hollywood, Fla.
23342	Avnet Electronics Corp, Franklin Park, Ill.
24446	G.E., Schenectady, N.Y. 12305
24454	G.E., Electronics Comp, Syracuse, N.Y.
24455	G.E. (Lamp Div), Nela Park, Cleveland, Ohio
24655	General Radio Co, W. Concord, Mass. 01781
26806	American Zettler Inc, Costa Mesa, Calif.
28520	Hayman Mfg Co, Kenilworth, N.J.
28959	Hoffman Electronics Corp, El Monte, Calif.
30874	I.B.M, Armonk, New York
32001	Jensen Mfg. Co, Chicago, Ill. 60638
33173	G.E. Comp, Owensboro, Ky. 42301
35929	Constanta Co, Mont. 19, Que.
37942	P.R. Mallory & Co Inc, Indianapolis, Ind.
38443	Marlin-Rockwell Corp, Jamestown, N.Y.
40931	Honeywell Inc, Minneapolis, Minn. 55408
42190	Muter Co, Chicago, Ill. 60638
42498	National Co, Inc, Melrose, Mass. 02176
43991	Norma-Hoffman, Stanford, Conn. 06904
49671	RCA, New York, N.Y. 10020
49956	Raytheon Mfg Co, Waltham, Mass. 02154
53021	Sangamo Electric Co, Springfield, Ill. 62705
54294	Shallcross Mfg Co, Selma, N.C.
54715	Shure Brothers, Inc, Evanston, Ill.
56289	Sprague Electric Co, N. Adams, Mass.
59730	Thomas and Betts Co, Elizabeth, N.J. 07207
59875	TRW Inc, (Accessories Div), Cleveland, Ohio
60399	Torrington Mfg Co, Torrington, Conn.
61637	Union Carbide Corp, New York, N.Y. 10017
61864	United-Carr Fastener Corp, Boston, Mass.
63060	Victoreen Instrument Co, Inc, Cleveland, O.
63743	Ward Leonard Electric Co, Mt. Vernon, N.Y.
65083	Westinghouse (Lamp Div), Bloomfield, N.J.
65092	Weston Instruments, Newark, N.J.
70485	Atlantic-India Rubber, Chicago, Ill. 60607
70563	Amperite Co, Union City, N.J. 07087
70903	Belden Mfg Co, Chicago, Ill. 60644
71126	Bronson, Homer D, Co, Beacon Falls, Conn.
71294	Canfield, H.O. Co, Clifton Forge, Va. 24422
71400	Bussman (McGraw Edison), St. Louis, Mo.
71468	ITT Cannon Elec, L.A., Calif. 90031
71590	Centralab, Inc, Milwaukee, Wisc. 53212
71666	Continental Carbon Co, Inc, New York, N.Y.
71707	Coto Coil Co Inc, Providence, R.I.
71744	Chicago Miniature Lamp Works, Chicago, Ill.
71785	Cinch Mfg Co, Chicago, Ill. 60624
71823	Darnell Corp, Ltd, Downey, Calif. 90241
72136	Electro Motive Mfg Co, Wilmington, Conn.
72259	Nytronics Inc, Berkeley Heights, N.J. 07922
72619	Dialight Co, Brooklyn, N.Y. 11237
72699	General Instr Corp, Newark, N.J. 07104
72765	Drake Mfg Co, Chicago, Ill. 60656
72825	Hugh H. Eby Inc, Philadelphia, Penn. 19144
72962	Elastic Stop Nut Corp, Union, N.J. 07083
72982	Erie Technological Products Inc, Erie, Penn.
73138	Beckman Inc, Fullerton, Calif. 92634
73445	Amperex Electronics Co, Hicksville, N.Y.
73559	Carling Electric Co, W.Hartford, Conn.
73690	Elco Resistor Co, New York, N.Y.
73899	JFD Electronics Corp, Brooklyn, N.Y.
74193	Heinemann Electric Co, Trenton, N.J.
74861	Industrial Condenser Corp, Chicago, Ill.
74970	E.F. Johnson Co, Waseca, Minn. 56093
75042	IRC Inc, Philadelphia, Penn. 19108
75382	Kulka Electric Corp, Mt. Vernon, N.Y.
75491	Lafayette Industrial Electronics, Jamica, N.Y.
75608	Linden and Co, Providence, R.I.
75915	Littelfuse, Inc, Des Plaines, Ill. 60016
76005	Lord Mfg Co, Erie, Penn. 16512
76149	Mallory Electric Corp, Detroit, Mich. 48204
76487	James Millen Mfg Co, Malden, Mass. 02148
76545	Mueller Electric Co, Cleveland, Ohio 44114
76684	National Tube Co, Pittsburg, Penn.
76854	Oak Mfg Co, Crystal Lake, Ill.
77147	Patton MacGuyer Co, Providence, R.I.
77166	Pass-Seymour, Syracuse, N.Y.
77263	Pierce Roberts Rubber Co, Trenton, N.J.
77339	Positive Lockwasher Co, Newark, N.J.
77542	Ray-O-Vac Co, Madison, Wisc.
77630	TRW, Electronic Comp, Camden, N.J. 08103
77638	General Instruments Corp, Brooklyn, N.Y.
78189	Shakeproof (Ill. Tool Works), Elgin, Ill. 60120
78277	Sigma Instruments Inc, S.Braintree, Mass.
78488	Stackpole Carbon Co, St. Marys, Penn.
78553	Tinnerman Products, Inc, Cleveland, Ohio
79089	RCA, Rec Tube & Semicond, Harrison, N.J.
79725	Wiremold Co, Hartford, Conn. 06110
79963	Zierick Mfg Co, New Rochelle, N.Y.
80030	Prestole Fastener, Toledo, Ohio
80048	Vickers Inc, St. Louis, Mo.
80131	Electronic Industries Assoc, Washington, D.C.
80183	Sprague Products Co, No. Adams, Mass.
80211	Motorola Inc, Franklin Park, Ill. 60131
80258	Standard Oil Co, Lafayette, Ind.
80294	Bourns Inc, Riverside, Calif. 92506
80431	Air Filter Corp, Milwaukee, Wisc. 53218
80583	Hammarlund Co, Inc, New York, N.Y.
80740	Beckman Instruments, Inc, Fullerton, Calif.
81030	International Insturment, Orange, Conn.
81073	Grayhill Inc, LaGrange, Ill. 60525
81143	Isolantite Mfg Corp, Stirling, N.J. 07980
81349	Military Specifications
81350	Joint Army-Navy Specifications
81751	Columbus Electronics Corp, Yonkers, N.Y.
81831	Filtron Co, Flushing, L.I., N.Y. 11354
81840	Ledex Inc, Dayton, Ohio 45402
81860	Barry-Wright Corp, Watertown, Mass.
82219	Sylvania Elec Prod, Emporium, Penn.
82273	Indiana Pattern & Model Works, LaPort, Ind.
82389	Switchcraft Inc, Chicago, Ill. 60630
82647	Metals & Controls Inc, Attleboro, Mass.
82807	Milwaukee Resistor Co, Milwaukee, Wisc.
83033	Meissner Mfg, (Maguire Ind) Mt. Carmel, Ill.
83058	Carr Fastener Co, Cambridge, Mass.
83186	Victory Engineering, Springfield, N.J. 07081
83361	Bearing Specialty Co, San Francisco, Calif.
83587	Solar Electric Corp, Warren, Penn.
83740	Union Carbide Corp, New York, N.Y. 10017
83781	National Electronics Inc, Geneva, Ill.
84411	TRW Capacitor Div, Ogallala, Nebr.
84835	Lehigh Metal Prods, Cambridge, Mass. 02140
84971	TA Mfg Corp, Los Angeles, Calif.
86577	Precision Metal Prods, Stoneham, Mass. 02180
86684	RCA (Elect. Comp & Dev), Harrison, N.J.
86687	REC Corp, New Rochelle, N.Y. 10801
86800	Cont Electronics Corp, Brooklyn, N.Y. 11222
88140	Cutler-Hammer Inc, Lincoln, Ill.
88219	Gould Nat. Batteries Inc, Trenton, N.J.
88419	Cornell-Dubilier, Fuquay-Varina, N.C.
88627	K & G Mfg Co, New York, N.Y.
89482	Holtzer-Cabot Corp, Boston, Mass.
89665	United Transformer Co, Chicago, Ill.
90201	Mallory Capacitor Co, Indianapolis, Ind.
90750	Westinghouse Electric Corp, Boston, Mass.
90952	Hardware Products Co, Reading, Penn. 19602
91032	Continental Wire Corp, York, Penn. 17405
91146	ITT (Cannon Electric Inc), Salem, Mass.
91293	Johanson Mfg Co, Boonton, N.J. 07005
91506	Augat Inc, Attleboro, Mass. 02703
91598	Chandler Co, Wethersfield, Conn. 06109
91637	Dale Electronics Inc, Columbus, Nebr.
91662	Elco Corp, Willow Grove, Penn.
91719	General Instruments, Inc, Dallas, Texas
91929	Honeywell Inc, Freeport, Ill.
92519	Electra Insul Corp, Woodside, L.I., N.Y.
92678	E.G.&G., Boston, Mass.
93332	Sylvania Elect Prods, Inc, Woburn, Mass.
93916	Cramer Products Co, New York, N.Y. 10013
94144	Raytheon Co, Components Div, Quincy, Mass.
94154	Tung Sol Electric Inc, Newark, N.J.
95076	Garde Mfg Co, Cumberland, R.I.
95121	Quality Components Inc, St. Mary's, Penn.
95146	Alco Electronics Mfg Co, Lawrence, Mass.
95238	Continental Connector Corp, Woodside, N.Y.
95275	Vitramon, Inc, Bridgeport, Conn.
95354	Methode Mfg Co, Chicago, Ill.
95412	General Electric Co, Schenectady, N.Y.
95794	Anaconda Amer Brass Co, Torrington, Conn.
96095	Hi-Q Div. of Aerovox Corp, Orlean, N.Y.
96214	Texas Instruments Inc, Dallas, Texas 75209
96256	Thordarson-Meissner, Mt. Carmel, Ill.
96341	Microwave Associates Inc, Burlington, Mass.
96791	Amphenol Corp, Jonesville, Wisc, 53545
96906	Military Standards
98291	Sealectro Corp, Mamaroneck, N.Y. 10544
98474	Compar Inc, Burlingame, Calif.
98821	North Hills Electronics Inc, Glen Cove, N.Y.
99180	Transitron Electronics Corp, Melrose, Mass.
99313	Varian, Palo Alto, Calif. 94303
99378	Atlee Corp, Winchester, Mass. 01890
99800	Delevan Electronics Corp, E. Aurora, N.Y.

PARTS LIST – POWER SUPPLY

Ref. No.	Description	GR Part No.	Fed. Mfg. Code	Mfg. Part No.	Fed. Stock No.
CAPACITORS					
C501	Electrolytic, 25 μF +100-10% 100 V	4450-5596	80183	DEE, 25 μF +100-10%	
C502	Electrolytic, 25 μF +100-10% 100 V	4450-5596	80183	DEE, 25 μF +100-10%	
C503	Electrolytic, 15 μF +100-10% 100 V	4450-5597	37942	20-15 μF +100-10%	
C504	Electrolytic, 15 μF +100-10% 100 V	4450-5597	37942	20-15 μF +100-10%	
C505A	1500 μF				
C505B	Electrolytic, 750 μF +100-10% 25 V	4450-0700	90201	203828510C10X2	5910-976-9415
C505C	750 μF				
C506	Electrolytic, 100 μF +100-10% 15 V	4450-2800	56289	D17872	5910-034-5368
C507A	50 μF				
C507B	Electrolytic, 25 μF +100-10% 450 V	4450-0800	56289	D28936	5910-976-9415
C507C	25 μF				
C508	Plastic, 0.1 μF ±10% 400 V	4860-7886	84411	663UW, 0.1 μF ±10%	
C509	Electrolytic, 15 μF +100-10% 100 V	4450-5597	37942	20, 15 μF +100-10%	
C510	Plastic, 0.1 μF +80-20% 50 V	4403-4100	80131	CC63, 0.1 μF +80-20%	5910-811-4788
RESISTORS					
R501	Composition, 2 kΩ ±5% 1/2 W	6100-2205	01121	RC20GF202J	5905-190-8887
R502	Composition, 51 Ω ±5% 1/2 W	6100-0515	01121	RC20GF510J	5905-279-3517
R503	Composition, 5.6 kΩ ±5% 1/2 W	6100-2565	01121	RC20GF562J	5905-195-6453
R504	Composition, 4.7 MΩ ±5% 1/2 W	6100-5475			
R505	Composition, 8.2 kΩ ±5% 1 W	6110-2825	01121	RC32GF822J	5905-279-1718
R506	Composition, 10 kΩ ±10% 1 W	6110-3109	01121	RC32GF103J	
R507	Wire-wound, 2.7 Ω ±10% 2 W	6760-9279	75042	BWH, 2.7 Ω ±10%	
R508	Composition, 3.9 kΩ ±5% 1/2 W	6100-2395	01121	RC20GF392J	5905-279-3505
R509	Composition, 3.9 kΩ ±5% 1/2 W	6100-2395	01121	RC20GF392J	5905-279-3505
R510	Composition, 2.2 kΩ ±5% 1/2 W	6100-2225	01121	RC20GF222J	5905-279-1876
R511	Pot, composition, 1 kΩ ±20% 1/4 W	6040-0400	24655	6040-0400	
R512	Composition, 2.2 kΩ ±5% 1/2 W	6100-2225	01121	RC20GF222J	5905-279-1876
R513	Composition, 1 MΩ ±5% 1/2 W	6100-5105	01121	RC20GF105J	5905-192-0390
R514	Composition, 150 kΩ ±5% 1/2 W	6100-4155	01121	RC20GF154J	5905-279-2522
R515	Composition, 51 kΩ ±5% 1/2 W	6100-3515	01121	RC20GF513J	5905-279-3496
R516	Composition, 240 kΩ ±5% 1/2 W	6100-4245	01121	RC20GF244J	5905-279-2521
R517	Composition, 250 kΩ ±10% 2.25 W	6045-1090	01121	JT, 250 kΩ ±10%	
R518	Composition, 240 kΩ ±5% 1/2 W	6100-4245	01121	RC20GF244J	5905-279-2521
R519	Composition, 6.8 Ω ±10% 2 W	6760-9689	75042	BWH, 6.8 Ω ±10%	
R520*	Composition, 3.9 MΩ ±5% 1/2 W	6100-5395	01121	RC20GF395J	5905-279-2510
MISCELLANEOUS					
CR501 thru CR504	DIODE, rectifier	6081-1001	79089	1N3253	5961-814-4251
CR505	DIODE, rectifier, Zener	6083-1036	28959	1N973B	5960-883-3701
CR506	DIODE, rectifier, Zener	6083-1036	28959	1N973B	5960-883-3701
CR507	DIODE, rectifier, Zener	6083-1009	07910	1N957B	
CR508 thru CR511	DIODE, rectifier	6081-1001	79089	1N3253	5961-814-4251
CR512	DIODE, rectifier, Zener	6083-1006	07910	1N753A	5961-814-4251
CR513 thru CR516	DIODE, rectifier	6081-1003	09213	1N3255	5961-964-5242
CR517	DIODE, rectifier, Zener	6083-1043	93916	1N985B	5960-813-9009
F501	FUSE, fusible, 0.5 Amp	5330-1000	71400	MDL, 0.5 A	5920-199-9498
P501	PILOT LIGHT	5600-0700	24454	MAZDA 44	6240-057-2887
PL501	PLUG, power	4240-0702	24655	4240-0702	
SO501	SOCKET, multiple connector	4230-0700	71785	S-2404-SB	5935-644-6594
S501	SWITCH, toggle	7910-1300	04009	83053-SA	
S502	SWITCH, toggle	7910-0831	42190	4603	
T501	TRANSFORMER	0485-4029	24655	0485-4029	
Q501	TRANSISTOR, 2N2147	8210-1072	75491	2N2147	
Q502	TRANSISTOR, 2N1305	8210-1305	96214	2N1305	5961-853-1079
Q503	TRANSISTOR, 2N1305	8210-1305	96214	2N1305	5961-853-1079
Q504	TRANSISTOR, 2N2147	8210-1072	75491	2N2147	
Q505	TRANSISTOR, 2N1305	8210-1305	96214	2N1305	5961-853-1079
Q506	TRANSISTOR, 2N1305	8210-1305	96214	2N1305	5961-853-1079
V501	TUBE, vacuum	8360-4523	82219	6DR7	

*R520 may be omitted from some instruments (removed in final stages of manufacture).

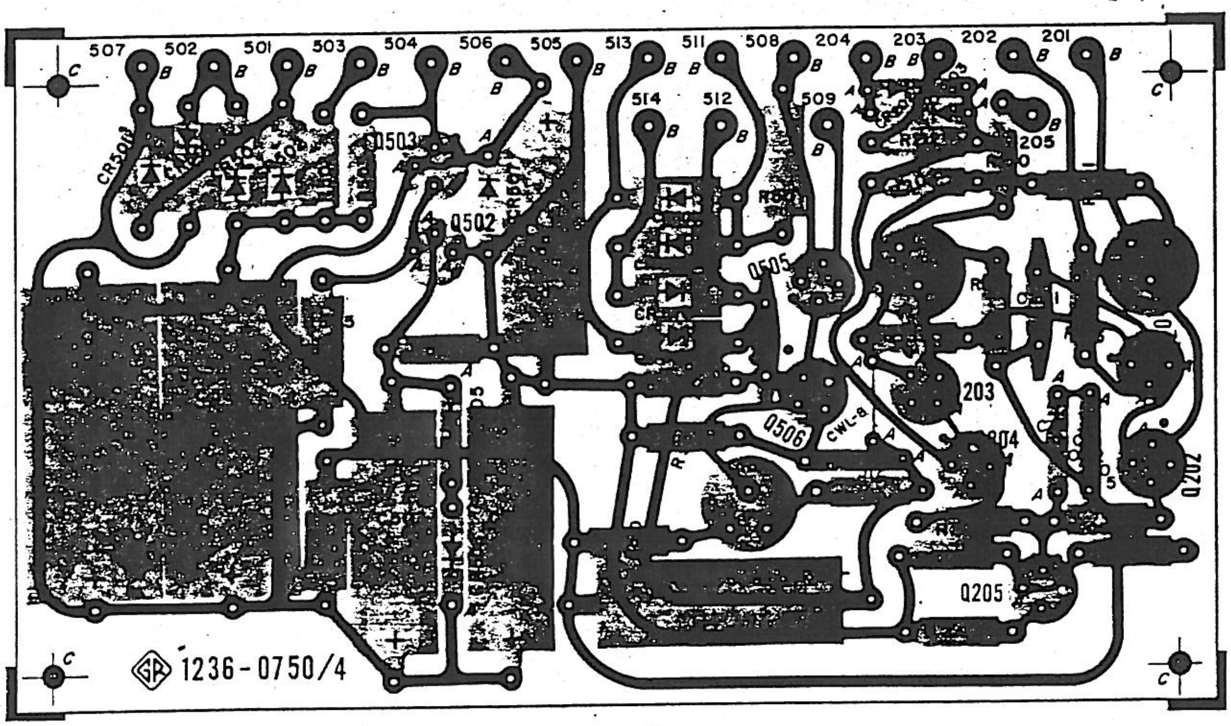


Figure 5-10. Etched-board layout for the 1236 I-F Amplifier power supplies and expansion amplifier.

NOTE

The number appearing on the etched board is the part number of the board only. The part number of the complete etched-board assembly with circuit components, is 1236-2750. The dot on the foil side at the transistor terminal indicates the collector lead.

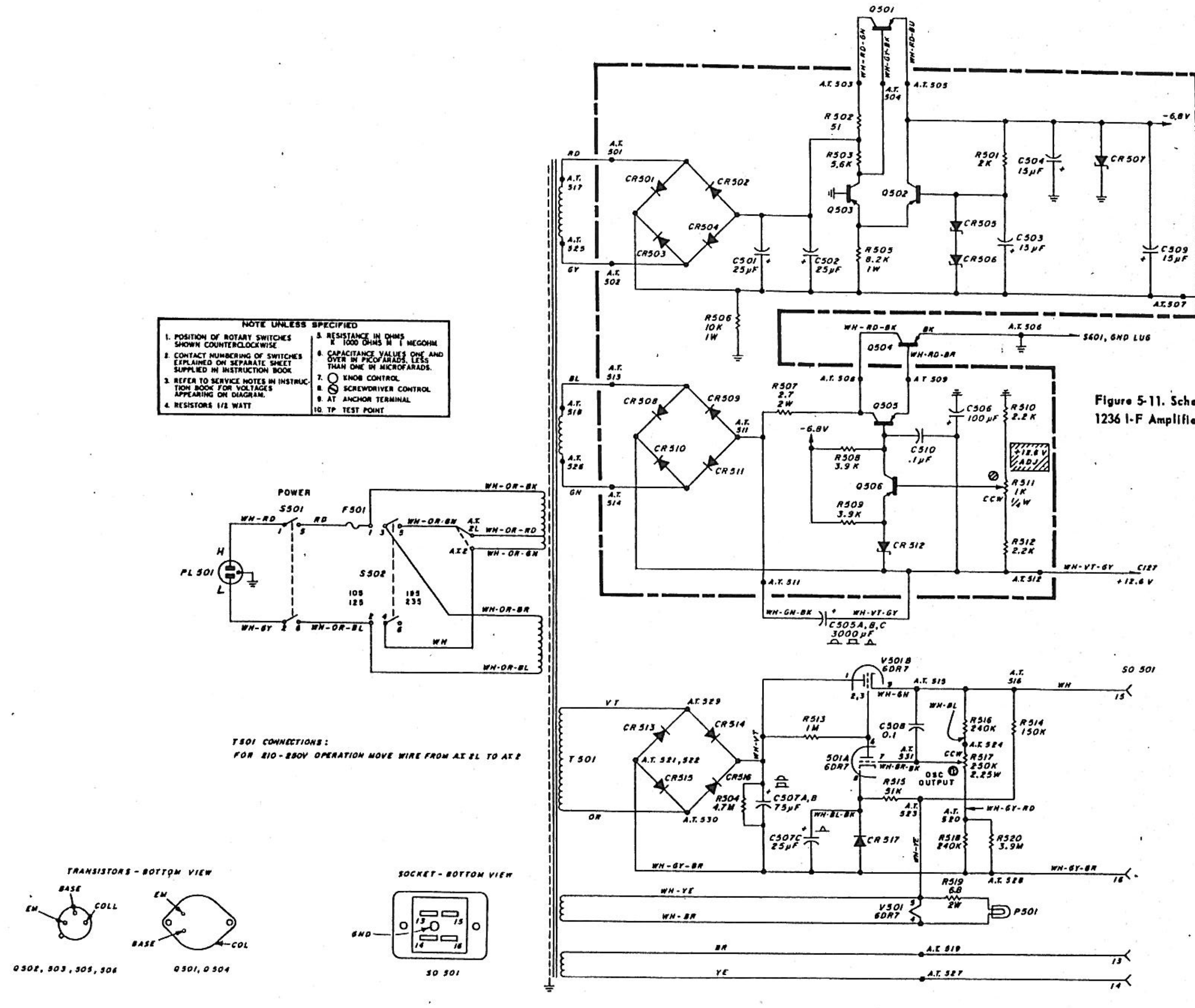


Figure 5-11. Schematic diagram for the 1236 I-F Amplifier power supplies.

PARTS LIST – EXPANSION AMPLIFIER

Ref. No.	Description	GR Part No.	Fed. Mfg. Code	Mfg. Part No.	Fed. Stock No.
CAPACITORS					
C201	Ceramic, 0.1 μF +80-20% 50 V	4403-4100	80131	CC63, 0.1 μF +80-20%	5910-811-4788
RESISTORS					
R201	Composition, 2.7 kΩ ±5% 1/2 W	6100-2275	01121	RC20GF272J	5905-279-1880
R202	Composition, 2.7 kΩ ±5% 1/2 W	6100-2275	01121	RC20GF272J	5905-279-1880
R203	Potentiometer, composition, 10 kΩ ±20% 1/4 W	6040-0700	24655	6040-0700	5905-549-2773
R205	Composition, 270 Ω ±5% 1/2 W	6100-1275	01121	RC20GF271J	5905-171-2006
R206	Composition, 270 Ω ±5% 1/2 W	6100-1275	01121	RC20GF271J	5905-171-2006
R207	Composition, 510 Ω ±5% 1/2 W	6100-1515	01121	RC20GF511J	5905-279-3511
R208	Composition, 1 kΩ ±5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R209	Composition, 1 kΩ ±5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R210	Composition, 5.6 kΩ ±5% 1/2 W	6100-2565	01121	RC20GF562J	5905-195-6453
R211	Potentiometer, composition, 500 Ω ±20% 1/4 W	6040-0300	24655	6040-0300	
R212	Composition, 750 Ω ±5% 1/2 W	6100-1755	01121	RC20GF751J	5905-195-9481
R213	Composition, 2.7 kΩ ±5% 1/2 W	6100-2275	01121	RC20GF272J	5905-279-1880
R214	Composition, 1 kΩ ±5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R215	Composition, 10 kΩ ±5% 1/2 W	6100-3105	01121	RC20GF103J	5905-185-8510
R601	Composition, 680 Ω ±5% 1/2 W	6100-1685	01121	RC20GF681J	5905-195-6791
R602	Composition, 51 Ω ±5% 1/2 W	6100-0515	01121	RC20GF510J	5905-279-3517
R603	Composition, 820 Ω ±5% 1/2 W	6100-1825	01121	RC20GF821J	5905-171-1999
R604A R604B	Composition, 100 kΩ ±10% 2.25 W dual pot 10 kΩ ±10% 2.25 W	6045-2000	01121	JT, 100 k/10 kΩ ±10%	
R605	Composition, 2.2 kΩ ±5% 1/2 W	6100-2225	01121	RC20GF222J	5905-279-1876
R606	Composition, 5.6 kΩ ±5% 1/2 W	6100-2565	01121	RC20GF562J	5905-195-6453
R607	Composition, 51 kΩ ±5% 1/2 W	6100-3515	01121	RC20GF513J	5905-279-3496
MISCELLANEOUS					
CR202 thru CR205	DIODE, rectifier	6082-1016	24446	1N645	5961-944-8222
M601	METER, special	5730-1393	40931	143004-0100	
S601	SWITCH, rotary wafer	7890-4180	76854	255065-F2	
Q201 thru Q205	TRANSISTORS, 2N3414	8210-1047	24454	2N3414	5961-989-2749

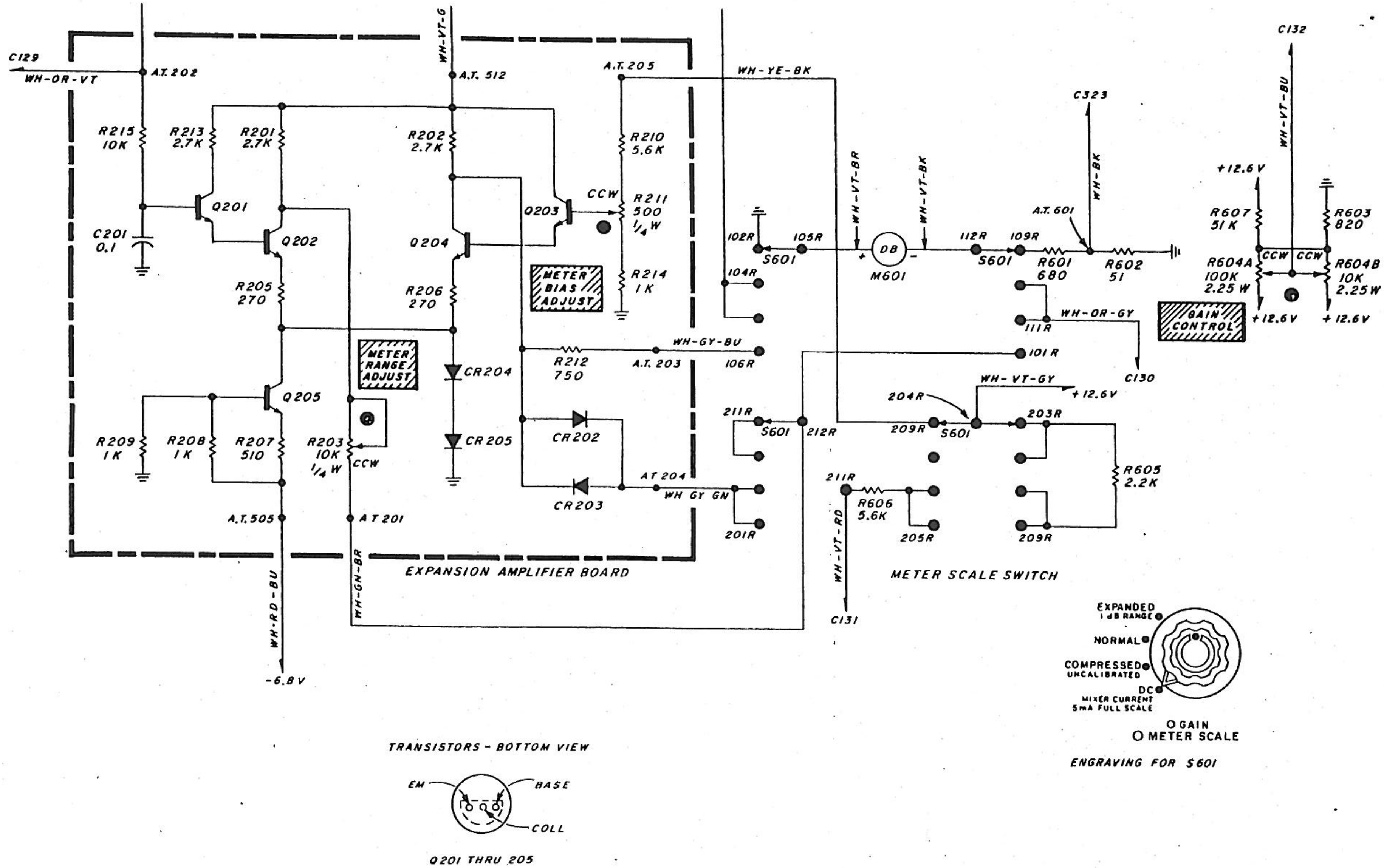


Figure 5-12. Schematic diagram for the 1236 I-F Amplifier expansion amplifier, METER SCALE switch, and GAIN control.

PARTS LIST – POST AMPLIFIER

Ref. No.	Description	GR Part No.	Fed. Mfg. Code	Mfg. Part No.	Fed. Stock No.
CAPACITORS					
C101 thru C106	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C107	Trimmer, 2-8 pF 350 V	4910-2045	72982	538-002, 2-8 pF	
C108 thru C110	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C111	Ceramic, 33 pF +80-20% 500 V	4404-0335	56289		
C112	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C113	Trimmer, 2-8 pF 350 V	4910-2045	72982	538-002, 2-8 pF	
C114 thru C116	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C117	Ceramic, 33 pF ±5% 500 V	4404-0335	56289		
C118	Ceramic, 1.5 pF ±5% 500 V	4400-0150	78488	GA, 1.5 pF ±5% 500 V	
C119 thru C122	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C123	Ceramic, 10 pF ±10% 500 V	4404-0108	72982	831, 10 pF ±10%	
C124	Ceramic, 10 pF ±10% 500 V	4404-0108	72982	831, 10 pF ±10%	
C125	Ceramic, 2.2 µF ±20% 20 V	4450-4500	56289	150D225X0020A2	5910-976-4604
C126	Electrolytic, 15 µF ±20% 20 V	4450-5200	56289	150D156X0020B2	5910-855-6335
C127	Ceramic, 0.001 µF +100-10% 500 V	4400-1800	01121	FB2B, 0.001 µF	5910-792-3172
C129	Ceramic, 0.001 µF +100-10% 500 V	4400-1800	01121	FB2B, 0.001 µF	5910-792-3172
thru C132	Ceramic, 0.001 µF +100-10% 500 V	4400-1800	01121	FB2B, 0.001 µF	5910-792-3172
C133	Ceramic, 2.2 µF ±20% 20 V	4450-4500	56289	150D225X0020A2	5910-976-4604
C134	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C135	Electrolytic, 15 µF +100-10% 15 V	4450-3700	80183	30D, 15 µF +100-10%	
C136	Ceramic, 220 pF ±10% 500 V	4404-1228	72982	831, 220 pF ±10%	
RESISTORS					
R101	Composition, 10 kΩ ±5% 1/4 W	6099-3105	75042	BTS, 10 kΩ ±5%	
R103	Composition, 510 Ω ±5% 1/4 W	6099-1515	75042	BTS, 510 Ω ±5%	
R104	Composition, 330 Ω ±5% 1/4 W	6099-1335	75042	BTS, 330 Ω ±5%	
R105	Composition, 4.7 kΩ ±5% 1/4 W	6099-2475	75042	BTS, 4.7 kΩ ±5%	
R106	Composition, 4.7 kΩ ±5% 1/4 W	6099-2475	75042	BTS, 4.7 kΩ ±5%	
R107	Composition, 510 Ω ±5% 1/4 W	6099-1515	75042	BTS, 510 Ω ±5%	
R108	Composition, 4.7 kΩ ±5% 1/4 W	6099-2475	75042	BTS, 4.7 kΩ ±5%	
R109	Composition, 4.7 kΩ ±5% 1/4 W	6099-2475	75042	BTS, 4.7 kΩ ±5%	
R110	Composition, 510 Ω ±5% 1/4 W	6099-1515	75042	BTS, 510 Ω ±5%	
R111	Film, 1.54 kΩ ±1% 1/8 W	6250-1154	75042	CEA, 1.54 kΩ ±1%	
R112	Film, 7.5 kΩ ±1% 1/8 W	6250-1750	75042	CEA, 7.5 kΩ ±1%	
R113	Composition, 82 Ω ±5% 1/4 W	6099-0825	75042	BTS, 82 Ω ±5%	
R114	Composition, 560 Ω ±5% 1/4 W	6099-1565	75042	BTS, 560 Ω ±5%	
R115	Composition, 180 Ω ±5% 1/4 W	6099-1185	75042	BTS, 180 Ω ±5%	5905-279-5476
R116	Composition, 120 kΩ ±5% 1/4 W	6099-4125	75042	BTS, 120 kΩ ±5%	
R117	Composition, 36 kΩ ±5% 1/4 W	6099-3365	75042	BTS, 36 kΩ ±5%	
R118	Composition, 33 kΩ ±5% 1/4 W	6099-3335	75042	BTS, 33 kΩ ±5%	
R119	Composition, 10 kΩ ±5% 1/4 W	6099-3105	75042	BTS, 10 kΩ ±5%	
R120	Potentiometer, composition, 500 Ω ±20% 1/4 W	6040-0300	24655	6040-0300	
R121	Composition, 270 Ω ±5% 1/4 W	6099-1275	75042	BTS, 270 Ω ±5%	
R122	Potentiometer, composition, 500 Ω ±20% 1/4 W	6040-0300	24655	6040-0300	
R123	Composition, 270 Ω ±5% 1/4 W	6099-1275	75042	BTS, 270 Ω ±5%	
R124	Composition, 150 Ω ±5% 1/4 W	6099-1155	75042	BTS, 150 Ω ±5%	
R125	Composition, 2.2 kΩ ±5% 1/4 W	6099-2225	75042	BTS, 2.2 kΩ ±5%	
R126	Composition, 270 Ω ±5% 1/4 W	6099-1275	24655	6040-0300	
R127	Composition, 3.3 kΩ ±5% 1/4 W	6099-2335	75042	BTS, 3.3 kΩ ±5%	
R128	Composition, 1.5 kΩ ±5% 1/4 W	6099-2155	75042	BTS, 1.5 kΩ ±5%	
R135	Composition, 2.2 kΩ ±5% 1/4 W	6099-2225	75042	BTS, 2.5 kΩ ±5%	
R136	Composition, 10 kΩ ±5% 1/4 W	6099-3105	75042	BTS, 10 kΩ ±5%	
R137	Composition, 10 kΩ ±5% 1/4 W	6099-3105	75042	BTS, 10 kΩ ±5%	
R138	Composition, 510 Ω ±5% 1/4 W	6099-1515	75042	BTS, 510 Ω ±5%	
R139	Composition, 5.6 MΩ ±5% 1/2 W	6100-5565	01121	RC20GF565J	5905-279-3838

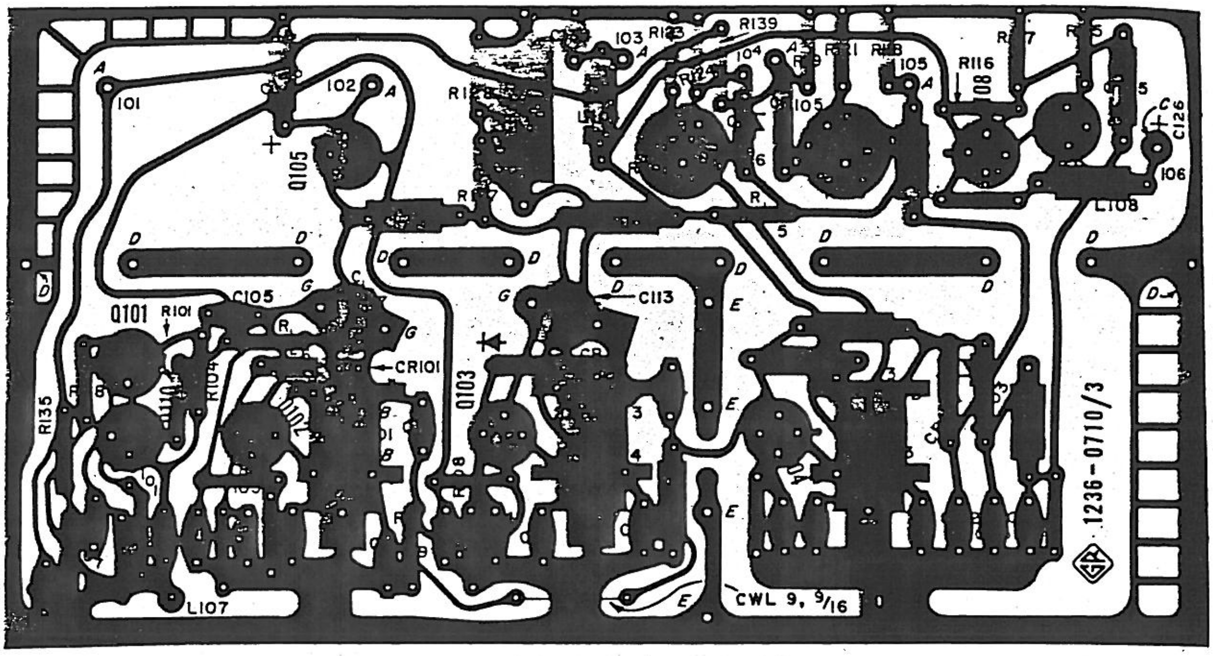


Figure 5-13. Etched-board layout for the 1236 I-F Amplifier postamplifier.

NOTE

The number appearing on the etched board is the part number of the board only. The part number of the complete etched-board assembly with circuit components, is 1236-2710. The dot on the foil side at the transistor terminal indicates the collector lead.

PARTS LIST (Cont) – POST AMPLIFIER

Ref. No.	Description	GR Part No.	Fed. Mfg. Code	Mfg. Part No.	Fed. Stock No.
MISCELLANEOUS					
CR101 thru CR104	DIODE, rectifier	6082-1001	24446	1N3604	5960-995-2199
CR105	DIODE, rectifier	6082-1016	24446	1N645	5961-944-8222
CR106	DIODE, rectifier	6082-1016	24446	1N645	5961-944-8222
CR107	DIODE, rectifier	6082-1001	24446	1N3604	5960-995-2199
L101 thru L106	INDUCTOR, choke, molded, 12 μH ±10%	4300-2300	99800	1537-38	5950-807-6050
L107	INDUCTOR, molded, 0.82 μH ±10%	4300-0605			
L108	INDUCTOR, choke, molded, 22 μH ±10%	4300-2600	71895	1537-22 μH ±10%	5950-668-5867
J101	JACK, connector multiple socket	4230-2300	81349	UG-1094/U	
J102	JACK, locking-connector assembly	0874-4631	24655	0874-4631	
J103	JACK, binding-post assembly	0938-3000	24655	0938-3000	
J104	JACK, binding-post assembly	0938-3022	24655	0938-3022	
T101	TRANSFORMER	1236-2160	24655	1236-2160	
T102	TRANSFORMER	1236-2170	24655	1236-2170	
T103	TRANSFORMER	1236-2164	24655	1236-2164	
Q101 thru Q103	TRANSISTOR, 2N708	8210-3089	24454	2N708	
Q104	TRANSISTOR, 2N2218	8210-1028	81349	2N2218	5960-059-4464
Q105	TRANSISTOR, 2N1304	8210-1304	01295	2N1304	5961-892-0800
Q108	TRANSISTOR, 2N3416	8210-1047	24454	2N3414	5961-989-2749
Q109	TRANSISTOR, 2N3416	8210-1047	24454	2N3414	5961-989-2749

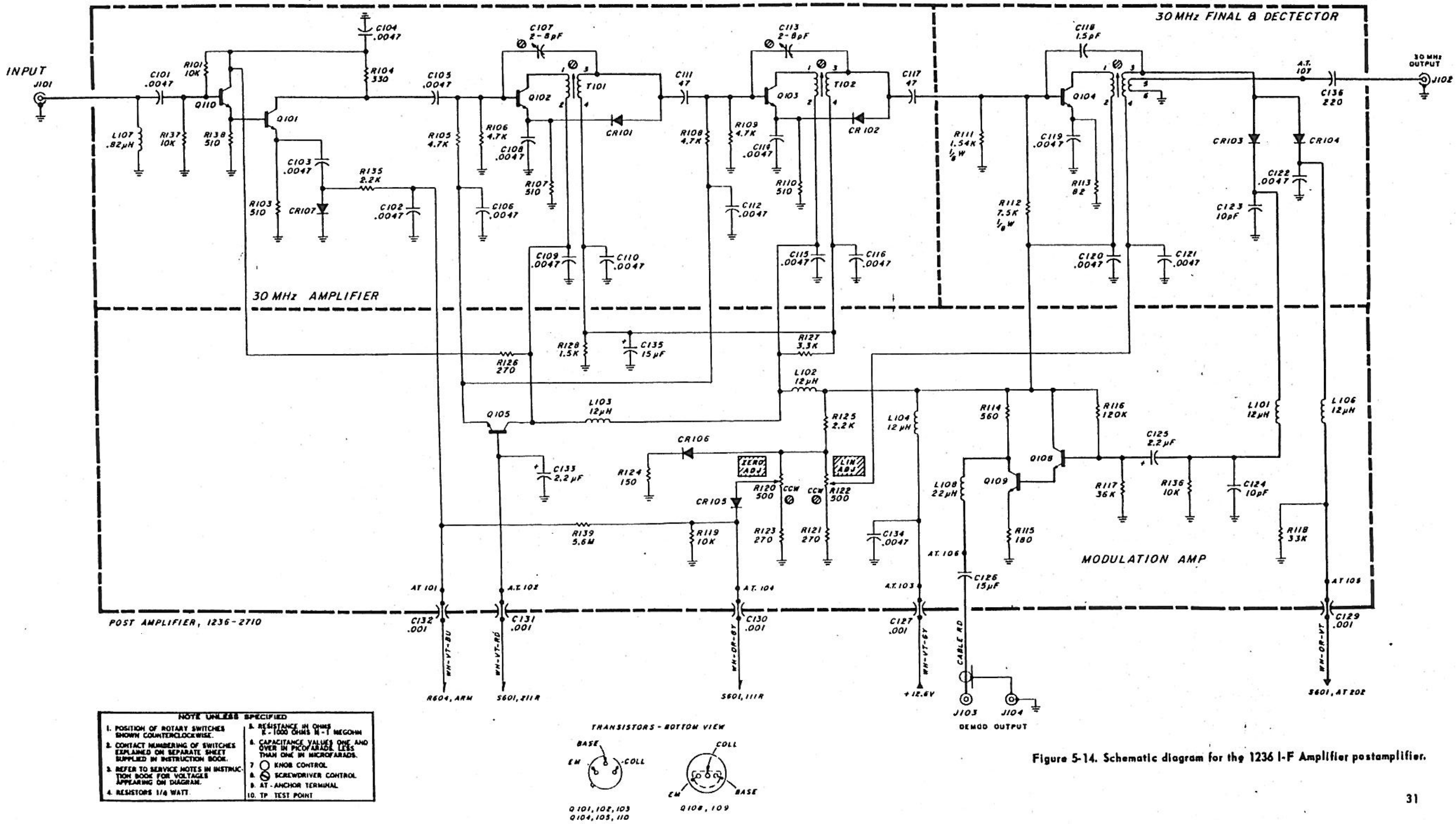


Figure 5-14. Schematic diagram for the 1236 I-F Amplifier postamplifier.

PARTS LIST – PREAMPLIFIER AND ATTENUATOR

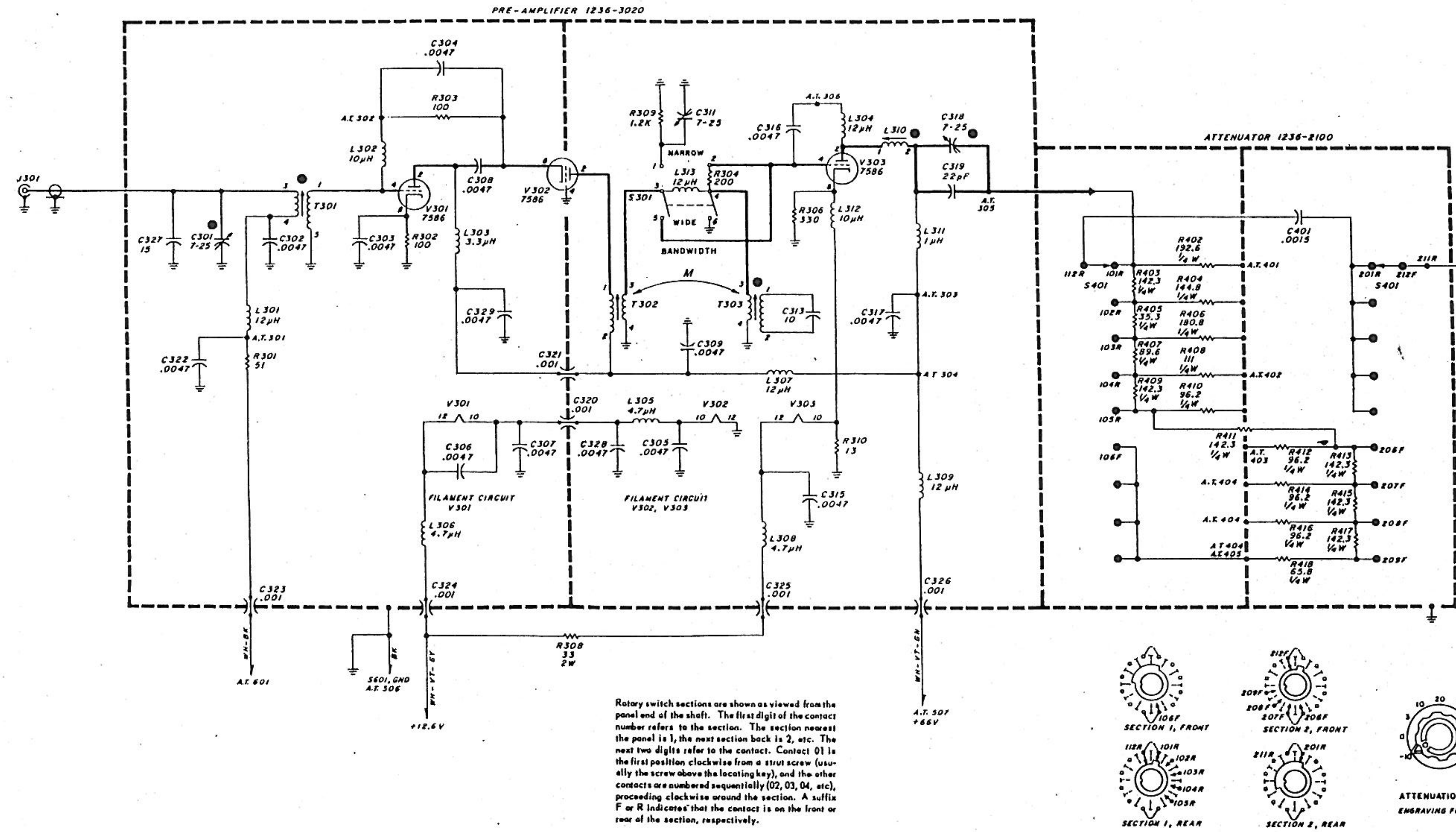
Ref. No.	Description	GR Part No.	Fed. Mfg. Code	Mfg. Part No.	Fed. Stock No.
CAPACITORS					
C301	Trimmer, 7-25 pF 350 V	4910-2043	72982	538-002 (7-25 pF)	
C302	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C303 thru C309	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C311	Trimmer, 7-25 pF 350 V	4910-2043	72982	538-002 (7-25 pF)	
C313	Ceramic, 10 pF 5% 500 V (N33)	4411-0105	56289	40C417	
C315	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C316	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C317	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C318	Trimmer, 7-25 pF 350 V	4910-2043	72982	538-002 (7-25 pF)	
C319	Ceramic, 22 pF ±5% 500 V (NPO)	4417-0225	80131	CC60, 22 pF ±5% (NPO)	
C320	Ceramic, 0.001 µF -0+100% 500 V	4400-1800	01121	FB2B, 0.001 µF	5910-792-3172
C321	Ceramic, 0.001 µF -0+100% 500 V	4400-1800	01121	FB2B, 0.001 µF	5910-792-3172
C322	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C323 thru C326	Ceramic, 0.001 µF -0+100%	4400-1800	01121	FB2B, 0.001 µF	5910-792-3172
C327	Ceramic, 15 pF ±5% 500 V (N750)	4417-0155	80131	CC60, 15 pF ±5%	
C328	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C329	Ceramic, 0.0047 µF +80-20% 500 V	4405-2479	72982	801, 0.0047 µF +80-20%	
C401	Ceramic, 0.0015 µF ±5% 500 V	4406-2155	72982	811, 0.0015 µF ±5%	
RESISTORS					
R301	Composition, 51 Ω ±5% 1/2 W	6100-0515	01121	RC20GF510J	5905-279-3517
R302	Composition, 100 Ω ±5% 1/2 W	6100-1105	01121	RC20GF101J	5905-190-8889
R303	Composition, 100 Ω ±5% 1/2 W	6100-1105	01121	RC20GF101J	5905-190-8889
R304	Composition, 200 Ω ±5% 1/2 W	6100-1205	01121	RC20GF201J	5905-279-2674
R306	Composition, 330 Ω ±5% 1/2 W	6100-1335	01121	RC20GF331J	5905-192-3971
R308	Composition, 33 Ω ±5% 2 W	6120-0335	01121	RC42GF330J	
R309	Composition, 1.2 kΩ ±5% 1/2 W	6120-2125	01121	RC42GF122J	
R310	Composition, 13 Ω ±5% 1/2 W	6100-0135	01121	RC20GF130J	
R402	Film, 192.6 Ω ±1% 1/4 W	6611-1192	03888	A3AG01, 192.6 Ω ±1%	
R403	Film, 142.3 Ω ±1% 1/4 W	6610-1300	35929	N8, 192.6 Ω ±1%	
R404	Film, 144.8 Ω ±1% 1/4 W	6611-1144	03888	A3AG01, 144.8 Ω ±1%	
R405	Film, 35.3 Ω ±1% 1/4 W	6611-1035	03888	A3AG01, 35.3 Ω ±1%	
R406	Film, 180.8 Ω ±1% 1/4 W	6611-1180	03888	A3AG01, 180.8 Ω ±1%	
R407	Film, 89.6 Ω ±1% 1/4 W	6611-1089	03888	A3AG01, 89.6 Ω ±1%	
R408	Film, 111 Ω ±1% 1/4 W	6611-1111	03888	A3AG01, 111 Ω ±1%	
R409	Film, 142.3 Ω ±1% 1/4 W	6610-1300	35929	N8, 142.3 Ω ±1%	
R410	Film, 96.2 Ω ±1% 1/4 W	6610-1200	35929	N8, 96.2 Ω ±1%	5905-719-5425
R411	Film, 142.3 Ω ±1% 1/4 W	6610-1300	35929	N8, 142.3 Ω ±1%	
R412	Film, 96.2 Ω ±1% 1/4 W	6610-1200	35929	N8, 96.2 Ω ±1%	5905-719-5425
R413	Film, 142.3 Ω ±1% 1/4 W	6610-1300	35929	N8, 142.3 Ω ±1%	
R414	Film, 96.2 Ω ±1% 1/4 W	6610-1200	35929	N8, 96.2 Ω ±1%	5905-719-5425
R415	Film, 142.3 Ω ±1% 1/4 W	6610-1300	35929	N8, 142.3 Ω ±1%	
R416	Film, 96.2 Ω ±1% 1/4 W	6610-1200	35929	N8, 96.2 Ω ±1%	5905-719-5425
R417	Film, 142.3 Ω ±1% 1/4 W	6610-1300	35929	N8, 142.3 Ω ±1%	
R418	Film, 65.8 Ω ±1% 1/4 W	6610-0900	35929	N8, 65.8 Ω ±1%	5905-719-5417
MISCELLANEOUS					
L301	INDUCTOR, choke molded 12 µH ±10%	4300-2300	99800	1537-38	5950-807-6050
L302	INDUCTOR, choke molded 10 µH ±10%	4300-2200	99800	1537-10 µH ±10%	
L303	INDUCTOR, choke molded 3.3 µH ±10%	4300-1401	99800		
L304	INDUCTOR, choke molded 12 µH ±10%	4300-2300	99800	1537-38	
L305	INDUCTOR, choke molded 4.7 µH ±10%	4300-6400	99800	1840, 4.7 µH ±10%	
L306	INDUCTOR, choke molded 4.7 µH ±10%	4300-6400	99800	1840, 4.7 µH ±10%	
L307	INDUCTOR, choke molded 12 µH ±10%	4300-2300	99800	1537-38	5950-807-6050
L308	INDUCTOR, choke molded 4.7 µH ±10%	4300-6400	99800	1840, 4.7 µH ±10%	
L309	INDUCTOR, choke molded 12 µH ±10%	4300-2300	99800	1537-38	5950-807-6050
L310	INDUCTOR	1236-2040	24655	1236-2040	
L311	INDUCTOR, choke molded 1 µH ±10%	4300-0700	99800	1537, 12	5950-683-7984
L312	INDUCTOR, choke molded 10 µH ±10%	4300-2200	99800	1537-10 µH ±10%	
L313	INDUCTOR, choke molded 12 µH ±10%	4300-2300	99800	1537-38	5950-807-6050
PL401	PLUG	1236-0300	24655	1236-0300	
S301	SWITCH, toggle	7910-1600	04009	83054-SP	

PARTS LIST (Cont) – PREAMPLIFIER AND ATTENUATOR

Ref. No.	Description	GR Part No.	Fed. Mfg. Code	Mfg. Part No.	Fed. Stock No.
MISCELLANEOUS (Cont)					
S401	SWITCH, rotary wafer	7890-4170	76854	255086-H2C	
T301	TRANSFORMER	1236-2010	24655	1236-2010	
T302	TRANSFORMER	1236-2020	24655	1236-2020	
T303	TRANSFORMER	1236-2030	24655	1236-2030	
J301	JACK, shielded lead set.	1236-0301	24655	1236-0301	
V301 thru V303	TUBE, vacuum, type 7586	8380-7586	86684	7586	

PARTS LIST – MISCELLANEOUS

Reference	Description	GR Part No	Fed. Mfg. Code	Mfg. Part No.	Fed. Stock No.
Fig. 5-6	Braided Cable	1236-0200	24655	1236-0200	
Fig. 5-6	Button-Snap	4160-0250	02768	207-230201-00-0108	
Fig. 1-1, #1	Knob, ATTENUATION	5520-5321	24655	5520-5321	
	Bushing Asm.	4143-3121	24655	4143-3121	
Fig. 1-1, #4	Knob, METER SCALE	5520-5331	24655	5520-5331	
	Bushing Asm.	4143-3121	24655	4143-3121	
Fig. 1-1, #3	Knob, GAIN	5520-5131	24655	5520-5131	
	Bushing Asm.	4143-1131	24655	4143-1131	
	Spacer	7650-0500	24655	7650-0500	
Fig. 1-1, #10	Knob, OSC OUTPUT	5520-5131	24655	5520-5131	
	Bushing Asm.	4143-1131	24655	4143-1131	
Fig. 5-3	Lens Cap	5620-0300	72765	25P Unfluted PSP-70	6210-299-3902
Fig. 5-8	Mt'g Device Fuse	5650-0100	71400	HKP-H	5920-284-7144
Fig. 5-5	Socket Assembly	7510-1930	24655	7510-1930	6210-475-9501
Fig. 5-5	Socket	7530-1900	71785	24324	5935-476-3275
Fig. 5-5	Insulator	7530-2000	16037	#111	
Fig. 5-5	Socket	7540-0100	81350	TS103C01	5935-222-9828
Fig. 5-8	Socket, Tube	7540-2263	71785	133-65-10-001	
	Dust cover	1236-1150	24655	1236-1150	
	End frame, right-side	5310-4086	24655	5310-4086	
	End frame, left-side	5310-4087	24655	5310-4087	
	Foot, rigid	5260-0700	24655	5260-0700	
	Foot, adjustable	5250-1800	24655	5260-1800	



Rotary switch sections are shown as viewed from the panel end of the shaft. The first digit of the contact number refers to the section. The section nearest the panel is 1, the next section back is 2, etc. The next two digits refer to the contact. Contact 01 is the first position clockwise from a strut screw (usually the screw above the locating key), and the other contacts are numbered sequentially (02, 03, 04, etc), proceeding clockwise around the section. A suffix F or R indicates that the contact is on the front or rear of the section, respectively.

NOTE UNLESS SPECIFIED	
1. POSITION OF ROTARY SWITCHES SHOWN COUNTERCLOCKWISE	5. RESISTANCE IN OHMS K 1000 OHMS M 1 MEGOHM
2. CONTACT NUMBERING OF SWITCHES EXPLAINED ON SEPARATE SHEET SUPPLIED IN INSTRUCTION BOOK	6. CAPACITANCE VALUES ONE AND OVER IN PICOFARADS. LESS THAN ONE IN MICROFARADS.
3. REFER TO SERVICE NOTES IN INSTRUCTION BOOK FOR VOLTAGES APPEARING ON DIAGRAM	7. ◯ KNOB CONTROL
	8. ⊖ SCREWDRIVER CONTROL
4. RESISTORS 1/2 WATT	9. AT ANCHOR TERMINAL
	10. TP TEST POINT

Figure 5-15. Schematic diagram for the 1236 I-F Amplifier attenuator and preamplifier.

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