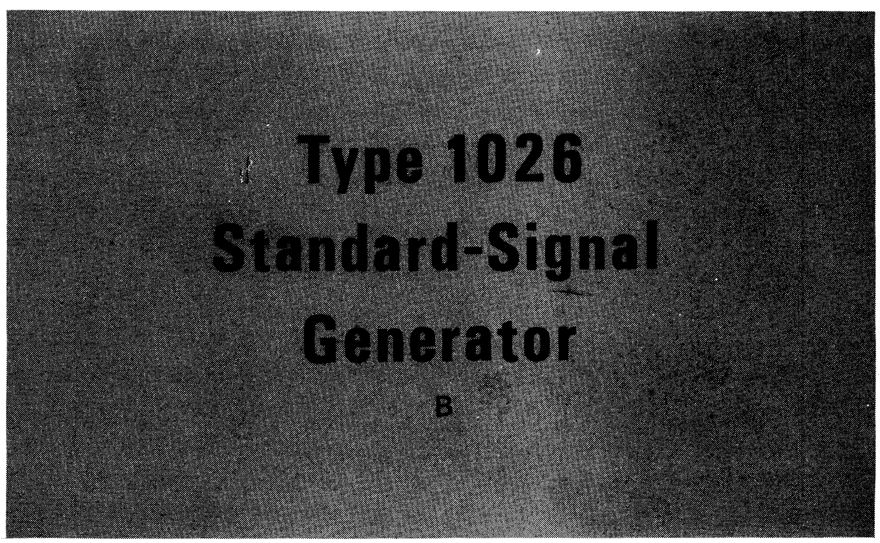
Contents

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.



West Concord, Massachusetts, U.S.A. 01781
Form 1026-0100-B
April, 1969
ID-B740

Specifications

FREQUENCY

Range: 9.5 to 500 MHz in 6 ranges: 9.5 to 22, 22 to 48, 48 to 108, 108 to 220, 220 to 420, and 400 to 500 MHz.

Manual Control: Main frequency control, spinner knob with 100-division vernier dial (25 turns per range) drives main drum-type dial. Illuminated scale indicates selected range. Parallax-free fiducial mark is adjustable for fine calibration. Scales to 108 MHz are linear. An uncalibrated Δf control spans typically ±0.003% at low end of range to ±0.015% at high end (actual spans may vary 2:1 depending on frequency range).

Scale Characteristics:

Frequency Range (MHz)	Main Scale Interval	kHz per Vernier Division	Scale Length (in.)
9.5-22	100 kHz	5	14¼
21.2-49.6	200 kHz	11	14¼
47.4-111	500 kHz	25	14¼
100-220	1.0 MHz	45-60	13
216-430	2.0 MHz	80-150	10½
400-500	2.0 MHz	150	4

External Electrical Fine Frequency Control: Applied voltage of ±20 V dc varies frequency typically ±0.04% at low end of range to ±0.2% at high end (actual variation may differ by 2:1 depending on frequency range).

Stability: After 1-h warmup, drift rate is typically <50 ppm per 10 min for carrier frequencies <400 MHz; from 400 to 500 MHz, rate is typically <100 ppm per 10 min. Following frequency change <10 min is required for restabilization.

Calibration Accuracy: ±0.5% direct reading, after initial adjustment of fiducial. With internal crystal calibrator, ±0.01% at 1.0-MHz intervals, typically ±0.05% by interpolation.

Calibration Provisions: Internal crystal frequency, accurate to ±0.001%, provides calibration at intervals of 1 and 5 MHz over entire frequency range. Calibration by external counter provided for by output of about 0.1 to 1 V behind 50 Ω. When not needed, this output can be disabled with > 100-dB isolation; external counter can be simultaneously disabled by a contact closure provided to eliminate interference from the counter's internal signals.

Harmonic Output: At least 30 dB below carrier.

RF OUTPUT

Range: CW, .05 μV to 5 V across 50 Ω, ½ W into 50 Ω (−133 to + 27 dBm); modulated, .05 μV to 2.5 V across 50 Ω (−133 to + 21 dBm). Load VSWR > 2.0 may restrict the max output available at some frequencies.

Control: Step attenuator, 140 dB in 10-dB steps, voltage and dBm calibration. Continuous interpolation with metered level control.

Meter Scales: 0.15 to 0.8 V, 0.5 to 2.5 V, and −13 to +1 dBm. Scale extensions (in red), for cw use only, to 5 V and to +7 dBm.

Accuracy: Metering, ±5% to 108 MHz; above 108 MHz, harmonics can add ±3% and rectifier characteristic can add ±2%. Attenuator, ±1% (±0.1 dB) per step to −110 dBm; ±2% (±0.2 dB) from −110 to −120 dBm; max accumulated error ±0.5 dB.

RF Interference: Leakage has negligible effect on measurements of receiver sensitivity down to 0.1 μV.

Leveling: CW output is held at preset level to within ±3% (0.3 dB) up to 108 MHz and to within ±5% (0.5 dB) to 500 MHz as frequency is varied, including effects due to range switching. Effectiveness of leveling under modulated operation is a function of modulation mode and frequency.

Stability: At any given frequency, in cw operation or internal 1-kHz modulation mode, and after 2-hour warmup, output will typically remain constant within ±0.0025 dB per minute, or ±0.01 dB over any 15-min period. Also under these conditions, variation due to ±10% line-voltage fluctuation is < ±0.005 dB.

Effective Generator Impedance (at panel jack): 50 Ω resistive; VSWR is < 1.05 with output attenuator set for 0 dBm or less. At higher outputs, source impedance viewed as Thévenin generator has a VSWR < 1.2.

MODULATION

Modes: Amplitude Modulation is provided in four modes:

1. Internal 1 kHz. Modulation level adjustable 0 to > 95% and metered to within ±3% of reading ±2% of full scale. Envelope feedback provides leveling and holds distortion to < 1% at 30% modulation and < 3% at 80% modulation. Modulating frequency, 1 kHz ±0.5%; after 2-hour warmup stable to better than 0.1% over 8-hour period or for line-voltage variations of ±10%. 1-kHz signal available at MOD binding posts, about 2.5 V behind 100 kΩ.

2. External Audio. Response flat to dc, down < 0.5 dB at 10 kHz. Square-wave response 0 to 10 kHz; rise and fall time < 10 μs; overshoot < 10%; rampoff negligible. Modulation is adjustable 0 to > 95% for dc to 5-kHz input, to > 70% at 10 kHz, and is metered to within ±5% of reading ±5% of full scale for sine-wave inputs from 20 Hz to 10 kHz. For 95% modulation < 3 V, peak required into 3 kΩ. Envelope feedback provides leveling and holds distortion at 30% modulation to < 1% up to 1 kHz, < 5% up to 10 kHz.

3. External Wide Band. Modulation level adjustable 0 to > 80%. Response flat to ±3 dB for 50-Hz to 1.5-MHz inputs at carrier frequencies above 108 MHz. Average carrier is leveled and metered, but modulation depth and linearity should be monitored externally. For full modulation, about 0.6 to 3.5 V (depending on carrier frequency) is required into 3 kΩ.

4. External Pulse. Required input pulses, at least 10 V peak, positive going (max 30 V); repetition rate 500 Hz to 150 kHz; duration 1 to 300 μs (min 3 μs on 9.5- to 22-MHz range); max 50% duty ratio. Input impedance 3 kΩ. Output pulse, duration within ±0.5 μs of input; rise and fall times < 1 μs each on all ranges but 9.5 to 22 MHz (up to 3 μs); rampoff < 5%. On-off ratio > 30 dB; at max output setting of carrier level is typically > 40 dB. Peak amplitude of pulses is leveled and metered to within ± 1 dB added to accuracy specified for cw leveling.

Incidental FM (accompanying a-m); < 1 ppm + 100 Hz, peak, at 1 kHz, 50% a-m.

Residual FM: < 0.05 ppm, peak.

Residual A-M: A-m due to hum and noise in 15-kHz bandwidth is at least 70 dB below carrier level in cw, internal 1-kHz, and external audio modes.

GENERAL

Power Required: 105 to 125 or 200 to 250 V, 50 to 60 Hz, 90 W.

Terminals: RF and counter outputs are GR874 coaxial connectors, recessed and locking; for rapid conversion to other common types, use locking GR874 adaptors. Modulation connection is to front-panel binding posts and rear-panel multiterminal connector. Audio (BEAT) output from front-panel telephone jack. Electrical frequency control is through rear-mounted 12-pin connector.

Accessories Supplied: 874-R22LA Patch Cord (GR874-to-GR874), phone plug, 12-pin connector plug, power cord, spare fuses, hardware for bench and rack mounting.

Mounting: Rack-bench cabinet.

Dimensions (width x height x depth): Bench, 19 x 17¾ x 15¼ in. (485 x 450 x 390 mm); rack, 19 x 17½ x 13 in. (485 x 445 x 330 mm).

Weight: Net, 96 lb (44 kg); shipping, 156 lb (72 kg).

CAUTION

Do not apply any source of power in excess of 1/4-W to the RF OUTPUT connector; damage could occur to the attenuator.

SECTION 1

INTRODUCTION

1.1 PURPOSE.

This manual contains installation, operation, and maintenance instructions for the Type 1026 Standard Signal Generator, shown in Figure 1-1. The 1026 provides a stable source of frequencies in the range 9.5 to 500 MHz. Coverage is achieved in six bands with single-dial tuning (no trimmer adjustment) throughout the selected band. This feature, combined with automatic output levelling in each of its modulation modes, makes the 1026 a valuable instrument in alignment and testing of receivers, filters, amplifiers and attenuators.

1.2 DESCRIPTION.

1.2.1 GENERAL.

The Type 1026 Standard Signal Generator is able to achieve its wide range of output level and excellent modulation characteristics through stringent attention to the suppression of rf leakage and a frequency-compensated negative-feedback loop. Rf circuits are housed in a rigid, shielded casting with all input and output lines filtered. Envelope detection of the rf output, and the associated negative feedback loop, limit modulation distortion and automatically level carrier amplitude.

For convenience, the operating controls are grouped by function. A six-position rotary switch selects the desired frequency range while a single vernier dial permits continuous tuning over each band. Unambiguous frequency readout can be made on the large, 6-scale drum dial; only the scale of the selected band is illuminated. A fiducial control permits precision adjustment of the scale at any of a series of crystal-controlled check points.

Five modulation modes are available. These are cw, internal 1-kHz, and three external modulation modes — audio, wide-band and pulse. Percentage of modulation is adjustable from zero to at least 95%, as indicated by a panel meter, in the internal 1-kHz mode. In the external audio mode, 95% modulation is possible from dc to at least 5 kHz; at least 70% modulation is possible up to 10 kHz.

Rf power output is adjustable over a range of 160 dB in the cw mode and 154 dB modulated. The output level is indicated by a meter and controlled by a 15-position step attenuator calibrated in volts and dBm.

Frequency checking with the 1026 is accomplished either through use of an internal crystal calibrator or by connecting an external frequency meter to the FREQUENCY METER output connector. Electrical fine-frequency control permits phase-locked operation of the 1026 in conjunction with suitable accessory equipment such as the GR 1040 Synchronizer/Sampling Detector. In addition, narrow-band frequency modulation of the rf output is obtainable with the 1026.

1.2.2 CONTROLS, INDICATORS AND CONNECTORS.

Table 1-1 lists the panel controls, indicators and connectors on the Type 1026 Standard Signal Generator, with separate columns for description and function data.

1.2.3 REAR-PANEL CONNECTORS AND FUSES.

Table 1-2 lists the Type 1026 Standard Signal Generator's rear panel connectors and fuses.

1.2.4 POWER REQUIREMENTS.

The Type 1026 generator is normally wired for operation from a power source of 105-125 V, 50-60

TABLE 1-1
PANEL CONTROLS, INDICATORS AND CONNECTORS

Figure 1-1 Ref.	Name	Description	Function
1	POWER	3-position rotary switch	Selects power OFF, STANDBY, ON
2	Indicator drum	Contains backlighted scales for 6 frequency bands	Frequency readout
3	FIDUCIAL ADJUST	Continuous rotary control	Permits precise adjustment of frequency scale at convenient checkpoints
4	FREQUENCY	25-turn vernier dial, calibrated 0-100	Main frequency control
5	FREQUENCY RANGE	6-position rotary switch, detented	Band selection
6	Meter	0.15 to 0.8 V, 0.5 to 2.5 V, and -13 to +1 dBm scales. Red scales cw only, and +1 to +7 dBm	Rf output-level indicator
7	CARRIER LEVEL	Potentiometer control	Sets reference to which internal feedback loop stabilizes output level
8	OUTPUT RANGE	15-step rotary attenuator; show-through dial calibrated in volts and dBm	Provides attenuation of rf output in 10-dB steps
9	RF OUTPUT	Type GR874 coaxial connector, $Z_0 = 50\ \Omega$	Rf output
10	AUDIO GAIN	Potentiometer control	Adjusts level of audio from the crystal calibrator to the BEAT OUTPUT telephone jack.
11	BEAT OUTPUT	Telephone jack	Provides audio from beat of carrier against internal crystal-calibration oscillator
12	ΔF	Potentiometer	Fine frequency control, at approx ±0.003% at low end of bands, ±0.015% at high end
13	FREQUENCY CALIBRATOR	4-position rotary switch	Selects EXTERNAL, OFF, INT XTAL 1 MHz or INT XTAL 5 MHz modes of calibration
14	FREQUENCY METER	Type GR874 coaxial connector	Connection for frequency meter in EXTERNAL calibration mode
15	Modulation jacks	Binding post	Input connections for modulating signals in EXTERNAL AUDIO, EXTERNAL WIDE BAND and EXTERNAL PULSE modes. Output connection in INT 1 kHz mode
16	MODULATION SELECTOR	5-position rotary switch: show-through dial	Selects INTERNAL 1-kHz, CW, EXTERNAL AUDIO, EXTERNAL WIDE BAND or EXTERNAL PULSE modulation modes
17	MOD OFF/MODULATION LEVEL	Ganged switch and potentiometer control	Disables modulation or permits adjustment of 0-95% modulation in INTERNAL 1-kHz and EXTERNAL AUDIO modes
18	Meter	PERCENT scale 0-100	Indicates modulation percentage in INTERNAL 1-kHz and EXTERNAL AUDIO modes

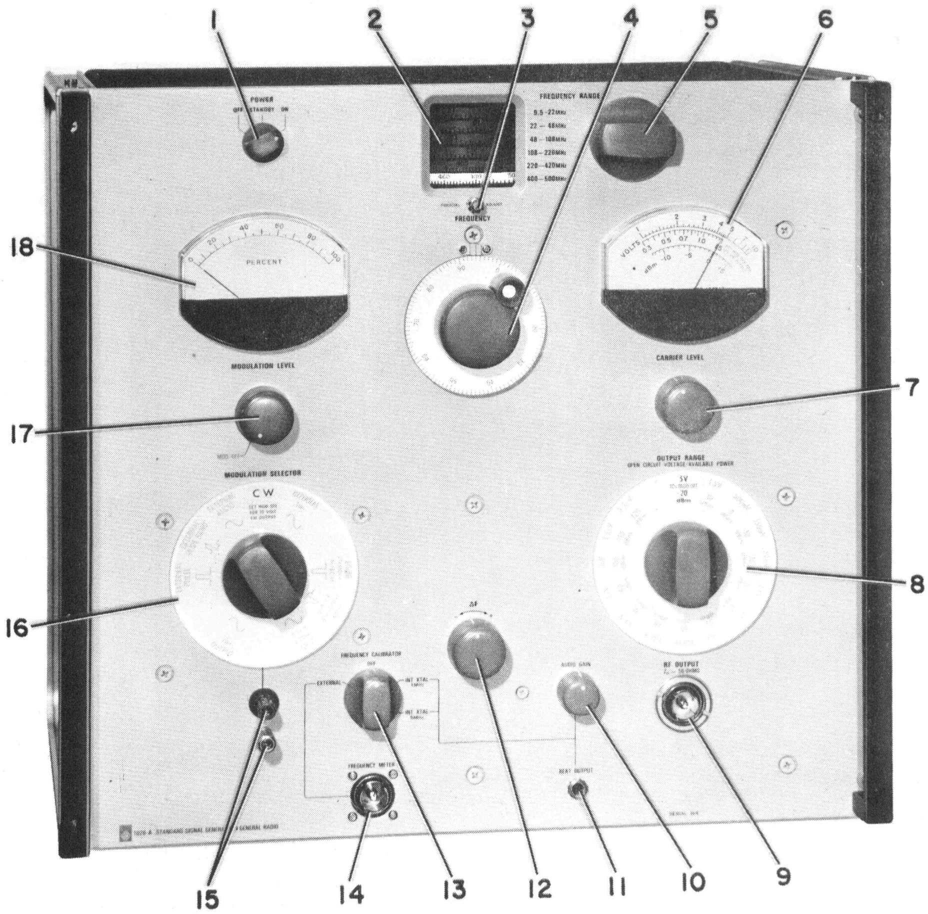


Figure 1-1. Panel View of the Type 1026 Standard Signal Generator (refer to Table 1-1).

Figure 1-2. Rear view of the Type 1026 Standard Signal Generator (refer to Table 1-2).

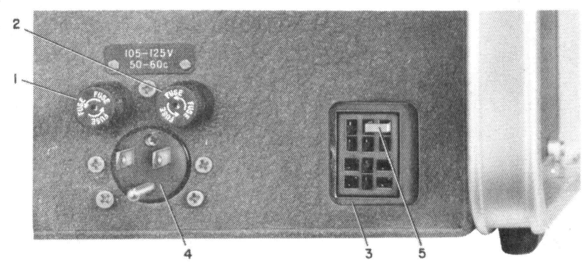


TABLE 1-2

REAR-PANEL CONNECTORS AND FUSES

Figure 1-2 Ref.	*Name*	*Description*	*Function*
1, 2	F401, F402 (115 V)	1.6A, 3AG type, Slo-Blo	115-V input-line fuses
	F401, F402 (230 V)	0.8A, 3AG type, Slo-Blo	230-V input-line fuses
3	Remote connector	12-pin Jones connector	Connections for external fine-frequency control, fm operation, external frequency-counter control, and external modulation signal input. (see paragraph 2.4)
4	Power plug	3-prong ac connector	Connects line power to the instrument
5	Jumper clip	Connects pins 1 and 2	Required when no external fine-frequency control used.

TABLE 1-3
EQUIPMENT SUPPLIED

Item	*Description*	*GR Part Number*
Power cord	3-wire, 7-foot length	4200-9622
Phone plug	2-conductor	4220-2000
Fuses: F401, F402 (115 V)	Spare	5330-1700
(230 V)	Spare	5330-1200
Patch cord	Rf, Type 874-R22LA, coaxial, 3-foot	0874-9683
Support set	For rack-mount conversion	7863-9602
Multipoint connector plug	Mates with rear-panel remote connector, SO414	1026-1950

Hz, 90 watts. The 1026 can be adapted to operate from a 200-250-V, 50-60-Hz, 90-watt power source with the wiring changes described in paragraph 2.1.

NOTE

The 1026 should not be operated from a 400-Hz power source.

1.2.5 EQUIPMENT SUPPLIED.

Table 1-3 lists the equipment supplied with the Type 1026 Standard Signal Generator.

1.3 ACCESSORIES AVAILABLE.

1.3.1 GENERAL.

General Radio has available a well-rounded grouping of accessory instruments and devices to facilitate introduction of the output signal of the 1026 in most usual measurement systems, to ensure full utilization of the many versatile features of the instrument, and to permit convenient external monitoring of its performance. Instruments and devices that most readily fall into this category are listed or briefly described in paragraphs that follow.

1.3.2 EXTERNAL MODULATION SOURCES.

Table 1-4 lists (with pertinent characteristics) instruments recommended to meet the very wide range of signal-source requirements presented by the three external modulation modes of the 1026.

1.3.3 COUNTERS.

To make precision frequency settings on the 1026, a digital-reading frequency counter, attached to the FREQUENCY METER connector on the front panel, is valuable ancillary equipment. The GR Type 1191-Z (500 MHz Counter) covers the entire frequency range of the 1026 and can be connected directly with a Type 874-R22LA Coaxial Patch Cord.

1.3.4 SYNCHRONIZER

To achieve extreme frequency stability, the 1026 may be phase locked to a highly stable reference frequency by means of the GR Type 1040 Synchronizer/ Sampling Detector. This instrument permits locking to an internal crystal-controlled frequency at harmonics of 100 kHz, 1MHz, 5MHz, or 20 MHz, or to harmonics of an external reference oscillator.

1.3.5 COAXIAL ADAPTORS.

The 1026 uses the low-VSWR, quick-connect, GR874 coaxial connector for its rf output. A comprehensive assortment of special coaxial devices and instruments, based on the GR874 50-ohm design, is available to complement it.

For the user who has components fitted with coaxial connectors of other leading coaxial series, GR874 adaptors are available to convert the OUTPUT connector to the desired type of plug or jack. Recommended adaptors, suitable for the frequencies involved, are listed in Table 1-5. All the types listed here can be locked to the 1026 for a rigid installation and minimum rf leakage at that junction.

1.3.6 OTHER COAXIAL DEVICES.

Applications of the convenience and low-loss performance of GR874 coaxial devices, in rf measurement hook-ups with the 1026, are too extensive for coverage here. However, at least some of these devices are of general enough application to merit particular mention.

To apply a standard signal to more than one point in a test set up, thus taking advantage of the high output power of the 1026, use of the Type 874-TPDL Power Divider, singly or in cascade arrangement, is suggested. The 874-TPDL is a coaxial tee that, connected to the OUTPUT of the 1026, splits the input signal into two equal portions, each 6 dB below the input, matched within 0.3 dB, with zero phase difference.

To monitor the modulation envelope of the 1026 output on an oscilloscope, connect the Type 874-VQL Voltmeter Detector (a coaxial crystal detector that can be terminated with a Type 874-W50BL 50-ohm load) directly to the FREQUENCY METER connector.

The Type 274-NL Double-Plug Patch Cord, a 3-foot unit terminated with shielded binding-post pairs at each end, offers rapid interconnection for recommended modulators at the EXTERNAL MODULATOR jacks of the 1026.

TABLE 1-4
ACCESSORIES AVAILABLE

MODULATORS

Modulation Mode	1026 Characteristic Range	Recommended Accessories	Accessory Range	Remarks
External Pulse	10 - 30 V peak, positive going; 500 Hz to 150 kHz	GR 1340	0.2 Hz - 20 MHz	
External Wide-Band	0 - 10 V, p-p;	GR 1310	2 Hz - 2 MHz sinewaves	For sinusoidal modulation
	50 Hz - 1.5 MHz	GR 1395	2.5 Hz - 1.2 MHz (1395-P1)	Plug-in modules required depend on desired waveform
		GR 1396	0 - 500 kHz	For use with GR 1310 to generate tone-burst modulation
		GR 1390	5 Hz - 5 MHz	For noise modulation
External Audio	Sinewave: 0 - 3 V, peak; 0 - 20 kHz Square-wave; 0 - 10 kHz PRF; 10-μs rise time 10-μs fall time	GR 1309	10 Hz - 100 kHz	For low-distortion sinusoidal or square-wave modulation
FM		GR 1310 GR 1309	2 Hz to 2 MHz 10 Hz - 100 kHz	For sinusoidal modulation
		GR 1390		For noise modulation
		GR 1395	2.5 Hz - 1.2 MHz	Plug-in modules required depend on desired waveform

SYNCHRONIZER

Carrier Frequency	Lock Spacing	Recommended Accessory	Accessory Freq. Range	Remarks
9.5 - 48 MHz 48 - 500 MHz	100 KHz, 1 MHz 1MHz, 5 MHz	GR 1040	50 kHz - 4 GHz	Other lock spacings available with external reference

TABLE 1-5
GR874 LOCKING ADAPTORS TO OTHER SERIES

Mates	Type	Contains GR874 and ...	Connects GR874 to ...	Catalog Number
Type BNC	874-QBJL	BNC Jack	BNC Plug	0874-9701
Type C	874-QCJL	C Jack	C Plug	0874-9703
Type MICRODOT	874-QMDJL	Microdot Jack	Microdot Plug	0874-9721
Type N	874-QNJL	N Jack	N Plug	0874-9711
Type SC	874-QSCJL	SC Jack	SC Plug (Sandia)	0874-9713
Type TNC	874-QTNJL	TNC Jack	TNC Plug	0874-9717
GR900	900-Q874	GR900	GR900 Precision 14-mm connector	0900-9883
Type SMA	874-QMMJL	SMA Jack	SMA Plug	0874-9723
AMPHENOL APC-7	874-QAP7L	APC-7	APC-7 Precision 7-mm connector	0874-9791

These uniform 50-ohm adaptors offer electrical performance to match their convenience of use. A special low-VSWR design assures that the over-all VSWR of the converted GR874 connector is no greater than that of the other-series connector by itself (with the exception of the Type 900-Q874).

SECTION 2

INSTALLATION

2.1 POWER INPUT CONNECTION.

Using the power cord supplied, connect the 1026 to a source of power as specified by the small plate attached at the rear of the cabinet over the power-input plug and line fuses.

If the instrument must be adapted for operation from a 230-V ac source, refer to Table 1-2 for fuse data.

The conversion is accomplished by rearrangement of jumper leads between solder terminals on the top surface of the power-supply assembly. Wiring instructions appear on the etched-circuit board. The cabinet must be removed and input power disconnected.

Wiring of the power supply for 115-V operation is shown in Figure 2-1. Ten links are required between terminals. To convert to 230-V operation, remove all links required for 115-V operation, and reinstall five links as shown in Figure 2-2. The links should be installed as indicated in Table 2-1.

NOTE

The shock mounted power supply of the 1026 is secured by two screws to prevent jarring during shipment. These screws should be removed prior to use. The screws are accessible at the left side of the instrument (viewed from the front).

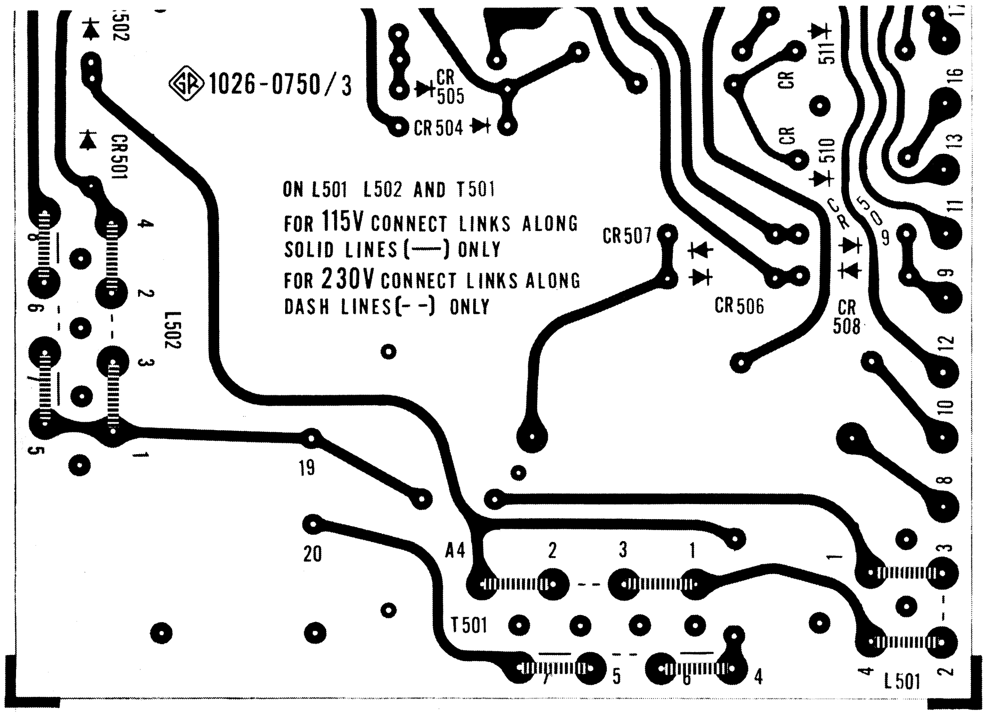


Figure 2-1. Detail view of Power Supply assembly, showing wire-link connections on top etched board for 115-V operation. Ten solder links are required.

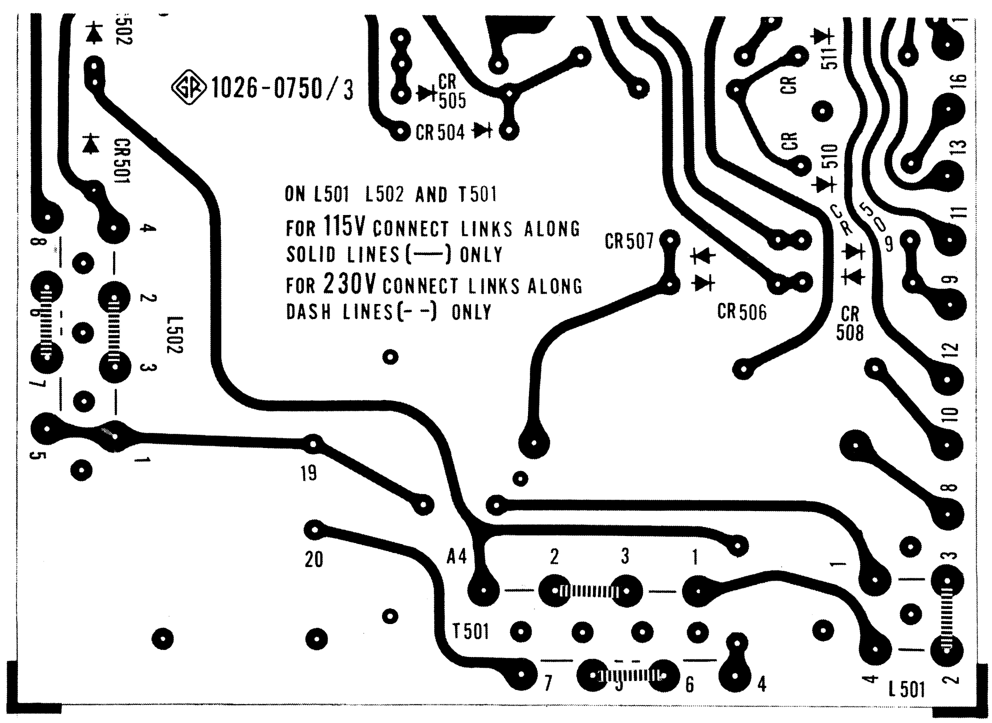


Figure 2-2. Detail view of Power Supply assembly, showing wire-link connections on top etched board for 230-V operation. Five solder links are required.

TABLE 2-1
POWER SUPPLY SOLDER LINK ARRANGEMENTS

Component	*115-V Connections*	*230-V Connections*
L501	connect 1 to 3 and 2 to 4	connect 2 to 3
L502	connect 1 to 3, 2 to 4, 5 to 7, and 6 to 8	connect 2 to 3 and 6 to 7
T501	connect 1 to 3, 2 to A4, 4 to 6, and 5 to 7	connect 2 to 3 and 5 to 6
F401, F402	Use 1.6A, 3 AG type Slo-Blo	use 0.8A, 3 AG type Slo-Blo

2.2 MOUNTING.

Remove power-supply shipping screws on left-side wall prior to use.

The 1026 Standard Signal Generator is supplied equipped for bench use, with aluminum end frames attached to the sides of the cabinet. Each frame is held in place by four panel screws and four 10-32 Phillips-head screws into the side of the cabinet. There are no special mounting requirements beyond the need for sufficient space to accommodate the dimensions of the 1026, shown in Figure 2-3.

For rack mounting, special brackets and a kit consisting of attaching hardware is supplied. Table 2-2 lists the contents of the kit. The brackets permit either cabinet or instrument to be withdrawn independently of each other. Figure 2-4 illustrates both bracket attachment and rack mounting.

To install the instrument in a relay rack:

a. Release the screws on the rear wall of the cabinet. Remove the cabinet from the instrument and the end frames from the cabinet.

b. Lay the cabinet on its left side (looking at it from the front) with the front-panel forward.

c. Place the right-side-rack support (A) on the right side of the cabinet. Be sure that the flange with the mounting holes is forward and flush with the front of the cabinet (see Figure 2-4) when the other flange (without holes) is resting against the bottom of the cabinet.

d. Assemble two pairs of flatwasher (D) and thumbscrew (E).

e. Install these as shown in the figure and tighten.

f. Turn the cabinet on its right side.

g. Place the left-side-rack support on the left side and align it in the same manner as the right side.

h. Repeat steps d and e for this side.

CAUTION

End frames and shipping screws must be in place when shipping this instrument.

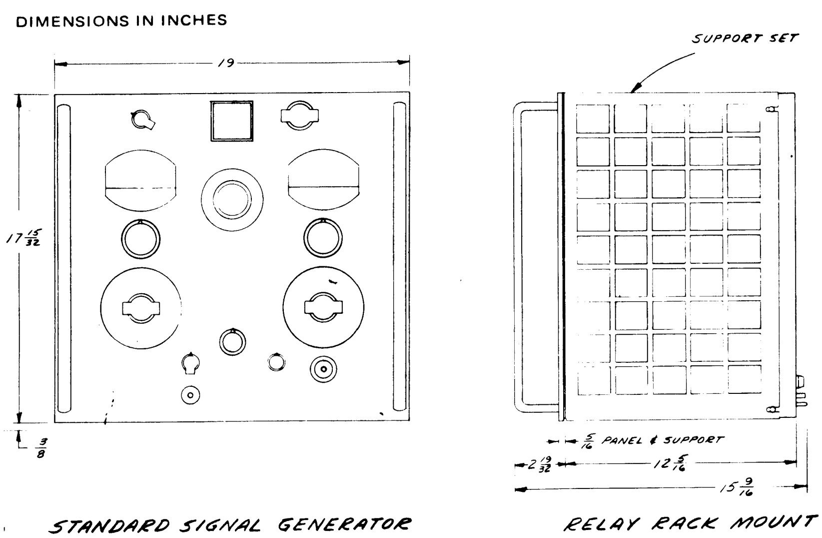


Figure 2-3. Dimension drawing for 1026.

TABLE 2-2

RACK-MOUNT KIT (P/N 7663-9602) CONTENTS (INCLUDING HARDWARE SET P/N 7863-3002)

Quantity	*Description*	*Index See Figure 2-4*	*Part Number*
1	Rack-support Frame, left	A	7863-8792
1	Rack-support Frame, right	A	7863-8692
4	Screw, No. 10-32, slotted-head, 5/8 inch inch, steel	B	7160-0325
8	Panel screws, No. 10-32, Phillips-head 5/8 inch, nickel gray, with cupwasher	C	7270-6210
4	Flatwasher, No. 10, 1/16 inch thick	D	8100-1517
4	Thumbscrew, No. 10-32, 1/4 inch	E	7270-3800

i. Install the cabinet with supports into the desired rack position by use of the four No. 10-32 washerless screws (B). The flange holes to be used are second in from the extreme outside, at the top and bottom.

j. Reinstall the instrument in its cabinet and attach it to the rack with the Nylon-cupped screws (C).

NOTE

Omit the cabinet-to-chassis screws in the rear.

When the instrument is to be removed from the rack, remove the panel screws (C) and pull the instrument forward.

To remove the cabinet and leave the instrument mounted, loosen the thumbscrews (E) and slide the cabinet off, through the back of the rack.

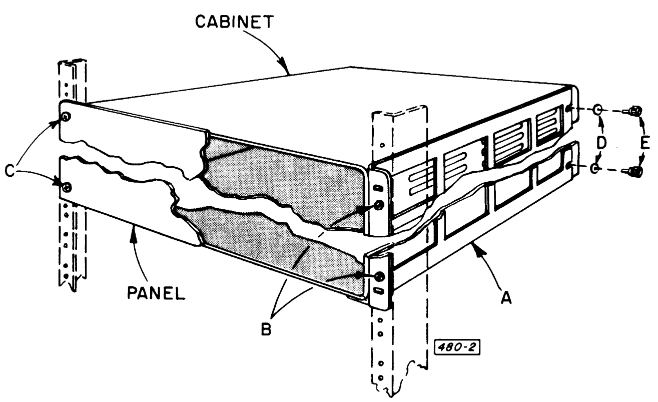


Figure 2-4. Relay rack mounting.

2.3 ENVIRONMENTAL CONSIDERATIONS.

The 1026 is intended for customary shop, laboratory and test-facility applications. The instrument should not be subjected to ambient temperatures outside the range 0-50° C in its operation. In addition, since the 1026 contains variable tuning capacitors, it should be afforded isolation from vibration to avoid microphonics.

2.4 REAR-PANEL CONTROL LINES.

2.4.1 PIN ASSIGNMENTS

Figure 2-5 illustrates pin assignments for the rear-panel remote connector SO414.

Pins 1 and 2 are used for electrical, fine-frequency control.

NOTE

When not used for this function, pins 1 and 2 must be connected together, either by the special clip installed in the instrument as shipped, or by means of a jumper connection installed in the mating accessory plug supplied.

Pin 3 supplies +30 V, pin 10 is ground, and pin 7 supplies - 12.4 V for external accessories.

Pins 4, 5 and 6 may be used for external frequency-counter control in frequency-calibration applications.

Pins 11 and 12 may be used to supply the external modulation signal to input jack J412.

2.4.2 PHASE-LOCK CONNECTIONS

By applying a suitable control voltage between pins 1 and 2, it is possible to produce the electrical

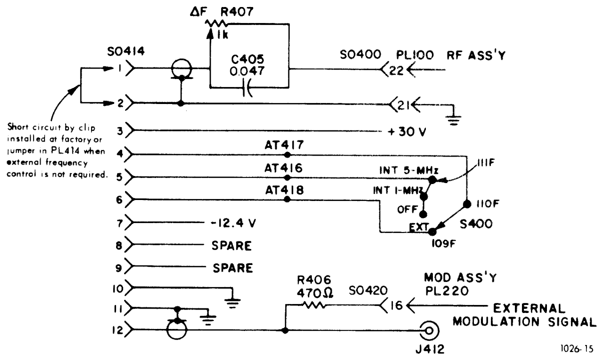


Figure 2-5. Wiring detail for SO414.

fine-frequency control required for phase-lock operation. The ΔF potentiometer control is still operative in the presence of an external control voltage. The external voltage should be ±20 V, peak, from a source whose dc resistance is less than 600 Ω. The GR Type 1040 synchronizer is fully compatible with the 1026; interconnection instructions are given in the 1040 manual.

With other synchronizers, the preferred connection depends on whether or not the output is offset below ground. Any negative offset can be overcome by connecting a Zener diode between the synchronizer output and pin 1 of SO414; 3 mA of bias current is delivered from pin 1 to energize the diode. In cases where the external circuit cannot tolerate this bias current, it can be balanced out by connection of a 4-kΩ resistor from pin 1 to pin 7. This connection may be desirable when using synchronizers whose output is symmetrical with respect to ground.

2.4.3 FM CONNECTIONS

An audio-frequency modulation source can be connected between pins 1 and 2 to provide narrow-band fm as described in paragraph 3.6.6 and Figure 3-2. The source should have an impedance at dc of less than 600 Ω. If the source cannot absorb 3 mA of bias current delivered from pin 2, a 4-kΩ resistor should be connected from pin 1 to pin 7 to balance this current.

2.4.4 COUNTER-SWITCH CONNECTIONS

Since some counter switching circuits radiate interference that can cause trouble in measurements on sensitive receivers, it may be desirable to disable these circuits when the counter is not actually in use. FREQUENCY CALIBRATOR switch S400 includes a single-pole, double-throw contact function to permit automatic control of the counter when switching from the EXTERNAL FREQUENCY METER to the OFF position. If the counter is to be disabled by opening a supply line, use pins 4 and 6; if it is to be disabled by short circuiting two points, use pins 4 and 5.

2.4.5 EXTERNAL LEVELING CONNECTIONS

Refer to paragraph 3.9 for circuits and connections required for external leveling.

2.5 ATTENUATOR PROTECTION.

In testing of transceivers with transmitter power output greater than 0.25 W, it is important to protect the output attenuator of the 1026 from damage due to inadvertent application of transmitter power. The simplest method is to provide a coaxial-relay in series with the rf output connections from the 1026 with suitable relay-coil connections to assure opening of the rf circuit in case the transmitter is energized. Fuse protection is not recommended since it cannot allow full 0.5 W output from the 1026 in the +20-dB position of the OUTPUT RANGE selector while protecting the attenuator from inputs in excess of 0.25 W at lower output settings.

SECTION 3

OPERATING PROCEDURE

3.1 GENERAL.

Operation of the 1026 Standard Signal Generator is greatly facilitated by its single-dial tuning feature. Functional grouping of the controls further contributes to the ease with which frequencies are selected and calibrated, power levels are set, and modulation is applied.

3.2 TURN-ON.

To place the 1026 in operation, turn the POWER switch to the STANDBY position and allow a minute for the instrument's tube heaters to warm up. In STANDBY, the rf generation and amplification circuits are disabled while tube heaters are allowed to function, a feature that proves very useful during laboratory tests that require the rf to be disabled temporarily without having to reset the OUTPUT level or having to start a new warm-up cycle.

Next, place the POWER switch in the ON position. At this point, the instrument may be used for measurements not requiring a high order of frequency or output-level stability. For most measurements, a fifteen-minute warmup period is desirable; up to four hours warmup may be required in the case of very critical measurements that need the full specified stability of the 1026. Even after protracted warmup, the frequency drift immediately following band changing or retuning is significant for about five minutes.

3.3 FREQUENCY SELECTION.

To set up the frequency of the 1026's rf output, first select the proper band with the FREQUENCY RANGE switch; scale illumination indicates the band that has been selected. Rotate the FREQUENCY spinner knob until the desired frequency is indicated by the fiducial. Frequency selection performed in this manner is accurate to ±0.5%, providing the fiducial adjustment is near the center of its adjustment range, or has been set to be correct near the center of the band in use. For greater accuracy, use one of the instrument's calibration modes discussed in paragraph 3.4.

The frequency scale is linear on the three ranges covering up to 108 MHz; dial-scale characteristics are given in Table 3-1.

TABLE 3-1
SCALE CHARACTERISTICS

Frequency Range (MHz)	*Main Scale Interval*	*kHz per Vernier Division*
9.5 - 22	100 kHz	5
22 - 48	200 kHz	11
48 - 108	500 kHz	25
108 - 220	1.0 MHz	45 - 60
220 - 420	2.0 MHz	80 - 150
400 - 500	2.0 MHz	150

Frequently it is desirable to set or maintain a frequency closer to the desired value than is convenient when using the main tuning control. The ΔF control permits the very fine adjustment that may be desired to keep the signal generator in tune with the internal crystal calibrator or an external monitoring device.

To obtain electrical frequency control, for narrow-band frequency-modulation or phase-lock applications, connect an external control voltage between pins 1 and 2 (ground) of remote-control connector SO414, at the rear of the 1026. Refer to paragraph 2.4 for instructions on the use of SO414.

3.4 FREQUENCY CALIBRATION.

3.4.1 GENERAL.

When frequency-setting accuracy greater than ±0.5% afforded by the drum dial scales is required, either an external frequency meter or counter, or the internal crystal calibrator can be employed.

3.4.2 INTERPOLATION SETTINGS.

For the most accurate frequency settings between 1-MHz points interpolation is usually necessary, although at the lower carrier frequencies intermediate beats at 0.50, 0.33, and 0.25 MHz can be used. To interpolate, note the difference in setting of the FREQUENCY control for adjacent beats, using the 0 to 100 scale on the spinner knob. Tune upward from the beat just below the desired frequency by that proportion of the 1-MHz setting difference which is represented by the fraction of a megahertz desired.

For example, the difference between 150 and 151 MHz is found to be 56 dial divisions and the desired frequency is 150.2 MHz. Find the 150-MHz beat, and tune upward by 11.2 dial divisions (0.2 x 56 = 11.2). Accurate interpolation requires that all dial settings be approached from the same direction, in order to avoid effects of backlash that may amount to as much as 2 dial divisions. Repeatability when tuning in the same direction is approximately ten times better than when direction is reversed.

3.4.3 USE OF INTERNAL CRYSTAL CALIBRATOR.

Internal calibration can be accomplished in either of two INT XTAL modes, 1 MHz or 5 MHz. The 1-MHz mode should be used for preliminary fiducial adjustment at frequencies up to 108 MHz, the 5-MHz mode at higher frequencies.

To adjust the FIDUCIAL, set the FREQUENCY calibrator to the 1-MHz or 5-MHz mode (depending on carrier frequency), plug headphones into the BEAT OUTPUT telephone jack, and adjust the audio gain control for a comfortable level of beats. Avoid excessively high output-level settings which may bring weaker intermediate beats up to a level which could cause confusion. Tune the FREQUENCY spinner knob to a beat near the desired operating frequency. At frequencies above 220 MHz, it is desirable to choose a beat occurring at a multiple of 10 MHz, since such beats coincide with dial-scale markings. When a suitable low audio beat has been obtained, set the FIDUCIAL ADJUST to agree with the appropriate scale mark.

The 1-MHz position of the FREQUENCY calibrator is useful at even the highest carrier frequencies, once the preliminary adjustment of the FIDUCIAL has been completed. The signal generator can be set very precisely to any integral megahertz by starting from a 5 MHz multiple, and counting the 1-MHz beats while tuning the FREQUENCY control until the appropriate offset has been reached. There is normally no advantage to resetting the FIDUCIAL again, assuming it was set correctly at the 10-MHz check point.

3.4.4 USE OF EXTERNAL FREQUENCY METER.

Place the FREQUENCY CALIBRATOR switch in the EXTERNAL position to furnish a sample of 1026 rf output (50 to 500 mV into 50 Ω) to the FREQUENCY METER jack. A digital-counter type of frequency meter, connected to this jack, can be used to display directly the output frequency of the 1026. Upon completion of a frequency check, return the FREQUENCY CALIBRATOR switch to the OFF position, in order to prevent rf leakage from the cables and auxiliary apparatus connected to the FREQUENCY METER jack. When not in use, the FREQUENCY METER output is disabled with greater than 100-dB isolation. If residual radiation from the counter's scaling circuits is objectionable, these may also be disabled by means of contact closures of the FREQUENCY CALIBRATOR switch, which are brought out to remote-control connector SO414. Refer to paragraph 2.4 and to Figure 2-5 for details of SO414 wiring.

3.5 CARRIER-LEVEL SETTING.

Two controls and a meter indicator are used to control the level of rf power output of the 1026 Standard Signal Generator. With the MODULATION SELECTOR in the CW position, the level of RF OUTPUT is adjusted by the CARRIER LEVEL control (in conjunction with the OUTPUT RANGE switch); the level remains constant despite frequency range-switching and tuning.

CAUTION

Do not apply any source of power in excess of 1/4-W to the RF OUTPUT connector; damage could occur to the attenuator.

Refer to paragraph 2.5 Attenuator Protection for recommended procedure when testing transceivers.

The OUTPUT RANGE switch is a 15-step attenuator with dual calibration. Its outermost calibrations identify the maximum value of output voltage. Early model signal generators were calibrated in terms of open-circuit output voltage, or "volts behind 50-Ω" (source emf). These generators have meter scales with ranges 0.3 - 1.5 and 1 - 5 V, with a red scale extension of 5 - 10 V for CW only. Late model signal generators are calibrated in terms of volts across 50 Ω; this is the voltage that exists at the output of the generator when it is connected to a 50 Ω purely resistive external load. The meter scales have ranges of 0.15 - 0.8 and 0.5 - 2.5 V, with a red scale extension of 2.5 - 5 V for CW only.

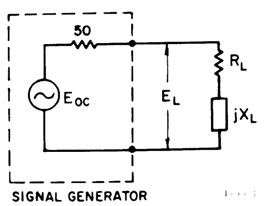
The inner dBm calibrations added algebraically to the meter's dB-scale indication, express AVAILABLE POWER at the RF OUTPUT; the incremental attenuation is 10 dB per step. This scale is identical in both early and late model signal generators. Wherever possible, it is advantageous to describe signal-generator output in terms of the available power (dBm) since this avoids the possible 2:1 confusion between open-circuit and volts-across calibration systems. The dBm scale has a range of -13 to +1 dBm, with a red scale extension from −1 to +7 dBm for CW only.

Up to +27-dBm output can be obtained in an unmodulated mode only. To achieve outputs above +21 dBm, leave the OUTPUT RANGE selector set to the +20-dB position and set the MODULATION LEVEL control fully counterclockwise, to the MOD OFF position. In this position, not only is modulation disabled, but the maximum CARRIER LEVEL setting is increased by 6 dB; the output can now be increased by the CARRIER LEVEL control into the region calibrated on the meter's red scale extensions.

It should be recognized that the actual voltage across, or power into, a load connected to the output of a signal generator with 50-Ω source impedance can only be read directly from the signal generator output meter when the load is a purely resistive 50 Ω. In other cases, calculation is required to know the actual voltage or power.

Consider first the procedure for establishing known predetermined conditions to a purely resistive 50-Ω load. Assume that it is desired to obtain a voltage of 100 µV across the load, or the equivalent power input of -67 dBm. Set the OUTPUT RANGE selector to the 250 µV position (or 500 µV on generators with open circuit voltage calibration). This is also the -60 dBm position. Next set the CARRIER LEVEL control for a reading of 1 volt on the outer voltage scale (2 V on generators with open-circuit voltage calibration). This is the same setting that can be read as -7 dBm on the inner scale.

Next consider the procedure for establishing a known source voltage (volts behind 50 ohms, or emf). This voltage is frequently called for in receiver-sensitivity specifications. It can be read directly from the meter scales of generators calibrated in open-circuit voltage, or by multiplying the indicated voltage by 2 on generators calibrated in volts across 50 Ω. An alternative procedure for generators calibrated in volts across 50 Ω is to connect a 6-dB pad (GR Type 874-G6L) between the generator rf output and the device under test. The meter voltage scales will now read the open-circuit voltage at the attenuator output directly. This connection should not be used when using the dBm scales, since they are direct reading without pads, irrespective of the type of output-voltage calibration. Finally, consider the problem of determining the actual voltage across an arbitrary load. The equivalent circuit for this situation is:



$$E_L = \frac{|R_L + jX_L|}{|50 + R_L + jX_L|} \cdot E_{oc}$$

$$= \frac{\sqrt{R_L^2 + X_L^2}}{\sqrt{(50 + R_L)^2 + X_L^2}} \cdot E_{oc}$$

where E_{OC} is the open-circuit generator voltage described above.

3.6 MODULATION CONTROL.

3.6.1 GENERAL.

To obtain amplitude modulation of the 1026 RF OUTPUT carrier, switch the MODULATION SELECTOR from the CW position to a suitable position for the type of modulation desired.

3.6.2 INTERNAL 1 kHZ.

In the INTERNAL 1-kHz position, a sample of the internal 1 kHz modulation is delivered to the binding posts J412 and J413 for use in synchronizing external equipment. Percentage of modulation is adjustable from zero to at least 95% by the MODULATION LEVEL control, as indicated on the associated percent meter.

3.6.3 EXTERNAL AUDIO.

If an audio-modulating signal other than 1 kHz is desired, select the EXTERNAL AUDIO mode and connect the signal source to the modulation binding posts beneath the MODULATION SELECTOR. Use the MODULATION LEVEL control to adjust the percentage of modulation. At frequencies up to 5 kHz the maximum modulation percentage attainable is at least 95%; at higher frequencies this decreases gradually, but is still at least 70% at 10 kHz. The flat response down to dc may also be used to provide remote control of carrier level.

NOTE

Any dc component in the modulation input signal will cause a shift in carrier level. This will be indicated correctly on the CARRIER LEVEL meter; the PERCENT MODULATION will no longer be indicated correctly by the MODULATION LEVEL meter. Carrier level shift can be avoided by connecting a blocking capacitor between the external modulating source and the MODULATION INPUT terminals of the 1026.

Typical control sensitivity, with the MODULATION LEVEL control fully CW, is 0.8 V dc input required per volt change in rf output across 50 Ω, or 0.4 V dc input per volt change in open-circuit output voltage. Positive input signals increase carrier level, and vice versa. Use of this feature to permit external levelling of the carrier is described in paragraph 3.9.

Typical modulation-frequency response and maximum percentage modulation vs modulation frequency are shown in Figure 3-1. The flat response to dc is accompanied by negligible low-frequency phase shift between input modulation signal and the resultant modulation envelope. At 10 kHz the phase shift is typically less than 30°. These characteristics make the 1026 suitable for use with the composite modulation used in the omni-range navigation system.

Envelope distortion is least at maximum carrier-level settings. For 1 kHz internal modulation of 90%

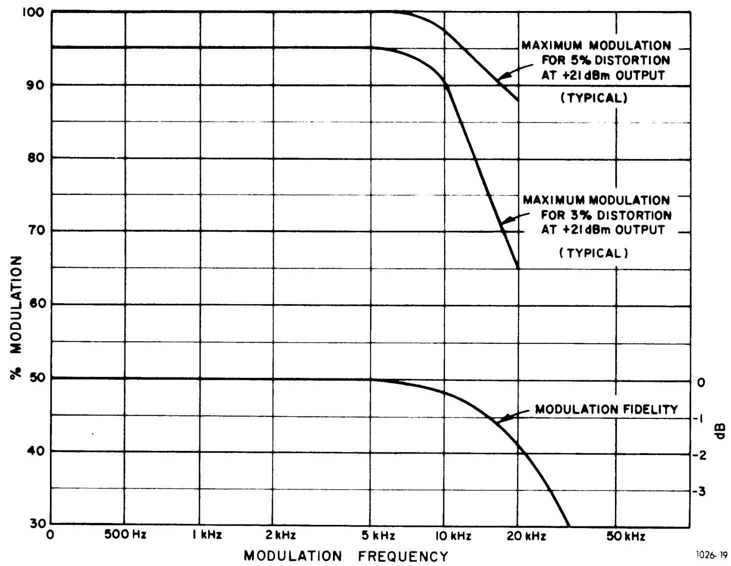


Figure 3-1. Typical modulation-frequency response and maximum percentage modulation at various modulation frequencies.

at +1 dBm reading of the carrier level meter, typical distortion is about 1%.

The MODULATION LEVEL meter is calibrated for sinewave audio inputs. Other waveforms (such as square waves up to 10 kHz) will be reproduced faithfully, but modulation percentage should be checked with an oscilloscope. Any change in reading of the CARRIER LEVEL meter, as the modulation level is increased, is an indication of overmodulation; typical input required to obtain 95% modulation is 1.8 V peak.

3.6.4 EXTERNAL WIDE BAND.

For sine wave or square-wave modulation at frequencies above 20 kHz, or for modulation by pulses of special shapes or varying amplitudes, the EXTERNAL WIDE-BAND mode has the best high-frequency response. This mode is ac-coupled only, with a low-frequency cutoff of about 50 Hz. For full modulation, a signal of from 0.6 to 3.5 V (depending on carrier frequency) is required into 3 kΩ.

NOTE

The depth of modulation can be adjusted by the MODULATION LEVEL control, but the PERCENT modulation meter is inoperative in this mode.

An external rf envelope detector, connected to the FREQUENCY METER output connector with the FREQUENCY CALIBRATOR switch in the EXTERNAL position, should be used to monitor modulation in the WIDE BAND mode. In this mode, leveling maintains the average carrier level constant. Thus, as the FREQUENCY is varied, the modulation depth (for a fixed modulation input and MODULATION LEVEL control setting) will change. Changes in setting of the CARRIER LEVEL control will also affect the modulation depth.

3.6.5 EXTERNAL PULSE

To generate rf pulses of a controlled amplitude, select the EXTERNAL PULSE mode and connect the output of a pulse generator with the following characteristics to the modulation binding posts beneath the MODULATION SELECTOR.

1. Positive pulse amplitude . . . 10 V minimum to 30 V maximum into 3 kΩ; any dc offset greater than 12 V must be removed by means of a blocking capacitor.
2. Repetition rate . . . 500 Hz to 150 kHz
3. Pulse width . . . 1.0 to 300 µS (minimum 3 µS on 9.5 to 22 MHz range)
4. Duty ratio . . . maximum 50%

Increase the setting of the MODULATION LEVEL control until a reading is obtained on the CARRIER LEVEL meter. The CARRIER LEVEL control may be used to adjust the peak amplitude of the output pulses as indicated by the CARRIER LEVEL meter. The peak pulse amplitude is maintained constant as the FREQUENCY is changed or as the input-pulse characteristics are changed. Provided the pulse input is adequate to trigger the modulation circuits, the actual input amplitude has no effect on the amplitude of the emerging rf pulse.

If it is desired to produce long pulses at repetition rates below 500 Hz, and if rise and fall times of 10 µS are acceptable, the EXTERNAL-AUDIO mode of

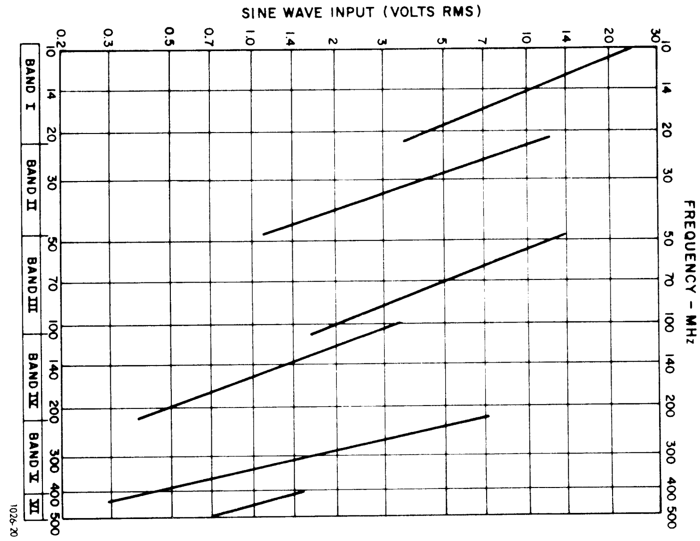


Figure 3-2. Audio input voltage vs carrier-frequency for 25 kHz peak deviation (10 kHz on Band 1). Variations of 2.5:1 from typical curves are to be expected.

operation should be employed. The procedure is as follows:

a. Set CARRIER LEVEL control fully cw. Set Modulation Level control fully cw.

b. Supply a positive-going pulse of peak amplitude controllable from 0-5 and with a base line level of -5V to the modulation input binding posts.

c. Set the MODULATION SELECTOR to EXTERNAL AUDIO.

The peak pulse amplitude in this mode of operation is controlled directly by the peak amplitude of the modulating pulse, but it is not indicated by the CARRIER LEVEL meter. The peak amplitude will be leveled in spite of changes in carrier frequency.

3.6.6 FREQUENCY MODULATION

Narrow-band frequency modulation can be obtained by connecting an external source of modulation to the rear panel remote connector, as described in paragraph 2.4. For FM without AM, set the MODULATION SELECTOR to cw. Deviation sensitivity is a function of frequency; typical characteristics are shown in Figure 3-2. Though the deviation is not calibrated, it may be measured by connecting a deviation meter to the FREQUENCY METER jack.

Simultaneous FM and AM are possible. First setup the FM conditions with the MODULATION SELECTOR at cw, then switch to the appropriate position and add AM as described above.

3.7 USE AS A FREQUENCY METER.

The 1026 Standard Signal Generator can be used as a heterodyne frequency meter to measure the frequency of an external source. Place the FREQUENCY CALIBRATOR in the EXTERNAL position, plug headphones into the BEAT OUTPUT jack, and connect the source of the unknown frequency to the FREQUENCY METER jack. For best accuracy, check the 1026 calibration, using the internal crystal calibrator as described in paragraph 3.4.

If the frequency of the external source is known approximately (and is within the tuning range of the generator), its frequency can be measured directly. Tune the 1026 over the range in which the external signal lies, until a strong beat is observed, and read the frequency from the drum dial of the 1026. Otherwise, it will be necessary to identify the harmonic order of the observed beat as follows.

The signal generator should be tuned to zero beat with the external source at two or more points on the dial, noting the frequencies of a pair of successive strong beats. Bandswitching should not usually be required, since at least one pair of beats will occur on each band of the 1026 up to 220 MHz, except that band which includes the fundamental frequency of the unknown source.

Let

f_x = unknown frequency of the external source

f_h = the higher frequency of two successive strong beats

f_ℓ = the lower frequency of two successive strong beats

$f_d = f_h - f_\ell$

The harmonic order $H = f_h/f_d$ (always an integer)

$$f_x = H f_\ell = (H - 1) f_h$$

3.8 USE WITH EXTERNAL SYNCHRONIZER.

When phase-locked operation is desired to stabilize the carrier frequency against an external

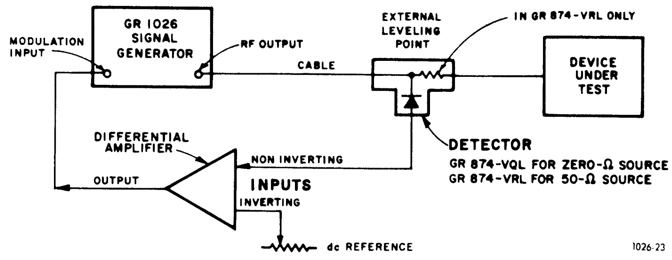


Figure 3-3. External leveling with a nondirectional detector.

reference, the GR Type 1040 Synchronizer/Sampling Detector should be used. Through the use of this synchronizer, the 1026 can be rapidly and unambiguously locked to any desired multiple of 100 kHz up to 48 MHz, and to any desired (multiple of 1 MHz up to 500 MHz, without the use of an auxilliary counter. Operation at closer lock spacings and at arbitrarily chosen frequencies is also described in the 1040 manual, together with detailed instructions for interconnection and step-by-step operating procedure.

3.9 EXTERNAL LEVELING.

In some measurement applications it may be desired to maintain the rf level constant at a point that is remote from the signal generator. To accomplish this, the rf is detected at the point where leveling is desired, and the dc output of the detector is compared with a stable dc reference voltage in a differential amplifier. Amplified error voltage is then fed back to the dc coupled MODULATION INPUT terminals of the 1026, thereby taking over control of the 1026 leveling circuits. The user should understand several implications of this mode of operation:

1. The external leveler must operate at high enough level for the associated crystal detector to deliver at least a few tenths of a volt of dc output. Thus the output-attenuator system of the signal generator is not used. Furthermore, the dc output from most external crystal detectors is not thoroughly filtered, so that the low leakage features of the 1026 are likely to be sacrificed unless special precautions are taken. This may be serious when the generator is used to make precision measurements of large values of attenuation.

2. The source impedance offered by the generator at the leveling point will depend on the detector characteristics. In the case of a simple shunt diode detector such as the Type 874-VQL connected as shown in Figure 3-3, the effective source impedance at the diode is zero. A source impedance of 50-Ω can be restored with this connection by adding a 50-Ω series resistor between the diode and the rf load; this resistor is built into the 874-VRL detector. Another way of maintaining 50-Ω source impedance is to use a directional coupler as shown in Figure 3-4, so that the detector sees only the forward-wave component at the leveling point. In this case both the effective source impedance and the leveling vs frequency characteristics depend on the characteristics of the coupler. The high output available from the 1026 permits the use of relatively weak coupling; a 10 dB coupler will usually be satisfactory.

3. If modulated operation is desired with external leveling, the envelope distortion will generally be higher than with internal leveling.

4. The readings of the 1026 Carrier Level meter are no longer meaningful. Although the carrier level meter still indicates the voltage behind the 50-Ω source resistor in the 1026, this voltage is not simply related to the voltage at the point where leveling is occurring, and it may fluctuate with adjustments of the carrier frequency or of the external rf load. The Modulation Percentage will also not, in general, be correctly indicated by the MODULATION LEVEL meter.

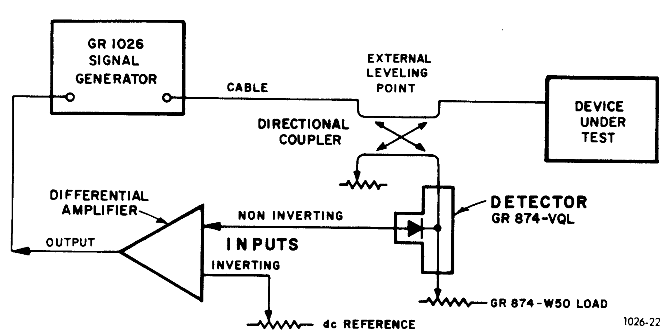


Figure 3-4. External leveling with a directional detector.

Satisfactory external leveling has been obtained using the circuit shown in Figure 3-5. Operating power for the differential amplifier is obtained from the 1026 accessory connector SO414, as shown. Using this arrangement, the operating procedure is as follows:

a. Set external-level control to minimum and disconnect the crystal detector dc from the operation-amplifier input.

b. Set the MODULATION SELECTOR on the 1026 to EXTERNAL AUDIO, and the CARRIER LEVEL control fully cw (to obtain +1 dBm meter reading); the MODULATION LEVEL control Should be fully ccw, but not so far as to actuate the MOD OFF switch.

c. Establish the maximum rf output or limiting level for the 1026 by turning the external rf level control up fully cw and turning up the 1026 MODULATION LEVEL control until the CARRIER LEVEL meter reads 10 V.

d. Connect the dc output of the external level detector to the operational amplifier input. The 1026 CARRIER LEVEL meter should drop, indicating that leveling action is occurring. If it does not drop, there is insufficient rf drive to the external detector. Do not try to adjust the carrier level using the 1026 CARRIER LEVEL control; it should be left fully cw. All adjustments of level should be by means of the external RF LEVEL Control. The leveling action can be monitored by connecting a dc voltmeter to the output of the external detector.

e. The CARRIER LEVEL meter of the 1026 will still read the source voltage correctly, but, since this is behind the 50-Ω source-impedance-determining resistor, it is not the value of the voltage at the point being leveled. The MODULATION meter of the 1026 will show an indication if an audio signal is connected to the EXTERNAL MODULATION input of the operational-amplifier circuit, but the percentage shown will not usually be correct. The meter reads correctly only when there is no dc input component in the voltage supplied to the modulation-input jacks of the 1026.

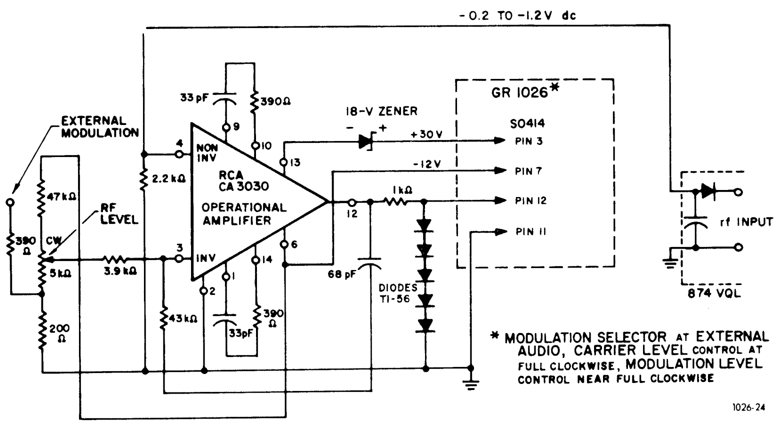


Figure 3-5. Schematic for external detector using a dc amplifier in an automatic leveling circuit for use with 1026.

SECTION **4**

PRINCIPLES OF OPERATION

4.1 GENERAL.

The Type 1026 is an a-m standard signal generator, with a frequency range extending from 9.5 to 500 MHz, that is capable of operation in four modulation modes. The term "standard signal generator" means that all primary characteristics (frequency, signal level, and modulation depth) are calibrated.

The instrument consists of four major functional assemblies. They are the rf assembly, the modulator assembly, the power supply, and the front panel assembly. They incorporate the band-selection, tuning, mode-switching, level controls, indicators, input-output connectors and shielding required to provide a source of rf energy of accurately known characteristics. The over-all electrical relationship of the major assemblies (except the power supply) is shown in the simplified block diagram of Figure 4-1.

In the paragraphs that follow, each assembly is discussed in general terms with reference to a detail block diagram. Following each general discussion, the assembly's circuits are discussed in greater detail. Detailed discussions reference the appropriate schematic diagram in Section 6.

4.2 RF ASSEMBLY DESCRIPTION.

4.2.1 GENERAL (Figure 4-2).

The primary function of the rf assembly is to generate the carrier frequency, amplify it to the maximum power level required, and provide a means by which the output can be varied in accordance with a signal supplied by the modulator assembly.

The modulator output amplifier (Figure 4-3) is also located within the rf assembly to facilitate the filtering required for leakage.

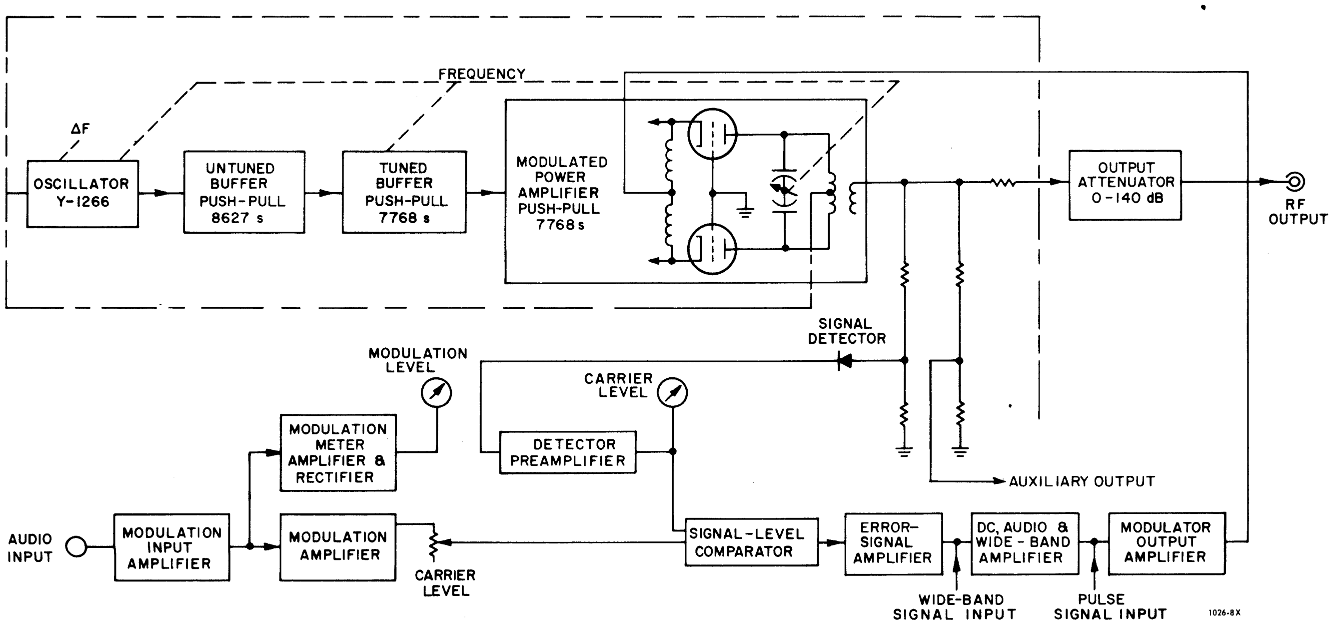


Figure 4-1. Type 1026 block diagram.

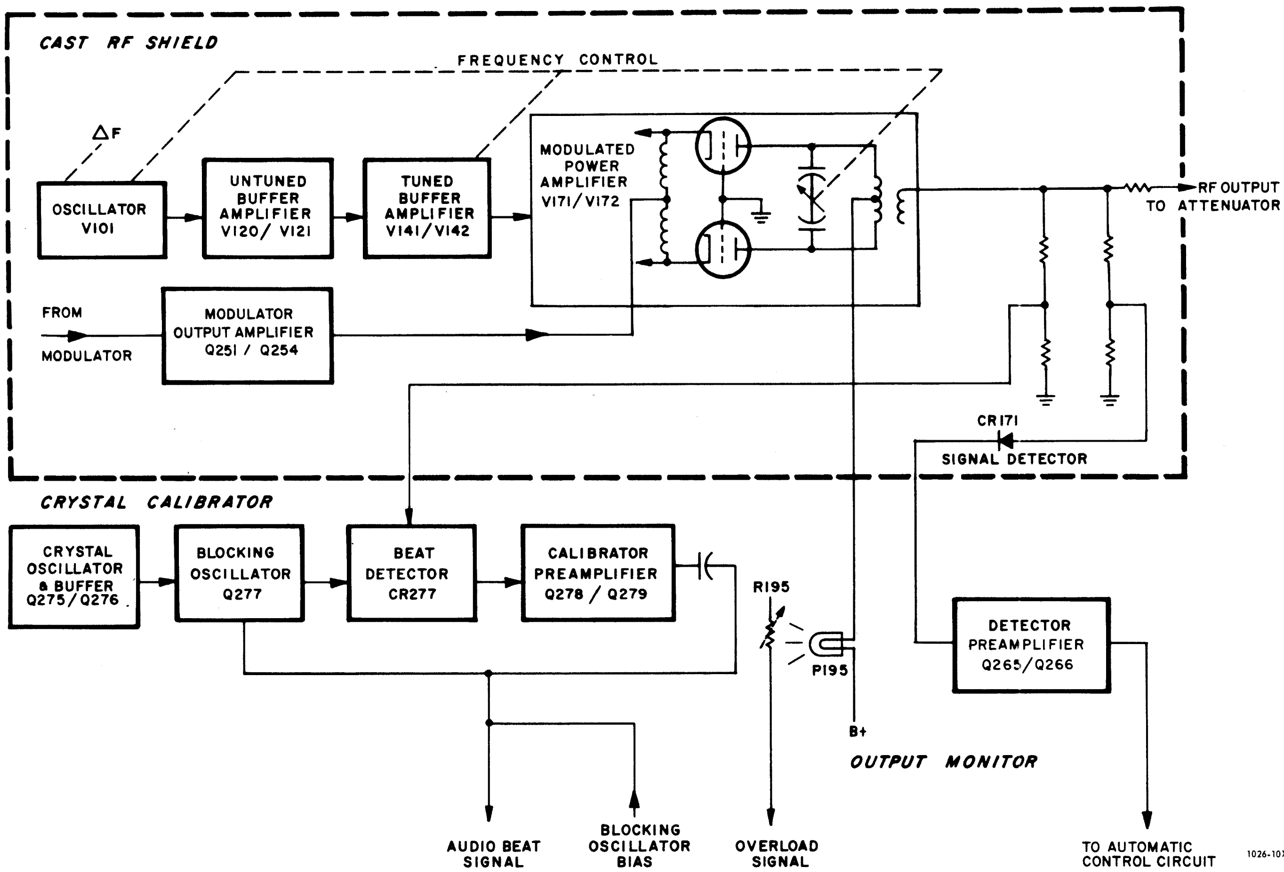


Figure 4-2. Block diagram of RF Assembly.

A diode signal detector and preamplifier monitor the rf output level and furnish a feedback signal for input to the modulator's level-control circuit.

The crystal calibrator included is useful for checking frequency calibration.

In order to deliver accurately known output over the very large output range of 160 dB, the rf unit is thoroughly shielded by use of three-compartment, cast construction and careful filtering on all leads entering the casting. Access covers are equipped with finger contacts to maintain the integrity of the shielding.

4.2.2 BAND SELECTION AND TUNING (Figure 6-2).

The frequency range of the 1026 Standard Signal Generator is covered in six bands (selected by three tuning-coil turrets) with tuning throughout each band accomplished by three ganged sets of tuning capacitors. The tuning capacitors are operated synchronously by means of a single front-panel control; there is no auxiliary front-panel trimming adjustment.

The tuning capacitors are of the translatory motion type, and are referred to as guillotines. They are precision units, factory adjusted to a precise capacitance schedule. Their plate shapes yield a linear frequency-tuning characteristic up to 108 MHz. The moving plungers are mounted on carriages supported by ball bearings riding in precision-ground Vee-grooved rails. These carriages are in turn coupled to racks that are spring-loaded against the driving spur gears. The shaft that carries these gears is coupled to the panel control through a 50:1 worm drive. A flexible coupling joins the metal worm shaft to the control shaft, which is made of ceramic to suppress leakage.

The three coil turrets used for band selection are all on a common shaft coupled to the front-panel control by means of a helical gear drive. The six tuning ranges are identified on the schematic by band numbers I through VI for a convenient shorthand notation; Table 4-1 lists them.

TABLE 4-1
BAND NUMBERS

Band Number	*Nominal Range MHz*	*Actual Calibrated Range MHz*
I	9.5 - 22	9.5 - 22
II	22 - 48	21.2 - 49.6
III	48 - 108	47.4 - 111
IV	108 - 220	100 - 220
V	220 - 420	216 - 430
VI	400 - 500	400 - 500

Each coil has provision for inductance and capacitance trimming to insure tracking between circuits and against the precalibrated frequency dial. Capacitance trimming for bands V and VI is provided by trimmers C105, C147 and C177 mounted on the casting. A cam-operated reset mechanism at the top of the casting readjusts the settings of these trimmers automatically for band VI. On bands I through IV, additional capacitance is provided by individual trimmers for each coil, mounted directly on the coil turrets.

B+ is fed to the active coil primaries through the primary of the next lower band coil. In the case of Band I, feed is through the Band VI coils. The pairs of feed resistors R117 and R118, R143 and R144, and R178 and R179, damp out undesired resonances in these adjacent-band coils. Additional damping for unwanted coil resonances is applied in the oscillator by R105.

4.2.3 RF OSCILLATOR.

V101 is a planar ceramic triode, type Y-1266, employed in a Colpitts-oscillator circuit. The oscillator plate current may be monitored at J101. The main tuning capacitor, C103, is paralleled by trimmers C105 (mounted on the casting) and C118 (mounted directly on C103). C105 is the main trimmer, actuated by the reset mechanism when band VI is in use. C118 compensates for capacitance changes due to oscillator tube change.

The tuning coils are L111 (Band I) through L116 (Band VI). Each consists of the tuned primary and small secondary coupling coil. The primary contacts mate with the "A" and "B" contacts on guillotine tuning capacitor C103, while the secondary contacts mate with the "C" and "D" contacts on small channels supported by the main casting. The secondary coils are connected to their contacts through suitable networks to shape the output-power-versus-frequency characteristic.

Electrical fine tuning is accomplished by varactor diode CR101. On bands V and VI a reverse bias of about 25 volts is applied to this diode in order to reduce its effect on the tuned circuit.

4.2.4 UNTUNED BUFFER AMPLIFIER.

V120 and V121, type 8627 Nuvistors, are the active elements of an untuned, transformer-coupled push-pull amplifier that provides isolation of the oscillator from variable loading effects of subsequent stages. The stage gain is approximately unity. The single-ended drive to the amplifier is delivered by two coaxial cables in parallel, which connect the C and D contacts in the oscillator to the primary of T120. The balanced secondary drives the cathodes of grounded-grid amplifier tubes V120 and V121.

These tubes operate at a substantially constant current of 40 mA, due to the large plate resistors R126 and R127; this current can be monitored at J102. The plate of V120 drives the cathode of the tuned buffer tube, V141, via step-down transformer T121. Similarly, the plate of V121 drives the cathode of V142 via T122. The broadband transformers are all of ferrite-cored, transmission-line design.

4.2.5 TUNED BUFFER AMPLIFIER.

The purpose of this stage is to supply the power gain needed to drive the output-power-amplifier stage. V141 and V142 (planar ceramic triode type 7768's) are used as a grounded-grid push-pull amplifier.

The main tuning capacitor, C146, tunes coils L151 (band I) through L156 (band VI). The push-pull tuned primaries of these coils connect directly to contacts on C146, while the single-ended secondaries are connected through appropriate networks to output contacts C and D, mounted on a channel supported by the main casting.

The tubes operate at a constant current of 45 ±5 mA, due to the large cathode resistors (R122 and R123) which are returned to the -12.4 V supply, while the grids are grounded directly. The total plate current can be monitored at J103.

4.2.6 POWER AMPLIFIER.

The primary purpose of this stage is to permit amplitude modulation of the carrier. The single-ended output of the tuned buffer is brought to the input coupling network of the power amplifier by two coaxial cables in parallel. These drive transformers, T171 and T172, which are connected in parallel. T171 is a 1:1 phase-reversing transformer that drives the cathode of V171, while T172 is a 1:1 noninverting phase-compensating transformer that drives the cathode of V172. V171 and V172 are also type 7768 triodes, operated grounded grid.

The transformers are coupled to the cathodes through RLC networks to permit insertion of the modulation voltage in the cathode-to-ground return at anchor terminal AT170.

The dc bias at this point can be monitored by connection of a meter to TP101. This bias varies from slightly over +1 V when the amplifier is turned on hard delivering maximum output, to as high as +20 V when the level control is turned down near minimum. The bias and plate current vary with frequency for each range, even at a fixed output setting. Typical values are tabulated in Section 5 of this manual. The plate current can be monitored at J104.

The main tuning capacitor for this stage is C172, which tunes the primaries of coils L181 (Band I) through L186 (Band VI). The capacitor contacts to the coil primaries are A and B. The coil secondaries are coupled to output contacts C and D directly, except on bands IV and V.

4.2.7 OUTPUT LEVEL MONITOR.

The power amplifier output is delivered via contacts C and D directly to a low-pass filter at the monitor input, consisting of C189, C190, plus FL187 and FL188. Following this filter is a compensated voltage divider, consisting of C185, C186, R187 and R188, which delivers approximately 2/3rds the output voltage to detector diode CR171, the output of which is fed to J108.

Another voltage divider, R175 and R176, delivers approximately 1/11th the output voltage to J109 for subsequent use in the frequency calibrator. The voltage at the junction of R177 and R187 is held constant by the automatic level-control circuits, thus making the effective impedance at that point zero. The main output of the monitor is then delivered via 50-ohm resistor R177 to the output attenuator via J105. R177 determines the effective output impedance of the signal generator when the output attenuator assembly (A400) is set to its maximum (+20 dBm) position.

4.2.8 DETECTOR PREAMPLIFIER.

Network R265, R266 and R267 supplies forward-bias current to monitor diode CR171, in order to linearize the diode characteristic. The detected output from the diode is amplified by Q265 and Q266, connected in a feedback configuration. This provides a low output impedance to drive output filter FL271 via resistor R271.

4.2.9 OVERLOAD PROTECTION.

Plate current to the rf output amplifier tubes, V171 and V172, is fed through a 90-mA pilot lamp, P195, which in turn illuminates photoresistor R195. The spacing of these elements is adjusted so that plate current exceeding 65 mA reduces the resistance of R195 sufficiently to insert an overriding control signal into the modulator control loop. Thus, plate current is limited to a safe value under conditions of excessive loading, such as may occur at certain carrier frequencies (in the HIGH CW mode) with high-VSWR rf loads. The lamp also acts as a fuse in case of any catastrophic failure in the modulator or in the power amplifier.

4.2.10 CRYSTAL CALIBRATOR.

The crystal calibrator comprises a crystal-controlled pulse generator that drives a diode mixer to which a small sample of the signal-generator output is also applied. When the signal frequency is close to being an integral multiple of the pulse repetition rate, the resulting audio beat note is amplified and delivered to a front-panel headphone jack, J415. The principal circuits involved are contained in the small shield can at the top of the rf assembly.

The crystal oscillator, Q275, is of the series-resonant Pierce type. Internal adjustment capacitor C275 sets the operating frequency to exactly 5 MHz. Isolating amplifier Q276 drives blocking oscillator Q277. This oscillator operates either at 5 MHz or as a 5:1 divider at 1 MHz. The selection is made by the front-panel FREQUENCY CALIBRATOR function selector S400, that controls the bias fed via filter C292 to Q277.

The heterodyne output of diode mixer CR277 drives preamplifier Q278 and Q279, a feedback pair with very low output impedance. The preamplifier output is delivered to the subsequent headphone amplifier through C292, the same filter capacitor used to supply bias voltage to the blocking oscillator The audio voltage on this lead is so low that it does not adversely affect operation of the blocking oscillator.

4.2.11 MODULATOR OUTPUT AMPLIFIER.

NOTE

Although this circuit is functionally part of the over-all modulator circuitry, it is physically located in the rf assembly to simplify the lead filtering required for shielding.

The amplifier increases the level of control signals (delivered by the modulator assembly) sufficiently to modulate the power amplifier output essentially 100%. Positive-going signals at the input of FL251 cause a positive-going signal at the cathodes of V171 and V172, resulting in a reduction of rf output. In the pulse mode, the normal level-control signal applied through FL251 is overridden between pulses, but is restored for the duration of the pulse.

The carrier level control signal, including modulation information in the 1 kHz, EXT AUDIO, and WIDE BAND modes, is fed to input amplifier Q251, an emitter follower, through low-pass filter FL251. In all except the PULSE mode of operation, Q252 is biased off and has no effect on circuit operation.

The output amplifier, Q253 and Q254, is a non-inverting feedback pair capable of delivering voltages from approximately +0.5 V to +25 V at currents up to the 65 mA required under certain conditions by the rf output amplifier tubes, V171 and V172. When positive bias is applied to the cathodes of these tubes, rf output is reduced.

In the pulse mode, Q252 is normally conducting, and therefore the drop in R255 adds a positive bias to the dc level-control signal coming from Q251, turning off the output amplifier Q253/Q254. When a positive pulse is applied through low-pass filter FL252 to the input of Q252, the current through R255 is cut off, and the output amplifier assumes the level commanded by the level-control signal from Q251.

4.3 MODULATOR ASSEMBLY DESCRIPTION.

4.3.1 GENERAL (Figures 4-3 and 6-3).

The modulator assembly provides a low-frequency signal of proper amplitude to vary the rf carrier level. In the 1-kHz modulation mode, the low-frequency modulating signal originates in the modulator assembly itself. In all external modulation modes, the low-frequency modulating signals originate outside the instrument, with the modulator assembly providing only amplification and level-control functions.

The modulator assembly consists of four functional groupings of circuit elements. These are the 1-kHz oscillator, the error amplifier board, the modulator board, and the pulse stretcher board. Considerable switching is also furnished by S200 to modify the function of these circuits, as required for the various modes of operation. Carrier-level and modulation-level meter-adjustment circuits are also modulator assembly functions. For purposes of clarity, the detailed discussions of these circuits are presented in the following paragraphs in terms of the various operating modes.

4.3.2 CW MODE.

In this mode, the modulator holds the rf carrier at the level preselected by the CARRIER LEVEL control (R405) without applying any modulation. This is true despite changes in frequency, load, or ambient temperature.

One of the primary elements in this automatic level control is the broad-band, linear rf detector in the rf assembly (Figure 6-3). This detector, CR171, rectifies a portion of the rf output voltage and delivers

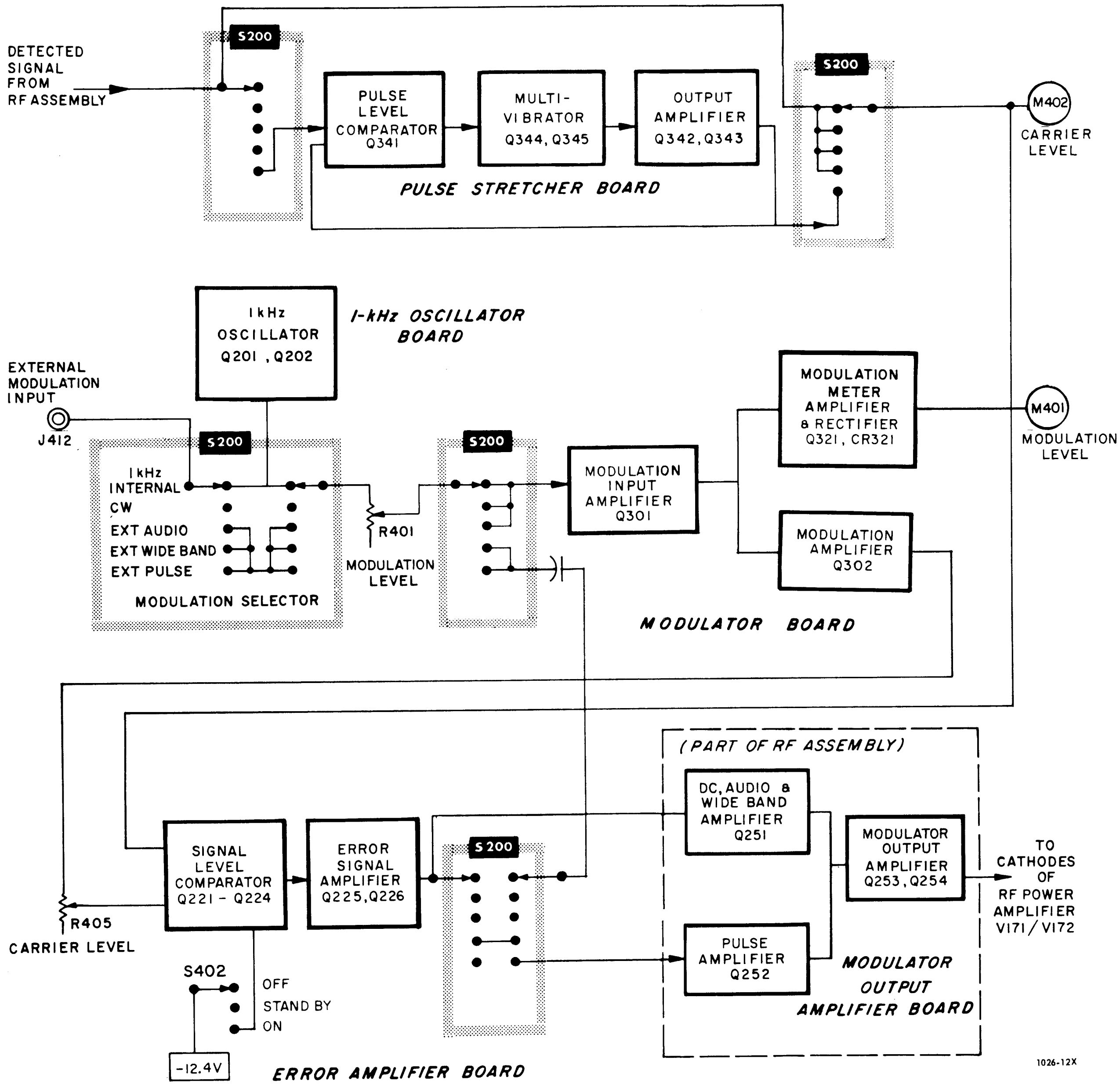


Figure 4-3. Block diagram of Modulator Assembly.

a dc voltage proportional to the applied rf. This dc voltage is amplified by the detector preamplifier, Q265/Q266, a low-distortion, low-impedance driver for feedthrough filter FL271, which removes any rf residue present with the detected dc.

The detected signal is passed through temperature compensating network R355, R356 and CR344 to the CARRIER LEVEL meter circuit and to the base of Q224, in the modulator assembly (Figure 6-3). Q224 is one side of a differential amplifier consisting of Q221 through Q224. The action of this amplifier is described later after its other input, the CARRIER-LEVEL control signal applied to the base of Q221, is traced.

The carrier level control signal required at the base of Q221 is established as follows. Starting at ground dc level, a positive dc offset voltage (corresponding to that which would arrive from the detector preamplifier for a +1 dBm carrier level) is added to the modulation input circuit. The bias path starts at R401, the MODULATION LEVEL control, which is returned to ground; thus, ground serves as a dc level reference. In this mode, R401 performs no function, since it is disconnected from the EXTERNAL modulation terminal, J412. The bias path leads to Q301, an emitter follower whose primary function is impedance matching. Q301 drives the low end of a voltage divider consisting of R305, R306, and temperature compensating diodes CR304-306. The current through this divider is adjusted by R551, the "Modulator Offset Voltage Adjust" control located in the power supply. This establishes the dc offset voltage at the base of Q302, which corresponds to a +1 dBm carrier level when the CARRIER LEVEL control is fully clockwise. Q302 is an emitter follower which drives the high side of R405, the CARRIER LEVEL control.

The arm of CARRIER LEVEL control R405 leads to the base of Q221, thus providing the reference input to the error amplifier. This reference level is identical in magnitude (except for the residual error signal of about 50-mV) to the output of the detector preamplifier; it varies over the range of approximately +1.8 V to -0.1 V, as the carrier level is reduced from maximum to minimum. With the MODULATION LEVEL control set to the MOD OFF position to obtain high cw output, the range is approximately +3.8 V to -0.1 V. The nominal differential gain between the bases of Q221 and Q224 and the collector of Q223 is 16, the common-mode gain being 0.35. The exact value of the differential gain is adjusted by R222 ("Loop Gain Adjust" control) to make the over-all loop gain equal to a maximum of 54 dB, giving about a minimum of 40-dB loop gain at the least favorable setting of the FREQUENCY dial.

The emitters of Q221 and Q224 and those of Q222 and Q223 are returned to the -12.4 volt supply, the latter pair returning through auxilliary contacts on the main POWER switch (S402). When S402 is in the STANDBY position, the emitter lead is opened, raising the collector of Q223 to the 30-V supply level and thereby cutting off all subsequent stages.

Error-amplifier output stages Q225 and Q226 furnish the proper level to drive the 800-ohm impedance of FL251. The termination of this filter in the rf section is also the collector load resistor for Q226. FL251 is identical to FL271, keeping any rf present at the power-amplifier cathode return from leaking out through the modulator output amplifier.

The output of Q226 is fed to the modulator output amplifier, Q251 through Q254. Q253 and Q254 are a feedback pair providing the desired low impedance as well as a nominal voltage gain to the cathode circuit of the rf power amplifiers. Q252 is required only for pulse and wide-band modes of modulation; in the CW MODE, Q252 is cut off and Q251 acts as a simple emitter follower.

4.3.3 HIGH CW MODE

The HIGH CW OUTPUT mode is a special case of operation in the basic cw mode; it is described separately in the interest of clarity.

When the MODULATION SELECTOR switch (S200) is in any one of the three positions INTERNAL 1 kHz, CW, or EXTERNAL AUDIO, the MODULATION LEVEL control in its extreme CCW position not only disconnects any internal 1 kHz or external modulation signal from the input to Q301, but substitutes a dc signal which increases the maximum output of the signal generator by approximately 6 dB. The carrier level meter will indicate this change directly.

The dc signal comes from a voltage divider consisting of R402, R403, and R404. The tap of R403 (HIGH CW ADJ control) is connected by S401 to the base of Q301 in place of MODULATION LEVEL control R401.

4.3.4 EXTERNAL AUDIO MODE.

When the MODULATION SELECTOR switch (S200) is set in the EXTERNAL AUDIO mode, the only change in circuit connection from the CW mode is that the high side of the MODULATION LEVEL control (R401) is now connected to the modulation jack, J412. Thus, any modulation signal applied to J412 is added to the dc carrier-level-control bias; the resulting composite signal constitutes the reference input to the error amplifier. Thus, the envelope of the rf output is a replica of the modulation input signal.

In this mode, the CARRIER LEVEL meter circuit responds to the average value of the modulated voltage presented to it. For symmetrical modulation such as sinusoidal, or any modulation coupled into the instrument by way of a capacitor, the CARRIER LEVEL reading on M402 is unaffected by the presence of modulation unless it exceeds 100%. However, any modulation having a dc component will change the carrier level, hence the CARRIER LEVEL reading.

The signal between the external modulation jacks J412 and J413, and the input to the differential error amplifier (base of Q221) follows the same path as previously described for cw operation; in addition, the modulation input signal is amplified by Q321 and rectified by CR321 for display on the MODULATION LEVEL meter (M401). The rectifier circuit is a quasi-peak detector which is calibrated using a sine-wave; signals of other wave shapes do not necessarily give an accurate reading of modulation percentage.

An important component in this mode is R309, the % MOD ADJ control. This control is necessary because of the dc offset present, even at zero carrier level. Returning the low end of the CARRIER LEVEL control to an adjustable dc divider (the arm of R309), ensures that the ratio of audio to dc voltage at the arm of the CARRIER LEVEL control (R405) is such that the modulation index will remain constant regardless of control setting.

The error amplifier in this mode establishes a controlled gain-versus-frequency characteristic. To accomplish this, there are four "roll-off" networks that act like simple RC low-pass filters except that, as the frequency is increased beyond a transition region, the attenuation becomes constant instead of approaching infinity, and the phase shift again approaches 0° instead of 90°. The first of these consists of R230 and C221 that act with collector loads R221 and R231 as the source, to establish a first break frequency of 650 Hz. R229, R235, R237 and C224 make up the second roll-off network, which breaks at 1150 Hz; the third is composed of R238, R240 and C226, which breaks at 20 kHz. The last roll-off network is made up of the collector load of Q226 (R251 located in the rf section) along with R246 and C243, which breaks at 55 kHz.

In the region of 100- to 300-kHz, a slight lead is introduced by R234, R236, and C222, to prevent too rapid gain roll-off.

The modulator output amplifier has the same functions as previously described for the cw mode.

4.3.5 1-kHz INTERNAL MODULATION.

All the circuitry described for the preceding modes is used in this mode, as well as the 1-kHz oscillator itself, which is switched to the high side of the MODULATION LEVEL control by S200-2.

The 1-kHz oscillator is a conventional Wien-bridge circuit. The 1 kHz ADJUST (R203) varies the frequency ±1 percent. The oscillator amplitude is controlled by thermistor R213, so that operation is restricted to the linear range of Q201 and Q202. As the ambient temperature varies, R213 causes significant variations in output amplitude, so a second thermistor, R214, compensates for these variations.

The 1-kHz oscillator is left on at all times to avoid switching transients when the MODULATION SELECTOR is set to the 1 kHz INTERNAL MODULATION mode. Otherwise there would be an initial surge in output level caused by the thermistor's thermal time constant. When the MODULATION SELECTOR switch is in the INTERNAL 1-kHz position a portion of the 1-kHz oscillator output is coupled to J412 (through R312) to permit synchronization of an external oscilloscope or synchronous detector.

4.3.6 WIDE-BAND MODULATION.

In the EXTERNAL WIDE BAND mode, the dc operation of the modulator is the same as in the EXTERNAL AUDIO mode except for changes to the reference input circuits and to the roll-off networks. The base of Q301 is returned to ground through R302 and R303 via S200, leaving the MODULATION LEVEL control (R401) free to be used as described below. In addition, the low side of the CARRIER LEVEL control (R405) is connected to the -12-V supply via R314. Thus, in the extreme CCW position of the control, the bias applied to the base of Q221 is sufficiently negative to drop the carrier level to zero.

Additional high-frequency roll-off filtering (C225 and C341) is switched in by S200-1 and S200-4, so that the first frequency break now occurs in the vicinity of 0.02 Hz, with the crossover about 10 Hz. For modulation frequencies above about 10 Hz, there is no significant feedback.

The modulation input is brought through MODULATION LEVEL control R401 to the collector of Q226 via C303 and R247. Here, the modulation signal is added to the dc-carrier-level control signal. The composite signal is amplified in output amplifier Q251, Q253 and Q254, and then applied to the cathode of the rf power amplifier tubes. Since the output amplifier is non-inverting, the modulation applied is opposite in sense to that of all other modes, so a positive input swing causes a drop in rf output. The modulation bandwidth for carrier frequencies above 108 MHz is approximately 50 Hz to 1.5 MHz, as determined by the bandwidth of amplifier Q251 - Q254. But, as there is no envelope feedback, the modulation is not as linear as in the EXTERNAL AUDIO mode. The MODULATION LEVEL meter does not function in this mode.

4.3.7 PULSE MODULATION.

In this mode it is possible to modulate to a peak rf pulse level that is controlled by a feedback circuit. The rms value of the rf voltage occurring during the pulse is read directly on the CARRIER LEVEL meter. The percent modulation meter is inoperative, but the modulation percentage is kept as high as possible; the on-off ratio is at least 30 dB. The pulses must recur at a rate of at least 500 per second, be of at least 1-μs duration, and be of at least 10-V peak amplitude, positive going; certain other restrictions are listed in the specifications.

Between pulses, the cathodes of V171 and V172 (in the rf section), are biased to +25 V, thus cutting off plate current and power output. Incoming pulses drive the cathodes down to an operating bias level which is automatically controlled so that the rf amplitude at the peak of the pulse is that selected by the setting of the CARRIER LEVEL control. This operating bias is an essentially steady-state voltage established by comparing the peak pulse amplitude (detected by CR171, amplified by the detector preamplifier, and converted to dc in the pulse-stretcher circuit) to the dc from the CARRIER LEVEL control, and amplifying the difference.

The dc-bias signal is applied via FL251, while the pulses that switch the modulator output amplifier from the +25-V output (V171/V172 cutoff) to the operating-bias condition are applied through FL252. The dc from FL251 passes through emitter follower Q251, to drive the output feedback pair Q253 and Q254 via a resistive combining network, R255 and R256. Between pulses, Q252 conducts heavily, by virtue of base current being drawn through R262, FL252, and R243 to ground. Its collector is in saturation, holding the base of Q253 close enough to +30 V to cut off Q254; the modulator output signal at the collector of Q254 is at about +25 V, effectively cutting off V171 and V172.

Pulses applied to J412 are routed through MODULATION LEVEL control R401, S200-2, C303, and S200-3 to FL252. A positive input pulse of sufficient magnitude applied to FL252 drives the base of Q252 positive, until CR252 clamps. This cuts off Q252, allowing the base of Q253 to assume the bias level established by the dc input to FL251, for the duration of the pulse. The collector of Q254 is thus set at the appropriate operating bias voltage and the rf pulse is generated.

The dc-bias signal applied to FL251 is generated in the same manner as for the EXTERNAL WIDE BAND mode, except for the interposition of the pulse stretcher in the detected signal path, between the output of the detector preamplifier and the input of the level comparator.

The pulse stretcher circuit generates a dc bias that is equal to the peak amplitude of an incoming detected pulse. The bias is built up across C343 by charging current flowing through R351 and R352, under the control of Q345. If the incoming pulse is larger than the bias across C343, more charging current flows until the two voltages are essentially equal. If the pulse is smaller, discharge current flowing through R353 reduces the bias until equality is achieved.

The comparison of pulse and dc bias occurs in the base to emitter circuit of Q341. The pulse is applied directly to the base, while the dc bias from C343 is coupled to the emitter by a unity-gain feedback amplifier, Q342 and Q343.

CR341 is a coupling diode that allows a transition to take place without being loaded by the input triggering circuit. Triggered into the metastable state, Q345 is turned off. Its collector voltage rises, raising with it the voltage at the junction of R352 and R353, thereby imparting a small increase in the voltage across C343. Diodes CR342 and CR343 are clamping diodes that limit the negative excursion of C343.

The output of the pulse stretcher is taken at the junction of R344 and R345; R345 provides a small dc offset to approximate the base-to-emitter voltage of Q341. This output is delivered via S200-4 to the "Detected Signal" input of the level comparator, that is, to the base of Q224, where it is compared with the dc from the arm of CARRIER LEVEL control, R405. The comparison is accomplished in the differential portion of the error amplifier. The gain of this amplifier is drastically reduced in this mode as contacts 108F and 109F of S200-1 open the bridging path between emitters of Q221 and Q224.

The circuit is similar to EXTERNAL WIDE BAND in that a relatively large amount of filtering is used, limiting the speed of response to level or load changes. The output of the error amplifier is the bias that establishes the rf level during the on-time of the pulse. It is the same bias that would be present for an identical CW level.

4.4 POWER SUPPLY ASSEMBLY.

4.4.1 GENERAL (Figure 4-4).

For purposes of discussion, the Type 1026 Standard-Signal Generator power-supply assembly is divided into three sections, preregulator, rectifier-filter, and postregulator. The preregulator stabilizes the supply against line-voltage variations. It consists of a reference source, a sampling rectifier-filter network, a control amplifier, and magnetic regulators, all associated with the power-transformer's primary side. The postregulator provides stability against load variations and ripple. It is comprised of suitable reference sources, control amplifiers, and series-losser circuits for both the +220 V and -12.4 V supplies, with a simpler reference and series losser arrangement for the +30 V supply.

4.4.2 PREREGULATOR.

The primary function served by this regulator is to regulate against changes in line voltage in such a manner that:

1. The main control elements are reactive rather than dissipative, thereby limiting the generation of heat.
2. The series-type postregulator operates with voltage drop sufficient to compensate load fluctuations and ripple, without need for an additional drop to allow for line-voltage fluctuations. Thus, power dissipation is minimized.
3. The variation in total heat dissipated, as line voltage varies, is also reduced. Therefore, once the Type 1026 comes up to operating temperature, possible frequency or level drifts due to line-voltage shifts are likewise reduced.
4. The preregulator holds the ac heater voltage on the rf buffer and power-amplifier tubes within approximately ±2 percent, so tube life is maintained with no need for further regulation of this voltage.

The basis of the preregulator is a magnetic amplifier consisting of saturable reactors L502A/B and associated control circuits. These reactors are used to switch the line voltage, on a time-sharing basis, between the full transformer winding and a lower voltage tap. When the switches formed by L502 are open, line current flows through L501 to the end of the transformer primary. Since L501 saturates, the voltage drop through it is relatively low. At high line voltages, the line is connected across the full primary winding for most of each cycle, while at low line voltages, it is connected to the tap for most of each cycle.

When the switches formed by L502 are closed, line current flows through them (with relatively low drop) to the tap on the transformer winding and L501 floats across the portion of the transformer between

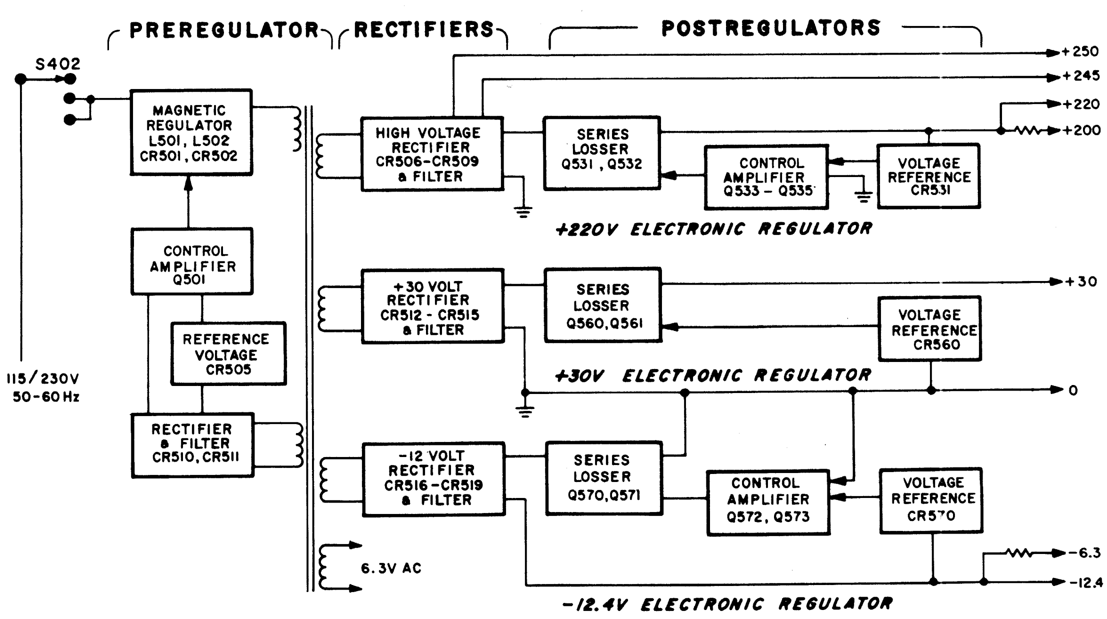


Figure 4-4. Block diagram of 1026 Power Supply.

the tap and the end of the winding; it is no longer carrying line current, and hence is no longer saturating. Since line current is flowing to one tap or the other during the entire cycle, the wave shape applied to the load has only moderate transients and relatively low harmonic content. Thus, the form factor (ratio of peak to rms) is relatively constant, and the dc output of the quasi-peak capacitor-input rectifier-filter circuits, and the rms output from ac heater windings, are both regulated.

The time in the cycle at which L502 saturates and starts conducting depends on its previous magnetic history, as determined by the flow of reset current through Q501, which acts as a variable resistor. The amount of current it passes is determined by comparing a portion of a dc voltage, derived by rectifying the output from a special secondary winding, to a Zener reference diode, CR505. In operation, a sudden increase in line voltage causes a slight rise in the voltage between transformer terminals 16 through 18 (as well as all other terminals), so that a rise in the voltage out of CR510 and CR511 (the full-wave rectifier) is applied to a bridge consisting of CR505, R502, R504, R505 and R506. This increase in voltage across the bridge increases the drop from the plus side of CR505 to the tap of R505; the increased negative voltage at that tap is applied to the emitter of Q501, turning it on harder.

The increased reset current flowing in the collector circuit of Q501 causes the reactors to saturate later in the half cycles. Thus the line remains connected to the end of the transformer via L501 until later in the cycle. Consequently the transformer output voltage is reduced, thereby counteracting the effect of increased line voltage.

The primary of power transformer T501 is tapped, as mentioned above, for the preregulator. It is split to allow 230-V operation and in all other respects is conventional. The rectifier and filters are also standard.

4.4.3 POSTREGULATOR.

The three postregulators are relatively conventional series types. In all three, the series element is a "White" emitter-follower pair, having unity gain and low output impedance.

The 220-volt regulator employs a differential amplifier, Q533 and Q534/Q535, to compare the drop across the 20-V Zener diode, CR531, with the drop across a portion of the resistive divider, R544, R545, R546, R547 and R548. The use of thermistor R547 provides compensation against temperature-voltage drift. Capacitors C533, C535, and C536 provide the frequency roll-off control needed for stability of the feedback loop. The value of R552 is selected for optimum compensation of the output voltage against variations in input voltage.

The 30-V regulator is straightforward. The White emitter follower holds the output (collector of Q560) equal (except for base-to-emitter offset of Q561) to the voltage at the base of Q561; this voltage is determined by the 30-volt Zener diode, CR560. C561 is necessary to filter out some of the noise from CR560.

The -12.4-V regulator has the greatest requirements for regulation and ripple reduction. It furnishes the largest gain around the control loop. The -12.4-V output is compared with the voltage across 10-V Zener diode CR570 in the base-to-emitter circuit of Q573. Additional gain is supplied by Q572. C571 and C572 are roll-off filters required for stability of the feedback loop.

4.5 FRONT-PANEL ASSEMBLY.

4.5.1 GENERAL.

The front-panel assembly contains all the operating controls and meters used in the 1026 Signal Generator. In addition the audio amplifiers used to amplify the crystal-calibrator beat-output signal are located in this assembly.

4.5.2 AUDIO AMPLIFIER.

The audio-amplifier consists of three capacitively coupled, Class-A stages with a series audio gain control, R417. The output is taken at J412, the BEAT OUTPUT jack.

4.5.3 OUTPUT ATTENUATOR.

The output attenuator, A400, is a resistive step attenuator which controls the rf output from +20 dBm to -120 dBm in 10 dB steps. Since most of the resistors employed are small film types, the user should avoid connecting any source of power capable of delivering more than 1/4 watt to the rf output connector, J407.

The attenuator includes the input switching required to provide proper impedance characteristics and straight-through operation with zero insertion loss. After an impedance-matching 10-dB input section, the attenuator is a continuous 100-ohm ladder. This provides a 50-ohm output impedance since the output always sees the source and load segments of the ladder connected in parallel.

The extremely low VSWR of the output impedance (less than 1.05 over the whole frequency range) is due to close control of resistor values and of physical dimensions, as well as of the size and shape of the shield pockets in which the resistors are located.

At the output tap, special rotating shield members are used to prevent pickup of stray leakage from the input, which could reduce the accuracy of the attenuator at the extremely high maximum insertion loss of 140 dB. Resistors are aged and checked for stability to ensure long-term accuracy.

SECTION **5**

SERVICE AND MAINTENANCE

5.1 FIELD SERVICE.

The two-year warranty stated, attests the quality of materials and workmanship in General Radio Company products. When difficulties do occur, 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 the General Radio Company Service Department (see rear), giving full information about the trouble and any steps taken to remedy it. Be sure to mention the serial and type numbers of the instrument.

5.2 INSTRUMENT RETURN.

Before returning an instrument to General Radio for service, please write the 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 MINIMUM PERFORMANCE STANDARDS.

The following checks are intended as a relatively quick test of the ability of the 1026 to function in all modes. They should be performed any time the instrument's operation is suspect. Figure 5-1 illustrates the front panel operating controls of the 1026. Table 5-1 lists test equipment required in the performance of the checks. Successful completion of all checks is a strong indication of a sound instrument. Failure to perform minimally is indicative of specific faults in some cases, and the need for detailed trouble analysis in others.

5.3.1 CARRIER LEVEL CHECK.

This check will demonstrate the ability of the radio-frequency portions of the signal generator to deliver rated power, to matched loads, the accuracy of the CARRIER LEVEL metering circuit, and proper leveling action. Failure to perform satisfactorily on one or more frequency ranges, while obtaining proper operation, on others is an indication of trouble in the RF Assembly. Failure to perform properly on even a single range may be due either to the RF Assembly, the Modulator Assembly or the Power Supply. To perform the carrier level check, proceed as follows:

a. Connect test equipment as shown in Figure 5-2.

b. Set the POWER METER RANGE switch to 10 mW full scale. This corresponds to a full-scale input to the 20-dB attenuator of 1 W. Power readings referred to below are at the power meter itself; the actual power delivered by the signal generator is 100 x greater.

c. Set the signal generator controls as follows: Allow 30-minute warmup.

POWER	ON
MODULATION LEVEL	fully ccw to MOD OFF position
MODULATION SELECTOR	CW
OUTPUT RANGE	+20 dBm

d. Set the FREQUENCY RANGE switch, S101, for band I operation, as determined by illumination of the 9.5-22 MHz range scale. Tune the FREQUENCY control to 22 MHz. Advance CARRIER LEVEL control R405 cw until the CARRIER LEVEL meter, M402, reads +7 dBm. The power meter reading should be 5 mW ±0.5 mW.

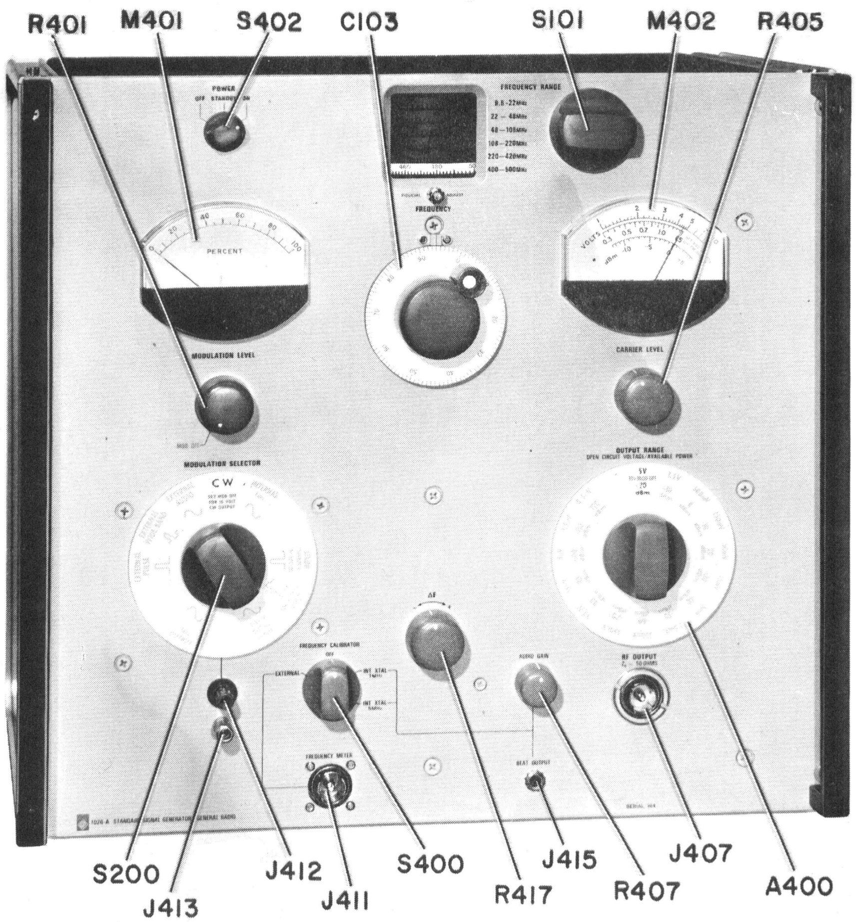


Figure 5-1. Front-panel controls and indicators.

TABLE 5-1
TEST EQUIPMENT-MPS

Equipment	*Manufacturer/Model*
Power Meter, rf	HP431B
6-dB Pad	GR874-G6L
20-dB Pad	GR874-G20L
3-dB Pad	GR874-G3L
Multimeter	Simpson 260
Digital Frequency Counter	GR1191-Z (500 MHz)
Oscilloscope	Tektronix 543
Audio Voltmeter	GR1346
Audio Oscillator	GR1309
Pulse Generator	GR1340
Video Detector	GR874-VQL
Coaxial 50-Ω load	GR874-W50BL
Coaxial Stub	GR874-D50L
Headphones	Telex

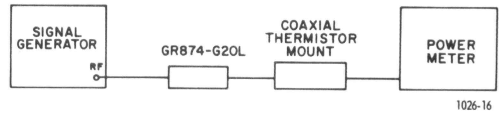


Figure 5-2. Test-equipment interconnections for carrier-level check.

e. Tune over Bands I (9.5-22 MHz), II (22-48 MHz), and III (48-108 MHz), and observe any variation in reading of the CARRIER LEVEL meter or of the external power meter. The CARRIER LEVEL meter should maintain a constant reading of +7 dBm, and the POWER meter reading should not vary more than ±0.5 mW from the value observed in step d.
f. Tune over BANDS IV (108-220 MHz), V (220-420 MHz) and VI (400-500 MHz). The CARRIER LEVEL meter reading should remain steady at +7 dBm, and the POWER meter reading should not vary more than ±1 mW from the value observed in step d.
g. Turn the MODULATION LEVEL control cw out of the MOD OFF position, and turn the CARRIER LEVEL control fully ccw. Using the 0.1 mW full-scale range on the POWER meter, check that the POWER METER reading is less than .05 mW.

5.3.2 POWER-OUTPUT CHECK.

This check will demonstrate the ability of the signal generator to deliver rated power to a mismatched load. Proceed as follows:
a. Connect the 874-D50L Stub to the OUTPUT and set 1026 controls as follows:

POWER	ON
MODULATION LEVEL	MOD OFF
MODULATION SELECTOR	CW
FREQUENCY CALIBRATOR	OFF
FREQUENCY RANGE	100-220 MHz
FREQUENCY	108 MHz
CARRIER LEVEL	+7 dBm meter reading
OUTPUT RANGE	+20 dBm

b. Tune the Stub over its entire range while watching the meter. It should not deviate from +7 dBm.

5.3.3 ATTENUATOR CHECK.

To check the OUTPUT RANGE selector (step attenuator A400), proceed as follows:
a. Set up test equipment and signal generator as described in 5.3.1 steps a through c.
b. Set the FREQUENCY RANGE switch, S101, for Band IV operation, as determined by illumination of the 108-220 MHz range scale. Tune the FREQUENCY CONTROL to 120 MHz. Advance CARRIER LEVEL control, R405 cw until the POWER meter reads 5.00 mW (approximately +7 dBm on the CARRIER LEVEL meter).
c. Reduce the output of the signal generator in two successive 10-dB steps by means of the OUTPUT RANGE selector, and increase the power meter full-scale sensitivity by corresponding 10-dB steps. The meter pointer should remain at the midscale setting of step b within 0.2 dB.
d. Restore the power meter to 10 mW full-scale sensitivity, leaving the OUTPUT RANGE selector set to 500 mV/0 dBm, and remove the 20-dB attenuator from the test setup. The power-meter reading should still be close to 5 mW. Reset the CARRIER LEVEL control to obtain a power meter reading of exactly 5 mW, and repeat step c above.
e. Check the remaining OUTPUT RANGE selector steps by placing the POWER switch in STANDBY and, with the ohmmeter, measuring the dc resistance looking into the RF OUTPUT jack. As the OUTPUT RANGE selector is switched to each setting, the resistance reading should be 50 ±0.5 Ω. Any significant departure from this resistance indidates that the attenuator has been damaged.
f. Connect the power meter (without the 20-dB pad) to the FREQUENCY METER jack, with the FREQUENCY CALIBRATOR switch in the EXT position and a frequency of 50 MHz selected on the FREQUENCY dial. The power meter should read between 2.5 and 10 mW.

5.3.4 FREQUENCY AND CRYSTAL CAL. CHECK.

The frequency calibration of the instrument can be checked by means of the internal crystal calibrator at each 1-MHz and 5-MHz point. Alternatively, a 500-MHz frequency counter such as the GR Type 1191-Z can be used to check any frequency. This check should be performed after the instrument has been allowed to warm up for at least one hour. To check frequency calibration, using the internal crystal calibrator, proceed as follows:
a. Plug headphones into BEAT OUTPUT jack and set controls:

MODULATION SELECTOR	CW
FREQUENCY CALIBRATOR	INT XTAL, 5 MHz
FREQUENCY RANGE	9.5 - 22 MHz
CARRIER LEVEL	−10 dBm

NOTE

It is important to use the lowest setting of the audio gain control that gives adequate output of the desired beats. In addition to the desired beats, there are normally many subsidiary beats that are somewhat weaker, and these may be confusing if excessive audio gain is used. Generally, the higher the carrier frequency to be checked, the higher the audio gain required.

b. Tune FREQUENCY control until a strong beat note is obtained near a dial reading of 15 MHz. With the frequency set to produce near zero beat, adjust the fiducial adjust knob to make the dial read exactly 15 MHz.
c. Switch the FREQUENCY CALIBRATOR to INT XTAL 1 MHz. The beat should be essentially unchanged except in loudness. Tune over the 9.5-22 MHz range, observing dial readings for zero beat in the vicinity of each integral MHz dial reading. The presence of weaker beats at 0.5 MHz and 0.33 MHz intervals is normal.
d. Repeat checks of dial on higher frequency ranges using 5-MHz position of FREQUENCY CALIBRATOR. Readjustment of the FIDUCIAL should not be required after range change, but at least five minutes stabilizing interval should be allowed prior to proceeding with measurements. Slight improvement in dial accuracy over an entire range may be obtained by readjustment of the FIDUCIAL, near the center of range in use.

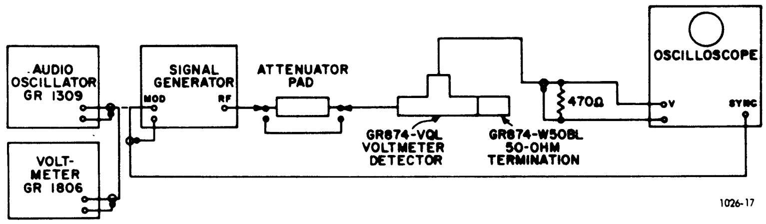


Figure 5-3. Test-equipment interconnection for modulation checks (other than pulse).

e. The crystal–calibrator frequency accuracy can be checked by connecting a GR Type 1191 Counter to the FREQUENCY METER jack, setting the POWER switch to STANDBY, and the FREQUENCY CALIBRATOR switch to INT XTAL, 1 MHz. The counter should read between 999990 and 1,000.010 kHz.

5.3.5 INTERNAL 1-kHz MODULATION.

To check for proper operation of the audio modulation circuits, internal modulator, and modulation meter, proceed as follows:

a. Connect test equipment as shown in Figure 5-3, omitting the Oscillator.

b. Set 1026 controls as follows:

Power	ON
MODULATION SELECTOR	CW
FREQUENCY CALIBRATOR	OFF
FREQUENCY RANGE	22-48 MHz
FREQUENCY	35 MHz
CARRIER LEVEL	1.5 V
OUTPUT RANGE	+10 dBm

c. Set oscilloscope controls as follows:

Input	DC
Trigger	EXT
Input Attenuator	As appropriate
Sweep Time	0.5 ms/cm

d. With a 20-dB pad in the circuit, and the MODULATION SELECTOR at CW, adjust the oscilloscope attenuator for a deflection of at least 2 cm when the POWER SWITCH is turned from STANDBY to ON, and set the trace with the signal generator ON to a midscale position. Remove the 20-dB pad, switch the MODULATION SELECTOR to INTERNAL 1 kHz, and increase the MODULATION LEVEL control until the negative peaks of the detected 1-kHz envelope just reach the midscale reference on the oscilloscope screen. The modulation-level meter should read between 85 and 95%.

e. Repeat step d using a 3-dB pad. The modulation level meter should read between 26 and 32%.

f. Repeat step d using a 6-dB pad. The modulation level meter should read between 47 and 53%.

g. With 30% modulation applied, as in e, set oscilloscope controls for a display of the detected 1-kHz signal, positive and negative peaks equally displayed from the midscale reference line, and horizontal position adjusted so that all zero crossings coincide with 0.5 ms horizontal graticule marks. Coincidence is evidence that the internal modulation oscillator is operating at exactly 1 kHz.

For a more accurate check, connect the Counter to J412 and J413. Set the counter to measure PERIOD. The counter should read between 995 and 1005 μs.

5.3.6 EXTERNAL AUDIO MODULATION.

To check modulator frequency response and high-frequency modulation capability, proceed as follows:

a. Connect test equipment as shown in Figure 5-3, including the oscillator but omitting the 20-dB pad. Set the 1026 controls as follows:

POWER	ON
MODULATION SELECTOR	EXTERNAL AUDIO
FREQUENCY CALIBRATOR	OFF
FREQUENCY RANGE	22-48 MHz
FREQUENCY	35 MHz
CARRIER LEVEL	1.5 V
OUTPUT RANGE	+10 dBm

b. With the oscillator tuned to 1 kHz, increase 1309 output to obtain a 5.0 V reading on the voltmeter, and increase the MODULATION LEVEL control on the 1026 to obtain a meter indication of 70%. Adjust the oscilloscope so that the negative modulation peaks just touch the midscale reference on the oscilloscope face.

c. Tune the 1309 to 10 kHz, and readjust its level so that the negative modulation peaks just touch the midscale reference on the oscilloscope. The MODULATION LEVEL control of the 1026 must not be readjusted. The 1806 reading should be between 4.75 and 5.25 V, and the waveshape of the negative peaks should be free of any evidence of clipping.

5.3.7 EXTERNAL WIDE BAND MODULATION.

a. Connect test equipment as shown in Figure 5-3, including the oscillator but omitting the 20-dB pad.

Set the 1026 controls as follows:

POWER	STANDBY
MODULATION SELECTOR	EXTERNAL WIDE-BAND
MODULATION LEVEL	CCW, but not to MOD OFF
FREQUENCY CALIBRATOR	OFF
FREQUENCY RANGE	220-420 MHz

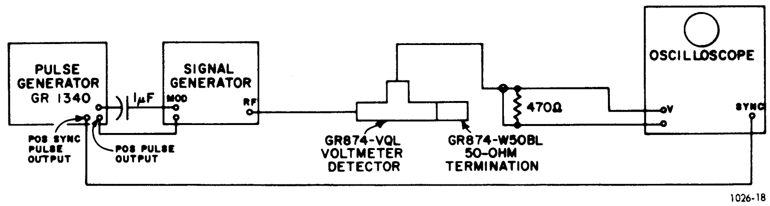


Figure 5-4. Test-equipment interconnection for pulse modulation checks.

FREQUENCY	420 MHz
OUTPUT RANGE	+10 dBm
CARRIER LEVEL	−1 dBm

b. Set oscilloscope sweep at 1 μsec/cm and gain for a 4 cm vertical deflection, when the POWER switch on the 1026 is moved from STANDBY to ON.
c. Set the oscillator to SQUARE WAVE at 100 kHz, and adjust its output for a voltmeter reading of 3 V. Increase the MODULATION LEVEL control of the 1026 until an oscilloscope deflection of 2 cm, peak-to-peak, is observed.
d. The rise and fall times of the square wave seen on the oscilloscope should be less than 1 μsec.

5.3.8 PULSE MODULATION.

To check for satisfactory operation of the pulse–modulation circuits, proceed as follows:
a. Connect test equipment as shown in Figure 5-4. Set the 1026 controls as follows:

POWER	ON
MODULATION SELECTOR	CW
MODULATION LEVEL	CCW, but not to MOD OFF
FREQUENCY CALIBRATOR	OFF
FREQUENCY RANGE	220-420 MHz
FREQUENCY	420 MHz
OUTPUT RANGE	+10 dBm
CARRIER LEVEL	−1 dBm

Set the pulse generator controls as follows:

PRF	1 kHz
PULSE DURATION	50 μs
AMPLITUDE	Maximum

b. Adjust the oscilloscope to trigger and produce a 10 μsec/cm sweep, using dc-coupled input, and adjust vertical gain to produce a base line shift of 4 cm, or similar convenient amount, when generator POWER switch is momentarily set to STANDBY. Center the base line with the generator POWER switch ON.
c. Turn MODULATION SELECTOR switch to EXTERNAL PULSE. The CARRIER LEVEL meter reading should drop to -13 dBm, or less.

Increase the MODULATION LEVEL control until the CARRIER LEVEL meter again reads about -1 dBm, and increase MODULATION LEVEL control about 30° further. The CARRIER LEVEL meter reading should remain unchanged with this further setting of the MODULATION LEVEL control. Pulses of approximately 50-μs duration should now be visible on the oscilloscope. Relatively slow transients, associated with stabilization of the pulse amplitude when pulsing is first initiated, are normal.
d. Readjust the CARRIER LEVEL control until the top of the pulses coincides with center of the screen, this being the CW amplitude reference established in b above. The CARRIER LEVEL meter reading should be between -2 and 0 dBm.
e. Reset the oscilloscope sweep to 500 μs/cm, and reduce the pulse generator rate to 500 pulses per second, as determined by a 4-cm spacing between pulses on the scope.
f. Reduce the pulse generator PULSE DURATION to 1 μs. Reset the oscilloscope to a 1 μ s/cm sweep speed, and repeat the check of step d above.

5.4 BASIC TROUBLE ANALYSIS

The first step in trouble shooting the 1026 Signal Generator is to identify the major section responsible for the particular problem. The generator consists of four major sections, each of which is described in a separate schematic diagram. In the block diagram of the complete generator (Figure 6-1), each major section is enclosed by a separate dashed outline.

The first three sections are independent plug-in modules which are supported and interconnected by the panel assembly. It will frequently be possible to determine the area of difficulty, even prior to removal of the cabinet, based on symptoms described in the Trouble Analysis Chart, Table 5-2.

In general, it should be recognized that if the generator operates satisfactorily on one or more frequency ranges, and in all modulation modes on these ranges, the problem is in the RF Assembly. If the generator operates satisfactorily on all rf ranges in the CW position of the MODULATION SELECTOR, but is unsatisfactory in one or more of the other positions of the MODULATOR SELECTOR, the problem is in the MODULATOR assembly, or possibly in the Modulator Output Amplifier, which is located in the top compartment of the RF Assembly. If the generator does not operate satisfactorily on any rf range in the CW position of the MODULATION SELECTOR, the problem may be either in the POWER SUPPLY assembly or in the MODULATOR assembly; a check of power–supply voltages should quickly determine which assembly is at fault.

Table 5-2

TROUBLE ANALYSIS CHART

Symptom	*Probable Cause*	*Remedy*
Frequency Range Lights do not light: a. All six ranges inopera-tive. b. Some ranges operative. c. Lights unduly bright.	 No power to instrument, power switch OFF, fuses blown, or internal cable disconnected. Dial light burned out Defective Power Supply Pre-regulator.	 See paragraph 5.6.15.
Frequency of RF Carrier is substantially dif-ferent than shown on dial: a. Pronounced error at high-frequency ends of ranges; measured fre-quency high. b. Significant error at high end of one range. c. Significant error over an entire range. d. Significant errors over all ranges, consistent in sign.	 Shorting link or other re-turn circuit not connected between pins 1 & 2 of SO414. Oscillator trimmer incorrectly set. Oscillator coil incorrectly adjusted. Dial fiducial not adjusted correctly. Dial installed incorrectly. Frequency drive has slipped.	 See Figure 1-2. See paragraph 3.4.3.
Crystal Calibrator Intervals incorrect: a. 5-MHz and 1-MHz positions of FREQ CALIBRATOR switch. b. Either 1-MHz or 5-MHz position of CALIBRATOR switch is OK'	 Crystal oscillator or block-ing oscillator defective. Blocking oscillator improper-ly adjusted (R412 or R414).	 See paragraph 5.6.14.
Crystal Calibrator No beat output: a. No noise from head-phones with audio gain turned up. b. Noise, but no beats.	 Defective headphone amplifier. Defective blocking oscilla-tor preamplifier.	
CARRIER LEVEL Meter Does not read, CW setting of MODULATION SELECTOR: a. All six ranges.	 POWER switch at STAND BY CARRIER LEVEL control fully ccw. Defective power supply. Defective modulator. Defective oscillator tube. Damaged contacts. Improper indexing of turret.	 Turn POWER switch to ON. Turn CARRIER LEVEL control cw. See paragraph 5.8. See paragraph 5.7. See paragraph 5.6.4. See paragraph 5.6.6. See paragraph 5.6.10.

Table 5-2 (cont)

TROUBLE ANALYSIS CHART

Symptom	*Probable Cause*	*Remedy*
b. One range only. c. Drops out over part of one range.	Damaged coil. Damaged coupling network. Damaged trimmer capacitor. Misaligned coil or trimmer. Damaged coupling network.	
CARRIER LEVEL Meter Reading for fully ccw setting of CARRIER LEVEL control is less than + 7 dbm with MODULATION SELECTOR at cw position:	MODULATION LEVEL control not at fully ccw "MOD OFF" position. Excessive load VSWR (short-circuit output) with OUTPUT RANGE at +20 dBm position. Misaligned coil or trimmer. Weak or defective tube. Defective modulator or modulator output amplifier.	This should only cause trouble at the low end of the 100–220-MHz frequency range.
CARRIER LEVEL Meter Reading varies with setting of MODULATION LEVEL control: a. MODULATION SELECTOR in EXTERNAL AUDIO or EXTERNAL WIDE BAND positions. b. MODULATION SELECTOR in EXTERNAL PULSE position.	Modulation input contains dc. Excessive modulation; if unusual waveform, this can occur for on-scale readings of MODULATION LEVEL meter. Sharp transition from −13 dBm, or less, to on-scale reading is normal as MODULATION LEVEL control is increased.	Add external blocking capacitor, if effect is undesirable.
CARRIER LEVEL Meter Reads, but no RF OUTPUT: a. at +20 dBm setting of OUTPUT RANGE b. OK at high-output settings, but sudden drop between two steps.	Defective cable from RF Assembly to OUTPUT RANGE selector. Attenuator resistors damaged.	
CARRIER LEVEL Meter Reading jumps by 6 dB when MODULATION LEVEL control is switched to MOD OFF: Reading drops when switching MODULATION SELECTOR from CW to EXT WIDEBAND.	This is normal in CW, INTERNAL 1 kHz, EXTERNAL AUDIO, and EXTERNAL WIDE BAND positions of MODULATION SELECTOR This is normal, expecially at lower CARRIER LEVEL settings.	
MODULATION LEVEL Meter Will not read: a. INTERNAL 1-kHz position of MODULATION SELECTOR.	MODULATION LEVEL control not turned up. Defective Audio oscillator.	Check for 1-kHz output at MODULATION terminals.

Table 5-2 (cont)

TROUBLE ANALYSIS CHART

Symptom	*Probable Cause*	*Remedy*
b. EXTERNAL AUDIO position of MODULATION SELECTOR.	External source not delivering sufficient input to generator, or MODULATION LEVEL control not turned up. Defective modulator board.	
c. EXTERNAL PULSE and WIDEBAND positions of MODULATION SELECTOR.	This is normal.	
MODULATION LEVEL Meter Reads incorrectly:		
a. EXTERNAL AUDIO position of MODULATION SELECTOR.	Dc component on input modulation signal. Nonsinusoidal input signal.	
b. INTERNAL 1-kHz position of MODULATION SELECTOR.	Incorrect adjustment of R309 or R325.	If error is much larger at low CARRIER LEVEL settings than at full output readjust R309. See paragraph 5.7.5.
MODULATION LEVEL Meter Overmodulation occurs with on-scale reading.		
a. EXTERNAL AUDIO position of Modulation Selector	This may occur with non-sinusoidal input waveforms, or with dc superposed on input modulation signal.	
b. EXTERNAL WIDE BAND position of MODULATION SELECTOR.	Meter does not read in this mode.	
c. INTERNAL 1 kHz position of MODULATION SELECTOR.	If pronounced at low settings of CARRIER LEVEL control % MOD Adjustment, R309. probably set incorrectly.	

5.5 DISASSEMBLY PROCEDURES.

5.5.1 REMOVAL FROM CABINET.

Figure 5-5 illustrates the 1026 removed from the cabinet. Prior to removing the 1026 from the cabinet, disconnect the power cord at the rear and all external connections on the front panel.

WARNING

Once the 1026 is removed from the cabinet, dangerously high voltage is exposed at several points.

Remove the 1026 from the cabinet as follows:

a. Remove the four panel screws behind the handles.

b. Place the instrument on the bench on its handles, so that the front panel is horizontal.

c. Remove the screws along each edge at the rear of the cabinet.

d. Pull the cabinet off the 1026, and disconnect the internal power cord, attached to the rear of the cabinet, from PL417, the receptacle at the rear of the panel assembly.

e. Place the cabinet in a safe place.

CAUTION

All normal service adjustments and tube replacements are possible without removing any of the major assemblies.

5.5.2 REMOVAL OF RF ASSEMBLY.

a. First, disconnect PL410 from J410. PL410 is on the rigid coaxial cable that extends from the rear of the FREQUENCY CALIBRATOR switch. Use a 5/16-in. open-end wrench on the large hollow nut, while restraining the cable from turning by holding the small hexagonal ferrule with a 5/32-in. open-end wrench. Withdraw PL405 (on the

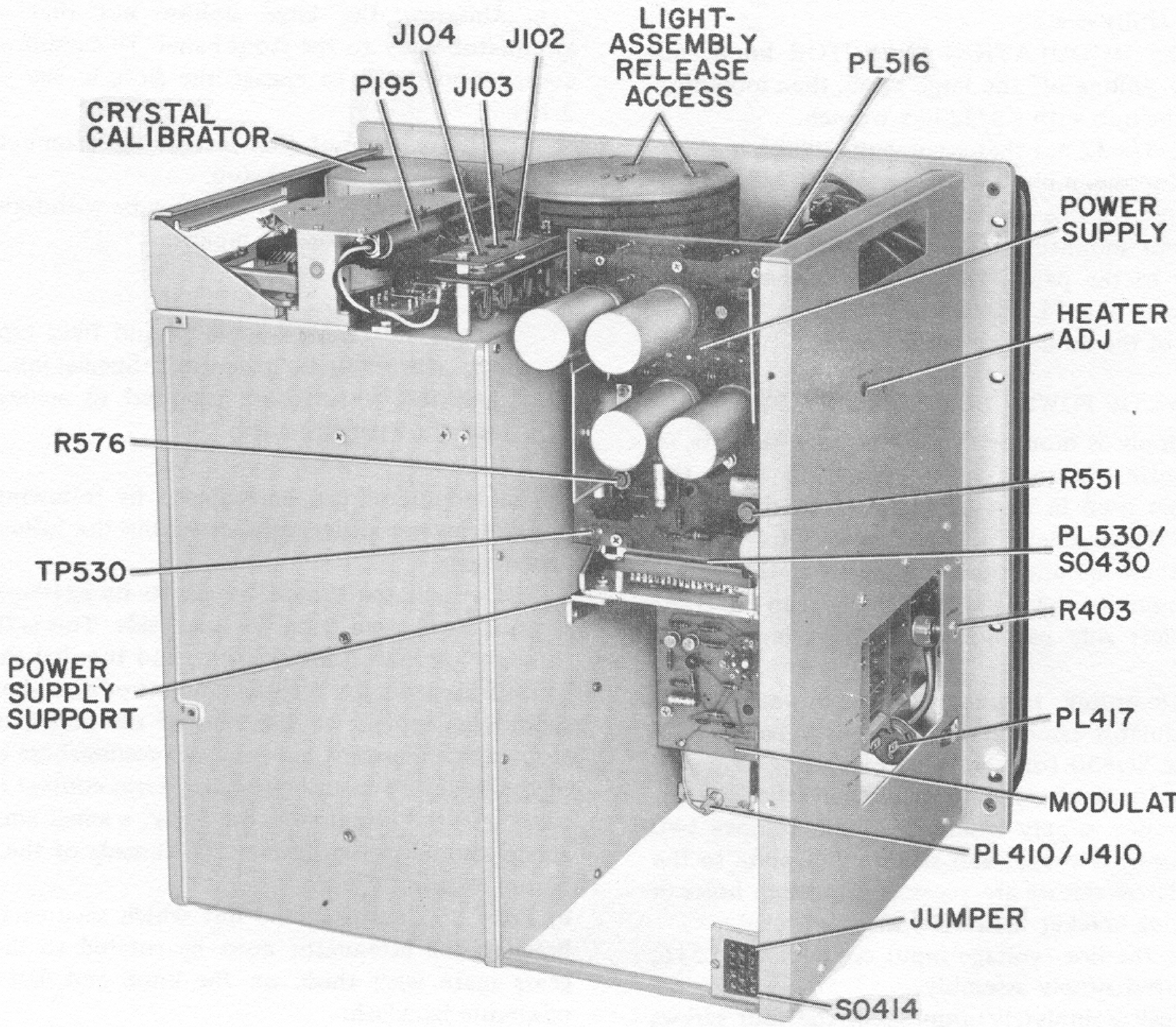


Figure 5-5. Interior rear view with cabinet removed.

end of the rigid coaxial cable from the attenuator) from J105 using the same procedure. Unplug multipin connector J400 from PL100, mounted on the front of the RF Assembly.

b. Remove the two 10-32 screws on the left shield cover, which secure the bracket that joins the left side pan to the RF Assembly. Remove, from the main power-supply support bracket, the pair of screws that secures the small angle bracket extending over to the shield cover of the RF Assembly. See Figure 5-5.

c. Record the setting of the 0-100 vernier FREQUENCY dial at the low-frequency (cw) stop position prior to removal of the RF Assembly, in order that the dial can be replaced in the same position on the shaft after reassembly. Readings of this dial are used in various test procedures. The nominal reading (to which most instruments are assembled) is 82, and this setting can be used at reassembly, if the actual original setting was not recorded.

d. Remove the FREQUENCY knob and 0-100 vernier dial assembly (only after recording its position as described above) by pulling it straight off, then loosening the setscrew in the hub with a 3/32-in. hex wrench.

e. Remove the small indicator just above the FREQUENCY shaft.

f. Remove the six large screws at the center and right side of the panel that secure the casting to the front panel, and pull the casting away from the panel, being careful to avoid damage to the rigid cable.

Upon reassembly, follow above steps in reverse order, being careful to engage the pin from the FIDUCIAL ADJUST knob in the fork of the dial–illuminator assembly just prior to mating the panel to the casting. Silver–bearing grease should be used between the inner ferrule and the 5/16-32 hollow nut on the connectors on the rigid cables, in order to minimize rf leakage. These connectors must be tightened with small open-end wrenches, as finger tightness is inadequate for control of rf leakage. Use a 5/32 wrench on the ferrule to prevent cable twisting while tightening the large nut with a 5/16 wrench.

5.5.3 REMOVAL OF MODULATOR ASSEMBLY.

a. Set the MODULATION SELECTOR switch to INTERNAL 1 kHz (fully ccw).

b. Remove the MODULATION SELECTOR knob and dial assembly by pulling off the large knob, then loosening the setscrew in the hub with a 3/32 hex wrench.

c. Remove the 3/8-32 nut that secures the switch bushing of the modulator assembly to the panel. A 1/2 socket wrench is preferred for this operation.

d. Remove four mounting screws that secure the modulator assembly to the panel, and pull the assembly out, thereby disengaging plug PL220 from SO420.

Replacement of the modulator is the reverse.

5.5.4 REMOVAL OF POWER SUPPLY ASSEMBLY.

The power supply is mounted on four shock mounts, in order to minimize transmission of vibration from the saturable reactors used in the preregulator, to the tuning elements of the signal generator. The power supply can be removed from these mounts, and thence from the instrument without removing the main bracket between the front panel and the left side pan to which these mounts are secured.

a. Before attempting to remove the power supply, remove the modulator assembly as described in para. 5.5.3.

b. Disconnect SO430 (on the cable extending from the panel) from PL430, the bottom edge of the vertical circuit board of the power supply assembly. First, remove two screws that secure the socket and strain relief plate to the power supply. These screws are accessible through holes in the main mounting bracket. Withdraw the connector.

c. Disconnect the line–voltage input connector, PL516, on top of the power supply assembly.

d. Loosen, until completely unmeshed, the four screws that secure the shock mounts to the power–supply assembly. Access is through the holes in the main bracket, just beneath the center of each shock mount; the screws are captive mounts.

e. Spring the left side pan of the instrument slightly to remove the power supply. If difficulty is encountered, it may be desirable to loosen the side pan.

Replacement of the power supply is accomplished in reverse order. If the main bracket has been removed, dress the branch of the cable which includes SO434 on the top left side of the bracket (as viewed from the rear of the instrument), nesting between the shock mounts and the vertical wall of the bracket. If left dangling below the shelf of the bracket, it will not reach to mate with PL530 on the power supply.

5.5.5 REMOVAL OF ATTENUATOR.

a. Begin by disconnecting the rigid cable that extends from the attenuator body. First loosen the cable clamps adjacent to the mounting bosses of the casting and disengage the cable from them. Next, use a 5/16 open-end wrench to unthread the hollow nut that secures the cable ferrule to the attenuator body. Withdraw the cable with care, since the small center contact button is delicate.

b. Remove the RF Assembly as described in para. 5.5.2, except that the PL405/J105 cable connection need not be opened up.

c. Unscrew the large hollow nut that secures the attenuator body to the front panel. This requires the use of a spanner wrench to engage the slots in the nut. (Figure 5-18).

d. Remove the nut that secures the attenuator antiturn bracket to the front-panel stud.

The attenuator assembly can now be withdrawn from the panel and returned for any repairs.

CAUTION

Under no circumstances should field repair of the attenuator be attempted. Special jigs, tools, and test fixtures are required to achieve the specified performance.

The attenuator can be replaced by following the above steps in reverse order, and observing the following special precautions:

a. The attenuator should be set to its extreme cw detent position, as viewed from the panel side. This is the "straight through" or +20 dBm position, and the dial should be set to read accordingly. A small amount of silver-bearing grease should be applied to the rear of the panel, immediately around the mounting hole and the counterbore on the front of the panel, to insure good long-term contact between the panel and the attenuator. Similarly, a small amount of this grease should be applied to the threads of the hollow nut before engaging them.

b. Prior to tightening the nut which secures the antiturn bracket, the attenuator must be rotated so that the drive gears mate with those on the knob and dial shafts with minimum backlash.

c. Extreme care must be exercised when mating the coaxial cable with the attenuator. Be certain that the center contact button on the cable is straight and true, otherwise the attenuator may be seriously damaged. Apply silver-bearing grease to the outer sholder of the cable ferrule, and to the threads of the hollow nut to assure good long-term contact.The cable should be inserted until the ferrule seats firmly, then the nut should be tightened securely with an open-end wrench. Finger tightening is inadequate and will result in severe rf leakage.

5.5.6 REMOVAL OF FREQUENCY CALIBRATOR.

It is first necessary to remove the rf assembly as described in para. 5.5.2.

a. Unsolder connecting wires, since this assembly is not equipped with multicontact connectors.

b. Next, remove the FREQUENCY CALIBRATOR switch knob, remove the bushing after loosening the setscrew.

c. Remove the four screws that secure the FREQUENCY METER connector to the front panel, and the one that secures the etched–circuit mounting post. Remove the 3/8-32 nut that secures the FREQUENCY CALIBRATOR switch bushing to the panel; a 1/2 socket wrench is preferred.

Reassembly is the reverse of the above procedure.

5.6 RF ASSEMBLY SERVICING.

5.6.1 R. F. ASSEMBLY TROUBLE ANALYSIS.

Make sure that the difficulty is in the rf assembly before removing any shield covers or attempting to reset any adjustments. Refer to para. 5.4 and Table 5-2 for basic trouble analysis procedures. Check all power-supply voltages before proceeding further. Most difficulties in the rf assembly will be manifested by inability of the generator to maintain a constant reading of the CARRIER LEVEL METER with tuning, when the MODULATION SELECTOR is set to the CW position. If rf trouble is suspected, check this characteristic as in para. 5.3.1 through 5.3.4.

Specific symptoms and probable causes of troubles in the rf assembly are shown in Table 5-3. When a problem occurs on one or two frequency ranges, but not on all six, it is usually in the rf assembly. In order to correct such difficulties it is necessary to localize the trouble. If problems exist on several frequency ranges, they are very probably due to degradation of a tube, whereas if they are confined to a single frequency range, they are more likely due to a poor contact or a passive component. In either event it will be necessary to determine the particular stage at fault, and then which component.

There are many contacts in the RF Assembly, all of which must have low resistance in order that the instrument work properly. If unstable or erratic performance can be improved by rotating the range–selector switch, or by exerting end pressure on the turret shaft, contacts are prime suspects. If the generator has been operated on a single tuning range for a protracted period, it may be possible to clean the offending contact satisfactorily by operating the range–selector switch a few times. For contact cleaning and servicing instructions, refer to para. 5.6.5 and 5.6.6.

One of the most important diagnostic tools in the localization of trouble to a particular stage is the measurement of tube plate currents and power–amplifier voltage in para. 5.6.2. These measurements are readily performed and will usually disclose which particular stage is at fault.

5.6.2 CURRENT AND BIAS MEASUREMENTS.

J101–J104 and TP101 simplify the measurement of the plate currents of all vacuum tube stages, and the bias applied by the automatic–level–control circuit to the output–amplifier stage. The currents and bias depend on the frequency range in use, and the particular frequency to which the generator is tuned within that range. Typical characteristics are shown in Figures 5-6 through 5-10.

Measurements should be made with controls set as follows:

POWER	ON
MODULATION LEVEL	MOD OFF
MODULATION SELECTOR	CW
FREQUENCY CALIBRATOR	OFF
CARRIER LEVEL	+7 dBm METER READING
OUTPUT RANGE	0 dBm

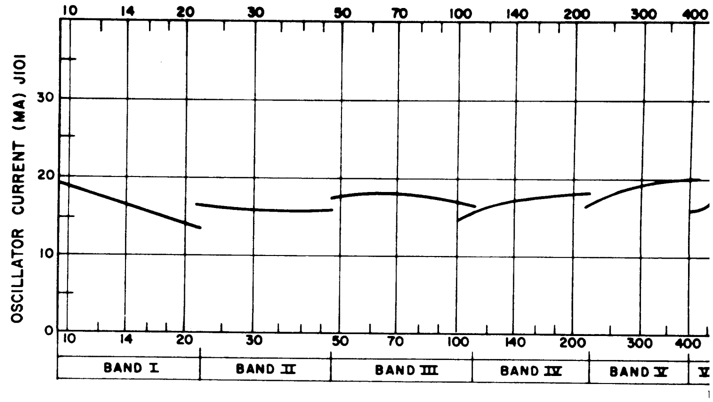


Figure 5-6. Typical oscillator plate currents. Variations of ±20% are acceptable.

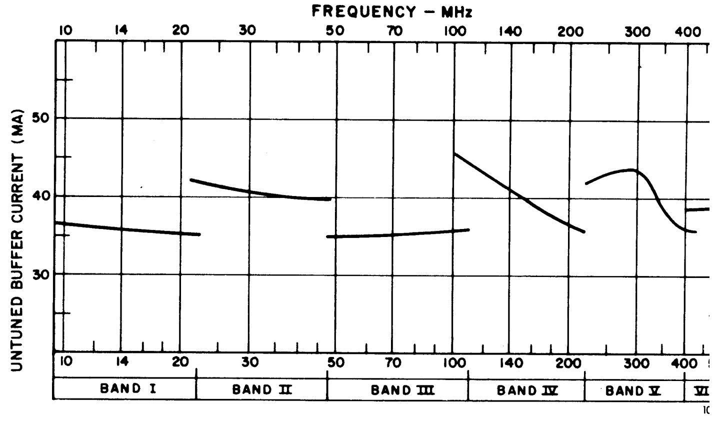


Figure 5-7. Typical untuned buffer plate currents. Variations of ±10% are acceptable.

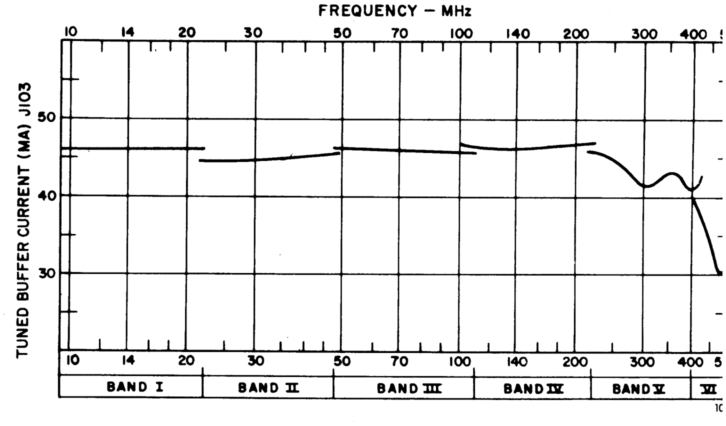


Figure 5-8. Typical tuned buffer currents. Acceptable variations: ±10% on Bands I - IV, ±15% on Band V, ±25% on band VI.

Table 5-3
RF ASSEMBLY TROUBLE ANALYSIS CHART

Symptom	*Probable Cause*
Carrier Level Meter reading changes with tuning within a single band	Defective tube or turret contact; defective turret component. Check currents and bias to localize difficulty.
CARRIER LEVEL meter reads but no output from RF OUTPUT JACK, J407.	a. Defective coaxial cable PL405 to PL406; b. Defective attenuator
CARRIER LEVEL meter reading does not respond to carrier-level control setting (all bands)	a. If output is high, output monitor diode CR171 may be defective. b. If output is low, check modulator and power supply.
CARRIER LEVEL meter does not read, but large RF Output is delivered with Output Range selector in + 20 dB position.	Monitor diode CR171 or detector preamplifier is defective if voltage at PL100 pin #7 is negative. If voltage at base of Q265 is also negative, replace diode; if positive, check Q265, Q266 and FL271.
Modulation of carrier at 0.5 to 1-MHz rate when in CW mode, usually near high-frequency end of ranges IV, V, or VI.	Defective oscillator tube V101, especially if plate current at J101 drifts slowly after tuning to new frequency.
Frequency is several percent high at high-frequency end of all ranges.	Check that jumper or external control bias is connected between pins 1 & 2 of SO414.
Frequency is several percent low at high-frequency end of all ranges.	Varactor diode CR101 shorted.
Frequency is incorrect over all tuning ranges; frequency stop not positive at both ends of dial travel.	Dial Drum incorrectly installed. Worm gear on main capacitor shaft slipped.
Frequency is in error at high end only of one of ranges I-IV.	Oscillator turret trimmer incorrectly aligned (piston trimmers C111-C114).
Frequency is in error at high end of all ranges.	Oscillator guillotine capacitor trimmer incorrectly aligned. (C105 or C118).
Frequency is in error by constant percentage over one range.	Inductance trimmer of oscillator coil of that range set incorrectly.
Excessive Tuning backlash.	Possibly due to creep of ball retaining cage; tune the generator once from stop to stop.
No plate current at J101, J102, J103 or J104.	No B+ voltage due to defective power supply; check B+ voltages at J101, J102, J103, J104.
No plate current at J101, J103 or J104, but normal at J102	Turret shaft improperly detented.

Table 5-3 (cont)
RF ASSEMBLY TROUBLE ANALYSIS CHART

Symptom	*Probable Cause*
No plate current at J101, all bands.	No B+ voltage due to defective power supply; voltage at J101 should be +180 to +220 V. Defective oscillator tube V101; if heater is open voltage at pin 14 of SO430 will be −12.4 V; −6.3 normal.
No plate current at J102.	No B+ voltage due to defective power supply. Voltage at J102 should be +220 V. Open heater on V120 or V121; replace both tubes.
Plate current at J102 is one-half normal or less, all bands.	V120 or V121 defective. Replace both tubes.
Plate current at J102 shows no increase when power switch moved from STAND-BY to ON.	No oscillator output. Defective contacts to oscillator turret if true of only some bands; defective oscillator tube if true on all bands.
No plate current at J103.	No B+ voltage due to defective power supply. Voltage at J103 should be +230 to +260 V.
Plate current at J103 is one-half normal, or less, on all bands.	V141 or V142 defective.
No plate current at J104.	No B+ voltage due to defective power supply. Voltage at J104 should be +230 to +260 V. Overload sensing lamp P195 burned out. Check for presence of plate voltage at AT180. Excessive bias at TP101 ($\simeq$ +30 V). If voltage of $\simeq$ +26 V at PL100 pin #11 or at FL251, check modulator. If $\simeq$ +20 V, check modulator Output Amplifier circuit located in rf assembly (Q251-254).
Steady plate current at J104 when tuned far into TUNE region of bands V or VI never reaches 60 mA.	V171 or V172 defective. P195 positioned incorrectly.
Bias at TP101 is low at high frequency end of one range	Trimmer capacitor incorrectly set. If frequency is incorrect, trouble is probably on oscillator turret; if correct, on buffer or amplifier turret. Output contacts c & d on one or more turrets may be weak.
Bias at TP101 is either very low or very high at high-frequency end of one range.	Output link circuit on one turret may be defective. Check all components in link circuits of affected band.
Bias at TP101 low at low frequency end of ranges V or VI	Poor contact between range coil on one turret and guillotine tuning capacitor, resulting in mistracking.
Sharp suckout in output or drop in TP101 bias with tuning on one band (bands II-V)	Improper mating of B+ contacts on coil of next lower frequency range.

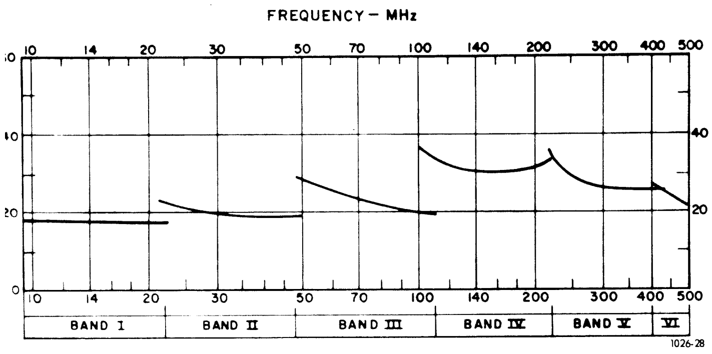


Figure 5-9. Typical power-amplifier plate currents for +27-dBm output into 50 ohms. Variations of ±20% acceptable.

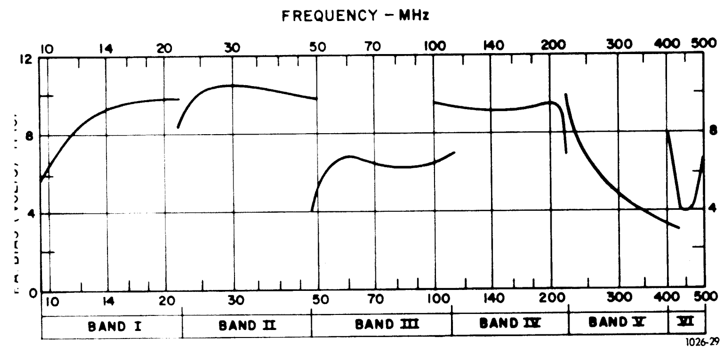


Figure 5-10. Typical power-amplifier bias voltages for +27-dBm output into 50 ohms. Variations of ± 25% acceptable.

Current variations of ±25% from the typical values are normal, and bias voltage variations of ±25% are normal. Sudden variations of bias or current with tuning, or instability after tuning to a new frequency are abnormal, and the general shape of bias or current vs frequency characteristics should be that shown in Figures 5-6 through 5-10. Troubles in one stage will generally be reflected in the currents of that and all subsequenct stages. Refer to Table 5-3 for analysis of symptoms.

5.6.3 REMOVAL OF SHIELD COVERS.

Removal of the right–hand shield cover gives access to all tubes and alignment adjustments. This cover does not have to be in place during any alignment operation; its sole function is to suppress r.f. leakage.

The right–hand shield cover can be removed from the RF Assembly as soon as the instrument has been removed from its case as in para. 5.5.1. Removal from the panel is not required. To remove the cover, remove all exposed screws.

When replacing the shield cover, the double row of spring contact fingers should be at the top of the casting. Apply a light coating of silver–loaded conductive grease, to the entire machined face of the casting. Although the signal generator may appear to function normally with only a few screws installed, it is necessary to secure all seventeen cover screws if minimum r-f leakage is to be achieved.

Removal of the left shield cover gives access to the drive mechanism for the tuning capacitors, and to several of the supply voltage rf filter and B+ feed elements. After removing the instrument from its case (see para. 5.5.1), remove the rf assembly from the panel as in para. 5.5.2, and remove all exposed screws from the cover to release it.

If both shield covers have been removed, be sure to replace the shorter cover with the large tapped holes on the left side of the casting. One pair of tapped holes, located near the corner of this cover, must end up at the lower left rear corner of the casting, in order to mate with the rear stiffening bracket which ties the left end pan of the instrument to the casting.

5.6.4 TUBE REPLACEMENT. (FIGURE 5-11).

Before concluding that tube replacement is required, be sure that the clip is installed that shorts pins 1 and 2 of SO-414 at the rear of the instrument. If these connections are not shorted or connected to a low-impedance source of modulating or phase-locking signals, the oscillator frequency will be pulled severely out of track at the high-frequency ends of the tuning range, particularly on the 220–420 and 400–500 MHz ranges.

Remove the right shield cover in para. 5.6.3 to gain access to all tubes.

Oscillator tube V101 is located on the tuning capacitor baseplate in the lowest of the three large compartments. To remove this tube, thread a long 10-32 screw several turns into the tapped hole in the top of the heat radiator and use as a tube puller. Once the tube has been removed from the instrument, tighten the puller screw until it forces the tube out from the end of the heat radiator, then back the puller screw off. A new tube can now be inserted easily because an internal plunger has been brought into position, which temporarily relieves the contact pressure supplied by the retaining ring. Do not remove the retaining ring. If the new tube does not pop in place readily, retighten the puller screw until the plunger forces the jaws open, then retract the puller screw before trying again. The tube should enter the heat radiator so that the plate flange is completely inside it. Orient the tube heater pins so that they line up with the socket contacts in the base plate and replace by pushing the tube and radiator assembly until they are fully seated. Inspect with a dental mirror to be sure that the grid contact fingers are making good contact. Realignment of trimmer capacitor C105 will be required after replacing the oscillator tube, see para. 5.6.8.

Untuned buffer tubes, V120 and V121, are located in the middle small compartment (see Figure 5-11). Remove plate clip carefully, grasp the cylindrical plate contact with a pair of long nosed pliers, and withdraw the tube. When replacing these tubes, the prongs protruding from the base are engaged by matching recesses on the tube sockets to orient the pins correctly. These tubes should be replaced in pairs, but no special matching is required. No realignment is required after replacing these tubes.

TABLE 5-4

RF ASSEMBLY VOLTAGES

All voltages measured with respect to ground
Carrier frequency 220 MHz on 100-220 MHz Range
Carrier Level Control fully cw (maximum output)

Circuit Function	*Test Location*	*Control Settings*		*Voltage*
	PL100 Pin	*Mod Sel*	*Mod Level*	
Power Amplifier B+	1	cw	MOD OFF	+243
Tuned Buffer B+	2	cw	MOD OFF	+240
Untuned Buffer B+	3	cw	MOD OFF	+220
Oscillator B+	4	cw	MOD OFF	+199
Transistor B+	6	cw	MOD OFF	+ 29.4
Detected Signal Out	7	cw	ccw+	+ 1.4
Detected Signal Out	7	cw	MOD OFF	+ 3.5
		Freq Cal		
Xtal Cal; AF out, BL Osc Bias	9	Int Xtal	1 MHz	– 9.8
Xtal Cal; AF out, BL Osc Bias	9	Int Xtal	5 MHz	+ 0.5
		Mod Sel	*Mod Level*	
DC, Audio, Wide Band Signal In	11	cw	ccw+	+ 21.4
DC, Audio, Wideband Signal In	11	cw	MOD OFF	+ 19.0
Tuned Buffer & PA Heater	14	cw	ccw+	6.5 V RMS△
Oscillator Heater	17	cw	ccw+	– 6.3
Transistor B-; Unt. Buffer Htr	18	cw	ccw+	– 12.4
Overload Signal	19	cw	ccw+	+ 29.4
Overload Signal	19	cw	MOD OFF	+ 22.1
		Freq Cal		
Crystal Oscillator B-	20	Int Xtal	1 MHz or 5 MHz	– 12.4
		Mod Sel	*Mod Level*	
Varactor Control Signal	22	cw	ccw+	+ 1.6
Pulse Signal	24	cw	ccw+	+ 29.4
Pulse Signal	24	EXT PULSE	ccw+	+ 25.0
		Mod Sel	*Mod Level*	
Oscillator Heater	PL100 pin 17	cw	ccw+	– 6.3
Plate	Oscillator Turret Hub	cw	ccw+	+180
Untuned Buffer Heater	C126	cw	ccw+	– 6.3
Plate	V120 Plate Cap	cw	ccw+	+105
	V121 Plate Cap	cw	ccw+	+105
Tuned Buffer Heater	V141 Heater Pins	cw	ccw+	6.4 V RMS△
	V142 Heater Pins	cw	ccw+	6.4 V RMS△
Cathode	V141 Cathode Ring	cw	ccw+	+ 1
	V142 Cathode Ring	cw	ccw+	+ 1
Plate	Buffer Turret Hub	cw	ccw+	+235
Power Amplifier Heater	V171 Heater Pins	cw	ccw+	6.4 V RMS△
	V172 Heater Pins	cw	ccw+	6.4 V RMS△
Cathode	V171 Cathode Ring	cw	ccw+	+ 10
	V172 Cathode Ring	cw	ccw+	+ 10
	V171 Cathode Ring	cw	MOD OFF	+ 5.7
	V172 Cathode Ring	cw	MOD OFF	+ 5.7
Plate	P. A. Turret Hub	cw	ccw+	+240
	P. A. Turret Hub	cw	MOD OFF	+230

\+ Do not switch to MOD OFF
△ Measured with Thermocouple voltmeter

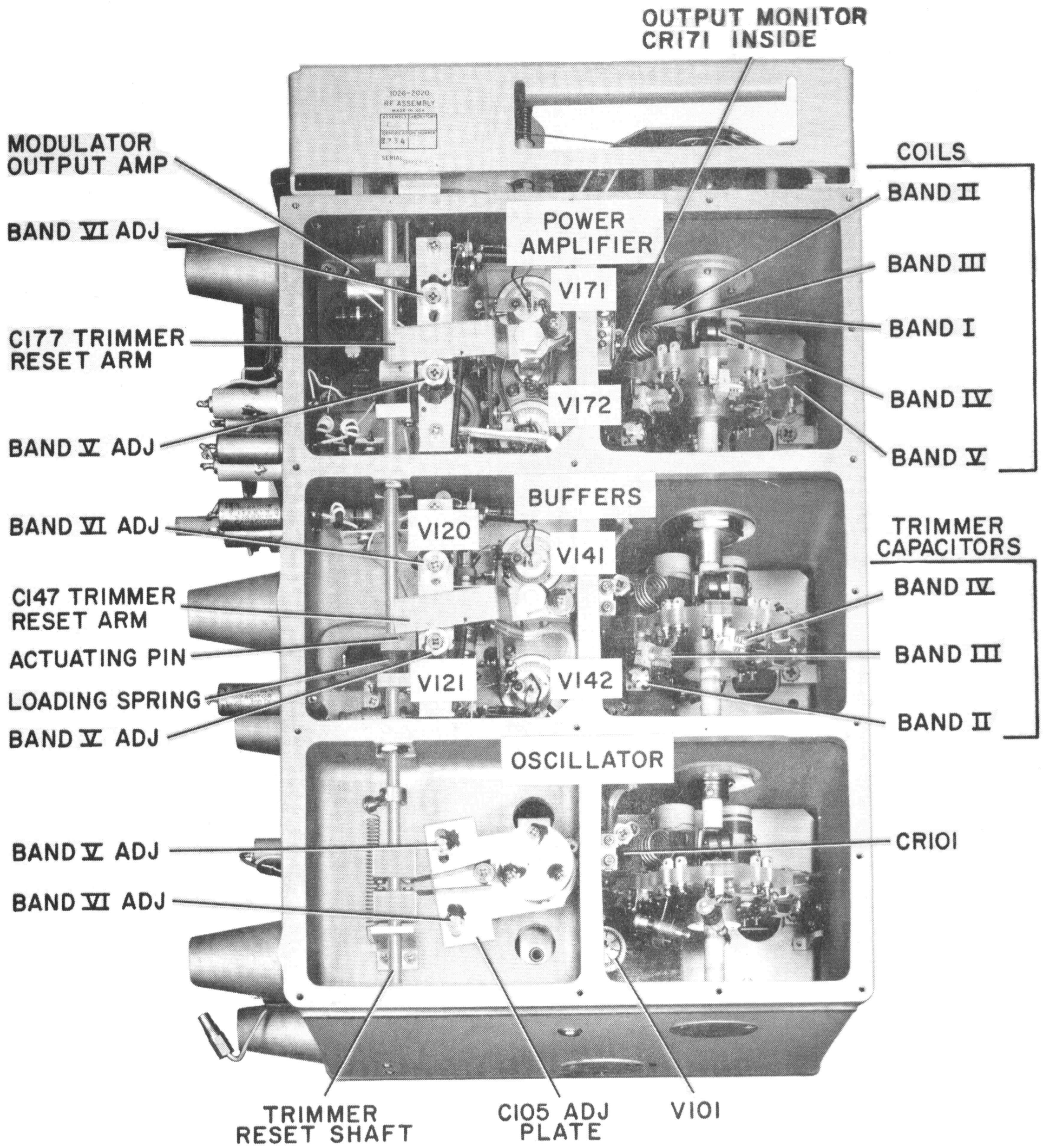


Figure 5-11. RF Assembly right interior view. Trimmer arms are shown with the lower stops engaged, as for Bands I — V.

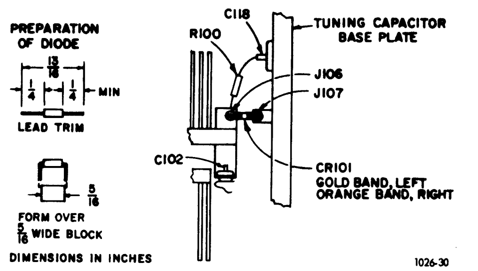


Figure 5-12. Varactor installation details.

Tuned buffer tubes V141 and V142 are reached through holes in the wall separating the small middle compartment from the large one. First, pull the heater contacts from the tube pins and remove the 2-56 screw that ties the connecting strap from the untuned buffer amplifier to the cathode contact ring, and withdraw the contact–ring. Withdraw the tube from the assembly and remove the heat radiator from the plate by loosening the small spline socket setscrew. Installation of a new tube is the reverse of this procedure. Replacement of either V141 or V142 will require readjustment of C147, see para. 5.6.8.

Power Amplifier tubes, V171 and V172, are reached through holes in the wall separating the small upper compartment from the large one. The procedure is identical to that used for tuned buffer tubes V141 and V142, except that it is necessary on early models to remove additional connections from the cathode contact rings to neutralizing capacitors C192 and C193. On later units, these are returned directly to C171 and C172. Replacement of either V171 or V172 will require readjustment of C177; see para. 5.6.8.

5.6.5 VARACTOR REPLACEMENT (FIGURE 5-11).

Varactor CR101 is located on the capacitor base plate in the lowest large compartment. Its leads have been formed so that it plugs into a pair of miniature jacks. To remove the diode, use a pair of long tweezers with right–angled tips to grasp the glass body, and pull the diode straight toward the rear of the r-f assembly. When replacing a diode, cut the leads and form as shown in Figure 5-12, and insert with the orange band next to J107 on the base plate, while the gold–band end is next to J106 on the grid–coupling circuit.

5.6.6 CONTACT CHECK (FIGURE 5-13).

Proper contact operation requires visible follow of each contact button as new contacts are engaged. The contacts are similar in each of the three large compartments, and are as follows:

a. One pair of blades on the turret disc (contacts A & B), for each coil range; each blade mates with three pairs of contacts on a guillotine tuning–capacitor stator.

b. One pair of post contacts on the turret disc (contacts C & D) for each coil range. Each post mates with a leaf contact tipped by a silver button.

c. A Pair of leaf contacts, on an insulator on the base plate, makes contact to the blade contacts associated with the next lower frequency range to the one in use.

d. On the oscillator only, another pair of leaf contacts, at the rear of the base plate, makes contact to the blade contacts associated with the coil two bands below the frequency range in use.

In all, there are sixteen contact buttons mounted on leaf springs in the top compartment (Power Amplifier), another sixteen in the middle compartment (Tuned Buffer Amplfiier), and eighteen in the bottom compartment (Oscillator). On frequency bands IV, V, and VI, it is essential that each of these buttons deflect visibly as it engages the associated blade or post. On bands I, II, and III, the failure of one or two of the twelve capacitor contacts will not be perceptible. The follow action of buried contacts can be observed with the aid of a small dental mirror.

5.6.7 CONTACT SERVICING.

If a poor contact is suspected despite evidence of satisfactory "follow" action (see para. 5.6.6), try to confirm the diagnosis. Apply additional light pressure from an insulating shaft to improve the contact, or lift the contact with a small insulating shim such as a thin sheet of

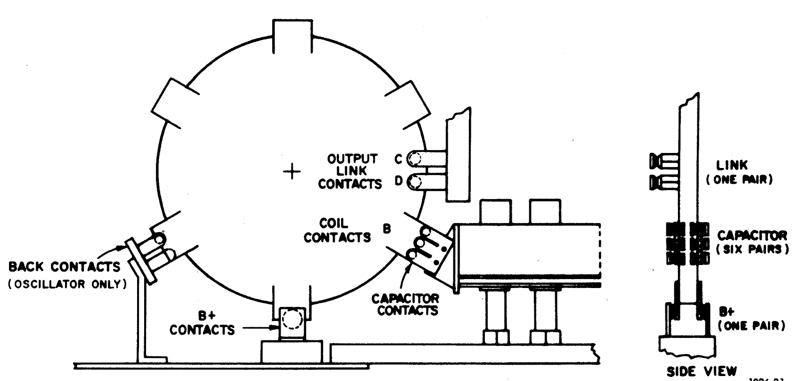


Figure 5-13. Typical layout of rf contacts on band-switching turrets.

paper to open the contact. If the former operation is beneficial, or if the latter has no effect, the contact is probably dirty and requires cleaning. Presence of a black track on blades or posts is not a prima facie indication of a need for cleaning, since this is usually silver oxide which is a good conductor.

If cleaning is required, it is usually either a blade or a post rather than the silver contact button that needs attention. Rotate the turret so that the offending part is readily accessible, and remove all loose dirt with a cotton tipped swab. Abrade the contact surface gently with crocus cloth, to remove any remaining film, and apply cramolin contact cleaner.

If the follow of the capacitor contacts is unsatisfactory on one or two blades of a particular coil turret, it can usually be improved by very careful and slight bending of the blade.

CAUTION

Blade bending is not a normal maintenance procedure and should only be attempted by highly skilled personnel.

Do not undertake any blade bending if a substantial number of blades do not line up correctly, and do not bend a blade more than .005 in. at a time. Rotate the band selector cautiously to be sure that no hang up has been introduced by blade bending. Both cw and ccw rotation must be checked with the detent pivot arm return spring temporarily released, so that any tendency to hang up can be felt.

If the follow of the B+ contacts is unsatisfactory or if there is a tendency for blades to hang up on them, the lateral position of the whole contact assembly may require adjustment. Access to the assembly requires removal of the left shield cover from the rf assembly. The B+ contacts assembly is secured to the tuning capacitor base plate by two 4-40 screws. When loosened, the whole insulator that carries the contacts can be slid laterally to align the contacts.

The follow of the link contacts should be .020 to .030 in. If not, it can usually be improved by loosening the mounting screws that secure the channel which supports these contacts, and sliding the entire assembly slightly.

NOTE

In some cases it may seem necessary to bend a leaf that carries one of the button contacts, in order to achieve satisfactory follow. Such bending is an extreme procedure that should be avoided, since it is likely to result in breakage of the leaf, which is made of heat–treated beryllium copper.

Replacement of damaged contacts is a very delicate operation which may require extensive disassembly and realignment. If contact replacement is required, the instrument should be returned to a General repair facility.

5.6.8 TRACKING ADJUSTMENT.

CAUTION

Retracking is not a routine maintenance operation.

Tracking between the three tuned stages is essential for satisfactory output and modulation to be achieved. Once set, all tracking adjustments should hold, unless tubes have been replaced or there has been major mechanical damage to the instrument.

Tube replacement requires only readjustment of the capacitance trimmer mounted on the guillotine turning capacitor associated with that particular tube. Readjustment of the trimmer capacitors mounted on the coil turrets is not required. The trimmers are adjusted at a point near the high–frequency end of Band V, namely 410 MHz. In the tuned buffer and power amplifier, an additional alignment near the high end of band VI, namely 484 MHz, is also required.

After replacement of oscillator tube V101 (see para. 5.6.4) it is necessary to check the setting of C105 to be sure that the frequency is correct. Be sure that the shorting jumper is installed between pins 1 and 2 of SO414.

Connect a 0–1 milliammeter between TP101 (located inside hex post near right front corner of top of casting) and ground as drive-level indicator. Allow one half hour warmup before alignment.

Set the 1026 controls as follows:

POWER	ON
MODULATION LEVEL	MOD OFF
MODULATION SELECTOR	CW
FREQUENCY CALIBRATOR	EXTERNAL
FREQUENCY RANGE	See text
FREQUENCY	See text
CARRIER LEVEL	+1 dBm
OUTPUT RANGE	0 dB

Start by selecting 220–420 MHz frequency range and tune to 410 MHz, as indicated on the main frequency dial, to a vernier reading of 24.5 divisions. Loosen upper adjustment post on the C105 adjustment plate and set for frequency of 410.00 MHz, while watching the 0–1 milliammeter. Use a socket wrench rather than a screwdriver, in order to avoid end pressure on the adjustment plate. The peak reading of the milliammeter and correct frequency should coincide. If not, slight compromise of the two may be required. Correct frequency should be obtained for main dial reading within 2 vernier divisions of specified setting. Secure and seal the trimmer adjusting screw. This adjustment takes care of all frequency ranges up through 420 MHz.

Next select 400–500 MHz frequency range and repeat above procedure, but work on the lower adjustment post. Main dial setting should be 484 MHz and the vernier dial setting 38.

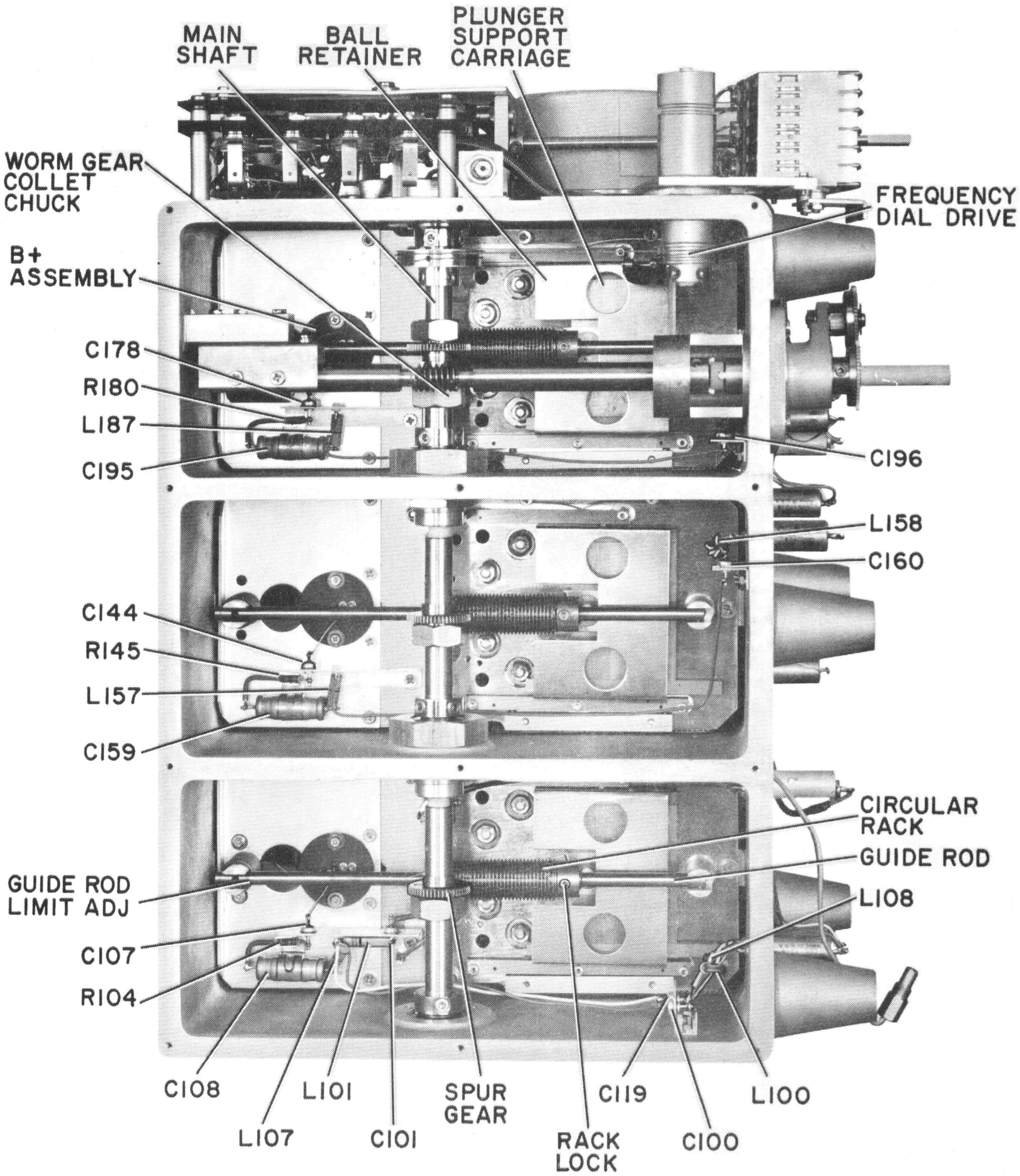


Figure 5-14. RF Assembly left interior view.

No realignment is required after replacement of untuned buffer tubes V120 or V121.

After replacing tuned buffer tube V141 or V142, readjustment of C147 is required. Set controls as above, and connect a 0-1-mA or 0-10-V meter between TP101 and ground. The correct position of the trimmer arm is one that gives a maximum meter indication. If readjustment of the stop is required, loosen the screw that secures the lower stop button and retighten in the position that gives maximum meter reading. The arm must be clear of the actuating pin on the trimmer reset shaft.

If readjustment has been required at 410 MHz, it will also be necessary to reset at 484 MHz by switching to the 400–500–MHz range, and setting the 0-100 vernier dial to exactly 38 divisions. The trimmer arm is now positioned against the upper stop button, which should be set for maximum meter indication. It is essential that in this position, the actuating pin on the trimmer–reset shaft be in contact with the trimmer arm. The block that carries the actuating pin should be causing partial, but not complete, compression of the associated loading spring.

After replacing Power Amplifier tubes V171 or V172, readjustment of trimmer C177 is required. The procedure is identical to that described above for C147.

Should more extensive realignment be required, the instrument should be returned to an authorized GR repair facility.

5.6.9 TUNING CAPACITOR SERVICING (FIGURE 5-14).

Do not attempt to reset the trimming plates on the main tuning capacitors; these have been set and sealed at the factory.

Do not attempt to reset the circular racks that establish the positions of the plungers of the three guillotine tuning capacitors. If the plungers short circuit against the stators before the low–frequency stop engages, the difficulty is almost certainly due to inadequate tightening of the worm gear to the main capacitor shaft. Should this occur, the correct gear position is that which results in a reading of 90 divisions on the 0-100 frequency dial for a frequency of 9.5 MHz; the low–frequency stop should engage just below this point, at approximately 82 divisions. The worm gear is secured to the tuning shaft by a collect chuck. Adjustment requires the use of a special spanner with 1/8 diameter pins, spaced 3/4 in. apart, and 7/8 open–end wrench.

The recommended lubricant for all gears and for the guide rods that support the circular racks is Molykote G.

5.6.10 TURRET SERVICING.

Most components on the turrets that may require servicing are accessible by rotation of the turret to an appropriate position. Numerous feed resistors and chokes are in through–holes in the turret discs, which establish their locations unambiguously.

Small ceramic feedthrough capacitors are mounted directly to the C and D output–link contacts on the oscillator and tuned–buffer turrets. These are required for very low inductance; replacement must be by parts that are both physically and electrically identical to the original units.

CAUTION

Use minimum heat when working on these capacitors as overheating will cause permanent instability and loss of capacitance.

Should replacement of resistors associated with any of these capacitors be required, be sure to use the same minimum–length lead dress as in the original assembly.

Should replacement of a main tuning coil or its associated secondary link be required, the instrument should be returned to an authorized GR repair facility, since realignment beyond the scope of this manual will be required.

If most contact blades seem to be either too low or too high, the whole turret is improperly positioned. Should all three turrets be in the same difficulty, the turret shaft has probably slipped relative to the stop collars that position it longitudinally.

If only one of the three turrets is out of line, loosen the two setscrews that secure it to its shaft and reposition to provide proper contact mesh, as described in para. 5.6.6. Be sure that the angular position is such that the blades of the 220–430-MHz coil are centered in the capacitor contacts when the detent is engaged.

5.6.11 DETENT AND TRIMMER MECHANISM.

The primary detenting of the turrets in one of six positions is accomplished by a spring–loaded pivot arm that rides on a notched circular cam plate mounted on the turret shaft. This detent is intentionally stiff to ensure the highly repeatable orientation of the turret positions required for frequency stability. The 3:1 helical–gear reduction, between the detent shaft and the bandswitch control shaft, reduces the torque required to change bands but increases the throw, in going from one band to the next, to 180°.

To prevent excessive shock when band changing rapidly, a dashpot slows up the return of the pivot arm. If the pivot arm is lifted manually from the detent notch and then released, the return should take approximately 0.5 s. Should the return be too rapid, the hex nut on the bottom of the dashpot must be tightened to reduce the dashpot leak rate.

If the dashpot or its ball joint have been damaged, the dashpot assembly should be replaced. The wire protruding from the dashpot ball joint should be engaged within the coupling spacer, to within 1/32 in. of the ball joint. The other end of the spacer is tapped and acts as a turnbuckle; it should be adjusted so that the dashpot plunger clears the bottom of the associated cylinder approximately 1/16 in., when the detent roller rides on the outer diameter of the detent cam plate.

A secondary detent is provided by a dual ball detent on the Frequency **Range** switch shaft, in order to maintain suitable "feel" in spite of the dashpot action. The ball detent is deliberately adjusted with enough backlash that it does not interfere with the primary detent action provided by the main pivot arm.

A second pivot arm is actuated only on Band VI (400-500 MHz) by a small trapezoidal cam plate, mounted on the main circular cam plate. It pulls the trimmer–reset shaft by means of a flexible cable riding over a pulley. The end of the pivot arm is coupled to the cable by means of a turnbuckle, whose adjustment determines the reset shaft throw. In the relaxed position (bands I-V) the collar of the reset shaft should be pulled against the casting by a reset spring located in the lowest small casting compartment. In this position, the upper part of reset actuators should not be in contact with the trimmer arms; these trimmer arms are pulled against the stops by individual return springs. The oscillator trimmer is pulled against its stop by the reset shaft acting through a leaf spring.

Normal travel of the reset shaft, when actuated to Band VI position, is approximately 7/16 in.

The turnbuckle adjustment should only be made with the right shield cover removed so that operation of the trimmer reset action in all three compartments can be observed. If all three arms fall short of complete actuation when set to band VI, the turnbuckle should be adjusted, but if only one or two fall short, it is preferable to readjust the individual reset actuators. In band VI, all three trimmer arms must be pulled up against the stops by the reset actuators on the reset shaft. The actuators include springs to allow some shaft overtravel beyond the point required for full seating of the arms against the stops. Shaft overtravel is normally about 1/16 in.

5.6.12 OVERLOAD CIRCUIT.

Absence of plate voltage at AT180 and on the Power Amplfiier turret, even though present at J104, is due to burnout of P195. Since this bulb is rated at 90 mA, although current limiting is set to begin at 60 to 65 mA, burnout is almost always due to a short circuit in the power amplifier; even a momentary short caused by a slip of a screwdriver when trouble shooting can blow the bulb. It is important to ascertain the cause of a blown bulb before replacing it by inspecting the turret and contacts carefully to make sure no "hot" B+ lead has been displaced, so that it can cause a short during rotation of the turrets by turning the Frequency Range Switch. With a dummy phone plug inserted in J104, an ohmmeter between AT180 and ground should indicate an open circuit for all positions of the Frequency Range Switch. After replacing P195, it will be necessary to readjust the overload setting. Proceed as follows:

a. Set the CARRIER LEVEL control fully cw, with the modulation level control in the MOD OFF position, the modulation selector switch in CW position, and output range switch in +20 dB position. Switch to Band VI and tune below the 400-MHz low band edge, until the Carrier Level meter reading drops, thereby indicating loss of automatic level control.

b. Connect a 0–100-mA meter to J104.

c. Set the top holding screw of the lamp housing for P195 and R195 to the middle of the adjustment slot.

d. Loosen the check nut on the adjustment screw on the side of the lamp housing and adjust the screw to limit the plate current to 62 mA (cw adjustment of the screw will increase the plate current at which limiting occurs).

e. If a plate current of 62 mA cannot be obtained, because leveling occurs at some lower current, as evidenced by return of the carrier level to 10 V, tune further down on Band VI until the current limiting can be set at 62 mA.

f. Secure the check nut on the adjusting screw.

5.6.13 MONITOR DIODE REPLACEMENT.

Diode CR 171 is located in the monitor assembly, which is in the upper left corner of the upper large shield compartment. CR171 monitors the r-f output level of the Power Amplifier and delivers a corresponding d-c signal to the automatic–level–control amplifiers. The diode itself is mounted in spring clips and is accessible for replacement after removing the right hand shield cover of the r-f assembly. Removal of the monitor assembly itself is not required. Rotate the coil turret to Band IV position, grasp the diode body with a small pair of tweezers, and pull straight toward the rear of the instrument. Leads on a diode to be used for replacement must be clipped symmetrically for an overall end to end length of 9/16 in. The diode must be installed with the cathode (banded) end out toward the right (open) side of the r-f assembly.

After replacing CR171, check for levelling flatness to determine whether frequency–compensation capacitor C186 requires readjustment. Levelling flatness is checked by connecting the thermistor mount of the power meter through 20 dB pad to the rf output jack, J407, using an 874–to–type–N adaptor, (GR type 874 QNJA) but without any intervening coaxial cable. With the OUTPUT RANGE selector set for +20 dB and the CARRIER LEVEL control set to produce a meter reading of +7 dBm, tuning from 108 to 500 mHz should not cause peak–to–peak power–meter reading excursions greater than 1 dB (±0.5 dB). If the power meter reading at 500 MHz is too high, the capacitance of C186 must be reduced by ccw adjustment, and vice versa. To obtain access to this capacitor, rotate the coil turret midway between detent positions and remove the short antileakage screw that caps the access hole in the top of the casting. A small insulated alignment tool with flat screwdriver blade is required for adjustment of the capacitor.

5.6.14 CRYSTAL CALIBRATOR (FIGURE 5-15).

If the spacing of beats of the crystal calibrator is significantly different from that anticipated from the drum-dial calibration, or if the beat notes are definitely unstable, the difficulty is probably due to improper locking of blocking oscillator Q277.

The two potentiometers used to control the locking range of the blocking oscillator are located on the rear of the headphone amplifier and crystal calibrator switch assembly. R412 sets the 5-MHz bias and R414 sets the 1-MHz bias. If Q277 has been replaced, it will be necessary to readjust these controls. They can be reset without removing the crystal calibrator shield can by the following procedure:

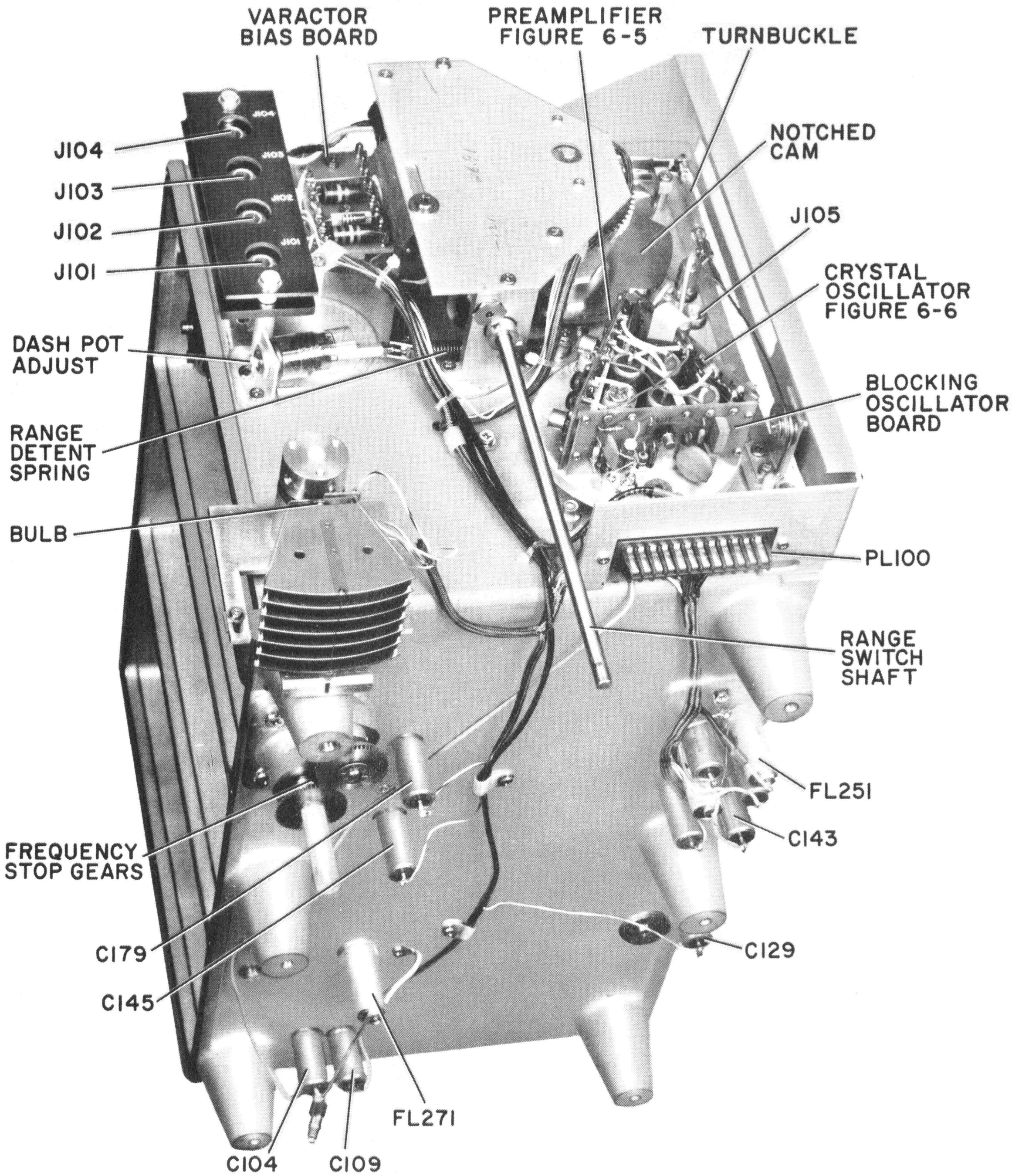


Figure 5-15. RF Assembly top-front exterior view.

Preliminary Set-UP

Connect the counter to FREQUENCY METER jack of 1026.

Set 1026 control as follows:

POWER – STAND-BY

FREQUENCY CALIBRATOR – EXTERNAL

a. Connect shorting plug between J416 and J418 (upper pair of jacks on rear of S400).

b. Adjust R414 until counter reads between 978 and 982 kHz.

c. Set FREQUENCY CALIBRATOR switch to INT XTAL 1 MHz.

d. Counter should read 1000.000 kHz ±.010 kHz.

5-MHz Adjustment (R412)

a. Set FREQUENCY CALIBRATOR switch to EXTERNAL.

b. Connect shorting plug between J415 and J418 (lower pair of jacks on rear of S400).

c. Adjust R412 until counter reads between 4.78 and 4.82 MHz.

d. Set FREQUENCY CALIBRATOR switch to INT 5 MHz, and depress the actuator for the coaxial portion of S400 by inserting a small screwdriver blade between the hub on the shaft and the plunger. An access hole is provided on the rear plate of the switch assembly, adjacent to J417. The counter should read 5000.000 kHz ±.050 kHz.

If the crystal frequency is outside the limits specified above, it can be corrected by adjustment of C275. Be sure that the counter time base is accurate to 1 part per million before attempting to correct the crystal frequency. It is necessary to remove the shield can in order to reach C275. Removal and replacement procedure is described below; since the crystal–oscillator frequency is affected by the shield can, note the magnitude and sense of the error before removing the shield. Then with the shield off, readjust C275 only by the amount required to correct the error. The frequency of the oscillator can be checked by connecting a counter to the Frequency Meter jack and setting the FREQUENCY CALIBRATOR switch to 1 MHz.

Access to the crystal oscillator circuit (including C275), the blocking oscillator circuit, or the detector preamplifier circuit requires removal of the round shield can on the top of the r-f assembly. The two screws which hold the can in place also serve as jacks to pry it off from the tapered base. They should be unscrewed alternately to avoid distorting the can. When replacing the shield, coat the outer diameter of the tapered base with silver–loaded grease, and tighten the two screws alternately so that the can sits squarely on the base. The screws should be tightened until they come to a firm stop. Refer to Figure 5-15 for relative board location and Table 5-4 for voltage.

5.6.15 DIAL LIGHT REPLACEMENT (FIGURE 5-15).

NOTE

Burned out lights may indicate a defective power–supply preregulator (para. 5.8.2).

a. Set 1026 to 16 MHz and note vernier dial reading for exactly 16 MHz as determined by crystal calibrator.

b. Loosen two 4-40 screws accessible through oval holes on top of drum dial assembly. Do not remove these screws.

c. Slide light assembly all the way back from panel and retighten the 4-40 screws.

d. Remove three 6-32 screws from the hub of the drum dial assembly and lift dial off carefully.

e. Push defective lamp toward left side of panel by inserting small Allen wrench in access hole on right side of light

TABLE 5-5
CRYSTAL CALIBRATOR ASSEMBLY VOLTAGES

Test Location	*Control Settings*		*Terminal#*	*Volts*	*Transistor Symbol*	*Voltages*		
	Control	*Setting*				*Base*	*Emitter*	*Collector*
Preamplifier Board 1026-2765	MOD LEVEL	ccw+	8	+ 3.6	Q265	+ 3.6	+ 3.0	+27.5
		MOD OFF	8	+ 7.9	Q265	+ 7.9	+ 7.3	+26.9
	ccw+	ccw+	3	+ 1.4	Q266	+27.5	+28.1	+ 3.0
		MOD OFF	3	+ 3.5	Q266	+26.9	+27.5	+ 7.3
	FREQ CAL	OFF	1	+ 2.4	Q278	+ 2.4	+ 1.8	+28.8
					Q279	+28.8	+29.4	+16
Crystal Oscillator Board 1026-2776	FREQ CAL	INT XTAL, 1 MHz	6	−12.4	Q275	– 6.2	– 6.8	0
					Q276*	– 1.3	– 1.0	– 6.7
Blocking Oscillator Board 1026-2755	FREQ CAL	INT XTAL, 1 MHz	T-275 #1	– 6.1				
		INT XTAL, 5 MHz	T-275 #1	– 7.0				
		INT XTAL, 1 MHz	2	– 9.8				
		INT XTAL, 5 MHz	2	+ 0.5				

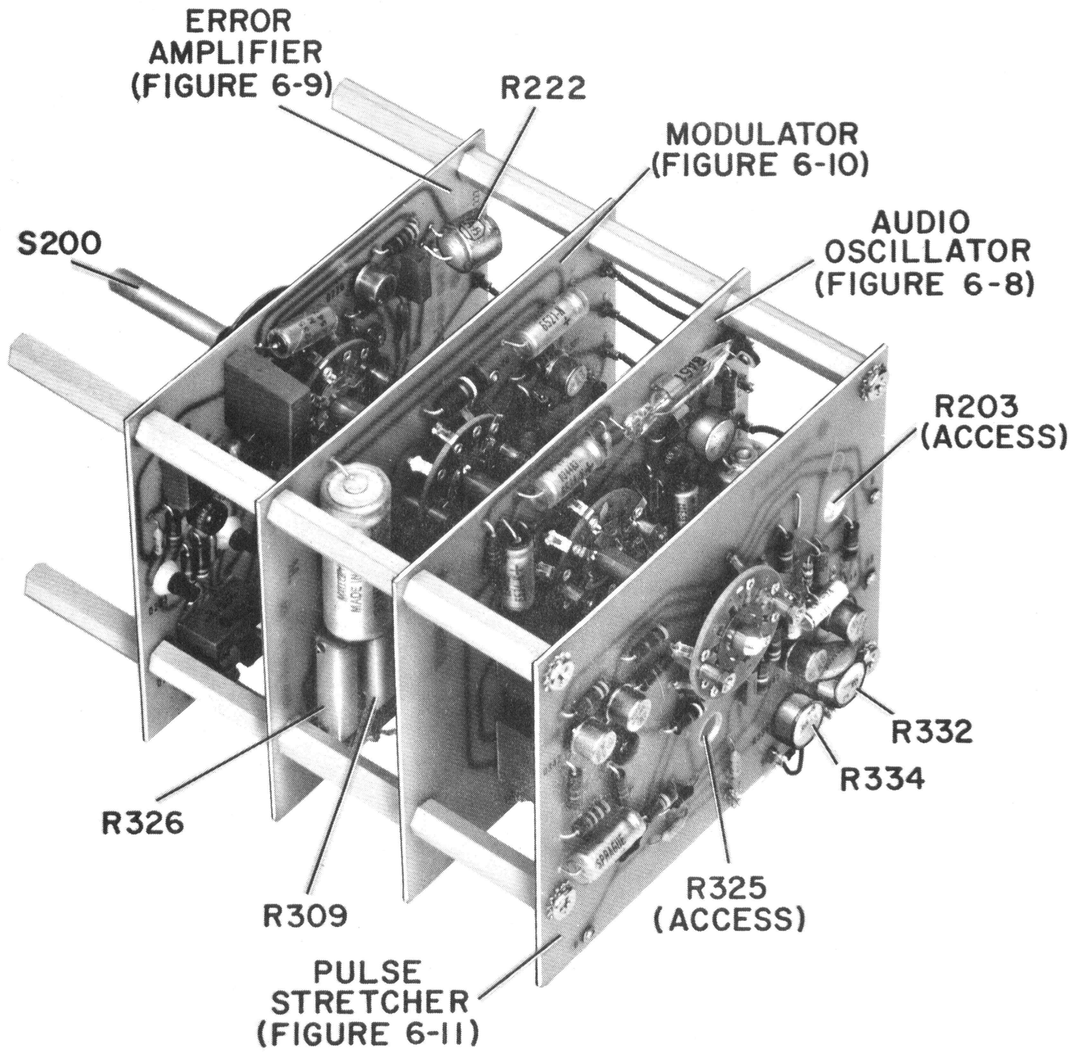


Figure 5-16. Modulator Assembly.

assembly. A small screwdriver or knife blade pressed lightly against rear of bulb, to keep it from cocking while pushing sidewise with the Allen wrench, will be helpful.

f. Remove lamp with small tweezers or knife blade, to get it started sufficiently to get finger grip.

NOTE

To ensure reliable contact, replacement bulb must have tall enough solder blob to lift retaining dimple of spring contact free of bakelite insulator on bulb base.

g. Insert replacement bulb, replace drum dial with screws secured only temporarily, loosen 4-40 light-assembly screws and slide light assembly all the way forward (as far as slots will allow) and secure them.

h. Turn on instrument, set fiducial adjust to midposition and adjust frequency to exactly 16 MHz, as determined by crystal calibrator; check that vernier dial reading agrees with that recorded in step a. Loosen the three 6-32 dial–mounting screws, and position dial to read exactly 16 MHz.

i. Check that dial lights operate on all bands and that dial rotates freely, without touching light assembly at any point in the dial rotation.

5.6.16 COAXIAL CABLES.

The low rf leakage of the 1026 depends upon integrity of all coaxial connections and of the solid outer conductors of the cables. Any looseness of jacks in the rf casting, or of plugs on the associated jacks, will cause severe leakage. Before retightening any jack that may have worked loose, apply a film of silver bearing grease between the jack flange and casting.

It is essential to follow the procedure described in para. 5.5.2 in order to avoid damage to the solid outer conductors when disassembling and reassembling connectors PL105/J105, PL108/J108, PL109/J109 and PL P110/J410. The procedure for PL406/J406 is described in para. 5.5.5.

If the cable assembly that includes R177 and J105 is defective, it should be replaced rather than repaired, since special cable–crimping tools are required. If emergency repair is necessary due to shorting of R177 to the outer conductor, be sure to install shouldered insulator to center the resistor contact button and cable center conductor. This shouldered design replaces the plain Teflon insulator employed in early instruments.

5.7 MODULATOR SERVICING (FIGURE 5-16).

5.7.1 TROUBLE ANALYSIS.

Make sure that all power–supply voltages are correct before attempting to service the modulator. Since the monitor and detector preamplifier (located in the crystal–calibrator shield on the top of the rf assembly) and the modulator output amplifier (located in the upper small pocket of the rf assembly) are part of the overall modulation and level control circuit, the possibility of failure in these related circuits must also be considered when trouble shooting the Modulator Assembly itself. Voltage Table 5-11 for the Crystal Calibrator Assembly includes data for the detector preamplifier; see para. 5.6.14. Voltage Tables 5-8, 5-9, and 5-10 cover all other modulator circuits, including the modulator output amplifier.

Test equipment required for modulator servicing is listed in Table 5-6.

TABLE 5-6
TEST EQUIPMENT FOR MODULATOR SERVICING

Mfr	*Type**	*Description*
GR	1191-Z (500 MHz)	Counter, 0-35 MHz
GR	1309	Oscillator, 10 Hz-100 kHz
GR	1398	Pulse Generator
GR	1806	Electronic Voltmeter
GR	1900	Wave Analyzer
GR	874-G3L	3-dB Fixed Attenuator (50 Ω)
GR	874-G20L	20-dB Fixed Attenuator (50 Ω)
GR	874-VQL	Voltmeter-Detector
GR	874-W50BL	50-ohm Termination
GR	874-QNJA	Adaptor, Type 874 to type-N jack
H-P	431-B	Power Meter
Tektronix	547 or 453	Oscilloscope

*Or equivalent.

TABLE 5-7
MODULATOR TROUBLE ANALYSIS

Symptom	*Probable Cause*	*Remedy*
CW MODE Poor levelling with tuning of frequency, especially at high carrier levels.	RF Assembly problems:	See Table 5-4
Carrier level cannot be increased to full scale at some frequencies	RF Assembly problems.	See Table 5-4 Check for presence of overload. Signal, modulator board terminal #19.
Large or off-scale CARRIER LEVEL meter readings.	Defective Error Amplifier or Modulator Output Amplifier	See Table 5-7
Large RF output but no reading on CARRIER LEVEL meter.	Defective Monitor Diode or Detector Preamplifier in RF Assembly.	See Table 5-4
Excessive CARRIER LEVEL drift.	Leaky transistor Q301 or 302.	Check stability of reference input, error amplifier terminal #21, Error Amplifier Board.
Inaccurate reading on CARRIER LEVEL meter.	Incorrect adjustment of R332, R334.	Readjust
Maximum CARRIER LEVEL inadequate a. Normal CW mode less than + 1 dBm b. MOD OFF CW mode less than + 7 dBm	Incorrect adjustment of: a. Modulator offset R551. b. R403	Readjust
Int 1 kHz MODE Modulation frequency very low and of square-wave appearance	Defective R213.	Replace
Clipping of negative modulation peaks for less than 95% Modulation Meter reading.	Incorrect adjustment of R325, R326, or R309. If only at low carrier levels, R309 adjustment is incorrect.	Readjust
No modulation attainable.	Defective 1-kHz oscillator or switch S200-2 (section located on modulator board). Check for presence of 1-kHz sync output at MOD terminals	Replace
Carrier level meter changes with modulation	Excessive modulation level (> 95%).	
Modulation Frequency not exactly 1000 Hz	Incorrect Adjustment of R203.	Adjust.
EXT AUDIO MODE No modulation	No modulation input voltage, or modulation level control turned ccw; defective switch wafer S200-2 on Modulator board.	

TABLE 5-7 (Cont)
MODULATOR TROUBLE ANALYSIS

Symptom	*Probable Cause*	*Remedy*
Incorrect modulation level meter indications.	Incorrect Settings of R325, R326, or R309. Check performance in INT 1 kHz mode.	Adjust.
	Nonsinusoidal inputs, or input frequencies greater than 10 kHz can cause substantial errors in indicated modulation level.	
Diagonal clipping of modulation troughs.	Excessive percentage modulation at high audio frequencies.	
Excessive overshoot of square waves at some carrier frequencies.	Incorrect adjustment of loop gain R222.	Readjust.
Carrier Level Meter reading changes with modulation.	Excessive modulation level; note limitations on level at high audio frequencies	
	Asymmetric audio waveforms.	
	Dc component at MOD IN.	Add external blocking capacitor in series with J412.
EXT. WIDE BAND Mode Modulation Level Meter does not read.	Meter can not be used; it is not in the circuit in this mode.	
CARRIER LEVEL meter reading drops when switching into this mode.	This is normal except with the CARRIER LEVEL control fully cw.	
Long time constant in leveling.	Normal in this mode	
Output modulation phase inverted relative to input signal.	normal in this mode.	
EXT PULSE Mode No pulse output, reading of CARRIER LEVEL meter stays below −13 dBm.	Incorrect input-pulse characteristics. Pulses too short, too low repetition rate, inadequate amplitude, or negative polarity.	Reset
Pulse output not levelled.	Defective Pulse Stretcher Board.	See Table 5-8.
Long time constant in levelling.	Normal in this mode.	
Residual pulse amplitude modulation.	Small percentage at low rate (up to ±1%)is normal.	
No reading of MODULATION LEVEL meter.	Normal in this mode	
CARRIER LEVEL meter does not drop to zero at minumum setting of CARRIER LEVEL control	Meter reading slightly below calibrated region of scale is normal in this mode.	
CARRIER LEVEL Meter reading stays above −13 dBm with no pulse input	Defective Pulse Stretcher Board.	See Table 5-8.

Trouble analysis should begin with the MODULATION SELECTOR set for CW operation, since this mode employs a minimum number of circuits and these circuits must function properly before any other mode can be expected to work, since they are active in all modes of operation. Consult the Trouble Analysis chart, Table 5-7 and try to localize the trouble to a particular circuit board before removing the modulator assembly.

If the specific cause of trouble cannot be identified with it in place, the modulator can be operated out of the instrument with an extension patch cord to connect PL220 to SO420. To fabricate the patch cord, the following connector types are required:

Module Connector	Amphenol 26-4200-24S
Chassis Cable Plug	Amphenol 26-4100-24P

Connect corresponding pin numbers to each other using #20 insulated leads except **use coax** for the following pairs

pins 7 Center conductor
pins 8 shield

pins 9 center conductor
pins 10 shield

pins 11 center conductor
pins 12 shield

pins 16 center conductor
pins 17 shield

pins 24 center conductor
pins 23 shield

pins 21 center conductor
pins 23 shield

pins 22 center conductor
pins 23 shield

The Modulator Assembly (see Figure 5-16) consists of an assembly of four etched–circuit boards and includes the modulation selector switch, S200. The front board is the Error Amplifier, which compares the output from the Detector Preamplifier (in the RF Assembly), or from the Pulse Stretcher (rear board), with a reference signal from the Modulator Board (second from front). The third board contains the 1 kHz audio oscillator. All circuits on the Modulator Board (symbol series 301 to 329) and on the Error Amplifier (symbol series 221 or 242) are required for CW and all other modes of modulation, whereas the active elements on the Audio Oscillator (symbol series 201-219) are used only in the INT 1-kHz mode, and those on the Pulse Stretcher (symbol series 331-359) are used only the EXT PULSE mode. Thus, CW operation must be satisfactory before any other mode can be expected to perform properly.

Troubles in the Modulator Board will cause incorrect dc output voltages to appear at the CARRIER LEVEL Control, R405, and at the reference input to the Error Amplifier (terminal 21, base of Q221). Troubles in the monitor diode or detector preamplifier will cause errors in the CARRIER LEVEL meter reading and in the detected signal input to the Error Amplifier (terminal B, base of Q224.) If both inputs to the error amplifier are correct, but the CARRIER LEVEL meter reading does not respond properly to setting of the reference input by means of the CARRIER LEVEL control, the problem is either in the Error Amplifier (Q221-226), or in the r-f assembly.

Most troubles in the Modulator Board, in the Error Amplifier, or in the Audio Oscillator will cause transistor voltages to differ significantly from those shown in Table 5-8. Although these voltages should not change when going from 1 kHz to CW, to EXT AUDIO, they are normally measured in the CW mode because this avoids voltmeter errors due to the presence of ac. The voltages do not depend perceptibly on carrier frequency in a generator that is operating correctly; the tabulated values were measured at 70 MHz. All voltages are shown with respect to ground. Since base–to–emitter voltages are significant, it is usually preferable to measure these directly. Use a voltmeter with at least 20,000 Ω/V resistance. Voltages identified by notes a through e are particularly important and easy to check; they should be looked at first.

Troubles in the Pulse Stretcher Board will generally cause transistor voltages to differ significantly from those shown in Table 5-9. These voltages are only significant when the MODULATION SELECTOR is set to EXT PULSE. If the voltage at the base of Q221 is correct, but not that at the base of Q224, the trouble is probably in the pulse stretcher, and voltages on transistors Q341 through Q344 should be checked.

Troubles in the Modulator output amplifier (located in the rf assembly) will generally cause transistor voltages to differ significantly from those shown in Table 5-10.

Note that in the STAND BY position of the POWER switch, the emitter circuit of Q222 and Q223 is opened, resulting in cut-off of Q225 and Q226, and eventually in the application of cut-off bias to Power Amplifier tubes V171 and V172 in the RF Assembly. Normal voltages in the Error Amplifier under stand-by conditions are shown in Table 5-11, and for the Modulator output amplifier in Table 5-10.

5.7.2 CARRIER–LEVEL METER ADJUSTMENTS.

a. Set FREQUENCY to 45 MHz on drum dial.

b. Set the Carrier Level control ccw.

c. Connect the Power Meter to the 1026 output through a 20-dB pad.

d. Power Meter — use –5 dBm range. Set output range selector to +20 dB position.

e. Increase the Carrier Level control to –2 dBm, as read on the Power Meter, and adjust R332 (Carrier Level Zero ADJ)

TABLE 5-8
MODULATOR ASSEMBLY DC VOLTAGES
(Modulation Selector at CW)

Circuit Board	*Level-Control Settings*		*Transistor Symbol*	*Voltages*		
	Carrier	*Modulation*		*Base*	*Emitter*	*Collector*
Modulator Board	cw	ccw, not MOD OFF	Q301	– .03 (1)	– 0.6	+29.4
1026-2725	cw	MOD OFF	Q301	+ 2.1	+ 1.5	+29.4
(Second Board)	cw	MOD OFF	Q302	+ 2.4	+ 1.8 (2)	+29.4
	cw	ccw, not MOD OFF	Q302	+ 4.5	+ 3.9 (2)	+29.4
	ccw	ccw MOD OFF Not	Q321*	– 0.6	– 0.7	+14
	cw	MOD OFF	Q321*	+ 1.5	+ 1.4	+ 7.5
Error Amplifier	cw	ccw, not MOD OFF	Q221	+ 1.9 (3)	+ 1.3	+ 8.2
1026-2716	ccw	ccw, not MOD OFF	Q221	– 0.1 (3)	– 0.7	+11.6
(Front Board)	cw	ccw, not MOD OFF	Q224	+ 1.9 (4)	+ 1.3	+ 8.1
	ccw	ccw, not MOD OFF	Q224	0 (4)	– 0.6	+10.5
	cw	ccw, not MOD OFF	Q222	+ 8.2	+ 7.7	+23.0
	cw	ccw, not MOD OFF	Q223	+ 8.1	+ 7.6	+23.6
	cw	ccw, not MOD OFF	Q225	+23.6	+24.2	+ 5.0
	cw	ccw, not MOD OFF	Q226	+ 5.0	+ 4.4	+21.4 (5)
Audio Oscillator	cw	ccw, not MOD OFF	Q201	+13.6	+13.0	+24.9
1026-2735	cw	ccw, not MOD OFF	Q202	+24.9	+25.5	+16.1
(Third Board)						

*Germanium transistor
(1) Variations of 2:1 are normal due to differences in transistors.
(2) Can be measured at terminal 20 at INT 1 kHz, cw, EX.
(3) Can be measured at terminal 21 at Error Amplifier Board.
(4) Can be measured at terminal B at Error Amplifier Board.
(5) Can be measured at terminal 11 at Error Amplifier Board.

TABLE 5-9
MODULATOR ASSEMBLY DC VOLTAGES
(MODULATION SELECTOR AT EXT PULSE)*

Circuit Board	*Level Control Settings*		*Transistor Symbol*	*Voltages*		
	Carrier	*Modulation*		*Base*	*Emitter*	*Collector*
Pulse Stretcher	cw	cw	Q341**	0	+ 1.3	+29.4
1026-2745	cw	ccw (not mod off)	Q341**	– 0.5	– 0.54	+29.4
(Rear Board)	cw	cw	Q342**	–11.8	–11.9	+ 1.3
	cw	ccw (not mod off)	Q342**	–11.7	–11.9	– 0.54
	cw	cw	Q343	+ 0.7	+ 1.3	–11.8
	cw	ccw (not mod off)	Q343	– 1.1	– 0.54	–11.7
	cw	cw	Q344**	0	+ 1.0	+20
	cw	ccw (not mod off)	Q344**	0	+ 0.9	+29.4
	cw	cw	Q345**	– 2.0	+ 1.0	+ 6.3
	cw	ccw (not mod off)	Q345**	+ 1.1	+ 0.9	+ 1.0
Error Amplifier	cw	cw	Q221	+ 1.8 (1)	+ 1.2	+ 8.4
1026-2716	cw	ccw (not mod off)	Q221	+ 1.8 (1)	+ 1.2	+ 6.0
(Front Board)	cw	cw	Q224	+ 1.8 (2)	+ 1.2	8.2
	cw	ccw (not mod off)	Q224	0 (2)	– 0.5	+13.3
	cw	cw	Q226	+ 5.0	+ 4.4	+21 (3)
	cw	ccw (not mod off)	Q226	+11.8	+11.2	+11.3 (3)

* +20-V, 10-kHz, 20-μS pulses supplied to MOD INPUT.
** Germanium transistor
1. Can be measured at terminal: 21 of Error Amplifier Board
2. Can be measured at terminal: B of Error Amplifier Board
3. Can be measured at terminal: 11 of Error Amplifier Board

TABLE 5-10
MODULATOR OUTPUT AMPLIFIER DC VOLTAGES
(In RF Assembly)

Operating Mode	*Modulation Level Control*	*Board Terminal*	*DC*	*Transistor Symbol*	*Voltages*		
					Base	*Emitter*	*Collector*
Power:ON	ccw †	1	0	Q251	+21.4	+20.8	+29.4
Mod Sel: CW	MOD OFF	1	0	Q251	+19.0	+18.4	+29.4
	ccw †	2	+21.4	Q252*	+29.4	+29.4	+20.8
	MOD OFF	2	+19	Q252*	+29.4	+29.4	+18.4
	ccw †	3	+29.4	Q253	+20.8	+21.4	+ 0.7
	MOD OFF	3	+29.4	Q253	+18.4	+19.0	+ 0.8
	ccw †	4	+29.4	Q254	+ 0.7	0	+10.0
	MOD OFF	4	+29.4	Q254	+ 0.8	0	+ 4.8
	ccw †	5	+10				
	MOD OFF	5	+ 4.8				
Power: ON	ccw †	1	0	Q251	+11.8	+18.8	+29.4
Mod Sel: EXT PULSE	cw	1	0	Q251	+21.4	+20.8	+29.4
Pulse Input:	ccw †	2	+11.1	Q252*	+29.2	+29.4	+29.4
+20 V pk	cw	2	+21.4	Q252*	+29.2	+29.4	+27.5
20 μs	ccw †	3	+29.2	Q253	+29.4	+27.2	0
10 kHz	cw	3	+29.2	Q253	+27.4	+26.3	+ 0.2
	ccw †	4	+29.4	Q254	0	0	+23.5
	cw	4	+29.4	Q254	+ 0.2	0	+20.6
	ccw †	5	+20.6				
	cw	5	+23.5				
Power: STAND BY	ccw†	1	0	Q251	+29.3	+28.6	+29.4
Mod Sel: CW	ccw†	2	+29.3	Q252*	+29.4	+29.4	+28.6
	ccw†	3	+29.4	Q253	+28.5	+27.4	0
	ccw†	4	+29.4	Q254	0	0	+23.7
	ccw†	5	+23.7				

*Germanium Transistor
† do not switch to MOD OFF

TABLE 5-11
ERROR AMPLIFIER DC VOLTAGES*

Transistor	*Base*	*Emitter*	*Collector*
Q222	+15.6	+22.5	+29.4
Q223	+25.8	+25.2	+25.8
Q225	+25.8	+26.4	− 6.9
Q226	− 6.9	0	+29.4

*In Stand-by mode.

on the rear modulator board for -7 dBm reading of the Carrier Level Meter.
f. Set the Power Meter to the +5 dBm range and increase the Carrier Level Control for 0 dBm reading of the Power Meter. Adjust R334 (Carrier Level Full Scale Adjust) on rear Modulator board for +5 dBm reading of the Carrier Level Meter.

5.7.3 MAXIMUM CARRIER LEVEL ADJUSTMENTS.

a. Turn Carrier Level control full cw and adjust R403 on left side pan to read slightly above full scale on the panel meter (+7.3 dBm).
b. Set the Modulation Level Control to ON position.
c. Set the Modulation Selector switch to EXT WIDEBAND and adjust R551 (lowest pot on the back of the Power Supply) for +1.5 dBm reading of the Carrier Level meter.
d. Return the Modulation Selector switch to CW. Set the Carrier Level Control for +1-dBm reading of the CARRIER LEVEL meter, and turn the Modulation Level Control to the MOD OFF position.
e. Readjust R403 for +7 dBm reading of the Carrier Level meter.
f. Increase the Carrier Level Control fully cw and make sure that the meter still reads about +7.3 dBm. Repeat the process if necessary.

5.7.4 LOOP–GAIN ADJUSTMENT.

a. Set 1026 Controls as follows:

POWER	ON
MODULATION LEVEL	FULLY CW
MODULATION SELECTOR	EXTERNAL AUDIO
FREQUENCY RANGE	BAND II (22-48 MHz)
FREQUENCY	45 MHz
OUTPUT RANGE	+10 dBm
CARRIER LEVEL	+1 dBm

b. Connect Type 874-VQL detector with Type 874-W50BL load to RF output connector of the 1026, and the dc output of the detector to the oscilloscope vertical input, shunted by a 10-kΩ load resistor. Connect the Type 1309 audio oscillator to the MODULATION INPUT of the 1026.
c. Set the 1309 for a 200-Hz sinewave.
d. Connect the Type 1900 Wave Analyzer to the detected–signal bus wire connecting anchor-terminals "B" of the front and rear etched–circuit boards of the 1026 modulator assembly.
e. Set the wave analyzer to 10-Hz bandwidth, the full-scale sensitivity to 1 V, and the frequency to 200 Hz.
f. Tune the 1309 for maximum meter reading on the wave analyzer, and adjust the 1309 output level for a midscale reading of 0.5 V (4 dB) on the wave analyzer.
g. Set the Oscilloscope gain for fullscale deflection.
h. Disconnect the audio oscillator from the modulation INPUT of the 1026, and connect it through 4.7 kΩ series resistor and a 1-μF capacitor to the detected signal bus to which the analyzer is connected.
i. Adjust the audio-oscillator output for full-scale deflection of the oscilloscope and increase the wave analyzer sensitivity by 50 dB to 3 mV full scale.
j. Set R222 for a wave–analyzer reading of 0 dB (1 mV).
k. Vary the frequency of the 1026, noting the frequency at which a minimum reading occurs on the wave analyzer meter. This will probably occur near the high end of the Band II (22-48 MHz), but all bands must be checked.
l. At whatever frequency the minimum is observed, reset R222 for a wave–analyzer reading of 0 dB (1 mV).

5.7.5 MODULATION–LEVEL CALIBRATION.

a. Set the 1026 Controls as follows:

MODULATION SELECTOR	Internal 1 kHz
MODULATION LEVEL	ON
FREQUENCY RANGE	Band II
FREQUENCY	Midscale (35 MHz)
OUTPUT RANGE	+10 dBm
CARRIER LEVEL	+1 dBm

b. Connect the rf output of the 1026 through attenuator pads specified in the following detailed procedures to the 874-VQL Voltmeter Detector terminated by a Type 874-W50 BL termination.
c. Connect the detector output to the vertical input of the oscilloscope, to the VTVM input, and to a 10-kΩ load resistor.
d. Set oscilloscope controls as follows:

INPUT	Dc
TRIGGER	EXT
INPUT ATTENUATOR	As required
SWEEP TIME	0.5 ms/cm

e. Connect the 20-dB pad between the output of the 1026 and the voltmeter detector input.
f. Set the Modulation Selector switch to CW and set the dc reference line on the scope for midscale.
g. Remove the 20-dB pad and set the Modulation Selector switch back to 1-kHz position.
h. Increase the modulation-level control until the negative peaks of the 1-kHz modulation-envelope pattern just touch the midscale reference point.
i. Adjust R325 (Mod Level Full Scale ADJ) for a 90% reading of the Modulation Level meter. R325 is accessible through a hole in the rear Modulator board. It may be necessary to adjust R309 (% MOD) in order to reach 90%.
j. Connect a 3-dB pad to the output of the 1026 and set the Modulation Selector switch to CW.
k. Set the dc reference line on the scope for midscale.
l. Remove the 3-dB pad and set the Modulation Selector switch back to the 1-kHz position.
m. Set the Modulation Level Control until the peaks of the 1-kHz signal touch the reference line.

n. Adjust R326 (Mod Zero ADJ) on the Modulator for 29.3% reading of the modulation meter.

o. Repeat adjustments of R325 and R326 until the meter reads correctly at both points to within ±2% of reading.

5.7.6 % MODULATION ADJUSTMENT.

This adjustment is required so that the % modulation is independent of the Carrier Level control. If misadjusted, very large errors in % MODULATION reading will occur at low CARRIER LEVEL Control settings. Two settings of the Carrier Level Control, 10 dB apart and at a modulation level of 90%, are used in making the adjustment, and performance is also checked at 30% Modulation.

a. Repeat steps e through i of para. 5.7.5 up to the point where the 90% modulation peaks just touch the reference line.

b. Note the dc reading on the 1806 voltmeter. It should be about 0.9 V.

c. Switch the attenuator to the +20-dBm position and decrease the Carrier Level control to obtain the same dc reading above.

d. Adjust R309 so that the peaks of the 1-kHz signal, as seen on the scope, again touch the reference line. As R309 is adjusted it will be necessary to adjust the Carrier Level control so the same dc reading, is maintained.

e. Switch the attenuator to the +10 dBm position and increase the Carrier Level control to obtain the same dc reading on the 1806. The peaks of the 1-kHz signal should still be at the reference line. If they are not, reset the Modulation Level control until they do and repeat the adjustment procedures for 90% Modulation at High and Low settings of carrier level.

f. Set up 29.3% modulation, with the Carrier Level control set to +10 dBm, using the procedure of steps j through o of para. 5.7.5 to set the Modulation Level control. Note the reading of the Modulation Level meter.

g. Reset the Output Range switch to +20 dBm and reduce the setting of the Carrier Level control, until the same dc reading on the 1806 is obtained.

h. Reset the Modulation Level Control as required to obtain 29.3% modulation as determined by having the peaks of the 1 kHz signal touch the oscilloscope reference line. Note the new reading on the Modulation Level meter. The two meter reading should agree within 2%; e.g., 28.5% vs 30% as indicated on the meter.

5.7.7 INTERNAL 1-kHz OSCILLATOR.

a. Set the 1026 MODULATION SELECTOR to INT 1-kHz and connect the counter to the 1-kHz output of the 1026 at J412-J413.

b. Adjust R203 to obtain a period reading between 999.8 and 1000.2 μs.

c. Adjust MODULATION LEVEL control cw until the MODULATION METER reads 100%. This should occur before the control reaches a 3 o'clock position.

5.8 POWER SUPPLY SERVICE (FIGURE 5-17).

5.8.1 TROUBLE ANALYSIS.

The first step in power–supply trouble analysis is to localize the trouble to one of four basic sections in the power supply These are:

1. Preregulator, including L501, L502, Q501, CR501-505 and CR510-CR511.

2. High–voltage supply including CR506-CR509, CR531, Q531-Q535.

3. The +30 V supply, including CR512-CR515, CR560, Q560-Q561.

4. The -12 V supply, including CR516-CR519, CR570, Q570-Q572.

The preliminary localization to one of these circuits can be made without removing the power supply by measuring output voltages with respect to ground at connector PL530, (see Figure 5-5) and the internal rectifier output voltages at the links that join the two etched boards. Accuracy of the general–purpose volt-ohm-multiammeter (see Table 5-12) is generally sufficient only for preliminary trouble analysis.

An accurate differential voltmeter is required to perform all adjustments except for the regulated heater voltage (TP530), which requires the use of the precision thermocouple voltmeter specified in Table 5-12. Normal output voltages and line–regulation characteristics are shown in Table 5-13. Set signal-generator controls as follows:

POWER	ON
MODULATION LEVEL	MOD OFF (Fully ccw)
MODULATION SELECTOR	CW
FREQUENCY CALIBRATOR	OFF
FREQUENCY	220 MHz
FREQUENCY RANGE	220-430 MHz
CARRIER LEVEL	+7 dBm
OUTPUT RANGE	0 dBm

NOTE

Do not reset R505, R545, R551, or R576 except in accordance with specific procedures described in para. 5.8.2 - 5.8.5. Major deviations of voltages from tabulated values generally indicate a fault that should be cleared before readjustment.

CAUTION

Do not operate the power supply when a short-circuit fault is known to exist. Momentary short circuits of the output voltages will cause no permanent damage, but the supply is not protected against prolonged overload.

If the regulated heater voltage is incorrect, the trouble is most likely in the preregulator, and dc voltages at pins 1 and 2 will be in error by similar percentages. High output of

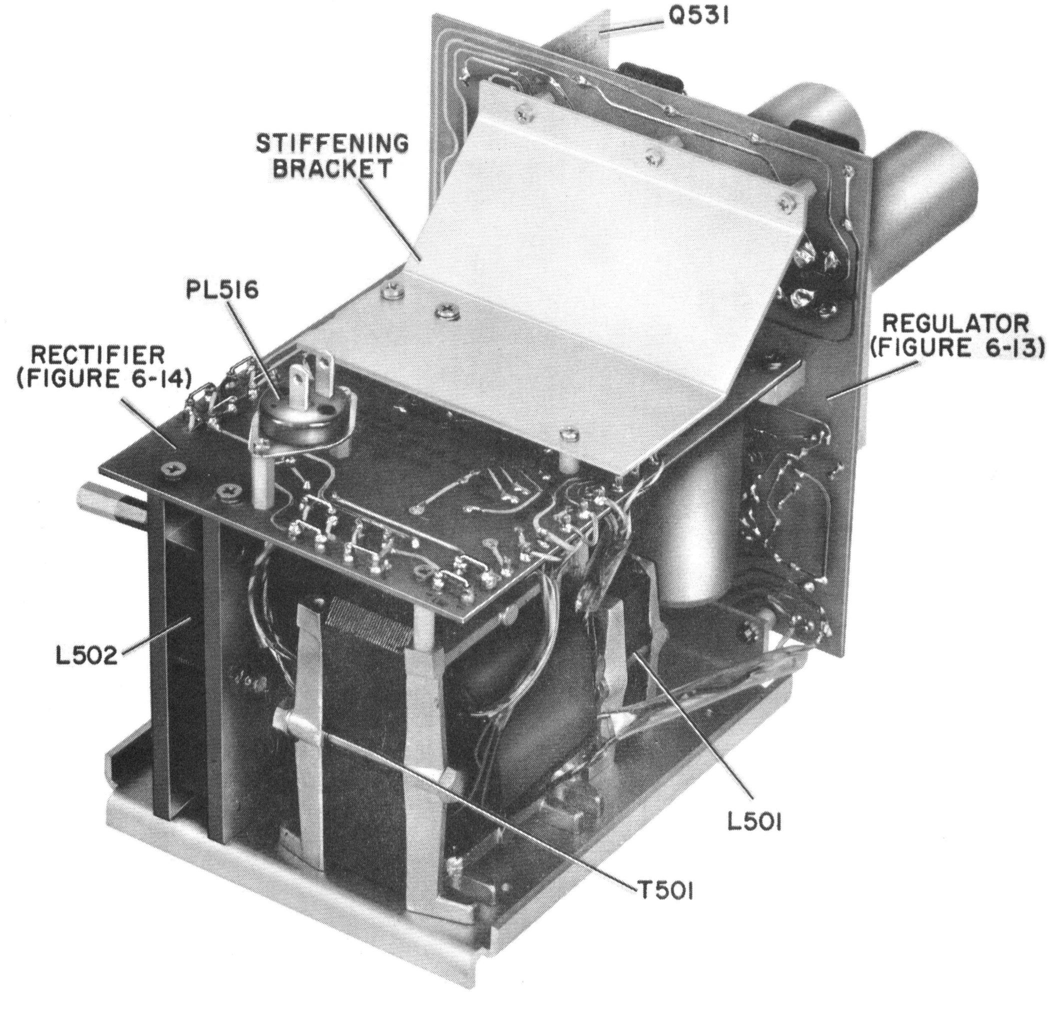


Figure 5-17. Power-Supply Assembly.

TABLE 5-12
TEST EQUIPMENT FOR POWER SUPPLY TROUBLE ANALYSIS

Equipment	*Manufacturer/Model**
Oscilloscope	Tektronix 453, 1 mV/cm vertical sensitivity.
Thermocouple voltmeter	Rawson type 502D, ±1% rms ac, dc accuracy.
Voltmeter	Fluke differential model 801, 871, ±0.5% of reading accuracy.
V-O-M	Triplett type 630A.
Autotransformer	GR W5MT3W or W5MT3AW

*Or equivalent.

about 8 V is indication of a shorted transistor Q501, and possibly of defective diodes CR503 or CR504. If power input to the supply is greater than 100 W, and at the same time output from one or more supplies is low, look for short circuits or defective electrolytic capacitors before attempting to readjust the regulated heater voltage. If the regulated heater voltage is correct, and one of the three main dc supplies is clearly farther from normal operation than the other two, concentrate on the area that is most clearly defective, since there may be some interaction between supplies.

Satisfactory regulation against line–voltage fluctuations by the electronic regulators on the +220 V, +30 V, and -12.4 V supplies is dependent on correct operation of the preregulator circuit. Normal line regulation characteristics are shown in Table 5-13; any substantial deviation from these characteristics indicates a defective regulator.

Normal operating voltages at the various capacitors, Zener diodes, and transistors used in the regulators are given in Table 5-14. The voltages associated with the preregulators and the +220-V regulator can be checked without removing the power supply from the instrument, but it is necessary to remove the stiffening bracket from the power supply (see Figure 5-17).

To measure voltages within the circuits of the +30 V and -12.4-V regulators, it is necessary to remove the power supply from the instrument and operate it with an 18-lead extension patch cord to join PL530 to SO430.

To fabricate the patchcord connect corresponding pin numbers on each of the following connector types, using #20 insulated leads:

Power-Supply Connector	Methode 71-6018
Chassis-Cable Plug	Methode 60-6018

All capacitor and diode voltages are measured across the two terminals of the component in question; transistor voltages are shown with respect to ground, except for Q501 where voltages are shown with respect to the negative terminal of C502. Since base--to–emitter voltages are significant, it is usually preferable to measure these directly. Use a voltmeter of at least 20,000 Ω/V sensitivity.

Additional help in localization of problems may be obtained from the Trouble Analysis Chart, Table 5-15. Presence of large ripple, which is primarily 120 Hz and has relatively low 60-Hz component, indicates a defective capacitor, whereas presence of a large 60-Hz component on the input capacitor of a filter indicates a defective rectifier. In multisection R-C filters, begin the analysis with the "A" section of the capacitor, which should have the largest ripple, and work through the filter to be sure each successive section has lower ripple.

5.8.2 PREREGULATOR/HEATER VOLTAGE.

NOTE

> Owing to significant distortion of the waveform by the preregulator circuits, it is essential that adjustment of the ac heater voltage be carried out using a true-rms-responding instrument of high accuracy, preferably of the thermocouple type recommended in Table 5-12.

Connect thermocouple voltmeter between TP530 and ground; meter range switch should be set to 10 V. Set 1026 controls as specified in para. 5.8.1. The output voltage should be 6.55 ±.05 V, and can be adjusted by means of R505, AC HTR ADJ, accessible through the left sidepan of the instrument. This is not a routine maintenance adjustment; it should only be required if components such as Q501 or CR505 have been replaced. If readjustment is required without having done the other service work on the preregulator, the entire circuit should be checked carefully. Protective diodes CR503 and CR504 must be checked, if Q501 is found to be defective.

5.8.3 +220 VOLT REGULATOR VOLTAGE.

Connect the differential voltmeter between J102 on the RF Assembly and ground, and set 1026 controls as specified in para. 5.8.1. The voltmeter should read 220 ±2 V. Adjust R545 if necessary. This adjustment is located near the middle of the regulator board, on the edge adjacent to the left end pan of the instrument, as shown in Figure 5-5. If the adjustment range available is not at least 210 to 225 V, the entire regulator circuit should be checked. After setting the voltage to 220 V, turn POWER SWITCH to STANDBY. If voltage increases more than 2 V, Q531 may be defective and should be replaced. When replacing the Germanium transistor used in early models with the newer Silicon type, it will be necessary to replace the heat radiator in order to accept the new mounting dimensions, to solder connections directly to the transistor pins instead of using contact clips, and to replace C533

TABLE 5-13
POWER SUPPLY OUTPUT VOLTAGES†

Test Location	Terminal	Voltage at 115-V line		Normal Change with Line	
		Nominal	Tolerance	100-V line	130-V line
Regulator Board 1026-2761	1	+260	±10	–5	+2
	3	+ 36	± 1	–1	+0.4
	5	+ 3.4	± 0.7	–0.4	+0.2
	6	– 12.4	± 0.2	0	0
	TP530	6.55*AC	± .10	– .05	+ .10
Cable Connector SO430	1	243	±10	–5	+2
	2	240	±10	–6	+1
	3	220	± 2	–0.1	+0.1
	5	202	±20	–0.1	+0.1
	6	199	± 5	–0.1	+0.1
	11	29.4	± 1.5	0	0
	13	– 12.4	± 0.2	0	0
	14	– 6.3	± 0.1	0	0
	15, 16	0	0	0	0
	17, 18	6.55*AC	± .10	– .05	+ .10

† All voltages measured with respect to ground Carrier Frequency 220 MHz on 220-430 MHz Range, + 7 dBm Output.

*Must be measured with thermocouple voltmeter; See Table 5-12.

TABLE 5-14
POWER-SUPPLY REGULATOR VOLTAGES

Circuit Function	Test Location	Symbol	Voltages			
			Across Component	Base To Ground	Emitter To Ground	Collector To Ground
Preregulator	Rectifier Board 1026-2751	C502	18.5	–	–	–
		CR505	10 V	–	–	–
		Q501†	–	+ 7.0	+ 6.4	+ 7.0
+220 V Regulator	Regulator Board 1026-2761 (Upper third)	C531A	+260	–	–	–
		C531B	+245	–	–	–
		C531C	+240	–	–	–
		C532A	+251	–	–	–
		C532B	+243	–	–	–
		C532C	+240	–	–	–
		CR531	20	–	–	–
		Q531	–	+241.4	+242	+220
		Q532	–	+220.6	+220	+241.9
		Q533	–	+200	+199.4	+220.6
		Q534	–	+219.4	+220	+199.4
		Q535	–	+200	+199.4	+219.4
+30 V Regulator	Regulator Board 1026-2761 (Bottom third)	C560	36	–	–	–
		CR560	30	–	–	–
		Q560*	–	+ 35.7	+ 35.9	+ 29.4
		Q561	–	+ 30	+ 29.5	+ 35.7
–12.4 V Regulator	Regulator Board 1026-2761 (middle third)	C570	16	–	–	–
		CR570	10	–	–	–
		Q570*	–	+ 2.8	+ 3.1	0
		Q571	–	+ 0.6	0	+ 2.8
		Q572	–	– 11.8	– 12.4	+ 0.6
		Q573	–	– 0.6	0	– 11.8

*Germanium Transistor

† Measure voltages with respect to negative terminal of C502.

TABLE 5-15
POWER-SUPPLY TROUBLE ANALYSIS CHART

Symptom	*Probable Cause*	*Remedy*
No output voltages.	No line voltage, POWER switch off, or blown fuse; cable from cabinet entrance box to SO417 not plugged into J417.	
PREREGULATOR ANALYSIS		
Incorrect ac heater voltage at TP530, accompanied by poor regulation against line.	Defective Preregulator.	Check CR501-CR505 and Q501.
Dial lights brighter than normal or burned out.	Defective Preregulator	
High ac heater voltage accompanied by high +250 V output and poor regulation against line.	CR503 or Q501 open.	
Low ac heater voltage accompanied by low 250-V output and poor regulation against line.	CR501 or CR502 open. Q501 or C501 shorted.	Replace
HIGH VOLTAGE ANALYSIS		
+250 output low.	Defective rectifier-filter circuit.	Check ripple on C531 & C532.
No + 220-V output	Q531 open.	Replace.
+220-V output regulation poor with change from STANDBY to ON of POWER switch.	Q531 defective	Replace (para. 5.8.3).
+250-V appears at +220-V terminal.	Q531 shorted.	Replace (para. 5.8.3).
+220-V drifts erratically	Defective CR531. Leaky transistor Q535.	Replace.
+30-V ANALYSIS		
+30-V output low.	Defective rectifier-filter circuit.	Check ripple on C503 and C500.
+30-V output out of tolerance and regulates poorly.	Defective CR500, or transistor Q560-Q561.	Replace
−12.4 V ANALYSIS		
−12.4 V output low.	Defective Rectifier-filter circuit.	Check ripple on C504/C570.
−12.4 V output out of tolerance and regulates poorly.	Defective CR570 or Q570-Q573.	Replace.
−12.4 V output out of tolerance but regulates satisfactorily.	Incorrect adjustment of R576, possibly result of setting −6.3 V dc output.	Reset.
−12.4 V output noisy.	Defective CR570.	Replace.

TABLE 5-16
POWER-SUPPLY RIPPLE VOLTAGE CHART

Circuit Function	*Symbol*	*Measurement Method*	*Typical 120-Hz pk/pk Ripple*
Preregulator	C502	Differential from + to case of C402	4 V
+250 V Supply	C531A	+ of C531A to ground	12 V
	C532A	+ of C532A to ground	2 V
	C532B	+ of C532B to ground	0.6 V
+245 V Supply	C532C	+ of C532C to ground	0.3 V*
+220 V Supply	C531B	+ of C531B to ground	0.6 V*
	C531C	+ of C531C to ground	10 mV*
	SO430 #3	To ground	0.2 mV
Oscillator Supply	C537A	+ of C537A to ground	0.2 mV
Modulator Offset	C537B	+ of C537B to ground	6 mV
+30 V Supply	C503	+ of C503 to ground	0.6 V
	C560	+ of C560 to ground	50 mV
	SO430, #11	To ground	1 mV
−12.4 V Supply	C504 C570	Differential, from + to case of C504	0.5 V
	SO430, #13	To ground	0.5 mV

*Low frequency "bounce" may exceed tabulated 120-Hz pk/pk ripple.

TABLE 5-17
COAXIAL SWITCH RESISTANCE CHART (S400)

Frequency Calibrator Switch Pos.	*PL110/ J410 Condition*	*Resistance Measured*		*Resistance Value in ohms*
		From	*To*	
External	Normally Mated	J411 Ctr	Ground	50
Off				0
INT XTAL, 1 MHz				50
INT XTAL, 5 MHz				0
External	Disconnected	J411 Ctr	J410 Ctr	0
Off				∞
INT XTAL, 1 MHz				0
INT XTAL, 5 MHz				∞
External	Disconnected	J410 Ctr	Ground	∞
Off				50
INT XTAL, 1 MHz				∞
INT XTAL, 5 MHz				50

with the new value and circuit location as shown in Figure 6-4.

5.8.4 +220 VOLT COMPENSATION.

R552 may require change if one or more of the transistors Q531-Q535 in the +220 V regulator circuit has been replaced. Check that the preregulator is functioning correctly before selecting R552.

Connect the differential voltmeter between J102 on the RF Assembly and ground. Balance the differential voltmeter at 220 ±2 V, and set to 1 V full-scale sensitivity in the differential mode. Set the 1026 controls as specified in para. 5.8.1.

Turn POWER switch ON, and vary the CARRIER LEVEL control over its entire range. The total variation in reading of the differential voltmeter must not exceed 0.05 V. If the voltage increases as the carrier level is turned up, the supply is overcompensated, and the value R552 is too low and should be increased, and vice versa.

5.8.5 -12.4 VOLT REGULATOR.

The setting of R576 affects both the -12.4 V supply voltage and the heater voltage supplied to oscillator tube V101, nominally -6.3 V. Use the differential voltmeter nulled to the design–center voltage being measured, and set for 1-V full-scale differential sensitivity. Set R576 so that the -6.3-V output, measured from SO430 terminal 14 to ground, is within ±0.1 V of nominal and the -12.4 V output measured from SO430, terminal 13, to ground, is within ±0.2 V of nominal.

5.9 PANEL ASSEMBLY SERVICING.

5.9.1 OUTPUT–ATTENUATOR ASSEMBLY.

If the attenuator (A400) has been damaged due to overload, remove it as described in para. 5.5.5. The spanner wrench described in Figure 5-18 must be fabricated to permit removal. Return the assembly to an authorized GR repair facility. Special fixtures are required to locate resistors correctly for proper impedance characteristics, and extensive electrical test facilities are necessary to prove out attenuator accuracy after servicing.

CAUTION

Do not attempt field repair of the attenuator.

5.9.2 FREQUENCY–CALIBRATOR SWITCH.

This assembly consists of a coaxial switch and a rotary wafer switch, both operated from a common shaft. In the event that the wafer switch requires service, it will be necessary to remove the entire frequency–calibrator and headphone–amplifier assembly, as described in para. 5.5.6. If malfunction of the coaxial switch is suspected, first check resistances as listed in Table 5-17; most malfunctions will be evident from the simple tests performed, leaving J410 mated normally to PL410. If the 0-Ω values are not obtained in this test, the switch is in need of adjustment. If the 50-Ω values are not obtained, proceed to the next test, which requires disconnecting PL110 from J410. If the 0-Ω values are not obtained in this test, the switch is in need of adjustment. If the resistance tests with PL110 disconnected are all satisfactory, but the 50-Ω values were not observed with it connected, the trouble is in the RF Assembly, either in the coaxial cables from PL110 to PL109, or in the monitor assembly, or its cable to J109.

If it becomes necessary to adjust the coaxial switch, this can usually be done without removing the assembly from the front panel. The action of the contact leaves can be observed by removing the bottom cover plate from the switch assembly, and can be adjusted by bending the tabs on the actuator plate on top of the switch body. If these tabs require adjustment, it will be necessary to remove the RF and Modulator assemblies, as described in para. 5.5.2 and 5.5.3. If the switch cover plate is removed, the mating surfaces should be coated with silver–bearing grease, prior to reassembly.

5.9.3 HEADPHONE AMPLIFIER.

In order to service the headphone amplifier, it is necessary to remove the rf assembly, as described in para. 5.5.2. Note that the only adjustments on this assembly are R412 (5 MHz and ADJ) and R414 (1 MHz ADJ), which are functionally part of the crystal calibrator. The adjustment procedure for these potentiometers is given in para. 5.6.14.

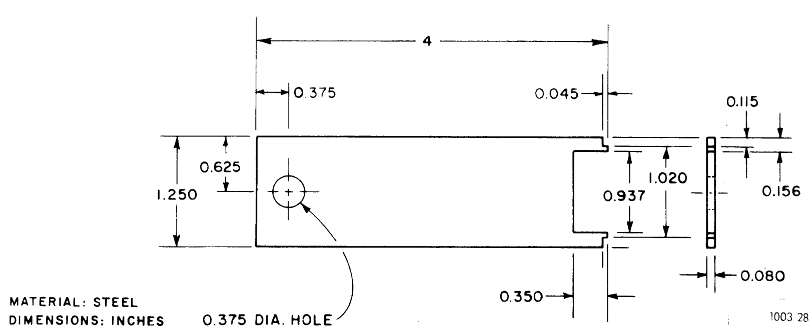


Figure 5-18. Assembly details for special spanner-wrench tool to remove front-panel mounting nut of Attenuator Assembly.

Replacement of components in the Headphone amplifier, including the wafer switch portion of S400, requires removal of this assembly as described in para. 5.5.6.

5.9.4 PANEL METERS.

Replacement of the modulation level meter requires removal of the Power Supply (see para. 5.5.4). Replacement of the carrier level meter requires partial removal of the RF Assembly (see para. 5.5.2), but it is neither necessary nor desirable to disconnect the rf output cable from PL405 to the attenuator, since reconnection of the cable requires considerable care. Simply loosen the two cable clamps on the rear of the front panel, adjacent to the casting bosses, and move the panel and rf assembly just far enough apart to gain access to the meter.

Since both meters are of premium taut-band construction, they should not become "sticky", but occasionally the zero adjustment fork may become distorted and cause sticking. This can be checked without removing the meter by unscrewing the pair of screws, which secures the front cover of the meter to the body, and removing the cover. If the stickiness disappears, check the appearance of the zero adjust fork and reform if necessary before replacing the cover.

The meter covers have been treated to prevent buildup of static charge, which can cause apparently erratic meter readings. If this treatment has been inadvertently removed by attempts at cleaning the meter cover, it should be restored by treatment with Statnul, a product of Weston Instruments Division of Daystron, Inc., Newark 12, New Jersey. Detailed instructions will be found on the Statnul squeeze bottle.

5.10 LUBRICATION.

Routine lubrication is not recommended as a standard maintenance procedure. Most load–carrying bearings are permanently lubricated ball bearings.

Where disassembly of rf shield covers or mating machined casting surfaces has occured, the surfaces should be coated lightly with silver bearing conductive grease. This consists of 30% by weight of Fine Silver Powder, Type P obtainable from the American Platinum and Silver Division of Engelhard Industries, Inc., Newark, N. J., in a light non-oxidizing grease vehicle.

For lubrication of most gears and sleeve bearings, the use of Master Lubricants Inc. Type Lubriko H-101 is recommended.

For lowest friction and smoothest operation of worm gears and racks in the frequency control and guillotine-capacitor drive mechanisms, use Dow Corning Corporation Molykote G Paste, a finely divided molydenum disulphide powder in soap-thickened mineral oil.

Contacts have been treated with a protective cleaner and lubricant, Cranolin Spray R. See para. 5.6.7 for procedure for renewal of this film. The material is available in 6-oz spray cans with 6-in. nozzle from Caig Laboratories, Inc. 155 Sulivan Lane, Westbury, N.Y., 11590.

SECTION 6

PARTS AND DIAGRAMS

INDEX OF SCHEMATICS

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 Zettlet 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, Lafeyette, 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

REF. NO.	DESCRIPTION	PART NO.	FED. MFG. CODE	MFG. PART NO.	FED. STOCK NO.
	Frequency Cal. Switch Asm.	1026-2510	24655	1026-2510	
	Audio Amp. Etched Circuit Board	1026-2781	24655	1026-2510	
	Power Supply Asm.	1026-2010	24655	1026-2010	
	Regulator Circuit Etched Board	1026-2761	24655	1026-2761	
	Rectifier Circuit Etched Board	1026-2751	24655	1026-2751	
	Radio Frequency Asm.	1026-2020	24655	1026-2020	
	Dial Light Asm.	1026-2640	24655	1026-2640	
	Drum Dial Asm.	1026-2650	24655	1026-2650	
	Crystal Calibrator Asm.	1026-2670	24655	1026-2670	
	Detector Preamp Etched Circuit Board	1026-2765	24655	1026-2765	
	Crystal Oscillator Etched Circuit Board	1026-2776	24655	1026-2776	
	Calibrator Preamp Etched Circuit Board	1026-2755	24655	1026-2775	
	Modulator Asm.	1026-2030	24655	1026-2030	
	Error Amp. Etched Circuit Board	1026-2716	24655	1026-2716	
	Modulator Etched Circuit Board	1026-2725	24655	1026-2725	
	Audio Oscillator Etched Circuit Board	1026-2735	24655	1026-2735	
	Pulse Stretched Etched Circuit Board	1026-2745	24655	1026-2745	
	Knob and Dial Asm. – Output	1026-1600	24655	1026-1600	
	Knob and Dial Asm. – Mod. Selector	1026-1610	24655	1026-1610	
	Knob – Frequency Calibrator	5500-5421	24655	5500-5421	
	Knob – Power	5500-5321	24655	5500-5321	
	Knob – Frequency Range	5500-5520	24655	5500-5520	
	Knob – Audio Gain	5520-5321	24655	5520-5321	
	Knob – ΔF	5520-5421	24655	5520-5421	
	Knob – Modulation Level	5520-5421	24655	5520-5421	
	Knob – Carrier Level	5520-5421	24655	5520-5421	
	Patch Cord – 874-R22LA	0874-9683	24655	0874-9683	5995-933-6852
	Power Cable	1026-0235	24655	1026-0235	
	Cord Asm.	1026-1515	24655	1026-1515	
	Window, Frequency Dial	1026-7100	24655	1026-7100	
	Power Cord, 3 wire, 7 foot	4200-9622	24655	4200-9622	6150-968-0081
	Phone Plug	4220-2000	82389	#440	5935-857-6301
	Indicator, Vernier	5460-1301	24655	5460-1301	6625-043-2124
	Label	5580-0802	24655	5580-0802	
	Meter Cover, clear	5720-3711	24655	5720-3711	
	End-Frame Set	5310-9602	24655	5310-9602	
	Handle – Rack Instrument	5360-2047	24655	5360-2047	
	Cabinet Asm.	1026-2040	24655	5360-2640	

Figure 6-1. Block diagram for 1026 Standard-Signal Generator.

PARTS LIST

REF. NO.	DESCRIPTION	PART NO.	FED. MFG. CODE	MFG. PART NO.	FED. STOCK NO.
CAPACITORS					
C401	Oil Impregnated, 0.01 μF ±20% 600 V	4516-3109	24655	4516-3109	
C402	Oil Impregnated, 0.01 μF ±20% 600 V	4516-3109	24655	4516-3109	
C405	Plastic, 0.047 μF ±10% 200 V	4860-7869	84411	663UW, 0.047 μF ±10%	
C411	Ceramic, 0.22 μF ±20% 25 V	4400-2052	80183	5C13, 0.22 μF	5910-974-5694
C412	Electrolytic, 15 μF ±20% 20 V	4450-5200	56289	150D156X0020B2	5910-855-6335
C413 thru C415	Electrolytic, 15 μF +100-10% 15 V	4450-3700	37942	TT, 15 μF +100-10%	
RESISTORS					
R400	Composition, 51 Ω ±5% 1/4 W	6099-0515	75042	BTS, 51 Ω ±5%	
R401	Pot. comp., 2.5 kΩ ±10% 2.25 W	6045-2258	01121	JT, 2.5 kΩ ±10% 1/4 W	
R402	Composition, 36 kΩ ±5% 1/2 W	6100-3365	01121	RC20GF363J	5905-249-4256
R403	Pot. comp., 2.5 kΩ ±10% 2.25 W	6010-0700	01121	JU, 2.5 kΩ ±10% 2.25 W	
R404	Composition, 2 kΩ ±5% 1/2 W	6100-2205	01121	RC20GF202J	5905-190-8887
R405	Composition, 5 kΩ ±10% 2.25 W	6000-0500	01121	JU, 5 kΩ ±10%	
R406	Composition, 470 Ω ±10%	6110-1479	01121	RC32GF471J	5905-299-2051
R407	Pot. comp., 500Ω ±10% 2 W	6010-0300	01121	JU, 500Ω ±10%	5905-448-5741
R410	Composition, 100Ω ±5% 1/4 W	6099-1105	75042	BTS, 100Ω ±5%	
R411	Composition, 2.2 kΩ ±5% 1/4 W	6099-2225	75042	BTS, 2.2 kΩ ±5%	
R412	Pot. wire-wound 20 kΩ ±5% 1 W	6058-3205	75042	CT-1000, 20 kΩ ±5%	
R413	Composition, 2.7 kΩ ±5% 1/4 W	6099-2275	75042	BTS, 2.7 kΩ ±5%	
R414	Pot. wire-wound 20 kΩ ±5% 1 W	6058-3205	75042	CT-100, 20 kΩ ±5%	
R415	Composition, 30 kΩ ±5% 1/4 W	6099-3305	75042	BTS, 30 kΩ ±5%	
R416	Composition, 390 kΩ ±5% 1/4 W	6099-4395	75042	BTS, 390 kΩ ±5%	
R417	Pot. comp., 10 kΩ ±10% 2-1/4 W	6020-0400	01121	JU, 10 kΩ ±10%	5905-829-3323
R418	Composition, 12 kΩ ±5% 1/4 W	6099-3125	75042	BTS, 12 kΩ ±5%	
R419	Composition, 1 kΩ ±5% 1/4 W	6099-2105	75042	BTS, 1 kΩ ±5%	
R420	Composition, 470 kΩ ±5% 1/4 W	6099-4475	75042	BTS, 470 kΩ ±5%	
R421	Composition, 33 kΩ ±5% 1/4 W	6099-3335	75042	BTS, 33 kΩ ±5%	
R422	Composition, 10 kΩ ±5% 1/4 W	6099-3105	75042	BTS, 10 kΩ ±5%	
R423	Composition, 220 Ω ±5% 1/4 W	6099-1225	75042	BTS, 220 Ω ±5%	
R424	Composition, 150 kΩ ±5% 1/4 W	6099-4155	75042	BTS, 150 kΩ ±5%	
R425	Composition, 8.2 kΩ ±5% 1/4 W	6099-2825	75042	BTS, 8.2 kΩ ±5%	
R426	Composition, 10 kΩ ±5% 1/4 W	6099-3105	75042	BTS, 10 kΩ ±5%	
R427	Composition, 39 kΩ ±5% 1/4 W	6099-3395	75042	BTS, 39 kΩ ±5%	
R428	Composition, 270 Ω ±5% 1/4 W	6099-1275	75042	BTS, 270 Ω ±5%	
MISCELLANEOUS					
F401	FUSE, 115 V 1.6 Amp	5330-1700	71400	MDL, 1.6 A	5920-131-9819
F402	FUSE, 115 V 1.6 Amp	5330-1700	71400	MDL, 1.6 A	5920-131-9819
F401	FUSE, 230 V 0.8 Amp	5330-1200	71400	MDL, 0.8 A	5920-284-6733
F402	FUSE, 230 V 0.8 Amp	5330-1200	71400	MDL, 0.8 A	5920-284-6733
A400	ATTENUATOR, Step, coaxial	0825-4030	24655	0825-4030	
J406	JACK, Coaxial, miniature	Part of A400			
J407	JACK, Coaxial, GR874	Part of A400			
J410	JACK, Coaxial, miniature	4260-1288	24655	4260-1288	
J411	JACK, Coaxial, GR874	Part of 1025-2510			
J412	JACK, binding post, type 938	0938-3002	24655	0938-3002	
J413	JACK, binding post, type 938	0938-3000	24655	0938-3000	
J415	JACK, telephone, o.c.	4260-1500	24655	4260-1500	
J416	JACK, connector, single jack	4260-0970	98291	SKT 23	
J417	JACK, connector, single jack	4260-0970	98291	SKT 23	
J418	JACK, connector, single jack	4260-0970	98291	SKT 23	
S400-1	SWITCH, rotary	7890-3500	24655	7890-3500	
S401	Part of R401				
S402	SWITCH, rotary	7890-3980	24655	7890-3980	
Q411	Type 2N3414	8210-1047	24446	2N3414	5961-989-2749
Q412	Type 2N3414	8210-1047	24446	2N3414	5961-989-2749
Q413	Type 2N3414	8210-1047	24446	2N3414	5961-989-2749
M401	METER, Modulation Level	5730-1386	40931	144003-0001	
M402	METER, Carrier Level	5730-1387	40931	144003-0002	
PL405	PLUG, Coaxial, miniature	Part of 1026-2840			
PL406	PLUG, Coaxial, miniature	Part of 1026-2840			
PL417	PLUG, Power, 3-wire, panel mount	4240-0600	24655	4240-0600	5935-816-0254
PL418	PLUG, Power, 3-wire, panel mount	4240-0700	24655	4240-0700	5935-794-3012
SO400	SOCKET, multiple connector	4230-2735	71785	36-4200-24S	
SO414	SOCKET, multiple connector	4230-3700	71785	S-312-AB	
SO416	SOCKET, multiple connector	4200-1923	24655	4200-1923	
SO417	SOCKET, multiple connector	4200-1921	24655	4200-1921	
SO420	SOCKET, multiple connector	4230-2735	71785	36-4200-24S	
SO430	SOCKET, multiple connector	4230-2699	95354	91-6018-1201-00	
S400	SWITCH, rotary, Freq. Calibrator	1026-2515	24655	1026-2515	

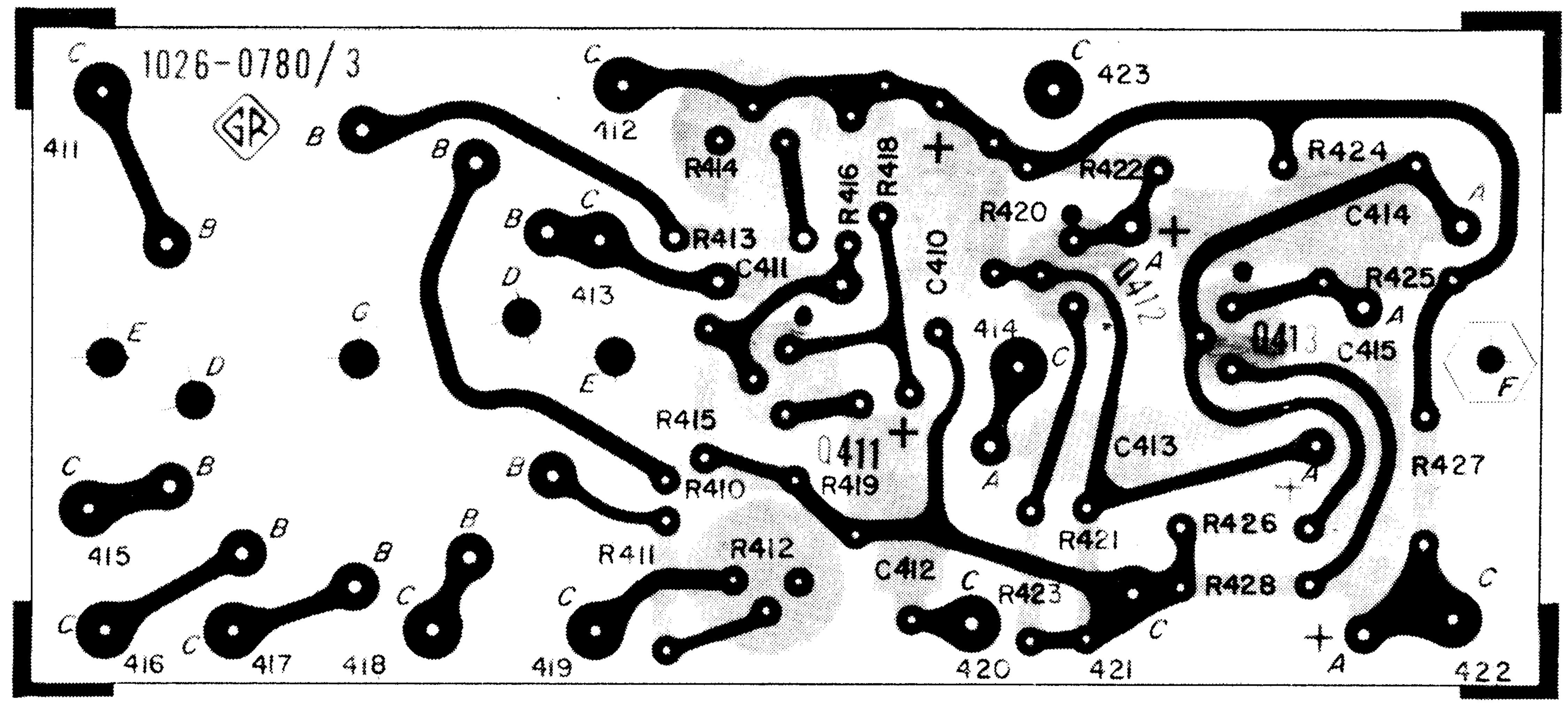
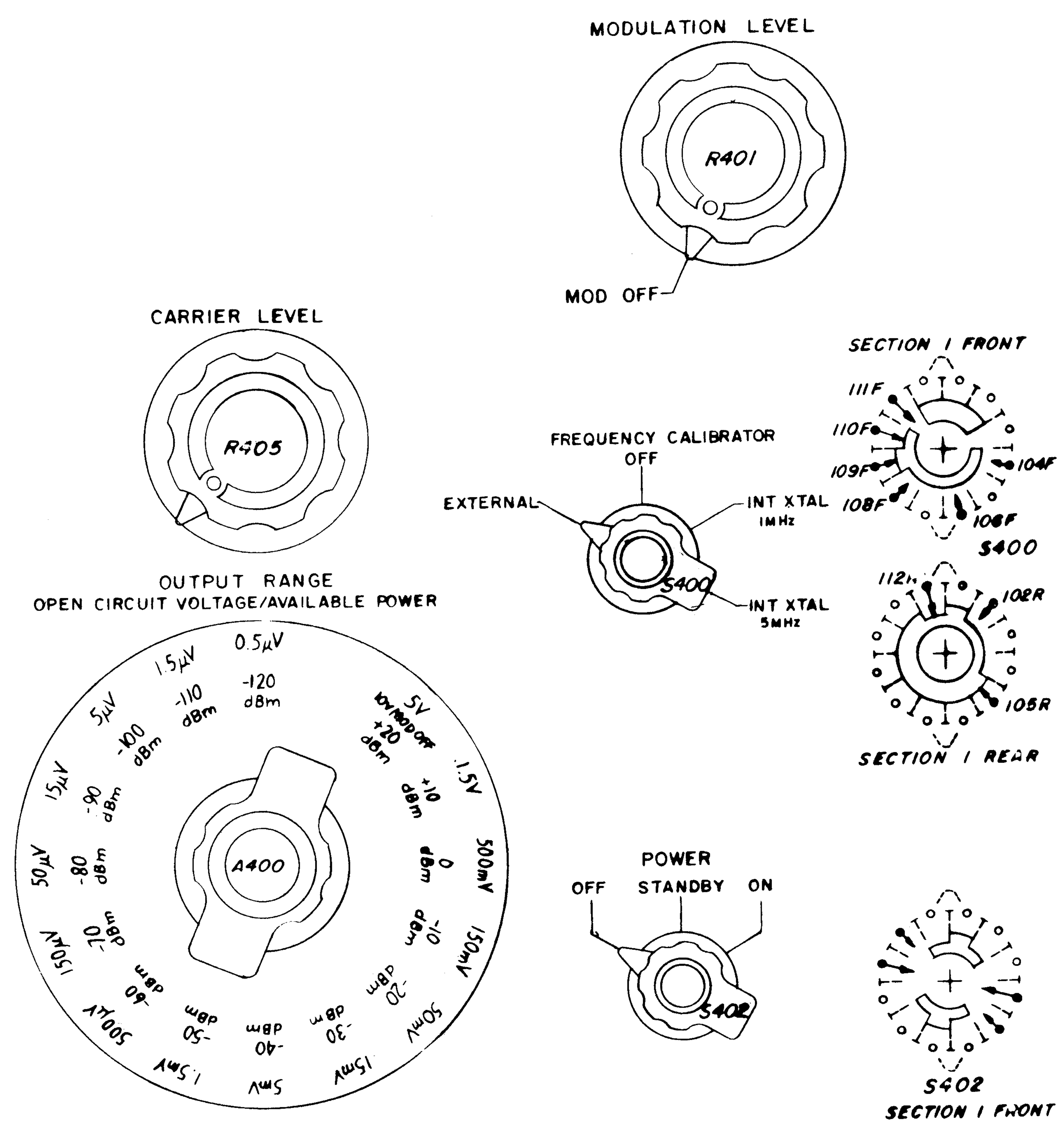


Figure 6-2. Etched-circuit-board diagram for Crystal Calibrator Audio-Amplifier Assembly (P/N 1026-2781).

NOTE: The number appearing on the foil side is not the part number. The dot on the foil at the transistor socket indicates the collector lead.

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.



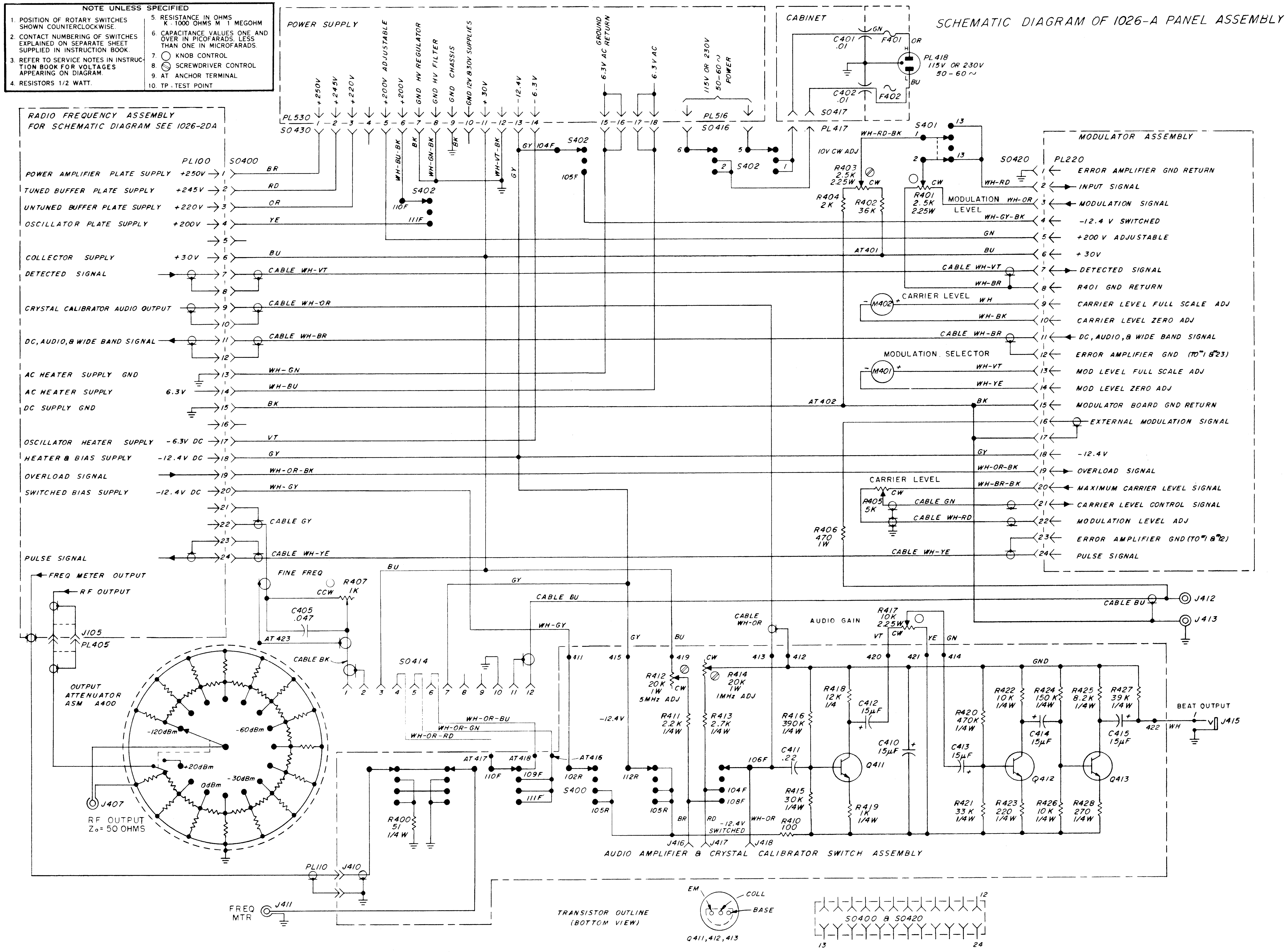


Figure 6-3. Interconnecting wiring diagram for 1026 Standard-Signal Generator.

PARTS LIST

REF. NO.	DESCRIPTION	PART NO.	FED. MFG. CODE	MFG. PART NO.	FED. STOCK NO.
CAPACITORS					
C100	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C,470 pF ±20%	
C101	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C102	Ceramic, 15 pF ±10%	4400-2096	01121	FU6D, 15 pF ±10%	
C103	Variable air, Guillotine, ganged	Part of RF Assembly			
C104	Oil Impregnated, 0.1 μF ±20% 400 V	4514-4109	56289	102P24	
C105	Variable air, Guillotine, ganged	Part of RF Assembly			
C106	Variable air, Guillotine, ganged	Part of RF Assembly			
C107	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C108	Miscellaneous, 0.01 μF +20-10% 400 V	4920-1200	80183	47P2, 0.01 μF 400 V	5910-280-7148
C109	Oil Impregnated, 0.1 μF ±20% 400 V	4514-4109	56289	102P24	
C110	Ceramic, 82 pF (NPO) ±5% 500 V	4410-0825	80131	CC63, 82 pF ±5% (NPO)	
C111 thru C114	Ceramic, 0.5 - 3 pF	1026-0401	24655	1026-0401	
C115	Ceramic, 22 pF ±10%	4400-2097	01121	FU6D, 22 pF ±10%	
C116	Ceramic, 6.8 pF ±10%	4400-2095	01121	FU6D, 6.8 pF ±10%	
C117	Ceramic, 68 pF (NPO) ±5% 500 V	4410-0685	80131	CC63, 68 pF ±5%	
C118	Ceramic, 470 pF ±20% 500 V	4400-2000	01121	FB2B, 470 pF ±20%	
C119	Ceramic, 470 pF ±20% 500 V	4400-2109	01121	FA5C, 470 pF ±20%	
C121	Ceramic, 470 pF ±20% 500 V	4400-2109	01121	FA5C, 470 pF ±20%	
C122	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C123	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C124	Ceramic, 220 pF ±10%	4404-1225	72982	831, 220 pF ±5%	
C125	Ceramic, 220 pF ±10%	4404-1225	72982	831, 220 pF ±5%	
C126	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C127	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C128	Oil Impregnated, 0.1 μF ±20% 400 V	4514-4109	56289	102P24	
C129	Oil Impregnated, 0.1 μF ±20% 400 V	4514-4109	56289	102P24	
C130	Ceramic, 470 pF ±20%	4400-2109	01121	5A5C, 470 pF ±20%	
C131	Ceramic, 470 pF ±20%	4400-2109	01121	5A5C, 470 pF ±20%	
C132	Feedthrough, 0.01 μF +20-10% 400 V	4920-1200	80183	47P2, 0.01 μF 400 V	5910-280-7148
C140	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C141	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C142	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C143	Oil Impregnated, 0.1 μF ±20% 400 V	4514-4109	56289	102P24	
C144	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C145	Oil Impregnated, 0.1 μF ±20% 400 V	4514-4109	56289	102P24	
C146	Variable air, Guillotine, ganged	Part of RF Assembly			
C147	Variable air, Trimmer, ganged	Part of RF Assembly			
C148	Ceramic, 82 pF (NPO) ±5% 500 V	4410-0825	80131	CC63, 82 pF ±5% (NPO)	
C149	Ceramic, 68 pF ±10%	4400-2099	01121	FU6D, 68 pF ±10%	
C151	Air Dielectric, 1.3 - 4.1 pF	4380-6004	74970	U189-26-5	
C152	Air Dielectric, 1.3 - 4.1 pF	4380-6004	74970	U189-26-5	
C153	Air Dielectric, 1.6 - 6.7 pF	4380-6008	74970	U-189	
C154	Air Dielectric, 1.3 - 4.1 pF	4380-6004	74970	U189-26-5	
C155 thru C157	Ceramic, 15 pF ±10%	4400-2096	01121	FU6, 15 pF ±10%	
C159	Feedthrough, 0.01 μF +20-10% 400 V	4920-1200	80183	47P2, 0.01 μF 400 V	
C160	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C170	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C171	Ceramic, 220 pF ±10%	4400-2103	01121	FA5C, 220 pF ±10%	
C172	Ceramic, 220 pF ±10%	4400-2103	01121	FA5C, 220 pF ±10%	
C173	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C174	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C175	Oil Impregnated, 0.1 μF ±20% 400 V	4514-4109	56289	102P24	
C176	Variable, air, Guillotine, ganged	Part of RF Assembly			
C177	Variable, air, Trimmer, ganged	Part of RF Assembly			
C178	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C179	Oil Impregnated, 0.1 μF ±20% 400 V	4514-4109	56289	102P24	
C180	Ceramic, 82 pF ±10%	4400-2102	01121	FA5C, 82 pF ±10%	
C181	Air Dielectric, 1.3 - 4.1 pF	4380-6004	74970	U189-26-5	
C182	Air Dielectric, 1.3 - 4.1 pF	4380-6004	74970	U189-26-5	
C183	Air Dielectric, 1.6 - 6.7 pF	4380-6008	74970	U189, 1.6 - 6.7 pF	
C184	Air Dielectric, 1.3 - 4.1 pF	4380-6004	74970	U189-26-5	
C185	Ceramic, 1.0 pF ±10% 500 V	4400-0100	78488	GA, 1 pF ±10%	5910-981-3425
C186	Variable, Trimmer				
C189	Ceramic, 1.0 pF ±10% 500 V	4400-0100	78488	GA, 1 pF ±10%	5910-981-3425
C190	Special Assembly				
C191	Ceramic, 5.6 pF ±10%	4400-0569	78488	GA, 5.6 pF	5910-931-0528
C192	Special Assembly				
C193	Special Assembly				
C194	Plastic, 0.015 μF ±10% 100 V	4860-7655	84411	663UW, 0.015 μF ±10%	
C195	Feethrough, 0.1 μF +20-10%	4920-1200	80183	47P2,0.01 μF 400 V	5910-280-7148
C196	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	5910-280-7148
C251	Ceramic, 470 pF ±20%	4400-2109	01121	FA5C, 470 pF ±20%	
C252	Electrolytic, 25 μF +100-10% 50 V	4450-3000	8018.,	D33883	5910-799-9285
C253	Oil Impregnated, 0.1 μF ±20% 400 V	4514-4109	56289	102P24	
C265	Oil Impregnated, 0.1 μF ±20%	4514-4109	56289	102P24	
C266	Oil Impregnated, 0.1 μF ±20%	4514-4109	56289	102P24	
C275	Air Dielectric, 1.8 - 13 pF	4380-6013	74970	U-189-6-1	
C276	Mica, 33 pF ±5% 500 V	4640-0159	72136	CM15D330J	
C277	Mica, 680 pF ±5% ,300 V	4700-0810	14655	22A, 680 pF ±5%	
C278	Oil Impregnated, 0.1 μF ±20% 400 V	4514-4109	56289	102P24	
C279	Ceramic, 0.01 μF +80-20% 50 V	4401-3100	80131	CC61, 0.01 μF +80-20%	5910-974-5698
C280	Mica, 240 pF ±5% 500 V	4700-0521	14655	22A, 240 pF ±5%	
C281	Ceramic, 0.01 μF +80-20% 50 V	4401-3100	80131	CC61, 0.01 μF +80-20%	5910-974-5698
C282	Ceramic, 0.01 μF +80-20% 50 V	4401-3100	80131	CC61, 0.01 μF +80-20%	5910-974-5698
C283	Ceramic, 0.01 μF +80-20% 50 V	4401-3100	80131	CC61, 0.01 μF +80-20%	5910-974-5698

PARTS LIST (cont)

REF. NO.	DESCRIPTION	PART NO.	FED. MFG. CODE	MFG. PART NO.	FED. STOCK NO.
C284	Mica, 51 pF ±5% 500 V	4700-0354	88419	22A5Q51, 51 pF ±5%	
C285	Mica, 240 pF ±5% 500 V	4700-0521	14655	22A, 240 pF ±5%	
C286	Ceramic, 0.1 μF +80-20% 50 V	4403-4100	80131	CC63, 0.1 μF +80-20%	5910-811-4788
C287	Ceramic, 5.6 pF ±10% 500 V	4400-0569	78488	GA, 5.6 pF ±10%	5910-931-0528
C288	Ceramic, 1 pF ±10% 500 V	4400-0100	78488	GA, 1 pF ±10%	5910-981-3425
C289	Ceramic, 0.1 μF ±20% 25 V	4400-2050	80183	5C13, 0.1 μF	5910-974-5695
C290	Electrolytic, 15 μF +100-10% 15 V	4450-3700	37942	TT, 15 μF +100-10%	
C291	Electrolytic, 1 μF ±20% 35 V	4450-4300	56289	TT, 1 μF ±20%	5910-726-5003
C292	Oil Impregnated, 0.1 μF ±20% 400 V	4514-4109	56289	102P24	
INDUCTORS					
L100	Choke, molded	1026-2195	24655	1026-2195	
L101	Choke, molded 22 μH ±10%	4300-6600	99800	3500, 22 μH ±10%	
L102	Choke, molded 1.5 μH ±10%	4300-1000	99800	1537, 1.5 μH ±10%	
L104	Special Assembly	1026-8990	24655	1026-8990	
L105	Choke, molded 10 μH ±10%	4300-2200	99800	1537, 10 μH ±10%	
L106	Choke, molded 2.2 μH ±10%	4300-1200	99800	1537-20, 2.2 μH ±10%	
L107	Choke, molded 33 μH ±10%	4300-2900	99800	2150-36, 33 μH ±10%	
L108	Choke, molded	1026-2195	24655	1026-2195	
L109	Choke, molded	1026-2195	24655	1026-2195	
L111A, L111B	Band 1, RF coil	1026-2420	24655	1026-2420	
L112A, L112B	Band 2, RF coil	1026-2400	24655	1026-2400	
L113A, L113B	Band 3, RF coil	1026-2110	24655	1026-2110	
L114A, L114B	Band 4, RF coil	1026-2100	24655	1026-2100	
L115A, L115B	Band 5, RF coil	1026-2220	24655	1026-2220	
L116A, L116B	Band 6, RF coil	1026-2340	24655	1026-2340	
L122 thru L125	Choke, molded 0.47 μH ±20%	4300-0400	99800	1537, 0.47 μH ±20%	
L126	Choke, molded 22 μH ±10%	4300-6600	99800	2890, 22 μH ±10%	
L127	Choke, molded 33 μH ±10%	4300-2900	99800	2150, 33 μH ±10%	5950-617-3738
L128	Choke, molded	1026-2195	24655	1026-2195	
L140	Choke, molded	1026-2195	24655	1026-2195	
L141	Filament Filter Element	1026-2050	24655	1026-2050	
L142	Filament Filter Element	1026-2050	24655	1026-2050	
L143	Choke, molded 22 μH ±10%	4300-6600	99800	2890, 22 μH ±10%	
L144	Choke, molded 22 μH ±10%	4300-6600	99800	2890, 22 μH ±10%	
L147	Choke, molded 10 μH ±10%	4300-2200	99800	1537, 10 μH ±10%	
L148	Choke, molded 2.2 μH ±10%	4300-1200	99800	1537-20, 22 μH ±10%	
L149	Choke, air core 0.04 μH	4290-4552	24655	4290-4552	
L151A, L151B	Band 1, RF coil	1026-2420	24655	1026-2420	
L152A, L152B	Band 2, RF coil	1026-2410	24655	1026-2410	
L153A, L153B	Band 3, RF coil	1026-2111	24655	1026-2111	
L154A, L154B	Band 4, RF coil	1026-2100	24655	1026-2100	
L155A, L155B	Band 5, RF coil	1026-2221	24655	1026-2221	
L156A, L156B	Band 6, RF coil	1026-2341	24655	1026-2341	
L157	Choke, molded 33 μH ±10%	4300-2900	99800	2150, 33 μH ±10%	5950-617-3738
L158	Choke, molded	1026-2195	24655	1026-2195	
L170	Choke, molded	1026-2195	24655	1026-2195	
L171	Choke, molded 0.47 μH ±20%	4300-0400	99800	1537, 0.47 μH ±20%	
L172	Choke, molded 0.47 μH ±20%	4300-0400	99800	1537, 0.47 μH ±20%	
L173	Filament Filter Element	1026-2050	24655	1026-2050	
L174	Filament Filter Element	1026-2050	24655	1026-2050	
L175	Choke, molded 22 μH ±10%	4300-6600	99800	2890, 22 μH ±10%	
L176	Choke, molded 22 μH ±10%	4300-6600	99800	2890, 22 μH ±10%	
L179	Choke, molded 10 μH ±10%	4300-2200	99800	1537, 10 μH ±10%	
L180	Choke, molded 2.2 μH ±10%	4300-1200	99800	1537-20, 2.2 μH ±10%	
L181A, L181B	Band 1, RF coil	1026-2440	24655	1026-2440	
L182A, L182B	Band 2, RF coil	1026-2400	24655	1026-2400	
L183A, L183B	Band 3, RF coil	1026-2112	24655	1026-2112	
L184A, L184B	Band 4, RF coil	1026-2102	24655	1026-2102	
L185A, L185B	Band 5, RF coil	1026-2222	24655	1026-2222	
L186A, L186B	Band 6, RF coil	1026-2300	24655	1026-2300	
L187	Choke, molded 33 μH ±10%	4300-2900	99800	2150-36	5950-617-3738
L188	Choke, molded	1026-2195	24655	1026-2195	
L251	Choke, molded 4.7 μH ±10%	4300-1600	99800	1537-28, 4.7 μH ±10%	
L252	Choke, molded	1026-2195	24655	1026-2195	
L275	Choke, molded 22 μH ±10%	4300-2600	99800	1537, 22 μH ±10%	5950-668-5867
RESISTORS					
R100	Composition, 100 kΩ ±5% 1/4 W	6099-4105	75042	BTS, 100 kΩ ±5%	

PARTS LIST (cont)

REF. NO.	DESCRIPTION	PART NO.	FED. MFG. CODE	MFG. PART NO.	FED. STOCK NO.
R101 thru R103	Composition, 2.7 kΩ ±5% 1/2 W	6100-2275	01121	RC20GF272J	5905-279-1880
R104	Composition, 47 Ω ±5% 1/2 W	6100-0475	01121	RC20GF470J	5905-252-4018
R105	Composition, 47 Ω ±5% 1/2 W	6100-0475	01121	RC20GF470J	5905-252-4018
R106	Composition, 56 Ω ±5% 1/2 W	6100-3565		RC20GF563J	5905-171-1986
R107	Composition, 51 Ω ±5% 1/2 W	6100-0515		RC20GF510J	5905-279-3517
R108A,B	Composition, 13 Ω ±5% 1/2 W	6100-0135		RC20GF130J	
R109	Composition, 47 Ω ±5% 1/2 W	6100-0475	01121	RC20GF470J	5905-252-4018
R111	Composition, 330 Ω ±5% 1/2 W	6100-1335	01121	RC20GF331J	5905-192-3971
R112	Composition, 330 Ω ±5% 1/2 W	6100-1335	01121	RC20GF331J	5905-192-3971
R113	Composition, 150 Ω ±5% 1/2 W	6100-1155	01121	RC20GF151J	5905-299-1541
R114 thru R118	Composition, 47 Ω ±5% 1/2 W	6100-0475	01121	RC20GF470J	5905-252-4018
R120	Composition, 470 Ω ±5% 1/2 W	6100-1475	01121	RC20GF471J	5905-192-3973
R121	Composition, 470 Ω ±5% 1/2 W	6100-1475	01121	RC20GF471J	5905-192-3973
R122	Composition, 560 Ω ±5% 1/2 W	6100-1565	01121	RC20GF561J	5905-195-6800
R123	Composition, 560 Ω ±5% 1/2 W	6100-1565	01121	RC20GF561J	5905-195-6800
R124	Composition, 1 kΩ ±5% 1/4 W	6099-2105	75042	BTS, 1 kΩ ±5%	
R125	Composition, 1 kΩ ±5% 1/4 W	6099-2105	75042	BTS, 1 kΩ ±5%	
R126	Wire wound, 4.3 kΩ ±5% 5 W	6660-2435	80183	246E, 4.3 kΩ ±5%	
R127	Wire wound, 4.3 kΩ ±5% 5 W	6660-2435	80183	246E, 4.3 kΩ ±5%	
R128	Wire wound, 1 kΩ ±10% 5 W	6660-2105	80183	246E, 1 kΩ ±10%	
R141	Composition, 1 kΩ ±5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R142	Composition, 1 kΩ ±5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R143 thru R145	Composition, 47 Ω ±5% 1/2 W	6100-0475	01121	RC20GF470J	5905-252-4018
R146A,B	Composition, 11 Ω ±5% 1/2 W	6100-0115		RC20GF110J	5905-279-3524
R148A,B	Composition, 30 Ω ±5% 1/2 W	6100-0305		RC20GF300J	5905-279-3518
R151	Composition, 180 Ω ±5% 1/2 W	6100-1185	01121	RC20GF181J	5905-279-3514
R152	Composition, 180 Ω ±5% 1/2 W	6100-1185	01121	RC20GF181J	5905-279-3514
R153	Composition, 150 Ω ±5% 1/2 W	6100-1155	01121	RC20GF151J	5905-299-1541
R154 thru R156	Composition, 47 Ω ±5% 1/2 W	6100-0475	01121	RC20GF470J	5905-252-4018
R170	Composition, 10 kΩ ±5% 1/2 W	6100-3105	01121	RC20GF103J	5905-185-8510
R171	Composition, 47 Ω ±5% 1/2 W	6100-0475	01121	RC20GF470J	5905-252-4018
R172	Composition, 47 Ω ±5% 1/2 W	6100-0475	01121	RC20GF470J	5905-252-4018
R173	Composition, 1 kΩ ±5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R174	Composition, 1 kΩ ±5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R175	Film, 560 Ω ±2% 1/8 W	6615-2560	03888	A3AG01, 560 Ω ±2% 1/8 W	
R176	Film, 56 Ω ±2% 1/8 W	6615-2056	03888	A3AG01, 56 Ω ±2% 1/8 W	
R177	Composition, 50 Ω 1 W	1026-0404	24655	1026-0404	
R178 thru R180	Composition, 47 Ω ±5% 1/2 W	6100-0475	01121	RC20GF470J	5905-252-4018
R181	Composition, 180 Ω ±5% 1/2 W	6100-1185	01121	RC20GF181J	5905-279-3514
R182	Composition, 180 Ω ±5% 1/2 W	6100-1185	01121	RC20GF181J	5905-279-3514
R183	Composition, 150 Ω ±5% 1/2 W	6100-1155	01121	RC20GF151J	5905-299-1541
R184 thru R186	Composition, 47 Ω ±5% 1/2 W	6100-0475	01121	RC20GF470J	5905-252-4018
R187	Film, 270 Ω ±2% 1/8 W	6614-2270	03888	A3AG01, 270 Ω ±2% 1/8 W	
R188	Film, 560 Ω ±2% 1/8 W	6615-2560	03888	A3AG01, 560 Ω ±2% 1/8 W	
R189	Composition, 1 kΩ ±5% 1/2 W	6100-2105	01121	RC20GF102J	5905-195-6806
R191	Composition, 4.7 Ω ±5% 1/2 W	6100-9475	01121	RC20GF4R7J	
R193	Composition, 560 Ω ±10% 1/4 W	6099-1569	75042	BTS, 560 Ω ±10%	
R194	Composition, 3.3 kΩ ±10% 1/4 W	6099-2339	75042	BTS, 3.3 kΩ ±10%	
R195	Miscellaneous	6741-2022	83186	TX	
R196	Composition, 82 kΩ ±5% 2 W	6120-3825	01121	RC42GF823J	5905-254-7096
R197	Composition, 12 kΩ ±5% 1/2 W	6100-3125	01121	RC20GF123J	5905-279-3502
R198	Composition, 68 kΩ ±5% 2 W	6120-3685	01121	RC42GF683J	5905-249-3663
R199	Composition, 1/2 W *	6100-			
R251	Composition, 820 Ω ±5% 1/4 W	6099-1825	75042	BTS, 820 Ω ±5%	
R252	Composition, 820 Ω ±5% 1/4 W	6099-1825	75042	BTS, 820 Ω ±5%	
R253	Composition, 3.9 kΩ ±5% 1/4 W	6099-2395	75042	BTS, 3.9 kΩ ±5%	
R254	Composition, 5.6 kΩ ±5% 1/4 W	6099-2565	75042	BTS, 5.6 kΩ ±5%	
R255	Composition, 2.7 kΩ ±5% 1/4 W	6099-2275	75042	BTS, 2.7 kΩ ±5%	
R256	Composition, 390 Ω ±5% 1/4 W	6099-1395	75042	BTS, 390 Ω ±5%	
R257	Composition, 1.2 kΩ ±5% 1/4 W	6099-2125	75042	BTS, 1.2 kΩ ±5%	
R258	Composition, 1 kΩ ±5% 1/4 W	6099-2105	75042	BTS, 1 kΩ ±5%	
R259	Composition, 270 Ω ±5% 1 W	6110-1275	01121	RC32GF271J	5905-279-2628
R260	Composition, 560 Ω ±10% 2 W	6120-1569	01121	RC20GF561J	5905-253-1233
R262	Composition, 820 Ω ±5% 1/2 W	6100-1825	01121	RC20GF821J	5905-171-1999
R265	Composition, 10 kΩ ±5% 1/4 W	6099-3105	75042	BTS, 10 kΩ ±5%	
R266	Composition, 1 kΩ ±5% 1/4 W	6099-2105	75042	BTS, 1 kΩ ±5%	
R267	Composition, 6.8 kΩ ±5% 1/4 W	6099-2685	75042	BTS, 6.8 kΩ ±5%	
R268	Composition, 10 kΩ ±5% 1/4 W	6099-3105	75042	BTS, 10 kΩ ±5%	
R269	Composition, 2.7 kΩ ±5% 1/4 W	6099-2275	75042	BTS, 2.7 kΩ ±5%	
R270	Composition, 270 Ω ±5% 1/4 W	6099-1275	75042	BTS, 270 Ω ±5%	
R271	Composition, 820 Ω ±5% 1/4 W	6099-1825	75042	BTS, 820 Ω ±5%	
R275	Composition, 3.3 kΩ ±5% 1/4 W	6099-2335	75042	BTS, 3.3 kΩ ±5%	

*Value selected at factory.

PARTS LIST (cont)

REF. NO.	DESCRIPTION	PART NO.	FED. MFG. CODE	MFG. PART NO.	FED. STOCK NO.
R276	Composition, 1.8 kΩ ±5% 1/4 W	6099-2185	75042	BTS, 1.8 kΩ ±5%	
R277	Composition, 1.2 kΩ ±5% 1/4 W	6099-2125	75042	BTS, 1.2 kΩ ±5%	
R278	Composition, 3.3 kΩ ±5% 1/4 W	6099-2335	75042	BTS, 3.3 kΩ ±5%	
R279	Composition, 10 kΩ ±5% 1/4 W	6099-3105	75042	BTS, 10 kΩ ±5%	
R280	Composition, 820 Ω ±5% 1/4 W	6099-1825	75042	BTS, 820 Ω ±5%	
R281	Composition, 4.7 kΩ ±5% 1/4 W	6099-2475	75042	BTS, 4.7 kΩ ±5%	
R282	Film, 5.11 kΩ ±1% 1/8 W	6250-1511	75042	CEA, 5.11 kΩ ±1%	5905-577-6734
R283	Composition, 130 Ω ±5% 1/4 W	6099-1135	75042	BTS, 130 Ω ±5%	
R284	Miscellaneous, 200 Ω ±10%	6740-1600	02606	KB22J1	
R285	Composition, 120 Ω ±5% 1/4 W	6099-1125	75042	BTS, 120 Ω ±5%	
R286	Composition, 200 Ω ±5% 1/2 W	6100-1205	01121	RC20GF201J	5905-279-2674
R287	Composition, 56 kΩ ±5% 1/4 W	6099-3565	75042	BTS, 56 kΩ ±5%	
R288	Composition, 10 kΩ ±5% 1/4 W	6099-3105	75042	BTS, 10 kΩ ±5%	
R290	Composition, 68 kΩ ±5% 1/4 W	6099-3685	75042	BTS, 68 kΩ ±5%	
R291	Composition, 160 kΩ ±5% 1/4 W	6099-4165	75042	BTS, 160 kΩ ±5%	
R292	Composition, 22 kΩ ±5% 1/4 W	6099-3225	75042	BTS, 22 kΩ ±5%	
R293	Composition, 2.2 kΩ ±5% 1/4 W	6099-2225	75042	BTS, 2.2 kΩ ±5%	
R294	Composition, 560 Ω ±5% 1/4 W	6099-1565	75042	BTS, 560 Ω ±5%	
R295	Composition, 4.7 kΩ ±5% 1/4 W	6099-2475	75042	BTS, 4.7 kΩ ±5%	
MISCELLANEOUS					
X275	CRYSTAL, 5.000 MC	5075-5701		5075-5701	
CR101	DIODE, Semiconductor, type MA4328C	6084-1018	96341	MA4328C	
CR171	DIODE, Semiconductor, type HD5000	6082-1021	73293	HD5000	
CR191	DIODE, Semiconductor, type 1N3253	6081-1001	79089	1N3253	5961-814-4251
CR241	DIODE, Semiconductor, type SSD531	6082-1001	24446	1N3604	5960-995-2199
CR251	DIODE, Semiconductor, type SSD531	6082-1001	24446	1N3604	5960-995-2199
CR252	DIODE, Semiconductor, type SSD531	6082-1001	24446	1N3604	5960-995-2199
CR275	DIODE, Semiconductor, type 1N34AS	6082-1003	90139	1N34A(S)	5960-081-0203
CR276	DIODE, Semiconductor, type 1N34AS	6082-1003	90139	1N34A(S)	5960-081-0203
CR277	DIODE, Semiconductor, type 1N994	6082-1017	24446	1N3668	
FL187	FILTER, assembly, rf	1026-1400	24655	1026-1400	
FL188	FILTER, assembly, rf	1026-1401	24655	1026-1401	
FL101	FILTER, assembly, rf	1026-2690	24655	1026-2690	
FL251	FILTER, assembly, rf	1026-2690	24655	1026-2690	
FL252	FILTER, assembly, rf	1026-2690	24655	1026-2690	
FL271	FILTER, assembly, rf	1026-2690	24655	1026-2690	
J101 thru J104	JACK, Phone, shorting	4260-0400	82389	2J-1439	5935-857-6751
J105	JACK, Coaxial, miniature	Part of 1026-2550			
J106	JACK, Coaxial, miniature	4260-1291	70563	380598-1	
J107	JACK, Coaxial, miniature	4260-1291	70563	380598-1	
J108	JACK, Coaxial, miniature	Part of 1026-2550			
J109	JACK, Coaxial, miniature	Part of 1026-2550			
P101 thru P106	PILOT LIGHT, Incandescent #328	5600-0300	24454	#328	6240-155-7857
P195	PILOT LIGHT	5600-1050	71744	1850	
PL100	PLUG, Multiple connector	4220-5295	02660	26-4100-24P	
PL108	PLUG, Multiple connector	1026-2830	24655	1026-2830	
PL109	PLUG, Multiple connector	1026-2831	24655	1026-2831	
PL110	PLUG, Multiple connector	1026-2832	24655	1026-2832	
SO120	SOCKET, Electrical	7540-2263	71785	133-65-10-001	
SO121	SOCKET, Electrical	7540-2263	71785	133-65-10-001	
SO195	SOCKET, Lamp	7510-1390	72765	308SOL20	
S101	SWITCH, Rotary wafer	7890-3480	76854	251794-H	
TP101	TEST POINT, pin jack	4260-0900	98291	SKT-1	
T120	TRANSFORMER, coupling	1026-2230	24655	1026-2230	
T121	TRANSFORMER, coupling	1026-2192	24655	1026-2192	
T122	TRANSFORMER, coupling	1026-2192	24655	1026-2192	
T171	TRANSFORMER, coupling	1026-2190	24655	1026-2190	
T172	TRANSFORMER, coupling	1026-2190	24655	1026-2190	
T183	TRANSFORMER, coupling part of	1026-2920			
T184	TRANSFORMER, coupling part of	1026-2920	24655	1026-2920	
T185	TRANSFORMER, coupling	1026-2191	24655	1026-2191	
T275	TRANSFORMER, coupling	1026-2710	24655	1026-2710	
Q265	TRANSISTOR, type 2N696	8210-1033	24454	2N696	5960-840-3561
Q266	TRANSISTOR, type 2N3638	8210-1096	07263	2N3638	
Q275	TRANSISTOR, type 2N708	8210-3089	24454	2N708	
Q276	TRANSISTOR, type 2N711A	8210-7111	93332	2N711A	
Q277	TRANSISTOR, type 2N2369	8210-1052	93916	2N2369	5960-682-7755
Q278	TRANSISTOR, type 2N696	8210-1033	24454	2N696	5960-840-3561
Q279	TRANSISTOR, type 2N3638	8210-1096	07263	2N3638	
V101	TUBE, Vacuum, type Y1266	8320-1266	24446	GE-Y1266 (8658)	
V120	TUBE, Vacuum, type 8627	8380-8627	86684	8627	
V121	TUBE, Vacuum, type 8627	8380-8627	86684	8627	
V141	TUBE, Vacuum, type 7768	8380-7768	81349	7768	5960-050-9200
V142	TUBE, Vacuum, type 7768	8380-7768	81349	7768	5960-050-9200
V171	TUBE, Vacuum, type 7768	8380-7768	81349	7768	5960-050-9200
V172	TUBE, Vacuum, type 7768	8380-7768	81349	7768	5960-050-9200

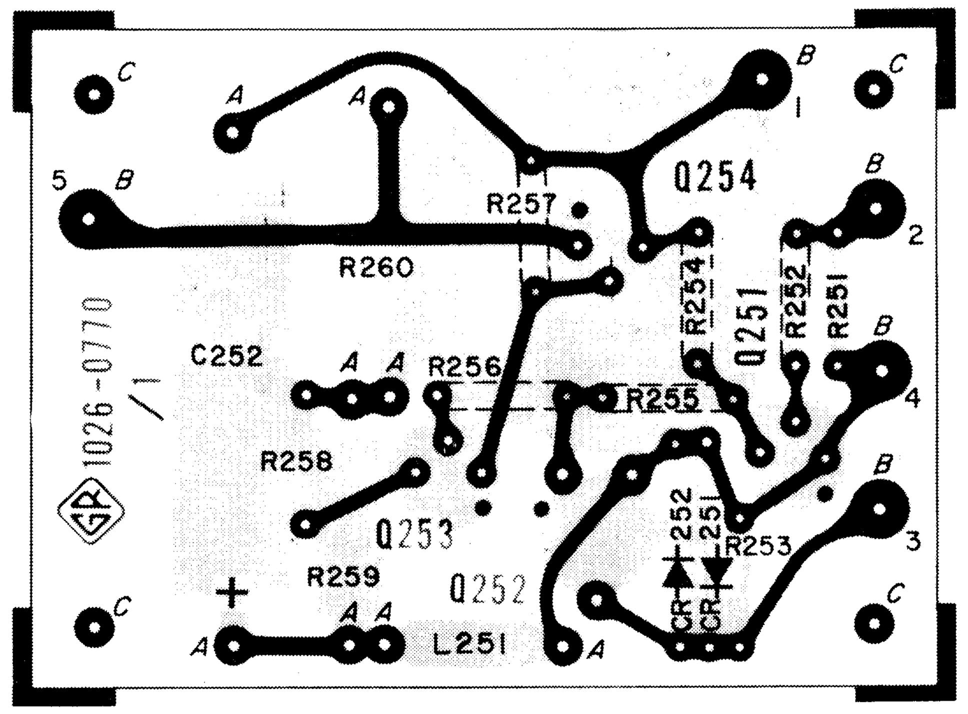


Figure 6-4. Etched-circuit-board diagram for Modulator Output Amplifier (P/N 1026-2770).

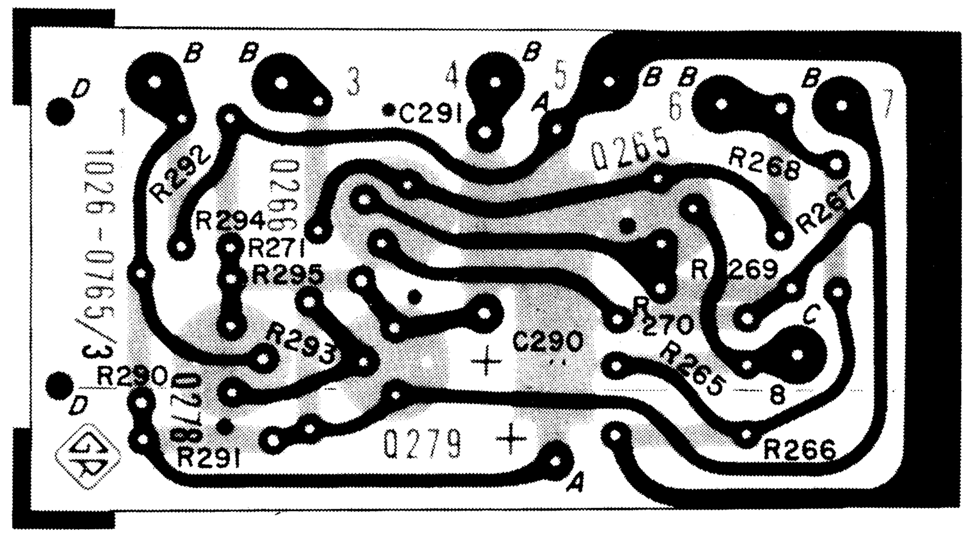


Figure 6-5. Etched-circuit-board diagram for Detector Preamplifier (P/N 1026-2765).

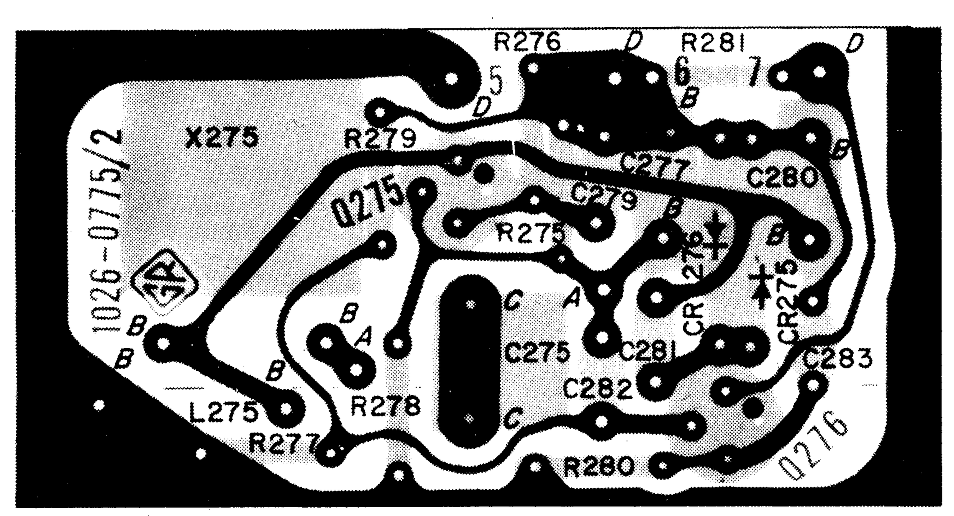


Figure 6-6. Etched-circuit-board diagram for Crystal Calibrator Oscillator (P/N 1026-2776)

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.

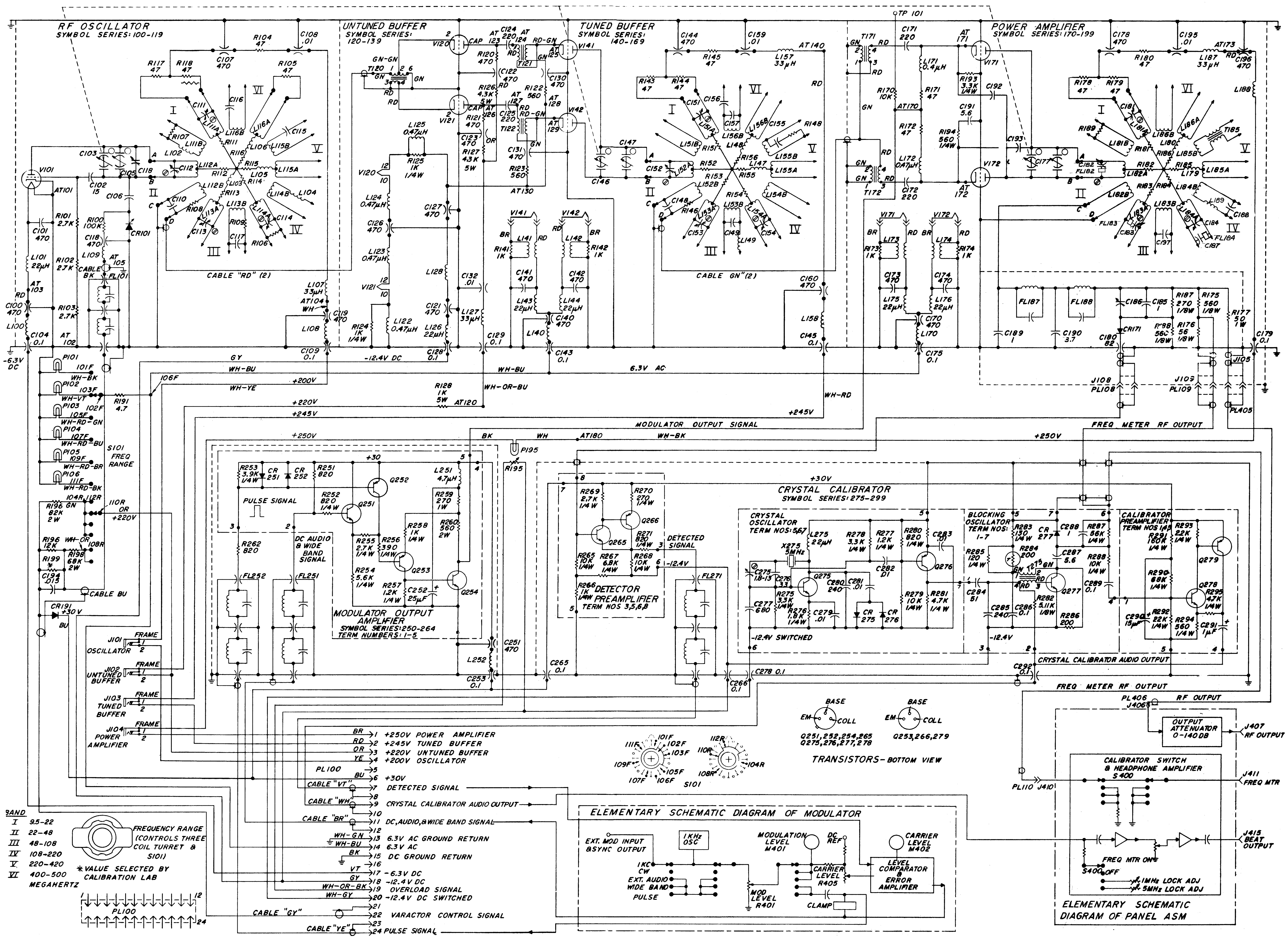


Figure 6-7. Schematic diagram of the RF Assembly (P/N 1026-2020).

PARTS LIST

REF. NO.	DESCRIPTION	PART NO.	FED. MFG. CODE	MFG. PART NO.	FED. STOCK NO.
CAPACITORS					
C201	Mica, 0.02 µF ±1% 100 V	4560-0400	14655	1AD3S2FF	5910-931-4151
C202	Mica, 0.02 µF ±1% 100 V	4560-0400	14655	1AD3S2FF	5910-931-4151
C203 thru C205	Electrolytic, 10 µF +100-10% 25 V	4450-3800	56289	30D106G025BB4M1	5910-952-8658
C206	Electrolytic, 25 µF +100-10% 50 V	4450-3000	80183	D33883	5910-799-9285
C207	Electrolytic, 50 µF +100-10% 50 V	4450-2200	80183	D32845	5910-893-0879
C221	Mica, 0.00187 µF ±2% 500 V	4590-0802	14655	5A, 0.0018 µF ±2%	
C222	Mica, 300 pF ±10% 500 V	4700-0511	14655	22A5T, 300 pF ±10%	
C223	Electrolytic, 15 µF +100-10% 15 V	4450-3700	37942	TT, 15 µF 15 V	
C224	Mica, 0.0127 µF ±2% 500 V	4550-0127	88419	1A, 0.0127 µF ±2% 500 V	
C225	Electrolytic, 68 µF ±20% 15 V	4450-5615	80183	150D686X0015R2, 15 V	
C226	Mica, 365 pF ±2% 500 V	4700-0550	14655	22A, 365 pF ±2% 500 V	
C227	Electrolytic, 68 µF ±20% 15 V	4450-5615	80183	150D686X0015R2 15 V	
C243	Mica, 0.00365 µF ±2% 100 V	4590-3650	14655	5A, 0.00365 µF ±2%	
C301	Electrolytic, 5 µF +100-10% 50 V	4450-3900	37942	2040595S9C10X3	5910-448-5527
C303	Electrolytic, 50 µF +100-10% 50 V	4450-2200	80183	D32845	5910-893-0897
C321	Electrolytic, 5 µF +100-10% 500 V	4450-3900	37942	2040595S9C10X3	5910-448-5527
C322	Electrolytic, 10 µF +100-10% 25 V	4450-3800	56289	30D106G025BB4M1	5910-952-8658
C331	Ceramic, 0.22 µF +80-20% 12 V	4432-4229	56289	29C365	
C341	Electrolytic, 33 µF ±10% 10 V	4450-5401	56289	150D336X9010B2	
C343	Electrolytic, 10 µF +100-10% 25 V	4450-3800	56289	30D106G025BB4M1	5910-952-8658
C344	Plastic, 0.015 µF ±5% 100 V	4860-7657	84411	663UW, 0.015 µF ±5%	
RESISTORS					
R201	Film, 16.9 kΩ ±1% 1/8 W	6250-2169	75042	CEA, 16.9 kΩ ±1%	5905-806-8487
R202	Film, 16.9 kΩ ±1% 1/8 W	6250-2169	75042	CEA, 16.9 kΩ ±1%	5905-806-8487
R203	Pot. wire-wound, 1 kΩ ±5% 1 W	6058-2105	75042	CT-100, 1 kΩ ±5%	5905-
R204	Composition, 3.3 kΩ ±5% 1/2 W	6100-2335	01121	RC20GF332J	5905-279-3506
R205	Composition, 560 Ω ±5% 1/2 W	6100-1565	01121	RC20GF561J	5905-195-6800
R206	Film, 10 kΩ ±1% 1/8 W	6250-2100	75042	CEA, 10 kΩ ±1%	5905-883-4847
R207	Film, 7.5 kΩ ±1% 1/8 W	6250-1750	75042	CEA, 7.5 kΩ ±1%	5905-660-4129
R208	Film, 10 kΩ ±1% 1/8 W	6250-2100	75042	CEA, 10 kΩ ±1%	5905-883-4847
R209	Composition, 240 Ω ±5% 1/2 W	6100-1245	01121	RC20GF241J	5905-279-2593
R210	Composition, 2.7 kΩ ±5% 1/2 W	6100-2275	01121	RC20GF272J	5905-279-1880
R211	Composition, 180 Ω ±5% 1/2 W	6100-1185	01121	RC20GF181J	5905-279-3514
R212	Composition, 270 Ω ±5% 1/2 W	6100-1275	01121	RC20GF271J	5905-171-2006
R213	Feedthrough, 100 kΩ ±20%	6740-1403	02606	BA5143	
R214	Feedthrough, 200 Ω ±10%	6740-1600	02606	KB22J1	
R221	Composition, 68 kΩ ±5% 1/2 W	6100-3685	01121	RC20GF683J	5905-249-3661
R222	Potentiometer, composition 10 kΩ ±20%	6040-0700	24655	6040-0700	5905-549-2773
R223	Composition, 15 kΩ ±5% 1/2 W	6100-3155	01121	RC20GF153J	5905-279-2616
R224	Composition, 15 kΩ ±5% 1/2 W	6100-3155	01121	RC20GF153J	5905-279-2616
R225	Composition, 11 kΩ ±5% 1/2 W	6100-3115	01121	RC20GF113J	5905-279-2667
R226	Composition, 4.3 kΩ ±5% 1/2 W	6100-2435	01121	RC20GF432J	5905-257-0935
R227	Composition, 16 kΩ ±5% 1/2 W	6100-3165	01121	RC20GF163J	5905-279-3501
R228	Composition, 4.3 kΩ ±5% 1/2 W	6100-2435	01121	RC20GF432J	5905-257-0935
R229	Film, 11 kΩ ±1% 1/8 W	6250-2110	75042	CEA, 11 kΩ ±1%	
R230	Film, 12.1 kΩ ±1% 1/8 W	6250-2121	75042	CEA, 12.1 kΩ	
R231	Composition, 68 kΩ ±5% 1/2 W	6100-3685	01121	RC20GF683J	5905-249-3661
R232	Composition, 6.8 kΩ ±5% 1/2 W	6100-2685	01121	RC20GF682J	5905-279-3503
R233	Composition, 15 kΩ ±5% 1/2 W	6100-3155	01121	RC20GF153J	5905-279-2616
R234	Composition, 3.6 kΩ ±5% 1/4 W	6099-2365	75042	BTS, 3.6 kΩ ±5%	5905-577-0627
R235	Composition, 10 Ω ±5% 1/2 W	6100-0105	01121	RC20GF100J	5905-190-8883
R236	Film, 2.43 kΩ ±1% 1/8 W	6250-1243	75042	CEA, 2.43 kΩ ±1%	5905-577-1685
R237	Film, 665 Ω ±1% 1/8 W	6250-0665	75042	CEA, 665 Ω ±1%	
R238	Film, 22.1 kΩ ±1% 1/8 W	6250-2221	75042	CEA, 22.1 kΩ ±1%	5905-702-5973
R239	Composition, 24 kΩ ±5% 1/2 W	6100-3245	01121	RC20GF243J	5905-279-1878
R240	Film, 4.48 kΩ ±1% 1/8 W	6250-1448	75042	CEA, 4.48 kΩ ±1%	
R241	Composition, 430 Ω ±5% 1/2 W	6100-1435	01121	RC20GF431J	5905-279-3512
R242	Composition, 560 Ω ±5% 1/4 W	6099-1565	75042	BTS, 560 Ω ±5%	
R243	Composition, 4.7 kΩ ±5% 1/2 W	6100-2475	01121	RC20GF472J	5905-279-3504
R244	Composition, 8.2 kΩ ±5% 1/2 W	6100-2825	01121	RC20GF822J	5905-299-1971
R245	Composition, 820 Ω ±5% 1/2 W	6100-1825	01121	RC20GF821J	5905-171-1999
R246	Film, 280 Ω ±1% 1/8 W	6250-0280	75042	CEA, 280 Ω ±1%	5905-815-3794
R247	Composition, 200 Ω ±5% 1/2 W	6100-1205	01121	RC20GF201J	5905-279-2674
R302	Composition, 1.8 kΩ ±5% 1/2 W	6100-2185	01121	RC20GF182J	5905-190-8881
R303	Composition, 6.8 kΩ ±5% 1/2 W	6100-2685	01121	RC20GF682J	5905-279-3503
R304	Composition, 12 kΩ ±5% 1/2 W	6100-3125	01121	RC20GF123J	5905-279-3502
R305	Composition, 430 kΩ ±5% 1/2 W	6100-4435	01121	RC20GF434J	5905-279-2518
R306	Film, 2.74 kΩ ±1% 1/8 W	6250-1274		CEA, 2.74 kΩ ±1%	5905-834-7208
R308	Composition, 12 kΩ ±5% 1/2 W	6100-3125	01121	RC20GF123J	5905-279-3502
R309	Pot., wire-wound 1 kΩ ±10% 1/4 W	6057-2109	07999	992P, 1 kΩ ±10%	

PARTS LIST (cont)

REF. NO.	DESCRIPTION	PART NO.	FED. MFG. CODE	MFG. PART NO.	FED. STOCK NO.
R312	Composition, 100 kΩ ±5% 1 W	6110-4105	01121	RC20GF104J	5905-299-2003
R313	Composition, 12 kΩ ±5% 1/2 W	6100-3125	01121	RC20GF123J	5905-279-3502
R314	Composition, 4.7 kΩ ±5% 1/2 W	6100-2475	01121	RC20GF472J	5905-279-3504
R321	Composition, 3.9 kΩ ±5% 1/2 W	6100-2395	01121	RC20GF392J	5905-279-3505
R322	Composition, 2.4 kΩ ±5% 1/2 W	6100-2245	01121	RC20GF242J	5905-279-1877
R323	Composition, 2.7 kΩ ±5% 1/2 W	6100-2275	01121	RC20GF272J	5905-279-1880
R324	Film, 5.11 kΩ ±1% 1/8 W	6250-1511		CEA, 5.4 kΩ ±1%	5905-577-6734
R325	Pot., comp., 25 kΩ ±20% 1/4 W	6040-0800	24655	6040-0800	5905-958-7950
R326	Pot., wire-wound 5 kΩ ±10% 1/4 W	6057-2509	07999	992P, 5 kΩ ±10%	
R327	Composition, 56 kΩ ±5% 1/4 W	6100-3565	01121	RC20GF563J	5905-171-1986
R331	Film, 10 kΩ ±1% 1/8 W	6250-2100	75042	CEA, 10 kΩ ±1%	5905-883-4847
R332	Pot., wire-wound 2 kΩ ±5% 1 W	6058-2205	75042	CT-100, 2 kΩ ±5%	
R333	Film, 10 kΩ ±1% 1/8 W	6250-2100	75042	CEA, 10 kΩ ±1%	5905-883-4847
R334	Pot., wire-wound 10 kΩ ±5% 1 W	6058-3105	75042	CT-100, 10 kΩ ±5%	
R335	Composition, 100 kΩ ±5% 1/2 W	6100-4105	01121	RC20GF104J	5905-195-6761
R339	Composition, 220 Ω ±5% 1/2 W	6100-1225	01121	RC20GF221J	5905-279-3513
R340	Composition, 220 Ω ±5% 1/2 W	6100-1225	01121	RC20GF221J	5905-279-3513
R341	Composition, 33 Ω ±5% 1/2 W	6100-0335	01121	RC20GF330J	5905-192-4490
R342	Film, 825 Ω ±1% 1/8 W	6250-0825	75042	CEA, 825 Ω ±1%	5905-702-4172
R343	Composition, 3.6 kΩ ±5% 1/2 W	6100-2365	01121	RC20GF362J	5905-171-2001
R344	Composition, 12 kΩ ±5% 1/2 W	6100-3125	01121	RC20GF123J	5905-279-3502
R345	Composition, 39 Ω ±5% 1/2 W	6100-0395	01121	RC20GF390J	5905-195-5546
R346	Composition, 3.3 kΩ ±5% 1/2 W	6100-2335	01121	RC20GF332J	5905-279-3506
R347	Composition, 220 Ω ±5% 1/2 W	6100-1225	01121	RC20GF221J	5905-279-3513
R348	Composition, 10 kΩ ±5% 1/2 W	6100-3105	01121	RC20GF103J	5905-185-8510
R349	Film, 3.65 kΩ ±1% 1/8 W	6250-1365	75042	CEA, 3.65 kΩ ±1%	
R350	Composition, 100 kΩ ±5% 1/2 W	6100-4105	01121	RC20GF104J	5905-195-6761
R351	Film, 8.06 kΩ ±1% 1/8 W	6250-1806	75042	CEA, 8.06 kΩ ±1%	5905-702-7233
R352	Composition, 15 kΩ ±5% 1/2 W	6100-3155	01121	RC20GF153J	5905-279-2616
R353	Composition, 33 kΩ ±5% 1/2 W	6100-3335	01121	RC20GF333J	5905-171-1998
R354	Composition, 75 kΩ ±5% 1/2 W	6100-3755	01121	RC20GF7535	5905-279-3495
R355	Film, 511 Ω ±1% 1/8 W	6250-0511	75042	CEA, 511 Ω ±1%	5905-721-0287
R356	Film, 1.62 kΩ ±1% 1/8 W	6250-1162	75042	CEA, 1.62 kΩ ±1%	5905-702-1144
R357	Composition, 27 kΩ ±5% 1/4 W	6099-3275	75042	BTS, 27 kΩ ±5%	5905-683-3838
MISCELLANEOUS					
CR301	DIODE, Semiconductor, type 1N3253	6081-1001	79089	1N3253	5961-814-4251
CR302	DIODE, Semiconductor, type 1N3253	6081-1001	79089	1N3253	5961-814-4251
CR303	DIODE, Semiconductor, type T156	6082-1016	24446	1N645	5961-944-8222
CR304	DIODE, Semiconductor, type T156	6082-1016	24446	IN645	5961-944-8222
CR305	DIODE, Semiconductor, type T156	6082-1016	24446	IN645	5961-944-8222
CR306	DIODE, Semiconductor, type T156	6082-1016	24446	IN645	5961-944-8222
CR321	DIODE, Semiconductor, type T156	6082-1016	24446	1N645	5961-944-8222
CR341	DIODE, Semiconductor, type 1N191	6082-1008	93916	1N191	5961-296-3360
CR342	DIODE, Semiconductor, type T156	6082-1016	24446	1N645	5961-944-8222
CR343	DIODE, Semiconductor, type T156	6082-1016	24446	1N645	5961-944-8222
CR344	DIODE, Semiconductor, type T156	6082-1016	24446	IN645	5961-944-8222
PL220	PLUG, Multipin	4220-5295	02660	26-4100-24P	
S221	SWITCH, Rotary wafer	7890-3781	76854	256492-F	
S241	SWITCH, Rotary wafer	7890-3783	76854	256494-F	
S301	SWITCH, Rotary wafer	7890-3782	76854	256493-F	
Q201	TRANSISTOR, type 2N2714	8210-1047	24454	2N3414	5961-989-2749
Q202	TRANSISTOR, type 2N3638	8210-1096	07263	2N3638	
Q221 thru Q224	TRANSISTOR, type 2N2714	8210-1047	24454	2N3414	5961-989-2749
Q225	TRANSISTOR, type 2N3638	8210-1096	07263	2N3638	5961-912-9008
Q226	TRANSISTOR, type 2N696	8210-1033	24454	2N696	5960-840-3561
Q251	TRANSISTOR, type 2N708	8210-3089	24454	2N708	
Q252	TRANSISTOR, type 2N711A	8210-7111	93332	2N711A	
Q253	TRANSISTOR, type 2N3905	8210-1114	04713	2N3905	
Q254	TRANSISTOR, type 2N2188	8210-1028	81349	2N2218	5960-059-4464
Q301	TRANSISTOR, type 2N3416	8210-1138	93916	2N3416	
Q302	TRANSISTOR, type 2N3416	8210-1138	93916	2N3416	
Q321	TRANSISTOR, type 2N1304	8210-1304	01295	2N1304	
Q341	TRANSISTOR, type 2N1304	8210-1304	01295	2N1304	
Q342	TRANSISTOR, type 2N1304	8210-1304	01295	2N1304	
Q343	TRANSISTOR, type 2N3638	8210-1096	07263	2N3638	
Q344	TRANSISTOR, type 2N1304	8210-1304	01295	2N1304	
Q345	TRANSISTOR, type 2N1304	8210-1304	01295	2N1304	
S341	SWITCH, Rotary wafer	7890-3784	76854	256495-F	

*Value selected at factory.

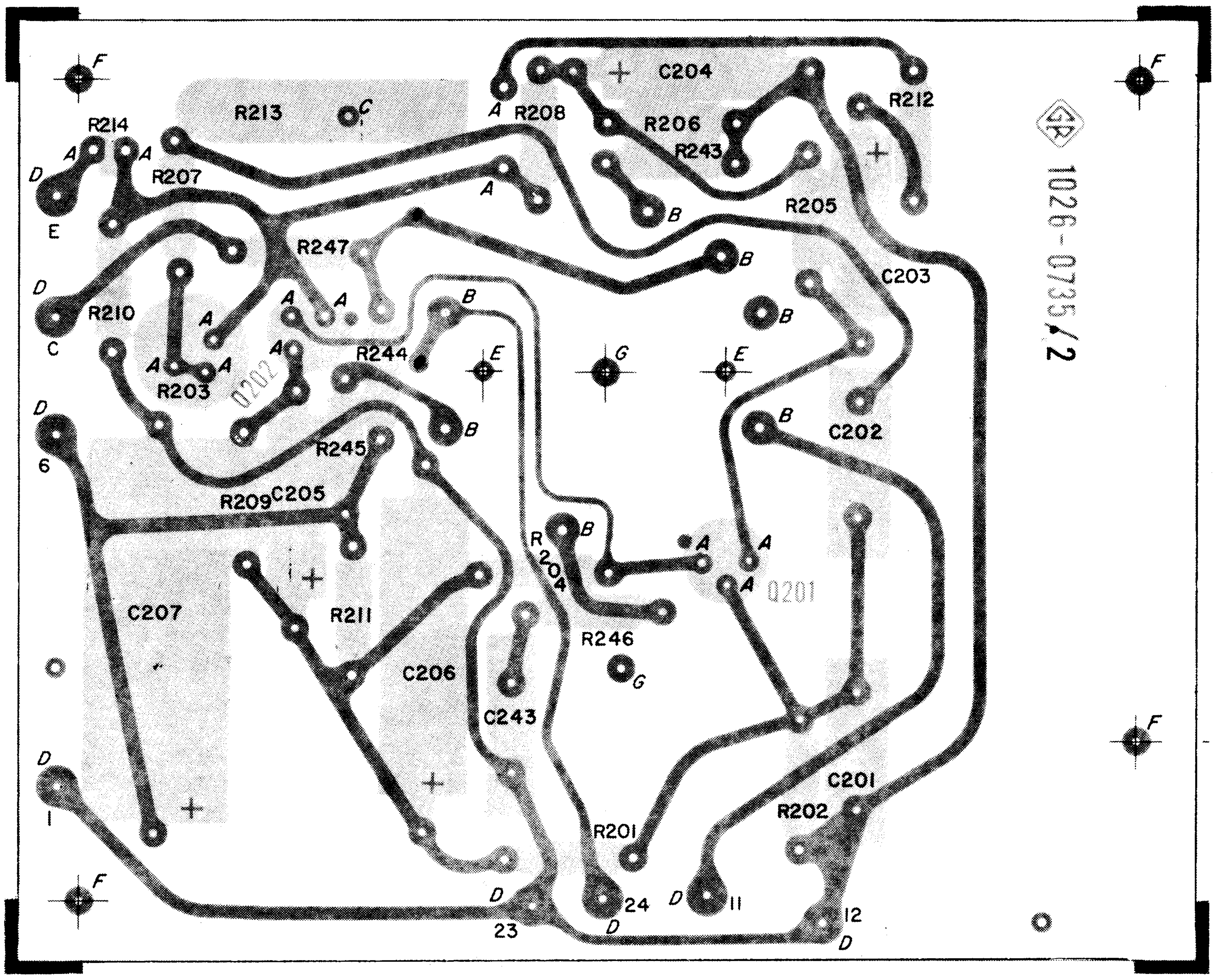


Figure 6-8. Etched-circuit-board diagram for Audio Oscillator (P/N 1026-2735).

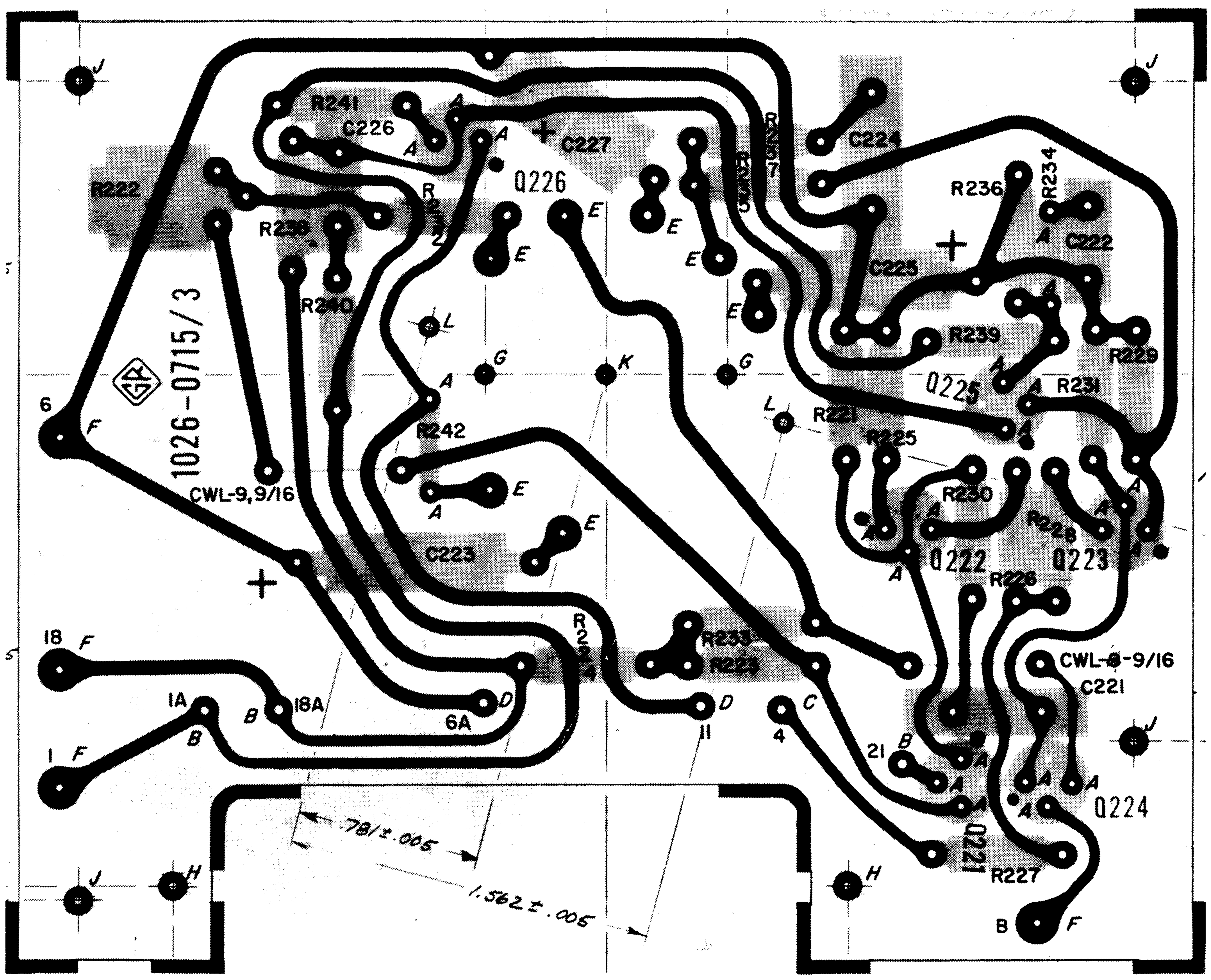


Figure 6-9. Etched-circuit-board diagram for Error Amplifier (P/N 1026-2716).

NOTE: The number appearing on the foil side is not the part number. The dot on the foil at the transistor socket indicates the collector lead.

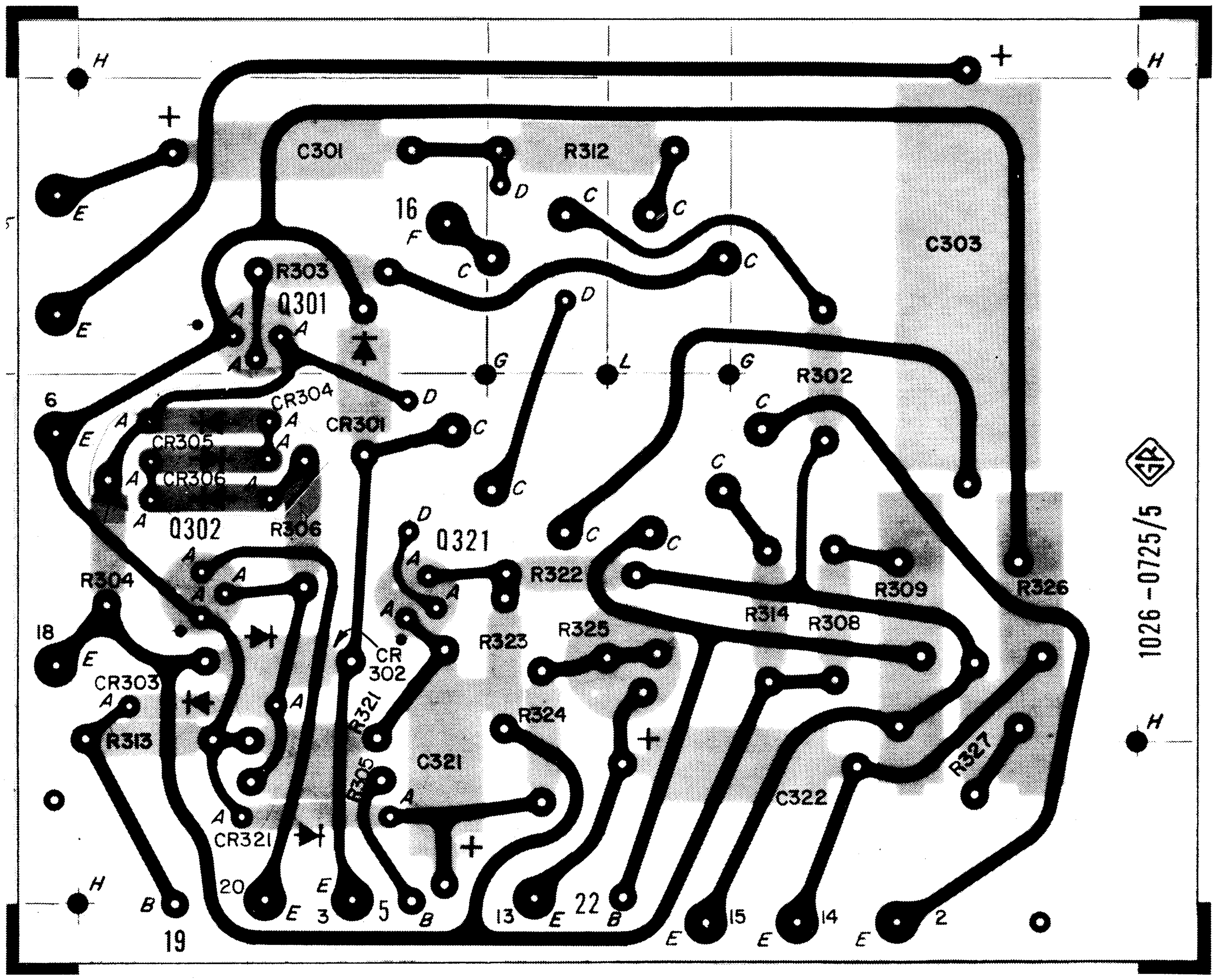


Figure 6-10. Etched-circuit-board diagram for Modulator (P/N 1026-2725).

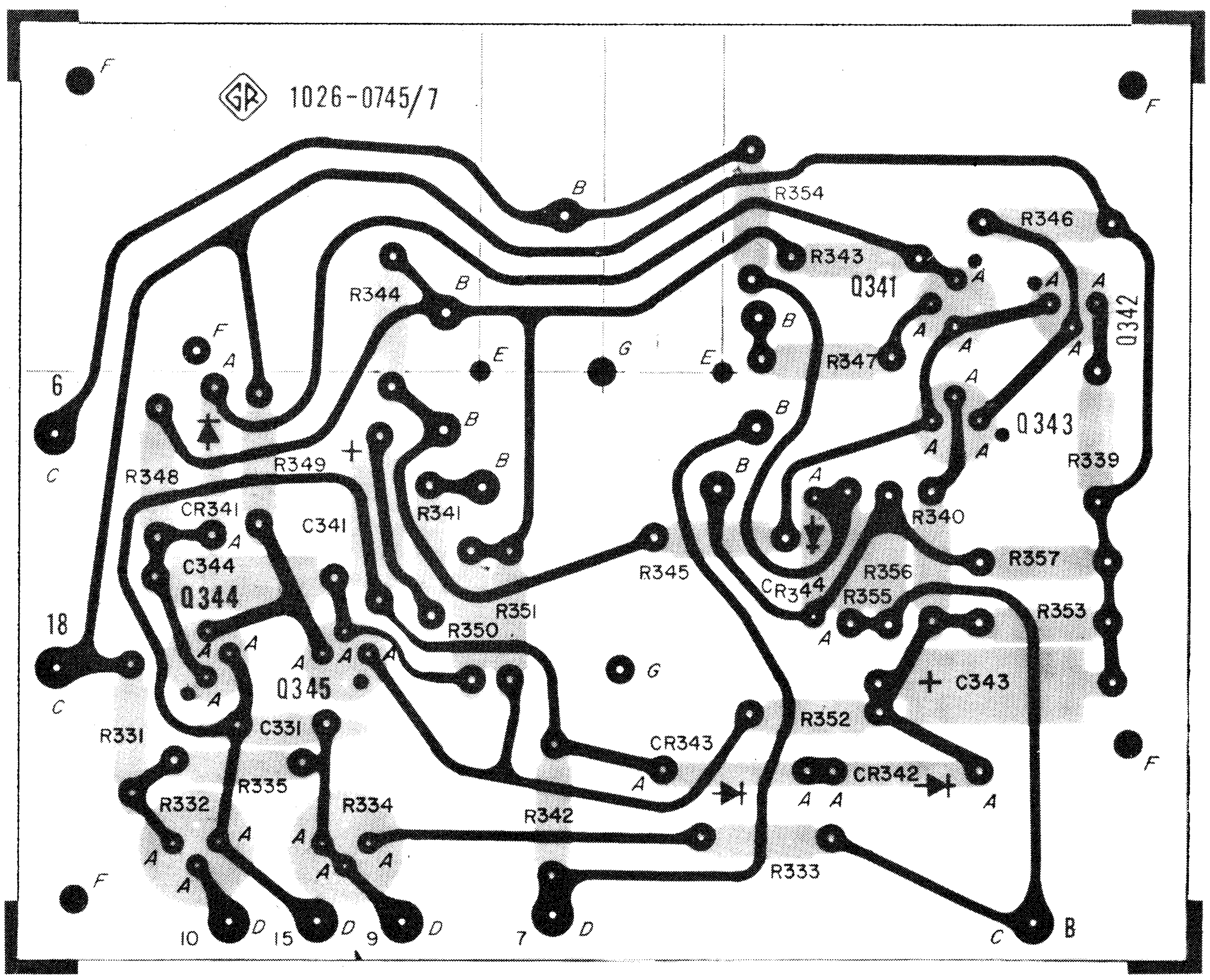
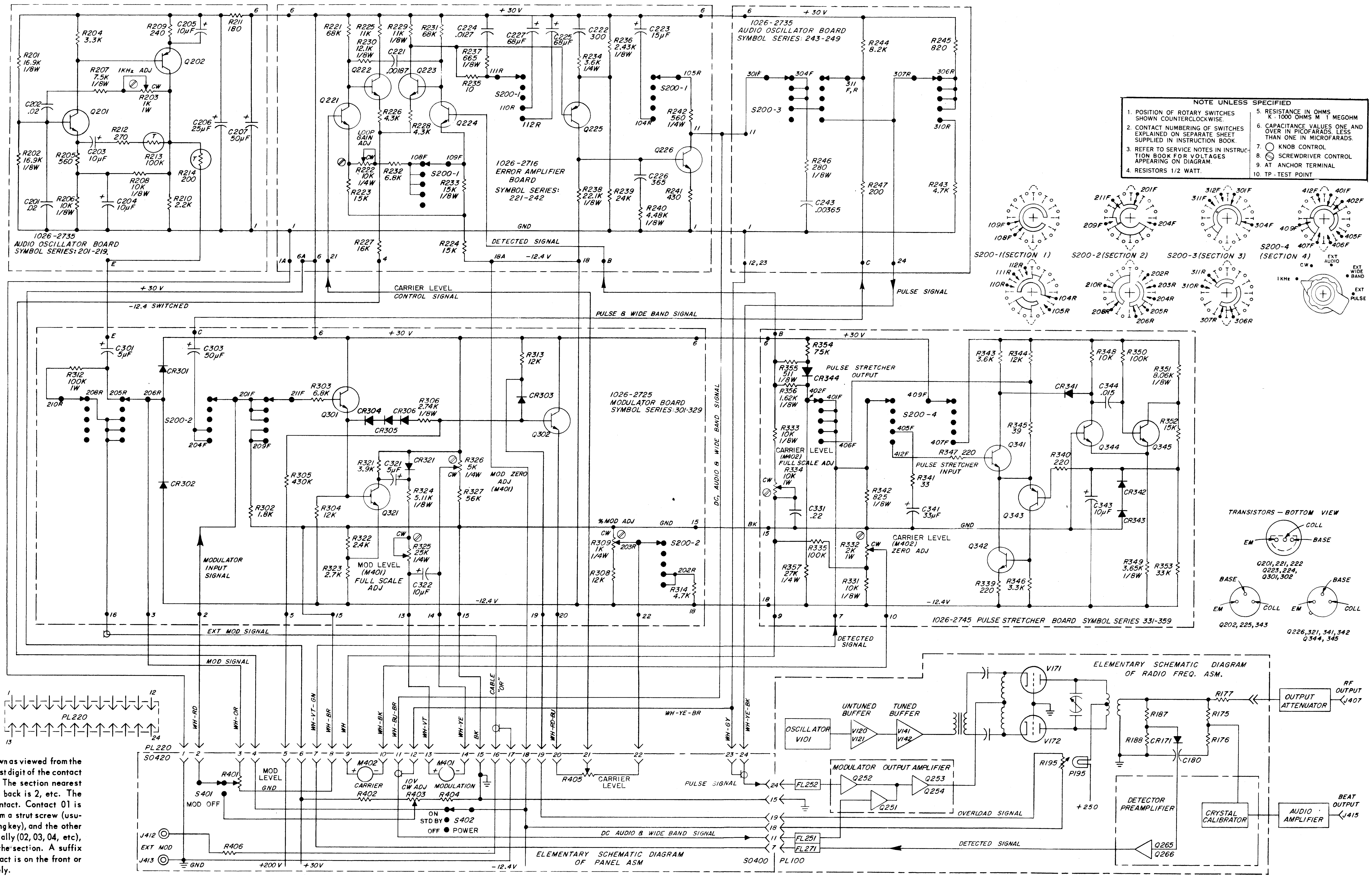


Figure 6-11. Etched-circuit-board diagram for Pulse Stretcher (P/N 1026-2745).

NOTE: The number appearing on the foil side is not the part number.
The dot on the foil at the transistor socket indicates the collector lead.



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.

Figure 6-12. Schematic diagram for Modulator Assembly (P/N 1026-2030).

PARTS LIST

REF. NO.	DESCRIPTION	PART NO.	FED. MFG. CODE	MFG. PART NO.	FED. STOCK NO.
CAPACITORS					
C501	Electrolytic, 200 µF 12 V	4450-5616	56289	150D127X0010R2	
C502A C502B	Electrolytic, 200 µF 50 V	4450-5591	80183	D38858	5910-959-4572
C503A	450 µF				
C503B	Electrolytic, 225 µF 100 V	4450-4000	74861	1B850RT	5910-448-5397
C503C	225 µF				
C504A	1500 µF				
C504B	Electrolytic, 750 µF 25 V	4450-0700	90201	203828S10C10X2	5910-976-9415
C504C	750 µF				
C531A	60 µF				
C531B	Electrolytic, 50 µF +100-10% 300 V	4450-2650	37942	20-21619-99-2	
C531C	50 µF				
C532A	60 µF				
C532B	Electrolytic, 50 µF +100-10% 300 V	4450-2650	37942	20-21619-99-2	
C532C	50 µF				
C533	Mica, 0.022 µF ±10% 300 V	4565-3229	14655	1AD, 0.022 µF ±10%	
C534	Electrolytic, 25 µF +100-10% 50 V	4450-3000	80183	D33883	5910-799-9285
C535	Ceramic, 0.1 µF ±20% 25 V	4400-2050	80183	5C13, 0.1 µF ±20%	5910-974-5695
C536	Plastic, 0.22 µF ±10% 400 V	4860-9501	84411	663F, 0.22 µF ±10%	
C537A C537B	Electrolytic, 15 µF +100-10% 350 V	4450-3500	37942	FTS2021131	5910-797-3788
C560A	400 µF				
C560B	Electrolytic, 200 µF +100-10% 50 V	4450-4000	74861	1B850RT	5910-448-5397
C560C	200 µF				
C561	Electrolytic, 25 µF +100-10% 50 V	4450-3000	80183	D33883	5910-799-9285
C570A	1500 µF				
C570B	Electrolvtic, 750 µF 15 V	4450-0700	90201	203828S10C10X2	5910-976-9415
C570C	750 µF				
C571	Plastic, 0.47 µF ±10% 100 V	4860-8248	84411	663UW, 0.47 µF ±10%	
C572	Plastic, 0.1 µF ±10% 100 V	4860-8250	59875	663UW, 0.1 µF ±10%	
RESISTORS					
R501	Composition, 470 Ω ±5% 1/2 W	6100-1475	01121	RC20GF471J	5905-192-3973
R502	Composition, 10 kΩ ±5% 1/2 W	6100-3105	01121	RC20GF103J	5905-185-8510
R503	Composition, 4.7 Ω ±5% 1/2 W	6100-9475	01121	RC20GF472J	
R504	Composition, 680 Ω ±5% 1/2 W	6100-1685	01121	RC20GF681J	5905-195-6791
R505	Pot., wire-wound 200 Ω ±10% 1/2 W	6059-1209	80294	3067P-1-201	
R506	Composition, 360 Ω ±5% 1/2 W	6100-1365	01121	RC20GF361J	5905-279-1889
R507	Power, wire wound 30 Ω ±5% 5 W	6660-0305	80183	246E, 30 Ω ±5%	
R508	Low power wire wound 2.4 Ω ±5% 2 W	6760-9245	75042	BWH, 2.4 Ω ±5%	
R509	Composition, 68 Ω ±5% 1/2 W	6100-1125		RC20GF121J	5905-252-5435
R510	Composition, 11 Ω ±5% 1/2 W	6100-0115	01121	RC20GF110J	5905-279-3524
R531	Power, wire wound 68 Ω ±5% 5 W	6660-0685	80183	246E, 68 Ω ±5%	
R532	Composition, 75 Ω ±5% 2 W	6120-0755	01121	RC42GF750J	5905-279-2627
R533	Power, wire wound 68 Ω ±5% 5 W	6660-0685	80183	246E, 68 Ω ±5%	
R534	Composition, 2.2 kΩ ±5% 1/2 W	6100-2225	01121	RC20GF222J	5905-279-1876
R535	Power, wire wound 68 Ω ±5% 5 W	6660-0685	80183	246E, 68 Ω ±5%	
R536	Composition, 75 Ω ±5% 2 W	6120-0755	01121	RC42GF750J	5905-279-2627
R537	Composition, 220 Ω ±5% 1/2 W	6100-1225	01121	RC20GF221J	5905-279-3513
R538	Composition, 10 kΩ ±5% 1/2 W	6100-3105	01121	RC20GF103J	5905-185-8510
R539	Composition, 680 Ω ±5% 1/2 W	6100-1685	01121	RC20GF681J	5905-195-6791
R540	Composition, 51 kΩ ±5% 2 W	6120-3515	01121	RC42GF513J	
R541	Composition, 120 kΩ ±5% 1 W	6110-4125	01121	RC32GF124J	5905-299-2001
R542	Composition, 4.7 kΩ ±5% 1/2 W	6100-2475	01121	RC20GF472J	5905-279-3504
R543	Composition, 15 Ω ±5% 1/2 W	6100-0155	01121	RC20GF150J	5905-279-3521
R544	Composition, 15 kΩ ±5% 1/2 W	6100-3155	01121	RC20GF153J	
R545	Pot., comp., 10 kΩ ±20% 1/4 W	6040-0700	24655	6040-0700	5905-549-2773
R546	Composition, 200 kΩ ±5% 1/2 W	6100-4205	01121	RC20GF204J	5905-171-2003
R547	Thermistor, 100 kΩ ±10%	6740-2024	02606	QA51J1	
R548	Composition, 36 kΩ ±5% 1/2 W	6100-3365	01121	RC20GF363J	5905-249-4256
R549	Power, wire wound 1.2 kΩ ±5% 5 W	6660-2125	80183	246E, 1.2 kΩ ±5%	
R550	Composition, 1.2 kΩ ±5% 1/2 W	6100-2125	01121	RC20GF122J	5905-190-8880
R551	Pot., comp., 100 kΩ ±20% 1/4 W	6040-1000	24655	6040-1000	5905-958-7949
R552	Composition, ±5% 1/2 W	*6100-			
R560	Low power wire wound, 2.4 Ω ±5% 2 W	6760-9245	75042	BWH, 2.4 Ω ±5%	
R561	Composition, 56 Ω ±5% 1/2 W	6100-0565	01121	RC20GF560J	5905-279-1897
R562	Composition, 220 Ω ±5% 1/2 W	6100-1225	01121	RC20GF221J	5905-279-3513
R563	Composition, 220 Ω ±5% 1/2 W	6100-1225	01121	RC20GF221J	5905-279-3513
R564	Composition, 100 kΩ ±5% 1 W	6110-4105	01121	RC32GF104J	5905-299-2003
R570	Low power wire wound 1 Ω ±5% 2 W	6760-9105	75042	BWH, 1 Ω ±5%	
R571	Composition, 27 Ω ±5% 1/2 W	6100-0275	01121	RC20GF270J	5905-279-1879
R572	Composition, 91 Ω ±5% 1/2 W	6100-0915	01121	RC20GF910J	5905-279-3516

*Value selected at factory.

PARTS LIST (cont)

REF. NO.	DESCRIPTION	PART NO.	FED. MFG. CODE	MFG. PART NO.	FED. STOCK NO.
R573	Composition, 27 kΩ ±5% 1/2 W	6100-3275	01121	RC20GF273J	5905-279-3499
R574	Composition, 150 Ω ±5% 1/2 W	6100-1155	01121	RC20GF151J	5905-299-1541
R575	Composition, 12 kΩ ±5% 1/2 W	6100-3125	01121	RC20GF123J	5905-279-3502
R576	Pot., comp., 2.5 kΩ ±20% 1/4 W	6040-0500	24655	6040-0500	
R577	Composition, 10 kΩ ±5% 1/2 W	6100-3105	01121	RC20GF103J	5905-185-8510
R578	Power, wire wound 24 Ω ±5% 5 W	6660-0245	80183	246E, 24 Ω ±5%	
MISCELLANEOUS					
CR501	DIODE, Semiconductor, type 1N3253	6081-1001	79089	1N3253	5961-814-4251
CR502	DIODE, Semiconductor, type 1N3253	6081-1001	79089	1N3253	5961-814-4251
CR503	DIODE, Semiconductor, type 1N3254	6081-1002	09213	1N3254	5961-082-3988
CR504	DIODE, Semiconductor, type 1N3253	6081-1001	79089	1N3253	5961-814-4251
CR505	DIODE, Semiconductor, type 1N728A	6083-1012	07910	1N758-A	
CR506 thru CR509	DIODE, Semiconductor, type 1N3254	6081-1002	09213	1N3254	5961-082-3988
CR510 thru CR519	DIODE, Semiconductor, type 1N3253	6081-1001	79089	1N3253	5961-814-4251
CR531	DIODE, Semiconductor, type 1N968B	6083-1018	80131	1N968B	5960-858-4180
CR560	DIODE, Semiconductor, type 1N972B	6083-1040	80131	1N972B	5960-858-4211
CR570	DIODE, Semiconductor, type IN58A	6083-1012		1N758A	
L501	INDUCTOR, Choke, iron core	0345-4014	24655	0345-4014	
L502A L502B	INDUCTOR, Choke, iron core	0365-4011	24655	0365-4011	
PL516	PLUG, Power, 3 wire	1026-0460		1026-0460	5935-816-0254
PL530	PLUG, Multipin Part of	1026-2010			
TP530	TEST POINT, pin jack	4260-1291	70563	380598-1	
T501	TRANSFORMER, power	0365-4012	24655	0365-4012	
Q501	TRANSISTOR, type 2N2714	8210-1047	24454	2N3414	5961-989-2749
Q531	TRANSISTOR, type 2N1540	8210-1540	80211	2N1540	
Q532	TRANSISTOR, type 2N696	8210-1033	24454	2N696	5960-840-3561
Q533	TRANSISTOR, type 2N696	8210-1033	24454	2N696	5960-840-3561
Q534	TRANSISTOR, type 2N3638	8210-1096	07263	2N3638	
Q535	TRANSISTOR, type 2N696	8210-1033	24454	2N696	5960-840-3561
Q560	TRANSISTOR, type 2N1540	8210-1540	80211	2N1540	
Q561	TRANSISTOR, type 2N2714	8210-1047	24454	2N3414	5961-989-2749
Q570	TRANSISTOR, type 2N1540	8210-1540	80211	2N1540	
Q571	TRANSISTOR, type 2N2714	8210-1047	24454	2N3414	5961-989-2749
Q572	TRANSISTOR, type 2N2714	8210-1047	24454	2N3414	5961-989-2749
Q573	TRANSISTOR, type 2N3638	8210-1096	07263	2N3638	

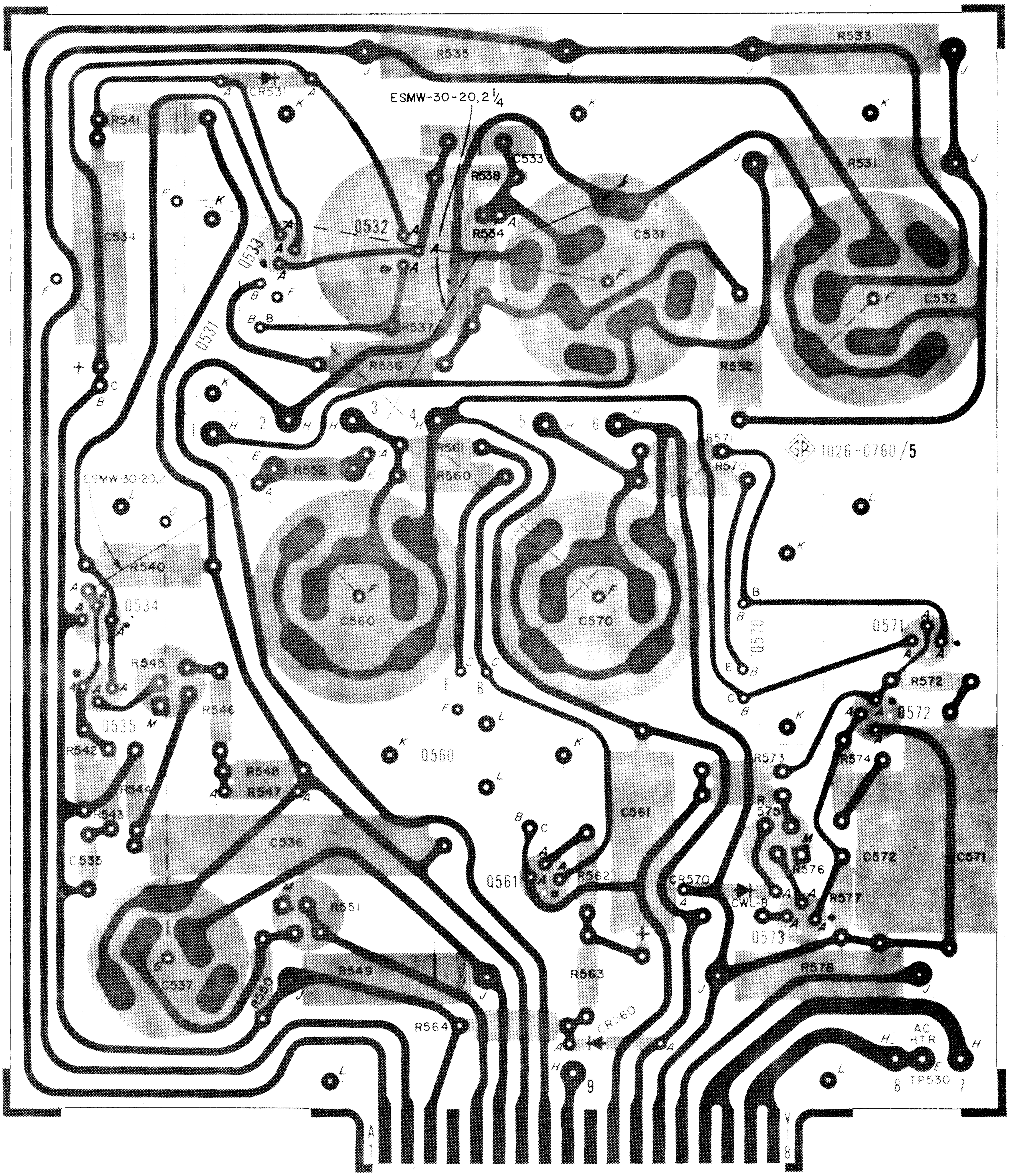


Figure 6-13. Etched-circuit-board diagram for Power-Supply Regulator (P/N 1026-2761).

NOTE: The number appearing on the foil side is not the part number.
The dot on the foil at the transistor socket indicates the collector lead.

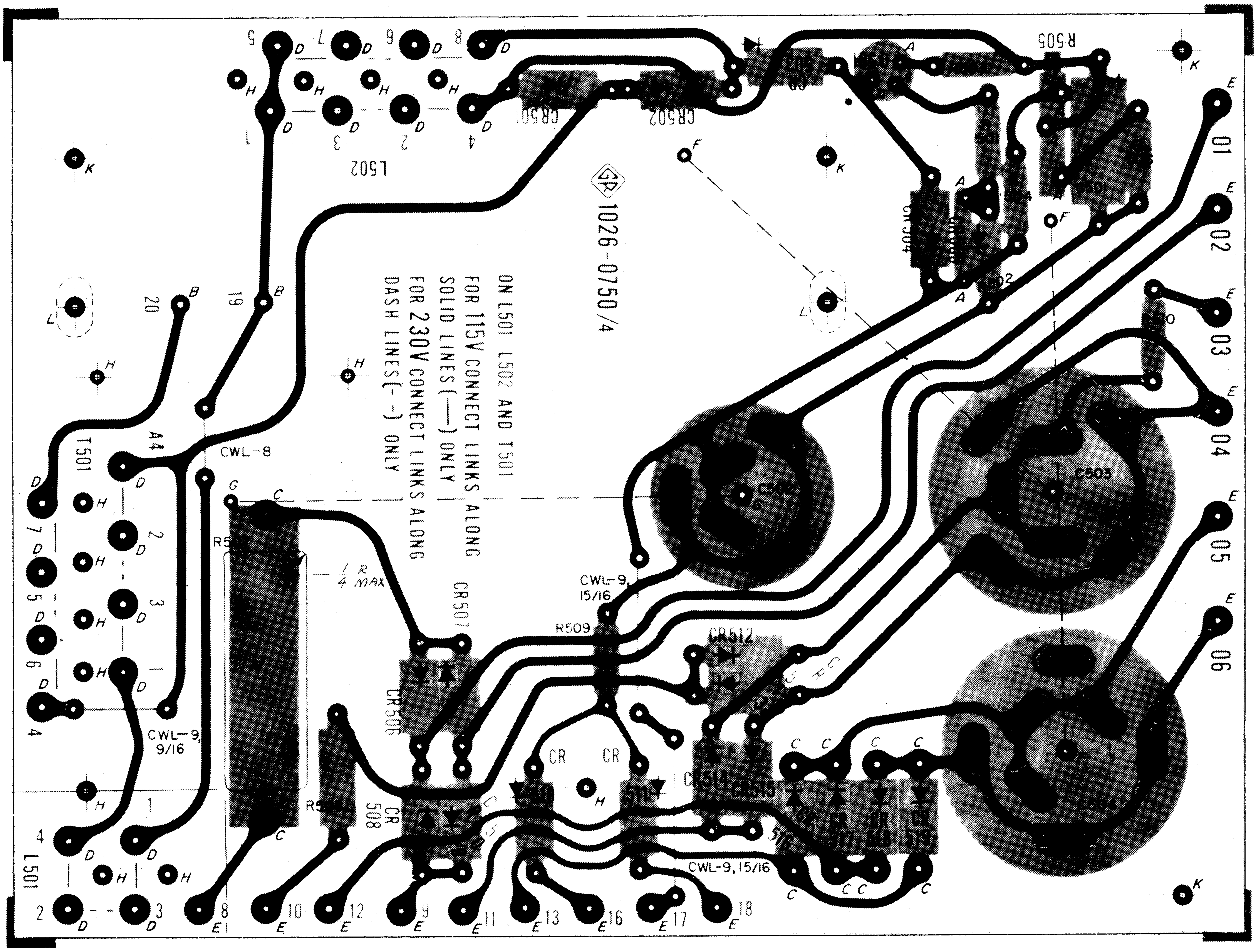


Figure 6-14. Etched-circuit-board diagram for Power-Supply Rectifier (P/N 1026-2751).

NOTE: The number appearing on the foil side is not the part number.
The dot on the foil at the transistor socket indicates the collector lead.

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

FOR L501 CONNECTIONS:
115V. OPERATION CONNECT #1 TO #3; #2 TO #4
230V. OPERATION CONNECT #2 TO #3

FOR L502 CONNECTIONS:
115V. OPERATION CONNECT #1 TO #3; #2 TO #4; #5 TO #7; #6 TO #8
230V. OPERATION CONNECT #2 TO #3; #6 TO #7

FOR T501 CONNECTIONS:
115V. OPERATION CONNECT #1 TO #3; #2 TO A4; #4 TO #6; #5 TO #7
230V. OPERATION CONNECT #2 TO #3; #5 TO #6

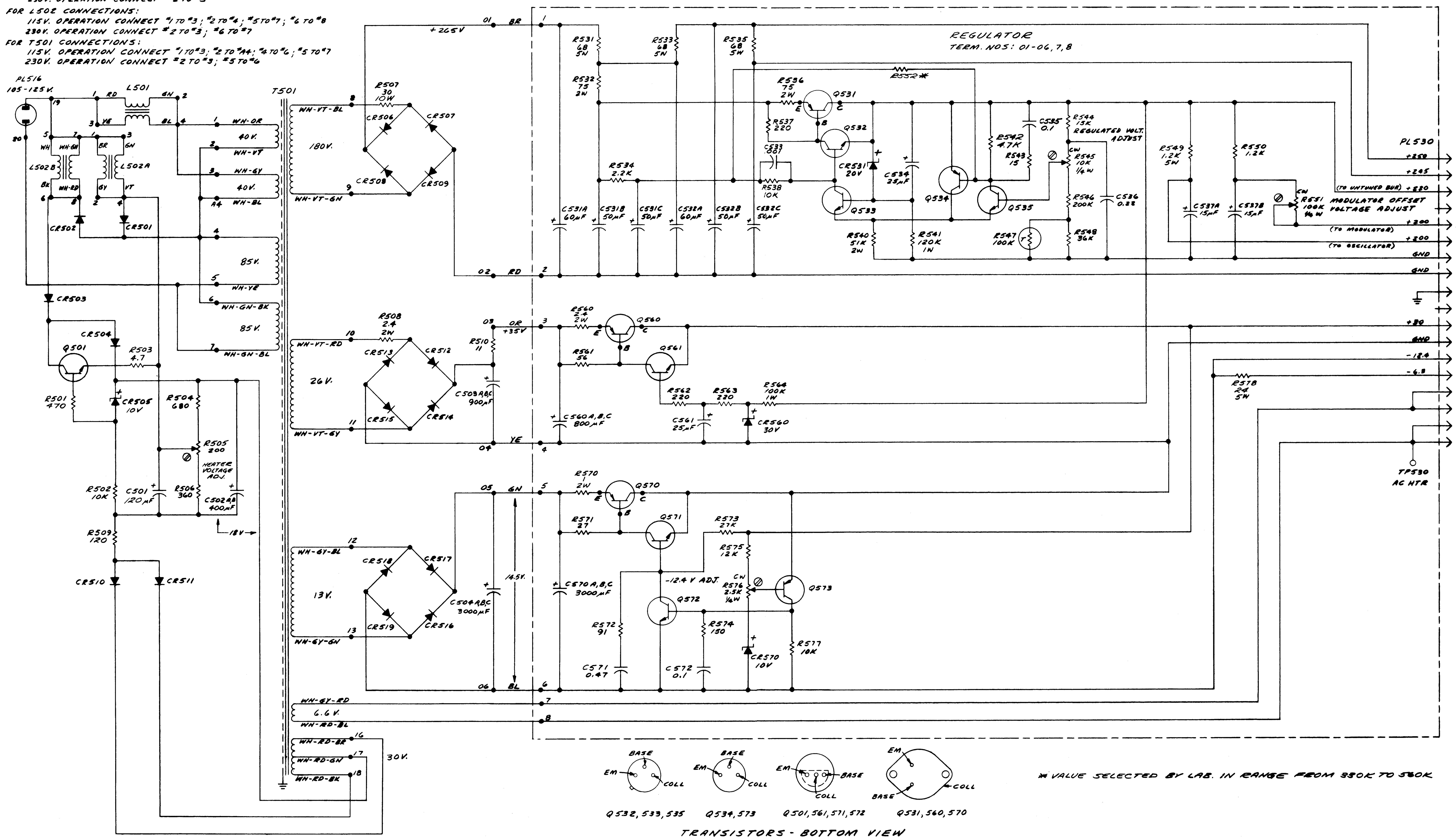


Figure 6-15. Schematic diagram for Power Supply Assembly (P/N 1026-2010).

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