

Printed: MAY 1980

HP Part No. 08406-90001

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1400 FOUNTAIN GROVE PARKWAY, SANTA ROSA, CALIFORNIA, 95404, U.S.A.

Refer to Appendix I for Instruments
Serial Prefixed 532 - and 541 -

SERIALS PREFIXED: 649- 737-

FREQUENCY COMB GENERATOR

MODEL 8406A

OPERATING AND SERVICE MANUAL



SAFETY CONSIDERATIONS

GENERAL — This is a Safety Class I instrument (provided with terminal for protective earthing).

OPERATION — BEFORE APPLYING POWER verify that the power transformer primary is matched to the available line voltage, the correct fuse is installed, and Safety Precautions are taken (see the following warnings). In addition, note the instrument's external markings which are described under "Safety Symbols."

WARNINGS

Servicing instructions are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

BEFORE SWITCHING ON THE INSTRUMENT, the protective earth terminal of the instrument must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two conductor outlet is not sufficient protection. If this instrument is to be energized via an auto-transformer (for voltage reduction) make sure the common terminal is connected to the earth terminal of the power source.

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation. Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short circuited fuseholders. To do so could cause a shock or fire hazard.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard. Do not install substitute parts or perform any unauthorized modification to the instrument.

SAFETY SYMBOLS

Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury. Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible, and when inevitable, should be carried out only by a skilled person who is aware of the hazard involved. Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.



Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the product.



Indicates hazardous voltages.



Earth terminal (sometimes used in manual to indicate circuit common connected to grounded chassis).

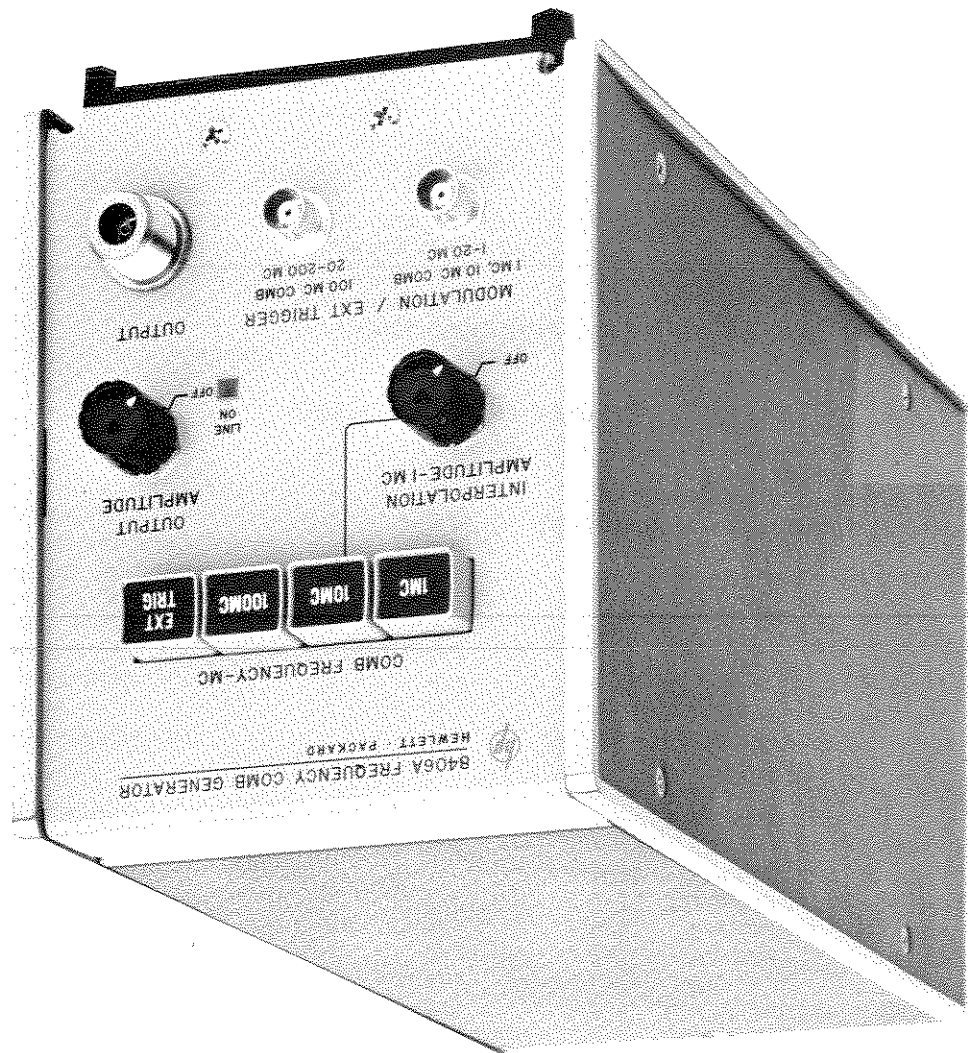
WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Figure 1-1. Frequency Comb Generator



SECTION I GENERAL INFORMATION

1-1. DESCRIPTION.

1-2. The hp Model 8406A supplies a frequency comb with a selectable spectral line spacing of 1 Mc, 10 Mc, 100 Mc, or the frequency of an external trigger signal. The frequency comb generated is usable to at least 4 Gc.

1-3. The Model 8406A provides these additional features:

- a. Output level is continuously variable by a front panel control.
- b. Interpolation amplitude level is continuously variable by a front panel control.
- c. Comb frequency or external trigger frequency is selectable by front panel pushbuttons. This switch will not permit more than one button to be actuated at a time to avoid confusion in the output signal.

- d. Front panel BNC jacks are provided for modulation and external trigger frequencies.
- e. A switch is provided on the rear apron to switch the instrument to 230-volt operation.

1-4. INSTRUMENT IDENTIFICATION.

1-5. Hewlett-Packard uses a two-section, eight-digit serial number (on instrument rear panel) to identify instruments (000-00000). The first three digits are a serial prefix number, and the last five digits refer to a specific instrument. If the serial prefix on your instrument does not appear on the title page of this manual, there are differences between the manual and your instrument which are described in a Manual Change sheet included with this manual or in the Appendix (if any). If this information is missing, it can be supplied by your nearest Hewlett-Packard field office.

Comb Fundamental Frequencies: 1, 10, and 100 Mc, pushbutton selected, generate harmonically related signals usable to beyond 5 Gc.

Comb Frequency Accuracy: $\pm 0.01\%$ (0° to 50°C).

Peak Amplitude*:

1 Mc Comb	10 Mc Comb	100 Mc Comb
> 80 dBm	> 60 dBm	-
> 82 dBm	> 45 dBm	-
> 70 dBm	> 50 dBm	-
-	-	> 35 dBm
-	-	> 47 dBm

*Peak signal level defined in terms of equipment CW signal level (as measured on hp 8551B/851B Spectrum Analyzer).

OUTPUT AMPLITUDE control permits continuous level adjustment.

Comb Output Connector: Type N female, source impedance approximately 50 ohm.

Maximum External Signal at Comb Output: Signals exceeding 1 watt (pk and av) may cause damage.

Interpolation Function: 10-Mc and 1-Mc combs can be combined into primary-secondary level of secondary (1 Mc) signal.

External Modulation: External modulation signals can be used to phase modulate any of the combs to produce sidebands for interpolation between fixed comb markers¹. BNC female connector.

External Trigger: External signals (normally sine waves) between 1 Mc and 200 Mc can be used to produce combs spaced at frequency of trigger signals². BNC female connector.

Power: 115 or 230 volts $\pm 10\%$, 50-400 cps, 2 watts

Dimensions:

NOTE
DIMENSIONS IN INCHES AND MILLIMETERS
ADD 1/16" (1.588) FOR TOTAL LENGTH INCLUDING KNOBS
ADD 2/16" (1.25) FOR HEIGHT INCLUDING FEET
ADD 7/16" (11 MM)

Weight: Net 6 lb (2.7 Kg); shipping 9 lb (4.1 Kg)

External modulation: Modulation frequencies can be as low as 5 kc. Although the level of modulation voltage required varies with modulating frequency and the harmonic number of the comb being modulated, the information here will serve as a guide:

To produce sidebands approximately 20 db below the main comb marker at the 1 Gc harmonic of the appropriate comb (comb output amplitude at maximum), typical modulation voltages are:

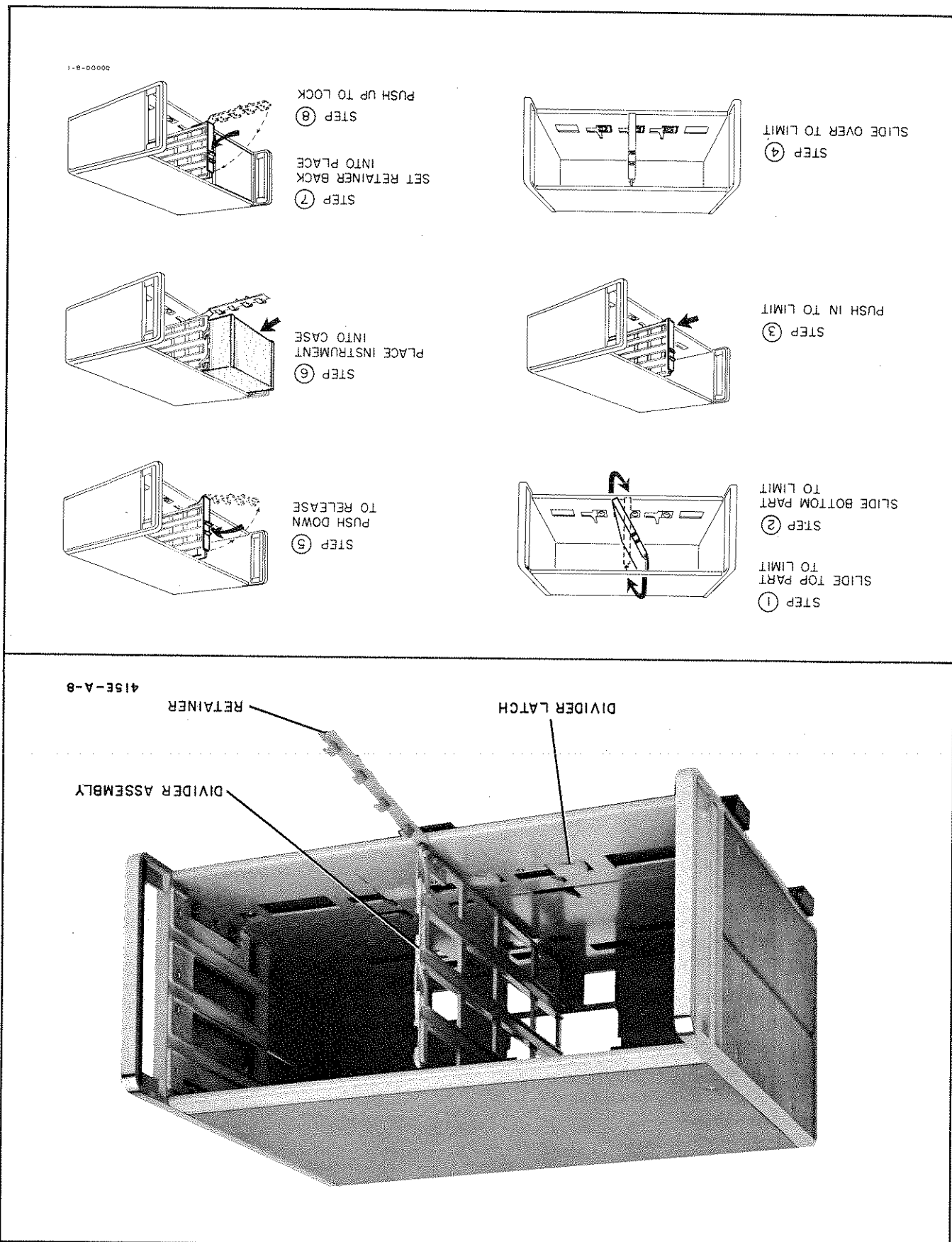
- 1-2 mv rms at 200 kc for the 1 Mc comb
- 5-10 mv rms at 2 Mc for the 10 Mc comb
- 50-100 mv rms at 20 Mc for the 100 Mc comb

Signals greater than 5v rms at modulation input may cause damage.

External Trigger: Typical input signal levels to generate externally triggered combs at the frequency of the external trigger are in the range of 1-3 volts rms. Input signals greater than 5 volts rms may cause damage. With input triggers in the 1-20 Mc frequency span, the OUTPUT AMPLITUDE control of the 8406A can be used to adjust the output comb level.

When using signals in the frequency span from 20-200 Mc, output comb amplitude is a function of the input signal level.

Figure 2-1. Combining Case



Section II
Figure 2-1

Model 8406A

SECTION II INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information on unpacking, inspection, repacking, storage and installation.

2-3. UNPACKING AND INSPECTION.

2-4. Inspect instrument for shipping damage as soon as it is unpacked. Check for broken knobs and connectors; inspect cabinet and panel surfaces for dents and scratches. A performance check is given in Table 5-2. If instrument is damaged in any way or fails to operate properly, notify carrier and your nearest Hewlett-Packard field office. For assistance of any kind, including help with instruments under warranty, contact your Hewlett-Packard field office (see list at rear of this manual).

2-5. STORAGE AND SHIPMENT.

2-6. PACKAGING. To protect valuable electronic equipment during storage or shipment, always use the best packaging methods available. Your Hewlett-Packard field office can provide packing material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice. Whatever packing method is used, be sure to attach a tag to the instrument itself giving your name, address, and pertinent details.

2-8. RACK INSTALLATION.

2-9. When the Model 8406A is to be rack-mounted, a combining case (Paragraph 2-10) or adapter frame (Paragraph 2-11) is required. These items are available through your Hewlett-Packard field office. The two methods for rack mounting are discussed in the following paragraphs.

2-10. COMBINING CASE. The combining case (hp 1051A) shown in Figure 2-1 is a full-module unit which accepts varying combinations of submodule units such as the 1/3 module Model 8406. The combining case can be used as a bench model or it can be rack-mounted. A rack-mounting kit (hp part number 5060-0777) is supplied to rack mount the combining case. Instructions for using the case are given in Figure 2-1. When only one-third of the case is used, a blank filler panel (hp part number 5060-0793) is available to enclose the unused front panel space.

2-11. ADAPTER FRAME. The adapter frame (hp part number 5060-0797) in Figure 2-2 is a rack frame that accepts any combination of submodule units;

a. Place adapter frame on edge of bench as shown in step 1, Figure 2-2. (Only two submodule units are illustrated for clarity. The method of operation is the same for three.)
b. Stack units in frame as shown in step 2. Place spacer clamp between units, step 3.

c. Place end spacer clamps as shown in step 4, and push units into frame.
d. Insert screws on either side of frame, step 5, and tighten until units are tight in frame.
e. The complete assembly is now ready for rack mounting.

2-12. OPERATING FROM 115 OR 230 VOLTS.

2-13. The Model 8406 may be operated from either 115- or 230-volt $\pm 10\%$, 50- to 400-cps power lines. A slide switch on the rear panel permits quick conversion for operating from either voltage. Insert a narrow-blade screwdriver in the switch slot and slide the switch to expose "115" marking for 115-volt operation or "230" marking for 230-volt operation. A 1/16 amp fuse is used for both voltages.

CAUTION: Be sure this switch is in proper position before turning on.

2-14. POWER CABLE. The Model 8406 is equipped with a detachable 3-wire power cable. Proceed as follows for installation:

a. Connect flat plug (three-socket connector) to ac line jack at rear of instrument.
b. Connect plug (two-blade with round grounding pin) to three-wire (grounded) power outlet. Exposed portions of the instrument are grounded for safety; when only a two-blade outlet is available, use connector adapter (hp part number 1251-0048), and connect short wire from side of adapter to ground.

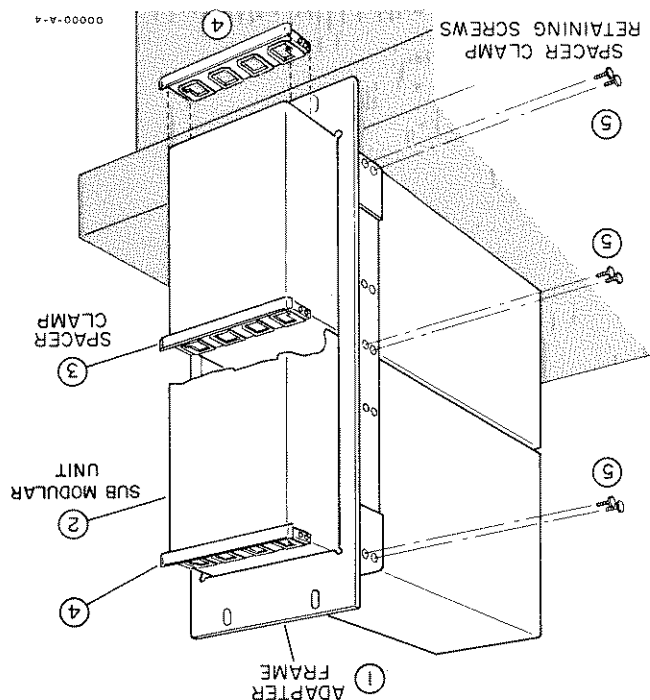
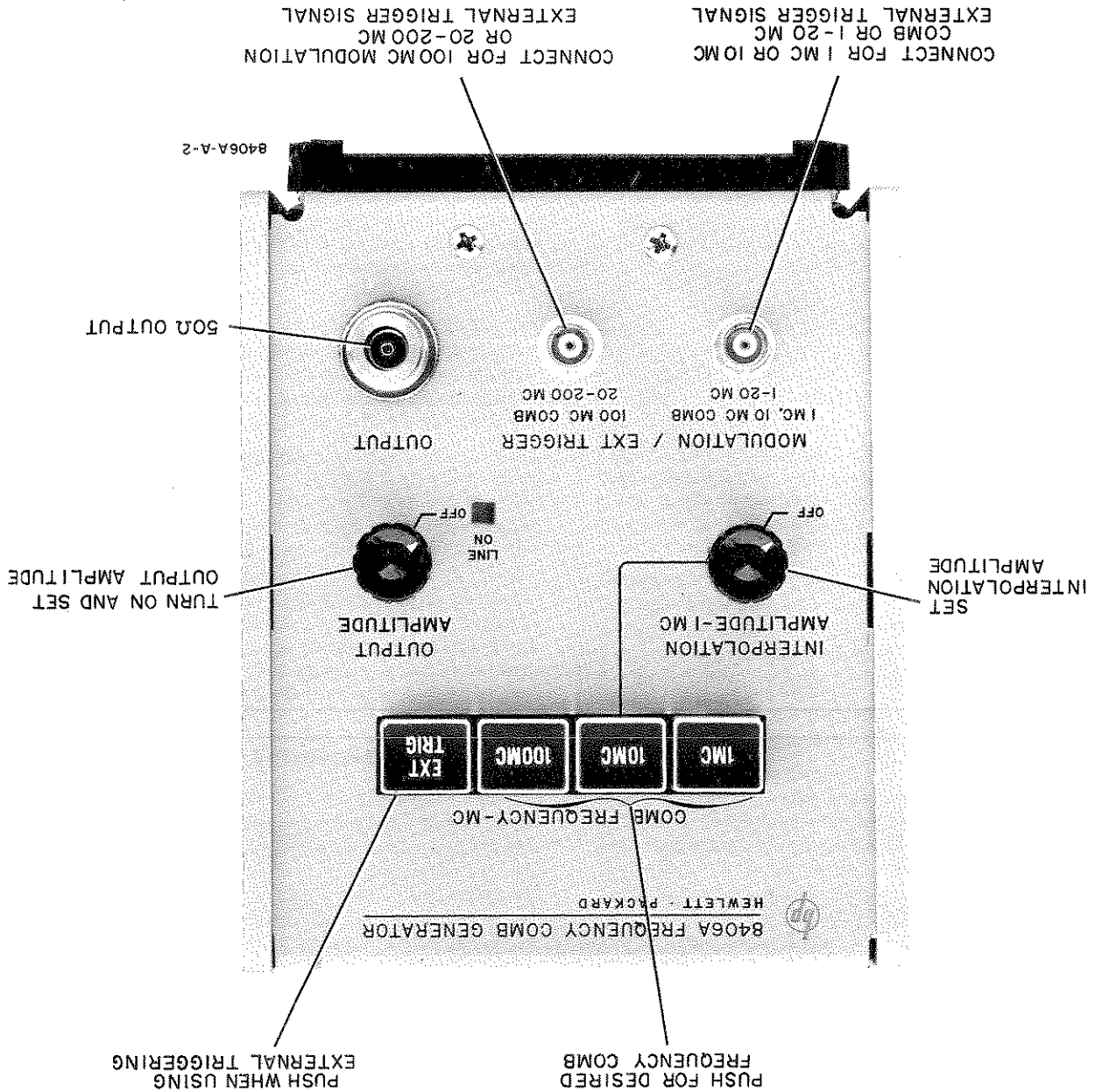


Figure 2-2. Adapter Frame

Figure 3-1. Operating Controls



SECTION III OPERATION

3-5. FREQUENCY CONSIDERATIONS. At low levels of modulation (phase modulation), a single pair of sidebands appear - variable with modulation for precise frequency determination. At higher levels of modulation more sidebands appear which permit calibration of devices (spectrum analyzers, frequency meters, etc.) in arbitrary frequency increments. As with all modulation, the absolute accuracy of the generator must be increased by the multiple of the harmonic used in order to obtain the required accuracy at the operating frequency (the percentage accuracy is the same for all harmonics).

3-6. EXTERNAL TRIGGER. The external trigger voltage is fed in by means of the EXT TRIGGER jacks, either 1-20 Mc or 20-200 Mc, depending upon frequency. The signal used for external triggering should be adjustable in amplitude around 2 volts. Note that in the EXTERNAL TRIGGER position the OUTPUT AMPLITUDE control is operable when the signal is fed into the 1-20 Mc EXT TRIGGER jack. The OUTPUT AMPLITUDE control may be used to adjust the output level when this jack is used. If the 20-200 Mc jack is used, the output level must be adjusted by varying the input level of the external trigger signal. The input from this jack does not go through the Diode Driver and therefore the OUTPUT AMPLITUDE control will have no effect. In fact, the instrument does not even have to be on if the 20-200 Mc jack is used. However, more power is needed (10-20 millivolts).

3-1. INTRODUCTION.

3-2. The Model 8406 Frequency Comb Generator is used to calibrate other instruments which display the frequency domain. It is usually used with Spectrum Analyzers to calibrate their frequency and output characteristics. The illustration on the facing page, Figure 3-1, shows in general the operation of the Model 8406. The following paragraphs discuss special points which are not covered in the general explanation.

3-3. INTERPOLATION MODULATION. Usually to calibrate an instrument, the 10-Mc comb is used first to determine which lines correspond to the 10-Mc markers. If a finer determination is required, the INTERPOLATION AMPLITUDE control is turned on and the amplitude adjusted. This will give ten times more lines, each marking a 1-Mc point, in addition to the 10-Mc lines. If the 1-Mc Oscillator only were used, the same accuracy would be obtained but there is the possibility that a wrong line would be chosen if the instrument being tested is badly out of calibration.

3-4. EXTERNAL MODULATION. If a modulation spectrum other than 1 Mc on the internally generated comb is desired, feed the output from an external oscillator into the appropriate MODULATION jack (1 Mc and 10 Mc or 100 Mc COMB). The level should be adjustable around 10 millivolts. Depress the COMB FREQUENCY pushbutton for the main frequency spectrum desired. The output will now contain major spectral lines spaced at the frequency of the external oscillator.

4-1. GENERAL.

4-2. The Model 8406 generates a train of sharp pulses at a repetition frequency of 1 Mc, 10 Mc, or 100 Mc supplied internally or at the frequency of an external oscillator. The frequency spectrum of the output is a comb with spectral lines spaced by the repetition frequency, 1-Mc, 10-Mc, 100-Mc or the frequency of an external oscillator.

4-3. BLOCK DIAGRAM.

4-4. Figure 4-1 is a block diagram which shows the inter-connections between the main sections of the instrument. Note that only one oscillator is on at any one time, except when the 1-Mc Interpolation Oscillator is used to interpolate between the main spectral lines of the 10-Mc Oscillator. In the case of the 1-Mc and 10-Mc Oscillators the signal is passed through a Diode Driver before it is applied to the Output Harmonic Generator (low-frequency signals do not generate harmonics with sufficient amplitude when applied directly to the Output Harmonic Generator). The Diode Driver

4-5. INDIVIDUAL CIRCUITS.

4-6. 1-MC AND 10-MC OSCILLATORS.

sharpen the transition so that higher amplitude harmonics are generated. The 100-Mc Oscillator-Amplifier generates high-level harmonics without shaping and thus triggers the step-recovery diode directly.

4-7. Since these oscillators are similar they will be described together. Both of these oscillators consist of a Colpitts-type oscillator in a common-emitter configuration. Crystal control is used in both oscillators. The output of the 1-Mc Oscillator goes directly to the Diode Driver. Output of the 1-Mc Oscillator goes either directly to the Diode Driver or to the 5-Mc Harmonic Generator Diode A1CR1. The filter following removes all harmonics above 5 Mc when the 1-Mc signal is used for interpolation between the spectral lines of the 10-Mc Oscillator. The Interpolation Oscillator phase-modulates the 10-Mc signal producing upper and lower sidebands. Line overlap would be produced if signals above 5 Mc were used for modulation. To

THEORY OF OPERATION

SECTION IV

4-13. The Diode Driver generates a fast-rise pulse for each cycle sine wave fed to the tunnel diode, CR2. This fast-rise pulse produces a large current in the reverse direction of the Output Harmonic Generator, CR1. When the stored charge in the diode is depleted, the diode opens, producing a step of voltage on the transmission line of the Harmonic Generator. The Emitter Follower is used as a source of variable voltage to the Diode

4-12. DIODE DRIVER AND EMITTER FOLLOWER.

4-11. This Amplifier is of standard configuration with a tuned input and a tuned output. The Amplifier is energized only in the 100-Mc switch position, since it is not needed otherwise.

4-10. 100-MC AMPLIFIER.

4-9. This oscillator is also of the Colpitts type with a tuned tank circuit. Series tuning of the crystal is used to adjust the frequency.

4-8. 100-MC OSCILLATOR.

to modulate the 10-Mc signal. modulating frequencies 5 Mc or below are permitted reduce the confusion caused by two sets of signals, only

4-17. This attenuator isolates the step-recovery diode from the output connector to give a 50-ohm output impedance.

4-16. ATTENUATOR ASSEMBLY.

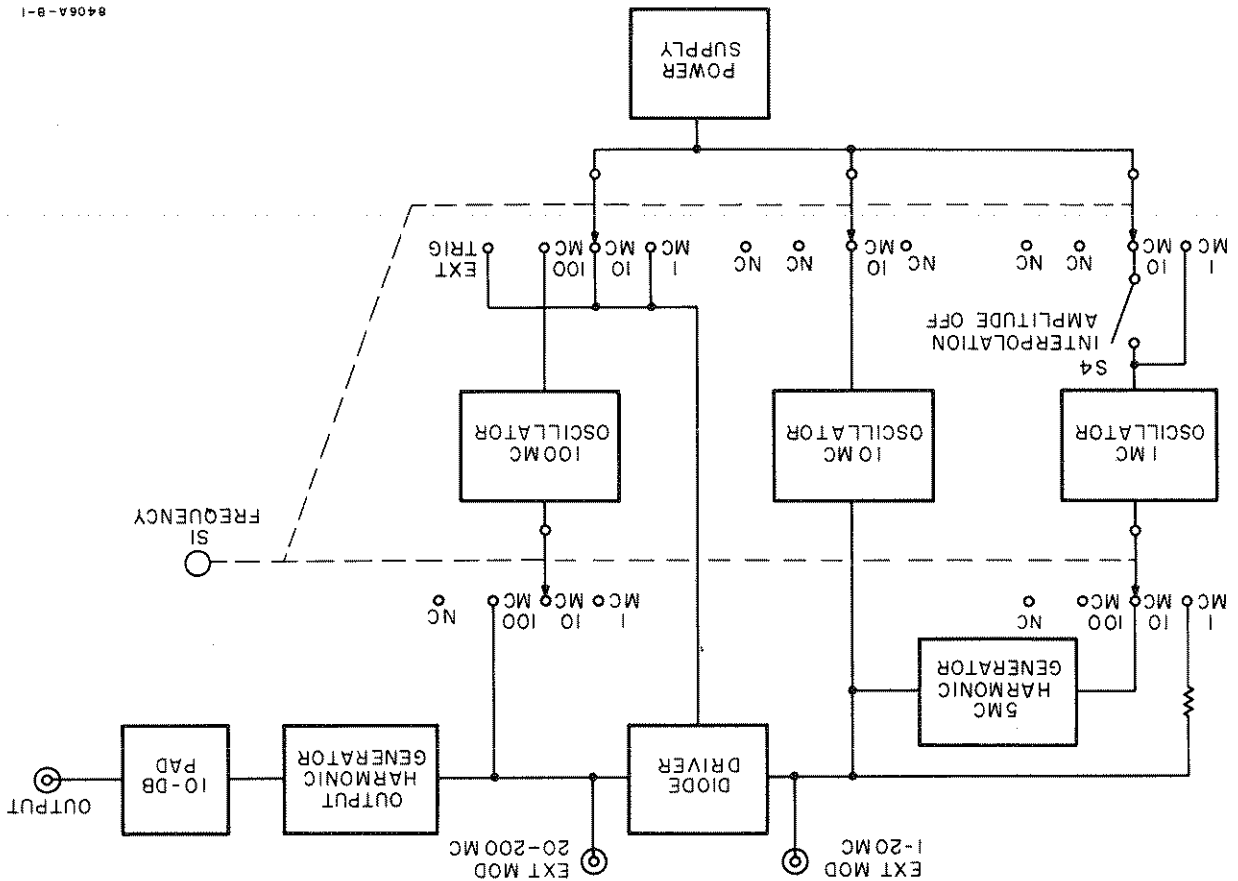
not have to be turned on. GER jack. For this application the instrument does situation when using the 20-200 MC EXTERNAL TRIG-

conduction takes place. The step-recovery diode may be used by itself for harmonic generation. This is the network (R19, L10) sets the voltage at the diode so that each pulse to replace the stored charge. A biasing The diode must conduct in the forward direction after shorted transmission-line stub at the diode output. function produced is formed into a impulse by the cutoff generates a multitude of harmonics. This sharp of stored carriers it shuts off abruptly. This sharp forward-biased condition they act as any diode. How- somewhat differently than normal diodes. In the harmonic generation. Step-recovery diodes operate 4-15. Diode CR1 is a step-recovery diode used for

4-14. STEP-RECOVERY DIODE.

Driver. As the output of the Diode Driver is varied, the level of the output frequency comb varies.

Figure 4-1. Block Diagram



8406A-8-1

SECTION V MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides maintenance and service information for the Model 8406 Frequency Comb Generator. Included are a table of recommended test equipment, troubleshooting procedures, repair and adjustment procedures, and an in-cabinet performance check which may be used to verify proper operation of the Generator.

5-3. TEST EQUIPMENT.

5-4. Recommended test equipment for performance checking, troubleshooting, and repair is listed in Table 5-1. Other test instruments may be used if their specifications satisfy the required characteristics.

5-5. IN-CABINET PERFORMANCE CHECK.

5-6. GENERAL. The In-Cabinet Performance Checks, Table 5-2, and Performance Check Test Card (to be filled out during incoming inspection), verify specifications and provide a permanent record of the performance of the instrument. The In-

- Cabinet Performance Check verifies the proper operation of all circuits in the Generator and may be used:
- a. As part of an incoming inspection check of instrument specifications;
 - b. Periodically, for instruments used in systems where maximum reliability is of utmost importance;
 - c. as part of a troubleshooting procedure to locate out-of-tolerance operation;
 - d. after any repairs or adjustments, before returning instrument to regular service.
- 5-7. VARIABLE LINE VOLTAGE.
- 5-8. During the Performance Check, Table 5-2, connect the Generator to a power source through a variable voltage device so that line voltage may be varied $\pm 10\%$ from nominal (115 or 230 Vac) to assure proper operation of the Generator under various supply conditions.

Table 5-1. Test Equipment Required

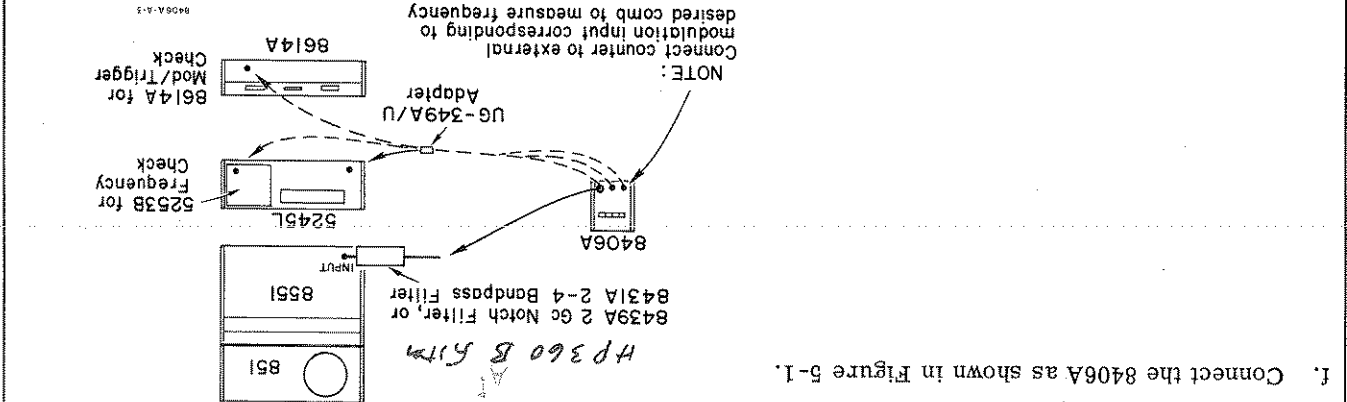
Instrument Type	Critical Specifications	Instrument Recommended
AC Voltmeter	Range: to 1 mV. Frequency Range: 40-200 cps	hp Model 400D/H/L/E/EL
DC Voltmeter	Range: 14 volts Resolution: 0.2 volts	hp Model 405BR
Electronic Counter	Range: 1 to 100 Mc Accuracy: $\pm 0.005\%$	hp Model 5254L with hp Model 5253B plug-in
Spectrum Analyzer	Range: 10 Mc - 4 Gc	hp Model 8551 with hp Model 851
Notch Filter	Rejects 2 Gc	hp Model 8439A
RF Voltmeter	Range: 100 Mc	hp Model 411A
Variable Autotransformer	Power: 1 amp Voltage: 102 to 128 volts	Ohmite VT8F
Signal Generator	Range: 200 Kc to 50 Mc	hp Model 606
Signal Generator	Frequency: 1-2 Gc	hp Model 8614A
Bandpass Filter	Pass: 2-4 Gc, reject other	hp Model 8431A
ACCESSORIES		
UG-274A/U	BNC T Connector	hp part number 1250-0072
UG-349A/U	Female N-Male BNC connector	hp part number 1250-0077
Tuning Wand		Walisco 2947
Plastic Tuning Wand		General Cement Company GC 8271

a. Repeat Analyzer Calibration steps a-d, using a 2-4 Gc Signal Generator with a 8431A Bandpass Filter and set the Spectrum Analyzer controls as follows:

TUNE 2.8/3.2 Gc (1.8-4.2 Gc FREQUENCY range)
 IF 200 Mc
 VERT DISPLAY LOG
 SWEEP TIME 1 SEC/CM
 SPECTRUM WIDTH 200 MC/CM
 ATTENUATOR 10 DB (to start)
 IF BANDWIDTH 10 Kc

If it is desired to check the output level from 2-4 Gc, fundamental mixing must be used to increase sensitivity in order that the lower levels may be observed. Proceed as follows:

- h. Leave Spectrum Analyzer controls as in b and d. The frequency comb should be smooth in output with an output level of greater than -35 dbm from 1-2 Gc and greater than -45 dbm from 100 Mc to 1 Gc.
- i. Depress the 10 Mc pushbutton on the 8406.
- j. The frequency comb should be smooth in output with an output level of greater than -50 dbm from 500 Mc to 2 Gc and greater than -60 dbm from 10 Mc to 500 Mc.
- k. Depress the 1 Mc pushbutton on the 8406.
- l. The frequency comb should be smooth in output with a level of greater than -70 dbm from 500 Mc to 2 Gc and greater than -80 dbm from 10 Mc to 500 Mc (ATTENUATOR may have to be switched to 0 DB).
- m. Connect the counter and measure the frequency. Must be within 100 cycles.
- n. Depress the 10 MC pushbutton on the 8406. The frequency must be within 10 kc.
- o. Depress the 100 MC pushbutton on the 8406. The frequency must be within 10 kc.
- p. Set the Spectrum Analyzer so that two successive 10-Mc harmonics are displayed, widely spaced.
- q. Turn the INTERPOLATION AMPLITUDE control on the 8406 fully clockwise. Ten 1-Mc pulses should appear in the space between the two 10-Mc pulses.



- f. Connect the 8406A as shown in Figure 5-1.
 - g. Adjust the Spectrum Analyzer for a display 6 cm high.
 - d. Increase the Signal Generator frequency at approximately 200-Mc intervals to 2 Gc, observing the display amplitude at each frequency. If the amplitude changes, mark the level with a grease pencil on the face of the Spectrum Analyzer.
 - e. Set Signal Generator for -35-dBm output at 1 Gc.
 - b. Set Spectrum Analyzer controls as follows:
- TUNE 1 Gc (.01-2 Gc FREQUENCY range)
 IF 2 Gc
 VERT DISPLAY LOG
 SWEEP TIME 1 SEC/CM
 SPECTRUM WIDTH 200 MC/CM
 ATTENUATOR 10 DB (to start)
 IF BANDWIDTH 10 Kc

a. Connect 1-2 Gc Signal Generator to Notch Filter at the input to the Spectrum Analyzer.

OUTPUT

Table 5-2. In-Cabinet Performance Check

Table 5-2. In-Cabinet Performance Check (cont'd)

<p>b. Measure 8406 comb output level, 100-Mc comb should be greater than -47 dbm over 2-4 Gc range 10-Mc comb should be greater than -62 dbm over 2-4 Gc range 1-Mc comb should be greater than -82 dbm over 2-4 Gc range (may have to reduce ATTENUATOR to 0 DB to see this sensitivity on last measurement).</p>	<p>MODULATION/EXT 1-20 MC Input</p>
<p>a. Connect the instrument as shown in Figure 5-1. b. Depress the 1 Mc pushbutton. c. Set the Spectrum Analyzer to a center frequency of 1 Gc and a spectrum width of about 3 Mc with an IF bandwidth of 1 Kc. d. Connect a Signal Generator to 1 MC, 10 MC COMB MODULATION jack on 8406. e. Set frequency of signal generator to 200 Kc and adjust output amplitude so that the sidebands displayed on Spectrum Analyzer are 20 db below the amplitude of the 1-Mc comb. f. Read the output level of the signal generator. This level should be less than 1 mV. (Actual modulating voltage required will be approximately twice this since the input impedance at this jack is high.) g. Depress the 10 MC pushbutton on the 8406. h. Set the Spectrum Analyzer to a spectrum width of 100 Mc and an IF bandwidth of 10 Kc. i. Set the frequency of signal generator to 2 Mc and level so that the sidebands displayed on spectrum analyzer are 20 db below carrier frequency. Signal Generator output level should be less than 6 mV. j. Insert a BNC T connector at the 1-20 Mc input and connect an RF Millivoltmeter to the open arm of the T to measure the input signal. k. Depress EXT TRIG pushbutton on 8406, set Signal Generator to 20 Mc and increase output level until 8406 triggers. This level should be less than 4 volts. <i>1-20 Trig. 4 volts</i> m. Connect Signal Generator to the 100 MC COMB MODULATION jack of 8406 with the same set-up as in step k. Depress 100 MC/pushbutton on 8406, set Signal Generator to 20 Mc and increase output level until 8406 triggers. This level should be less than 200 mV. <i>20 mV</i> n. Set Signal Generator frequency to 50 Mc, depress EXT TRIG pushbutton on 8406, and increase output level of Signal Generator until Comb Generator triggers. This level should be less than 2 volts.</p>	

CAUTION

TO AVOID DAMAGE, REMOVE POWER FROM INSTRUMENT BEFORE REMOVING OR REPLACING INSTRUMENT COVERS, ASSEMBLIES, OR COMPONENTS.

5-9. INSTRUMENT COVER REMOVAL.

5-10. To remove top or bottom cover, unscrew and remove the countersunk Phillips-head screws which secure cover to the instrument at the rear. Then slide cover toward rear of instrument.

WARNING: 115/230 VAC AND DC SUPPLY WIRES ARE EXPOSED WHEN EITHER TOP OR BOTTOM INSTRUMENT COVER IS REMOVED. BE CAREFUL DURING TROUBLESHOOTING, ADJUSTMENTS, OR REPAIR.

5-11. TROUBLESHOOTING AND REPAIR.

5-12. PRELIMINARY TROUBLESHOOTING.
5-13. The first step is to decide if the trouble is catastrophic or marginal. If catastrophic, start with the power supply and then trace the signal through the in-

5-14. TRANSISTOR TROUBLESHOOTING.

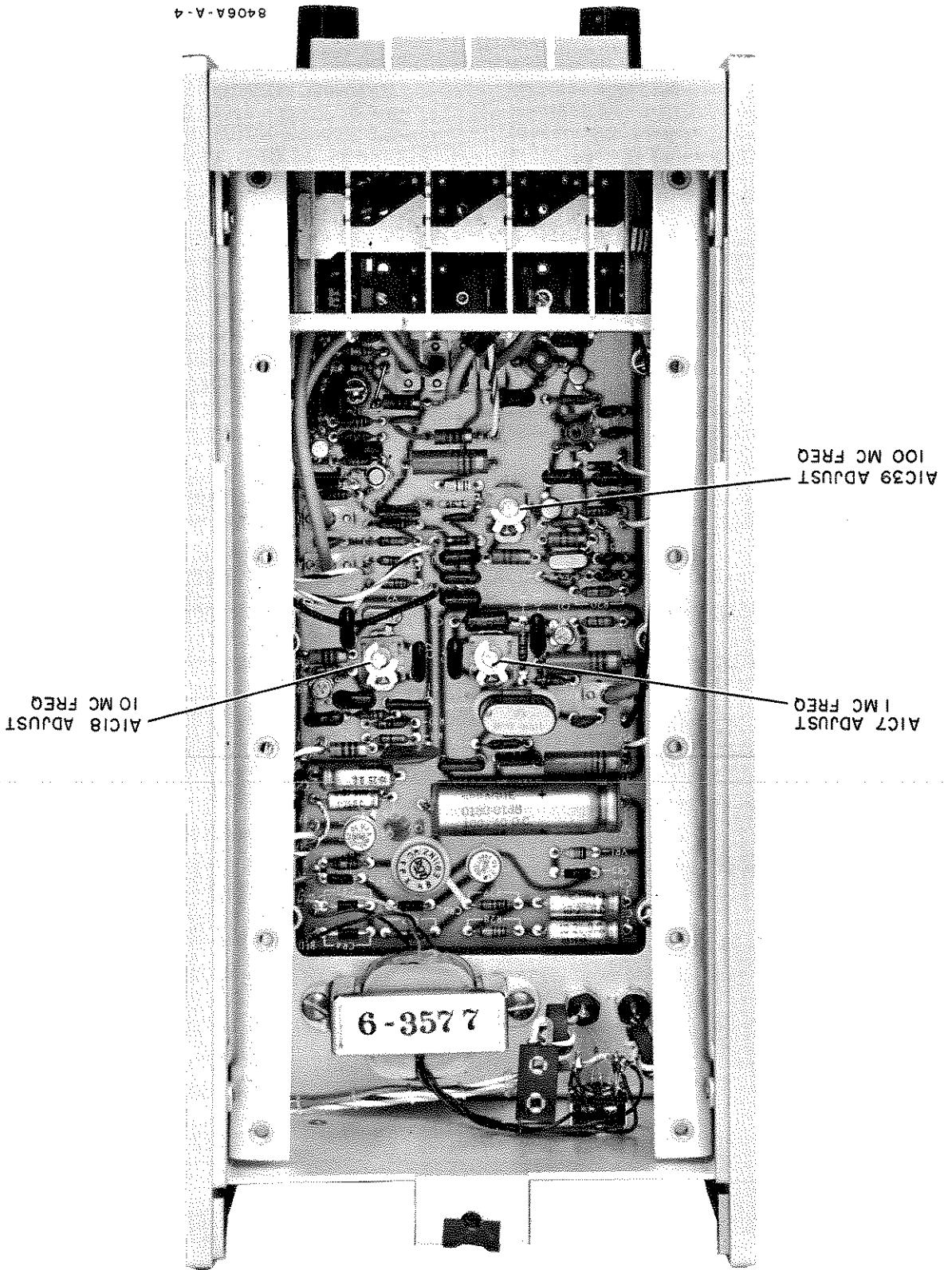
5-15. When troubleshooting transistor circuits certain precautions must be observed. Transistors can be damaged by small voltages or by heat. Be very careful not to short the circuit and thereby apply excessive voltage to the transistors. When using a VTVM measure emitter-to-base voltages to a common point, such as the chassis (there may be enough loop current between the leads of the VTVM to damage transistor). When measuring resistance use only the ranges on the ohmmeter which have 1.5 volts or less between the leads and whose short-circuit current is less than 3 mA. See Table 5-4 for the safe ranges of popular ohmmeters.

5-15. When troubleshooting transistor circuits certain precautions must be observed. Transistors can be damaged by small voltages or by heat. Be very careful not to short the circuit and thereby apply excessive voltage to the transistors. When using a VTVM measure emitter-to-base voltages to a common point, such as the chassis (there may be enough loop current between the leads of the VTVM to damage transistor).

When measuring resistance use only the ranges on the ohmmeter which have 1.5 volts or less between the leads and whose short-circuit current is less than 3 mA. See Table 5-4 for the safe ranges of popular ohmmeters.

Figure 5-2. Location Diagram

02293-1



Section V
Figure 5-2

Model 8406A

Table 5-3. Performance Check Test Card

Description	
Output	100 Mc
Level deviation ±	db
Frequency	Frequency
Level deviation ±	db
Interpolation frequency	Interpolation frequency
1 Mc	1 Mc
Modulation/External Trigger	
1-20 Mc Input	200 Kc
2 Mc	2 Mc
20 Mc	20 Mc
2-200 Mc Input	Input level
20 Mc	Input level
20 Mc	Input level
Trigger voltage	Trigger voltage
20 Mc	volts

5-16. IN-CIRCUIT TESTING. The most common causes of transistor failures are internal short- and open-circuits. In transistor circuit testing the most important consideration is the transistor base-emitter junction. Like the control grid of a vacuum tube, the base is the control point of the transistor. The emitter-base voltage should be a fraction of a volt, the polarity and exact value depending upon the material

Table 5-4. Safe Ohmmeter Ranges for Transistor Resistance Measurements

Ohmmeter	Safe Range(s)	Voltage	Current	Color		Lead
				Short	Polarity	
HP 412A	R x 1K	1.0V	1 ma	Red	+	
	R x 10K	1.0V	100 µa	Black	-	
HP 410C	R x 1K	1.3V	0.57 ma	Red	+	
	R x 10K	1.3V	57 µa	Black	-	
HP 410B	R x 100	1.1V	1.1 ma	Black	+	
	R x 100K	1.1V	1.1 µa	Red	-	
Simpson 260	R x 100	1.5V	1 ma	Red	+	
	R x 1K	1.5V	0.82 ma	Black	-	
Triplet 630	R x 100	1.5V	3.25 mA	Red	+	
	R x 1K	1.5V	325 µa	Black	-	
Triplet 310	R x 10	1.5V	750 µa	Red	+	
	R x 100	1.5V	75 µa	Black	-	

Section V
Paragraphs 5-16 to 5-18

of the transistor and the current carried. Short the emitter to the base. If the transistor is working, the voltage on the collector should go toward the supply voltage.

5-17. OUT-OF-CIRCUIT TESTING. While it is not recommended to remove the transistors from the instrument for troubleshooting as a general rule, sometimes it is impossible to isolate troubles to a particular transistor. In such case it may be necessary to remove the suspected transistor and test it on a curve tracer. Do NOT remove a transistor for testing without some indication that this particular transistor is at fault. Use a heat sink, such as a pair of long-nosed pliers, between the soldering iron and the transistor. When soldering a transistor back in the circuit use the same precautions as when unsoldering. If a particular transistor is all right but the circuit still does not work, try the transistor ahead and behind the suspected one. Table 5-5 gives typical resistance measurements of transistors.

5-18. PRINTED CIRCUIT COMPONENT REPLACE-MENT. Component lead holes in the Model 8406 circuit board have plated walls to ensure good electrical contact between conductors on the opposite sides of the board. To prevent damage to this plating and to the replacement component, apply heat sparingly and work carefully. The following replacement procedure is recommended:

- Remove defective component.
- Melt solder in component lead holes. Use clean, dry soldering iron to remove excess solder. Clean holes with toothpick or wooden splinter. Do not use metal tool for cleaning as this may damage through-hole plating.

Table 5-5. Output-of-Circuit Transistor Resistance Measurement

Transistor Type	Connect Ohmmeter		Resistance Measure (ohms)
	Pos. lead to	Neg. lead to	
PNP	Small emitter	base*	200-500
	Signal emitter	collector	10K-100K
Ger-manium	Power emitter	base*	30-50
	Power emitter	collector	several hundred
NPN	Small base	emitter	1K-3K
	Signal collector	emitter	very high (might read open)
Silicon	base	emitter	200-1000
	Power collector	emitter	high, often greater than 1M

*To test for transistor action, add collector-base short. Measured resistance should decrease.

c. Bend lead of replacement component to correct shape and insert component leads into lead holes. Using heat and solder sparingly, solder leads in place. Heat may be applied to either side of the board. Use heat sink (long-nose pliers, commercial heat-sink tweezers, etc.) when replacing transistors and diodes in order to prevent conduction of excessive heat from the soldering iron to the component. Firm application of heat for the shortest possible time is the rule.

d. Through-hole plating breaks are indicated by the separation from the board of the round conductor pad on either side of the board. To repair breaks, press conductor pads against board and solder replacement component lead to conductor pad on both sides of the board.

5-19. ADJUSTMENTS.

5-20. Rarely, if ever, will it be necessary to perform adjustments on a particular instrument. Do NOT perform these adjustments as a performance check. Use the performance check. Test limits given here should not be construed as part of the specifications.

5-21. POWER SUPPLY. Perform the following tests at either 115 or 230 volt 50-400 cps, unless otherwise noted. When line voltage variations are specified, the test limits apply at the following voltages:

115 VOLTS		230 VOLTS	
Low line	103 volts	207 volts	230 volts
Normal line	115 volts	230 volts	253 volts
High line	127 volts		

Proceed as follows:

a. Depress 10 MC COMB FREQUENCY pushbutton. Proceed as follows:

b. Set INTERPOLATION AMPLITUDE fully clockwise.

- c. Set OUTPUT AMPLITUDE fully clockwise.
 - d. Connect a dc and an ac voltmeter to the -14 volt third terminal from the rear (see Figure 5-2 for location).
 - e. Vary the line voltage from low to high while watching the meters. The dc voltage should stay in regulation within 0.5 Vdc and the ac voltage (ripple) should be below 3 millivolts.
- 5-22. OSCILLATOR FREQUENCIES. Connect the instrument as shown in Figure 5-1. The 2 Gc Notch Filter prevents overloading of 851/851 Spectrum Analyzer at the intermediate frequency, but may not be necessary with all Spectrum Analyzers. Set Generator controls as follows:

COMB FREQUENCY 100 MC
 INTERPOLATION AMPLITUDE OFF
 OUTPUT AMPLITUDE fully clockwise

a. Set Spectrum Analyzer to a center frequency of 1 Gc with spectrum width of 2 Gc. The frequency combination should be smooth in output. If not, tune A1T1 (see location diagram, Figure 5-2) with a Walco 2547 tuning wand for a stable frequency and A1T2 for maximum flat output in the 400-Mc region as the OUTPUT AMPLITUDE control is varied from maximum to minimum.

b. Connect counter and tune A1C39 (see location diagram, Figure 5-2) for 100-Mc frequency.

c. Depress 10 Mc pushbutton and use counter to measure frequency. Tune A1C18 with a General Cement 8271 plastic tuning wand to 10 Mc.

d. Depress 1 Mc pushbutton and use counter to measure frequency. Tune A1C7 to 1 Mc.

SECTION VI REPLACABLE PARTS

6-3. Miscellaneous parts not indexed in Table 6-1 are listed at the end of the table.

6-4. ORDERING INFORMATION.

- 6-5. To order a replacement part, address order or inquiry to your nearest Hewlett-Packard field office. Lists parts in alpha-numerical order of their hp stock numbers and provides the following information on each part:
- a. Model and complete serial number of instrument.
 - b. Hewlett-Packard stock number.
 - c. Circuit reference designation.
 - d. Description.
- 6-7. To order a part not listed in Table 6-1 and 6-2, give a complete description of the part and include its function and location.

6-1. INTRODUCTION.

- 6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alpha-numerical order of their reference designators and indicates the description and hp stock number of each part, together with any applicable notes. Table 6-2 lists parts in alpha-numerical order of their hp stock numbers and provides the following information on each part:
- a. Description of the part (see list of abbreviations below).
 - b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in Table 6-3.
 - c. Manufacturer's stock number.
 - d. Total quantity used in the instrument (TQ column).

REFERENCE DESIGNATORS

A	= assembly	F	= fuse	MP	= mechanical part
B	= motor	FL	= filter	P	= plug
BF	= battery	IC	= integrated circuit	Q	= transistor
C	= capacitor	J	= jack	R	= resistor
CP	= coupler	K	= relay	RT	= thermistor
CR	= diode	L	= inductor	S	= switch
DL	= delay line	LS	= loud speaker	T	= transformer
DS	= device signaling (lamp)	M	= meter	TP	= test point
E	= misc electronic part	MK	= microphone		

ABBREVIATIONS

A	= amperes	H	= henries	N/O	= normally open
AFC	= automatic frequency control	HDW	= hardware	NPO	= negative positive zero
AMP	= amplifier	HEX	= hexagonal		
BFO	= beat frequency oscillator	HG	= mercury	NPN	= negative-positive-negative
BE CU	= beryllium copper	HZ	= hertz		
BH	= binder head	HR	= hour(s)	NRF	= not recommended for
BP	= bandpass	IF	= intermediate freq	NRF	= not recommended for
BRS	= brass	IMP	= impedance	NSR	= not separately
BWO	= backward wave oscillator	INCD	= incandescent		
CW	= counter-clockwise	INCL	= include(s)	OBD	= order by description
CER	= ceramic	INS	= insulation		
CMO	= cabinet mount only	INT	= internal	OH	= oval head
COEF	= coefficient	K	= kilo = 1000	OX	= oxide
COMP	= composition	LH	= left hand	P	= peak
COMPL	= complete	LIN	= linear taper	PC	= printed circuit
CONN	= connector	LK WASH	= lock washer	PF	= picofarads = 10 ⁻¹²
CP	= cadmium plate	LOG	= logarithmic taper		
CRT	= cathode-ray tube	LPF	= low pass filter	PH BRZ	= phosphor bronze
CW	= clockwise			PHL	= Phillips
DEPC	= deposited carbon	M	= mill = 10 ⁻³	PIV	= peak inverse voltage
DR	= drive	MEG	= meg = 10 ⁶	PNP	= positive-negative-positive
ELECT	= electrolytic	MET FILM	= metal film	P/O	= part of
ENCAP	= encapsulated	MET OX	= metallic oxide	POLY	= polystyrene
EXT	= external	MFR	= manufacturer	POT	= potentiometer
F	= farads	MINAT	= miniature	PP	= peak-to-peak
FH	= flat head	MOM	= momentary	PT	= point
FIL H	= filament head	MTC	= mounting	PWV	= peak working voltage
FXD	= fixed	MY	= "mylar"	RECT	= rectifier
G	= giga (10 ⁹)	N	= nano (10 ⁻⁹)	RF	= radio frequency
GE	= germanium	N/C	= normally closed	RH	= right hand
GL	= glass	NI PL	= nickel plate		
GND	= grounded			W/O	= without

See list of abbreviations in introduction to this section

Reference Designation	Stock No.	Description #	Note
A1	08406-6001	BOARD ASSY., ETCHED CIRCUIT	
A1C1	0160-0174	C:FXD CER 0.47UF +80-20% 25VDCW	
A1C2	0160-0127	C:FXD CER 1UF 20% 25VDCW	
A1C3	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A1C4	0160-0194	C:FXD MY 0.015UF 10%	
A1C5	0150-0050	C:FXD CER 1000PF 600 VDCW	
A1C6	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A1C7	0121-0127	C:VAR AIR 1.7-14PF	
A1C8	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A1C9	0150-0093	C:FXD CER 0.01UF +80-20% 100VDCW	
A1C10	0140-0192	C:FXD MICA 68PF 5% 300VDCW	
A1C11	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A1C12	0140-0192	C:FXD MICA 68PF 5% 300VDCW	
A1C13	0150-0096	C:FXD CER 0.05UF 100VDCW	
A1C14	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A1C15	0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	
A1C16	0140-0232	C:FXD MICA 460PF 1% 300VDCW	
A1C17	0160-0178	C:FXD MICA 27PF 5% 300VDCW	
A1C18	0121-0127	C:VAR AIR 1.7-14PF	
A1C19	0140-0176	C:FXD MICA 100 PF 2% 300 VDCW	
A1C20	0150-0050	C:FXD CER 1000PF 600 VDCW	
A1C21	0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	
A1C22	0150-0093	C:FXD CER 0.01UF +80-20% 100VDCW	
A1C23	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A1C24	0160-0340	C:FXD MICA 600 PF 1% 300VDCW	
A1C25	0150-0050	C:FXD CER 1000PF 600 VDCW	
A1C26	0180-0119	C:FXD ELECT 1UF -10+100% 25VDCW	
A1C27	0150-0050	C:FXD CER 1000PF 600 VDCW	
A1C28	0140-0209	C:FXD MICA 5PF 10% 500VDCW	
A1C29	0160-2197	C:FXD MICA 5PF 10% 500VDCW	
A1C30	0150-0050	C:FXD CER 1000PF 600 VDCW	
A1C31	0150-0050	C:FXD CER 1000PF 600 VDCW	
A1C32	0140-0209	C:FXD MICA 5PF 10% 500VDCW	
A1C33	0140-0232	C:FXD MICA 460PF 1% 300VDCW	
A1C34	0150-0050	C:FXD CER 1000PF 600 VDCW	
A1C35	0180-0138	C:FXD ELECT 100UF -10+100% 40VDCW	
A1C36	0180-0059	C:FXD ELECT 10UF -10%+100% 25VDCW	
A1C37	0180-0059	C:FXD ELECT 10UF -10%+100% 25VDCW	
A1C38	0180-0059	C:FXD ELECT 10UF -10%+100% 25VDCW	
A1C39	0121-0127	C:VAR AIR 1.7-14PF	
A1C40	0150-0050	C:FXD CER 1000PF 600 VDCW	
A1C41	0160-2140	C:FXD CER 470 PF +80-20% 1000VDCW	
A1C42	1912-0007	DIODE:SILICON 30 MA AT 1V 30 PIV	
A1C43	1901-0026	DIODE:TUNNEL EIA TYPE 1N3714	
A1C44	1901-0026	DIODE:SILICON 200 PIV 0.5 AMP	
A1C45	1901-0025	DIODE:SILICON 200 PIV 0.5 AMP	
A1C46	1901-0025	DIODE:JUNCTION:5MA AT 1V 100 PIV	
A1C47	1901-0025	DIODE:JUNCTION:5MA AT 1V 100 PIV	
ALL1	9140-0131	COIL:FXD RF 10 MH	

Table 6-1. Reference Designation Index

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description #	Note
A1L2	9140-0131	COIL:FXD RF 10 MH	
A1L3	9140-0131	COIL:FXD RF 10 MH	
A1L4	9140-0181	COIL:FXD RF 22UH 5%	
A1L5	9140-0210	COIL:FXD RF 100 UH 5%	
A1L6	9140-0210	COIL:FXD RF 100 UH 5%	
A1L7	9140-0210	COIL:FXD RF 100 UH 5%	
A1L8	9140-0158	COIL:FXD 1.0UH 10%	
A1L9	9100-1612	COIL:FXD RF 0.33 UH 20%	
A1L10	9140-0210	COIL:FXD RF 100 UH 5%	
A1L11	9100-1613	COIL:FXD RF 0.47 UH 20%	
A1Q1	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A1Q2	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A1Q3	1850-0099	TRANSISTOR:GERMANIUM 2N964 PNP	
A1Q4	1854-0019	TRANSISTOR:SILICON NPN	
A1Q5	1854-0073	TRANSISTOR:SILICON NPN 2N3478	
A1Q6	1850-0062	TRANSISTOR:GERMANIUM PNP 2N404	
A1Q7	1854-0073	TRANSISTOR:SILICON NPN 2N3478	
A1Q8	1850-0062	TRANSISTOR:GERMANIUM PNP 2N404	
A1Q9	1850-0064	TRANSISTOR:GERMANIUM PNP 2N1183	
A1R1	0698-3156	R:F XD MET FLM 14.7K OHM 1% 1/8W	
A1R2	0757-0439	R:F XD MET FLM 6.81K OHM 1% 1/8W	
A1R3	0698-0082	R:F XD MET FLM 464 OHM 1% 1/8W	
A1R4	0698-3441	R:F XD MET FLM 215 OHM 1% 1/8W	
A1R5	0698-0083	R:F XD MET FLM 1960 OHM 1% 1/8W	
A1R6	0757-0465	R:F XD MET FLM 100K OHM 1% 1/8W	
A1R7	0698-0082	R:F XD MET FLM 464 OHM 1% 1/8W	
A1R8	0757-0280	R:F XD MET FLM 1.00K OHM 1% 1/8W	
A1R9	0698-3136	R:F XD MET FLM 17.8K OHM 1% 1/8W	
A1R10	0757-0439	R:F XD MET FLM 6.81K OHM 1% 1/8W	
A1R11	0698-0082	R:F XD MET FLM 464 OHM 1% 1/8W	
A1R12	0698-3441	R:F XD MET FLM 215 OHM 1% 1/8W	
A1R13	0698-0084	R:F XD MET FLM 2150 OHM 1% 1/8W	
A1R14	0698-0084	R:F XD MET FLM 2150 OHM 1% 1/8W	
A1R15	0757-0280	R:F XD MET FLM 1.00K OHM 1% 1/8W	
A1R16	0757-1094	R:F XD MET FLM 1.47K OHM 1% 1/8W	
A1R17	0757-0401	R:F XD MET FLM 100 OHM 1% 1/8W	
A1R18	0698-3441	R:F XD MET FLM 215 OHM 1% 1/8W	
A1R19	0757-0401	R:F XD MET FLM 100 OHM 1% 1/8W	
A1R20	0757-0441	R:F XD MET FLM 8.25K OHM 1% 1/8W	
A1R21	0698-3154	R:F XD MET FLM 4220 OHM 1% 1/8W	
A1R22	0757-0417	R:F XD MET FLM 562 OHM 1% 1/8W	
A1R23	0698-3440	R:F XD MET FLM 196 OHM 1% 1/8W	
A1R24	0698-3441	R:F XD MET FLM 215 OHM 1% 1/8W	
A1R25	0698-3430	R:F XD MET FLM 21.5 OHM 1% 1/8W	
A1R26	0698-3430	R:F XD MET FLM 21.5 OHM 1% 1/8W	
A1R27	0757-0346	R:F XD MET FLM 10.0 OHM 1% 1/8W	
A1R28	0698-0084	R:F XD MET FLM 2150 OHM 1% 1/8W	
A1R29	0698-0084	R:F XD MET FLM 2150 OHM 1% 1/8W	
A1R30	0757-0346	R:F XD MET FLM 10.0 OHM 1% 1/8W	
A1R31	0698-3445	R:F XD MET FLM 348 OHM 1% 1/8W	
A1R32	0757-0416	R:F XD MET FLM 511 OHM 1% 1/8W	
A1T1	08406-6013	TRANSFORMER:RF (OSCILLATOR)	

See list of abbreviations in introduction to this section

See list of abbreviations in introduction to this section

Reference Designation	Stock No.	Description #	Note
A1T2	08406-6014	TRANSFORMER:RF (AMPLIFIER)	
A1V1	1902-0055	DIODE BREAKDOWN: SILICON 14.7V 10%	
A1X1	1200-0028	SOCKET: CRYSTAL 2-CONTACT	
A1Y1	0410-0013	CRYSTAL UNIT: QUARTZ 100KC	
A1Y2	0410-0109	CRYSTAL: QUARTZ 10 MC	
A1Y3	0410-0108	CRYSTAL: QUARTZ 100 MC	
C1	0150-0097	C:FXD CER 6800 PF 1000 VDCW	
C2	0150-0019	C:FXD CER 1000PF 20%	
C3	0150-0019	C:FXD CER 1000PF 20%	
C4	0150-0097	C:FXD CER 6800 PF 1000 VDCW	
CR1	1901-0169	SEMICON DEVICE: DIODE	
CR1MP1	08406-6002	HOLDER ASSEMBLY, DIODE INCLUDES:	
	1250-0014	CONTACT: OUTER N MALE CONNECTOR	
	1250-0016	RING: LOCKING FOR TYPE N CONNECTOR	
	5020-0306	NUT: CONNECTOR	
	08406-2002	BODY, DIODE HOLDER	
	08406-2003	CENTER CONDUCTOR	
	08406-2005	SPACER	
	08551-2041	POST, DIODE	
CR1MP2	1460-0300	SPRING: COMPRESSION	
DS1	2140-0047	LAMP: GLOW 1/10W 0.8 MA 68K OHM	
F1	2110-0040	FUSE: CARTRIDGE 1/16 AMP SLOW BLOW	
J1	1250-0001	CONNECTOR: BNC	
J2	1250-0001	CONNECTOR: BNC	
J3	1251-0148	CONNECTOR: POWER 3 PIN MALE	
J4		NSR PART OF STEP DIODE ASSY.	
J5	08406-2004	CONNECTOR: PANEL	
L1	9170-0019	CORE: TOROID	
L2	9170-0019	CORE: TOROID	
P1		NSR PART OF ATTENUATOR ASSY	
R1	2100-0350	R:IVAR COMP 1.5K OHM 20% LIN 1/2W	
R2	0687-6831	R:FXD COMP 68K OHM 10% 1/2W	
R3	2100-0350	R:IVAR COMP 1500 OHM 20% LIN 1/2W	
S1	3101-0186	SWITCH: PUSHBUTTON (FREQUENCY)	
S2	3101-0033	SWITCH: SLIDE DPDT	
S3	3101-1248	SWITCH: PUSHBUTTON (LINE)	
S4		NSR PART OF R3	
T1	9100-1680	TRANSFORMER: POWER	
XF1	1400-0084	HOLDER: FUSE POST TYPE 3AG	
Z1	08406-6012	ATTENUATOR PAD ASSEMBLY INCLUDES:	
	1460-0297	SPRING: COMPRESSION	
	08491-6000	CARTRIDGE ASSEMBLY	
	08491-2101	CONNECTOR: FEMALE	
	08491-2102	SPACER (QTY 2)	

Table 6-1. Reference Designation Index (Cont'd)

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description #	Note
08742-0006		SPACER	
08491-2002		BEAD	
08491-4001		PIN, FEMALE	
08491-2009		CONTACT, SLIDING	
MISCELLANEOUS			
08406-0003		BRACKET, BOTTOM COVER	
08406-0004		BRACKET, RIGHT SUPPORT	
08406-0005		BRACKET, LEFT SUPPORT	
08406-0006		BRACKET, SWITCH	
08406-6004		CABLE ASSY., COAX(ORANGE)	
08406-6005		CABLE ASSY., COAX(RED)	
08406-6006		CABLE ASSY., COAX(BROWN)	
08406-6007		CABLE ASSY., COAX(BLACK)	
08406-6009		CABLE ASSY., COAX(YELLOW)	
08406-6010		CABLE ASSY., COAX(GREEN)	
08406-6011		CABLE ASSY., COAX(BLUE)	
8120-0078		CABLE ASSY:POWER	
5040-0235		BASE/LAMPHOLDER	
5040-0234		LAMPHOLDER	
0370-0118		KNOB/GRAY PUSHBUTTON 11/16 IN DIA	
		1MC	
		10MC	
		100MC	
		EXT TRIG	
5000-3227		LABEL:PUSHBUTTON (1 MC)	
5000-3228		LABEL:PUSHBUTTON(10 MC)	
5000-3229		LABEL:PUSHBUTTON(100 MC)	
5000-3248		LABEL:PUSHBUTTON(EXT. TRIG)	
08406-0001		SUPPORT, LEFT	
08406-0002		SUPPORT, RIGHT	
		KNOB:BLACK ROUND	
		OUTPUT AMPLITUDE	
		INTERPOLATION AMPLITUDE 1MC	

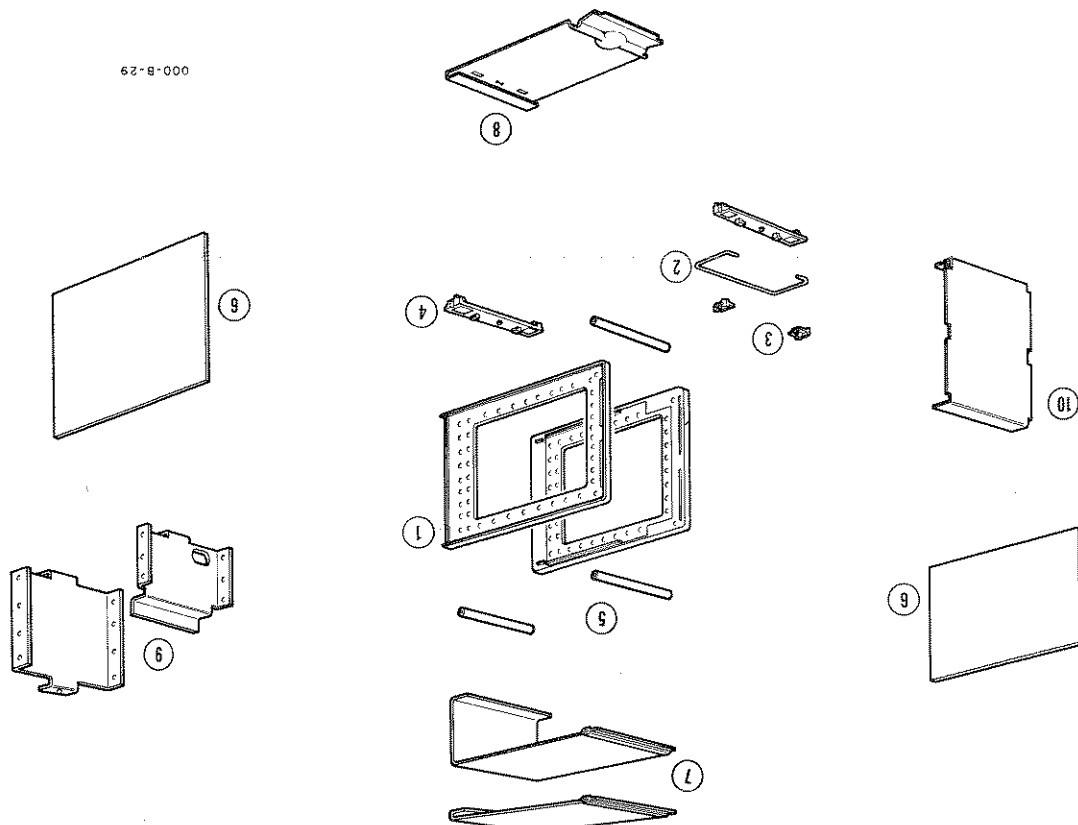
See list of abbreviations in introduction to this section

See list of abbreviations in introduction to this section

Reference Designation	Stock No.	Description #	Note
1	5060-0703	FRAME ASSEMBLY	
2	1490-0031	STAND: TILT	
3	5040-0700	HINGE	
4	5060-0727	FOOT ASSEMBLY	
5	5020-0700	SPACER	
6	5000-0703	COVER: SIDE	
7	5060-0709	COVER ASSEMBLY: TOP	
8	5000-0711	COVER ASSEMBLY: BOTTOM	
9	5000-0714	COVER ASSEMBLY: UNPERFORATED	
10	SEE MAT'L LIST	PANEL: REAR	
	SEE MAT'L LIST	PANEL: FRONT	

CABINET PARTS

MODULE
SIZE 29



000-B-29

Table 6-1. Reference Designation Index (Cont'd)

Table 6-2. Replaceable Parts (Cont'd)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
0121-0127	C:VAR AIR 1.7-14PF	28480	0121-0127	3
0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	04062	RDM15C220J5C	1
0140-0176	C:FXD MICA 100 PF 2% 300 VDCW	04062	RDM15F101G3C	1
0140-0192	C:FXD MICA 68PF 5% 300VDCW	04062	RDM15E680J3C	2
0140-0204	C:FXD MICA 47PF 5% NP0 500VDCW	04062	RDM15E470J5C	2
0140-0209	C:FXD MICA 5PF 10% 500VDCW	04062	RDM15C050D5C	2
0140-0232	C:FXD MICA 460PF 1% 300VDCW	04062	RDM15F461F3C	2
0150-0050	C:FXD CER 1000PF 20% 50VDCW	72982	327005X5U0102M	2
0150-0093	C:FXD CER 0.01UF +80-20% 100VDCW	91418	TA	2
0150-0096	C:FXD CER 0.05UF 100VDCW	91418	-TA	1
0150-0097	C:FXD CER 6800 PF 1000 VDCW	91418	B	2
0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	56289	5C50A	3
0160-0127	C:FXD CER 1UF 20% 25VDCW	56289	5C13	1
0160-0134	C:FXD MICA 220PF 5% 300VDCW	14655	RDM15F221J3C	1
0160-0174	C:FXD CER 0.47UF +80-20% 25VDCW	56289	5C11A	1
0160-0178	C:FXD MICA 27PF 5% 300VDCW	04062	RDM15E270J35	1
0160-0179	C:FXD MICA 33PF 5% 300VDCW	04062	RDM15E330J35	1
0160-0194	C:FXD MY 0.015UF 10%	28480	0160-0194	1
0160-0340	C:FXD MICA 600 PF 1% 300VDCW	04062	RDM15F601F3C	1
0160-2140	C:FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B	1
0160-2197	C:FXD MICA 10PF 5%	28480	0160-2197	3
0180-0059	C:FXD ELECT 10UF -10%+100% 25VDCW	56289	30D1066025B84	1
0180-0119	C:FXD ELECT 1UF -10%+100% 25VDCW	56289	30D1056025A44	1
0180-0138	C:FXD ELECT 100UF -10+100% 40VDCW	56289	036254	1
0370-0103	KNOB:BLACK ROUND	28480	0370-0103	2
0370-0118	KNOB:GRAY PUSHBUTTON 11/16" DIA	28480	0370-0118	4
0410-0013	CRYSTAL UNIT:QUARTZ 100KC	28480	0410-0013	1
0410-0108	CRYSTAL:QUARTZ 100 MC	28480	0410-0108	1
0410-0109	CRYSTAL:QUARTZ 10 MC	28480	0410-0109	1
0687-6831	R:FXD COMP 68K OHM 10% 1/2W	01121	EB-6831	3
0698-0082	R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082	1
0698-0083	R:FXD MET FLM 1960 OHM 1% 1/8W	28480	0698-0083	3
0698-0084	R:FXD MET FLM 2150 OHM 1% 1/8W	28480	0698-0084	4
0698-2136	R:FXD MET FLM 17.8KOHM 1% 1/8W	28480	0698-2136	1
0698-2154	R:FXD MET FLM 4220 OHM 1% 1/8W	28480	0698-2154	1
0698-2156	R:FXD MET FLM 14.7KOHM 1% 1/8W	28480	0698-2156	1
0698-2430	R:FXD MET FLM 21.5 OHM 1% 1/8W	28480	0698-2430	1
0698-2470	R:FXD MET FLM 196 OHM 1% 1/8W	28480	0698-2470	2
0698-3441	R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441	4
0698-3445	R:FXD MET FLM 348 OHM 1% 1/8W	28480	0698-3445	4
0698-3455	R:FXD MET FLM 1.0KOHM 1% 1/8W	28480	0698-3455	2
0757-0280	R:FXD MET FLM 1.0KOHM 1% 1/8W	28480	0757-0280	2
0757-0246	R:FXD MET FLM 10.0 OHM 1% 1/8W	28480	0757-0246	2
0757-0401	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401	2
0757-0416	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416	2
0757-0417	R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417	1
0757-0439	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439	1
0757-0441	R:FXD MET FLM 8.25KOHM 1% 1/8W	28480	0757-0441	1
0757-1094	R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094	1
1200-0028	SOCKET:CRYSTAL 2-CONTACT	91662	430 BC	1
1250-0014	CONTACT:OUTER N MALE CONNECTOR	28480	1250-0014	1
1250-0016	RING:LOCKING FOR TYPE N CONNECTOR	28480	1250-0016	1
1250-0083	CONNECTOR:BNB	28480	1250-0083	2
1251-0148	CONNECTOR:POWER 3 PIN MALE	60427	H-1061-2	1
1400-0084	HOLDER:FUSE POST TYPE 3AG	75915	342014	1

See list of abbreviations in introduction to this section

See list of abbreviations in introduction to this section

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
1460-0297	SPRING:COMPRESSION	28480	1460-0297	2
1490-0031	STAND:TILT	28480	1490-0031	1
1850-0062	TRANSISTOR:GERMANIUM PNP 2N404	28480	1850-0062	2
1850-0064	TRANSISTOR:GERMANIUM PNP 2N1183	28480	2N1183	1
1850-0099	TRANSISTOR:GERMANIUM 2N964 PNP	28480	2N964	1
1854-0005	TRANSISTOR:2N708 NPN SILICON	07263	2N708	2
1854-0019	TRANSISTOR:SILICON NPN	28480	1854-0019	1
1854-0075	TRANSISTOR:SILICON NPN 2N3478	93332	2N3478	2
1901-0025	DIODE:JUNCTION:5MA AT 1V 100 PIV	28480	1901-0025	2
1901-0026	DIODE:SILICON 200 PIV 0.5 AMP	28480	1901-0026	2
1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	28480	1901-0040	1
1901-0169	SEMICON DEVICE:DIODE	28480	1901-0169	1
1902-0055	DIODE BREAKDOWN:SILICON 14.7V 10%	28480	1902-0055	1
1912-0007	DIODE:TUNNEL EIA TYPE 1N3714	03508	1N3714 SPEC	1
2100-0350	RIVAR COMP 1500 OHM 20% LIN 1/2W	28480	2100-0350	1
2100-1624	RIVAR COMP 2.5K OHM 20% LIN 1/2W	28480	2100-1624	1
2110-0040	FUSE:CARTRIDGE 1/16 AMP SLOW BLOW	75915	313.062	1
2140-0047	LAMP:GLOW 1/10W 0.8 MA 68K OHM	24455	A1C	1
3101-0033	SWITCH:SLIDE DPDT	42190	4633	1
3101-0186	SWITCH:PUSHBUTTON(FREQUENCY)	28480	3101-0186	1
5000-0011	CLIP:ELECTRICAL RETAINING	28480	5000-0011	1
5000-3227	LABEL:PUSHBUTTON (1 MC)	28480	5000-3227	1
5000-3228	LABEL:PUSHBUTTON(10 MC)	28480	5000-3228	1
5000-3229	LABEL:PUSHBUTTON(100 MC)	28480	5000-3229	1
5000-3248	LABEL:PUSHBUTTON(EXT. TRIG)	28480	5000-3248	1
5020-0306	NUT:CONNECTOR	28480	5020-0306	1
5040-0234	LAMPHOLDER(FOR 4 LAMPS)	28480	5040-0234	1
5040-0235	BASE:LAMPHOLDER	28480	5040-0235	1
5040-0700	HINGE	28480	5040-0700	1
5060-0703	COVER:6 X 11 SIDE	28480	5060-0703	1
5060-0709	COVER ASSY:TOP 5 X 11 SM	28480	5060-0709	1
8120-0078	CABLE ASSY:POWER	70903	KH-4147	1
9100-1612	COIL:FWD RF 0.33 UH 20%	28480	9100-1612	1
9100-1678	TRANSFORMER:OSCILLATOR	28480	9100-1678	1
9100-1679	TRANSFORMER:RF AMPL	28480	9100-1679	1
9100-1613	COIL:FWD RF 0.47 UH 20%	28480	9100-1613	1
9100-1680	TRANSFORMER:POWER	28480	9100-1680	1
9140-0131	COIL:FWD RF TO MH	28480	9140-0131	1
9140-0158	COIL:FWD 1.0UH 10%	28480	9140-0158	1
9140-0181	COIL:FWD RF 22UH 5%	75226	12201M	1
9140-0210	COIL:FWD RF 100 UH 5%	28480	9140-0210	4
9170-0019	CORE:TOROID	72656	CF104 Q-1	2
08406-0001	SUPPORT: LEFT	28480	08406-0001	1
08406-0002	SUPPORT: RIGHT	28480	08406-0002	1
08406-0003	BRACKET: BOTTOM COVER	28480	08406-0003	1
08406-0004	BRACKET: RIGHT SUPPORT	28480	08406-0004	1
08406-0005	BRACKET: LEFT SUPPORT	28480	08406-0005	1
08406-0006	BRACKET: SWITCH	28480	08406-0006	1
08406-0007	COVER: TOP	28480	08406-0007	1
08406-0008	COVER: BOTTOM	28480	08406-0008	1
08406-0009	PANEL: REAR	28480	08406-0009	1

Table 6-2. Replaceable Parts (Cont'd)

Table 6-2. Replaceable Parts (Cont'd)

Stock No.	Description #	Mtr.	Mtr. Part No.	TQ
08406-0010	PANEL: FRONT	28480	08406-0010	1
08406-0011	CHASSIS	28480	08406-0011	1
08406-2002	BODY: DIODE HOLDER	28480	08406-2002	1
08406-2003	CENTER CONDUCTOR	28480	08406-2003	1
08406-2004	CONNECTOR: PANEL	28480	08406-2004	1
08406-2104	CONNECTOR: PANEL	28480	08406-2104	1
08406-6001	BOARD ASSY.: ETCHED CIRCUIT	28480	08406-6001	1
08406-6002	HOLDER ASSEMBLY: DIODE	28480	08406-6002	1
08406-6004	CABLE ASSY.: COAX (ORANGE)	28480	08406-6004	1
08406-6005	CABLE ASSY.: COAX (RED)	28480	08406-6005	1
08406-6006	CABLE ASSY.: COAX (BROWN)	28480	08406-6006	1
08406-6007	CABLE ASSY.: COAX (BLACK)	28480	08406-6007	1
08406-6009	CABLE ASSY.: COAX (YELLOW)	28480	08406-6009	1
08406-6010	CABLE ASSY.: COAX (GREEN)	28480	08406-6010	1
08406-6011	CABLE ASSY.: COAX (BLUE)	28480	08406-6011	1
08406-6012	ATTENUATOR PAD ASSEMBLY	28480	08406-6012	1
08491-2101	CONNECTOR: FEMALE	28480	08491-2101	1
08491-2002	BEAD	28480	08491-2002	2
08491-2004	PIN: FEMALE	28480	08491-2004	2
08491-2005	CONTACT: SLIDING	28480	08491-2005	2
08491-6000	CARTRIDGE ASSEMBLY	28480	08491-6000	1
08551-2041	POST: DIODE	28480	08551-2041	1
08742-0006	SPACER	28480	08742-0006	1
5000-0703	COVER: SIDE 6X11 SM	28480	5000-0703	2
5000-0711	COVER: BOTTOM 5X11 SM	28480	5000-0711	1
5060-0727	FOOT ASSY.: 1/3 MOD	28480	5060-0727	1

See list of abbreviations in introduction to this section

TABLE 6-3. CODE LIST OF MANUFACTURERS

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

Table with 4 columns: Code No., Manufacturer, Address, and Code No. Manufacturer, Address. It lists various electronic components and manufacturers such as Aiken Products Co., Allen Bradley Co., and many others.

SECTION VII SCHEMATIC DIAGRAMS

7-1. INTRODUCTION.

7-2. This section contains schematic diagrams. Figure 7-1 lists notes and symbols which apply to all schematic diagrams. Each diagram follows the guide lines listed below.

a. Schematics in this manual are meant to show electrical circuit operation and not intended as wiring diagrams.

b. Assembly sections of schematics may or may not be shaded as in the example shown.

7-3. REPLACEMENT INFORMATION.

7-4. For repair and replacement information, refer to the MAINTENANCE section of this manual which is Section V. For specific component descriptions and/or ordering information refer to page 6-1.

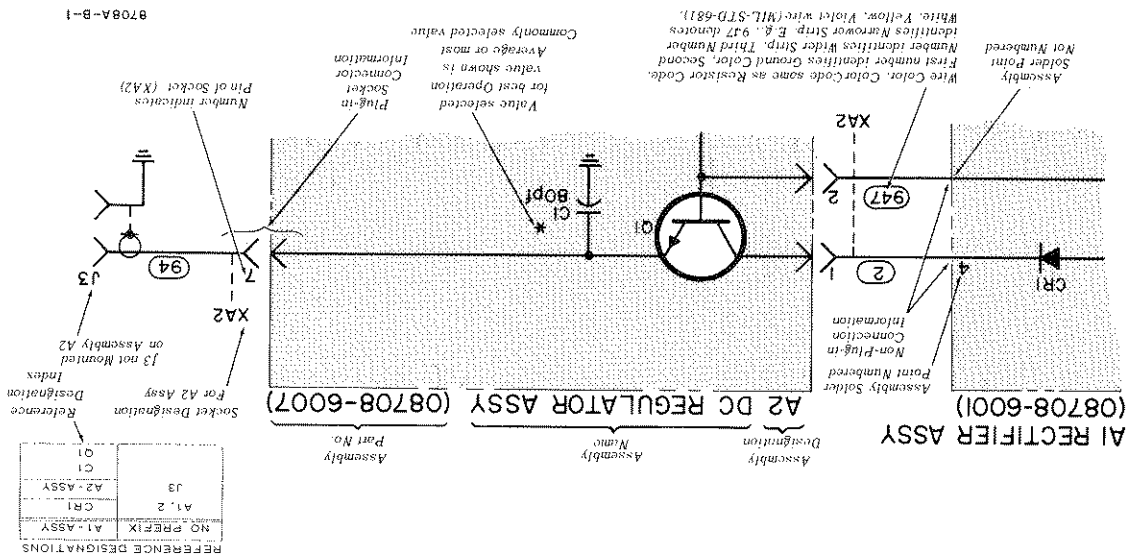


Figure 7-1. Schematic Information Illustration

MANUAL CHANGES

MANUAL IDENTIFICATION
 Model Number: 8406A
 Date Printed: JUNE 1967
 Part Number: 08406-90001

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:

Make all ERRATA corrections

Make all appropriate serial number related changes indicated in the tables below.

Serial Prefix or Number	Serial Prefix or Number	Serial Prefix or Number	Serial Prefix or Number
737-00386 thru 737-00555	1, 2	1441A01266 thru 1441A01275	3, 4, 5, 6, 7
737-00556 thru 737-00585	1, 2, 3	1441A01276 thru 1441A Prefix	3, 4, 5, 6, 7, 8
737-00586 thru 737-00675	2, 3, 4	1628A, 1632A	3, 4, 5, 6, 7, 8, 9
961-, 0961A	3, 4, 5	1711A	3, 4, 5, 6, 7, 8, 9, 10
1145A	3, 4, 5, 6	1915A	3 - 11

NEW ITEM

ERRATA

Inside front cover:

Insert new information regarding SAFETY, CERTIFICATION, and WARRANTY AND ASSISTANCE immediately inside front cover of manual (new information sheet supplied in this Manual Changes Supplement).

Page 1-1, General Information:

Add the following information preceding Paragraph 1-1:

1-A. SAFETY CONSIDERATIONS

Operation

General BEFORE APPLYING POWER, make sure the instrument's ac input is set for the available ac line voltage, that the correct fuse is installed, and that all normal safety precautions have been taken.

This instrument has been designed and tested according to IEC Publication 348, "Safety Requirements for Electronic Measuring Apparatus," and has been supplied in safe condition. This is a Safety Class I instrument.

Although the instrument has been designed in

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

ERRATA (Cont'd)

accordance with international safety standards, the information, cautions, and warnings in this manual must be followed to ensure safe operation and to keep the instrument safe. Service and adjustments should be performed only by qualified service personnel.

Adjustment or repair of the opened instrument with the ac power connected should be avoided as much as possible and, when inevitable, should be performed only by a skilled person who knows the hazard involved.

Capacitors inside the instrument may still be charged even though the instrument has been disconnected from its source of supply.

Make sure only fuses of the required current rating and type (normal blow, time delay, etc.) are used for replacement. Do not use repaired fuses or short circuit the fuse holders.

Whenever it is likely that the protection has been impaired, make the instrument inoperative and secure it against any unintended operation.

WARNING

If this instrument is to be energized through an autotransformer (for voltage reduction), make sure the common terminal is connected to the earthed pole of the power source.

BEFORE SWITCHING ON THE INSTRUMENT, the protective earth terminals of the instrument must be connected to the protective conductor of the mains power cord. The mains plug shall only be inserted in a socket outlet provided with protective earth contact. The protection must not be

negated by using an extension cord (power cable) without a protective grounding conductor.

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal is likely to make this instrument dangerous. Intentional interruption of the earth ground is prohibited.

Servicing this instrument often requires that you work with the instrument's protective covers removed and with ac power connected. Be very careful; the energy at many points in the instrument may, if contacted, cause personal injury.

With the ac power cable connected, the ac line voltage is present at the terminals of the power line module and at the LINE power switch. Be very careful. Bodily contact with this voltage can be fatal.

CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure instrument's ac input is set to the voltage of the ac power source.

BEFORE SWITCHING ON THIS INSTRUMENT, make sure that all devices connected to the instrument are connected to the protective earth ground.

make sure the line power (mains) plug is connected to a three-conductor line power outlet that has a protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient.

BEFORE SWITCHING ON THIS INSTRUMENT, make sure the ac line fuse is of the required current rating and type (normal-blow, time-delay, etc.).

SAFETY

This instrument has been designed and tested according to IEC Publication 348, "Safety Requirements for Electronic Measuring apparatus," and has been supplied in safe condition. This is a Safety Class I instrument. To ensure safe operation and to keep the instrument safe, the information, cautions, and warnings in this manual must be heeded. Refer to Section I for general safety considerations applicable to this instrument.

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facilities, or to the calibration facilities of other International Standards Organization members.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery. Hewlett-Packard will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

ERRATA (Cont'd)

Page 5-3, Table 5-2, step e:
Change 10-MC to read 1 MC.

Page 6-3, Table 6-1:
Change to read:
A1T1 08406-6013 Transformer: RF (Oscillator)

Page 6-4, Table 6-1:
Change to read:

- ▶ A1T2 08406-6014 Transformer: RF (Amplifier)
- ▶ C2 Refer to Change 11 for PREFERRED REPLACEMENT
- ▶ C3 Refer to Change 11 for PREFERRED REPLACEMENT
- ▶ CRI 1901-0169 SEMICON DEVICE: DIODE
- ▶ CRIMP1 08406-6002 HOLDER ASSEMBLY, DIODE; INCLUDES:

08551-2041 POST, DIODE
 1250-0014 CONTACT: OUTER N MALE CONNECTOR
 1250-0016 RING: LOCKING FOR TYPE N CONNECTOR
 5020-0306 NUT: CONNECTOR
 08406-2002 BODY: DIODE HOLDER
 08406-2003 CENTER CONDUCTOR
 Add to Z1 Attenuator Pad Assy: Spacer 2 ea 08491-2102

Page 6-4, Table 6-1 and Page 6-7, Table 6-2:
Change J1, J2 to read: 1250-0001 Connector: BNC

Page 6-4, Table 6-1; Page 6-7, Table 6-2; Page 7-3/7-4, Figure 7-2:
Change R1 to read: 2100-0350 R: VAR COMP 1.5K OHM 20% L1N 1/2W

Page 6-9, Table 6-2:
Add: 08406-6013 Transformer: RF (Oscillator)

08406-6014 Transformer: RF (Amplifier)
08491-2102 Spacer: Attenuator Pad Assy

Page 7-3, Figure 7-2:
Change (906) at wiper of R3 (top part of schematic) to (904)

Page 7-5, Figure 7-3:
Change (908) to (918) at line input.
Change (908) to (918) at line input.

CHANGE 1

Page 6-2, Table 6-1; Page 6-7, Table 6-2; Page 7-3/7-4, Figure 7-2:
Change A1C17 to C: FXD MICA 33 pF 300 V 5% 0160-0179

CHANGE 2

Page 6-4, Table 6-1; Page 6-8, Table 6-2; Page 7-3/7-4, Figure 7-2:
Change R1 to R: VAR COMP 1500 OHM 20% L1N 1/2W 2100-0350

CHANGE 3

Page 6-3, Table 6-1; Page 7-5/7-6, Figure 7-3:
Change to read: A1Q8 1850-0040 Transistor: Germanium PNP

A1Q9 1853-0051 Transistor: Silicon 2N4037
A1R30 0683-0395 R: FXD COMP 3.9 OHM 5% 1/4W

Page 6-4, Table 6-1:

Change to read:
A1VR1 1902-3203 DIODE BREAKDOWN: SILICON 14.7V 5% 400 mW
Add:
A1MP1 1205-0011 HEAT DISSIPATOR: TO-5/9 CASE USED ON A1Q9

CHANGE 4

Page 6-2, Table 6-1; Page 7-3/7-4, Figure 7-2:
 Change to read: A1C7 0121-0166 C:VAR AIR, 2.4 TO 24.5 PF
 A1C17 0160-2263 C:FXD CER, 18 PF 5% 500 VDCW
 A1C18 0121-0166 C:VAR, AIR 2.4 TO 24.5 PF

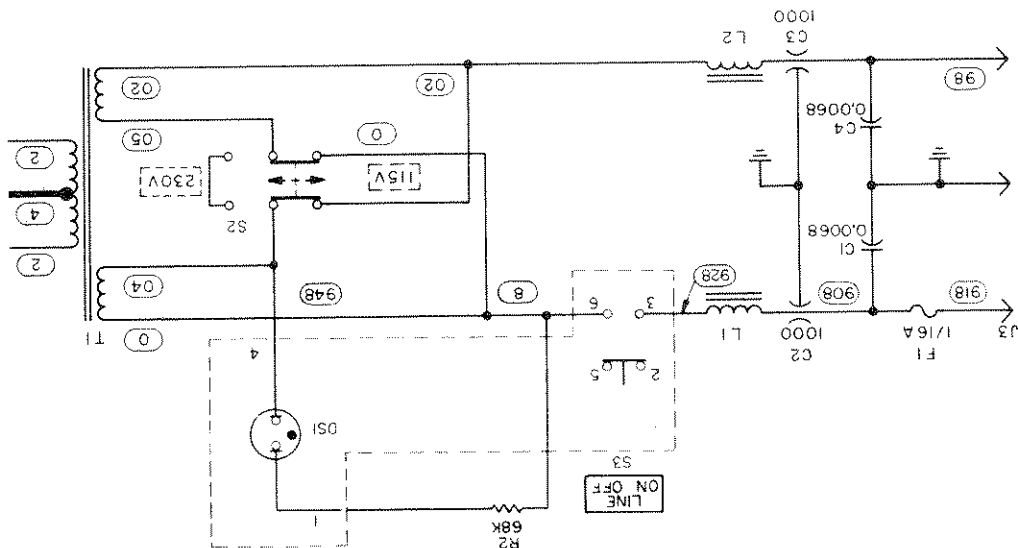
CHANGE 5

Page 6-4, Table 6-1:
 Change to read: DS1 2140-0244 LAMP: GLOW 1.0 mA TYPE A1H P/O S3
 F1 2110-0311 FUSE: CARTRIDGE 1/16 AMP TYPE MDL-1/16
 J3 1251-2357 CONNECTOR: POWER 3 PIN MALE
 R1 2100-0067 R:VAR COMP 2.5K OHM 20% LIN 1/2W
 S2 3101-1234 SWITCH: SLIDE DPDT 115/230V
 S3 3101-1248 SWITCH: PUSHBUTTON (LINE)

Page 6-5, Table 6-1:
 Change 8120-0078 to read: 8120-1348 CABLE ASSY: POWER
 Delete: 5040-0234 LAMPHOLDER
 5040-0235 BASE: LAMPHOLDER

Page 6-6, Table 6-1:
 Change to read: 9 08406-0015 PANEL: REAR
 10 08406-00016 PANEL: FRONT

Page 7-5/7-6, Figure 7-3:
 Change schematic as indicated below:



P/O Figure 7-3, (Change 5)

Page 1-1, Table 1-1:
Change "Peak amplitude*" to "Typical amplitude*";

CHANGE 9

Page 6-2, Table 6-1:
Change A1C6 to 0160-2306, C:FXD CER 27 pF 5% 300 V, Factory Selected Part.
Change A1C17 to 0140-0145, C:FXD MICA 22 pF 5% 500 VDCW, Factory Selected Part.
Page 7-3, Figure 7-2:
Change the value of A1C6 to A1C6 * 27 pF.
Change the value of A1C17* to 22 pF.

CHANGE 8

Page 6-4, Table 6-1:
Change R1 to 2100-2769, R:VAR 2.5K OHM 20% 2W.

CHANGE 7

10	08406-00017	PANEL:FRONT (MINT GRAY)
9	08406-00015	PANEL:REAR
8	5000-8571	COVER ASSEMBLY:BOTTOM (OLIVE GRAY)
7	5060-8555	COVER ASSEMBLY:TOP (OLIVE GRAY)
6	5000-8565	COVER:SIDE (OLIVE GRAY)

Page 6-6, Table 6-1 Cabinet Parts:
Change items 6 through 10 to read:

Page 6-5, Table 6-1:
Add: 0370-1400 KNOB, MINT GRAY PUSHBUTTON 11/16 IN DIA IMC, 10MC, 100MC EXT TRIG.

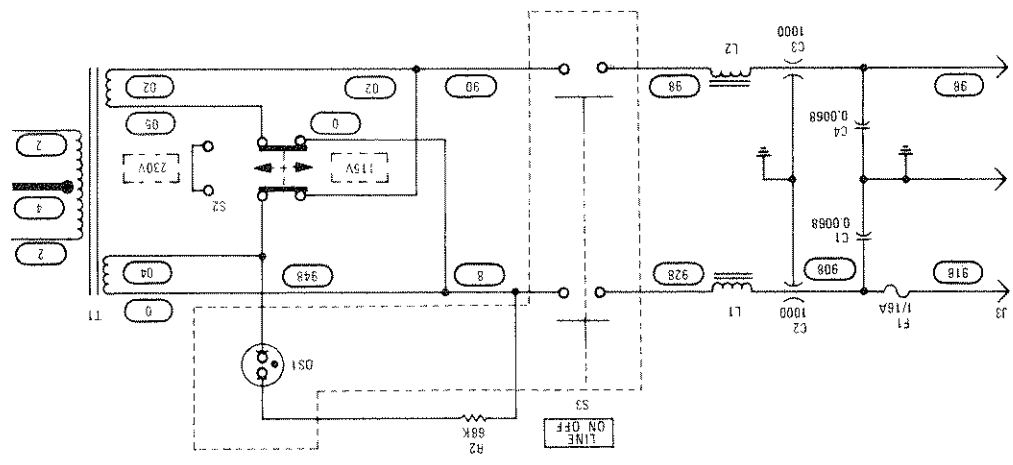
Page 6-2, Table 6-1 and Page 7-3/7-4, Figure 7-2:
Change A1C17 to C:FXD MICA 60 pF 300 V 5% 0140-0214 (*) Factory Selected Component.

CHANGE 6

Page 6-4, Table 6-1: Change C2 and C3 to 0160-3484 C:F XD 1000PF 20% 2100 VDCW (PREFERRED REPLACEMENT; REQUIRES NEW BOTTOM COVER BRACKET).
 Page 6-5, Table 6-1: Change 08406-0003 to 08406-00018; BRACKET, BOTTOM COVER.

CHANGE 11

P/O Figure 7-3. (Change 10)



Page 7-5, Figure 7-3: Change schematic as indicated below:

Change XF1 to 2110-0470 BODY: FUSEHOLDER
 Add the following parts under XF1:
 2110-0465, CAP: FUSEHOLDER
 2110-0467, NUT: HEX
 1400-0090, WASHER: FLAT NEOPRENE

For instruments with serial prefix 1632A or below, HP Part Number for replacement of line switch S3 is 3101-1248.

NOTE

Page 6-4, Table 6-1: Change S3 to 3101-1957, SWITCH: PUSHBUTTON DPST (LINE).

CHANGE 10

APPENDIX I

BACKDATING INFORMATION

This manual applies to instruments with Serial Prefixes 649-, and 737-. Listed below are changes to be made to the manual so that it will apply directly to Prefixes 532-, and 541-.

Instrument Serial No. Prefix		Change Number
541-		1
532-		1 and 2

CHANGE 1:

Table 6-1 Page	Table 6-2 Page	Schematic Page	Delete, Change, or add	Circuit Ref.	Stk No.	Item Description
6-2	6-7	7-3/7-4	Change	A1C7	0121-0031	C: Var 1.85-10.38 pF
"	"	"	"	A1C18	"	"
"	"	"	"	A1C39	"	"

CHANGE 2:

6-7	6-7	7-3/7-4	Change	A1C29	0160-0370	20 pF 5%
6-3		"	"	A1L11	9100-1612	0.33 μ H
"		"	"	A1Q5	1854-0031	2N2865
"		"	"	A1Q7	1854-0031	2N2865
"		"	"	A1R20	0698-3156	14.7 K Ω
"		"	"	A1R21	0698-3155	4640 Ω
"		"	"	A1R22	0698-0084	2150 Ω
6-2		"	Delete	A1C41	-	-
6-3		"	"	A1R31	-	-
"		"	"	A1R32	-	-

ANGOLA

Electra
Empresa Técnica de Equipamentos Eléctricos, S.A.R.L.
R. Barbosa Rodrigues, 41-1ª DT.*
Caixa Postal. 6487
Tel: 35515/6

LUANDA

Hewlett-Packard Argentina S.A.
Santa Fe 2035, Marfinez
6140 Buenos Aires
Tel: 792-1239, 798-6086
Telex: 122443 AR OGY

Biotron S.A.C.I.y.M.
Avda. Paseo Colon 221
9 piso
1399 Buenos Aires
Tel: 30-4846/185/18384
34-9356/0460/4551
Telex: (33) 17595 BID AR

AUSTRALIA

AUSTRALIA CAPITAL TERR.
Hewlett-Packard Australia Pty. Ltd.
121 Wollongong Street
Fyshwick, 2609
Tel: 804244
Telex: 62650

NEW SOUTH WALES

Hewlett-Packard Australia Pty. Ltd.
31 Bridge Street
Pymble, 2073
Tel: 4496566
Telex: 21561

QUEENSLAND

Hewlett-Packard Australia Pty. Ltd.
5th Floor
Teachers Union Building
495-499 Boundary Street
Spring Hill, 4090
Tel: 2291544

SOUTH AUSTRALIA

Hewlett-Packard Australia Pty. Ltd.
153 Greenhill Road
Parkside, 5063
Tel: 2725911
Telex: 82536

VICTORIA

Hewlett-Packard Australia Pty. Ltd.
31-41 Joseph Street
Blackburn, 3130
Tel: 89-6351
Telex: 31024 MELB

WESTERN AUSTRALIA

Hewlett-Packard Australia Pty. Ltd.
141 Stirling Highway
Nedlands, 6009
Tel: 3865455
Telex: 93859

AUSTRIA

Hewlett-Packard Ges.m.b.H.
Wehlstrasse 29
P.O. Box 7
A-1205 Vienna
Tel: 35-16-21-0
Telex: 13582/135066

BAHRAIN

Medical Only
Wael Pharmacy
P.O. Box 648
Bahrain
Tel: 54886, 56123
Telex: 8550 WAEI GJ

Al Hamdiya Trading and Contracting
P.O. Box 20074
Tel: 259978, 259958
Telex: 8895 KALDIA GJ

BANGLADESH

The General Electric Co. of Bangladesh Ltd.
Magnet House 72
Dikusha Commercial Area
Motijheel, Dacca 2
Tel: 252415, 252419
Telex: 734

BELGIUM

Hewlett-Packard Benelux S.A./N.V.
Avenue du Col-Vert, 1,
(Grootkraaglaan)
B-1170 Brussels
Tel: (02) 660 50 50
Telex: 23-494 patoben br

BRAZIL

Hewlett-Packard do Brasil I.e.C. Ltda.
Alameda Rio Negro, 750
Alphaville
06400 Barueri SP
Tel: 429-3222

ARGENTINA

Hewlett-Packard do Brasil I.e.C. Ltda.
Rua Padre Chagas, 32
90000-Pôrto Alegre-RS
Tel: 22-2968, 22-5621

CANADA

ALBERTA
Hewlett-Packard (Canada) Ltd.
11620A - 168th Street
Edmonton T5M 3T9
Tel: (403) 452-3670
TWX: 610-831-2431

BRITISH COLUMBIA

Hewlett-Packard (Canada) Ltd.
10691 Sheilbridge Way
Richmond V6X 2W7
Tel: (604) 270-2277
TWX: 610-925-5059

MANITOBA

Hewlett-Packard (Canada) Ltd.
380-550 Century St.
St. James,
Winnipeg R3H 0Y1
Tel: (204) 786-6701
TWX: 610-671-3531

NOVA SCOTIA

Hewlett-Packard (Canada) Ltd.
P.O. Box 931
800 Windmill Road
Dartmouth B3B 1L1
Tel: (902) 469-7820
TWX: 610-271-4482

ONTARIO

Hewlett-Packard (Canada) Ltd.
3020 Morrison Dr.
Ottawa K2H 8K7
Tel: (613) 820-6483
TWX: 610-563-1636

Hewlett-Packard (Canada) Ltd.

6877 Goreway Drive
Mississauga L4V 1M8
Tel: (416) 678-9430
TWX: 610-492-4246

Hewlett-Packard (Canada) Ltd.

552 Newbold Street
London N6E 2S5
Tel: (519) 686-9181
TWX: 610-352-1201

QUEBEC

Hewlett-Packard (Canada) Ltd.
275 Hymus Blvd.
Pointe Claire H9R 1G7
Tel: (514) 697-4232
TWX: 610-422-3022

FOR CANADIAN AREAS NOT LISTED:

Contact Hewlett-Packard (Canada) Ltd. in Mississauga.
CHILE
Jorge Calcagni y Cia. Ltda.
Arturo Burtie 065
Casilla 16475
Correo 9, Santiago
Tel: 220222
Telex: JCALCAGNI

COLOMBIA

Instrumentación
Henrik A. Langebaek & Kier S.A.
Carrera 7 No. 48-75
Apartado Aéreo 6287
Bogotá, 1 D.E.
Tel: 289-8877
Telex: 44400

FRANCE

Hewlett-Packard France
Zone d'activités de Courtabouef
Avenue des Tropiques
Boite Postale 6
91401 Orsay-Cédex
Tel: (1) 907 78 25
Telex: 600048F

Hewlett-Packard France

Chemin des Moulles
B.P. 162
69130 Ecully
Tel: (78) 33 81 25
TWX: 310617F

CYPRUS

Kypricos
19 Gregorios Xenopoulos
Street
P.O. Box 1152
Nicosia
Tel: 45628/29
Telex: 3018

CZECHOSLOVAKIA

Hewlett-Packard France
Obchodni zastupitelství v CSSR
Psemny styk
Post. schránka 27
CS 118 01 Praha 011
CSSR
Vývojeva a Provozní Zakladna
Vyzkumných Ústavů v
Bechovicích
CSSR-25097 Bechovice u
Prahy
Tel: 89 93 41
Telex: 12133

institute of Medical Bionics

Vyskumny Ústav Lekarskej
Bioniky
Jedlova 6
CS-88346 Bratislava-
Kramare
Tel: 44-551
Telex: 93229

DENMARK

Hewlett-Packard A/S
Datavej 52
DK-3460 Birkerød
Tel: (02) 81 66 40
Telex: 37409 hpas dk

Hewlett-Packard A/S

Nuvejvej 1
DK-8600 Silkeborg
Tel: (06) 82 71 66
Telex: 37409 hpas dk

ECUADOR

CYEDE Cia. Ltda.
P.O. Box 6423 CCI
Av. Eloy Alfaro 1749
Quito
Tel: 450-975, 243-052
Telex: 2548 CYEDE ED

EGYPT

I.E.A.
International Engineering
Associates
24 Hussein Hegazi Street
Kasr-el-Aim
Cairo
Tel: (416) 678-9430
TWX: 610-492-4246

ETHIOPIA

Abdella Abdulkalk
P.O. Box 2635
Addis Ababa
Tel: 11 93 46

EL SALVADOR

Bulevar de los Heroes 11-48
Edificio Sarah 1148
San Salvador
Tel: 252787

FINLAND

Hewlett-Packard Oy
Revontulente, 7
SF-02100 Espoo 10
Tel: (90) 453 0211
Telex: 121563 hewpa sf

FRANCE

Hewlett-Packard France
Zone d'activités de Courtabouef
Avenue des Tropiques
Boite Postale 6
91401 Orsay-Cédex
Tel: (1) 907 78 25
Telex: 600048F

Hewlett-Packard France

Chemin des Moulles
B.P. 162
69130 Ecully
Tel: (78) 33 81 25
TWX: 310617F

Hewlett-Packard France

20, Chemin de La Cèprière
31081 Toulouse
Le Mirail-Cédex
Tel: (61) 40 11 12

Hewlett-Packard France

Le Ligoures
Place Romée de Vileneuve
13100 Aix-en-Provence
Tel: (42) 59 41 02
TWX: 410770F

Hewlett-Packard France

2, Allée de la Bourgonette
35100 Rennes
Tel: (99) 51 42 44
TWX: 740912F

Hewlett-Packard France

18, rue du Canal de la Maine
67300 Schiltigheim
Tel: (88) 83 08 10
TWX: 890141F

Hewlett-Packard France

Immeuble péronière
rue van Gogh
59650 Villeneuve D'Ascq
Tel: (20) 91 41 25
TWX: 160124F

Hewlett-Packard France

Bâtiment Ampère
Rue de la Commune de Paris
B.P. 300
93153 Le Blanc Mesnil-
Cédex
Tel: (01) 931 88 50
Telex: 211032F

Hewlett-Packard France

Av. du Pdt. Kennedy
33700 Mérignac
Tel: (56) 97 01 81

Hewlett-Packard France

Immeuble Lorraine
Boulevard de France
91035 Evry-Cédex
Tel: 077 96 60
Telex: 692315F

Hewlett-Packard France

23 Rue Lothaire
57000 Metz
Tel: (87) 65 53 50

GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Berner Strasse 117
Postfach 560 140
D-6000 Frankfurt 56
Tel: (06011) 50041
Telex: 04 13249 hpfm d

Hewlett-Packard GmbH

Technisches Büro Böblingen
Herrenberger Strasse 110
D-7030 Böblingen,
Württemberg
Tel: (07031) 667-1
Telex: 07265739 bbn

Hewlett-Packard GmbH

Technisches Büro Düsseldorf
Emanuel-Leutze-Str. 1
(Seestern)
D-4000 Düsseldorf
Tel: (0511) 5971-1
Telex: 085186 533 hppd d

Hewlett-Packard GmbH

Technisches Büro Hamburg
Kapsladring 5
D-2000 Hamburg 80
Tel: (040) 63804-1
Telex: 21 63 032 hphn d

Hewlett-Packard GmbH

Technisches Büro Hannover
Am Grossmarkt 6
D-3000 Hannover 91
Tel: (0511) 46 60 01
Telex: 092 3259

Hewlett-Packard GmbH

Technisches Büro Nürnberg
Neumeyersstrasse 90
D-8500 Nürnberg
Tel: (0911) 52 20 83
Telex: 0623 860

Hewlett-Packard GmbH

Technisches Büro München
Eschenstrasse 5
D-8021 Taufkirchen
Tel: (089) 6117-1
Telex: 0524985

Hewlett-Packard GmbH

Technisches Büro Berlin
Kathstrasse 2-4
D-1000 Berlin 30
Tel: (030) 24 90 86
Telex: 018 3405 hpbm d

Hewlett-Packard GmbH

Kostas Karayannis
8 Omarou Street
Athens 133
Tel: 32 30 303/32/37 731
Telex: 21 59 62 RKAR GR

GUAM

Gum Medical Supply, Inc.
Suite C, Airport Plaza
P.O. Box 8947
Tamuning 96911
Tel: 646-4513

GUATEMALA

IPESA
Avenida Reforma 3-48
Zona 9
Guatemala City
Tel: 316627, 314786,
664715, ext. 9
Telex: 4192 Teletro Gu

HONG KONG

Hewlett-Packard Hong Kong Ltd.
11th Floor, Four Seas Bldg.
212 Nathan Rd.
Kowloon
Tel: 3-697446 (5 lines)
Telex: 36678 HX

Medical/Analytical Only

Schmidt & Co. (Hong Kong)
Wing On Centre, 28th Floor
Connaught Road, C.
Hong Kong
Tel: 5-455644
Telex: 74766 SCHMX HX

INDIA

Blue Star Ltd.
Sahas
41/42 Vir Savarkar Marg
Prabhadevi
Bombay 400 025
Tel: 45 78 87
Telex: 011-4093

Blue Star Ltd.

Band Box House
Prabhadevi
Bombay 400 025
Tel: 45 73 01
Telex: 011-3751

Blue Star Ltd.

Bhandari House
91 Nehru Place
New Delhi 110 024
Tel: 682547
Telex: 031-2463

Blue Star Ltd.

T.C. 7/603 'Poomina'
Masulipatnam
Tiruvandrum 695 013
Tel: 65799
Telex: 0884-259

Blue Star Ltd.

11 Magarath Road
Bangalore 560 025
Tel: 55668
Telex: 0845-430

Blue Star Ltd.

Meeakshi Mandram
XXXXV/1379-2 Mahatma
Gandhi Rd.
Cochin 682 016
Tel: 32069
Telex: 085-514

Blue Star Ltd.

1-117/1 Sarojini Devi Road
Secunderabad 500 039
Tel: 70126
Telex: 0155-459

Blue Star Ltd.

133 Kodambakkam High Road
Madras 600 034
Tel: 82057
Telex: 041-379

ICELAND

Medical Only
Elding Trading Company Inc.
Hafnarfjörður, Tryggvagötu
P.O. Box 895
IS-Reykjavik
Tel: 1 58 201 63 03

INDONESIA

BERCA Indonesia P.T.
P.O. Box 496/Jk1.
Jln. Abdul Muis 62
Jakarta
Tel: 349255, 349886
Telex: 46748 BERSIL IA

BERCA Indonesia P.T.

P.O. Box 174/Sby7
23 Jln. Jemerlo
Surabaya
Tel: 42027

IRELAND

Hewlett-Packard Ltd.
Kestrel House
Clanwilliam Place
Lower Mount Street
Dublin 2, Eire
Hewlett-Packard Ltd.
2C Avonberg Ind. Est.
Long Mile Road
Dublin 12
Tel: 514322/514224
Telex: 30439

Dublin 12

Tel: 514322/514224
Telex: 30439

Medical Only

Cardiac Services (Ireland) Ltd.
Kilmore Road
Artane
Dublin 5, Eire
Tel: (01) 315820

Medical Only

Cardiac Services Co.
95A Finaghy Rd. South
Belfast BT10 0BY
GB-Northern Ireland
Tel: (0232) 625566
Telex: 747626

ISRAEL

Electronics Engineering Div.
of Motorola Israel Ltd.
16, Kremenetski Street
P.O. Box 25016
Tel-Aviv
Tel: 38973
Telex: 33569, 34164

ITALY

Hewlett-Packard Italiana S.p.A.
Via G. Di Vittorio, 9
20063 Cornusco Sul
Naviglio (MI)
Tel: (2) 903691
Telex: 334632 HEWPACKIT

Hewlett-Packard Italiana S.p.A.

Corso Giovanni Lanza 94
I-10133 Torino
Tel: (49) 664888
Telex: 430315 HEWPACKIT

Hewlett-Packard Italiana S.p.A.

Via G. Arminini 10
I-00143 Roma
Tel: (06) 54 69 61
Telex: 610514

Hewlett-Packard Italiana S.p.A.

Corso Giovanni Lanza 94
I-10133 Torino
Tel: (49) 664888
Telex: 221079

Hewlett-Packard Italiana S.p.A.

Via Principe Nicola 43 G/C
I-95126 Catania
Tel: (095) 37 05 04
Telex: 979291

Hewlett-Packard Italiana S.p.A.

Via Nuova San Rocco A
Capadimonte, 62A
80131 Napoli
Tel: (081) 710698

Hewlett-Packard Italiana S.p.A.

Via Martin Luther King, 38/111
I-40132 Bologna
Tel: (051) 402394
Telex: 511830

JAPAN

Yokogawa-Hewlett-Packard Ltd.
29-21, Takaido-Higashi
3-chome
Suginami-ku, Tokyo 168
Tel: 03-331-6111
Telex: 232-2024 YHP-Tokyo

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