UNIT INSTRUCTIONS

TD-537
1 APRIL 1962

786M-1
STEREO GENERATOR

CEDAR RAPIDS, IOWA, U.S.A.

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COLLINS

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GENERAL DESCRIPTION

1.1 PURPOSE OF INSTRUCTION BOOK.

Unit Instructions TD-537 provides information about 786M-1 Stereo Generator, Collins part number 522-2914-00. Information which is furnished includes a general description of the equipment, principles of operation, maintenance procedures, and a parts list.

1.2 PURPOSE OF THE EQUIPMENT.

The 786M-1 Stereo Generator is used to convert stereophonic audio input signals into main and stereophonic subchannel signals and to generate a pilot subcarrier. The resultant signal is suitable for modulation of wideband FM broadcast exciters.

1.3 DESCRIPTION OF EQUIPMENT.

1.3.1 PHYSICAL DESCRIPTION.

The 786M-1 Stereo Generator, shown in figure 1-1, is constructed on a standard 19-inch rack-mounted panel. This panel is 19 inches wide, 10-1/2 inches high, 7 inches deep, and weighs approximately 14 pounds. All operating controls are located on the front panel with seldom-used adjustments located inside the back panel. A meter is placed conveniently on the lower left portion of the front panel for monitoring of input and output signals. All transistors and the 38-kc crystal are placed on the front panel for convenient access. Bulky components are grouped in the upper right-hand corner of the front panel leaving the remaining portion of the panel free of obstacles for ease of maintenance and adjustment. All components located in the rear of the unit are protected in a dust-resistant enclosure.

1.3.2 ELECTRICAL DESCRIPTION.

The 786M-1 Stereo Generator is an all transistorized unit consisting of the following circuits; a crystal controlled 38-kilocycle oscillator, a 19-kilocycle locked oscillator, a meter amplifier, two audio amplifiers, and a balanced modulator. All components for operation of the time division stereo generator are

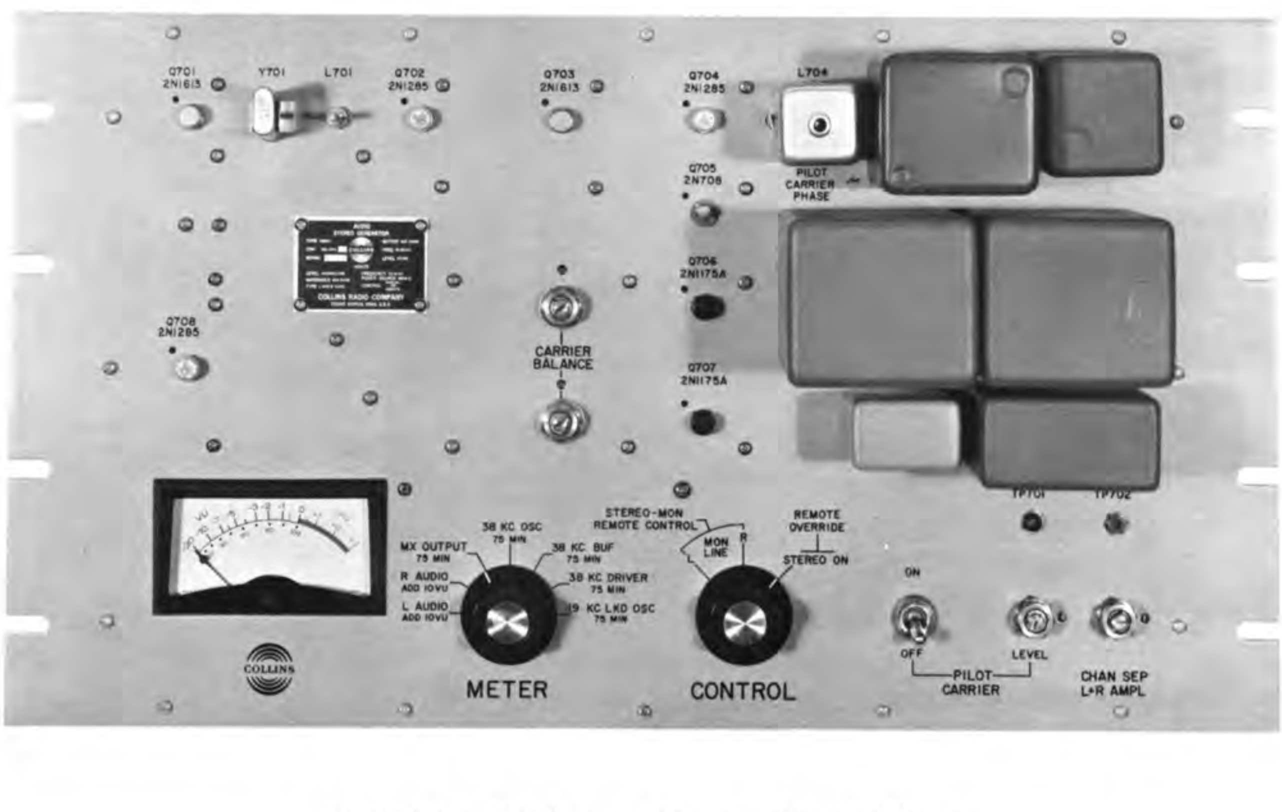


Figure 1-1. 786M-1 Stereo Generator, Over-all View

contained within the 19-inch rack-mounted panel with the exception of a left audio channel pre-emphasis network. This function must be supplied externally and is available in the Collins A830-2 10 W Wide-Band FM Broadcast Exciter.

Power input required is 20 ±0.1 volts d-c which is supplied by the A830-2. Remote control can be exercised over the stereophonic and monophonic modes. Power required for operation of remote control is 28 ±2.8 volts d-c. Instruction books covering the exciter and power amplifiers, used in conjunction with the 786M-1, are listed in table 1-1.

TABLE 1-1
ASSOCIATED EQUIPMENT INSTRUCTION BOOKS

ASSOCIATED EQUIPMENT	INSTRUCTION BOOK PART NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	TD-536
B830-1 250-Watt FM Power Amplifier	TD-538
D830-1 1000-Watt FM Power Amplifier	TD-567
E830-1 5-Kw FM Power Amplifier	TD-539

1.4 EQUIPMENT SUPPLIED.

Table 1-2 lists equipment that is supplied as part of the 786M-1 Stereo Generator.

TABLE 1-2
EQUIPMENT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
786M-1 Stereo Generator	522-2914-00

1.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Table 1-3 lists equipment that is required for operation of the 786M-1 Stereo Generator but not supplied as part of the 786M-1.

TABLE 1-3
EQUIPMENT REQUIRED BUT NOT SUPPLIED

EQUIPMENT	COLLINS PART NUMBER
A830-2 10 W Wide-Band FM Broadcast Exciter	522-2714-00

1.6 ACCESSORY EQUIPMENT.

Table 1-4 lists accessory equipment that is available for use with 786M-1 Stereo Generator.

TABLE 1-4
ACCESSORY EQUIPMENT

EQUIPMENT	COLLINS PART NUMBER
B830-1 250-Watt FM Power Amplifier	549-2008-00
D830-1 1000-Watt FM Power Amplifier	522-2948-00
E830-1 5-Kw FM Power Amplifier	549-2009-00
250-Watt/1-Kw Harmonic Filter	549-2010-00

1.7 EQUIPMENT SPECIFICATIONS.

1.7.1 MECHANICAL.

Weight . . . . 14 pounds approximately.

Size . . . . 19 inches wide, 10-1/2 inches high, 7 inches deep.

Ambient temperature range . . . . +15°C (59°F) to 45°C (113°F).

Ambient humidity range . . . . 0 to 95% relative humidity.

Altitude . . . . 0 to 7500 feet.

1.7.2 ELECTRICAL.

Power source . . . . . 20 ±0.1 volts d-c.

28 ±2.8 volts d-c (for remote operation).

Input . . . . Balanced 600 ohms, left and right channels.

Input level . . . . . . 10 ±2 dbm for 100% composite modulation.

Frequency range . . . 30 to 15,000 cps for each channel.

Output level . . . . . 280 ±50 mv peak to peak.

Pilot carrier frequency . . . . . . 19 kc ±2 cps.

Pilot carrier level . . Equivalent to 9% ±1% modulation of the main carrier.

Channel separation . . Greater than 30 db, 50 cps to 15,000 cps.

Crosstalk . . . . . . More than 40 db below single channel level.

Distortion . . . . . . Less than 0.5% over the frequency range of 30 to 15,000 cps.

38-kc subcarrier suppression . . . . . 40 db below output with 10-dbm input level.

Main channel and stereophonic subcarrier phase relationship . . . ±3 degrees for audio frequencies from 50 to 15,000 cps.

Audio-frequency response . . . . Complies with FCC standard 75-microsecond pre-emphasis curve (right channel only, left channel pre-emphasis is obtained from exciter).

1.8 SEMICONDUCTOR COMPLEMENT.

Table 1-5 lists the semiconductor complement supplied as part of 786M-1 Stereo Generator.

TABLE 1-5. SEMICONDUCTOR COMPLEMENT

SYMBOL	QUANTITY	TYPE	FUNCTION
Q701	1	2N1613	38-kc oscillator
Q702	1	2N1285	38-kc buffer
Q703	1	2N1613	38-kc driver
Q704	1	2N1285	38-kc isolation amplifier
Q705	1	2N708	19-kc locked oscillator
Q706	1	2N1175A	Left audio amplifier
Q707	1	2N1175A	Right audio amplifier
Q708	1	2N1285	Meter amplifier
CR702	4	1N270	Balanced modulator diode switches

SECTION II
PRINCIPLES OF OPERATION

2.1 GENERAL.

The 786M-1 Stereo Generator provides facilities for the conversion of stereophonic input signals to an output which conforms to the standards approved by the FCC for the transmission of stereophonic signals. The following paragraphs discuss stereophonic principles and the operation of the 786M-1 Stereo Generator.

2.2 PRINCIPLES OF FM STEREO.

2.2.1 STEREOPHONIC SOUND SYSTEMS.

An elementary stereophonic sound system consists of two directional microphones placed to the right and left of a sound source. See figure 2-1. Each microphone in turn is connected to an amplifier and speaker system. When the listener is situated between the speakers, the left channel will be received by the left ear and the right channel will be received by the right ear. The effect upon the listener of such a system is to simulate placing the listener at a point midway between the two microphones and receiving a true representation of the originating sound source.

To provide a realistic stereo effect, the difference in time delay and signal amplitude from the sound source to each of the microphones must be maintained through the entire stereo system. If the time delay or amplitude difference is changed in one of the amplifier or speaker systems, the effect to the listener will be a change in direction of the sound source, when in reality no change has occurred. A change in time delay of the left or right channel is referred to as a phase relationship change. This phase relationship between the channels must be held, in stereo transmitting equipment, to within ±3 degrees.

If the amplitude difference and time delay in each system is identical (as when the sound source is centered between the microphones), the sound source will

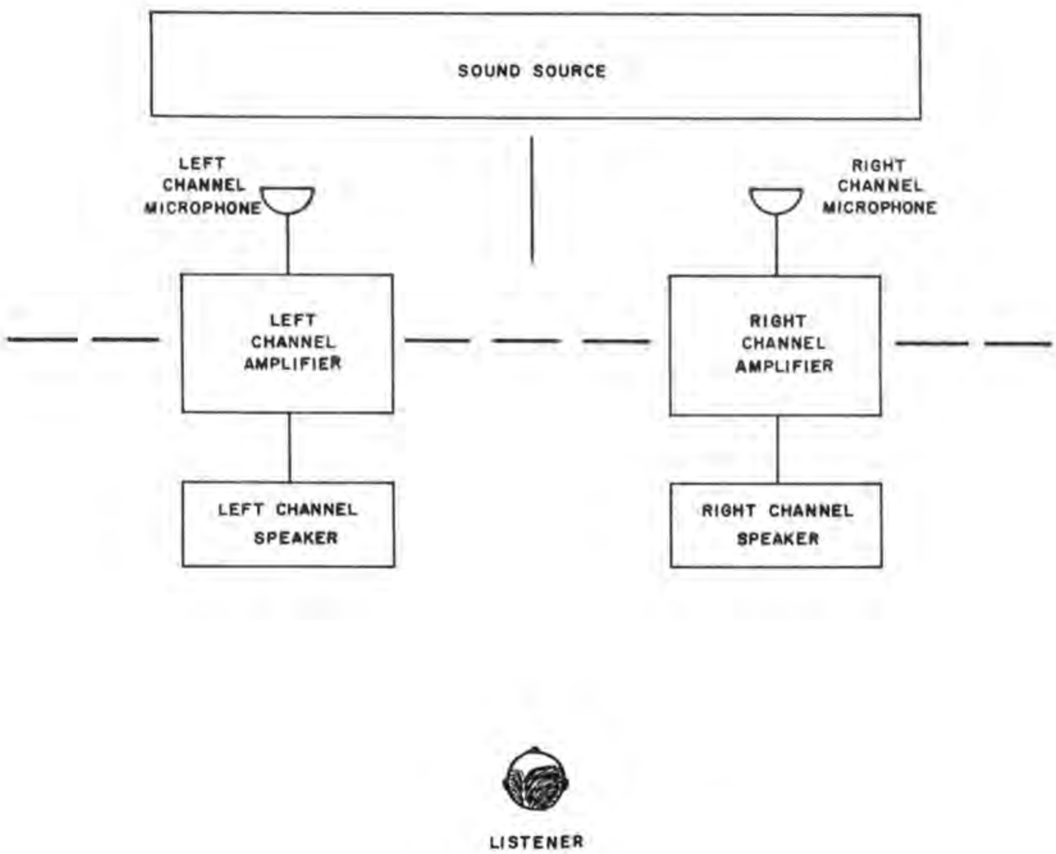


Figure 2-1. Elementary Stereophonic System

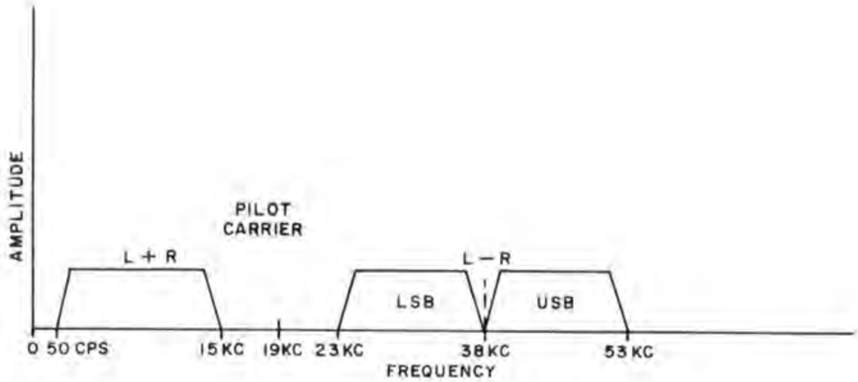


Figure 2-2. Spectrum of Signals in Baseband Audio

appear to the listener to be centered between the speakers. This is actually the true relationship of the microphones and the sound source.

To enhance the stereo effect to the listener, it is desirable for each microphone to be directional, as stated previously, so that sounds originating directly in front of the right microphone will be received by the right microphone, and as little as possible by the left microphone, and vice versa. If too much of the right sound source is picked up by the left microphone or vice versa, the effect to the listener will be to move the sound source to the center. This isolation between the two sound systems is known as channel separation and must be held greater than 29.7 db in stereo transmitting equipment.

If proper isolation of the amplifiers is not obtained, and there is an interchange of signals, the sound source will again appear to move toward the center. If the channel separation is reduced to zero, the effect would be to replace the two microphones with a single microphone feeding the same information to both amplifier and speaker systems. It is then understood that monophonic operation can be obtained by paralleling (adding) the left and right microphone outputs. This monophonic component is referred to as L+R.

An interchange of information between channels (main and subchannel) is referred to as crosstalk. Crosstalk will deteriorate the stereo signals by adding noise to the signal. In stereo transmitting systems, crosstalk must remain at least 40 db below a single channel level.

2.2.2 METHODS OF GENERATING FCC STEREO.

Signals which are prescribed by the FCC for the transmission of stereophonic intelligence is shown in figure 2-2. This band of frequencies must be generated and transmitted in order that both monaural and stereophonic receivers will be able to detect the FM signal. For monaural receivers, only the L+R (left plus right) channel is received, with the pilot carrier and L-R (left minus right) signals rejected by the pass band of the monaural receiver. Stereophonic FM receivers detect the complete band of frequencies in a discriminator and will process the signals into left and right stereophonic channels. The 19-kc pilot carrier is used in this process. The method of generating the signals shown in figure 2-2 depends upon the method chosen for modulating an FM signal.

The methods of modulating an FM signal may be broken down into two groups, a direct and an indirect method. These two general categories may be broken down further into various methods of obtaining the end result. Phase modulation is the most generally used method of generating an FM signal by the indirect method. If this system is used to modulate the composite stereo signal, various problems are encountered. The most serious problem is that of frequency response of the phase modulator. As the phase modulator audio response exhibits nonlinear modulation characteristics (rises 6 db per octave from the lowest to the highest frequency), predistortion is employed to compensate for this trait. In a stereo FM modulator this predistortion would amount to 65.5 db over the entire modulating frequency range of 50 cps to 75 kc (SCA added to stereo signal). When a 65-db signal to noise ratio and a 60-db dynamic range is added to this, it is apparent that baseband amplifiers cannot be built to give this characteristic.

It is possible to split the phase modulation into two steps and modulate one phase modulator with the L+R signal and the second phase modulator with the L-R and pilot carrier signals. This type of stereophonic phase modulation is not desirable because of the required phase linearity of ±3 degrees and the gain requirements of stereophonic transmission systems. These requirements are difficult, if not impossible, to maintain.

Another method of FM stereophonic modulation which could be employed is a combination of direct and indirect modulation. With this method the L+R signal directly FM modulates an oscillator, while the L-R signal phase modulates the signal produced in the oscillator, in a later stage. As in phase modulation of the stereophonic signal, it is difficult to maintain phase linearity and gain characteristics.

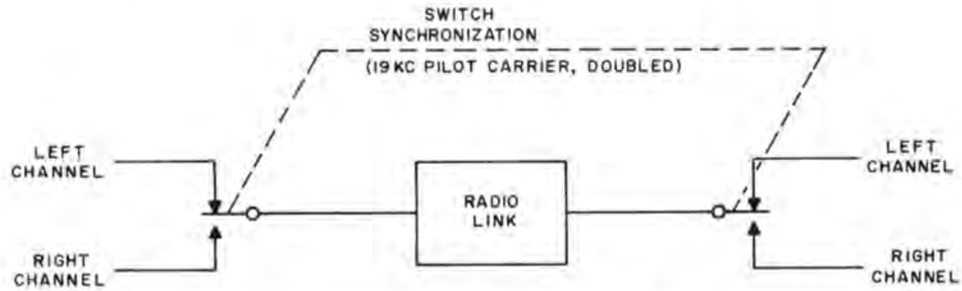


Figure 2-3. An Elementary Time Division Multiplex System

A third method of generating a stereophonic FM signal is by the use of direct modulation over the entire stereophonic generator frequency range. Phase relationship and gain characteristics are then easy to maintain because of the point input source. Until recently, it has been difficult to directly modulate an FM signal with a wide bandwidth of signals. With the advent of solid state components and specifically the production of the variable capacity diode, this wide-band type of modulation is possible. This is the type of modulation used in the Collins A830-2 10 W Wide-Band FM Broadcast Exciter. The development of the wide-band type of modulator made possible the development of 786M-1 Stereo Generator which is discussed in paragraph 2.3.

2.3 PRINCIPLES OF OPERATION OF 786M-1.

The 786M-1 Stereo Generator generates the spectrum of signals shown in figure 2-2 by the time division multiplex method. By this method, shown simplified in figure 2-3, the left and the right channels are switched alternately at a 38-kc rate. If the receiver switching rate is synchronized with the transmitter switching rate, the original left and right audio signals will be detected. In the receiver, the 19-kc pilot carrier is doubled to synchronize the receiver to the transmitter. It is important that the switching frequency in both the stereo generator and the receiver be of the same phase to retain the identity of the left and right audio signals.

The mathematical analysis of two audio signals being switched alternately by a square wave shows that the resultant signal is made up of two components. One component is directly proportional to the sum of the two audio signals (L+R) and the other is a double-sideband (DSB) signal centered on a frequency equal to the switching frequency (38 kc). The modulation appearing on this DSB signal is directly proportional to the difference of the two audio channels (L-R). If L is defined as the audio signal in the left channel, R is defined as the audio signal in the right channel, and ω_c is defined as the switching frequency, the composite signal is equal to:

$$\frac{L+R}{2} + \frac{2}{\pi}(L-R) \quad \cos\omega_c t$$

The following is a block diagram explanation of the 786M-1 Stereo Generator which generates the signals just mentioned. Refer to figure 2-4. It is noted on the block diagram that the left audio channel is fed through the pre-emphasis network and high-pass filter of the A830-2 wide-band exciter and then to the 786M-1.

The right audio channel utilizes the pre-emphasis network and the high-pass filter located in the 786M-1. The outputs of the high-pass filters are fed through 15-kc low-pass filters where audio components above 15 kc are attenuated sharply. The 15-kc filter outputs are then fed to emitter follower amplifiers where isolation of the two channels from the balanced modulator is obtained. The two-channel audio output is then fed to a balanced modulator whose action resembled that of a switch. The balanced modulator utilizes the signal generated in the 38-kc oscillator to alternately switch on and off each audio channel. The output of the balanced modulator consists of an L+R component and an L-R DSB component. The fundamental 38-kc modulating signal and all even order harmonics are balanced out.

The balanced modulator output is mixed with a small amount of direct L+R signal (correction factor) and is fed through a 50-cps to 53-kc low-pass linear phase filter where all odd order harmonics above 53 kc are attenuated. The filter output is mixed with a 19-kc signal from the pilot carrier phase locked oscillator and is fed to the 786M-1 output. All FCC phasing, channel separation, crosstalk, and amplitude specifications are satisfied within the 786M-1 Stereo Generator.

2.3.1 DETAILED DESCRIPTION OF 786M-1 STEREO GENERATOR.

Refer to figure 5-1, a schematic diagram of the 786M-1. The right audio channel is identical to the left audio channel except that the pre-emphasis network and the 15-kc filter for the left channel are located within the A830-2 exciter. Only the right channel is discussed in the following paragraphs.

The 600-ohm balanced right audio channel is fed into a pre-emphasis network, FL701. Due to the inherently low level of high-frequency audio components in program material, pre-emphasis is employed to overcome the effects of noise which is often found in home receivers. The 786M-1 follows the standard

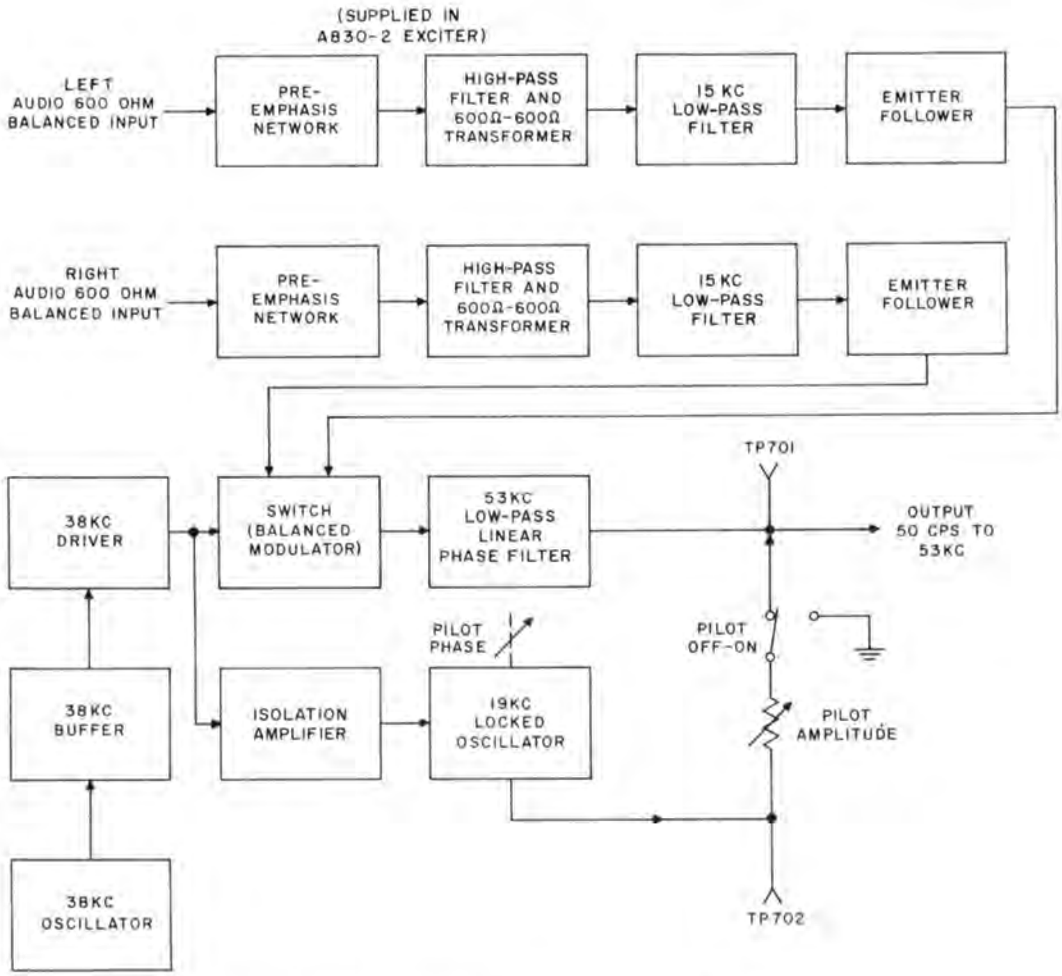


Figure 2-4. 786M-1 Stereo Generator, Block Diagram

75-microsecond pre-emphasis curve established by the FCC. The output of pre-emphasis filter FL701 is fed into a 30-cps high-pass filter, FL702, which sharply attenuates audio components below 30 cps. This is necessary to prevent 5-cps audio components from interfering with the 5-cps sampling circuits within the A830-2 exciter. Filter FL702 also transforms the 600-ohm balanced input into a 600-ohm single-ended output.

The output of FL702 is connected to relay K701 which remotely selects either the stereo mode for transmission, or the left or right audio channels for monaural operation. Relay K701 operates by applying 28 volts d-c across the solenoid. This 28-volt d-c source is supplied by the A830-2 exciter. Selection of either the left or right monaural channel is determined by the position of S701. At this point, if either the left or right channel is selected for monaural operation, the single 50-cps to 15-kc audio signal is fed through an 8-db loss pad to the output of the 786M-1 Stereo Generator. The 8-db loss pad is made up of R750, R751, and R752. The resulting audio input to the A830-2 is the same as that obtained without the stereo generator. Switch S701 will also override the remote relay if desired.

If the stereo mode is selected by S701, the audio component is fed to a 15-kc low-pass filter, FL704. FL704 attenuates all frequencies over 15 kc to prevent their interfering with adjacent channels. The output of FL704 is fed to the base of emitter follower Q707, which isolates the audio circuits from the balanced modulator.

The function of the balanced modulator is to generate the L+R and the L-R components shown in figure 2-2. The balanced modulator resembles a switch which samples the left audio channel and the right audio channel in turn. The 38-kc switching frequency and all even order harmonics are balanced out in the modulator output. The 38-kc switching frequency is obtained from the 38-kc driver and is impressed across transformer T701. If the primary switching voltage is negative, the secondary voltage will switch on diodes CR703 and CR704. Thus, right audio will appear at the secondary center tap. If the primary switching voltage is positive, the secondary voltage will switch

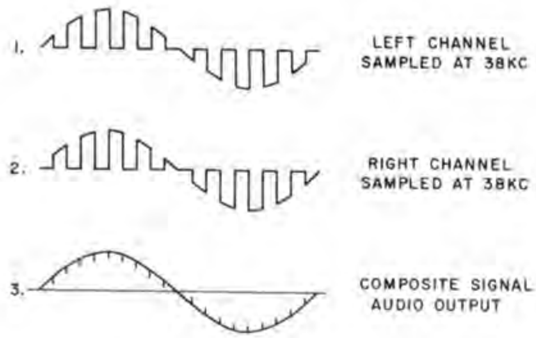


Figure 2-5. Balanced Modulator Output
When L+R=2, L-R=0

on diodes CR702 and CR705. The left audio channel will then appear on the secondary of T701. A representation of a sine wave input in each channel (L=R, L+R=2, L-R=0) switched in this manner is shown in figure 2-5. It is seen in this illustration that the composite signal at the output of the balanced modulator is a sine wave of an amplitude equal to the original signal level in each channel. The spikes shown on the composite sine wave result from imperfect switching and are filtered out in FL705.

Figure 2-6 shows the balanced modulator output when R=0, L+R=1, and L-R=1. The output of the balanced modulator is an audio component plus DSB components centered on the switching frequency and odd harmonics which form the square wave shape. When the odd harmonics are filtered out by the 53-kc harmonic filter, FL705, the third waveform results. Because the fundamental component of a square wave is $\frac{4}{\pi}$ times the square wave amplitude, the DSB component is larger than the audio. The audio component is then increased by $\frac{4}{\pi}$ and the fourth illustration results. The audio component is added by resistors R724 and R730 which leak a small portion of L+R directly around the balanced modulator. Potentiometer R755 adjusts the audio component so the $\frac{4}{\pi}$ loss in filtering is exactly compensated.

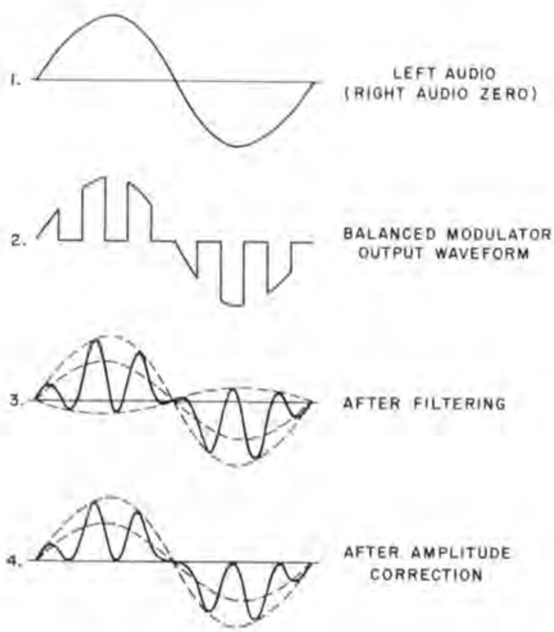


Figure 2-6. Balanced Modulator Output
When L+R=1 and L-R=1

Figure 2-7 shows the time division signal when L=-R, or L+R=0, L-R=2. The composite waveform from the balanced modulator is shown in the third illustration. This waveform is composed of audio components and odd harmonics centered on the switching frequency. When the odd harmonics are removed by filtering in FL705, the waveshape in the fourth illustration results. This waveshape is a DSB signal which equals L-R as required by the matrix process.

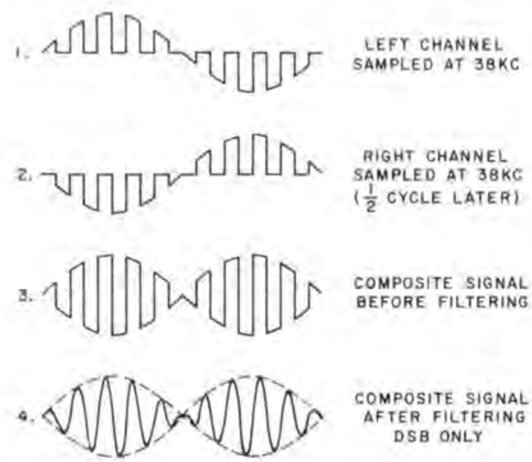


Figure 2-7. Balanced Modulator Output
When L+R=0 and L-R=2

The output of the balanced modulator and L+R mixing is fed to a low-pass 53-kc filter, FL705. Filter FL705 removes all harmonics and noise above 53 kc to form the DSB waveshape as shown in figures 2-6 and 2-7. The output from FL705 is mixed with a 19-kc pilot carrier and fed to the stereo override switch, S701, and the remote relay, K701. Operation at this point is similar to audio switching which was discussed earlier. If relay K701 is energized and S701 is in the STEREO ON position, the composite stereo is fed to J701 for connection to the A830-2 10 W Wide-Band FM Exciter.

The balanced modulator switching frequency is obtained from crystal-controlled oscillator Q701. Oscillations are sustained by taking the output of L701 and feeding it into the base of Q701. The 38-kc output of L701 is also capacitively coupled into the 38-kc buffer amplifier, Q702. The output of Q702 is tuned to 38 kc by C714 and L702. The output of buffer amplifier Q702 is further amplified to approximately 4 volts peak to peak by driver amplifier Q703. The gains of Q701,

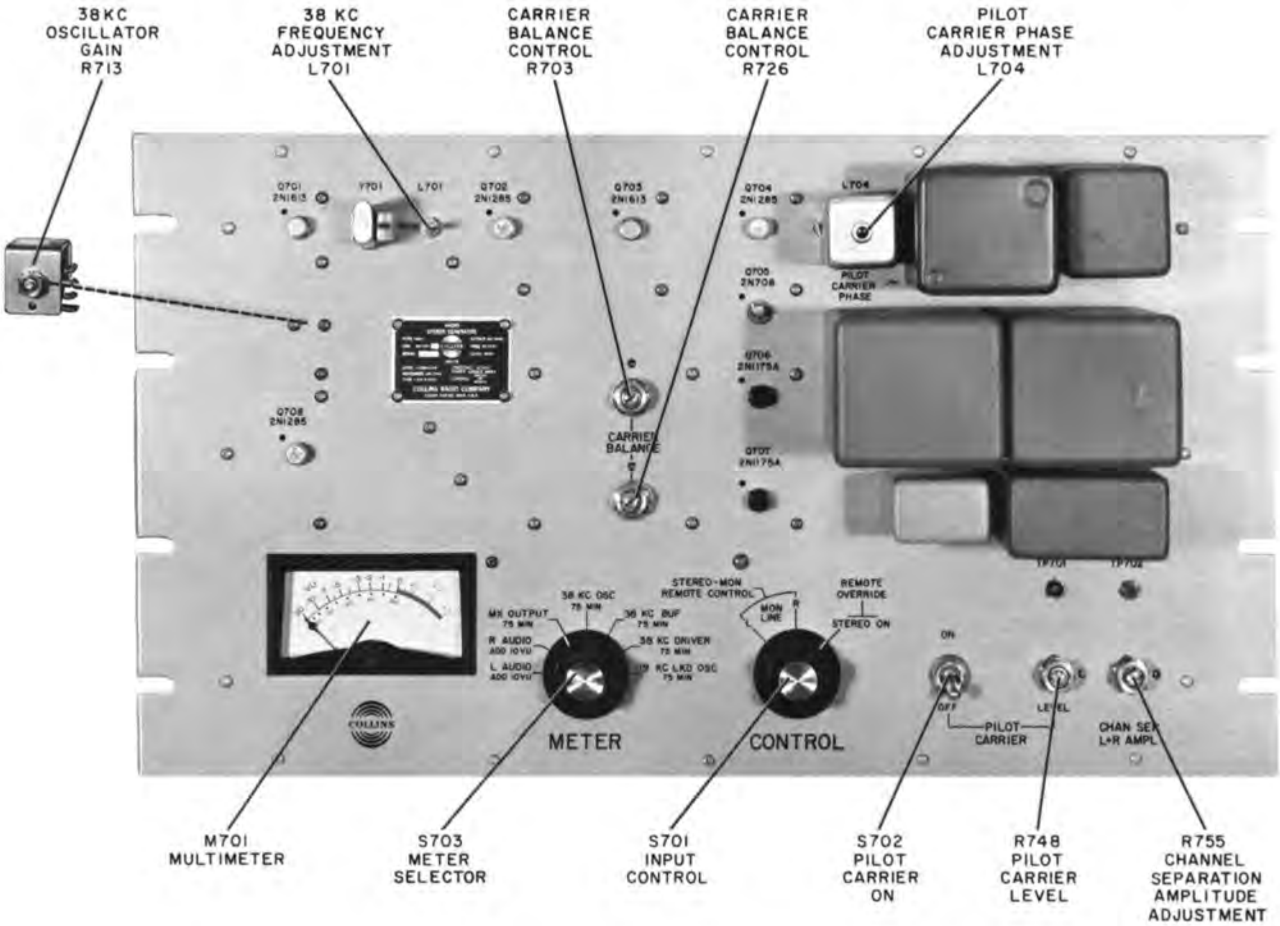


Figure 2-8. 786M-1 Control and Adjustment Locations

Q702, and Q703 are stabilized by emitter degeneration to reduce gain variations between transistors. The output of Q703 is capacitively coupled to the primary of T701 (balanced modulator switching transformer) and to the 19-kc pilot carrier locked oscillator through an isolation stage, Q704.

The pilot carrier oscillator, Q704, is basically a grounded base oscillator which is synchronized by injecting a 38-kc signal into the base. The oscillator output is a 19-kc resonant tank placed across the base to emitter junction by means of a capacity voltage divider. The 19-kc output is taken from the emitter circuit and is injected into the output of FL705. The pilot carrier phase, which must be maintained in phase with the output of FL705, is adjusted by varying the inductance of L704. Pilot carrier level is adjusted with R748.

Metering circuits are provided within the 786M-1 to assist in trouble shooting. Meter amplifier Q705 provides isolation of the matrixing and oscillator circuits from the metering circuits. The right audio and left audio channels are fed directly from the 600-ohm balanced input through meter multiplying resistors R711 and R710 to meter M701.

2.3.2 CONTROL FUNCTIONS.

The following paragraphs describe the functions of all controls in the 786M-1 Stereo Generator. Refer to figure 2-8 for control locations.

Meter selector S703 connects meter M701 into various circuits for monitoring purposes. The metering positions are as follows; L AUDIO (left audio), R AUDIO (right audio), MX OUTPUT (multiplex output), 38 KC OSC (38-kc oscillator), 38 KC BUF (38-kc buffer amplifier), 38 KC DRIVER, and 19 KC LKD OSC (19-kc locked oscillator output).

Audio input switch S701 selects one of three possible audio inputs; left audio, right audio, and stereo. If switch S701 is placed in the left audio or right audio positions, remote relay K701 is able to provide remote control over the monaural or stereo modes. When S701 is in the stereo mode, relay K701 is disabled and has no effect on stereo generator inputs.

CARRIER BALANCE controls R703 and R726 balance out the 38-kc carrier and 76-kc second harmonic in the secondary of T701. These controls are adjusted for zero indication at TP701 with no audio in either channel.

Channel separation L+R amplitude control (CHAN SEP L+R AMPL) R755 adjusts the amount of L+R fed around the balanced modulator to raise the L+R level by $\frac{4}{\pi}$.

Inductor L701 adjusts the frequency of the 38-kc oscillator. Resistor R713 adjusts the level of the 38-kc driver output into the balanced modulator. This level is set for 6 volts peak to peak at TP701 at the factory and should never need readjustment.

PILOT CARRIER PHASE control L704 adjusts the phase of the 19-kc pilot carrier. The control is set for an in-phase condition with relation to the output of FL705. PILOT CARRIER LEVEL control R748 adjusts the level of the 19-kc pilot carrier. This control is set for 0.009 volt rms at TP701. PILOT CARRIER switch S702 turns the 19-kc pilot carrier off and on for adjustment and testing purposes.

SECTION III
MAINTENANCE

3.1 GENERAL.

This section contains information concerning the maintenance of the 786M-1 Stereo Generator.

NOTE

As some transistor cases are electrically above ground, do not short transistor cases to ground or damage to the transistor may result. Always replace transistors with the transistor locating mark placed adjacent to the transistor socket.

3.2 SERVICING TRANSISTOR CIRCUITS.

Servicing procedures and test equipments that have been used in the past with other types of electronic equipment, for the most part, may be used with transistor circuits. Some special precautions which must be used are listed below.

3.2.1 TEST EQUIPMENT.

Damage to transistors by test equipment is usually the result of accidentally applying too much voltage to the transistor elements. Common causes of damage from test equipment are as follows:

a. Test equipment with a transformerless power supply is one source of such voltage. This type of test equipment can be used by employing an isolation transformer in the power line.

b. It is still possible to damage transistors from line voltage even though the test equipment has a power transformer in the power supply, if the test equipment is equipped with a line filter. This filter may act like a voltage divider and apply 55 volts a-c to the transistor. To eliminate trouble from this situation, connect a ground wire from the chassis of the test equipment to the chassis of the equipment under test before making any other connections.

c. Another cause of transistor damage is a multimeter that requires excessive current for adequate indications. Multimeters that have sensitivities of less than 5000 ohms per volt should not be used. A multimeter with lower sensitivity will draw too much current through many types of transistors and damage them. Use of 20,000-ohm-per-volt meters or vacuum-tube volt meters is recommended. Check the ohmmeter circuits (even those in vtvm's) on all scales with an external, low-resistance milliammeter in series with the ohmmeter leads. If the ohmmeter draws more than one milliampere on any range, this range cannot be used safely on small transistors.

3.2.2 ELECTRIC SOLDERING IRONS.

The following are possible causes of transistor damage from soldering irons:

a. Electric soldering irons may damage transistors through leakage current. To check a soldering iron for leakage current, connect an a-c volt meter between the tip of the iron and a ground connection, allow the iron to heat, the check for a-c voltage with the meter. Reverse the plug in the a-c receptacle and again check for voltage. If there is any indication on the meter, isolate the iron from the a-c line with a transformer. The iron may be used without the isolation transformer if the iron is plugged in and brought to temperature then unplugged for the soldering operation. It is also possible to use a ground wire between the tip of the iron and the chassis of the equipment being repaired to prevent damage from leakage current.

b. Light-duty soldering irons of 20 to 25 watts capacity are adequate for transistor work and should be used. If it is necessary to use a heavier duty iron, wrap a piece of number 10 copper wire around the tip of the iron and make it extend beyond the tip of the iron. Tin the end of the piece of copper wire and use it as the soldering tip.

3.2.3 SERVICING PRACTICES.

a. If a transistor is to be evaluated in an external test circuit, be sure that no more voltage is applied to the transistor than normally is used in the circuit from which it came.

b. Test prods should be clean and sharp. Because many of the resistors used in transistorized equipments have low values, any additional resistance produced by a dirty test prod will make a good resistor appear to be out of tolerance.

3.2.4 TROUBLE SHOOTING.

The usual trouble-shooting practices apply to transistors. Be sure the test equionment and tools meet the requirements outlined in the above paragraphs. It is recommended that transistor testers be used to evaluate the transistor.

If a transistor tester is not available, a good ohmmeter may be used for testing. Be sure the ohmmeter meets the requirements as set forth in the paragraph on test equipment, above. To check a PNP transistor, connect the positive lead of the ohmmeter to base and the negative lead to the emitter. (The red lead is not necessarily the positive lead on all ohmmeters.) Generally, a resistance reading of 50,000 ohms or more should be obtained. Connect the negative lead to the collector; again a reading of 50,000 ohms or more should be obtained. Reconnect the circuit with the negative lead of the ohmmeter to the base. With the positive lead connected to the emitter, a value of resistance in the order of 500 ohms or less should be obtained. Likewise, with the positive lead connected to the collector, a value of 500 ohms or less should be obtained.

Similar tests made on an NPN transistor produces results as follows: With the negative ohmmeter lead connected to the base, the value of resistance between the base and the emitter and between the base and the collector should be high. With the positive lead of the ohmmeter connected to the base, the value of resistance between the base and the emitter and between the base and collector should be low. If the readings do not check out as indicated, the transistor probably is defective and should be replaced.

CAUTION

If a defective transistor is found, make sure that the circuit is in good operating order before inserting the replacement transistor.

Make sure that the value of the bias resistors in series with the various transistor elements are as shown on the schematic diagram. The transistor is very sensitive to improper bias voltages; therefore, a short or open circuit in the bias resistors may damage the transistor. For this reason, do not trouble-shoot by shorting various points in the circuit to ground and listening for clicks.

3.3 TROUBLE SHOOTING.

Trouble shooting can best be accomplished by using standard trouble-shooting techniques. Suspected troubles should be isolated to individual stages before components are replaced. The pilot carrier can be turned off with switch S702 as an aid in trouble shooting and testing.

3.4 ADJUSTMENTS AND TESTS.

The 786M-1 is fitted with adjustments which adjust 38-kc oscillator tui ng, carrier balance, pilot carrier level, and pilot carrier phase.

NOTE

Do not attempt the following adjustments without using the proper test equipment as serious deterioration of the 786M-1 output quality may result from the use of inferior test equipment.

The test equipments or their equivalents required to perform the specified tests are listed in table 3-1.

TABLE 3-1
TEST EQUIPMENT REQUIRED

EQUIPMENT	MANUFACTURER AND TYPE
Oscilloscope	Tektronix Model 545A with Type 53/54C plug-in unit and a Type D plug-in unit
Oscillator	Hewlett-Packard Model 200AB
Distortion and noise meter	Hewlett-Packard Model 330D
Vtvm	Hewlett-Packard Model 400H

Figure 3-1 is a standard transistor base, viewed from the bottom, which provides a transistor element reference.

3.4.1 38-KC OSCILLATOR TUNING.

Turn on the A830-2 10 W Wide-Band FM Exciter. Connect an a-c vtvm to the collector of Q702. (See figure 3-1.) Adjust L701 for a maximum indication on the vtvm. The oscillator output at the collector of Q702 should be approximately 1.5 volts.

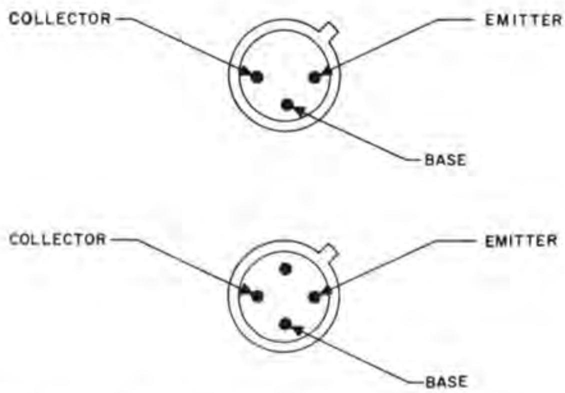


Figure 3-1. Transistor Base Configuration

3.4.2 38-KC AMPLITUDE CHECK.

Connect a calibrated Tektronix oscilloscope, provided with a Type D plug-in unit, across terminals 1 and 2 of T701. The voltage at this point should be 6 volts peak to peak as read on the oscilloscope.

3.4.3 CARRIER BALANCE.

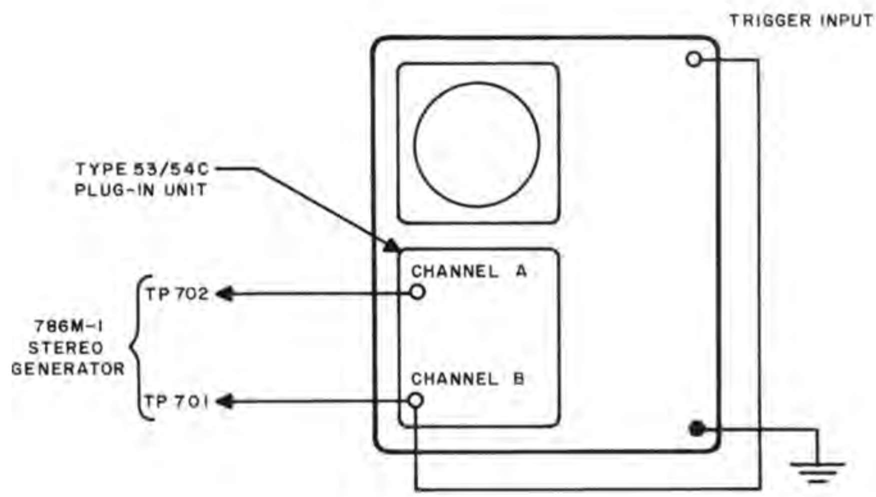
Turn the PILOT CARRIER switch to OFF. Remove any audio from the left and right audio channels. Connect the Tektronix oscilloscope with the Type D plug-in unit to TP702 and ground. Adjust in turn R703 and R726 in small steps for a minimum indication on the oscilloscope. The final indication on the oscilloscope must be more than 40 db below 100 millivolts (1 millivolt).

3.4.4 PILOT CARRIER PHASE.

Connect the Tektronix oscilloscope to the 786M-1 Stereo Generator as shown in figure 3-2. Connect the audio oscillator into the 786M-1 through 10-db pads to give an L= -R signal (right audio channel 180 degrees out of phase with the left audio channel) into the audio input terminals at a frequency of 1000 cps and a level of 7.8 volts rms. Set the PILOT CARRIER switch to OFF. Switch the CONTROL switch to STEREO ON. Adjust the PILOT CARRIER PHASE control until both traces on the oscilloscope are stationary and an exact coincidence of the zero crossings of the 19-kc pilot carrier and the L-R signal is obtained as shown in figure 3-3. Expand the sweep to 5X, and adjust the horizontal position knob to check the two points of coincident zero crossing.

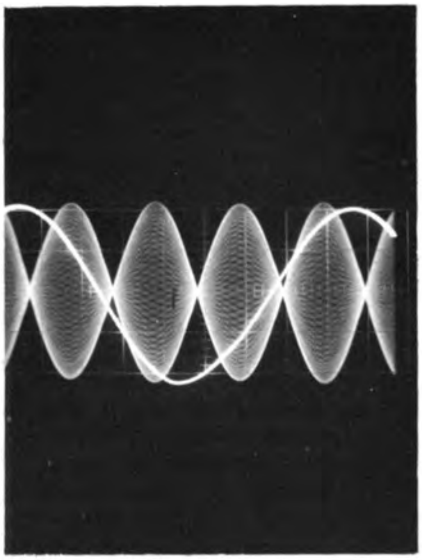
3.4.5 PILOT CARRIER LEVEL.

Remove any audio from the 786M-1 audio input channels and connect a vtvm to TP702. Set the PILOT CARRIER switch to ON, and adjust the PILOT CARRIER LEVEL control for a reading of 0.009 volt rms as read on the vtvm.

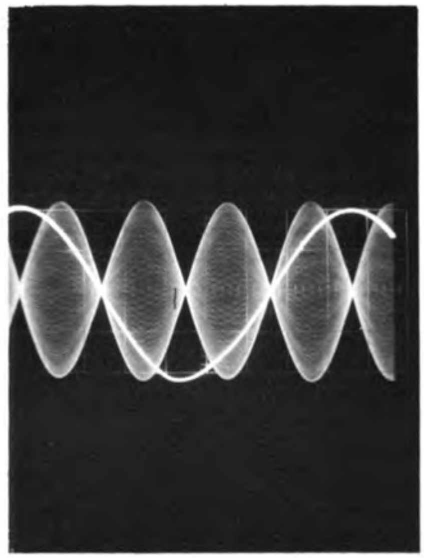


CONTROL SETTINGS	
1. CHANNEL A	0.05 V/CM, TP702
2. CHANNEL B	0.05 V/CM, TP701
3. MODE - ALTERNATE	
4. TRIGGERING MODE - AUTOMATIC TRIGGER SLOPE - + EXTERNAL	
5. SWEEP TIME/CM 5 USEC	
6. MAGNIFIER	X1, X5

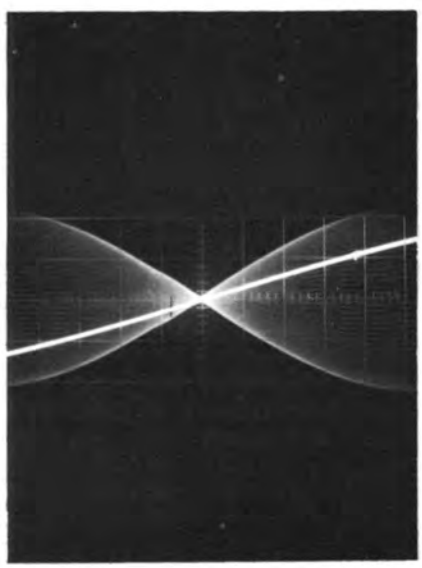
Figure 3-2. Pilot Carrier Phase Test Setup



MALADJUSTMENT OF PILOT CARRIER PHASE CONTROL.



PROPER ADJUSTMENT OF PILOT CARRIER PHASE CONTROL.



PROPER ADJUSTMENT OF PILOT CARRIER PHASE CONTROL, EXPANDED HORIZONTAL DEFLECTION.

Figure 3-3. Pilot Carrier Phase Adjustment, Oscilloscope Pattern

3.4.6 CHANNEL SEPARATION ADJUSTMENT.

Set the audio oscillator to 5000 cps, and connect it to the left audio input of the 786M-1. Connect the Tektronix oscilloscope with the type D plug-in unit to TP702 and ground, and adjust the audio oscillator for a 300-millivolt peak-to-peak indication on the oscilloscope. Adjust the CHAN SEP L+R AMPL control to produce a straight zero axis (within 4 millivolts) as shown in figure 3-4. Repeat with the audio input into the right audio channel. The final adjustment must bring the zero axis to within 4 millivolts of a straight zero axis.

3.5 MINIMUM PERFORMANCE STANDARDS.

3.5.1 OVER-ALL GAIN.

a. Connect the Tektronix oscilloscope to TP702 and ground.

b. Switch the PILOT CARRIER switch to OFF.

c. Connect the audio oscillator through 10-db pads to the 786M-1 in such a way to obtain an L=R signal (left channel equal in amplitude and phase with right channel).

d. Adjust the audio oscillator frequency to 1000 cps, and adjust the audio oscillator output to obtain 0 VU on the 786M-1 VU meter when the METER switch is set to L AUDIO or R AUDIO. The peak-to-peak indication on the oscilloscope shall be from 200 to 300 millivolts.

e. Connect the audio input so L= R- (right channel equal in amplitude but 180 degrees out of phase with the left channel). The peak-to-peak indication shall be from 200 to 300 millivolts.

3.5.2 FREQUENCY RESPONSE.

a. Connect the distortion analyzer between TP702 and ground.

b. Switch the PILOT CARRIER switch to OFF.

c. Connect the audio oscillator through 10-db pads to each channel in such a way to obtain an L=R signal (left channel equal in amplitude and in phase with right channel).

d. Adjust the audio oscillator frequency to 1000 cps, and adjust the audio oscillator output to obtain 0 VU on the 786M-1 VU meter when the METER switch is set to L AUDIO. Set the distortion analyzer to 0 db.

e. Set the audio oscillator to 50 cps, and adjust the audio level from the audio oscillator for 0 VU on the 786M-1 VU meter. The indication on the distortion analyzer shall be within ±0.5 db of the level at 1000 cps.

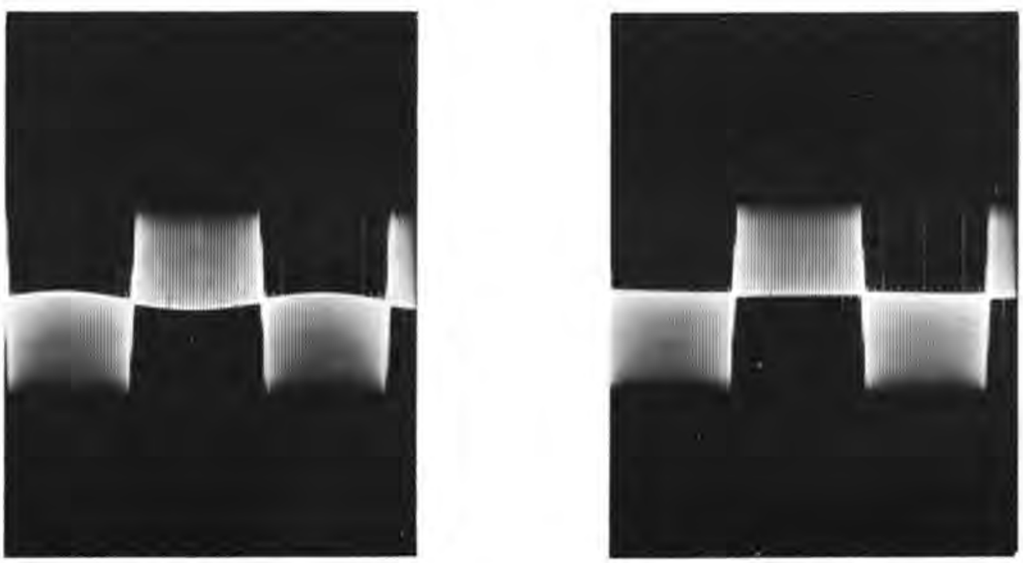
f. Repeat step e at 15,000 cps. The indication on the distortion analyzer shall be within ±1.5 db of the level at 1000 cps.

g. Repeat steps d, e, and f with the METER switch set at R AUDIO.

3.5.3 HARMONIC DISTORTION.

a. Connect the test setup as described in paragraph 3.5.2, steps a, b, and c.

b. The distortion at 50, 1000, and 15,000 cps should be not more than one percent.



MALADJUSTMENT OF CHANNEL SEPARATION L AND R AMPL CONTROL

PROPER ADJUSTMENT OF CHANNEL SEPARATION L AND R AMPL CONTROL.

Figure 3-4. Channel Separation Adjustment, Oscilloscope Pattern

SECTION IV
PARTS LIST

ITEM	DESCRIPTION	COLLINS PART NUMBER
	786M-1 STEREO GENERATOR	522-2914-00
C701	CAPACITOR, FIXED, ELECTROLYTIC: 30 uf -10% +100%, 10 vdcw	183-1377-00
C702	CAPACITOR, FIXED, ELECTROLYTIC: 50 uf -10% +100%, 25 vdcw	183-1379-00
C703	CAPACITOR, FIXED, ELECTROLYTIC: same as C701	183-1377-00
C704	CAPACITOR, FIXED, ELECTROLYTIC: same as C702	183-1379-00
C705	CAPACITOR, FIXED, ELECTROLYTIC: 250 uf -10% +100%, 12 vdcw; Sprague Electric part no. 30D157A1	183-1190-00
C706	CAPACITOR, FIXED, ELECTROLYTIC: same as C705	183-1190-00
C707	CAPACITOR, FIXED, ELECTROLYTIC: 15 uf -10% +100%, 25 vdcw; Sprague Electric part no. 30D183A1	183-1164-00
C708	CAPACITOR, FIXED, MICA: 6800 uuf ±10%, 300 vdcw	935-2110-00
C709	CAPACITOR, FIXED, PAPER: 0.047 uf ±10%, 400 vdcw; Sprague Electric part no. 160P47394	931-0295-00
C710	CAPACITOR, FIXED, PAPER: 0.1 uf ±10%, 400 vdcw; Sprague Electric part no. 160P10494	931-0299-00
C711	CAPACITOR, FIXED, ELECTROLYTIC: 20 uf -10% +100%, 25 vdcw; Sprague Electric part no. 40D181A2	183-1365-00
C712	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C713	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C714	CAPACITOR, FIXED, MICA: 1500 uuf ±5%, 500 vdcw; Electro Motive part no. DM20F152J	912-3327-00
C715	CAPACITOR, FIXED, FILM: 0.10 uf ±1%, 50 vdcw; Sprague Electric part no. 114P1041 R5S4	933-0279-00
C716 thru C719	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C720	CAPACITOR, FIXED, MICA: 510 uuf ±5%, 500 vdcw; Electro Motive part no. DM19E511J	912-2980-00
C721	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C722	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C723	CAPACITOR, FIXED, FILM: same as C715	933-0279-00
C724	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C725	CAPACITOR, FIXED, MICA: 10,000 uuf ±2%, 500 vdcw; Electro Motive part no. DM30F103G	912-2734-00
C726	CAPACITOR, FIXED, PAPER: same as C710	931-0299-00
C727	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C728	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C729	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
C730	CAPACITOR, FIXED, ELECTROLYTIC: 20 uf -10% +100%, 50 vdcw	183-1369-00
C731	CAPACITOR, FIXED, ELECTROLYTIC: same as C711	183-1365-00
CR701	NOT USED	
CR702 A, B, C, & D	SEMICONDUCTOR DEVICE, SET: four hermetically sealed matched germanium diodes; Hughes Products part no. MQ4032	353-2041-00
FL701	ATTENUATOR, FIXED: pre-emphasis network for u/in FM commercial broadcast equipment; 75 microseconds, 600 ohms input and output	379-0426-00
FL702	FILTER, HIGH PASS: metal encased, hermetically sealed, input 600 ohms, output 600 ohms, 4 solder-type terminals, continuous duty cycle; A. D. C. part no. D10390	673-0869-00
FL703	FILTER, LOW PASS: continuous duty cycle, input 600 ohms ±20%, output 600 ohms ±20%, metal encased, hermetically sealed; C. A. C. part no. 90-1015-00	673-0871-00
FL704	FILTER, LOW PASS: same as FL703	673-0871-00
FL705	FILTER, LOW PASS: linear, continuous duty cycle, input 600 ohms ±20%, output 600 ohms ±20%, metal encased, hermetically sealed; solder-type terminals; C. A. C. part no. 90-1012-00	673-0870-00
J701	JACK, TIP: insulated for u/w 0.080 in. test probes; brown; E. F. Johnson part no. 105-208-200	360-0152-00
J702	JACK, TIP: insulated for u/w 0.080 in. test probes; red; E. F. Johnson part no. 105-202-200	360-0150-00
K701	RELAY, ARMATURE: 4C contact arrangement; 0.25 amp, 300 v dc, 1 inductive winding, 250 ohms resistance, 27.5 vdc; 0.11 amp approx operating current; Aemco, Inc. part no. 94-3473	974-0127-00
L701	COIL, RADIO FREQUENCY: multilayer solenoid type winding; 2.3 ohms; -15°C to +55°C; 0.5 to 3.5 mh; Chicago Standard Transformer Corp. part no. WC-7	278-0734-00
L702	COIL, RADIO FREQUENCY: single layer wound, 10,000 uh, 66.5 ohms dc, 75 ma current rating; Delevan part no. 2500-76	240-2564-00
L703	COIL, RADIO FREQUENCY: same as L702	240-2564-00
L704	COIL, RADIO FREQUENCY: +15 to +55°C operating temp; 8 mh, 100 v rms	278-0713-00
M701	METER, AUDIO LEVEL: VU meter for use in equipments exposed to environments; background color, white	456-0056-00
O701	KNOB: setscrew type; black phenolic body; 1.125 in. dia by 0.843 in. thk; w/ skirt	546-1294-003
O702	KNOB: same as O701	546-1294-008
P701	PLUG, TELEPHONE: brass; phenolic insulation, w/ solder-lug terminal; Switchcraft part no. 3501MC	361-0062-00
Q701	TRANSISTOR: hermetically sealed NPN diffused silicon planar transistor; Fairchild Semiconductor Corp. part no. 2N1613	352-0349-00
Q702	TRANSISTOR: germanium; RCA part no. 2N1285	352-0243-00
Q703	TRANSISTOR: same as Q701	352-0349-00
Q704	TRANSISTOR: same as Q702	352-0243-00
Q705	TRANSISTOR: hermetically sealed, NPN silicon; Fairchild Semiconductor Corp. part no. 2N708	352-0322-00
Q706	TRANSISTOR: hermetically sealed, PNP germanium; General Electric part no. 2N1175A	352-0315-00
Q707	TRANSISTOR: same as Q706	352-0315-00
Q708	TRANSISTOR: same as Q702	352-0243-00
R701	RESISTOR, FIXED, FILM: 750 ohms ±1%, 1/4 w	705-7090-00
R702	RESISTOR, FIXED, FILM: same as R701	705-7090-00
R703	RESISTOR, VARIABLE, WIREWOUND: 10 ohms ±10%, 2 W	377-0113-00
R704	RESISTOR, FIXED, COMPOSITION: 3900 ohms ±10%, 1/2 w	745-1377-00
R705	RESISTOR, FIXED, COMPOSITION: 15,000 ohms ±10%, 1/2 w	745-1401-00
R706	RESISTOR, FIXED, COMPOSITION: 3300 ohms ±10%, 1/2 w	745-1373-00
R707	RESISTOR, FIXED, COMPOSITION: same as R704	745-1377-00
R708	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
R709	RESISTOR, FIXED, COMPOSITION: same as R706	745-1373-00
R710	RESISTOR, FIXED, FILM: 1330 ohms ±1%, 1/4 w	705-7102-00
R711	RESISTOR, FIXED, FILM: same as R710	705-7102-00
R712	RESISTOR, FIXED, COMPOSITION: 33,000 ohms ±10%, 1/2 w	745-1415-00
R713	RESISTOR, VARIABLE, COMPOSITION: 5000 ohms ±20%, 1/2 w	376-0205-00
R714	RESISTOR, FIXED, COMPOSITION: 10,000 ohms ±10%, 1/2 w	745-1394-00
R715	RESISTOR, FIXED, COMPOSITION: 120 ohms ±10%, 1/2 w	745-1314-00
R716	RESISTOR, FIXED, COMPOSITION: 4700 ohms ±10%, 1/2 w	745-1380-00
R717	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%, 1/2 w	745-1352-00
R718	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R719	RESISTOR, FIXED, COMPOSITION: 47,000 ohms ±10%, 1/2 w	745-1422-00
R720	RESISTOR, FIXED, COMPOSITION: selected in production	
R721	RESISTOR, FIXED, COMPOSITION: 180 ohms ±10%, 1/2 w	745-1321-00
R722	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
R723	RESISTOR, FIXED, COMPOSITION: 39 ohms ±10%, 1/2 w	745-1293-00
R724	RESISTOR, FIXED, FILM: 1,960 ohms ±1%, 1/4 w	705-7110-00
R725	RESISTOR, FIXED, FILM: 464 ohms ±1%, 1/4 w	705-7080-00
R726	RESISTOR, VARIABLE, WIREWOUND: same as R703	377-0113-00
R727	RESISTOR, FIXED, FILM: same as R725	705-7080-00
R728	RESISTOR, FIXED, FILM: same as R725	705-7080-00
R729	RESISTOR, FIXED, FILM: same as R725	705-7080-00
R730	RESISTOR, FIXED, FILM: same as R724	705-7110-00
R731	RESISTOR, FIXED, COMPOSITION: same as R706	745-1373-00
R732	RESISTOR, FIXED, COMPOSITION: 6800 ohms ±10%, 1/2 w	745-1387-00
R733	RESISTOR, FIXED, COMPOSITION: 150 ohms ±10%, 1/2 w	745-1317-00
R734	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
R735	RESISTOR, FIXED, FILM: 13,300 ohms ±1%, 1/4 w	705-7150-00
R736	RESISTOR, FIXED, COMPOSITION: 560 ohms ±10%, 1/2 w	745-1342-00
R737	RESISTOR, FIXED, COMPOSITION: same as R719	745-1422-00
R738	RESISTOR, FIXED, COMPOSITION: same as R736	745-1342-00
R739	RESISTOR, FIXED, COMPOSITION: same as R719	745-1422-00
R740	RESISTOR, FIXED, COMPOSITION: same as R714	745-1394-00
R741	RESISTOR, FIXED, FILM: 287 ohms ±1%, 1/4 w	705-7070-00
R742	RESISTOR, FIXED, COMPOSITION: 8200 ohms ±10%, 1/2 w	745-1391-00
R743	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R744	RESISTOR, FIXED, COMPOSITION: same as R717	745-1352-00
R745	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R746	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R747	RESISTOR, FIXED, COMPOSITION: same as R716	745-1380-00
R748	RESISTOR, VARIABLE: composition; 10,000 ohms ±30%, 1/4 w	376-4730-00
R749	RESISTOR, FIXED, COMPOSITION: same as R712	745-1415-00
R750	RESISTOR, FIXED, FILM: 562 ohms ±1%, 1/4 w	705-7084-00
R751	RESISTOR, FIXED, FILM: 261 ohms ±1%, 1/4 w	705-7068-00
R752	RESISTOR, FIXED, FILM: same as R751	705-7068-00
R753	RESISTOR, FIXED, COMPOSITION: same as R714	745-1394-00
R754	RESISTOR, FIXED, COMPOSITION: same as R714	745-1394-00
R755	RESISTOR, VARIABLE: composition, 250 ohms ±20%, 1/4 w	376-4725-00
R756	RESISTOR, FIXED, FILM: 619 ohms ±1%, 1/4 w	705-7086-00
R757	RESISTOR, FIXED, COMPOSITION: same as R736	745-1342-00
R758	RESISTOR, FIXED, COMPOSITION: same as R736	745-1342-00
R759	RESISTOR, FIXED, COMPOSITION: same as R723	745-1293-00
R760	RESISTOR, FIXED, COMPOSITION: 12,000 ohms ±10%, 1/2 w	745-1398-00
R761	RESISTOR, FIXED, FILM: same as R724	705-7110-00
R762	RESISTOR, FIXED, COMPOSITION: same as R717	745-1352-00
R763	NOT USED	
R764	RESISTOR, FIXED, COMPOSITION: selected in production	
R765	RESISTOR, FIXED, FILM: 5110 ohms ±1%, 1/4 w	705-7130-00
R766	RESISTOR, FIXED, FILM: same as R765	705-7130-00
R767	RESISTOR, FIXED, FILM: same as R765	705-7130-00
R768	RESISTOR, FIXED, FILM: same as R765	705-7130-00
R769	RESISTOR, FIXED, COMPOSITION: same as R717	745-1352-00
R770	RESISTOR, FIXED, COMPOSITION: same as R719	745-1422-00
R771	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
R772	RESISTOR, FIXED, COMPOSITION: same as R705	745-1401-00
R773	RESISTOR, FIXED, COMPOSITION: selected in production	
S701	SWITCH SECTION, ROTARY: 6 circuit, 6 pole, 3 position, 3 section, 45° detent & stops limiting rotation to 3 positions, phenolic insulation	379-1597-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
S702	SWITCH, TOGGLE: spdt; 40 amp continuous; 28 v dc, 20 amp resistive, 15 amp inductance; 115 v, 400 cps, 10 amp resistance, 10 amp inductance; Hetherington, Inc. part no. T1003-AN	266-3099-00
S703	SWITCH SECTION, ROTARY: 4 circuit, 4 pole, 7 position, 4 section, 30° detent & stops limiting rotation to 7 positions, phenolic insulation	379-1596-00
T701	TRANSFORMER, RADIO FREQUENCY, BALANCED: c/o plastic fabric base phenolic board 1/16 in. by 1-3/16 in. by 1-3/16 in.; plus 3 coils, 75 turns ea; coil #1, wound ccw, coils #2 & #3, cw; plus plastic rod 0.159 in. w by 0.413 in. dia	549-1639-003
TB701	TERMINAL BOARD: phenolic, barrier type w/ lug for back connection; 12 terminals	367-0020-00
TB702	TERMINAL BOARD: bakelite, 4 terminals, 3/8 in. by 1/2 in. by 1-1/2 in.; Cinch Mfg. Corp. part no. 1534-A	306-2240-00
TB703	TERMINAL BOARD: same as TB702	306-2240-00
TB704	TERMINAL BOARD: 4 solder-lug terminals, brass; 3/8 in. by 1-1/2 in. overall	306-0698-00
TB705	TERMINAL BOARD: phenolic, 4 brass solder lug terminals; 1/16 in. by 3/8 in. by 1-1/2 in.; Cinch Mfg. Corp. part no. 1532A	306-9032-00
TB706	TERMINAL BOARD: phenolic, 3 solder-lug terminals; 11/16 in. by 1-1/8 in. lg	306-0587-00
TB707	TERMINAL BOARD: same as TB706	306-0587-00
TB708	TERMINAL BOARD: same as TB702	306-2240-00
TB709	TERMINAL BOARD: phenolic, 5 brass solder lug terminals; 1/16 in. by 3/8 in. by 1-7/8 in.; Cinch Mfg. Corp. part no. 1542-A-FV	306-0951-00
TB710	TERMINAL BOARD: same as TB702	306-2240-00
TB711	TERMINAL BOARD: laminated phenolic w/ 4 solder lug terminals; 27/32 in. w by 1-1/2 in. lg; Cinch Mfg. Corp. part no. 1909	306-0838-00
TB712	TERMINAL BOARD: same as TB702	306-2240-00
TB713	TERMINAL BOARD: same as TB706	306-0587-00
TB714	TERMINAL BOARD: same as TB711	306-0838-00
TB715	TERMINAL BOARD: same as TB711	306-0838-00
TB716	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1520-A	306-9033-00
TB717	TERMINAL BOARD: phenolic w/ 3 solder-lug terminals; 11/16 in. w by 1-1/8 in. lg; Cinch Mfg. Corp. part no. 1525A	306-0001-00
TB718	TERMINAL BOARD: same as TB704	306-0698-00
TB719	TERMINAL BOARD: same as TB702	306-2240-00
TB720	TERMINAL BOARD: same as TB717	306-0001-00
TB721	TERMINAL BOARD: same as TB704	306-0698-00
TB722	TERMINAL BOARD: 12 terminals, brass, 4.125 in. by 5.1875 in. overall; phenolic board; Cinch Mfg. Corp. part no. 12-160-AL	367-1385-00
XFL701	SOCKET, ELECTRON TUBE: 8 prong octal tube socket w/ steel mtg plate; Amphenol-Borg Electronics part no. 88-8TM	220-1005-00
XQ701	SOCKET, TRANSISTOR: 3 contacts spaced on 0.200 in. dia circle; Elco Corp. part no. 3307X	352-9903-00
XQ702	SOCKET, TRANSISTOR: 4 contacts spaced on 0.200 in. dia circle; Elco Corp. part no. 3307	352-9902-00
XQ703	SOCKET, TRANSISTOR: same as XQ701	352-9903-00
XQ704	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XQ705	SOCKET, TRANSISTOR: same as XQ701	352-9903-00
XQ706	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XQ707	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XQ708	SOCKET, TRANSISTOR: same as XQ702	352-9902-00
XY701	SOCKET, CRYSTAL: 2 regularly spaced contact positions, 0.486 in. c to c ea contact, 0.243 in. from center; cadmium plated phosphor bronze or beryllium copper; Hugh H. Eby part no. 8879	292-0082-00
Y701	CRYSTAL UNIT, QUARTZ: 38,000 kc; type CR-50/U	289-1490-00

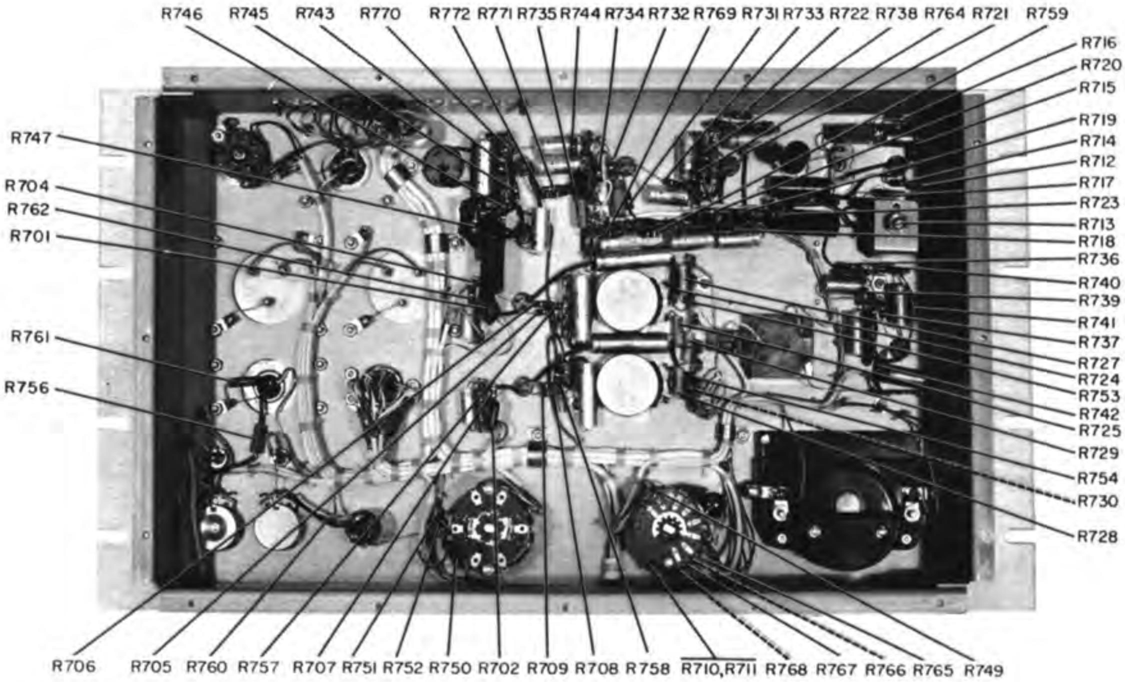


Figure 4-1. 786M-1 Stereo Generator, Rear View, Resistor Location

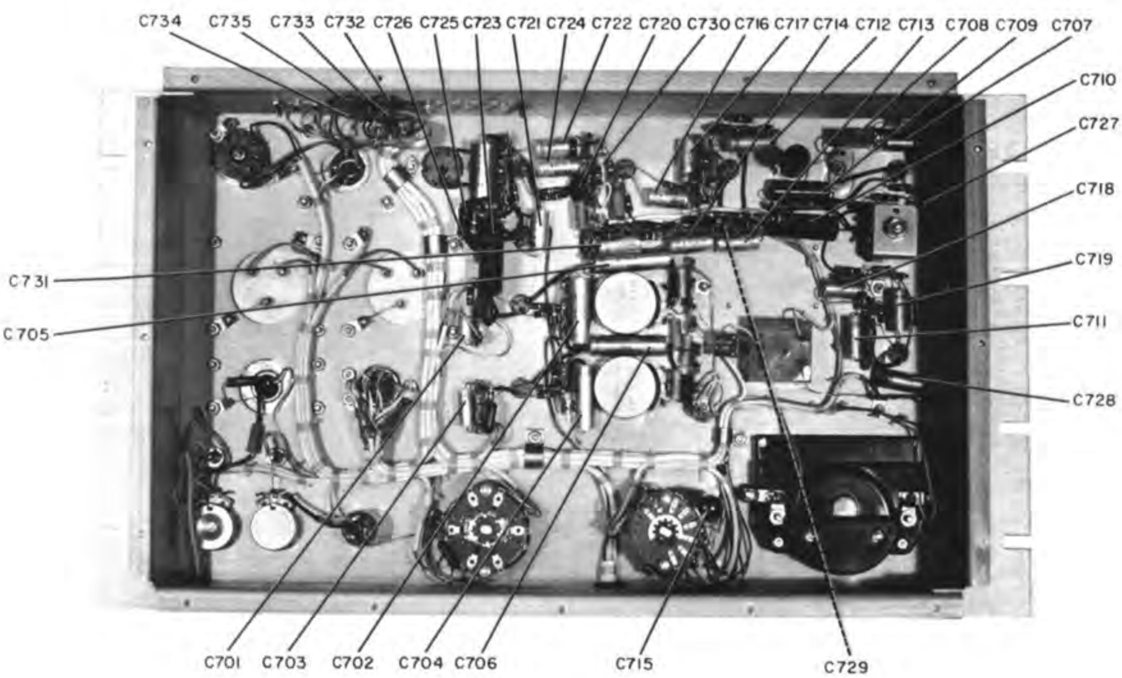


Figure 4-2. 786M-1 Stereo Generator, Rear View, Capacitor Location

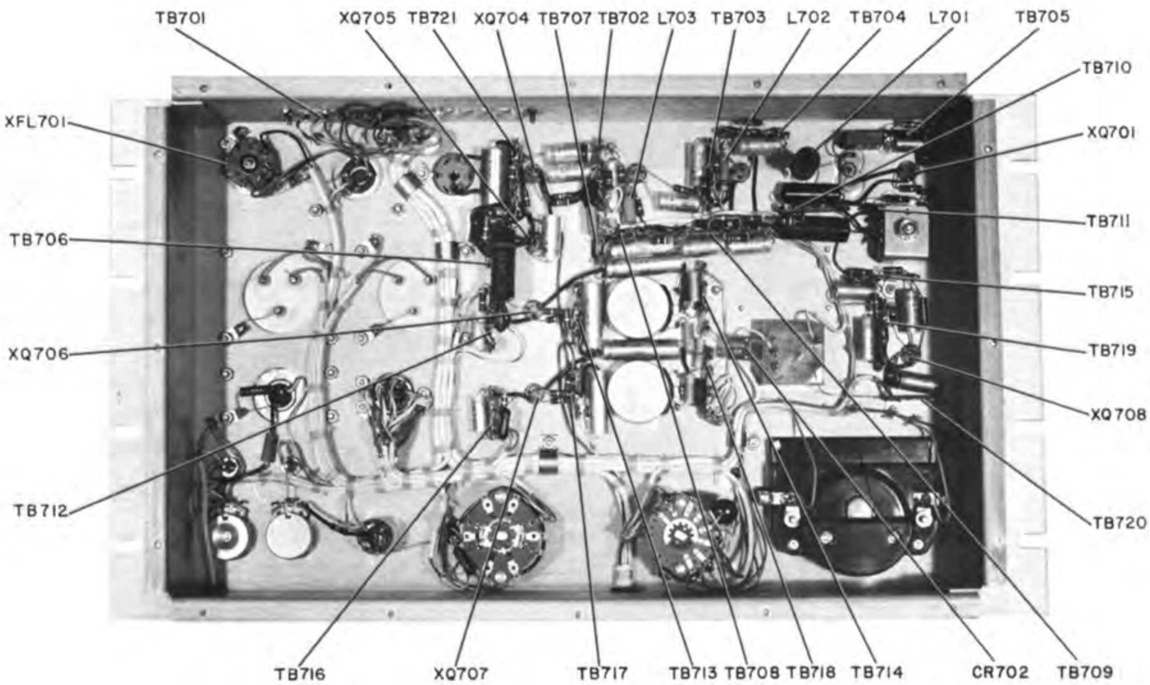


Figure 4-3. 786M-1 Stereo Generator, Rear View, Miscellaneous Parts Location

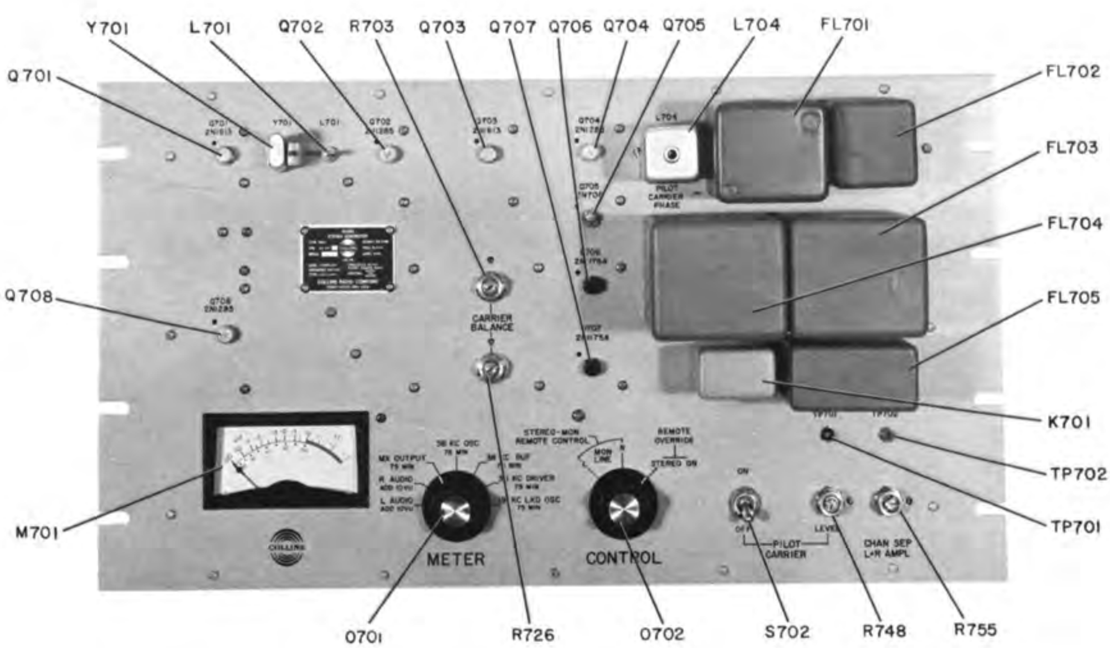
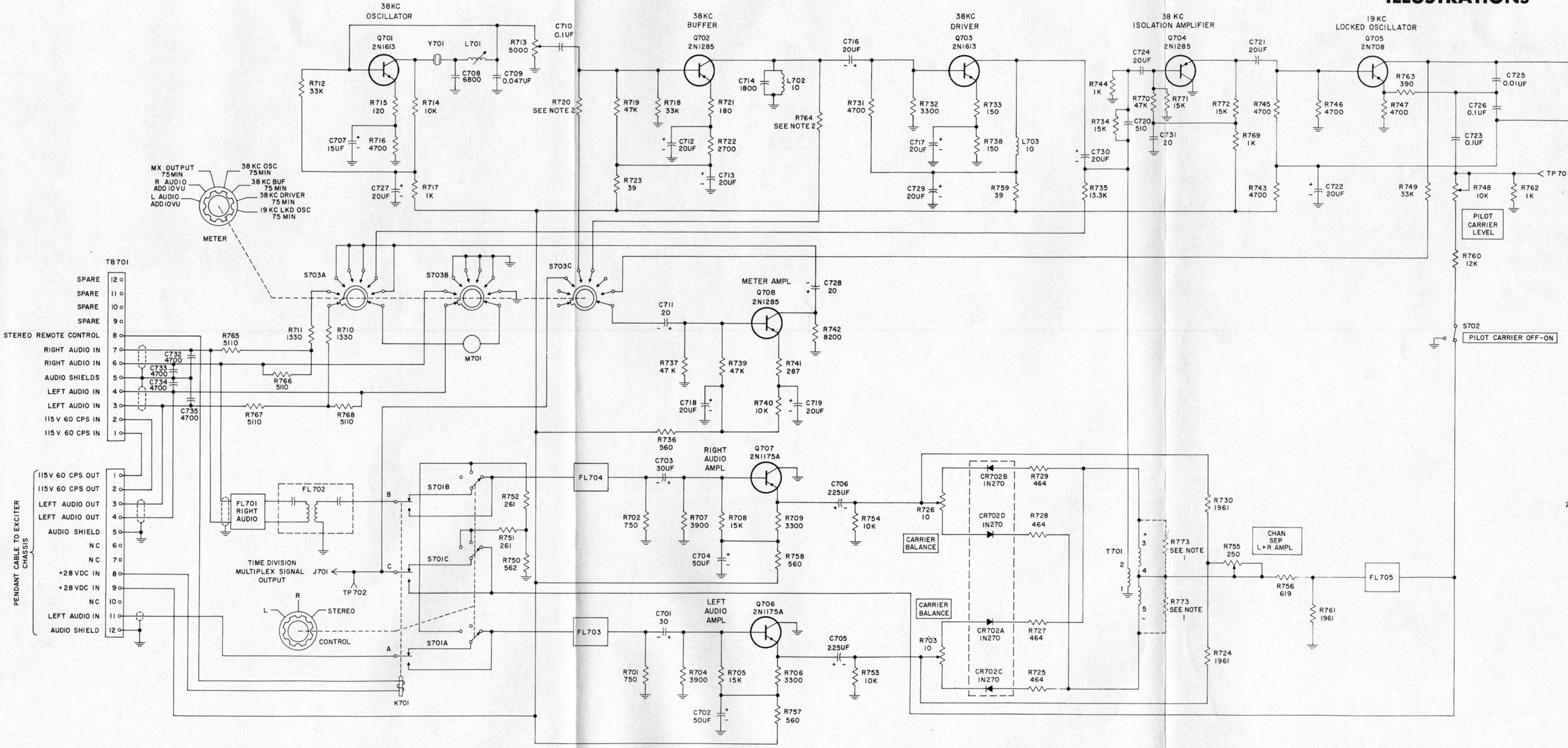


Figure 4-4. 786M-1 Stereo Generator, Front View Parts Location

SECTION V
ILLUSTRATIONS



NOTES:
1. THE VALUE OF RESISTOR R773 IS DETERMINED IN PRODUCTION. IN SOME UNITS THIS RESISTOR MAY BE OMITTED.
2. THE VALUES OF RESISTORS R720 AND R764 ARE DETERMINED IN PRODUCTION.

Figure 5-1. 786M-1 Stereo Generator, Schematic Diagram