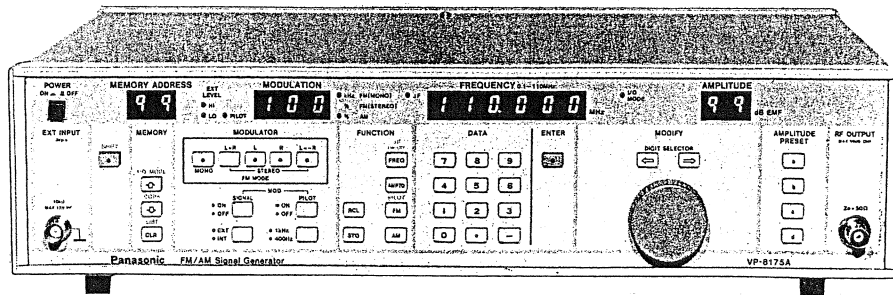


# Service Manual

FM/AM SIGNAL GENERATOR

VP-8175A



**Panasonic**

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## W A R N I N G

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It does not contain warnings or cautions to advise non-technical individuals of potential dangers in attempting to service a product.

Products powered by electricity should be serviced or repaired only by experienced professional technicians. Any attempt to service or repair the product or products dealt with in this service information by anyone else could result in serious injury or death.

## CONTENTS

1. GENERAL.....	1-1
1.1 DESCRIPTION.....	1-1
1.2 STEREO SYSTEM.....	1-1
2. SPECIFICATION.....	2-1
3. CIRCUIT DESCRIPTION.....	3-1
3.1 COUNTER ASSY.....	3-1
3.2 RF & ATT ASSY.....	3-4
3.3 MODULATOR ASSY.....	3-5
4. ADJUSTMENT.....	4-1
4.1 POWER SUPPLY CHECK.....	4-2
4.2 MODULATOR ADJUSTMENT.....	4-3
4.3 COUNTER UNIT ADJUSTMENT.....	4-5
4.4 RF UNIT ADJUSTMENT.....	4-5
4.5 OVERALL ADJUSTMENT.....	4-6
4.6 FREQUENCY ACCURACY CHECK.....	4-9
4.7 ATTENUATOR ADJUSTMENT.....	4-10
4.8 PARTS LOCATION.....	4-12
5. PARTS LIST.....	5-1
6. CIRCUIT DIAGRAMS.....	6-1

## 1.GENERAL

### 1.1 DESCRIPTION

The VP-8175A is a standard signal generator which generates CW, FM and AM signals in the frequency range of 100kHz to 110MHz. It also has a built-in stereo modulator based on the FM stereo broadcasting system.

Frequencies between 30 and 110MHz are generated through direct fundamental oscillation and those between 100kHz to 29.9999MHz are through heterodyne downconversion. Every frequency generated is synchronized with the reference crystal oscillator and is settable with resolutions of 100Hz in 100kHz to 30 MHz range and 1kHz in 30 to 110MHz range. The  $\Delta F$  function directly reads increment and decrement (detuning frequencies) from the reference frequency.

The output amplitude can be set in 1dB increment between -19 to 99dB.

The generator provides FM and AM modulation by using internal or external modulation signals. Stereo modulation is also available by the built-in composite stereo signal generator based on the FM stereo broadcasting system. The built-in generator allows an easy selection of a modulation mode on the operation panel.

The VP-8175A has two types of preset functions: the assorted preset that stores and recalls up to 100 sets of parameters (frequency, modulation, and output amplitude) and the independent preset that stores and recalls up to four output amplitude alone. The setting is made with the numeric input keys and the MODIFY knob. Battery backup is provided so that the setting are retained even after the power has been turned off.

For remote control, the unique EXT CONTROL I/O function are provided.

These features make the VP-8175A not only a highly efficient instrument which streamlines the production and inspection of high-performance FM-AM receivers, transmitters, elements, parts, and other components, but also a good general purpose signal generator for use in maintenance, research, and development applications.

### 1.2 STEREO SYSTEM

#### (1) Stereo broadcasting

FM broadcasting is generally based on the suppressed carrier AM-FM system as shown in Fig.1-1.

The system has been approved by the FCC (Federal communications Commission),



EBU (European Broadcasting Union). In Japan, it has been recommended by the Radio Wave Committee of the Ministry of Posts and Telecommunications. The SCA (Subsidiary Communications Authorization) channel indicated by the dotted lines in Fig.1-1 is specified by the FCC, while they have been excluded by the EBU. In Japan the channel is termed secondary subchannel.

The VP-8175A functions both as a stereo modulator shown enclosed in the dotted line and a standard signal generator.

## (2) Modulation mode

The stereo modulator section provides one out of the four modulation modes (a) to (d) below by single modulating signal.

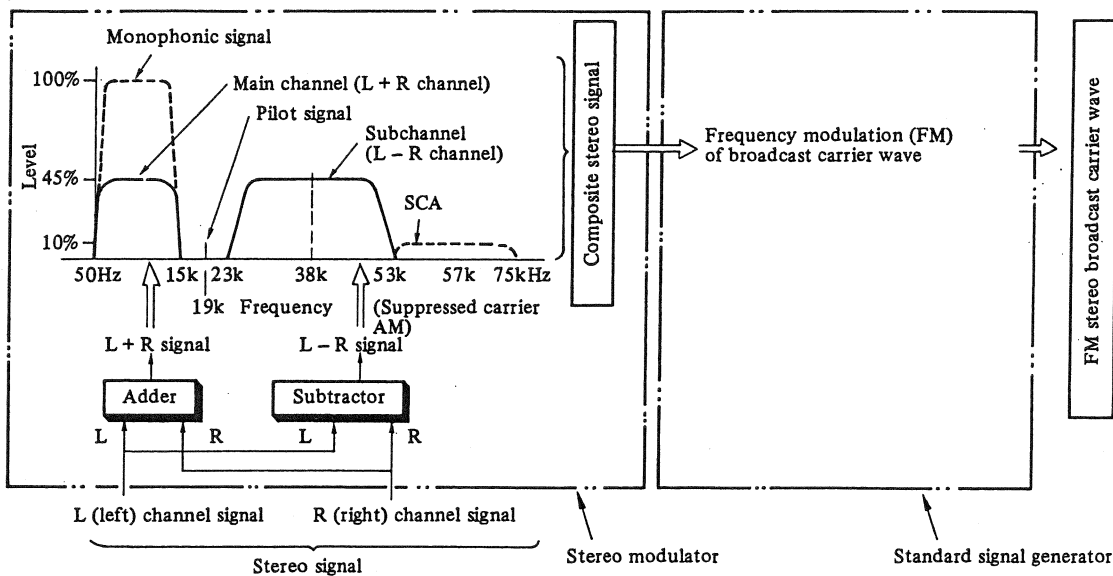


Fig.1-1 FM Stereo Broad casting

### (a) L=R mode

A composite stereo signal obtained by applying the identical test tone signals in the same phase to both the L and R terminals in Fig1-1. The signal is composed of the main channel signal and the pilot signal components only.

## (b) L mode

A composite stereo signal obtained by applying a test tone signal only to the L terminal in Fig.1-1. The signal is composed of the main and sub channel components of the same level and the pilot signal component.

If demodulated through a stereo receiver, the signal is obtained in the L channel only.

## (c) R mode

A composite stereo signal obtained by applying a test tone signal only to the R terminal in Fig.1-1. The signal composition is the same as that in the L mode with L and R reversed.

If demodulated through a stereo receiver, the signal is obtained in the R channel only.

## (d) L=-R mode

A composite signal obtained by applying the identical test tone signals in the opposite phase to the L and R terminals. The signal is composed of the sub-channel signal and pilot signal component only.

As test tone signals for the above four modes, the internal 400Hz/1 kHz sine wave or external 50Hz to 15kHz signal are available.

## (3) Modulation factor, pilot level

The VP-8175A indicates the FM stereo modulation factor and pilot level independently of each other.

In the modulation factor indication, only the FM deviation component caused by the main and subchannel components of the composite signal is shown with the pilot level ignored. In the pilot level indication, only the FM deviation component by the pilot signal is shown with the modulation indication level for the composite signal ignored. The FM stereo modulation factor and pilot level cannot be indicated at the same time.

The stereo modulation factor is expressed as; 100% =67.5kHz deviation. Setting can be made in the range 0 to 133 % in 1 % steps.

The pilot level is expressed as; 10 % =7.5kHz deviation. Setting can be made in the range 0 to 15 % in 1 % steps.

## (4) SCA (Suppressed Carrier AM) input

The VP-8175A has an SCA input terminal. When a signal applied to this

terminal, the RF output signal is modulated independently of the modulation operation of the generator. Do not therefore apply any signal to the SCA terminal unless the SCA signal is required. A 0.56 Vp-p SCA input signal produces the FM deviation of 7.5 kHz. Keep this value during the SCA application, since the instrument has no indication for SCA.

(5) Composite signal output

The VP-8175A has a COMP OUTPUT terminal from which the composite stereo signal can be acquired. Output level is about 5 Vp-p when the modulation factor is 100 % and the pilot level is 10 %. Since the output level changes with the RF frequency setting, keep the RF frequency at a certain level when using the composite stereo signal alone.

## 2. SPECIFICATIONS

Designation	Performance	Conditions or Remarks
<u>RF FREQUENCY</u>		
Range	0.1 to 110MHz	
Normal display	0.1000 to 29.9999MHz 30.000 to 110.000MHz	
$\Delta F$ display	-0.9999 to 0.9999MHz  -0.999 to 0.999MHz	Within the range of 0.1 to 29.9999MHz  Within the range of 30 to 110MHz
Resolution	100 Hz 1 kHz	RF < 30MHz RF $\geq$ 30MHz
Accuracy	$\pm (5 \times 10^{-5} + 1 \text{ count})$	
<u>RF OUTPUT</u>		
Range	-10 to 99dB EMF	0dB EMF = 1 $\mu$ V
Display range	-19 to 99dB	
Resolution	1dB	
Reference level	99dB EMF	
Accuracy	$\pm 1$ dB	
Attenuator accuracy	$\pm 1.5$ dB $\pm 2$ dB	$\geq 0$ dB EMF < 0dB EMF
Output impedance	50 $\Omega$	
VSWR	< 1.2	$\leq 66$ dB EMF
Spurious output		
Harmonics	$\leq -30$ dBc	
Non-harmonically related	None $\leq -30$ dBc $\leq -40$ dBc	RF $\geq 30$ MHz RF < 30MHz RF < 30MHz and measured in the frequency range below 30MHz

Designation	Performance	Conditions or Remarks
<u>RF OUTPUT (Cont'd)</u>		
Residual modulation (S/N)		
FM component	$\geq 76\text{dB}$ $\geq 73\text{dB}$	$76\text{MHz} \leq \text{RF} \leq 108\text{MHz}$ All range As S/N relative to 75kHz deviation, with post-detection BW of 50Hz to 15kHz and with 50 $\mu\text{s}$ de-emphasis (exclude beat components close to RF 16,20 and 26.7MHz)
AM component	$\geq 55\text{dB}$	As S/N relative to 30% AM with post-detection BW of 50Hz to 15kHz (exclude beat components close to RF 16,20 and 26.7MHz)
<u>MODULATION</u>		
Internal modulation frequency	400Hz, 1kHz within $\pm 3\%$	
External modulation input impedance	Approx. 10k $\Omega$	
External modulation input level required	Approx. 3Vp-p	
Display range/resolution		
AM depth	0 to 60%/1%	
FM deviation	0 to 99.5kHz/0.5kHz	
FM stereo	0 to 133%/1%	
Pilot level	0 to 15%/1%	
Accuracy		
AM depth	$\pm(0.08 \text{ of reading} + 2)\%$	
FM deviation	$\pm(0.08 \text{ of reading} + 0.5)\text{kHz}$	
FM stereo	$\pm(0.08 \text{ of reading} + 0.5)\%$	
Pilot level	$\pm(0.08 \text{ of reading} + 1)\%$	

Designation	Performance	Conditions or Remarks
<u>MODULATION (Cont'd)</u>		
Amplitude modulation		
Modulation depth	0 to 60%	
Distortion	$\leq 0.5\%$ $\leq 1.5\%$	$0.15 \leq RF < 30\text{MHz}$ $RF \geq 30\text{MHz}$ At 30% AM, with 1kHz rate and with post-detection BW of 50Hz to 15kHz (exclude beat components close to RF 16,20 and 26.7MHz)
Frequency response	20Hz to 10kHz within $\pm 1\text{dB}$	with reference to 1kHz
Incidental FM	$\leq 150\text{Hz}$ $\leq 300\text{Hz}$	$1 \leq RF < 30\text{MHz}$ $30 \leq RF \leq 108\text{MHz}$ At 30% AM, with 1kHz rate
Frequency modulation		
Frequency deviation	0 to 99.5kHz	
Distortion	$\leq 0.05\%$  $\leq 0.1\%$	$RF 10.7 \pm 1\text{MHz}$ and 76 to 108MHz $RF \geq 0.2\text{MHz}$ At 75kHz deviation, with 1kHz rate and with post-detection BW of 50Hz to 15kHz and with 50 $\mu\text{s}$ de-emphasis (exclude beat components close to RF 16,20 and 26.7MHz)
Frequency response	20Hz to 80kHz within $\pm 1\text{dB}$	with reference to 1kHz
Incidental AM	$\leq 0.5\%$	$RF 10.7 \pm 1\text{MHz}$ and 76MHz to 108MHz At 75kHz deviation, with 1kHz rate

Designation	Performance	Conditions or Remarks
<u>MODULATION (Cont'd)</u>		
FM stereo modulation		RF $\geq 76$ MHz
Stereo mode	Four modes (L=R, L,R, L=-R) by internal or external single tone	
Modulation factor	0 to 100%	100% = 67.5 kHz deviation
Stereo separation	$\geq 55$ dB $\geq 40$ dB	$400 \text{ Hz} \leq \Delta F \leq 1 \text{ kHz}$ $50 \text{ Hz} \leq \Delta F \leq 15 \text{ kHz}$
Frequency response	50 Hz to 15 kHz within $\pm 1$ dB	with reference to 1 kHz
Pilot signal		
Frequency	19 kHz $\pm 1$ Hz	
Level/resolution	0 to 15%/1%	1% = 0.75 kHz deviation
SCA input		
Level required	Approx. 0.56 Vp-p	10% FM = 7.5 kHz deviation
Frequency response	20 to 75 kHz within $\pm 1$ dB	with reference to 57 kHz
<u>PRESET FUNCTION</u>		
Number of memory registers		
Assorted preset	100: memory address 00 to 99	
Independent amplitude preset	4: amplitude preset keys a to d	
Item to be stored to assorted preset at a time	1) Frequency 2) Amplitude 3) Modulation setups (AM/FM/FM stereo/PILOT) 4) Mod. signal ON/OFF 5) PILOT ON/OFF 6) Internal 400 Hz/1 kHz 7) Mod. source INT/EXT 8) FM mode selection (MONO/L=R/L/R/L=-R) 9) Function keys selection (FREQ/AMPTD/FM/AM/PILOT) 10) Ext. control signal	

Designation	Performance	Conditions or Remarks
<u>EXT CONTROL I/O</u> <u>INTERFACE</u>	1) Sequential memory recall 2) Direct memory recall 3) Modify control 4) Control signal output 5) Memory copy 6) Memory list output	
<u>OTHERS</u> Leakage Power requirements Main voltages  Main frequency Power consumption Ambient temperature and humidity (R.H.) Limit range of guaranteed performances Limit range of operation Storage and transportation Dimensions Mass	Will not interface with measurement of $1\mu V$  100V: 90 to 112V 120V: 106 to 132V 220V: 196 to 244V 240V: 214 to 250V  50/60Hz 30VA or less  10 to 35°C, 85% or less 0 to 40°C, 90% or less -20 to 70°C, 90% or less  426mm(W), 99mm(H), 250mm(D) Approx. 8 kg	excluding legs, knobs, etc.



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Designation	Performance	Conditions or Remarks
<u>ACCESSORIES FURNISHED</u>	Output cable (VQ-027C) .. 1	
	Power cable ..... 1	
	Spare fuse ..... 1	
	Instruction manual ..... 1	

### 3. CIRCUIT DESCRIPTION

The VP-8175A consists of the COUNTER, RF & ATT and MODULATOR circuits, which are controlled by the CPU.

The counter circuit is looped so that the frequency displayed on the front panel and that of the RF oscillator are matched. The RF oscillator circuit consists of three voltage variable type oscillators and a fixed oscillator and is capable of generating frequencies 100 kHz through 110 MHz.

Maximum RF output voltage is 99 dB (open termination, 0 dB=1  $\mu$ V) and controlled by the 118 dB variable attenuator. The modulation mode is selectable out of CW, AM, FM and stereo. The 400 Hz/1 kHz internal oscillator or an external AF signal may be used as the modulation signal.

#### 3.1 Counter Assy

See Fig.3-4 and COUNTER ASSY [A5] circuit diagram. This circuit conducts phase comparison of the 50 Hz signal obtained by counting down the RF frequency with the 50 Hz signal obtained by dividing the 16 MHz reference frequency. Phase difference obtained is converted to a pulse width and integrated for generating the  $V_t$  voltage. The  $V_t$  voltage is sent to the RF oscillator as the feedback information for frequency control. The phase comparison is repeated aiming at "0" phase difference.

##### (1) RF count down

Transistors Q1, Q2 and Q3 form the low-impedance, RF sample signal amplifier. The RF sample signal is connected to the 1/20 divider of U12 (high-speed prescaler) and the 1/2 divider of U10-12 (JK flip flop).

The F RANGE signal goes high when the RF sample signal is between 30 and 110 MHz while it goes low when the RF sample signal is between 0.1 and 30 MHz.

When the F RANGE signal is high, the 1/20 divider is activated. When it is low, the 1/2 divider is activated. As for U1 through U6 (presetable down counter), data are entered into 1A through 6B when the LOAD input is low. When a sample signal is connected to the count-down input, the counter begins counting down. When all of U1 through U6 become "0", the BORROW output of U1-13 goes low. At this time, the RF sample frequency becomes approximately 50 Hz as the result of the count down operation.

## (2) Reference frequency divider

The 50 Hz is obtained by dividing the reference frequency from Y1 (16 MHz crystal oscillator). The 4-bit binary counter U19 acts as a 1/16 divider. Dual decade counters U20 and U21 act as 1/100 dividers. Dynamic flip flop U17 acts as a 1/2 divider.

## (3) Phase comparator

The phase comparator compares the BORROW output (50 Hz) obtained by count down operation and the counter output (50 Hz) from the reference frequency divider. Phase difference is converted to a pulse width and further converted to a negative pulse when the frequency display is  $+\Delta F$  or to a positive pulse when it is  $-\Delta F$ .

U15-8 (NAND) goes low when the counter consisting of U1 through U6 is being activated while U15-6 (NAND) goes high during the period. When both CLR input of U16-13 and U16-10 (JK flip flops) go low, the Q output of U10-5 (JK flip flop) goes high and the phase comparator is reset.

Fig. 3-1 shows the relationship between the RF frequency and the pulse width.

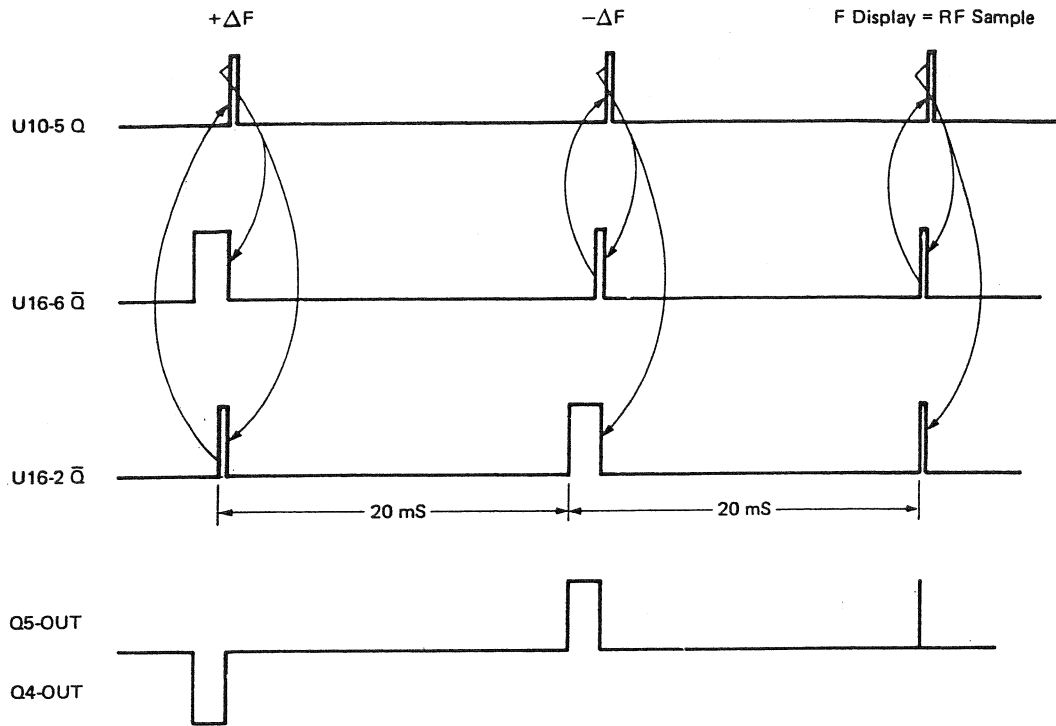


Fig.3-1 Phase Comparator Timing Chart

## (4) Vt output circuit

The pulse voltage from the phase comparator is converted to the corresponding DC voltage by the integrator. The DC voltage is supplied to the RF oscillator as a Vt signal. When the frequency exceeds the upper or lower F RANGE limit, the blinking oscillator is activated to blink the value on the frequency display.

The operational amplifier U7 is an inverted input integrator, its input resistor is selected out of R51, R54, R56 and R57 for adjusting the gain. The quad bilateral switch U14 selects an input resistor. Its input pins 5, 6, 12 and 13 are activated when the input is high or deactivated when it is low. U13 (OR) selects loading data to U1 and U2 (presettable down counter), of which output is connected to U14.

The operational amplifiers U25-1 and U25-2 are the comparators for the F RANGE upper and lower limit, respectively. Since the comparators are open loop amplifiers, the output is inverted when deviation between the reference and  $V_t$  signal levels is some hundreds mV or more. The normal output is a low signal.

The operational amplifier U25-14 is the inverted input blinking oscillator. When input from the comparator goes high, the CAUTION signal alternates low and high levels. This signal is connected to the frequency display decoder.

### 3.2 RF & ATT Assy

See Fig. 3-5 and RF & ATT Assy [A6] circuit diagram. The assembly has three voltage controlled oscillators, an 80 MHz crystal oscillator a mixer for generating 100 kHz through 30 MHz RF frequency, an RF amplifier, an attenuator and ALC loop. The FM function is included in the voltage controlled oscillator section and the AM in the ALC section.

One of the L, M, or H input of the voltage controlled oscillator (VCO) is always high. When the L input goes high, 30 MHz to 47.9 MHz VCO Q31 and Q32 oscillate. The VCOs are push-pull type and the oscillation time constant is determined by center tap coil L1 and variable diodes CR35 through CR44. A frequency between 30 MHz and 47.9 MHz is obtained by changing the sync voltage  $V_t$ . The closer to  $-ΔV$  the  $V_t$  gets, the higher the frequency becomes. The AF signal is superposed on the  $V_t$  line and FM deviation is applied to the RF signal for the FM input.

When the F RANGE input is low, 74 MHz to 110 MHz VCO Q41 and Q42 and 80 MHz crystal oscillator Q11 are activated and double balanced mixer U1 begins its operation. When 30 MHz to 110 MHz gate switch Q7 turns off, 100 kHz to 30 MHz gate amplifier switch Q8, Q12 and Q13 is activated. Thus, RF frequencies 100 kHz through 30 MHz are obtained.

The ALC loop acts as the output level deviation controller, AM modulator and 1 dB attenuator. The loop consists of C31, CR4, U2 and CR3 or Q9 and Q10 controls CR3 or CR5. The pin diodes CR3 and CR5 act as pure resistor elements for the RF signal and their resistances are varied by the bias voltage (ALC voltage). The AF signal is superposed on the ALC loop and the RF signal is AM modulated for the AM input. The AM input is also used as a 1 dB attenuator control signal.

The output is adjusted to the desired level by combining 2, 4, 6, 8, 16, 32 and 64 dB attenuators. Each attenuator control input is on when the input signal is high.

### 3.3 Modulator Assy

See Fig.3-6 and MODULATOR ASSY [A2] circuit diagram.

- (1) Inversion type EXT AF input amplifier U3 is connected to the EXT IN connector on the front panel and amplifies the external AF signal.
- (2) The bridged T-type circuitry is used for the 400 Hz/1 kHz AF oscillator. The oscillation time constant is determined by R1 through R5, R6, C1 and C2. Analog switch U2 selects the frequency to be used. When the switch is on, R2 and R3 are shorted and 1 kHz is selected. The amount of the positive feedback is determined by Q1, R7, R8, CR2 and CR3.
- (3) The switch selects one of the two signals and the selected signal is used as the modulation signal.
- (4) For modulation control, A/D converter U4 controls the modulation signal amplitude.
- (5) At buffer amplifier U6-1, the L signal amplitude circuit is connected to the L signal switching and R signal amplitude circuits in the next stage.
- (6) R signal amplitude amplifier U6-2 inverts and amplifies the L signal, and is connected to the R signal switching circuit in the next stage. Trimmer capacitor C12 compensates the phase against the L signal while variable resistor R28 compensates the amplitude.

(7) The modulator circuit mainly consists of the L signal switching, R signal switching, mixer, amplifier, low-pass filter, analog switch U10 and phase inversion amplifier U16. See Fig. 3-2 for the switching and mixer block diagram while proceeding to the following description.

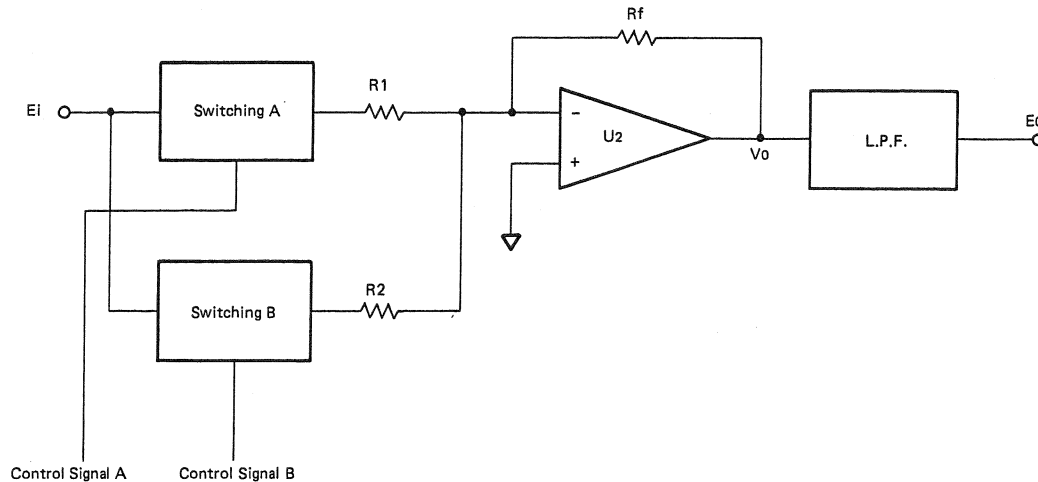


Fig. 3-2 Switching and Mixer Circuit

U2 is the phase inversion amplifier. The current mixer consists of Rf, R1 and R2. When resistors R1 and R2 are set to  $R1 \neq 2 \times R2$ , the output ratio of U2 is:

o When switch A is off and switch B is on:

$$E_o \doteq E_i \cdot R_f / R_2 \dots \dots \dots x1$$

o When switch A is on and switch B is off:

$$E_o \doteq E_i \cdot R_f / R_1 \doteq E_i \cdot R_f / 2R_2 = 1/2 \cdot E_i \cdot R_f / R_2 \dots \dots \dots x1/2$$

o When both switches A and B are on:

$$E_o \doteq E_i (R_f / R_2 + R_f / R_1) \doteq E_i \cdot 3R_f / 2R_2 = 3/2 \cdot E_i \cdot R_f / R_2 \dots \dots \dots x3/2$$

o When both switches A and B are off:

$$E_o \doteq E_i (R_f / \infty + R_f / \infty) \doteq E_i \cdot 0 \dots \dots \dots x0$$

Consequently, output voltage waveform  $E_o$  is as shown in Fig.3-3 when  $E_i$  voltage is applied to the input.

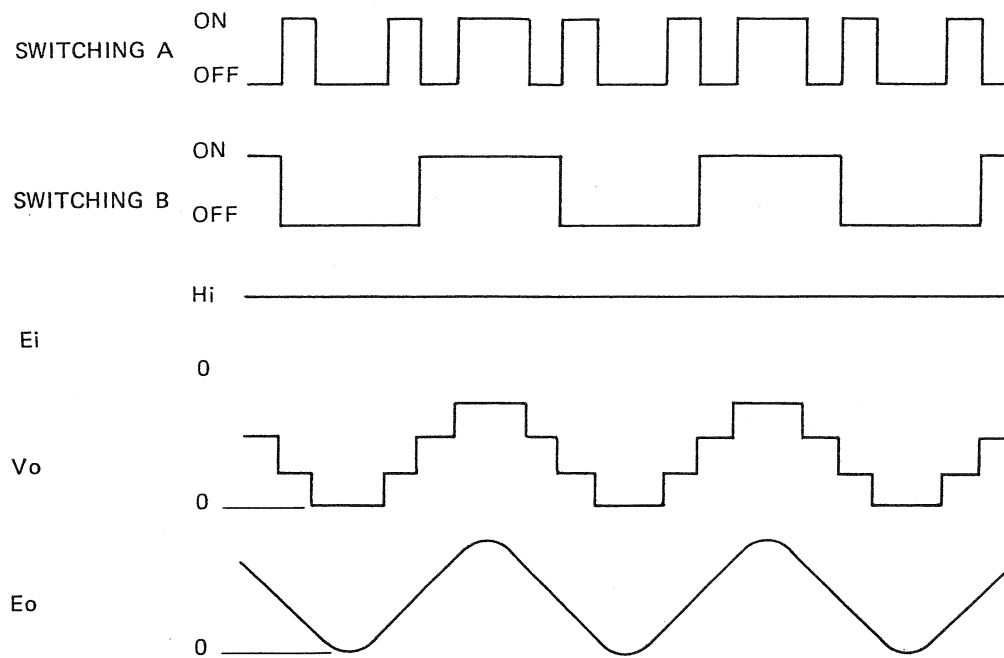


Fig.3-3 Output Voltage Waveform by Switch Setting

As shown in the  $V_o$  waveform, the waveform is made similar to the sinewave, achieving low distortion. The  $V_o$  signal is passed through the low-pass filter to obtain low distortion  $E_o$  signal.

- (8) The output signal is distributed to the COMPOSITE OUTPUT connector on the rear panel and FM and AM signal amplifier circuits. It is compensated to obtain the FM and AM modulation signals which are supplied to RF & ATT ASSY [A6].
- (9) The 14.592 MHz oscillator circuit is installed in the shielded casing with the COUNTER ASSY[A5]. The circuit contains the 14.592 MHz oscillator and 1/16 and 1/3 dividers, and generates the 304 kHz signal. When this frequency is divided by 1/8, it yields the 38-kHz sub-carrier. When it is divided by 1/16, the 19-kHz pilot frequency is obtained.



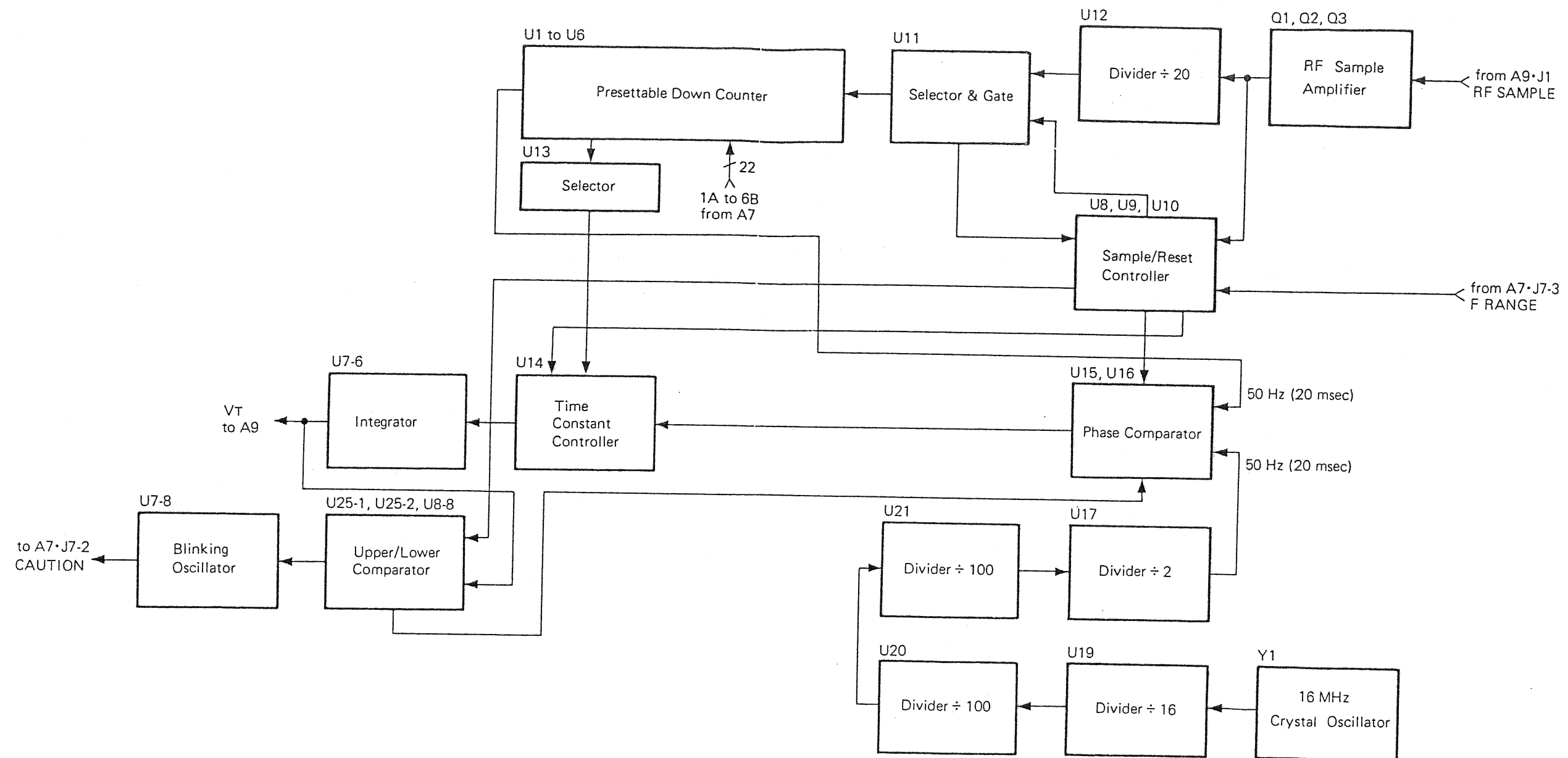


Fig. 3-4  
COUNTER, BLOCK DIAGRAM

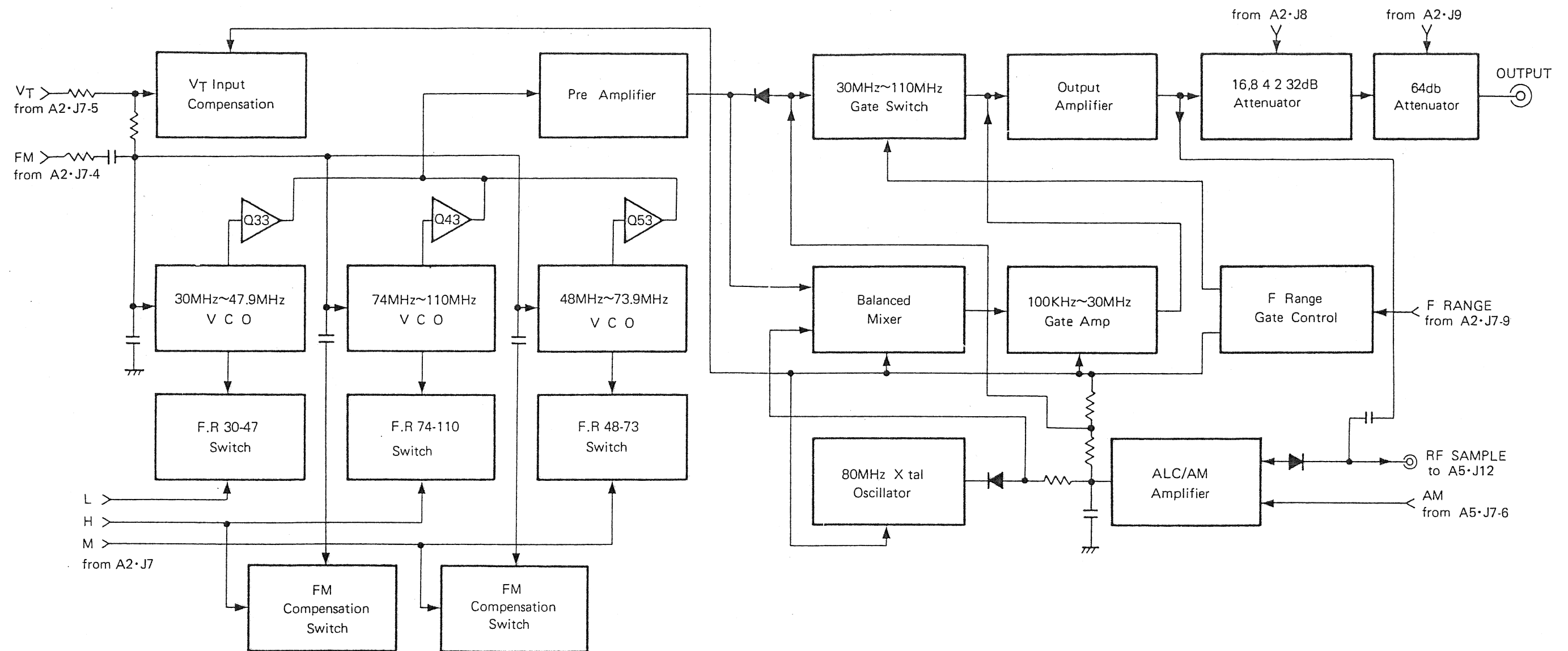


Fig. 3-5  
RF&ATT, BLOCK DIAGRAM

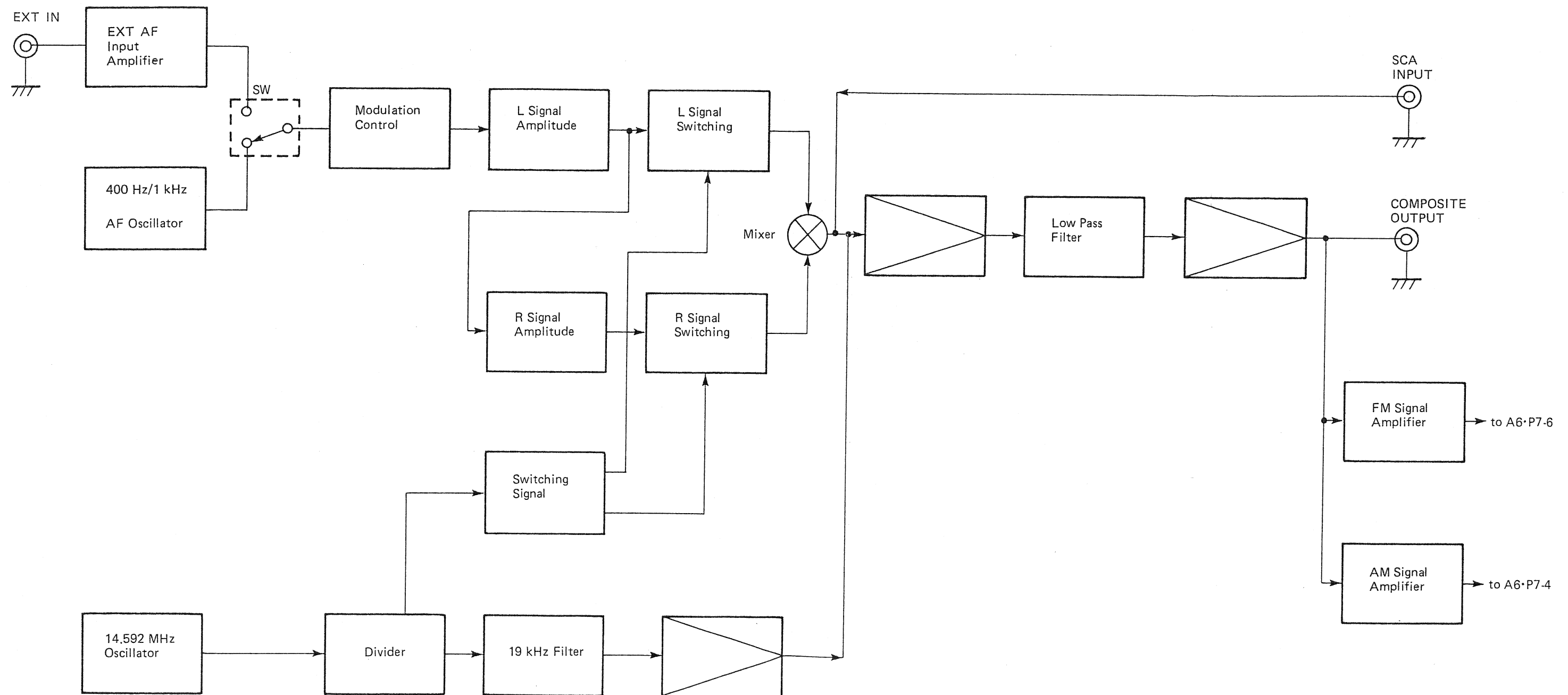


Fig. 3-6  
MODULATOR, BLOCK DIAGRAM

## 4. ADJUSTMENT

### Table of Contents

- 4.1 POWER SUPPLY CHECK
  - 4.1.1 Preparation
  - 4.1.2 Voltage Checks
- 4.2 MODULATOR ADJUSTMENT
  - 4.2.1 AF Oscillator Check
  - 4.2.2 Composite Signal
- 4.3 COUNTER UNIT ADJUSTMENT
  - 4.3.1 Pilot Frequency
  - 4.3.2 RF Frequency
- 4.4 RF UNIT ADJUSTMENT
- 4.5 OVERALL ADJUSTMENT
  - 4.5.1 Output Level
  - 4.5.2 AM Modulation Factor
  - 4.5.3 AM Distortion
  - 4.5.4 FM Distortion
  - 4.5.5 FM Deviation
  - 4.5.6 Internal Modulation Deviation
  - 4.5.7 Separation
  - 4.5.8 Pilot Signal
    - (A) Phase adjustment
    - (B) Pilot deviation
- 4.6 FREQUENCY ACCURACY CHECK
- 4.7 ATTENUATOR ADJUSTMENT

## EQUIPMENT REQUIRED

- |   |   |          |
|---|---|----------|
| (1) Frequency counter:                  | 400 Hz to 150 MHz   | VP-4071A |
| (2) Oscilloscope:                       | DC to 200 MHz   | VP-5520C |
| Oscilloscope:                           | For separation measurement  | VP-5403A |
| (3) Audio analyzer:                     | 20 Hz to 100 kHz with 0.005% distortion or less<br>(VP-7722A or equivalent) |          |
| (4) Modulation analyzer:                | (HP-8901A or equivalent)  |          |
| (5) Spectrum analyzer:                  | (HP-8553B, HP-8554L or equivalent)  |          |
| (6) Low-frequency spectrum<br>analyzer: | (HP-3580A or equivalent)  |          |
| (7) RF voltmeter:                       | 0.1 MHz to 150 MHz or more  | 92A      |
| (8) Digital voltmeter:                  | Accuracy of $\pm 1\%$ or less   | VP-2650A |
| (9) Receiver:                           | For calibration (ME-642A or equivalent)                                     |          |
| (10) RF amplifier:                      | 26 dB (HP-8447D or equivalent)  |          |
| (11) Loop antenna:                      | For leakage measurement   |          |
| (12) Special jig:                       | For pilot phase adjustment  |          |

## 4.1 POWER SUPPLY CHECK

## 4.1.1 Preparation

- (1) Check for short-circuit between each supply line and ground before turning the power on.
- (2) Check that the power source voltage is within the specified range.

## 4.1.2 Voltage Checks

- (1) Check that the voltage measured at test point A shown in Fig.4-1 is  $-15V \pm 0.5V$ .
- (2) Check that the voltage measured at test point B shown in Fig.4-1 is  $-5V \pm 0.2V$ .
- (3) Check that the voltage measured at test point C shown in Fig.4-1 is  $+5V \pm 0.2V$ .
- (4) Change the AC power source voltage and read the voltage when the ripple voltage measured at test point A, B and C is 5 mVp-p or more. Check that the voltage range is  $\pm 10\%$  or more.

## 4.2 MODULATOR ADJUSTMENT

### 4.2.1 AF Oscillator Check

- (1) Connect the COMPOSITE OUTPUT connector to the 600 $\Omega$ -terminated L INPUT connector of the audio analyzer with a BNC cable.

Set the audio analyzer frequency to 1 kHz, the level to approximately -2.8 dBm and connect it to the EXT INPUT connector of the signal generator.

- (2) Set the front panel as follows.

FREQUENCY:	1 MHz
AMPLITUDE:	99 dB
FUNCTION:	AM
EXT/INT:	EXT
SIGNAL:	ON
INT FREQUENCY:	1 kHz
MODULATION:	50%

Temporarily adjust GAIN ADJ control R55 so that the audio analyzer input level is approximately 1.5 Vrms.

- (3) Change the EXT/INT setting to INT. Temporarily adjust INT AF ADJ control R10 so that the output voltage is approximately 1.5 Vrms. Check that the frequency and distortion at 400-Hz and 1-kHz internal frequency settings are within the following ranges:

Reference information:

	<u>400 Hz</u>	<u>1 kHz</u>
Frequency:	388 to 412 Hz	970 to 1030 Hz
Distortion:	0.04% or less	0.04% or less

- (4) Adjust the audio analyzer so that the output level is at the center of the range in which the external level indicator HI and LO LEDs go off. The input level at that time must be approximately 3 Vp-p. Change the audio analyzer output level and check that the HI and LO LEDs go off at  $\pm 2\%$  from the center value determined above.

#### 4.2.2 Composite Signal

- (1) Maintain the previous connection between the EXT INPUT and the audio analyzer. Connect the COMPOSITE OUTPUT connector to the 600 $\Omega$ -terminated input terminal of the low-frequency spectrum analyzer with a BNC cable.
- (2) Set the audio analyzer frequency to approximately 5 kHz and the output level to the center of the range in which HI and LO LEDs go off.
- (3) Set the front panel as follows:

AMPLITUDE:	99 dB
FUNCTION:	FM
EXT/INT:	EXT
SIGNAL:	ON
MODULATION (L=-R):	100%
PILOT:	OFF
- (4) Adjust L=-R BAL ADJ control R28 so that the 5-kHz component (difference signal of L and R) is minimum when observed with the low frequency spectrum analyzer.
- (5) Set the audio analyzer frequency to 15 kHz. Adjust trimmer C12 so that the 15-kHz component (difference signal of L and R) is minimum.
- (6) Repeat procedures (4) and (5) a few times for optimum conditions.
- (7) Set the MODULATION to 0%, connect the COMPOSITE OUTPUT connector to the 600 $\Omega$ -terminated input terminal of the audio analyzer.
- (8) Turn L=-R OFFSET ADJ control R30 fully counterclockwise. Adjust 38 kHz DIST ADJ control R50 for minimum distortion at 38 kHz.
- (9) Return the MODULATION to 100%. Adjust L=-R OFFSET ADJ control R30 for minimum sub-carrier wave (38 kHz).
- (10) Set the STEREO MODULATION (L or R) to 100%. Adjust L OFFSET ADJ control R41 for minimum sub-carrier component (38 kHz).
- (11) Repeat procedures (9) and (10) for optimum conditions.
- (12) Connect the COMPOSITE OUTPUT connector to the 600 $\Omega$ -terminated input terminal of the VP-5403A with a BNC cable. Temporarily adjust SEPA ADJ control R35 for optimum separation characteristics at both 400 Hz and 1 kHz.

#### 4.3 COUNTER UNIT ADJUSTMENT

##### 4.3.1 Pilot Frequency

- (1) Install the RF and CPU in the measuring instrument to be adjusted and connect the required connectors firmly including the BNC connected to the RF OUTPUT connector.
- (2) Set the front panel as follows:

AMPLITUDE:	99 dB
FUNCTION:	FM
EXT/INT:	INT
SIGNAL:	OFF
MODULATION (L=R):	100%
PILOT:	ON
PILOT MODULATION:	10%
- (3) Connect the frequency counter to the COMPOSITE OUTPUT connector. Adjust trimmer C4 so that the frequency reading is 19.0000 kHz.

##### 4.3.2 RF Frequency

- (1) Set the front panel as follows:

FREQUENCY:	110 MHz
AMPLITUDE:	99 dB
EXT/INT:	EXT
SIGNAL:	OFF
MODULATION (MONO):	75 kHz
PILOT:	OFF
- (2) Connect the frequency counter to the RF OUTPUT connector. Temporarily adjust trimmer C61 so that the frequency reading is approximately 109.99950MHz. (For the VP-8174A, temporarily adjust Y1.)
- (3) Set the frequency to 0.1 MHz. Check that the frequency counter reads approximately 100.000 kHz and the reading is steady.

#### 4.4 RF UNIT ADJUSTMENT

- (1) Connect the positive terminal of the digital multimeter to connector J7-5 and the negative terminal to the ground.
- (2) Set the frequency to 110 MHz. Adjust L3 so that the digital multimeter reads approximately -9.3 V.
- (3) Set the frequency to 48 MHz. Adjust L5 so that the digital multimeter reads approximately -2.8 V.



- (4) Set the frequency to 30 MHz. Adjust L1 so that the digital multimeter reads approximately -2.8 V.
- (5) Connect the positive terminal of the digital multimeter to pin 6 of U2, set the frequency to 0.1 MHz to 29.9999 MHz and connect an oscilloscope to the cathode of CR5 in the RF section. Adjust L8 so that the 80-MHz crystal oscillator is activated. The oscillation stops as the core is turned. Turn the core about two turns from the point where the oscillation stops and adjust it so that the ALC voltage at pin 6 of U2 is between 1.4 and 1.45 V. Fix the core with paraffin. (If the ALC voltage is greater than 2 V, the adjustment is accepted.)
- (6) Set the oscilloscope range to 10 mV/div and connect it to connector J7-5. Adjust L3 so that the oscilloscope reads approximately -0.2 V when the frequency is set to 0.1 MHz.
- (7) Connect the RF level meter to the output terminal. Check that attenuation is normal when the frequency is set to 110 MHz and the amplitude is reduced from 99 dB to 83 dB, 1 dB at a time.

#### 4.5 OVERALL ADJUSTMENT (MODULATOR SECTION, RF SECTION)

##### 4.5.1 Output Level (Modulator Section)

- (1) Set the front panel as follows:

FREQUENCY:	90 MHz
AMPLITUDE:	99 dB
FUNCTION:	AM
EXT/INT:	INT
SIGNAL:	OFF

- (2) Connect the RF voltmeter to the RF OUTPUT connector on the front panel. Adjust 99dB LEVEL ADJ control R103 so that the voltmeter reads 99 dB (-14 dBm).
- (3) Set the AMPLITUDE to 98 dB and check that the RF voltmeter reads 98 dB (-15 dBm).

#### 4.5.2 AM Modulation Factor (Modulator Section)

(1) Set the front panel as follows:

FREQUENCY:	1 MHz
AMPLITUDE:	99 dB
FUNCTION:	AM
EXT/INT:	EXT
SIGNAL:	ON
INT FREQUENCY:	1 kHz
MODULATION:	30%

(2) Adjust GAIN ADJ control R55 so that the AM modulation is 30%.

#### 4.5.3 AM Distortion (Modulator Section)

- (1) After the modulation adjustment is complete, adjust AM DIST ADJ control R97 so that distortions measured at 98- and 99-dB amplitude settings are the same.
- (2) Repeat the modulation and distortion adjustments a few times for optimum conditions.
- (3) Measure modulation accuracy at the 30% setting over the entire frequency range. Take balance, if necessary.

#### 4.5.4 FM Distortion

(1) Set the front panel as follows:

AMPLITUDE:	99 dB
FUNCTION:	FM
EXT/INT:	EXT
SIGNAL:	ON
MODULATION MONO):	75 kHz

- (2) Connect the audio analyzer with frequency setting at 1 kHz to the EXT INPUT connector. Adjust the audio analyzer output level so that it is at the center of the range in which the EXT LEVEL indicator HI and LO LEDs go off.
- (3) Adjust L1, L5 and L3 so that the distortion factors are the same when frequency is set to the lower or upper portion of each band. The core to be adjusted are as follows:

<u>Frequency</u>	<u>Coil adjusted</u>
30 MHz and 47.999 MHz	L1
48 MHz and 73.999 MHz	L5

Set the oscilloscope range to 10 mV/div and connect it to connector J7-5. Adjust core L3 so that the oscilloscope reads approximately 0 V when the frequency is set to 0.1 MHz.

Fix all cores with paraffin.

Distortion measurement procedure:

- (1) Set the frequency to 30 MHz and measure the distortion.
- (2) Change the frequency setting to 47.999 MHz. Adjust L1 so that the distortion at 47.999 MHz is approximately the same as that at 30 MHz. Conduct the other adjustment in the same way.

#### 4.5.5 FM Deviation

- (1) Set the frequency as shown below. Adjust the variable resistors corresponding to the frequency so that the deviation is 75 kHz. Measure the deviation within each band and take balance, if necessary.

<u>Frequency</u>	<u>Variable resistor</u>
40 MHz	OSC 1 (R84)
61 MHz	OSC 2 (R90)
92 MHz	OSC 3 (R92)

- (2) Set the frequency to about 83 MHz where the FM deviation is 75 kHz. Set the modulation to 100% (L=R). Adjust L=R 90% control R20 so that the FM deviation is 67.5 kHz.

Note: The FM deviation is influenced if variable resistor R55 for the AM modulation adjustment is turned after the FM deviation is adjusted. Whenever R55 is turned, confirmation and adjustment of the FM deviation is necessary.

#### 4.5.6 Internal Modulation Deviation

Maintain the settings in 4.5.5, set the RF frequency to 85 MHz and switch the FM EXT to FM INT. Adjust INT AF ADJ control R10 so as to obtain the distortion factor identical to that of the EXT MODULATION.

#### 4.5.7 Separation

Set the FM MODULATION (L or R) to 100%. Connect the COMPOSITE OUTPUT connector to the 600 $\Omega$ -terminated CH1 input of the VP-5403A with a BNC cable. Connect the RF signal (83 MHz) detection output to CH2 of the same oscilloscope. Adjust SEPA ADJ control R35 so that separation of both channels is of the same value and is optimum.

## 4.5.8 Pilot Signal

## (A) Phase adjustment

- (1) Set the front panel settings as follows:

FUNCTION:	FM
EXT/INT:	INT
SIGNAL:	OFF
MODULATION (L=-R):	10%
PILOT:	ON
PILOT MODULATION:	10%

- (2) Connect the output connector of the measurement jig directly to CH1 of the VP-5403A. Connect the jig input and pin 7 of U19 via a BNC cable. Connect the COMPOSITE OUTPUT connector to the 600 $\Omega$ -terminated input terminal of the CH2 of the VP-5403A with a BNC cable.
- Set the oscilloscope to the X-Y mode and the vertical deflection of both channels to 10mV/div. Adjust the variable resistor of the jig so that the waveform displayed on the screen is a straight line, not an ellipse shape.
- (3) The waveform changes to a cross shape when the SIGNAL is set to ON. Adjust PHASE control R70 so that the intersection is a point.

## (B) Pilot deviation

Set the frequency to about 83 MHz where the FM deviation (MONO) is 75 kHz. Set the SIGNAL to OFF and PILOT to 10%. Adjust PILOT LEVEL control R65 so that the FM deviation is 7.5 kHz.

## 4.6 FREQUENCY ACCURACY CHECK (COUNTER SECTION)

- (1) Check frequency accuracy after 12-hour or more of warm-up run period with all units being set up.
- (2) Set the front panel as follows:
- |            |         |
|------------|---------|
| FREQUENCY: | 100 MHZ |
| AMPLITUDE: | 99 dB   |
| FUNCTION:  | AM      |
| EXT/INT:   | INT     |
| SIGNAL:    | OFF     |
- (3) Connect the frequency counter to the RF OUTPUT terminal on the front panel. Check that the frequency is within the specification. If not, readjust trimmer C61.
- (For the VP-8174A, temporarily adjust Y1.)

#### 4.7 ATTENUATOR ADJUSTMENT

(1) Set the front panel as follows:

FREQUENCY:	110 MHZ
AMPLITUDE:	99 dB
FUNCTION:	AM
EXT/INT:	INT
SIGNAL:	OFF

- (2) Connect the calibration receiver to the OUTPUT connector. Measure attenuation at 2, 4, 8, 16, 32 and 64 dB settings and 1-dB before and after them. If necessary, adjust attenuator resistor positions for correct attenuation.
- (3) Check that attenuation accuracy between 99 dB through -10 dB is correct.

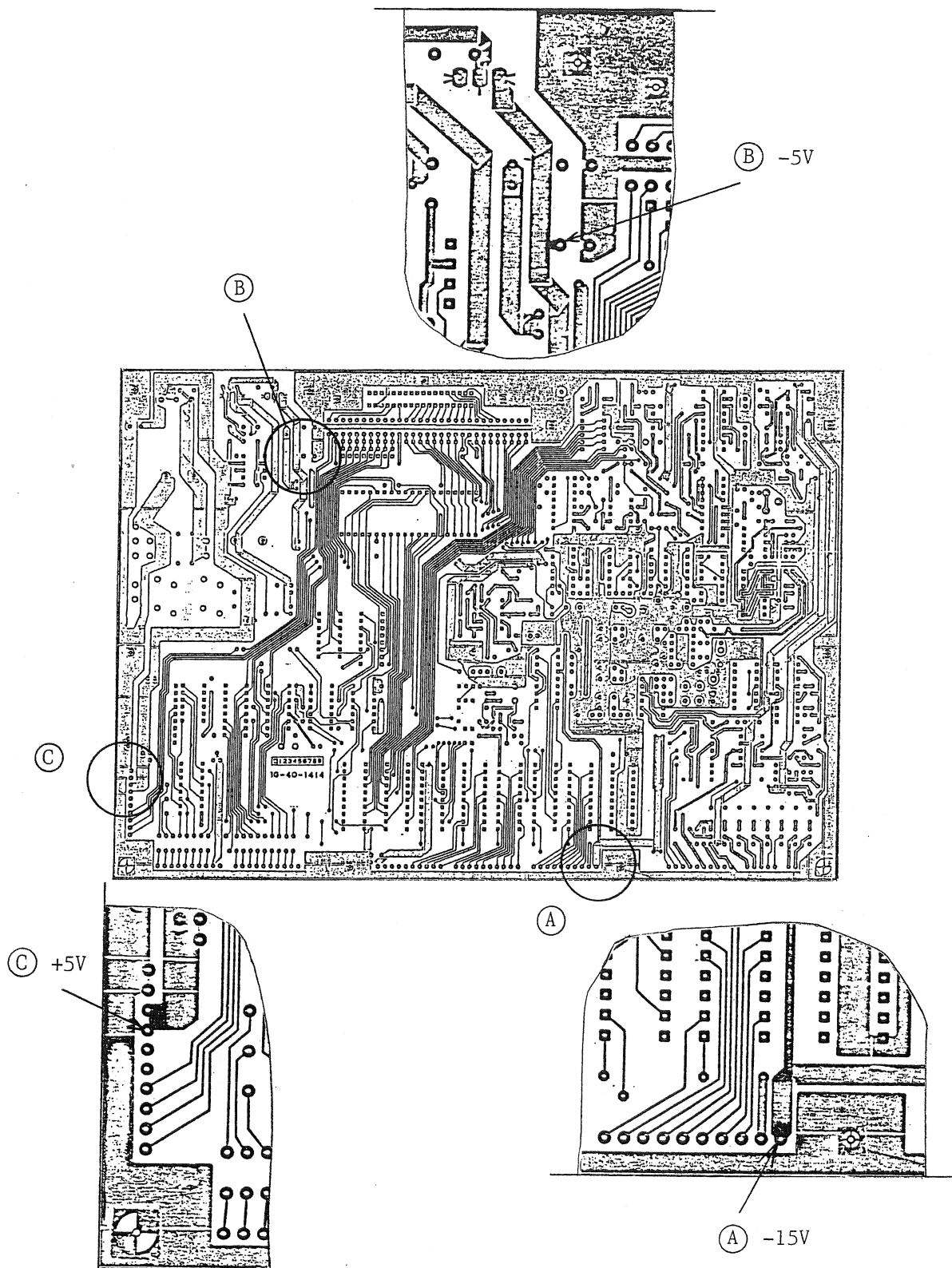
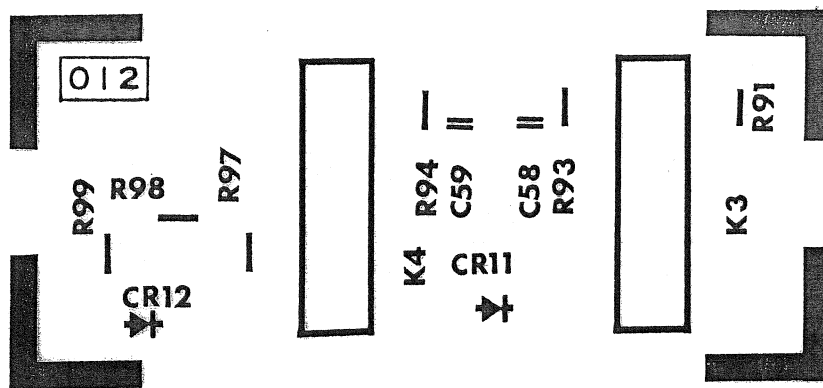
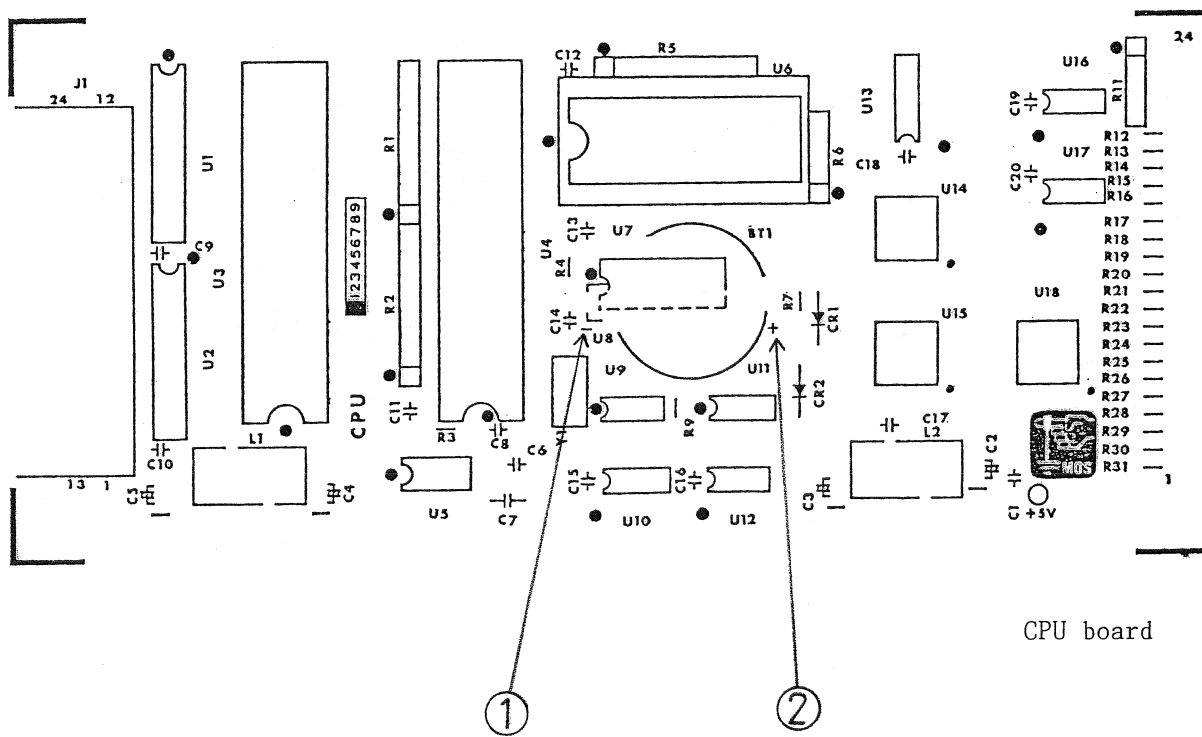


Fig.4-1 Power supply check points

# 4.8 PARTS LOCATION



MAIN ATT board

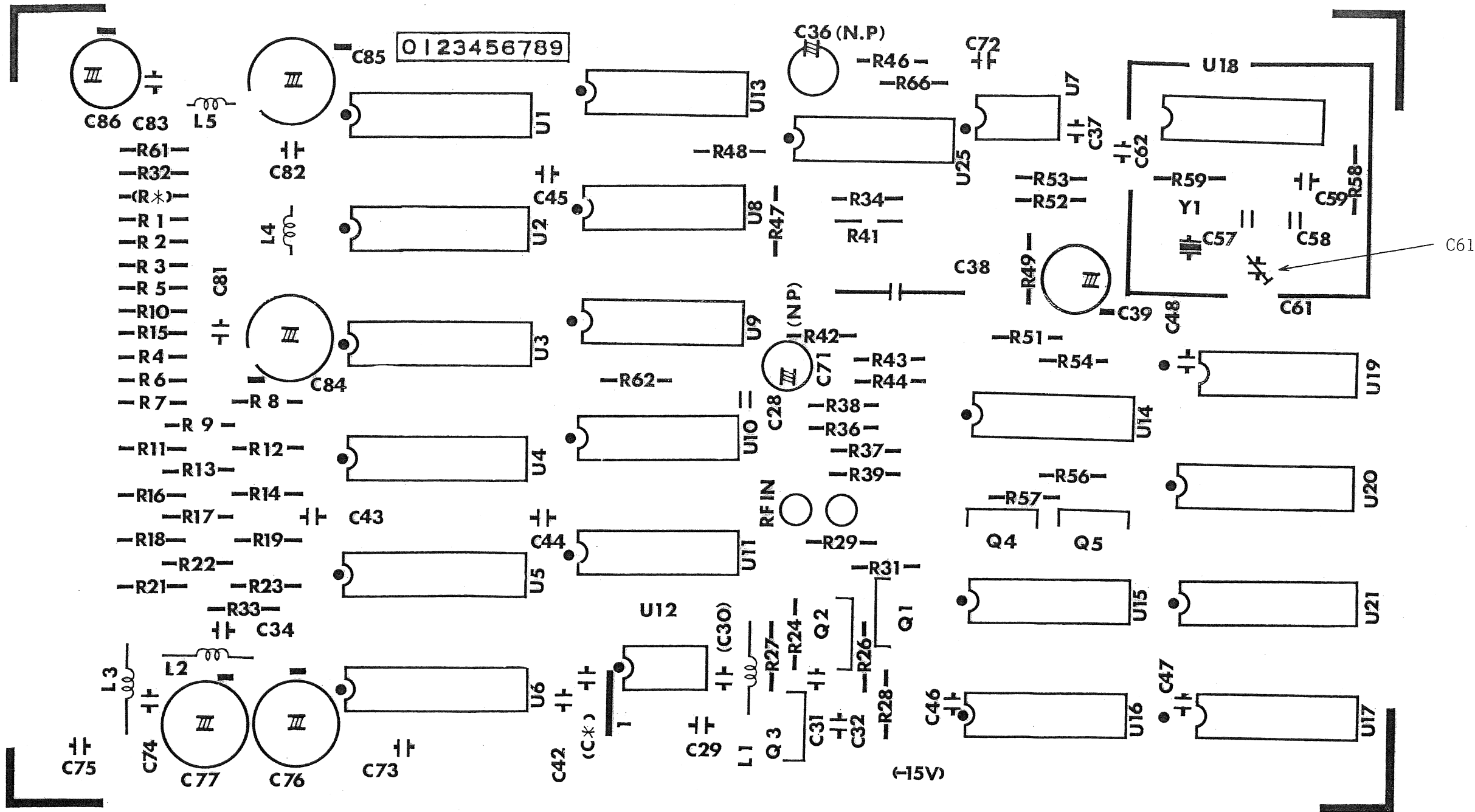


CPU board

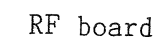
## PARTS LOCATION

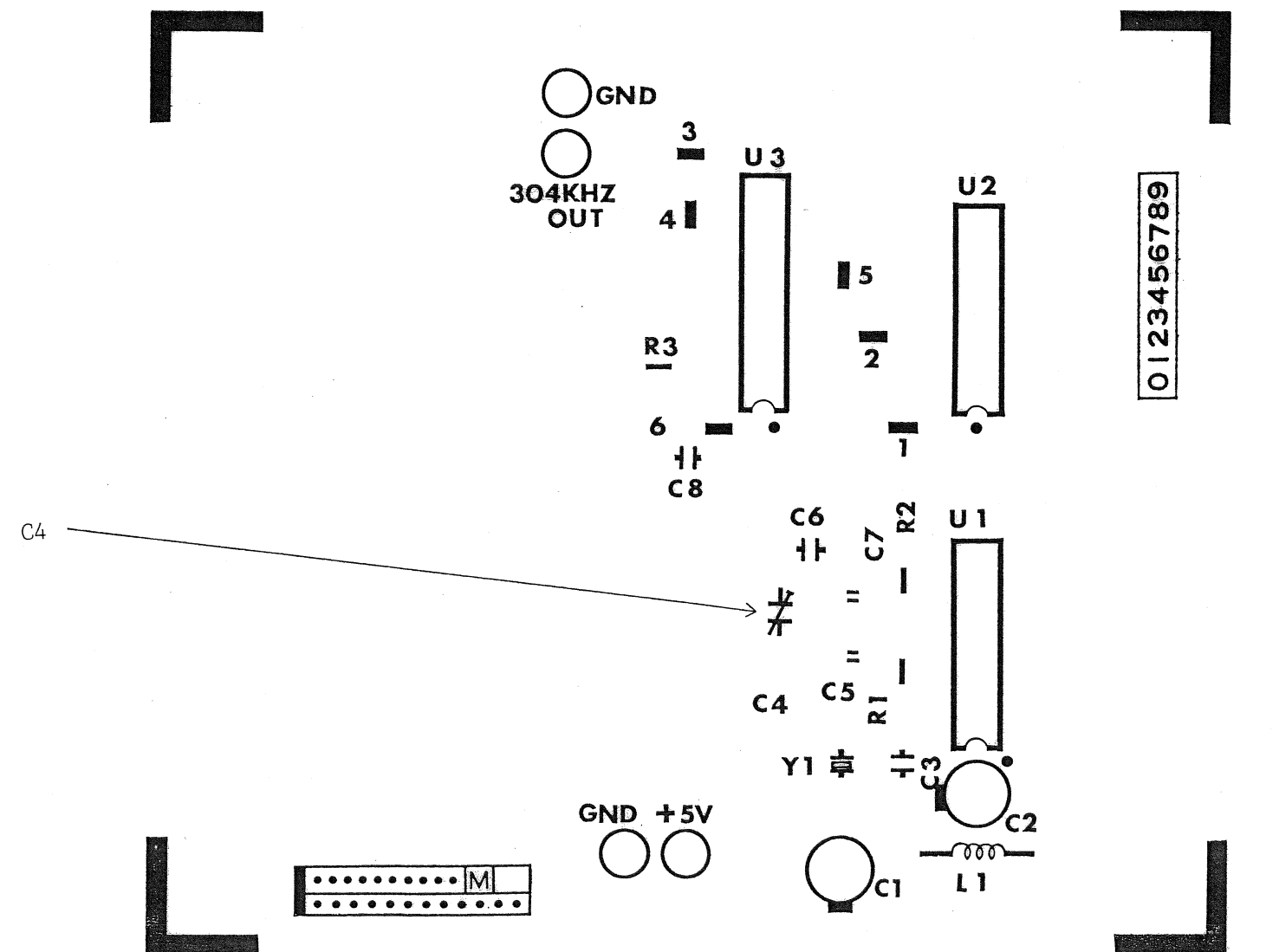




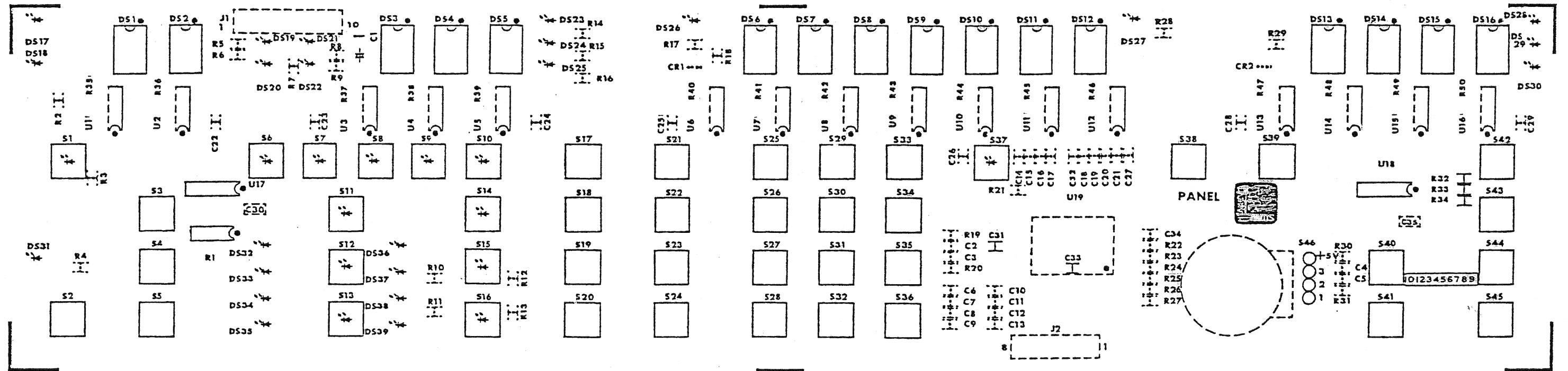


COUNTER board



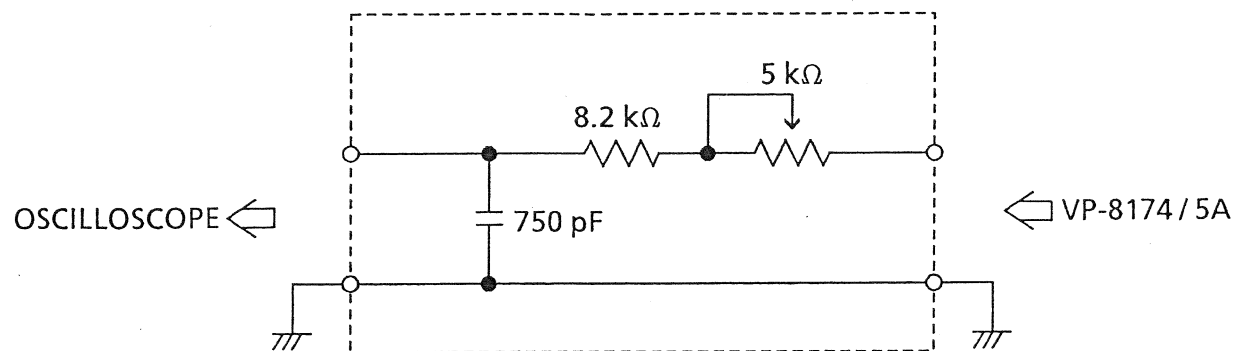


304kHz CLK board



PANEL board

## VP-8174/5A PILOT PHASE ADJUSTMENT JIG



## BATTERY REPLACEMENT PROCEDURE

Before replacing the battery, confirm the residual voltage of the battery to be replaced. If considered the replacement to be necessary, follow the next instructions.

1. Prepare a new lithium battery.

PART NAME: BR2330-1HM(250mAh, 3V)

MANUFACTURER: Matsushita Battery Industrial Co., Ltd.

2. When removes the battery from the PCB, the minus pole lead① is to be removed first, then the plus pole lead② is to be removed by using soldering tool.
3. For installation a new battery, insert the plus pole lead to the PCB first and next insert the minus lead.

### NOTE

When the battery removed from PCB, the stored data saved in the IC memory will be lost.



### CAUTION

- 1: Do not make the battery short-circuit and never throw it into a fire.
- 2: Battery must be recycled or disposed of properly.