SP01364

SONY®

# SERVICE MANUAL

# AV-8650

VIDEOCORDER

**VOL.1**



SONY CORPORATION

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# SECTION 1
# GENERAL DESCRIPTION

## 1-1. INTRODUCTION

The SONY Videocorder, model AV-8650, is a highly advanced color video tape recorder featuring total editing capability. It will record video signals which conform to EIA monochrome or NTSC color standards.

*Features:*

1) The AV-8650 will record and play back video tapes which conform to the EIAJ type 1 format. This permits tapes made on any SONY AV series videocorder to be played back on the AV-8650. In addition, the AV-8650 has the capability to record high-band, high resolution video signals, using high density tape. These high density recordings can only be played back on other machines equipped for use with high density tape. such as another AV-8650.
2) Either regular tape or high density tape may be used to make a recording. The use of high density tape permits high resolution recordings. This feature is particularly useful in conjunction with the editing feature in making master recordings for subsequent duplication. A TAPE SELECT switch adapts the videocorder to the type of tape in use.
3) Video and/or audio signals can be inserted into or assembled onto a previously recorded tape. The rotary erase heads and vertical blanking switcher assure smooth insertion and assembly.
4) A converted subcarrier direct recording system and dropout compensator are employed.
5) External sync may be checked during playback without disconnecting the signal source.
6) The capstan servo system monitors and controls the tape speed, assuring precise editing and a stable picture with minimum jitter.
7) The video recording level can be controlled either automatically or manually by the setting of the VIDEO AUTO/MANUAL button. The audio limiter for recording is selected by means of an AUDIO LIMITER ON/OFF button.
8) A still-frame playback picture can be obtained by setting the FUNCTION SELECTOR to PAUSE/STILL. Slow motion tape playback is available, and the speed is adjustable by means of the SLOW SPEED control.
9) Tracking and skew conditions are manually controlled in the playback mode. A level meter indicates the tracking condition.

## 1-2. SPECIFICATIONS

### GENERAL

| | |
|---|---|
| Power requirement: | AC 120 V ±10%, 60 Hz ±0.5% |
| Power consumption: | 95 W |
| Temperature: | Storage: −10 to +60 degress C (+14 to +140 degress F)<br>Operation: +5 to +40 degress C (+41 to +104 degress F) |
| Video recording standards: | Monochrome, EIA standard<br>Color, NTSC standard |
| Video recording system: | Rotary 2-head helical-scan system, FM recording |
| Tape pattern: | EIA Japan type-1 |
| Tape speed: | $7\frac{1}{2}$ ips |
| Recording time: | More than 60 min. with SONY V-32 (regular) or V-72 (high density) |
| Rewind and fast forward time: | Within 6 min. with SONY V-32 or V-72 |
| Dimensions: | 410 mm(W) x 270 mm(H) x 455 mm(D)<br>($17\frac{1}{2}$") x ($10\frac{3}{4}$") x ($18\frac{5}{16}$") |
| Weight: | 24.95 kg (55 lbs) |

### VIDEO SIGNAL

| | |
|---|---|
| Input: | Composite, sync negative<br>0.5 – 2.0V(p-p), 75 Ω, unbalanced |
| Output: | Composite, sync negative<br>1.0V(p-p), 75 Ω, unbalanced |
| Resolution: | Monochrome<br>regular tape, more than 300 lines<br>high density tape, more than 350 lines<br>Color<br>regular tape, more than 240 lines<br>high density tape, more than 250 lines |
| Signal-to-noise ratio: | regular tape, better than 40 dB<br>high density tape, better than 43 dB |

### AUDIO SIGNAL

| | |
|---|---|
| Input: | MIC: −60 dB, LOW impedance, unbalanced<br>AUX: 0 dB, HIGH impedance, unbalanced<br>TV: −20 dB, HIGH impedance, unbalanced |
| Output: | LINE: 0 dB, less than 2 kΩ, unbalanced<br>TV: 0 dB, less than 2 kΩ, unbalanced<br>Headphone: 8 Ω |
| Frequency response: | regular tape, 80～10,000 Hz<br>high density tape, 80～12,000 Hz |
| Signal-to-noise ratio: | better than 40 dB |

### SPECIAL FUNCTIONS

| | |
|---|---|
| Slow: | Playback speed is continuously Variable from $\frac{1}{16}$ to $\frac{1}{5}$ normal speed |
| Tracking: | Adjustable (with meter) |
| Skew: | Adjustable |
| Editing: | Assemble: video and audio (simultaneously)<br>Insert: video and audio, video only, audio only (independently selectable) |

### ACCESSORIES SUPPLIED

| | |
|---|---|
| Reel, RH-7V: | Lubricating oil SONY video tape V-30 |
| Head cleaner set: | Splicing tape |
| AC power cord: | Polishing cloth |

Design and specifications are subject to change without notice.

# SECTION 2
# CIRCUIT DESCRIPTION

## 2-1. GENERAL

The circuits of the AV-8650 consist of the following 11 printed circuit boards:

| Printed circuit board name: | Function |
|---|---|
| MOD | FM modulator for Y signal<br>Chroma signal record processor |
| RP | Record/playback amplifier,<br>Blanking switcher, and 30 PG amplifier |
| Y-DEM | Dropout compensator and Y-FM demodulator |
| C-DEM | Chroma signal reproduce processor |
| VOA | Video input selector and Video output amplifier |
| RE | Rotary erase amplifier |
| SVO | Servo circuit |
| AUD | Audio record/playback amplifier |
| SYS | System control circuit |
| MIC | Microphone input preamplifier and audio input circuitry |
| REG | Power supply regulator circuit |

The main function of each printed circuit board is listed above.

The video system consists of the MOD, RP, Y-DEM, C-DEM, VOA, and RE circuit boards. The video input signal is supplied to the MOD board where it is separated into luminance and chroma signals. The luminance signal is converted into an FM signal by the FM modulator. The chroma signal is down-converted to 767 kHz from 3.58 MHz, amplified by the record amplifier on the RP board, and supplied to the video head.

In playback operation, the output of the video head is amplified by the playback amplifier on the RP board, fed to the switching circuit, and then separated into the Y-FM signal and the chroma signal. The Y-FM signal is supplied to the Y-DEM board where it is dropout-compensated and then demodulated back into a video signal. The demodulated video signal is then fed to the C-DEM board. The 767 kHz chroma signal is supplied to the C-DEM board where it is frequency-converted back to 3.58 MHz. The Y signal supplied from the Y-DEM board and the 3.58 MHz up-converted chroma signal are added to produce an NTSC compatible color video signal. This signal is then amplified by the video output amplifier on the VOA board, and delivered to the video output connector. The rotary erase amplifier, mounted on the RE board, amplifies an erase signal, supplied from the RP board in the insert mode, and feeds it to the rotary erase heads.

The servo circuitry mounted on the SVO board consists of the drum servo and capstan servo circuits. In the Record and Playback modes, the drum servo circuit compares the phase of vertical sync with that of the 30 PG signal supplied from the RP board, and controls both the speed and phase of the drum rotation. In the Record mode, the capstan servo circuit makes the tape run at a constant speed, and in the playback mode, the capstan servo works as a tracking servo to make the rotating video head scan the recorded magentic patterns correctly.

The audio circuit consists of the circuitry on the AUD board and the microphone preamplifier, mounted on the MIC board. The AUD board contains the record amplifier, line amplifier, limiter, and bias/erase oscillator circuits. The audio input and output circuitry is on the MIC board.

The system control circuit is made up of circuitry contained on the SYS board. The SYS board performs mechanical system controls such as Forward, Fast forward, Stop, and Rewind.

The power supply circuit is mounted on the REG board and consists of a +24 V regulator and a +12 V regulator circuit.

## 2-2. VIDEO CIRCUIT

A simplified block diagram of the video system is shown in Fig. 2-1. A detailed block diagram of the video system will be found on Pages 4 and 5 of Volume 2 of this manual.

The line or TV video signal, supplied to the connector panel, is selected by a switching circuit on the VOA board. The selected input signal is supplied to the MOD board where the signal is separated into luminance and chrominance signals. The luminance signal is converted into an FM signal by the FM modulator, also located on the MOD board. The chroma signal is frequency-converted to a band centered about 767 kHz from its normal 3.58 MHz frequency. This converted signal is supplied to the RP board. The Y-FM signal and the converted chroma signal are amplified by the record amplifiers and supplied to the video head where they are added together and recorded on the tape.

In playback, the playback RF output from the video head, is amplified by the preamplifier and equalizer amplifier on the RP board. The playback frequency characteristic is corrected by the equalizer. The playback signals from the two rotating video heads are combined into one continuous signal by switching action of the playback switcher. The playback switcher, controlled by pulses from the PG coils, alternately switches the two channels in the playback amplifier on and off so that only the signal from the head contacting the tape passes through. The combined playback RF signal is then separated to the Y-FM signal and the 767 kHz chroma signal The Y-FM signal is fed to the Y-DEM board and the 767 kHz chroma signal to the C-DEM board. The Y-FM signal is dropout-compensated and demodulated on the Y-DEM board. It is then supplied to the C-DEM board. The 767 kHz chroma signal is converted back to 3.58 MHz and any amplitude variations are corrected by means of an A.C.C. circuit on the C-DEM board. The 3.58 MHz chroma signal and the luminance signal supplied from the Y-DEM board are then added together to form an NTSC compatible signal. This signal is fed to the VOA board. The video output amplifier on the VOA board amplifies the playback signal and supplies it to the video output connector.

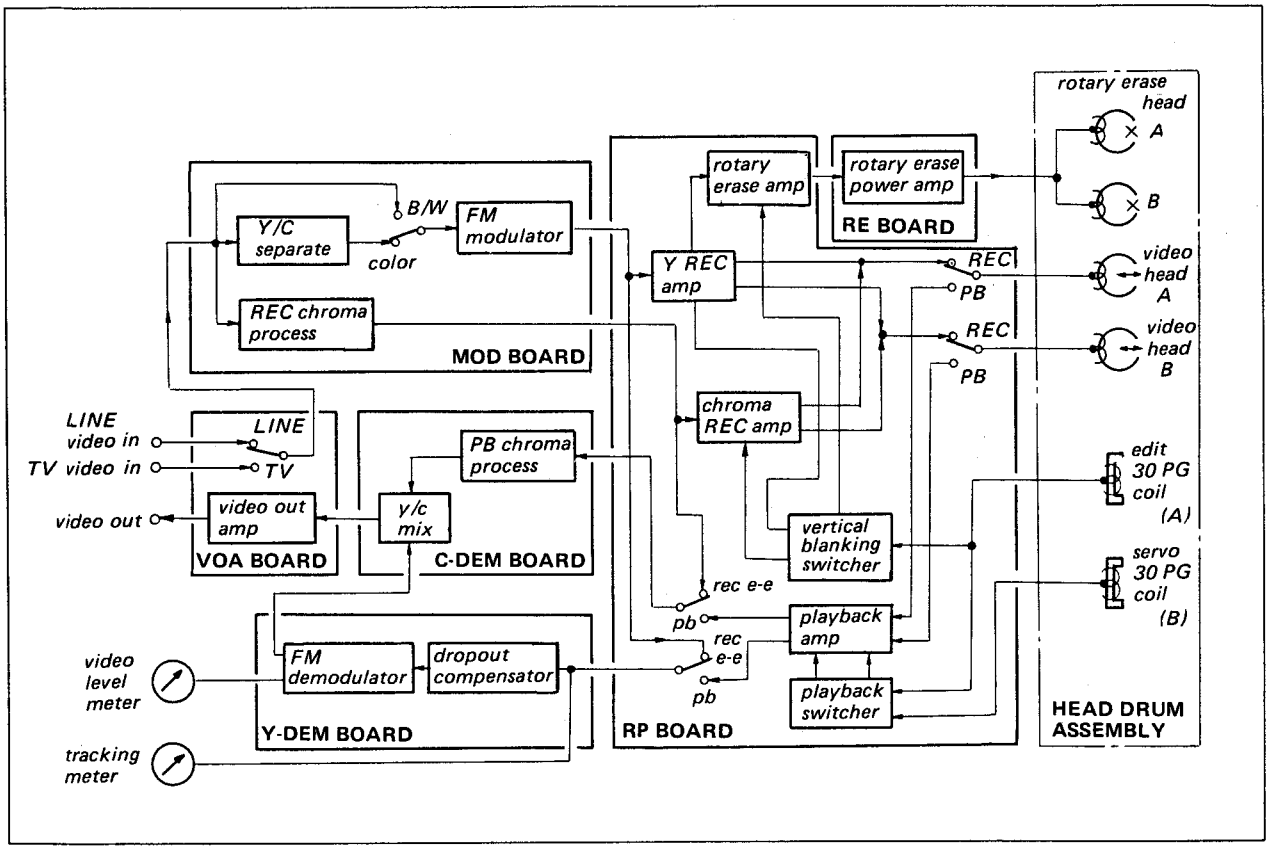



*Fig. 2-1. Video system block diagram*

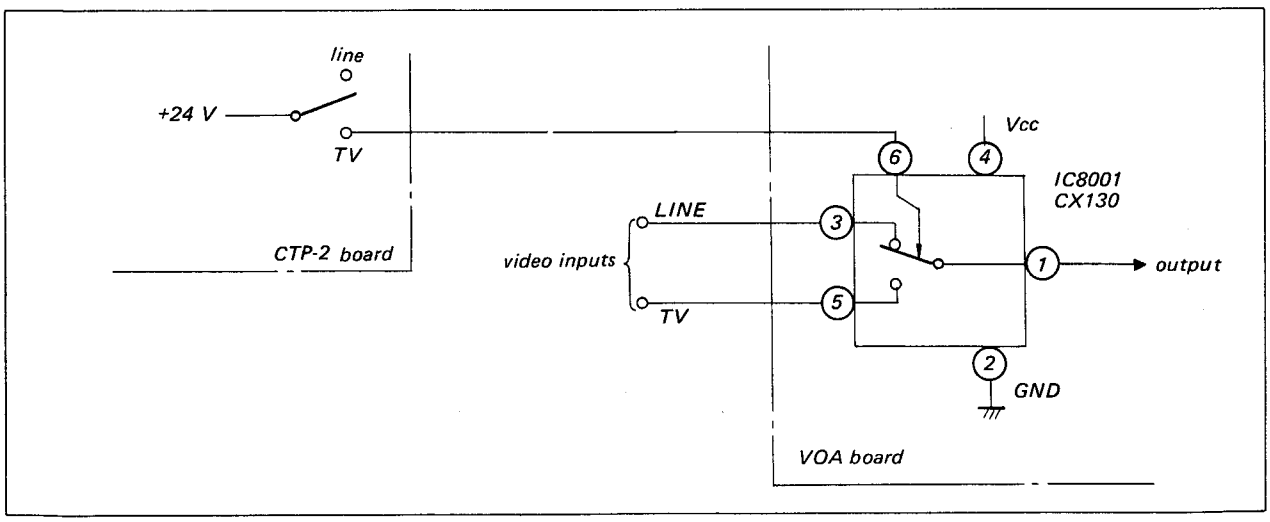



*Fig. 2-2. Video input switching circuit*

**Video input switching circuit ------ VOA IC8001, Q8006**

LINE and TV video input signals, supplied to the connector panel, are applied to type CX130 integrated circuit electronic switch, IC8001 on the VOA board. See Fig. 2-2. Two input signals, connected to Pins 3 and 5 of CX130 respectively, are selected by means of a voltage applied to Pin 6, and the selected signal appears at Pin 1 as an output.

The signal selected by IC8001 is supplied to the MOD board via buffer amplifier transistor Q8006, an emitter follower stage.

**AGC circuit ------ MOD**

The desired video input signal, selected by IC8001 on the VOA board, is routed to the MOD board where it passes first through FL1101. FL1101 is a low pass filter which removes unwanted high frequency components from the signal. A sample of the video input signal is supplied to the SVO board through resistor R1101, located ahead of the filter. The output of the filter passes to the base of Q1101.

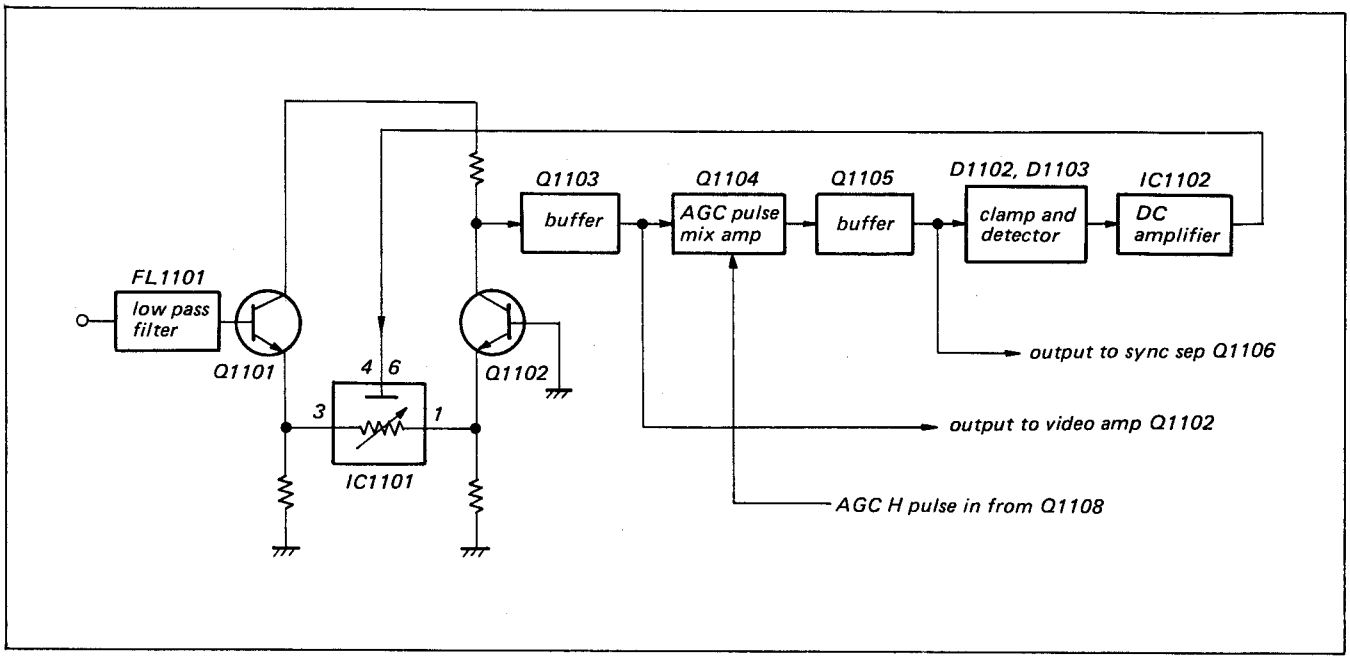



*Fig. 2-3.*

The level of the video input signal is controlled by an AGC (automatic gain control) circuit. The AGC circuit is formed by transistors Q1101 through Q1105, diodes D1102 and D1103, and integrated circuits IC1101 and IC1102. See Fig. 2-3. Q1101 and Q1102 form a differential amplifier whose emitters are not directly connected. The emitters are connected through IC1101, a special semiconductor device developed for gain control purposes by SONY. Internally, IC1101 is similar to a field effect transistor in which the source-to-drain resistance is controlled by the voltage potential applied to the gate. In the case of IC1101, the source-to-drain resistance (between pins 1 and 3) is what ties the emitters of Q1101 and Q1102 together. The gain of the Q1101-Q1102 stage depends upon the value of this resistance, the lower it is the higher the gain. The resistance between pins 1 and 3 of IC1101 is controlled by a dc potential derived by amplification and rectification of the video signal output from Q1102.

The output from Q1102 is buffered by emitter follower Q1103, and supplied to AGC pulse mixer amplifier Q1104. The signal buffered by Q1103 is also supplied to video amplifier integrated circuit IC1201.

A positive pulse is added onto the back porch of the horizontal blanking interval of the video signal. This occurs in Q1104. The pulse, supplied to the emitter of Q1104, adds in Q1104's collector to the video signal supplied to its base. See Fig. 2-4. C1109 and L1101, in Q1104's emitter circuit are tuned parallel resonant at chroma frequency (3.58 MHz). The impedance becomes infinite at resonance, thereby reducing the gain of Q1104 to zero at chroma frequency. This eliminates the chroma from the video signal within the AGC loop.

The pulse added to the video signal in Q1104 is equal to 100% peak white. This fixes the peak white level of the signal at 100%, allowing the detector circuit, which follows, to respond only to changes in the sync amplitude. It is these changes in sync amplitude which are detected by D1103 and dc amplified by IC1102. The output of IC1102 is the control signal which is fed back to the control input of IC1101. AGC action, therefore, serves to keep the sync level constant without regard to level

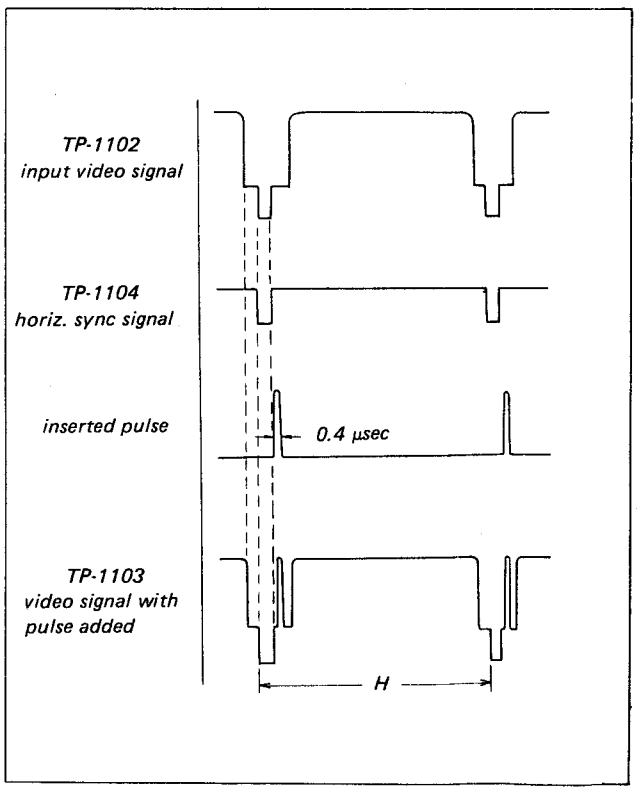



*Fig. 2-4.*

variation of the video components, so long as the video signal level at the input to AGC pulse mix amplifier Q1104 does not exceed 100% peak white. Above this point, the AGC system acts as a peak to peak limiter to prevent over-modulation. If the video signal exceeds 100% peak white, the sync pulses are shortened to keep the total peak to peak signal constant.

The output of buffer Q1105 is supplied to Q1106, the sync separator. The sync separator has two outputs. One output, taken at the junction of R1127 and R1128, is fed to switching amplifier Q1109. The other sync separator output, taken from the collector of Q1106, is fed as a toggling pulse to the one-shot circuit formed by Q1107 and Q1108. This one-shot toggles on the trailing edge of the horizontal sync signal producing a 0.4 μsec wide pulse. This is the pulse supplied to pulse mix amplifier Q1104. Q1109 inverts the phase of the sync separator output and supplies it to the burst gate circuit. The integrator circuit extracts the vertical sync signal from the sync separator output and supplies it to Q1207.

The above description applies to automatic gain operation. In the manual mode, a separate dc control voltage is supplied to gain control IC1101 in addition to the dc feedback signal. This gain control signal is supplied from the video level control by way of the AUTO/MANUAL Selector switch. IC1101 is then controlled by the dc voltage from the video level control. Adjustment pots R1152 and R1155 set the minimum and maximum adjustment limits of the video level control.

#### Video amplifier IC1201

The video signal from the AGC circuit is supplied to Pin 2 of IC1201 from Q1103. IC1201 is a type CX087B, which is an IC used in a color TV receiver. It is used as a video amplifier in the AV8650. The circuit from Pin 2 to Pin 8 is a common base amplifier. Pot R1204 between Pins 3 and 4 controls its gain. The output from Pin 8 is fed to three places, the comb filter circuit, Color/BW electronic switcher/buffer Q1202, and the chroma process circuit.

### Y SIGNAL COLOR PROCESS CIRCUIT AND COLOR/MONOCHROME ELECTRONIC SWITCHER

In the color operating mode, the luminance and chrominance signals are separated by means of a comb filter. This technique allows the two signals to be separated without loss of the high frequency video components which occupy the same band as the chroma signal. The operation of the comb filter Y/C separator is described below. Refer to Fig. 2-5.

The full NTSC color video signal appears at pin 8 of IC1201. It is applied to the comb filter through two components, C1205 and R1209. C1205 is small in value (110 pf). It therefore has the effect of differentiating the video signal coupled through it, so that only the high frequency luminance components and the chroma signal reach the base of Q1201. Chroma amplifier transistor Q1201 amplifies these high frequency signals. Pot R1214 adjusts the high frequency gain of the chroma amplifier by varying the amount by which the emitter of Q1201 is bypassed. The output of the chroma amplifier drives the input of DL1201, a 1 H glass delay line. DL1201 is a tuned delay line which has a bandwidth limited to about 1 MHz, centered on the 3.58 MHz chroma frequency. Only the chroma signal and the luminance components which fall into the same frequency band as the chroma signal therefore, appear at the delay line output. The output signal from the delay line is, of course, delayed by 1 H (about 63.5 microseconds). The delay line's input signal, at the collector of Q1201, is referenced to circuit ground. For this reason, since input terminal A of the delay line is connected to the collector of Q1201, the other input terminal, B, is connected to the +12 V line, which is at ac ground. The delay line's output at terminals C and D however, is not ground referenced. The output signal current simply loops between terminals C and D. Coil L1202, at the delay line's output, is adjusted to tune the delay line.

Resistors R1215 through R1218 comprise a balanced, four-arm resistive bridge. The output loop current from the delay line, which consists only of chroma signals and luminance components in the chroma frequency band, flows from terminal C of the delay line to node Z of the bridge, out of the bridge at node Y, and back to the delay line at terminal D. The current divides equally in the bridge, half flowing through nodes Z-W-Y and the other half flowing through nodes Z-X-Y.

As mentioned previously, the other component through which the full NTSC color video signal is applied to the comb filter is R1209. This signal, flowing through R1209, enters the bridge at node W, divides equally across the two sides, and flows to ground through C1207. (Node X of the bridge is ac grounded by C1207.)

Both the delayed, narrow band chroma signal and the non-delayed, full-bandwidth NTSC color video signal are, thus, flowing through the bridge simultaneously, but along different routes.

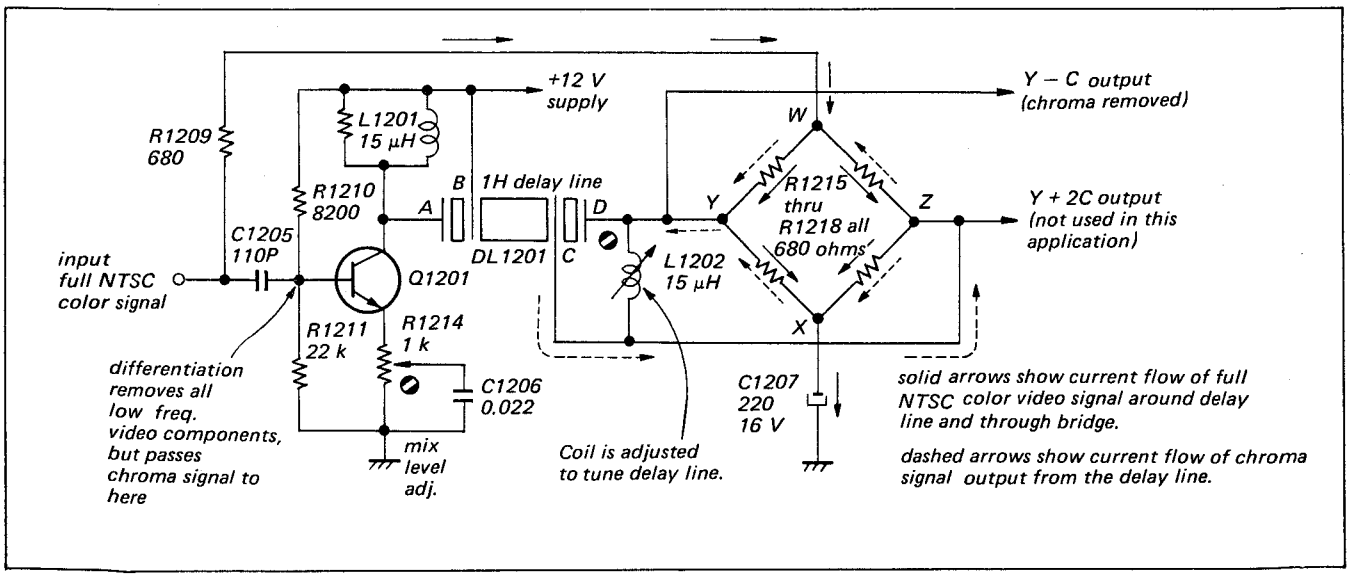



*Fig. 2-5. Comb filter*

In the NTSC system, the phase of the chroma signal is inverted (i. e. shifted by 180°) during each horizontal interval. The chroma signal in any given line of video is therefore 180° out of phase with the chroma signal in the line immediately preceeding or following it. For this reason, since the chroma output signal from the delay line is the signal from the line immediately previous to the full-bandwidth signal flowing into the bridge through R1209, the two chroma signals flowing in the bridge at any given time are always 180° out of phase with each other. It is this fact which forms the principle of operation of the comb filter. As the two separate loop currents flow through the bridge, phase cancellation occurs across resistor Y-X. In contrast, phase addition occurs across resistor Z-X. If the amplitudes of both chroma signals are exactly equal, the result is a total nulling to zero of the chroma signal seen between node Y of the bridge and circuit common. Between node Z of the bridge and circuit common, on the other hand, the amplitude of the chroma component in the video signal is doubled. In this application only the chroma cancellation function is utilized. To assure proper phase cancellation, the amplitudes of both the delayed and non-delayed signals must be equal. Mix level pot R1214 is adjusted to set the amplitude of the delayed chroma signal equal to that of the chroma component in the non-delayed video signal.

The output from the comb filter is routed through delay line DL1202. This delay line delays the phase of the luminance signal to match the delay introduced by the chroma processing circuits in the record system. See Fig. 2-6.

The Y signal, stripped of its chroma components and suitably delayed, is routed back to pin 20 of IC1201. IC1201 is a SONY type CX-087B, which was originally designed for use in SONY television sets. Three separate parts of it are used here for video amplification. The Y signal is amplified between pins 20 and 22 of IC1201. From pin 22, the signal is routed to an equalization network made up of C1212, C1213, and L1203.

The comb filter, in the process of removing the chroma component, also doubles the amplitude of any luminance signal components which happen to fall within the chroma passband. This occurs because the Y signal does not reverse phase with each succeeding horizontal line, so phase addition rather than phase cancellation takes place. The purpose of the equalization network is to attenuate only the luminance signals which fall within the chroma passband, to obtain an overall flat response in the luminance channel.

Following the equalization network, the Y signal routes back to Pin 17 of IC1201. The third section of IC1201 used in this circuit is between pins 17 and 14. This part of IC1201 is a buffer amplifier. From pin 14 of IC1201 the signal passes to the emitter of common base amplifier Q1203 through R1229, the Y level adjustment pot. Q1203 and Q1204 form a two stage video amplifier which amplifies the Y signal and delivers it to the low pass filter. Q1204 is an output buffer for proper impedance matching to the filter.

Low pass filter FL1201 limits the bandwidth of the luminance channel when the machine is operated in the color mode. This is done to prevent the generation of spurrious signals due to interaction of the luminance FM signal with the 767 kHz chroma component.

Following the low pass filter, the luminance signal passes to pin 5 of IC1202. This IC is an electronic switch, exactly like IC1001 described earlier. The electronic switch is controlled by a signal from the collector of Q1404 and selects Y signal from the low pass filter when the machine is operated in the color mode and from pin 8 of IC1201, directly, when the machine is operated in the monochrome mode.

The output of IC1202 is buffered by emitter follower Q1206 and supplied to the clamp and pre-emphasis circuits which follow.

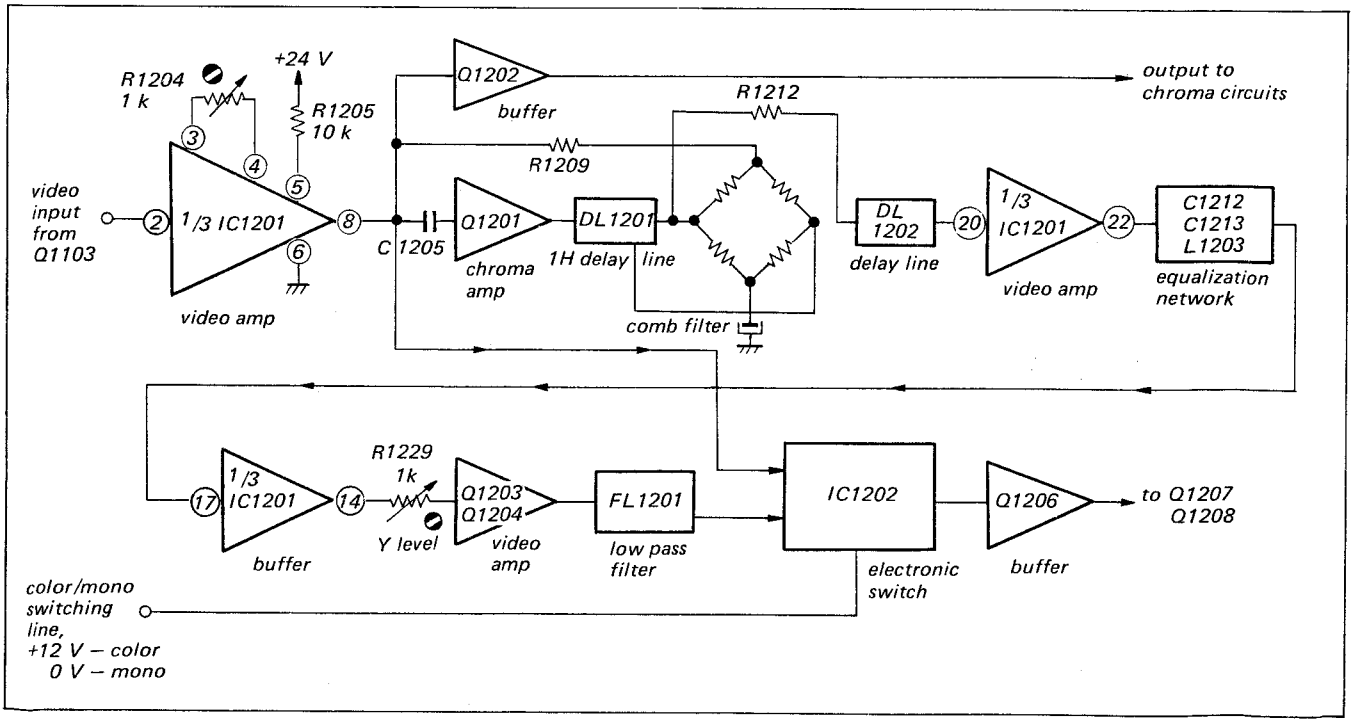



*Fig. 2-6.*

### CLAMP AND PRE-EMPHASIS

The video signal, supplied through buffer Q1206, is clamped at sync tip by clamp diode D1202. The clamp level is set by pot R1252. Clamp switching transistor Q1207 is normally saturated. It opens during the vertical interval to disable the clamp at that time. Diode D1203 is a temperature compensator for D1202. The clamped video signal is buffered by PNP emitter follower Q1208 and driven into the emitter of Q1209 through the pre-emphasis network. C1221, R1243, and R1245 form the pre-emphasis network. Q1209 is a common base amplifier which amplifies the clamped, pre-emphasized video signal, supplying it to the white clip circuit. Q1210 is the white clipper. A PNP transistor is utilized to lower the clip impedance and prevent variation of clip potential due to signal variation. The white clip level is adjusted by pot R1254 in the HIGH DENSITY mode and by pot R1259 in the REGULAR mode. Following white clipping, the video signal is buffered by emitter follower Q1211, which supplies it to the FM modulator.

### FM MODULATOR AND RF AMPLIFIER

Transistors Q1302 and Q1303 form an astable multivibrator which oscillates at a frequency determined by R1312, R1313, C1303, and C1304. The actual instantaneous frequency is proportional to the level variation of the video signal applied to the two bases through R1312 and R1313. PNP clipper transistors Q1304 and Q1305 clip the base voltage of the two multivibrator transistors, preventing them from driving into hard saturation. Good waveform symmetry is obtained over a wide range through proper adjustment of the base voltage applied to the two clipper bases. This adjustment is affected through pot R1305. Emitter follower Q1301 simply supplies dc to the clipper bias circuit. FM modulation takes place as the varying instantaneous level of the video signal shifts the instantaneous frequency of the astable multivibrator.

The modulator output is coupled into the RF amplifier through transformer T1301, which drives the signal into the emitter of common base amplifier Q1306. The output of Q1306 is buffered by emitter follower Q1307 and supplied to IC1301 via two paths. IC1301 is an electronic switch, exactly like IC1202 described previously. The output of the RF amplifier passes through a high pass filter, located on the separate EQ board, before reaching input pin 5 of IC1301. IC1301 is switched by the color/BW switching line which also controls IC1202. In the monochrome mode, the unfiltered output from the RF amplifier is selected, allowing maximum recording deviation for best picture detail. In the color mode, however, the converted color signal is recorded on the tape at a frequency of 767 kHz. IC1301 is switched to select the high pass filtered RF. The high pass filter removes FM carrier components below about 1.2 MHz, making room for the chroma signal.

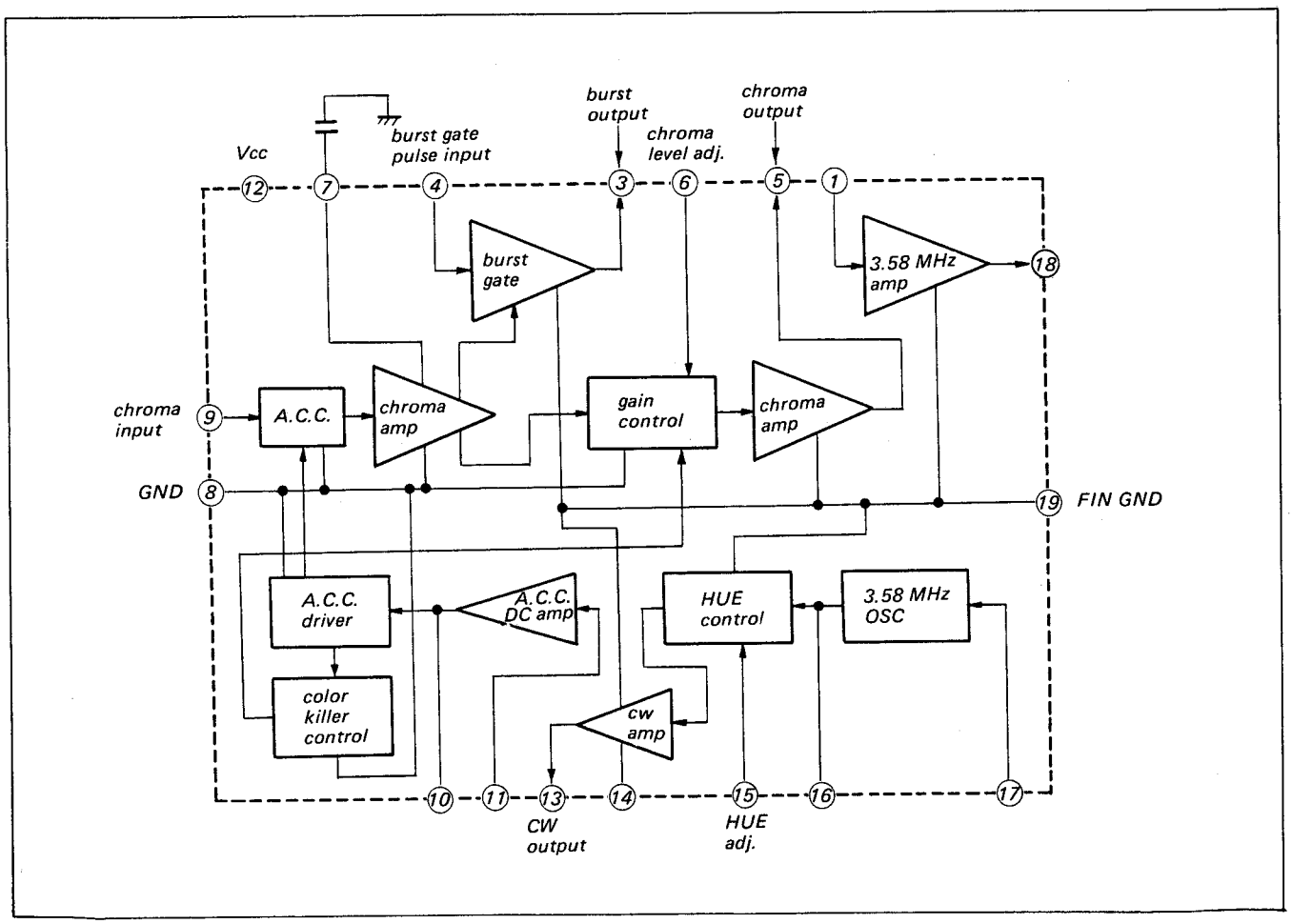



*Fig. 2-7. SONY type CX-103D I.C*

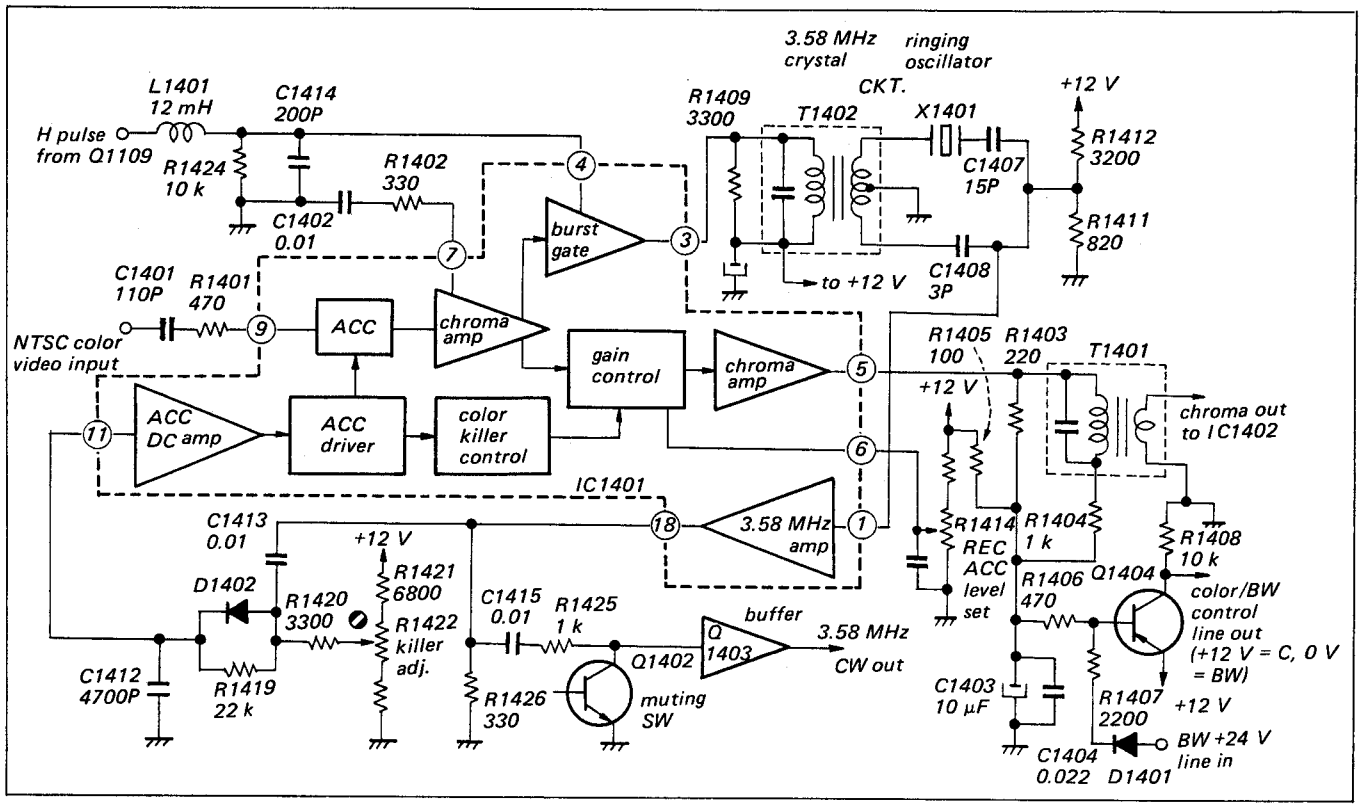



*Fig. 2-8. A.C.C., color killer, and burst gate ckt.*

In all modes other than RECORD/E to E, the +24 V supply for IC1301 and Q1308 is disconnected. This affords about −30 dB of Y-RF output muting. Transistor Q1308 is an emitter follower which buffers the output from IC1301, supplying it as Y-RF output to pin 10 of CN1001.

### A.C.C., COLOR KILLER, AND BURST GATE CIRCUIT

The heart of this circuit is integrated circuit IC1401, a SONY type CX-103D, which was originally developed for use in SONY television receivers. Fig. 2-7 shows the inner workings of the type CX-103D in block diagram form. Only part of the integrated circuit is utilized on the MOD board, the A.C.C., burst gate, and 3.58 MHz amplifier sections. Fig. 2-8 shows the portions of IC1401 which are utilized, re-drawn together with the surrounding discrete components which make up the entire circuit. The following description will refer to Fig. 2-8.

The circuit utilizes two input signals and develops two output signals. The full NTSC color video signal, from the emitter of buffer Q1202, is supplied to pin 9 of IC1401 through C1401 and R1401. The signal is differentiated by C1401, which is small in capacitance, removing the low frequency video components. The chroma signal remains, and enters the IC at pin 9. It passes through the ACC block, an automatic chroma level control stage, and on to a chroma amplifier. This chroma amplifier block has two outputs, one goes to the burst gate, the other to the gain control block. The chroma signal is controlled by the gain control block. Manual ACC level is set by adjustment of pot R1414. Following the gain control block the chroma signal is further amplified by a second chroma amplifier. The output of this amplifier appears at pin 5 of IC1401, where it is driven across the primary of coupling transformer T1401. The signal is then coupled to the frequency converter, IC1402.

The burst gate portion of IC1401 is actuated by a pulse supplied from switching transistor Q1109. This pulse is integrated by R1141 and C1120 and shaped by L1401, R1424, and C1414. It is applied to IC1401 at pin 4. The full chroma signal is supplied to the burst gate from the first chroma amplifier in IC1401. No signal passes through the burst gate, however, except when the switching pulse is present at pin 4. This is timed to be coincident with the reference burst in the chroma signal. The output from the burst gate consists only of the chroma burst signals. All other parts of the chroma signal are removed by switching action of the burst gate.

The output from the burst gate, taken at pin 3 of IC1401, is driven across the primary of transformer T1402. Both the primary and secondary of T1402 are tuned, forming a tank circuit. 3.58 MHz crystal X1401 is in series with the secondary, forming part of the tank. The chroma burst signals ring the tank circuit, setting up continuous oscillation within the tank. Energy is added with each successive burst, keeping the tank oscillating in phase with the burst signal. The amplitude of these oscillations is proportional to the amplitude of the chroma burst signal. Its phase is always locked to the phase of the burst.

The output from this 3.58 MHz ringing oscillator circuit is coupled to pin 1 of IC1401. The signal is amplified and buffered by the 3.58 MHz amplifier portion of the IC and supplied as output at pin 18. From pin 18, the 3.58 MHz cw signal takes two paths. One is through C1415 and R1425, where it is the input to buffer transistor Q1403. Q1403 buffers the signal, supplying it as the 3.58 MHz CW OUT signal at pin 1 of CN1002. Muting switch Q1402 is saturated in all operating modes except RECORD and E to E. This cuts off the 3.58 MHz cw out signal except in the RECORD and E to E modes. The second path for the 3.58 MHz

signal is through C1413, where it is rectified by diode D1402. The rectified signal forms a dc control signal which is supplied to the ACC dc amplifier portion of the IC at pin 11. The average level of this control signal is established by the adjustment of pot R1422, the color killer. Biasing is set so that the output from the second chroma amplifier in the IC is cut off when no chroma signal is present. This prevents colored noise in the recorded picture when the input signal is monochrome.

Transistor Q1401 is a constant current generator. It provides a constant discharge current on the output of the ACC dc amplifier in the IC to improve the color killer response.

When a chroma signal is present, switching transistor Q1404 is biased into saturation. This switches the color/BW control line, taken from Q1404's collector, to +12 V. When no chroma signal is present there is no output from pin 5 of the IC. In this case Q1404 cuts off and the COLOR/BW control line switches to zero volts. A manual override is provided for switching Q1404 when the machine is placed in the MONOCHROME operating mode. In the manual MONOCHROME mode, the BW +24 V line, from pin 5 of CN1002, goes to +24 V. This voltage is coupled to the base of Q1404 through D1401 and R1407, keeping Q1404 cut off.

### FREQUENCY CONVERTER AND 4.34 MHz OSCILLATOR CIRCUITS

As in all other EIAJ color videocorders the chroma signal is down-converted from 3.58 MHz to 767 kHz and direct recorded onto the tape by the video heads in the space provided below the lowest deviation of the Y-FM signal. The down-conversion is affected by beating the 3.58 MHz chroma signal against a reference signal from a crystal oscillator and taking and the difference frequency as output. In SONY videocorders, this down-conversion is accomplished by means of a balanced modulator.

IC1402, a type SN76514N, is a complete self-contained balanced modulator. The 3.58 MHz chroma signal from the secondary of T1401 is coupled to pin 5 of IC1402 through C1425. Transistor Q1407 forms a crystal oscillator circuit whose nominal 4.34 MHz free running frequency is exactly set by adjustment of trimmer C1420. The 4.34 MHz output signal from this oscillator is coupled into pin 11 of IC1402 through C1429. The two signals heterodyne in IC1402 yielding sum and difference frequencies. Both the input frequencies are eliminated due to balanced modulator action.

Of the two sum and difference frequencies produced in IC1402, only the 767 kHz difference frequency is utilized. The output signal, taken at pin 3 passes through a low pass filter, consisting of L1402, L1403, C1431, C1432, and C1433. The low pass filter removes the upper sideband, passing only the 767 kHz signal.

The 767 kHz down-converted chroma signal is coupled to the base of Q1406 through C1434. Q1406 is an emitter follower stage which buffers the signal, supplying it as the 767 kHz CHROMA OUT signal at pin 1 of CN1001. Switching transistor Q1405 is a muting switch which saturates in all operating modes except RECORD and E-to-E, eliminating any output from the balanced modulator.

### MODE SWITCHER, Q1408

In the RECORD and E-to-E modes, the VIDEO E-E +24 V line, from pins 5 and 6 of CN1001, goes to +24 V. In all other operating modes this line is at zero. When it is at +24 V, Q1408 is forward biased into saturation, so its collector voltage goes to zero. So long as the BW +24 V in line is also at zero, forward bias is removed from muting switch transistors Q1402 and Q1405 so they cut off, allowing signals to pass. When the VIDEO E-E +24 V line is at zero, bias is removed from Q1408 and it cuts off. When Q1408 cuts off, its collector goes to +12 V driving Q1402 and Q1405 into saturation. Q1402 and Q1405 switch, grounding out any signals present at their collectors.

The BW +24 V IN line overrides the action of Q1408, keeping Q1402 and Q1405 saturated whenever the VTR is manually placed in the MONOCHROME mode.

## RP BOARD

### Y-FM SIGNAL RECORD AMPLIFIER

Both the Y-FM and 767 kHz chroma signals, developed on the MOD board, are amplified by signal recording amplifiers on the RP board before they are applied to the rotating video heads. Both signals are processed in different parts of the same integrated circuit before being passed on to the final record amplifiers. This integrated circuit is IC2101, the Y/C Amp and Buffer. IC2101 is a SONY type CX-087B, developed for use in TV receivers. It is exactly like IC1201 on the MOD board, described previously. For clarity, the Y/C Amp and Buffer circuits, utilizing IC2101, are shown re-drawn in Fig. 2-9.

The 767 kHz down-converted chroma signal is supplied to pin 7 of CN2021 as the REC CHROMA IN signal. The signal is coupled through capacitor C2106 to pot R2106, the chroma record current adjustment control. From the wiper of R2106, the chroma signal passes through R2107, L2102, and C2107, entering IC2101 at pin 20. Between pins 20 and 22 of IC2101 is a chroma amplifier stage. The 767 kHz chroma signal is amplified by this stage and supplied as output to pin 22. The output signal from pin 22 is coupled to the chroma record amplifier Q2104 through C2112.

The Y-FM signal is supplied to pin 9 of CN2021 as the REC Y-RF INPUT signal. This signal is coupled through capacitor C2115 directly into pin 2 of IC2101. Between pins 2 and 8, the IC has a video amplifier. Resistors R2128 and R2129 and capacitor C2117 form a rolloff network to stabilize gain vs. frequency response of this stage. The amplified Y-RF signal appears at pin 8 and routes to two places. One path is through R2523, C2517, C2518, and C2519, where it is the input to buffer transistor Q2505. The output of Q2505 is supplied to the RE board where it is amplified to become the erase current for the rotary erase heads. The second path for the Y-RF signal is through R2131, where it is supplied to pin 17 of the IC across a 767 kHz trap, formed by R2132, C2125 and L2103. The signal at pin 17 is input to three buffer amplifiers, two of which are utilized here. The two buffers supply the Y-RF signal at pins 11 and 13 which connect to coupling capacitors C2108 and C2122 respectively. C2108 and C2122 couple the Y-RF signal to the two Y RECORD AMPLIFIERS. The input to the Y-RF buffer amplifiers in the IC (i.e. pin 17) is switched on and off, within the I.C. by means of the blanking circuit. The blanking circuit is controlled by a potential applied to pin 18 which allows the signal to pass only in the RECORD, ASSEMBLE, AND INSERT operating modes.

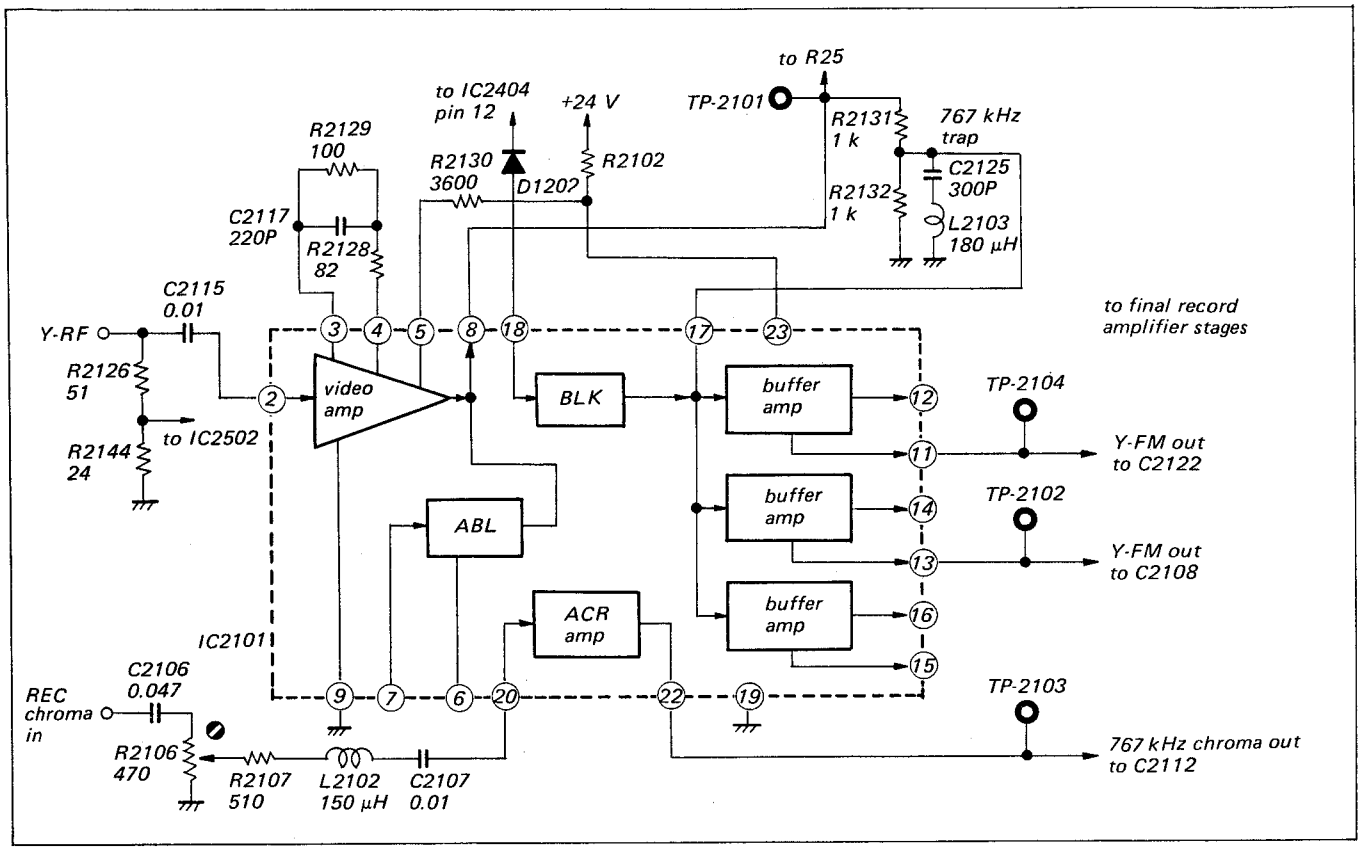



*Fig. 2-9. Y/C AMP and buffer circuits, IC2101*

There are two Y RECORD amplifiers, one for each of the two rotary video heads. Both receive the same input signal, but through different buffers in the IC. The input to channel A is supplied across pot R2112 via C2108. Similarly, the input to channel B is supplied to pot R2136 via Q2136. The two pots are adjusted to set the proper Y record currents. The signals from the two Y RECORD CURRENT ADJ. pots are coupled to the bases of Q2102 and Q2106, which are emitter follower buffer stages. These stages directly drive the bases of the output transistors Q2103 and Q2107. Q2103 and Q2107 are common emitter power amplifier, stages which couple their outputs through transformers T2101 and T2102. The secondaries of these transformers directly drive the heads. The output record current is switched into the heads through relays RY2201 and RY2202, which select the record or playback mode.

Transistor Q2104 is the single stage chroma record amplifier output. The 767 kHz down-converted chroma signal is coupled from pin 22 of IC2101 to the base of Q2104 through C2112. Q2104 is a common emitter power amplifier which amplifies the chroma record signal and supplies it, via C2111 and R2120 to the secondary of T2101, and via C2114 and R2125 to the secondary of T2102. The chroma record signal adds (i.e. linearly mixes with) the Y-FM output signals and is recorded on the tape along with them.

It is worth noting here that no record bias is used for either the luminance or chrominance channels. None is needed for the luminance signal, which is FM saturation recorded. The purpose of record bias is to eliminate amplitude distortion and the FM recording system is immune to this form of amplitude distortion. The chrominance signal, however, is not saturation recorded and would normally require bias. In this case, the much higher frequency FM luminance signal acts as the record bias for the chroma signal.

### ROTARY ERASE FILTER AND GATE

As previously stated, the Y-FM signal supplied from pin 8 of IC2101 is, in part, used to form the erase signal for the rotary erase heads. Only the portion of the Y-FM signal between 3.8 and 5.35 MHz is utilized. A high pass filter, consisting of C2517, C2518, and L2504 extracts this portion of the Y-FM signal and passes it to the base of buffer Q2505 across gate switching transistor Q2504. Q2504 is normally always saturated, preventing the rotary erase heads from being energized. Base drive is removed from Q2504 when the machine is placed in the INSERT MODE. This condition is held for the duration of the insert, allowing the rotary erase heads to clear the video track on the tape of any previously recorded signal. In the ASSEMBLE mode, the gate opens for a period of six seconds, allowing time for the forward moving tape to span the distance between the stationary video erase head and the rotary video heads.

### PLAYBACK AMPLIFIER, EQUALIZER AND SWITCHER CKTS.

Each of the two rotary video heads has its own playback amplifier channel. The output signals are combined into a single RF envelope by means of electronic switching. Both the playback RF amplifier channels are exactly the same. They are designated CH-A and CH-B on the schematic diagram. In this circuit description, only CH-A will be treated. The description also applies, point for point, to the corresponding portions of CH-B. Refer to the schematic diagram.

In the playback mode, RY2201 is de-energized. This connects the primary of transformer T2201 across the head. T2201 couples the playback signal into the gate of FET Q2201 referenced to ground. The secondary circuit of T2201 is tuned by pot R2206. C2209, and varicap diode D2202 to resonate with the head. Pot R2207 adjusts the capacitance by varying the bias on D2202.

Q2201 and Q2202 form a single stage cascode type voltage amplifier. A cascode stage is used because of its low noise characteristic and a low noise FET is utilized for the input. Low noise is essential in this stage since the signal-to-noise ratio of this stage determines the signal-to-noise ratio of the playback video signal.

Q2203 is an emitter follower buffer stage which couples the high impedance output of the cascode amplifier, at the collector of Q2202, to the low impedance input of the equalizer stage at the base of Q2204. Q2204 is a common emitter voltage amplifier with parallel resonant tuned circuits in both its emitter and collector circuits. Tuning of the collector circuit is adjustable, and is set to boost the response in the mid-range of playback frequency.

The output of the equalizer stage is directly coupled from the collector of Q2204 to the base of buffer Q2206 across C2216 and Q2205. Q2205 is a switching transistor which is cut off when the CH-A head is in contact with the tape. When the CH-A head is not in contact with the tape Q2205 is saturated, grounding the bottom end of C2216 and shunting any output signal from Q2204 to ground. This technique reduces noise in the combined RF playback signal. Q2211 is the switching transistor in CH-B whose switching action complements that of Q2205. Switching control pulses are alternately applied to the bases of Q2205 and Q2206 from IC2301, through R2226 and R2250.

The switched output signals from both the CH-A and CH-B channels are buffered by emitter followers Q2206 and Q2212. The buffer outputs are coupled together across pots R2253 and R2254. These pots are adjusted to balance the amplitudes of the two switched RF playback envelopes. R2253 supplies playback RF to the luminance channel and R2254 supplies RF to the chroma channel.

## RECORD/PLAYBACK ELECTRONIC SWITCHES FOR THE RF SIGNAL

The Y-playback RF signal is coupled from the wiper of R2253 to pin 3 of IC2502 through C2509. The record Y-RF signal is coupled to pin 5 of IC2502 through C2508. IC2502 is a SONY type CX-130 electronic switch (previously described) which is switched to select either the record Y-RF signal, when the machine is in the RECORD or E to E mode, or the playback Y-RF signal when the machine is in the PLAYBACK mode. The switch is controlled by the E-E +24 V line.

Similarly, the chroma playback RF signal is coupled to pin 3 of IC2501 through C2503 and the RECORD CHROMA IN signal is coupled to pin 5 of IC2501 through C2502. IC2501 is also a SONY type CX-130 electronic switch. IC2501 is switched to select either the RECORD CHROMA IN signal, when the machine is in the RECORD or E to E mode, or the playback chroma RF signal when the machine is in the PLAYBACK mode. This switch is also controlled by the E-E +24 V line.

The Y-RF signal, selected by IC2502, is coupled through C2510 to Q2502. Q2502 is a common emitter RF amplifier stage whose output is directly coupled to Q2503, an emitter follower buffer stage. Q2503 supplies the Y-RF signal to IC2503 along two paths.

The emitter load of Q2503 is split, consisting of two equal value resistors R2517 and R2518. These two resistors form a voltage divider which halve the amplitude of the RF signal, supplying it to pin 3 of IC2503 through C2515.

The output from the emitter of Q2503 is applied to a high pass filter which consists of C2511, C2512, and L2503. The high pass filter removes the 767 kHz chroma signal, passing only the Y-RF signal to pin 5 of IC2503.

IC2503, another SONY type CX-130 electronic switch, selects the Y-RF signal which has passed through the EQ board and high pass filter when the machine is operated in the color mode. In the monochrome mode, IC2503 is switched to select the Y-RF signal which has not passed through the high pass filter and equalization. This affords maximum signal bandwidth for best picture resolution in the monochrome mode. The output from pin 1 of IC2503 is the Y-RF output signal supplied to pin 7 of CN2024.

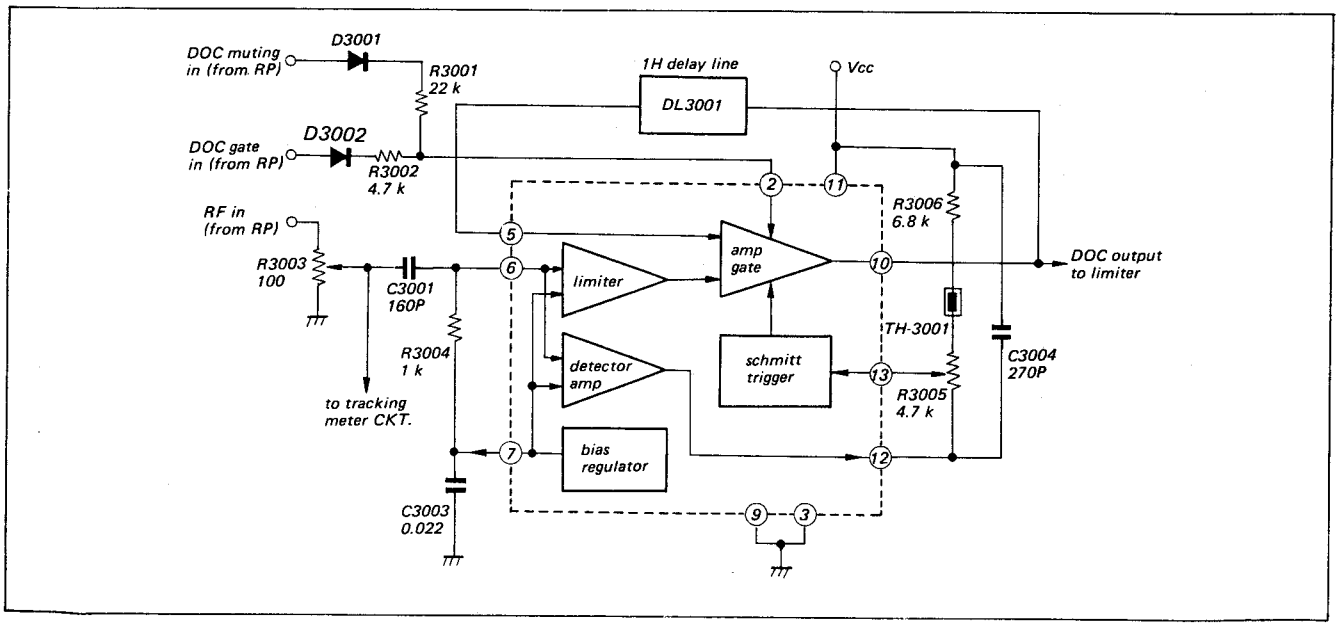



*Fig. 2-10. Dropout compensator*

The output from pin 1 of IC2501 passes through a low pass filter consisting of C2504, C2505, and L2501. This filter removes the Y-FM component from the playback RF signal, leaving only the 767 kHz chroma signal. This signal, buffered by emitter follower Q2501, is supplied to pin 9 of CN2023 as the CHROMA OUT signal.

The remaining circuitry on the RP board is pulse and switching circuitry and logic, not part of the video signal processing system. This circuitry is discussed in section 2-3 PULSE AND SERVO CIRCUITS.

## Y-DEM BOARD

### DROPOUT COMPENSATOR CIRCUIT

The Y-FM signal, supplied from the RP board, enters the Y-DEM board at pin 9 of CN3032 where it appears across DOC IN LEVEL control R3003. The signal from the wiper of R3003 routes to two places, one is to the tracking meter circuit, the other, through C3001, is to pin 6 of IC3001. All active portions of the dropout compensator circuit are contained within IC3001, a SONY type CX-121A integrated circuit. Fig. 2-10 shows the dropout compensator circuit re-drawn to show the inner workings of IC3001 in block diagram form. Refer to Fig. 2-10.

The Y-FM signal supplied to pin 6 of IC3001 is amplitude limited by the limiter and supplied to the amp gate circuit. Normally, the limiter output passes through the amp gate and appears as output at pin 10. A sample of the output is routed through the 1H delay line and applied to a second input of the amp gate at pin 5.

The Y-FM signal at pin 6 is also supplied to the detector amp, where it is rectified. This rectified output appears at pin 12, where it is filtered by C3004. A mean dc voltage level proportional to the amplitude of the Y-FM RF envelope is thus established at pin 12. R3006, TH-3001, and pot R3005 form a voltage divider between the regulated +12 V power supply and pin 12. The voltage at pin 13, the wiper of R3005, is a function of the voltage at pin 12 and the setting of R3005. Pin 13 is the input to a schmitt trigger, and the setting of R3005 determines triggering sensitivity.

The occurance of a dropout, which is a momentary loss of the Y-FM RF signal, results in a step-function change in the dc voltage on pin 12. This transition is reflected at the wiper of R3005 where it toggles the schmitt trigger. The schmitt trigger remains switched for as long as the dropout lasts. The schmitt trigger applies a pulse to one of the two control inputs to the amp gate circuit. It causes the amp gate to switch inputs, supplying the 1H delayed signal as output to pin 10.

The amp gate circuit has a second control input which connects to pin 2 of the IC. This is an inhibit line. A positive voltage applied at pin 2 inhibits operation of the amp gate and allows the limiter output to pass through to pin 10 even if the schmitt trigger toggles. The dropout compensator is inhibited in two cases. In the FORWARD mode, a DOC killer pulse is applied from the RP board to inhibit operation of the dropout compensator during the vertical blanking interval. In the PAUSE mode, a steady dc potential is applied from the RP board to inhibit dropout compensator action.

### LIMITER AND FREQUENCY DOUBLER

The output of the dropout compensator is applied to pin 1 of IC3002 through C3008. IC3008 is a SONY type CX-034 FM limiter, which provides about 50 dB of limited gain. The limiter and frequency doubler circuit is shown in Fig. 2-11, re-drawn for clarity.

The CX-034 IC has symmetrical inputs, pins 1 and 14, and symmetrical outputs, pins 6 and 9. Since the input signal is referenced to circuit ground, pin 1 is used for the input and pin 14 is ac grounded through C3012. Pins 4 and 11 are feedback inputs. DC feedback resistors R3009-R3014, connected into a bridge differential configuration, are low in value providing good stability. Pot R3013, the carrier balance adjustment, is adjusted to optimize the dc balance so as to obtain the best symmetry of output waveform. The feedback loop is ac bypassed at pin 4 through C3009 and C3010. This causes the IC to run open loop at the FM carrier frequency, utilizing the full open loop gain for limiting action.

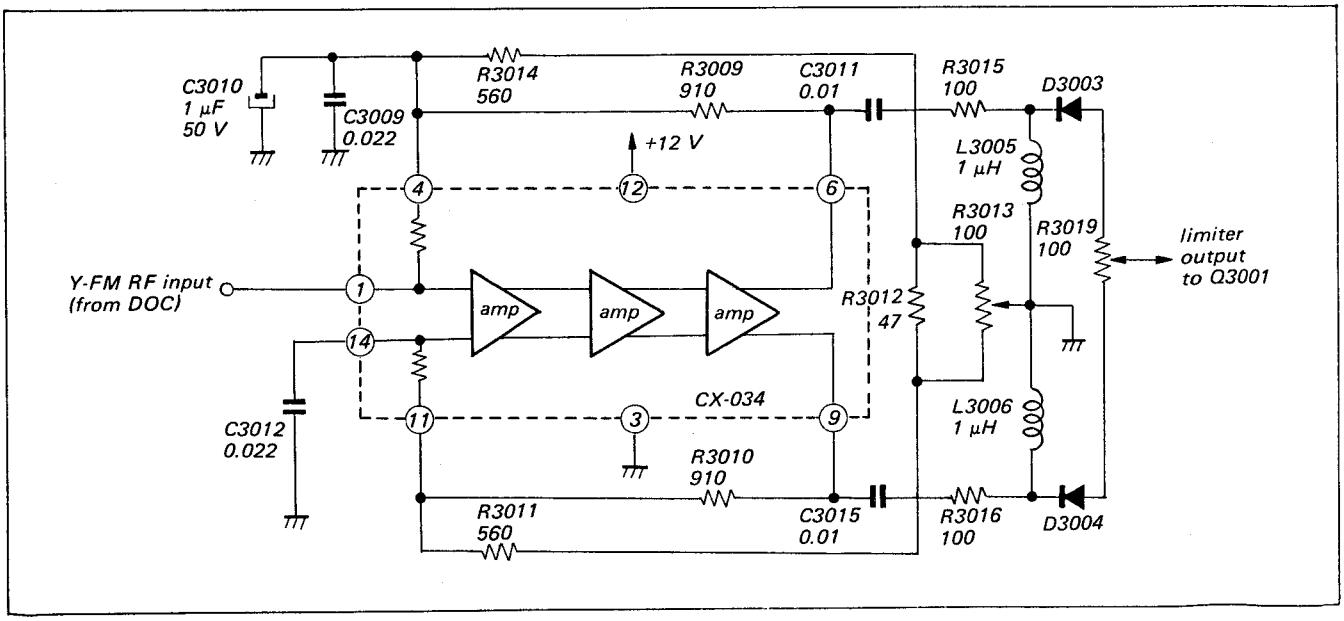



*Fig. 2-11. Limiter circuit*

The limiter output appears at pins 6 and 9 and the limited waveform is rectangular in shape. The signals at pins 6 and 9 are 180° out of phase with each other. These are coupled through C3011 and C3015 across the low impedance networks formed by R3015-L3005 and R3016-L3006, which sharply differentiate the rectangular waveforms into a series of pulses. Both positive and negative-going spikes are produced, corresponding to each transition of the rectangular waveform. Diodes D3003 and D3004 couple only the negative going pulses from each side across pot R3019. The two signals mix in R3019 and, due to the 180° out of phase relationship of the two limiter output signals, the pulse frequency is doubled by the process of full wave rectification. The Y-FM carrier deviates between 3.4 and 4.8 MHz, which is partially within the video band. By doubling the carrier frequency the deviation is shifted to between 6.8 and 9.6 MHz, out of the video band. This eliminates interference patterns caused by beats between the video and FM carrier signals.

### FM DEMODULATION

The rectified, frequency-doubled pulses from the wiper of pot R3019 are amplified and inverted into positive-going pulses by common emitter amplifier Q3001. They are then fed through FL3001, a low pass filter which passes only signals of video frequency. R3019 is adjusted so that the pulses rectified by each diode appear at the same amplitude.

Acting together, the RCL differentiation network at the limiter output, the diodes, and the low pass filter form what is known as a pulse counting discriminator. This pulse counting discriminator demodulates the Y-FM carrier in the following way. Since all the rectified pulses are of the same polarity (positive following inversion by Q3001) they develop a net (positive) charge across the capacitive element in the low pass filter. The pulses are of very short duration, so the net charge, which appears between the low pass filter output and circuit ground, is directly proportional to their spacing (or frequency). The closer together the pulses are spaced (the higher the frequency), the greater the charge. The result is that the FM carrier pulses are averaged into an instantaneously varying dc level, in other words a video signal, in which the lowest dc voltage (sync tip) corresponds to the lowest FM carrier deviation frequency and the highest dc voltage (peak white) corresponds to the highest FM carrier frequency. Since the frequency of the carrier component was doubled, it is rejected by the low pass filter leaving only the video signal.

The high frequency video signals were pre-emphasized, prior to recording, to improve the signal-to-noise ratio. The demodulated signal must be de-emphasized to equalize overall response. The RC network formed by C3017 and R3022 serves this purpose.

### VIDEO AMPLIFIER

The demodulated video signal is supplied to the base of Q3002 via C3019. Q3002 is a common emitter amplifier which amplifies the video signal and supplies it to the base of Q3003, a second common emitter stage. A feedback peaking network between the collector of Q3003 and the emitter of Q3001 boosts the high frequency video gain to attain an overall flat response. Part of the collector load of Q3003 is video output level adjustment pot R3034. The signal is directly coupled from the wiper of R3034 to the base of Q3004. Q3004 is an emitter follower buffer amplifier which supplies the video signal, at a low output impedance, to the succeeding circuits.

### VIDEO MUTING AND 3.58 MHz TRAP SWITCH

The video signal routes from the emitter of Q3004 through C3025 and R3040 to pin 17 of IC3003, across the collector circuits of Q3005 and Q3006. During the threading and unthreading operations, video muting transistor Q3005 switches from cutoff to saturation, grounding out the video signal. At all other times Q3005 remains cut off, allowing the signal to pass. Q3006 is a similar type of switch. In the monochrome mode it remains cut off, but saturates when the machine is in the color mode. This grounds the bottom end of L3009, placing the 3.58 MHz trap circuit, formed by C3027 and L3009, across the video signal line. The trap removes video signal components which might interfere with the chroma signal when it is subsequently added.

### NOISE ELIMINATOR AND VIDEO LEVEL METER

The video signal supplied to pin 17 of IC3003 is distributed to the inputs of three buffer amplifiers whose outputs appear at pins 11, 16, and 13. The output at pin 13 is rectified by a full wave voltage doubler circuit consisting of D3010, D3011, C3038 and C3039. This circuit produces a dc current through R3068, R3069, and the video level meter. Pot R3069 adjusts the current through the meter to set the calibration.

Noise in the demodulated video signal tends to be predominantly high frequency in nature. The purpose of the noise eliminator circuit is to improve the signal to noise ratio by clipping out the high frequency noise.

The full-bandwidth video signal is present at the buffer outputs on both pins 11 and 16 of IC3003. The signal from pin 16 routes through a high pass filter composed of C3035 and R3056. The filter removes the low frequency video signals, leaving only the high frequency signals for processing. The output of the high pass filter enters pin 20 of IC3003 and is amplified by a video amplifier between pins 20 and 22. The amplifier's output at pin 22 passes to the base of Q3007. Q3007 is an emitter follower buffer stage which drives the signal through slicer diodes D3008 and D3009. The slicer output goes to ground through R3045 and pot R3046. R3046 adjusts the high frequency mix level. Only the high frequency video signals greater in amplitude than the forward conducting drop of the diodes (about 0.6 V) appear across R3046. Since most of the noise components are below this level, the majority of the high frequency noise is eliminated. The full bandwidth video signal from pin 11 of IC3003 is coupled into pin 2 of the IC through C3036. The signal is amplified and appears at pin 3 where it passes through a low pass filter composed of R3050 and C3031. This filter removes the high frequency components, allowing only the low frequency video signals to reach pin 4. The noise-clipped high frequency signals are mixed with the low frequency signals at pin 4. The high frequency mix level is set by adjustment of pot R3046. The re-combined video has a better signal to noise ratio than the signal ahead of the noise eliminator. This signal is amplified by the amplifier between pins 4 and 8, and appears as output at pin 8.

### COLOR/BW SWITCHING CIRCUIT

The output luminance signal from pin 8 of the noise eliminator routes to the inputs of IC3004 via two separate paths. The path to input pin 5 is through R3061 and delay line DL3002, across a 3.58 MHz trap formed by C3040 and L3010. IC3004 is a SONY type CX-130 electronic switch such as is utilized throughout the video signal processing system and has previously been described.

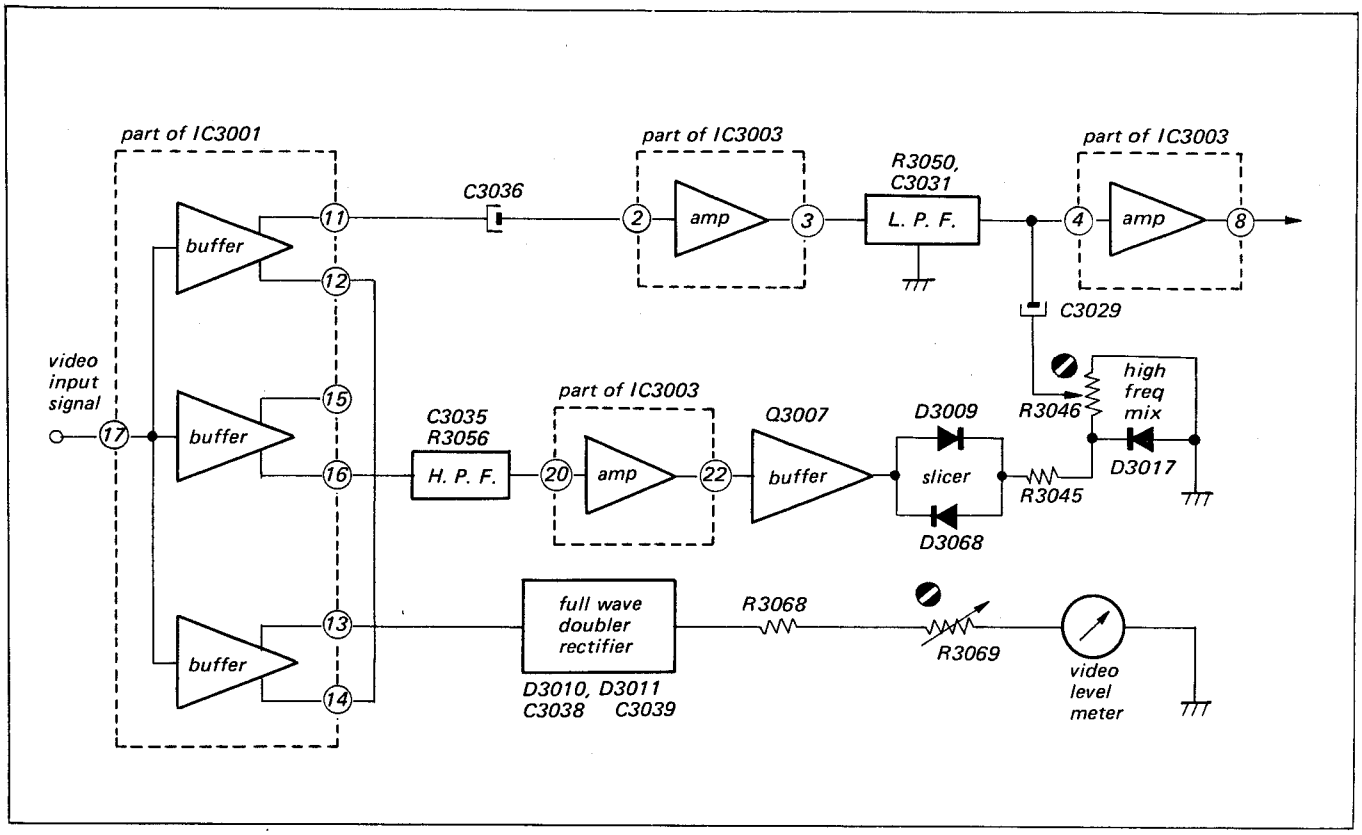



*Fig. 2-12. Noise eliminator*

The second luminance signal path to IC3004 is through a level attenuator formed by R3085, R3059, and R3060. R3059 is the VIDEO OUT LEVEL adjustment pot for the monochrome mode. The signal connects from its wiper to pin 3 of IC3004 through C3042. IC3004 switches to select between the two signal paths depending on whether the unit is in the color or monochrome mode. In the color mode, the path through the delay line is used. The delay line delays the time of the luminance signal to match the delay in the chroma processing circuits. In the monochrome mode, the path through the level attenuator is selected, but the signal is not delayed.

### TRACKING METER CIRCUIT

Proper tracking requires that the rotary video heads exactly scan down the center of the diagonal tracks recorded on the tape. If the head gets partly off the track the playback output signal level is reduced with a corresponding increase in noise. The reduction in output signal level results in a reduction in the amplitude of the Y-FM RF envelope seen at the wiper of the DOC IN LEVEL control R3003. This signal is coupled through capacitor C3046 to the base of Q3010. Q3010 is a common emitter voltage amplifier which amplifies the Y-FM signal and supplies it to the base of Q3012 across Q3011. Q3012 is an emitter follower buffer stage which drives the signal into a rectifier circuit formed by diodes D3015 and D3016. The output of the rectifier circuit is a dc level, filtered by C3052, which is proportional to the amplitude of the RF envelope. This dc signal provides current which flows to ground through R3083, R3084, and the tracking meter. Pot R3084 calibrates the tracking meter.

## C-DEM BOARD

### CHROMA SIGNAL FREQ

The C-DEM board is a color playback signal processor whose function is to convert the 767 kHz chrominance information recorded on the tape into a form suitable for demodulation by a color television monitor or color TV set. These 767 kHz signals are subject to frequency and phase errors caused by jitter inherent in video tape recorders. The basic idea is to beat the 767 kHz signal against a 4.34 MHz signal which has identical frequency and phase errors (jitter). The result is a constant difference frequency, containing no jitter, which is centered about the NTSC subcarrier frequency of 3.58 MHz. Using this technique, the up-conversion of the chroma playback signal to 3.58 MHz and the jitter correction process are both accomplished simultaneously. Fig. 2-13 is a block diagram of the chroma frequency conversion circuits. Refer to this block diagram and the schematic diagram as you read the following circuit description. Circled numbers in the circuit description refer to reference numbers in Fig. 2-13.

The 767 kHz chroma playback signal enters the C-DEM board at pin 9 of CN4001 and routes to pin 1 of IC4001 through C4027. Resistors R4039 and R4040 provide bias to pin 1 of IC4001. The 767 kHz signal is amplified by amplifier (1), between pins 1 and 18 of IC4001, and delivered to a low pass filter (2). The low pass filter, consisting of L4002, C4029, and C4031, removes any high frequency components which may be present, allowing only the 767 kHz signal to pass through. Following the low pass filter, the signal again enters IC4001, at pin 14. It is amplified by amplifier (3), between pins 14 and 13, and supplied to input pin 5 of IC4002.

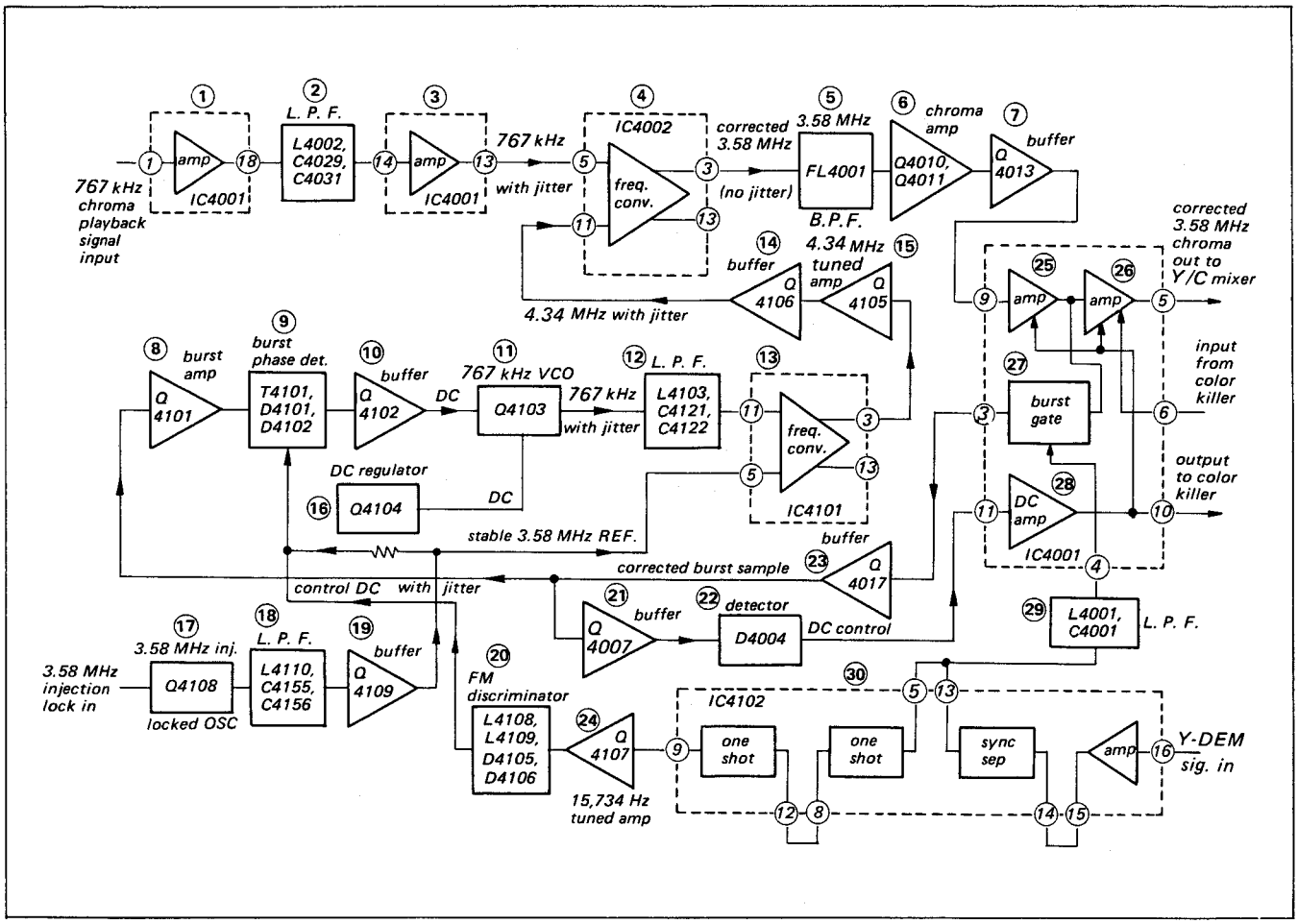



*Fig. 2-13. C-DEM board (partial block diagram)*

IC4002, (4) , is a type SN76514N doubly balanced modulator, identical with IC1402 on the MOD board which was used for the chroma down-converter, It heterodynes the 767 kHz chroma signal, containing jitter, against a 4.34 MHz signal which contains the same jitter. The result is that the two sum and difference frequencies produced contain no jitter. This output appears at pin 3 of IC4002 and passes to band pass filter FL4001. FL4001, (5) , is a 3.58 MHz tuned filter which passes only the lower sideband output from frequency converter (4) . This is the 3.58 MHz up-converted and stabilized chroma signal.

The output of the band pass filter is coupled to the base of Q4010 via C4038. Transistors Q4010 and Q4011 form chroma amplifier (6) in Fig. 3-13. Q4011 is a common emitter voltage amplifier whose emitter resistor, R4056, is partially bypassed by capacitor C4039. In normal operation, C4039 returns to ground through 82 ohm resistor R4085. The collector of STILL GAIN SWITCHER transistor Q4015 (see schematic) is across R4085. In the still mode, Q4015 is saturated by the D.O. MUTING +24 V IN signal, applied to pin 4 of CN4001. When Q4015 saturates it shorts out R4085, increasing the gain of chroma amplifier (6) to prevent actuation of the color killer. Transistor Q4011 in chroma amplifier (6) is an emitter follower output stage.

Chroma amplifier (6) delivers the 3.58 MHz chroma signal across ACC IN LEVEL ADJ pot R4067. The wiper of R4067 connects to buffer amplifier (7) , Q4013, through C4042. Q4013 is another emitter follower stage which supplies the chroma signal to pin 9 of IC4001 through C4044.

The chroma signal entering IC4001 at pin 9 passes through ACC amplifiers (25) and (26) , which regulate the amplitude of the chroma signal supplied to the Y/C MIXER. The output of amplifier (25) is internally coupled to burst gate (27) within IC4001. No signal passes through burst gate (27) except when a gating pulse is applied to pin 4 of IC4001. Such a pulse is supplied from pin 13 of IC4102 through low pass filter (29) , and phasing is selected so that the burst gate is open only during the occurance of the chroma reference burst, in the horizontal blanking interval. The burst signal, separated from the rest of the chroma signal by (27) , appears at pin 3 of IC4001. It is buffered by (23) , a common base amplifier, and supplied through transformer T4002 to the input of burst amplifier (8) , Q4101. Another output from T4002 supplies the burst signal to buffer (21) , emitter follower Q4007. The burst signal output from Q4007 is rectified by detector (22) , diode D4004, which supplies a dc control voltage, proportional to the burst amplitude, to pin 11 of IC4001. This is the input to dc amplifier (28) in IC4001, whose output controls the gain of ACC chroma amplifiers (25) and (26) . The dc control line input to pin 11 of IC4001 is biased to set the ACC control range. This is adjusted by means of pot R4029. The amplitude regulated chroma signal output from ACC amplifier (26) appears at pin 5 of IC4001 and is supplied to the Y/C mixer circuit.

The burst signals, separated from the phase corrected chroma signal by burst gate (27) and buffered by buffer (23) are supplied to the input of (8), common emitter burst amplifier Q4101. Transistor Q4101 amplifies the burst signals and drives them into burst phase detector (9) through the primary of transformer T4101. Burst phase detector (9) compares the phase of the corrected chroma signal burst with that of reference 3.58 MHz oscillator (17) which is locked to the 3.58 MHz reference oscillator in the MOD board. The output of burst phase detector (9) is a dc control voltage, adjusted line-by-line, which is proportional to the phase error between reference oscillator (17) and the sampled burst.

Transistor Q4108 and crystal X4101 form 3.58 MHz oscillator (17). The oscillator's free running frequency is precisely adjustable by means of trimmer capacitor C4153. In operation, this oscillator is phase locked to the 3.58 MHz ringing oscillator in the MOD board. A sample of the signal from the oscillator in the MOD board is fed into the C-DEM board at pin 2 of CN4002. This signal is coupled into the Q4108 oscillator circuit through diode D4107, R4160, and C4150. The Q4108 oscillator phase locks to this signal. The output signal from the Q4108 oscillator is coupled to the base of buffer amplifier transistor Q4109, (19), through low pass filter (18). The low pass filter removes unwanted high frequency components, ensuring good sinusoidal output waveform. Buffer (19) is an emitter follower stage which couples the signal into the burst phase detector, (9).

The output of burst phase detector (9) is a dc control signal voltage which is proportional to any phase error between the corrected 3.58 MHz chroma signal and the 3.58 MHz locked oscillator, (17). Phase error is sensed during the reference burst interval, and the dc output of the phase detector adjusted to compensate. This correction is held for the duration of the next horizontal scan line, so phase correction is applied on a line-by-line basis. The dc control signal output of phase detector (9) routes to buffer (10), source follower FET Q4102. The high input impedance of a source follower FET is what permits the circuit to hold the dc correction voltage for the duration of a horizontal line. The dc correction voltage, applied to the control input of 767 kHz voltage controlled oscillator (11) determines the exact frequency of that oscillator during each scan line.

The output of burst phase detector (9) is biased at the cathode of D4102 by a dc control voltage from the output of FM discriminator (20). The actual dc control voltage for V.C.O. (11) is determined by two correction loops. The first, or minor correction loop, is the one described in the above paragraph, using phase detector (9). This loop provides all necessary correction so long as there are no major speed variations in the forward motion of the tape. When wide tape speed variations occur however, such as in slow motion or still frame operation, the frequency changes in the playback chroma signal become too great for the limited lock range of the automatic phase correction (APC) circuit. In this case, the automatic frequency control (AFC) circuit, described below, takes over to widen the lock range. Wide tape speed variations are reflected by changes in horizontal sync frequency. The AFC circuit is a major correction loop, utilizing horizontal sync, which has a wide range of control over the VCO frequency.

The demodulated luminance signal, fed into the C-DEM board at pin 7 of CN4002, is coupled into pin 16 of IC4102 through C4135. The signal is amplified and H sync is separated and supplied as output at pin 13 where it is routed to burst gate (27) through low pass filter (29) and also back into IC4102 at pin 5. The H sync signal fed into pin 5 toggles two serially connected one shots within IC4102, whose output is a square wave locked to H sync. This square wave appears as output at pin 9, and is supplied as an input signal to Q4107, 15,734 Hz tuned amplifier (24). Amplifier (24) is tuned sharply resonant at H frequency by L4107 and C4143, which form a tank in the collector circuit of Q4107. This resonant amplifier has the effect of filtering the square wave output from IC4102, (30), into a sine wave. The sine wave output from amplifier (24) is fed as input to FM discriminator (20), which is tuned to null at H frequency. The actual dc output voltage from the FM discriminator, however, is biased by voltage divider action of the VCO SET pot, R4155, and the COLOR LOCK control. These controls are adjusted to set the nominal operating frequency of VCO (11). The AFC sensitivity is adjusted by means of pot R4146, which controls the amplitude of the input signal to amplifier (24).

Voltage controlled oscillator (11), centered around Q4103, is an LC oscillator with the tank connected in a colpits configuration in the emitter-base circuit. Control over the oscillating frequency is obtained by inserting additional capacitance in series with one end of the coil, and making this capacitance voltage-variable. In the circuit, capacitance C4116 and C4117 form a tank with L4112. Capacitors C4114 and C4115 are connected between one end of L4112 and ground. In addition, capacitors C4112 and C4113 provide a second path to ground through diode D4103. D4103 is an ordinary signal diode, forward biased by dc current flowing from the source of FET Q4102 through R4117. The junction capacitance of D4103 is proportional to how heavily it is forward biased, the more current flowing through it, the greater the capacitance. (In other words, the impedance to ground at the anode of D4103 is lower as the forward current through it increases). Since the forward current through D4103 is a direct function of the dc control voltage applied to the gate of FET Q4102, the control voltage adjusts the oscillator's frequency by changing the forward bias on D4103.

DC collector supply voltage for Q4103 is supplied by Q4104, connected as a series voltage regulator, (16). The output voltage from Q4104 is adjusted by pot R4124, which sets the voltage level of the VCO output signal. By proper adjustment the VCO output can be optimized for best waveform and minimum distortion.

Some distortion, however, does remain in the VCO output signal. To eliminate the distortion, the 767 kHz signal is routed through low pass filter (12) before it is applied to pin 11 of frequency converter (13). IC4101.

IC4101 is another type SN76514N doubly balanced modulator, exactly like IC4002 described previously. The 767 kHz output from the VCO (whose exact frequency corresponds, to any jitter induced errors in the playback chroma signal), applied to pin 11 of IC4101, is heterodyned against the stable 3.58 MHz reference signal applied to pin 5 from buffer (19). The resultant upper and lower sideband frequencies appear as output from IC4101 at pin 3. These signals are fed into 4.34 MHz tuned amplifier (15), centered around Q4105. Tuned circuits in both the emitter and collector circuits of Q4105 cause the transistor to amplify only the 4.34 MHz component of the frequency converter's output, rejecting the lower sideband. This amplified 4.34 MHz signal, which contains the jitter phase corrections, is buffered by buffer (14), emitter follower Q4106, and fed into input pin 11 of frequency converter (4), IC4002.

The foregoing description covers the operation of the 767 kHz to 3.58 MHz up-conversion process and the operation of the ACC loop. The following descriptions cover those remaining

sections of the C-DEM board which are not included in the block diagram of Fig. 2-13.

#### COLOR KILLER, Q4016 AND SWITCH, Q4008

The output from dc amplifier (28) in IC4001 is fed from pin 10 to the base of Q4016 through R4080. Resistor R4012 and pot R4013 form the collector load for color killer transistor Q4016. When the video signal contains color information, chroma reference bursts are present in the signal. These produce an output from dc amplifier (28) which is sufficient to keep Q4016 saturated. This places the lower end of CHROMA LEVEL pot R4013 at about +2 V level. R4013 adjusts the dc control voltage applied to pin 6 of IC4001 which sets the gain of ACC amplifier (26) . When the video signal is monochrome, no reference bursts are present. In this case the output from dc amplifier (28) drops to zero cutting off Q4016. This opens the lower leg of pot R4013, applying the full +12 V supply voltage to pin 6 of IC4001 through R4012. This causes ACC amplifier (26) to cut off, inhibiting any output from the chroma processing circuits which might introduce noise into the picture.

The output of ACC amplifier (26) is loaded by the primary of Y/C MIXER transformer T4001 and resistor R4018 which ties to the +12 V line. When the amplifier cuts off, as is the case when no chroma signal is present, the IR drop across R4018 disappears. This cuts off PNP transistor Q4008, whose base-emitter circuit is across R4018. When Q4008 cuts off, the COLOR +12 V line, originating at its collector, drops to zero. Conversely, the presence of chroma signals produces enough IR drop across R4018 to saturate Q4008, switching its collector to +12 V.

#### ACC SLEW LIMITER SWITCHING CIRCUIT, Q4002 – Q4004

The output of ACC dc control amplifier (28) , in IC4001, is proportional to the amplitude of the burst signal. Since this dc signal controls chroma gain, it is necessary to slew limit the output of the dc amplifier with a fairly large value capacitor in order to slow the ACC response time and prevent "hunting". This could be done using a single capacitor between pin 10 of IC4001 and ground, however, if a large capacitor is used, as is desirable, chroma level flicker can occur due to differences in the playback chroma RF level between the two heads. To circumvent this problem, as well as the ACC gain problem caused by the fact there are no burst signals during the vertical interval, an unique slew limiter switching circuit is employed. Capacitors C4004 and C4005, each a 10 microfarad electrolytic unit, are both connected at the positive end to pin 10 of IC4001. The negative ends of the capacitors each connect to the collector of Q4003. The emitters of these transistors are tied together to the positive end of capacitor C4006, a 100 microfarad unit across diodes D4002 and D4003. Q4003 and Q4004 are alternately switched by a 30 Hz square wave, supplied from the RP board through pin 3 of CN4001. The switching signal is applied directly to Q4004. Q4002 inverts its phase for application to Q4003. Transition times of the 30 Hz square wave switching signal coincide with head switching. Capacitors C4004 and C4005 are alternately switched in and out of circuit with each change of head, in such a way that the same slew limiting capacitor is always in circuit for a given head. Since the dc output at pin 10 of IC4001 is proportional to burst amplitude in the unregulated chroma signal, it may be different from head to head but should remain the same for the same given head. The use of this switching scheme and two different slew limiting capacitors allows each capacitor to store the dc output voltage which provides correct ACC limiting for that head. This allows the use of long time constants without objectionable flicker.

#### Y/C MIXER AND BUFFER, T4001 and Q4009

The ACC controlled chroma output signal from pin 5 of IC4001 is driven into the primary of Y/C mixer transformer T4001. The secondary of T4001 connects, at one end, to the demodulated luminance signal, supplied to pin 7 of CN4002. The other end of the secondary of T4001 connects to the base of Y + C buffer transistor Q4009. The luminance and chrominance signals add in the secondary of T4001 and the combined signal is buffered by emitter follower Q4008,which drives it out of the C-DEM board at a low impedance level.

## 2-3. PULSE AND SERVO CIRCUIT

The servo circuits, mounted on the SVO board, consist of two systems, the drum servo and the capstan servo. In both the Record and Playback modes, the drum servo system compares the phase of the vertical sync pulse in the video input signal (the external video input signal or internal sync signal in the Playback mode) with that of the 30PG signal synchronized with the drum rotation to produce an error voltage which corrects drum rotation.

The capstan servo employs a dc motor which drives the capstan. The capstan servo system has two functions, speed servo and tracking servo. In both the Record and Playback modes, the speed servo senses the tape speed by means of the FG signal obtained from the dc capstan drive motor, controling the motor for constant speed.

In the Record mode, the capstan servo locks the FG signal to a reference signal supplied from the built-in sync signal generator in order to stabilize the tape speed. In the Playback mode, it compares the phase of the CTL signal with that of Playback vertical sync, producing an error voltage that is added to the speed servo to assure correct tracking.

The 30 PG pulse is amplified by the 30 PG amplifier on the RP board and supplied to the speed servo.

Fig. 2-14. Shows a block diagram of the servo system.

#### 30 PG AMPLIFIER (RP board)

#### 30 PG Coil

The 30 PG coil, placed near the head drum, generates one pulse for one turn of the drum. Two 30 PG coils (A) and (B) are placed about 140° apart. 30 PG coil (B) generates the servo reference pulse. The pulse generated by coil (A) is used as reference pulse in editing, and is therefore placed about 40° advanced from what would be its normal position, 180° apart from the other coil. The pulse from this coil turns the rotary erase heads on, ahead of the video record heads,during editing. The outputs from the PG coils are supplied to the 30 PG amplifier on the RP board.

#### RP BOARD
#### 30 PG AMPLIFIER AND DELAY MULTIVIBRATOR

30 PG pulses (A) and (B), from the 30 PG coils in the head drum are amplified by 30 PG(A) amplifier Q2302 and by 30 PG(B) amplifier Q2301, respectively. See Fig.2-16. The output of the 30 PG amplifiers are supplied to the RF switching pulse forming circuit and D.O.C. killer pulse forming circuit.The output of the 30 PG(A) amplifer is also supplied to the blanking switcher circuit. The blanking switcher circuit is discussed in section 2-5. The 30 PG(B),

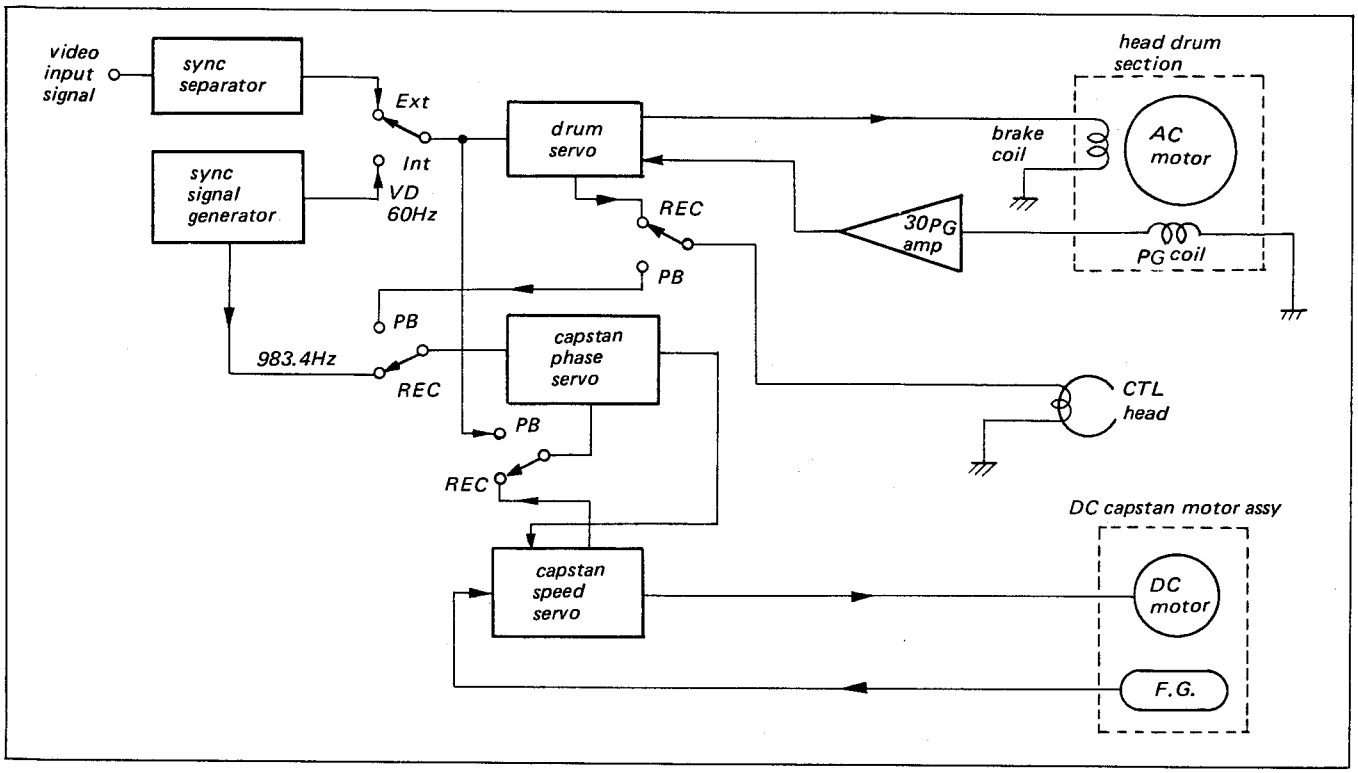



*Fig. 2-14. Block diagram of servo system*

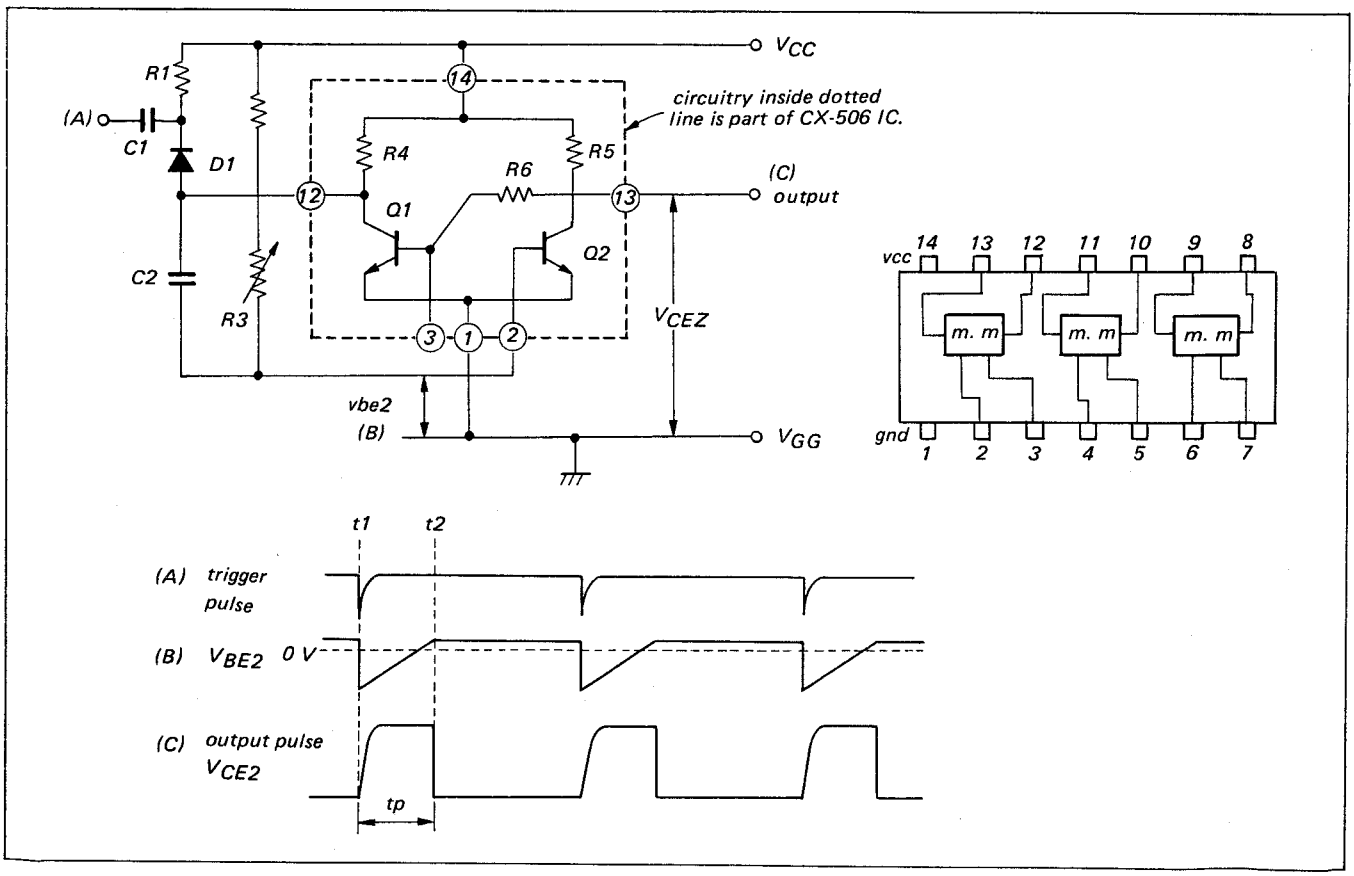



*Fig. 2-15. Monostable multivibrator operation*

output of Q2301 is supplied to Pin 12 of IC2301 and triggers the delay multivibrator. The delay multivibrator corrects electrically for mechanical tolerance errors in the mounting position of the 30 PG coil (B). the 30 PG output (B) from Pin 13 is supplied back to IC2301 at pin 4, one of the inputs to the switching pulse former flip-flop and to pin 3 of CN2024 from which it routes to the SVO board. The 30 PG (A), output of Q2302, is supplied to pin 8 and corrected by the edit PG delay multivibrator so that its waveform is 180° out of phase with the 30 PG (B) output from the servo PG delay multivibrator. The 30 PG (A) output from pin 9 is supplied back to pin 5 of IC2301, the other input to the switching pulse former flip-flop.

IC2301 and IC2302 (as well as IC2401, IC2403, and IC2404 in the blanking switcher circuit) on the RP board are SONY type CX-506 triple monostable multivibrator (one-shot) intergrated circuits. A typical one-shot circuit constructed around one section of the type CX-506 is shown in Fig. 2-15 together with its operating waveforms. Only part of the circuitry is contained within the integrated circuit, the rest consists of discrete components. The circuitry shown within the dotted line is part of the IC. Each CX-506 IC contains three such sections. The base of Q1 is dc coupled to the collector of Q2 via R6. When no trigger pulses are applied, base drive flowing through resistors R2 and R3 keep Q2 saturated, which in turn keeps Q1 cut off. C2 is charged to the value of Vcc. When a fast negative-going trigger pulse is applied to the circuit through C1, C2 discharges through D1 and voltage $V_{BE2}$ drops below zero volts. See waveforms (A) and (B). With base drive to Q2 thus removed, Q2 cuts off and its collector voltage rises to Vcc. See waveform (C). Cutoff of Q2 forward biases Q1 through R5 and R6 so its collector voltage drops to zero. C2 then begins to recharge, increasing $V_{BE2}$. Eventually $V_{BE2}$ gets above zero volts, and forward biases Q2. At that point, Q2 turns on removing base drive from Q1, so Q1 turns off. The circuit has now returned to its stable state. In the waveforms in Fig. 2-15, time $t_1$ is when the trigger pulse occurs (A), and $V_{BE2}$ drops below zero (B). Q2 then turns off (C). The recharge time of C2 is from time $t_1$ to time $t_2$ (B). This recharge time determines the total pulse width $t_p$ (C). The recharge time of C2, and thus the pulse width $t_p$, depend upon the RC time constant of R2, R3, and C2. C2 is chosen for nominal time, and R2 is adjusted to closely calibrate the pulse width.

The switching pulse forming flip-flop uses one section of IC2301. Here the external components have been connected to form a flip-flop, rather than a one-shot. This flip-flop is toggled alternately by 30 PG (A) and (B) to produce a 30 Hz rectangular wave. The switching pulses supplied from pins 10 and 11, are 180° out of phase. They are supplied to playback amplifier switchers Q2205 and Q2211. See Fig. 2-17.

#### D.O.C. Killer pulse forming circuit

This circuit produces a single output pulse from the 30 PG (A) and (B) pulses. The pulse disables the dropout compensator during the vertical blanking period. 30 PG pulse (A), the output of Q2302, is applied to pin 12 and triggers the delay one-shot. This one-shot delays 30 PG (A) so that it is 180° out of phase with 30 PG (B). The delay one-shot output from pin 13 and the 30 PG pulse output from Q2301 are applied to pin 10, triggering the output one-shot. The output one-shot produces a 60 Hz pulse of 2 msec. width. The output of the output one-shot, from pin 11, is supplied to Y-DEM board, as the D.O.C. killer pulse. See Fig. 2-17.

### DRUM SERVO CIRCUIT (SVO board)

In both the RECORD and PLAYBACK operations, the drum servo compares the phase of the vertical sync pulse in the externally supplied video input signal (in playback, if no video input signal is provided, the sync signal is derived from an internal sync generator) with that of the 30PG signal synchronized with the drum rotation, and corrects drum rotation and its phase by means of an error signal proportional to any phase difference.

### SYNC SEPARATOR AND 30 Hz SQ WAVE FORMER (SVO Board)

The video input signal, supplied to pin 5 of connector CN9003 is routed to pin 16 of IC9001 through C9001. IC9001 is a type AN301 servo integrated circuit containing two one-shot circuits, a sync separator and two amplifiers. IC9001, as connected, makes use of all of this except for one of the two amplifiers. The circuit is shown in Fig. 2-18, re-drawn to better illustrate signal flow.

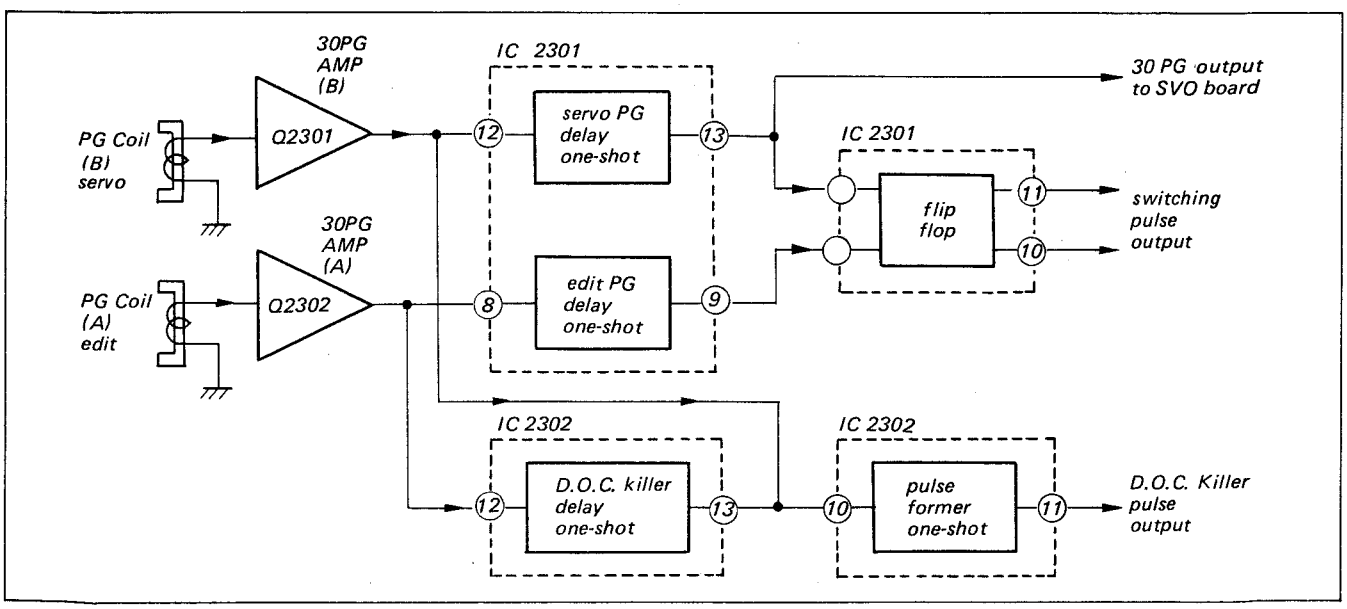



*Fig. 2-16. 30 PG Amplifier and Delay Multivibrator*

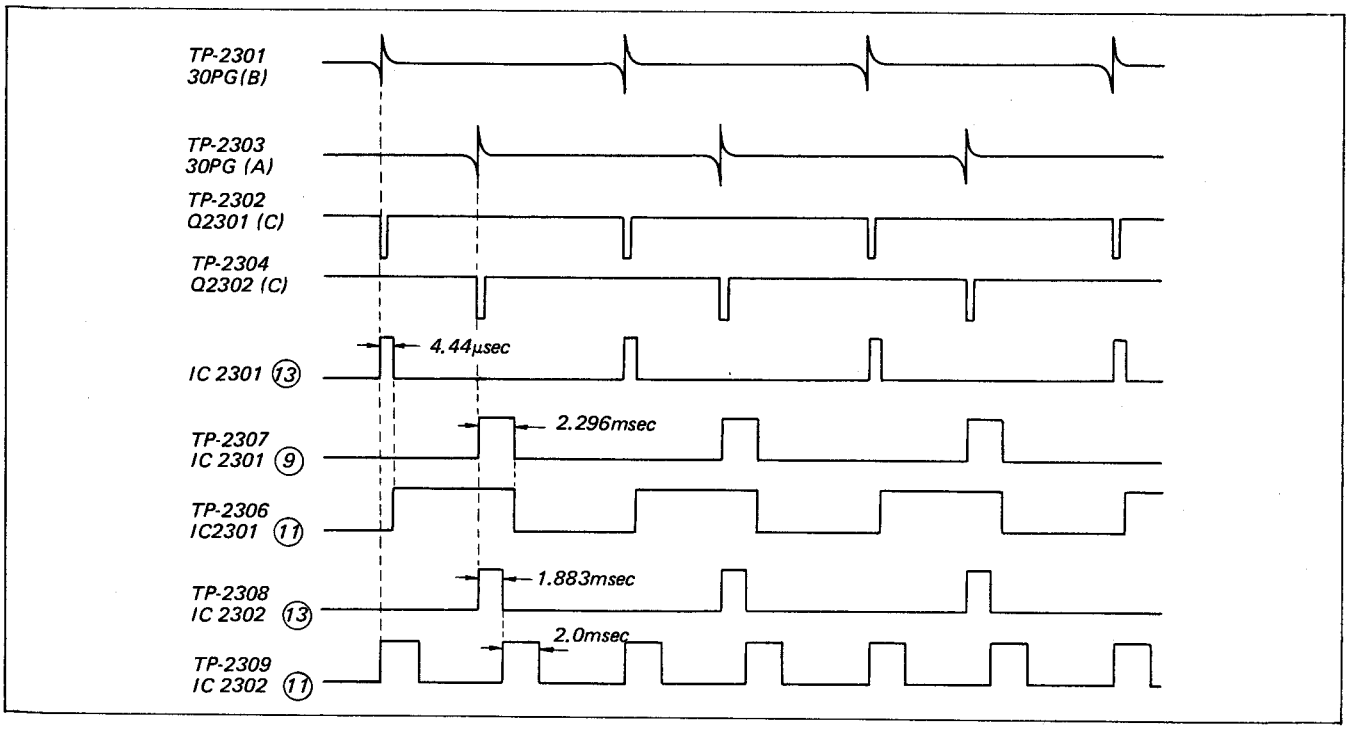



*Fig. 2-17. Waveforms of 30 PG pulse circuit*

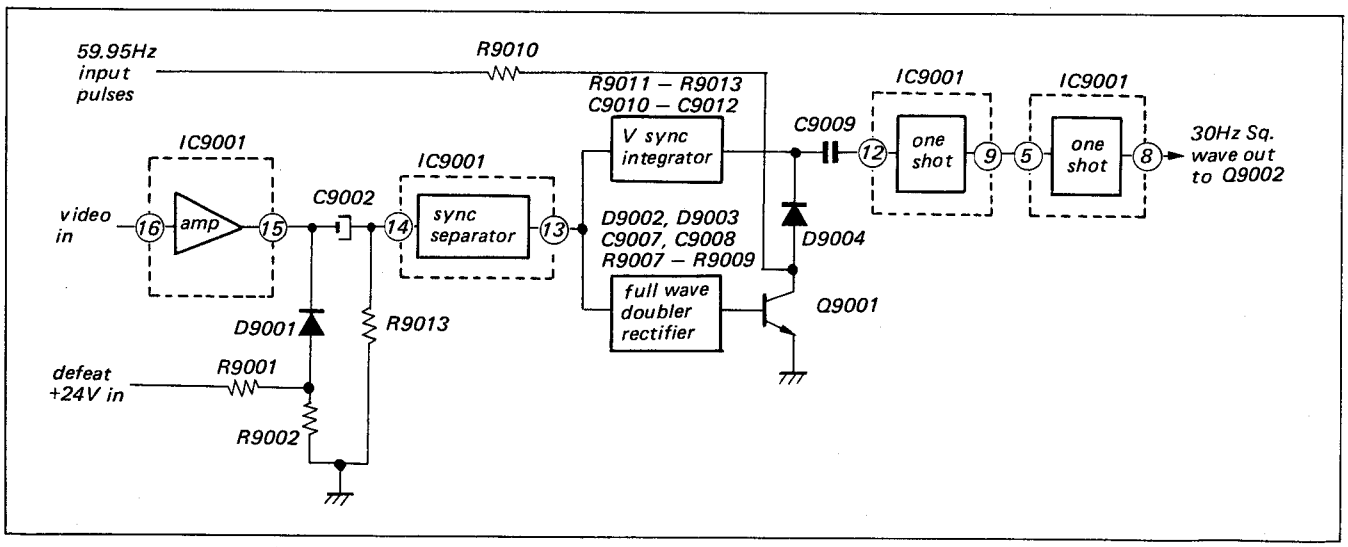



*Fig. 2-18. Sync Separator and 30 Hz Sq. Wave Former*

The video signal applied to pin 16 of IC9001 is amplified by the amplifier between pins 16 and 15. The output at pin 15 is coupled to pin 14, through C9002, across a defeat gate formed by diode D9001. The defeat gate actuates whenever the DEFEAT +24V IN line, at pin 1 of CN9003, goes to +24V. It clamps the output of IC9001 at pin 15, inhibiting signal flow. This occurs when the EXTERNAL SYNC switch is placed in the DEFEAT position.

The amplified video signal, supplied to pin 14 of IC9001, passes through a sync separator circuit between pins 14 and 13. The separated sync output at pin 13 passes to a vertical sync integrator network, formed by R9011-R9013 and C9010-C9012. The separated sync also is routed to the input of a full-wave voltage doubling rectifier circuit. This circuit, using diodes D9002 and D9003, detects the presence or absence of an input video signal by producing an output voltage proportional to sync amplitude.

Transistor Q9001 and diode D9004 form a sync gate which selects between two sync signal sources applied to input pin 12 of IC9001 depending upon whether or not an external video signal is supplied. Its operation is described below.

When an external video signal is present, separated sync is rectified by the rectifier circuit, supplying base drive to Q9001. This keeps Q9001 in saturation. Pulses, occuring at a 59.94 Hz rate, are supplied to the collector of Q9001 through R9010. These pulses, supplied from pin 7 of servo sync generator IC9004, are used for servo sync reference when no video input signal is provided.

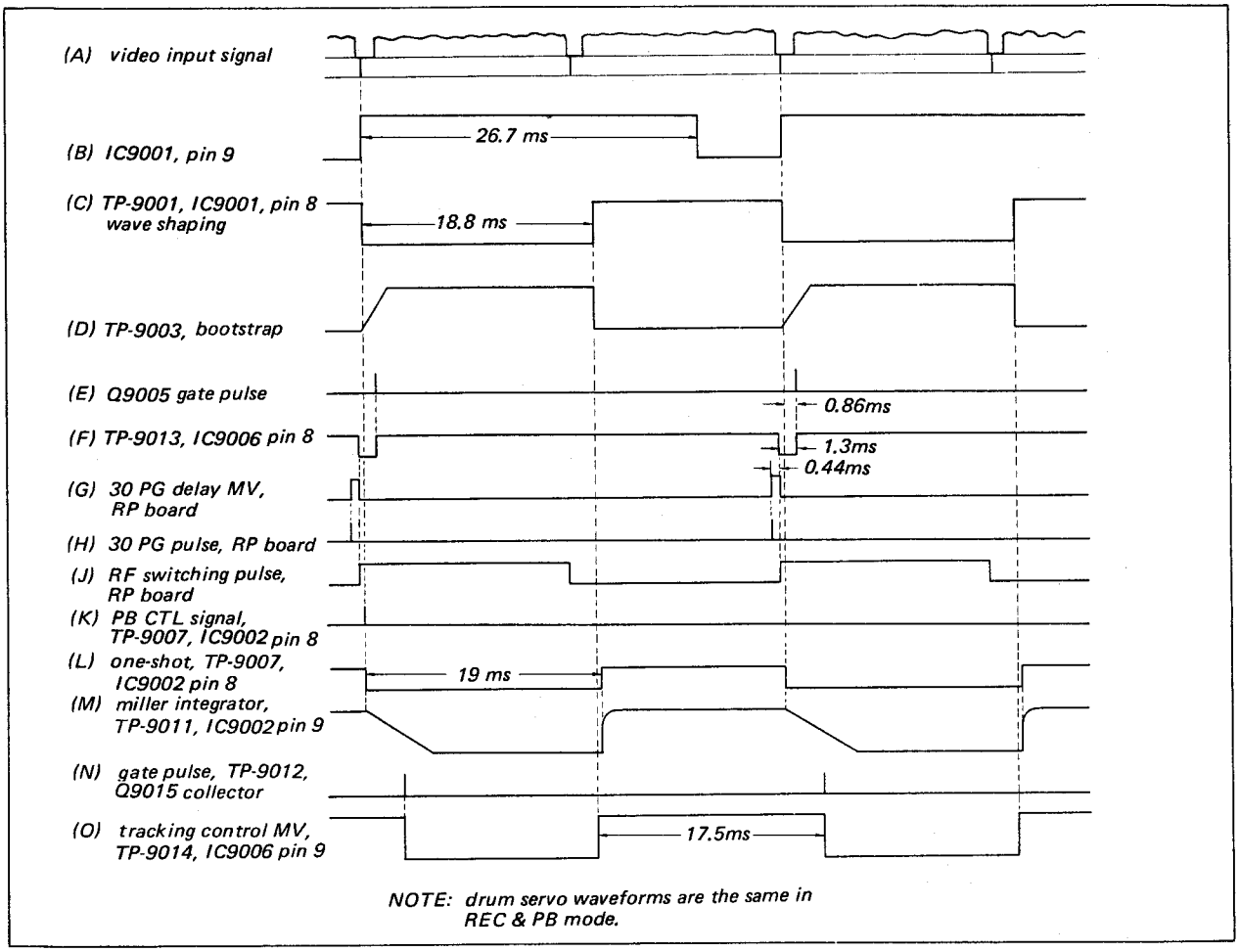



*Fig. 2-19 Servo waveforms in PLAYBACK mode*

The presence of a video input signal keeps Q9001 saturated, so the pulses pass to ground through its collector. The separated sync passes through the V sync intergrator and all but the V sync pulses are removed. These separated V sync pulses are coupled into pin 12 of IC9001 through C9009.

When no video signal is present there is no output from the sync separator,so there is also no output from the V sync intergrator or rectifier circuit. In this case Q9001 cuts off, allowing the 59.94 Hz pulses coming through R9010 to couple into pin 12 of IC9001 through D9004 and C9009.

The 60 Hz V sync signal entering pin 12 of IC9001 triggers a one-shot, between pins 12 and 9, whose time constant is greater than one TV field. It therefore triggers on every other sync pulse, or in-other-words, at a frame rate. The output pulses from this one-shot, occurring at a frame rate, are direct coupled from output pin 9 to pin 5. Pin 5 is the input to a second one-shot. The time constant of this one-shot is chosen so that it will produce a 30 Hz square wave (50% duty cycle) output signal. This signal, supplied from pin 8, is supplied to the bootstrap circuit, the capstan servo control record amplifier, and the phase servo circuit in the Playback mode.

**PHASE COMPARISON CIRCUIT**

Transistors Q9002 and Q9003 form a bootstrap circuit which converts the 30 Hz square wave output from pin 8 of IC9001 into a trapezoidal waveform. The fast square wave rise time is converted into a ramp having excellent linearity. This signal is applied to the emitter of sampling gate Q9004 through C9015. The base of Q9004 connects to the collector of Q9005 through C9017. Q9005 is a common base pulse amplifier which amplifies a sample pulse, derived from the 30 PG signal and shaped by a one-shot in IC9006. The sample pulse, which is of short duration, causes sample gate Q9004 to saturate for its duration. This brief switching of Q9004 transfers whatever instantaneous voltage was present at its emitter into stored charge held in capacitor C9020. C9020's stored charge provides bias for FET Q9006. The high input impedance of a FET allows C9020 to hold the charge without bleeding it away. Transistors Q9006, Q9008, and Q9027 form a dc amplifier whose output is proportional to the stored charge bias on the gate of Q9027. The output of this dc amplifier provides dc current to a brake coil in the head drum which regulates the drum speed.

The 30 PG signal from the RP board is supplied to the SVO board at pin 1 of CN9002. It is coupled into pin 16 of IC9006 through R9067. IC9006 is also a type AN301 intergrated circuit just like the one used for IC9001 in sync separation.The 30 PG signal is inverted by the amplifier between pins 16 and 15 and supplied from pin 15 to trigger a one-shot at pin 5. The output pulse from the

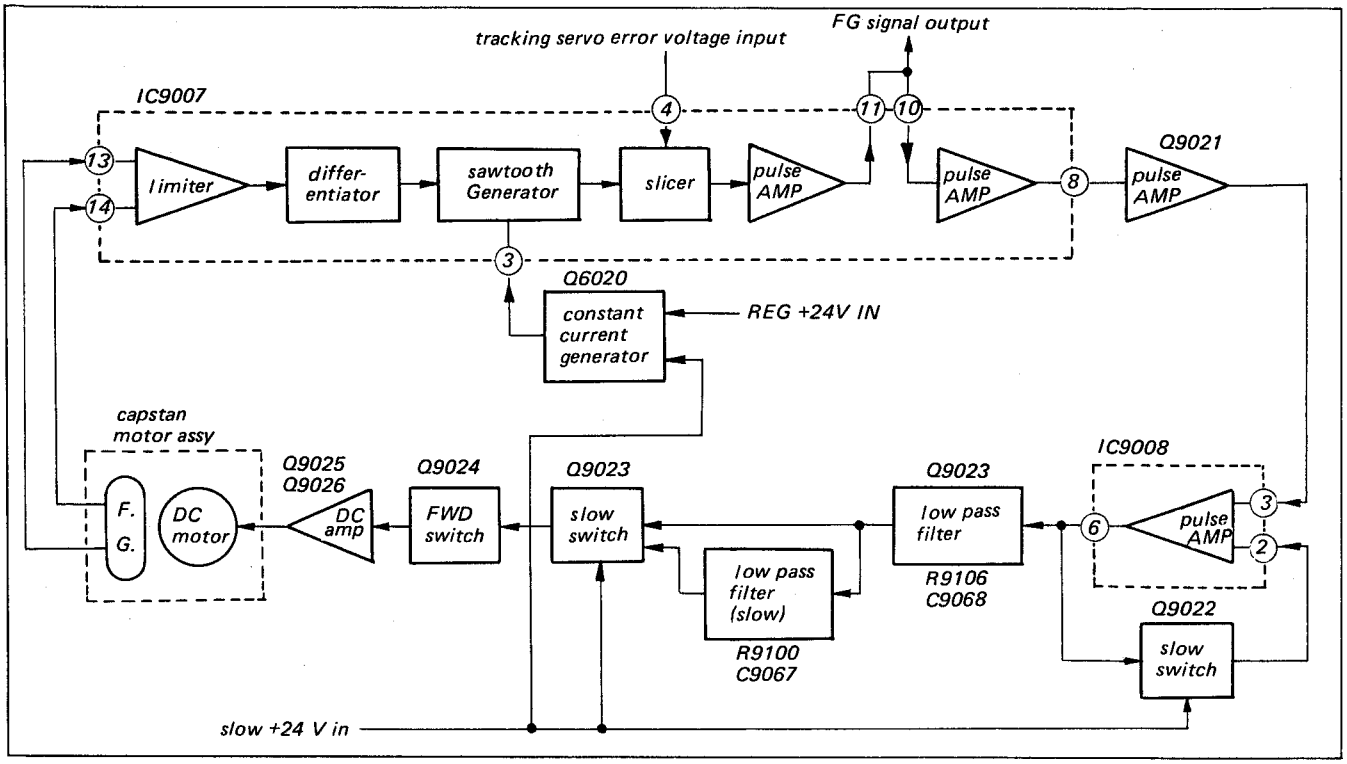



*Fig. 2-20 Speed Servo Block Diagram*

one-shot, at pin 8, is supplied to the input of the sync separator section at pin 14. The sync separator acts as a pulse amplifier, supplying the pulse at pin 13. The pulse is coupled from pin 13 to the emitter of Q9005 through C9018.

### CAPSTAN SERVO CIRCUIT (SVO board)

The capstan servo system consists of a speed servo and a tracking servo. In both the Record and Playback modes, the speed servo senses the tape speed by means of the FG signal obtained from the frequency generator in the dc capstan motor, and controls the motor for constant tape speed.

In the Record mode, the capstan servo makes the FG signal phase lock to the 983.4 Hz reference signal supplied from the built-in sync signal generator to stabilize the tape speed. In the playback mode, it compares the phase of the CTL signal with that of the vertical sync signal, and applies an error signal to the speed servo to assure tracking.

### SPEED SERVO CIRCUIT

The speed servo system is shown in block diagram form in Fig. 2-20. Its operating waveforms are shown in Fig. 2-21.

The dc capstan motor contains a frequency generator (FG) which generates a sine wave signal at approximately 983 Hz. This signal enters the SVO board at pins 1 and 2 of CN9002 and is directly coupled to pins 13 and 14 of IC9007. IC9007 is SONY type CX-032B servo processing integrated circuit which contains a limiter, differentiator, sawtooth wave generator, slicer and pulse amplifier.

The sine wave FG input signal to pins 13 and 14 is converted to a square wave by the limiter. This square wave is then differentiated by the differentiator into a spike waveform. Capacitor C9061, connected between pins 1 and 2, determines the differentiation time constant. The output of the differentiator triggers the sawtooth wave generator circuit which follows. The sawtooth wave is generated by charging and discharging of C9060, connected between pin 3 and ground. Transistor Q9020 is a constant current generator which supplies charging current to C9060; allowing it to charge at a constant current produces a very linear ramp. The sawtooth wave is supplied to the slicer, which conducts only when

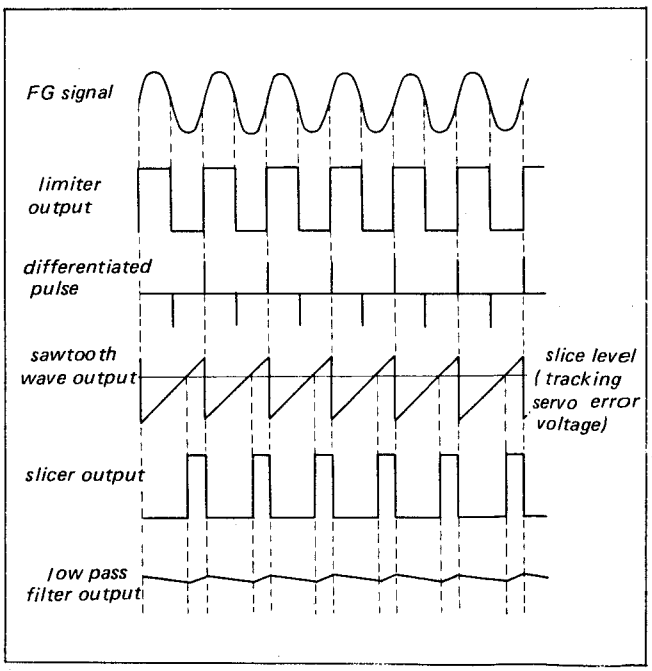



*Fig. 2-21 Waveforms of Speed servo*

the ramp reaches a predetermined level, producing a rectangular output. The tracking servo error voltage is supplied to pin 4 and determines the slice level. The rectangular slicer output appears at pin 11 and is supplied to pin 10 as input to the pulse amplifier and to the tracking servo circuit in the RECORD mode. The pulse amplifier output from pin 8, a short negative-going pulse, is supplied to the base of transistor Q9021 through R9090.

Q9021 and IC9008 are connected together to form an operational amplifier, the output of which is applied across a low pass filter formed by R9101 and C9068. The low pass filter integrates the pulses to obtain a dc voltage proportional to pulse width. The dc voltage, which appears across C9068, is the input signal to the dc motor drive amplifier. The operational amplifier inverts the negative-going pulses supplied from pin 8 of IC9007 into positive pulses to charge C9080. Darlington connected transistors Q9025 and Q9026 form the emitter follower motor drive amplifier. The dc capstan motor is connected between the emitter of Q9026 and circuit ground. Power for the motor drive is provided from a separate supply. AC power, at a 10 V rms level, is supplied to D9505, a full-wave bridge rectifier. The rectified dc output from the bridge is filtered by capacitor C9514 and supplied between the collectors of Q9025 and Q9026 and circuit common. In normal operation, the speed servo holds the dc voltage applied across the motor between 6.5 and 7 volts.

### CAPSTAN SERVO CIRCUIT IN THE RECORD MODE

The capstan speed is controlled by two servo loops working together. The phase servo aids the speed servo by supplying a dc control voltage to the slicer in IC9007. This dc control signal is obtained by phase comparing the 983.4 Hz reference signal, supplied from the sync signal generator circuit, with the FG signal. This locks the FG signal to 983.4 Hz, assuring stable speed. A block diagram of the record capstan phase servo circuit is shown in Fig. 2-22.

A 15,734.26 Hz signal, supplied from the sync signal generator circuits is applied to pin 14 of IC9005. IC9005 is a type M53293P digital counter integrated circuit which divides the 15,734.26 Hz input signal by 16 to obtain a 983.4 Hz output. The 983.4 Hz signal output, at pin 11 of IC9005, is supplied to pin 5 of IC9003. Between pins 5 and 7, IC9003 contains a one-shot circuit. This one shot wave-shapes the 983.4 Hz signal, supplying it to bootstrap circuit Q9013.

In the RECORD mode, Q9013 is a bootstrap sawtooth generator. In the PLAYBACK mode it becomes an emitter follower.

Bootstrap amplifier Q9013 converts the pulse output from the one-shot into a sawtooth waveform. The sawtooth is supplied to the emitter of sample gate Q9014. Transistors Q9014, Q9015, Q9016, and Q9017 form another sample and hold circuit and dc amplifier, very similar to the Q9004 – 9008 circuit described previously. Q9015 is a common base pulse amplifier which amplifies a sample pulse, supplied at its emitter from IC9003, and supplies it to the base of Q9014 as a switching pulse. The pulse is very short, but when it occurs it momentarily saturates Q9014. Q9014 transfers whatever instantaneous voltage exists at its emitter at the time of the pulse to its collector circuit. The sampled voltage is held in capacitor C9047, biasing the gate of FET Q9016. Q9016 and Q9017 form a dc amplifier which supplies a dc control voltage, proportional to the stored charge in C9047, to pin 4 of IC9007 through R9066. The dc control voltage is proportional to the phase relationship between the FG signal, which supplies the sample pulse from a one-shot in IC9003, and the 983.4 Hz sync generator signal supplied to the bootstrap. Transistor Q9019 is a switch across the line feeding the FG signal from pin 11 of IC9007 to pin 12 of IC9003. Q9019 remains cut off in the record mode, so it has no effect. In the playback mode it saturates, preventing the FG signal from reaching IC9003.

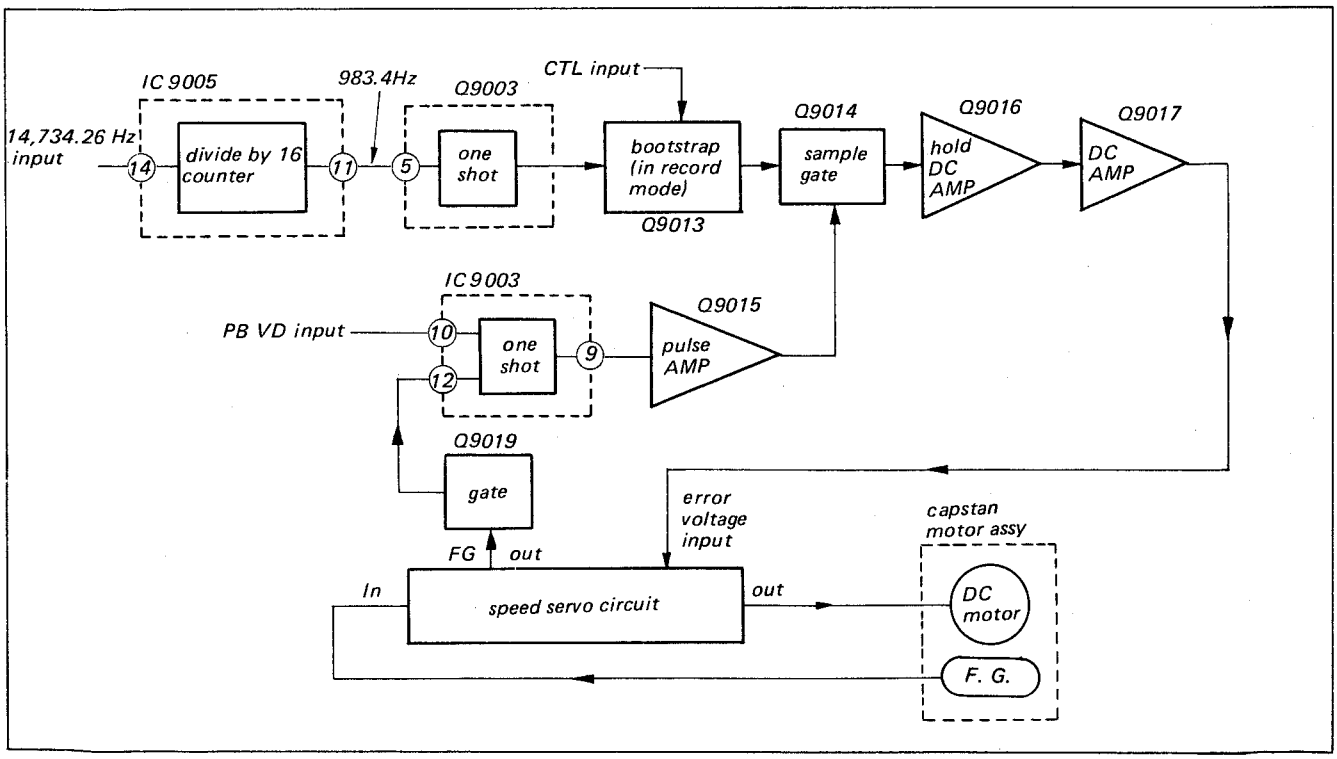



*Fig. 2-22 Block Diagram of Capstan Phase Servo in the Record Mode*

### CAPSTAN PHASE SERVO IN THE PLAYBACK MODE

In the playback mode, the capstan phase servo compares the phase of reference V sync, obtained from the input video signal, with that of the playback CTL signal. The dc control voltage produced is applied to the speed servo in the same manner as in the RECORD mode. In playback, the capstan phase servo functions to assure proper tracking. Fig. 2-23 shows a block diagram of the tracking servo in the playback mode.

During recording, a series of control pulses are recorded along the edge of the tape by the CTL head. Timing of these pulses corresponds to the start of each slant video track on the tape. In playback, the capstan phase servo compares the phase of these control pulses with reference V sync to ensure proper tracking.

In playback, the CTL head reproduces the CTL pulses recorded on the tape. The signal from the CTL head is amplified by FET amplifier Q9011. This amplified signal, from the drain of Q9011 is coupled to pin 3 of IC9002 through C9024. The CTL pulse is amplified by the amplifier between pins 3 and 2 in IC9002. The output from pin 2 is fed into pin 5 to trigger a one-shot. The one-shot output, at pin 8 is fed into the second one-shot input of IC9002 at pin 12. The one-shot section of IC9002 between pins 12 and 9 is not used as a one-shot. C9028 and D9010 turn the circuit into a Miller integrator which generates a trapezoidal 30Hz waveform. The output of the Miller integrator is supplied from pin 9 of IC9002 to the base of Q9013 through D9016, Q9013, which functions as a bootstrap amplifier to generate a sawtooth wave in the record mode, serves as an ordinary emitter follower in playback. This occurs because the polarity of diode D9014 prevents bootstrap feedback action from occurring for input signals applied through D9016. The trapezoidal waveform is applied to the emitter of sample gate Q9014.

The 30Hz output signal from pin 8 of sync separator IC9001 (See Fig. 3-18) is coupled into pin 12 of IC9006 through C9057 and R9071. Pin 12 of IC9006 is the input to a one-shot circuit whose output is a 33 millisecond wide pulse applied to pins 10 and 9 of a one-shot in IC9003. The one-shot generates a sample pulse which is amplified by Q9015 and used to switch sampling gate Q9014. The operation of the sample and hold circuit is exactly the same as is described above for the RECORD mode.

In the PLAYBACK mode, a dc voltage is applied to pin 5 of IC9003. This inhibits the 983.4 Hz RECORD mode reference signal from being applied to Q9013.

### CTL AMPLIFIER

The 30Hz square wave output from pin 8 of sync separator IC9001 in the RECORD mode, is applied to the base of CTL record amplifier Q9010. The CTL record/playback head is connected between the collectors of CTL record amplifier transistors Q9009 and Q9010. Q9009 and Q9010 are turned on and off alternately by the 30Hz output signal from IC9001, coupled through D9007. As the transistors turn on and off, they alternately supply current in opposite directions through the CTL head to record pulses on the tape.

In the PLAYBACK mode, inverter transistor Q9018 applies a dc voltage to Q9010. This holds Q9010 on and Q9009 off, allowing the playback CTL signal to reach the gate of Q9011.

### SLOW MODE

When the FUNCTION SELECTOR is placed in the PAUSE/STILL position, a slow speed playback mode is set up in which the forward tape speed may be adjusted by means of the front panel SLOW SPEED control.

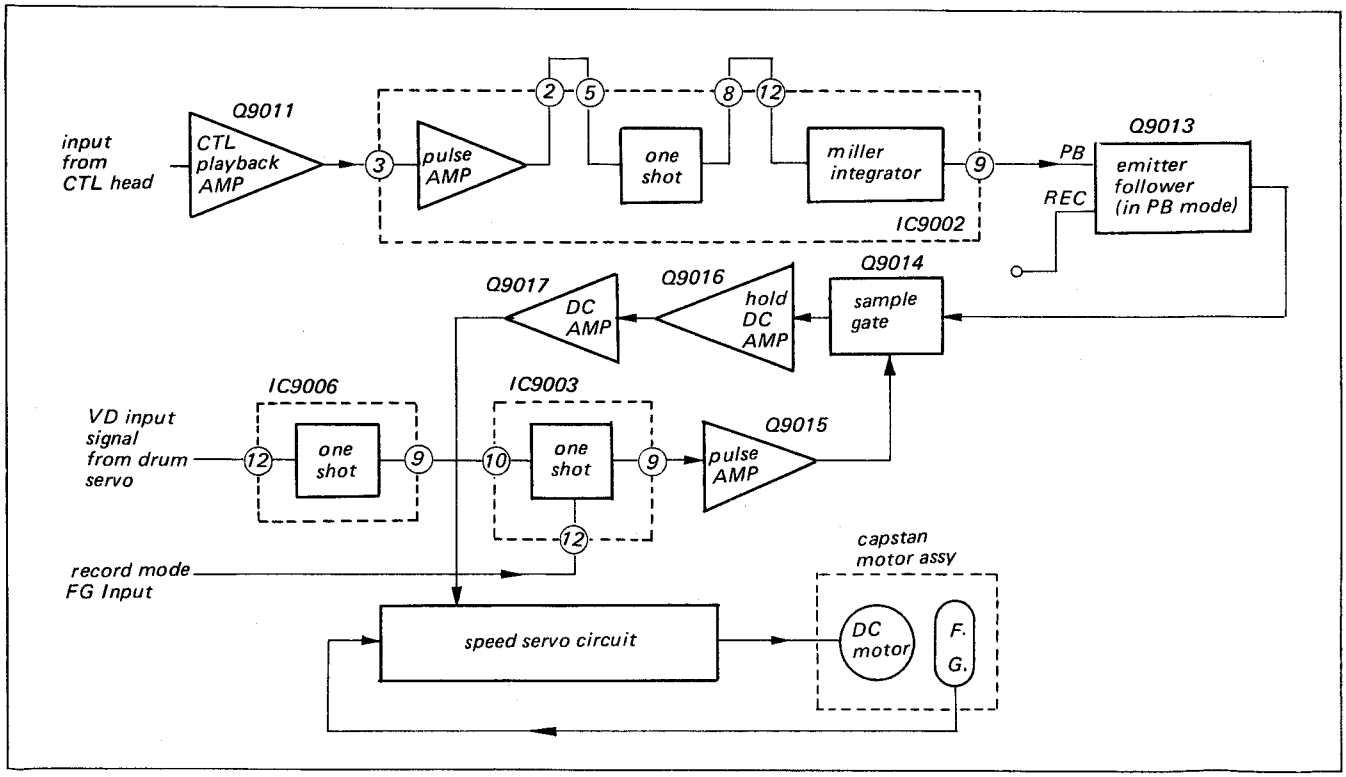



*Fig. 2-23. Block Diagram of Capstan Phase Servo in the Playback Mode.*

When the slow speed mode is set up, current is supplied to the base of constant current generator Q9020 from the +24 V line through the SLOW SPEED control, D9019, and R9200. This reduces the forward base drive on Q9020 which varies the charging slope of the sawtooth wave generator in IC9007. The +SLOW line also goes to +24 V saturating transistors Q9022 and Q9023. Saturation of Q9022 connects the output of operational amplifier IC9008 to its inverting input, reducing the gain to one. This reduces the voltage at IC9008's output to about +2.6 V. Saturation of Q9023 increases the value of the pulse averaging capacitor by pulling the bottom end of C9067 to ground. The capstan phase servo still tries to correct the speed, but has no effect due to the reduced loop gain of the speed servo. Slow speed is determined entirely by the speed servo.

### SYNC SIGNAL GENERATOR

This section produces 15,734.26 and 59.94 MHz reference sync signals for the drum and capstan servos.

X9001 is a 31,468.5 Hz crystal connected between pins 2 and 3 of IC9003. The circuit uses one of the amplifier sections of IC9003 to form a 31,468 Hz oscillator. The oscillator's output is buffered by the amplifier section of IC9003 between pins 14 and 13. Output from pin 13 is supplied to input pin 5 of frequency divider IC9004. IC9004 is a special integrated circuit for sync generator use. It has two sections, a divide by two section produces 15,734.26 Hz HD signals, the other section, a divide by 525 circuit produces 59.94 Hz VD signals. The 59.94 Hz, VD signal is supplied to the sync selector from pin 7. The 15,734.26 Hz HD signal is supplied to pulse amplifier Q9012 from pin 4. This signal, amplified by Q9012 is supplied to the capstan servo circuit.

## 2-4. AUDIO SYSTEM

The circuitry of the audio system is contained on two printed circuit boards, the MIC board and the AUD board. An overall block diagram, together with RECORD mode and PLAYBACK mode block diagrams with level charts, is given on pp. 8 and 9 of volume two of this manual.

### MIC BOARD

The MIC board serves as a preamplifier for microphone input signals and as a switcher to select between audio input signals. As such it is only used in the RECORD mode. The MIC board also serves as the connection point for the COLOR LOCK control. Connections to the COLOR LOCK control feed through connector CN6001 on the MIC board to the C-DEM board. The COLOR LOCK CONTROL, and resistor R6008 which connects between one end of it and the +24 V power supply line, have nothing to do with the audio circuitry on the MIC board.

There are three inputs provided to the MIC board, MIC IN at input jack J6001, AUX IN at input jack J6002, and TV from pin 3 of the 8 pin receiver-monitor connector. LINE OUT jack J6003 also ties to the MIC board. The LINE OUT signal is supplied to pin 9 of connector CN6001 from the AUD board, from which it connects to the LINE OUT jack.

Microphone input signals from jack J6001 are directly coupled into pin 2 of IC6001 through coupling capacitor C6002. AUX IN signals, from jack J6002, are divided by a voltage divider (attenuator) consisting of R6001 and R6003 and also applied to pin 2 of IC6001 through C6002. The voltage divider attenuates the AUX IN signals, which are at about a 0 dBm level, to match the MIC IN signal level of about −60 dBm.

IC6001, a type TA7122AP audio preamplifier integrated circuit, amplifies the audio input signal by about 29 dB, or in other words, to a −31 dB level. See the record mode level diagram on page 8 in volume 2. The output of IC6001 is coupled through capacitor C6008 to input pin 3 of IC6002, a SONY type CX-130 electronic switch.

The other input to IC6002 is supplied through capacitor C6011 from the output of emitter follower buffer stage Q6001. The input signal to Q6001 is supplied through C6012 from pin 3 of monitor connector CN12500.

IC6002 is an electronic switch which is used to select between TV IN and MIC/AUX. It is controlled by the + TV/LINE CTL line, at pin 5 of CN6001. The selected input signal is supplied from pin 1 of IC6002 to pin 6 of CN6001 through capacitor C6010. It becomes the AUDIO IN signal, at pin 5 on CN7071 on the AUD board.

### AUD BOARD

The AUDIO IN signal is coupled as input to pin 5 of IC7002 through C7023. The wiper of the playback level control supplies the other input to IC7002. IC7002, another SONY type CX-130 electronic switch, selects between the AUDIO IN signal in the RECORD mode, and the output from the playback level control, in the PLAYBACK mode. IC7002 is switched by the REC E-E ON CONTROL line.

The output from IC7002 is coupled to the input of IC7003 through capacitors C7025 and C7002 and the bias trap. Audio muting switch Q7005 and the limiter circuit are across this line.

The audio system is muted in certain modes of machine operation, such as REWIND and FAST FORWARD. In this case, the MUTING line supplies forward base drive to Q7005, saturating its collector. Q7005 grounds out any audio signal, muting the system.

The limiter serves to limit the amplitude of the audio signal applied to the input of AUDIO LINE AMPLIFIER IC7003. The circuit operates by controlling the forward conduction of transistor Q7001, which shunts away part of the signal through R7001. Complete operation of the limiter is covered in a subsequent paragraph.

AUDIO LINE AMPLIFIER IC7003 boosts the amplitude of the signal to 0 dBm. This circuit uses another type TA-7122AP audio amplifier integrated circuit. The output signal is coupled across RECORD LEVEL control R7012, via capacitor C7017. The output signal also couples through capacitor C7009 to emitter follower buffer amplifier Q7003. Output from Q7003 is directly coupled to pin 10 of CN7073, the HEADPHONE output. It is also coupled through C11, where it is rectified by two diodes. D7002 develops a positive voltage across LIMIT LEVEL ADJ pot R7017. Diode D3 supplies current to the audio level meter which is proportional to output signal level. Pot R7019 is the output level meter calibration control.

The voltage developed across LIMIT LEVEL ADJ pot R7017 is in direct proportion to the output signal amplitude. The wiper of R7017 supplies the control feedback signal for the limiter circuit. Transistor Q7004 is a limiter defeat switch.

Whenever forward base drive is supplied to Q7004, through D7004 or D7005, Q7004 saturates grounding out the limiter control feedback signal. When the limiter circuit is in use, the dc feedback control signal, from the wiper of R7017, supplies forward base drive to transistor Q7002. Q7002 in turn supplies base drive to Q7001 through diode D7001. The base-emitter junctions of Q7001 and Q7002 in series with D7001 provide a non-linear characteristic to limiter operation. As the dc feedback voltage applied to the base of Q7002 rises (due to a higher sound level input) nothing happens until it gets high enough to overcome the forward current transfer characteristic of the three diodes. At that point a sudden flow of base current in Q7002 produces collector current which supplies base drive to Q7001. Q7001 conducts, shunting away some of the signal at the input to IC3 which, in turn, reduces the output signal at the emitter of Q7003. Limiter action, therefore, works in a manner similar to AGC, but only for high level signals. There is no limiter action for weak signals.

The output of AUDIO LINE AMPLIFIER IC7003 appears across RECORD LEVEL pot R7012. The output from the wiper of R7012 is supplied to the base of transistor Q7007, the AUDIO RECORD AMPLIFIER. This is a common emitter voltage amplifier stage which amplifies the signal and supplies it through the bias trap to the RECORD/PLAY audio head, through relay RY-7001. The record bias, supplied from the ERASE/BIAS circuit, is mixed with the audio signal at the output side of the bias trap. Trimmer capacitor C7032 adjusts the bias level. The bias trap, consisting of C7028, C7029, L7002, and R7036 blocks the high frequency bias signal from reaching the collector of Q7007.

Transistor Q7006 is a switching transistor which switches bypass capacitor C7031 in and out of the circuit. The model AV-8650 has the capability of making both regular and high density recordings, depending upon the tape used. In the regular mode, Q7006 receives no forward base drive, so C7031 is out of the circuit. In the high density mode, the HIGH REC 24 V line, at pin 8 of CN7072, goes to +24 V from zero. This saturates Q7006, bypassing resistor R7039. When R7039 is bypassed, the voltage gain of Q7 is increased, increasing the record current output.

Transistors Q7008 and Q7009 and transformer T7001 make up an inverter type bias/erase oscillator. The oscillator signal voltage is stepped up in the secondary of T7001 and supplied to the audio erase head at pin 5 of CN7072. The bias signal is also coupled into the record circuit thorugh C7032, which adjusts the proper bias current.

DC supply voltage for the oscillator is provided from the emitter of Q7010 and filtered by C7040, C7041, and L7003. Q7010 and Q7011 form a delay circuit which slows the turn-on time of the oscillator to prevent a noise "pop" from being recorded on the tape when the record function is initiated. The base of Q7010 is tied to the collector of Q7011. When the machine first goes into the RECORD mode, either the HIGH REC 24 V or LOW REC 24 V line goes to +24 V from zero. This voltage appears at the collector of Q7010 and begins charging C7042 through R7055. While C7042 is charging it supplies base current to transistor Q7010. Q7010 turns on, robbing base drive from Q7010, so Q7010 remains cut off. As C7042 charges it draws less and less charging current. This reduces the base drive to Q7011 which begins to cut off. As Q7011 cuts off Q7010 begins to turn on, supplying power to the oscillator which itself begins to turn on. When C7042 is fully charged no base drive is supplied to Q7011. At this point Q7010 is in full saturation, allowing full transfer of the supply current to the oscillator circuit.

Diodes D7009 and D7010 form an OR gate which couples either the HIGH or LOW REC 24 V line to the emitter of Q7010. In the low, or regular recording mode, resistor R7050 drops the +24 V input to about +12 V. In the HIGH, or high density mode, resistor R7051 allows almost all the +24 V to reach the oscillator. This increases the oscillator output voltage, as needed to properly bias the high density tape.

There are two relays on the AUD board. RY-7001 switches the RECORD/PLAY audio head between the output of the record amplifier and the input of the playback preamplifier. In the relaxed state the head is connected in the playback configuration. In the RECORD or E to E modes the REC E-E ON CONTROL line goes high supplying coil current to RY-7001. RY-7001 pulls in, switching the head to the output of the record amplifier. RY-7002 switches the fixed video erase head in and out. When both the audio and video tracks are being recorded, the SERVO REC line, at pin 6 of CN7072 goes high. This supplies coil current to RY-7002, pulling it in. When RY-7002 is energized, the audio and video erase heads are series connected. Erase current flows from the secondary of T-7001 out through pin 5 of CN7072, through the audio erase head and back in at pin 4 of CN7072. It then flows through the contacts of RY-7002 and out pin 2 of CN7072. From pin 2 of CN7072 the erase current flows to ground through the video erase head. When only the audio channel is being recorded, such as in an audio only insert, the SERVO REC line stays low. In this case, erase current flowing through the audio erase head is returned to ground through coil L7005. L7005 simulates the load of the video erase head.

## 2-5. BLANKING SWITCHER AND ROTARY ERASE CIRCUIT

The blanking switcher circuit controls cut in and cut out of the record circuits in the insert and assemble edit modes so that switching occurs during the vertical blanking interval. This prevents breakup and switching noise from appearing in the picture.

In the insert editing mode, erasure of the previously recorded video track is performed entirely by the rotary erase heads. In the assemble editing mode, the rotary erase heads and the full width video erase head are simultaneously energized. The rotary erase heads remain enerigzed long enough to allow the section of tape between the fixed video erase head and the head drum to pass through the machine, they are then de-energized.

The rotary video erase heads are mounted so that they scan along each slant video track 40 degrees in advance of the rotary video record/play heads. See Fig. 2-24. Since the head drum rotates at a constant speed, the vertical interval always occurs when the heads are at the same instantaneous vector. As the rotary erase heads scan the tape 40° in advance of the video heads, they must be switched on and off slightly ahead of the time the video heads are switched so that the switch point of both heads occurs at the same location on the recorded tape track.

An EDIT 30 PG (pulse generator) coil is provided, in addition to the regular servo 30 PG coil. The purpose of this coil is to signal when the position of a rotary erase head is at the instantaneous vector which corresponds to its scanning of the portion of the vertical interval designated for editing. The physical position of the edit 30 PG coil is such that it is mounted 155° advanced from the servo 30 PG coil in the direction of head drum rotation. See Fig. 2-24. The edit 30 PG coil generates a pulse each time the erase head is at the proper point. The blanking switcher

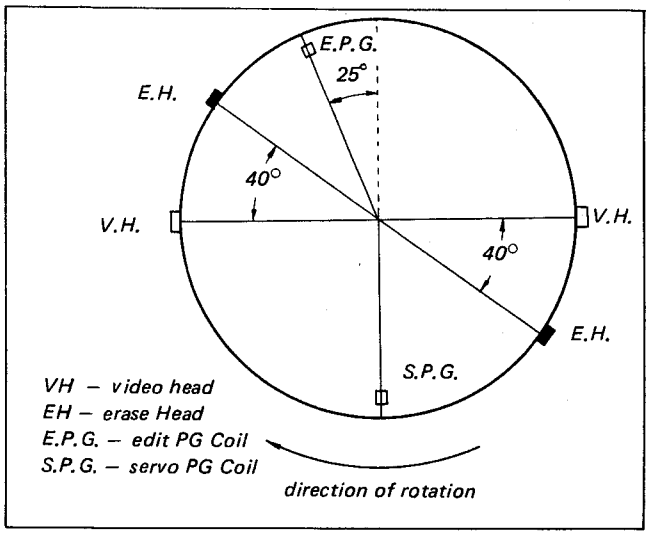



*Fig. 2-24. Angular relationship of rotary erase heads to video heads and edit PG coil to servo PG coil*

circuitry uses this pulse to control the on and off switching of both the rotary erase and rotary video heads.

The blanking switcher circuitry, located on the RP board, consists entirely of digital logic. Fig. 2-25 is a logic diagram which illustrates signal flow and operation of the blanking switcher and also shows the operation of the rotary erase circuit in block diagram form. Refer to Fig. 2-25 and the schematic diagram of the RP board as you read the following circuit description.

The blanking switcher coordinates two input signals, the timing pulse from the Edit 30 PG coil and an edit command signal. The timing pulse from the Edit 30 PG coil is amplified by Edit 30 PG AMPLIFIER Q2302 and supplied to the EDIT 30 PG DELAY ONE SHOT at pin 12 of IC2403, and to input pins 1 and 4 of two NAND gates in IC2402, the ON and OFF NAND GATES. The edit command signal is applied to the input (pin 6) of the OFF DELAY ONE SHOT in IC2402, to the input of the SWITCHING AMPLIFIER formed by Q2401 and Q2402, and to video R/P head switching relays RY2201 and RY2202 through diode D2416.

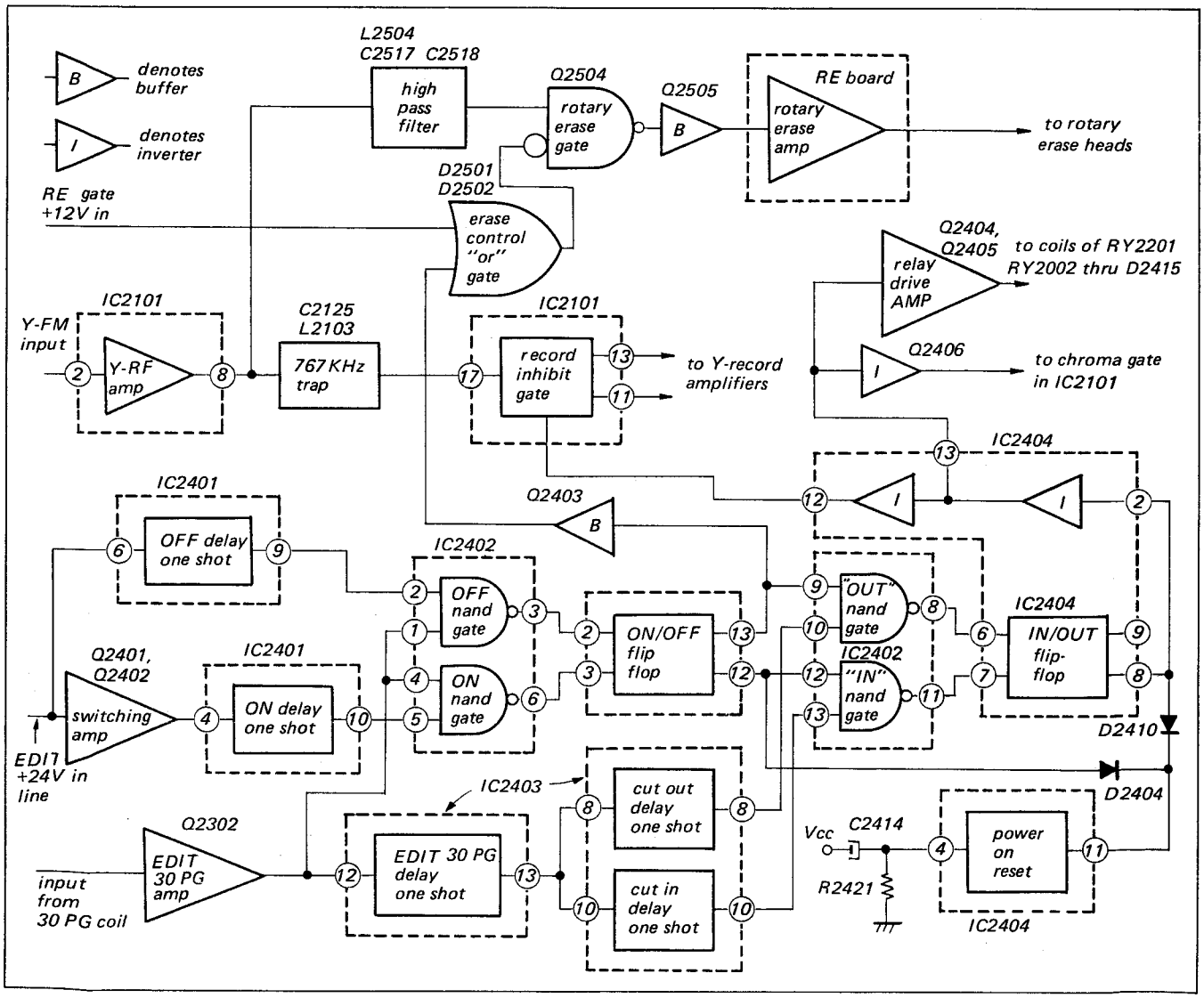



*Fig. 2-25. Logic and block diagram of blanking switcher and rotary erase circuits*

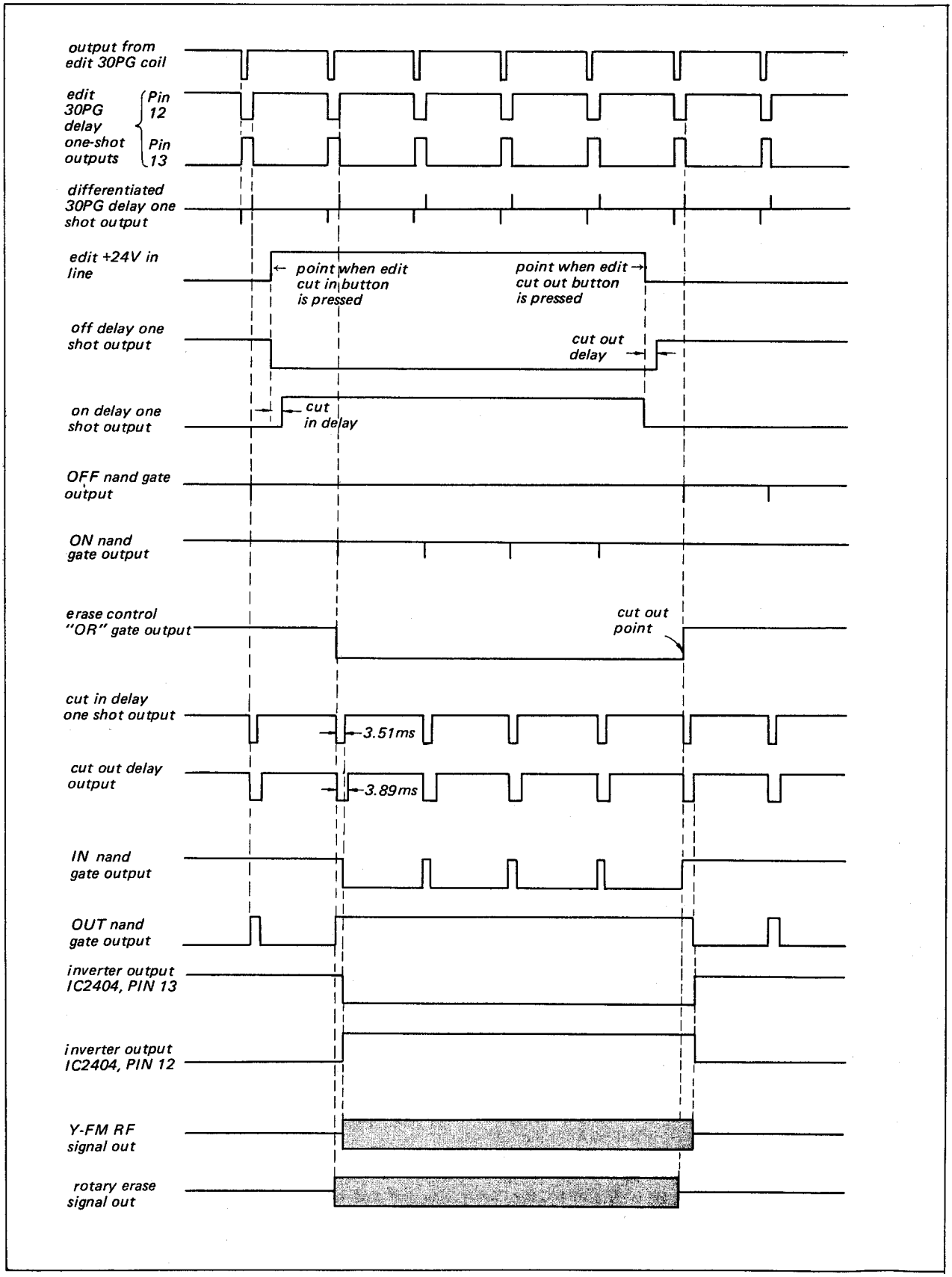



*Fig. 2-26. Timing chart of blanking switcher circuit operation*

The edit CUT IN command occurs when the EDIT line goes high (to +24 V), the edit CUT OUT command occurs when the EDIT line goes low (to zero). Fig. 2-26 is a timing chart of the blanking switcher circuitry which will assist the reader in following this description.

When the edit CUT IN command occurs, the EDIT line goes high. This line is applied to the coils of video head switching relays RY2201 and RY2202, through diode D2416. The video heads are immediately switched from the inputs of the playback amplifiers to the output of the record amplifiers. (No record current flows as yet, as it is held off by the RECORD INHIBIT GATE in IC2101. When the edit CUT IN command occurs it causes the output of the OFF DELAY ONE SHOT (IC2401, pin 9) to immediately toggle from high to low and triggers the ON DELAY ONE SHOT (output at pin 10 of IC2401,) which goes high after a delay of 12 milliseconds.

When the edit CUT OUT command occurs. the EDIT line goes low (to zero). When this occurs, coil drive to video head switching relays RY2201 and RY2202, applied through diode D2416, is removed. (The relays will remain pulled in, however, as coil current is supplied from relay driver Q2405 through diode D2415). Initiation of the edit CUT OUT command also immediately causes the output of the ON DELAY one shot to go low and triggers the OFF DELAY one shot so that it goes high after a period of 12 milliseconds.

The function of the ON and OFF DELAY one shots is to supply enabling signals to the ON and OFF NAND gates as follows: Following initiation of the edit CUT IN command, a high state is applied to ON NAND GATE (2) at pin 5, after a delay of 12 milliseconds. Following initiation of the edit CUT OUT command, a high state is applied to OFF NAND GATE (1) at pin 2, after a delay of 12 milliseconds. The purpose of the ON and OFF DELAY ONE SHOTS is to preclude the possibility of simultaneous application of toggling pulses to both inputs of the ON/OFF FLIP FLOP.

The other inputs (pins 1 and 4) of the ON and OFF NAND GATES are tied together and connected through a differentiation circuit to the output of PG amplifier Q2302. Only one of the two NAND gates will be enabled at any given time, due to action of the ON and OFF DELAY ONE SHOTS. The outputs of the ON and OFF NAND GATES connect, respectively, to the two toggle inputs of the ON/OFF FLIP FLOP. The ON/OFF FLIP FLOP is an RS flip flop constructed using one section of IC2401, connected to form a flip flop rather than a one shot. The state of the ON/OFF FLIP FLOP determines whether the system is in the RECORD or PLAYBACK function. The ON and OFF NAND GATES control the switching of the ON/OFF FLIP FLOP. Whichever of the two NAND gates is enabled, depending on the command signal, passes the next successive EDIT PG PULSE, causing the ON/OFF FLIP FLOP to toggle in synchronism with the EIDT PG PULSE.

The ROTARY ERASE GATE, transistor Q2504, is directly controlled, in the editing modes, by the state of the ON/OFF flip flop. The output of the ON/OFF FLIP FLOP, at pin 13 of IC2401, is buffered by emitter follower Q2403 and supplied to the ERASE CONTROL OR GATE, at the anode of diode D2502. The ERASE CONTROL OR GATE is formed by diodes D2501 and D2502. Its other input, applied to the anode of D2501, is the RE GATE +12 V IN control line, which is used to inhibit ROTARY ERASE GATE operation in the regular, or non-editing, mode of machine operation. The ROTARY ERASE GATE passes or blocks the flow of the erase current signal to the rotary erase heads, depending upon whether it is enabled or disabled. The ROTARY ERASE GATE is enabled only when a low state is applied to its control input from the output of the ERASE CONTROL OR GATE. This requires that both inputs to the ERASE CONTROL OR GATE also be low. If either input to the ERASE CONTROL OR GATE is high the ROTARY ERASE GATE blocks the erase signal from reaching the rotary erase heads.

The RECORD INHIBIT GATE, which is part of IC2101, blocks or passes the flow of the Y-FM signal immediately prior to the Y-RECORD AMPLIFIERS. The Y-FM signal, amplified by the Y-RF AMPLIFIER in IC2101, passes through the 767 kHz trap to input pin 17 of the RECORD ENABLE GATE. Output from the gate is supplied at pins 11 and 13 to the two Y-RECORD AMPLIFIERS. The gate is controlled by the logic level applied at pin 18. When the logic level is high at pin 18 the RECORD INHIBIT GATE opens, allowing the Y-RF signal to pass through.

As previously stated, the position of the EDIT 30 PG COIL is selected so that a pulse occurs in synchronism with the arrival of the rotary erase head at the edit point on the tape. The rotary erase head is therefore turned on immediately when the pulse occurs. However since the erase head is positioned so that it leads the video head by 40° it is necessary to delay the control pulse long enough to permit the video head to arrive at the edit point. The EDIT 30 PG, CUT IN, and CUT OUT DELAY ONE SHOTS provide this function. These circuits are set so that the logic levels at their outputs toggle from a normally high to a low state in synchronism with the occurance of the PG pulse. The delay which occurs before the outputs reset to their normally high state is different in each case, 3.51 milliseconds for the CUT IN DELAY ONE SHOT and 3.89 milliseconds for the CUT OUT DELAY ONE SHOT. See Fig. 2-26.

The state of the RECORD INHIBIT GATE is directly controlled by the state of the IN/OUT FLIP FLOP, located in IC2404. This flip flop is, in turn, controlled by the IN and OUT NAND GATES in IC2402. The ON/OFF FLIP FLOP, which controls the rotary erase signal, also alternately enables the IN and OUT NAND GATES. When the logic level at output pin 8 of the IN/OUT FLIP FLOP is high, it applies a high enabling signal at control pin 18 of the RECORD INHIBIT GATE. This occurs because the logic level is inverted twice by the two inverters between pins 2 and 12 in IC2404. Output pin 9 of the IN/OUT FLIP FLOP is unused.

Both the RELAY DRIVE AMPLIFIER, which supplies coil current to the two head switching relays, and the CHROMA GATE, which controls the flow of chroma record signal current, are also controlled by the state of the IN/OUT FLIP FLOP. The inverted output of the IN/OUT FLIP FLOP is supplied from pin 13 of IC2404 to the RELAY DRIVE AMPLIFIER input and to the input of inverter Q2406. The RELAY DRIVE AMPLIFIER inverts this signal to supply coil current to the head switching relays. The CHROMA GATE, like the RECORD INHIBIT GATE, requires a high logic level input to open it. Q2406 supplies this signal so that the CHROMA GATE and RECORD INHIBIT GATE both open simultaneously.

When the machine is first turned on, the two flip flops would normally have a tendency to randomly set themselves into one state or the other as the power supply voltage comes up. To preclude this possibility, a POWER ON RESET circuit is provided to force the flip flops into the desired state every time. The circuit, which utilizes a portion of one section in IC2404, consists of a single transistor whose collector, tied to pin 11, is connected to the cathodes of diodes D2404 and D2410. The anodes of these diodes tie respectively to output pin 8 of the

IN/OUT FLIP FLOP and to output pin 12 of the ON/OFF FLIP FLOP. These are the two flip flop outputs which are both at a low state when the editing system is in the PLAYBACK mode. When the power supply voltage first comes up, capacitor C2414 begins charging through resistor R2421. While the capacitor is charging it supplies base drive to the POWER ON RESET transistor through pin 4 of IC2404. The transistor saturates, grounding the two flip flop outputs through the diodes. The charging time of C2414 lasts long enough to ensure that the flip flops are forced into the proper state. When the capacitor is charged, the POWER ON RESET transistor cuts off and the voltage on pin 11 of IC2404 goes to +12 volts, back biasing D2404 and D2410.

### INSERT MODE "CUT IN" AND "CUT OUT" FUNCTIONS DESCRIPTION OF OPERATIONAL SEQUENCE

In the first part of this section, the function of each part of the blanking switcher, as shown in Fig. 2-25, was described. Below is described the operational sequence of events occuring for EDIT CUT IN and EDIT CUT OUT. Refer again to Fig. 2-25 and the timing chart in Fig. 2-26.

Assume the machine is in the playback mode and a video insert edit is to be made. Initially, both the ON/OFF FLIP FLOP and the IN/OUT FLIP FLOP are in their reset state, that is, pins 8 and 12 of IC2401 are both low. The EDIT +24 V IN LINE is also low. The Y-FM signal, derrived from the externally applied video input signal, is amplified by the Y-RF AMPLIFIER, in IC2101, and is applied through the HIGH PASS FILTER to the ROTARY ERASE GATE and through the 767 kHz TRAP to the RECORD INHIBIT GATE. Although not shown in Fig. 2-25, the 767 kHz down-converted chroma signal is also applied to the CHROMA GATE, in IC2101. All three gates are inhibited, however, so none of the applied signals pass through them. The head switching relays, RY2201 and RY2202, are in the relaxed state, connecting the video heads to the playback amplifier.

When the INSERT "CUT IN" pushbutton is pressed, the EDIT +24 V IN LINE goes from zero to +24 V. This immediately applies coil current to the two head switching relays, through diode D2416, and they pull in, connecting the video heads to the outputs of the record amplifiers. When the EDIT +24 V IN LINE goes high, the output of the OFF DELAY ONE SHOT, at pin 9 of IC2401, simultaneously goes low. This applies a low state to input pin 2 of the OFF NAND GATE. Following a delay of 12 milliseconds, the output of the ON DELAY ONE SHOT, at pin 10 of IC2401, goes from a low to a high state. This applies a high logic state to input pin 5 of the ON NAND GATE. Input pins 2 and 5 of IC2402 are the control inputs to the ON AND OFF NAND GATES. They are now set so that the OFF NAND GATE is inhibited. The ON NAND GATE is enabled, waiting for the next EDIT 30 PG PULSE to come along.

The EDIT 30 PG PULSE is generated by the EDIT 30 PG coil at the exact instant when the rotary erase head is in the proper position to be turned on. The pulse is amplified by EDIT 30 PG AMPLIFIER Q2302 and passed through a differentiator which shapes it into sharp spikes at the transition point. The differentiated PG pulse is applied to pin 12 of the EDIT 30 PG DELAY ONE SHOT. The negative-going spike triggers the one shot, causing the logic level at its input (pin 12 of IC2403) to go low. The EDIT 30 PG DELAY ONE SHOT widens the pulse, so that the pulse seen at its input is always of constant width and amplitude. This pulse is coupled from pin 12 of IC2403 to input pins 1 and 4 of the ON and OFF NAND GATES through a second differentiator. This differentiator shapes the pulse into a pair of sharp spikes, negative and positive going corresponding to the beginning and end of the pulse. The first of these positive going pulses to occur following initiation of the EDIT "CUT IN" operation (which corresponds to the end of the widened PG pulse) passes through the enabled ON NAND GATE to input pin 3 of the ON/OFF FLIP FLOP. The NAND gate inverts the pulse to negative-going.

The pulse, inverted by the ON NAND GATE, toggles the ON/OFF FLIP FLOP causing its output pin 13 to go low and pin 12 to go high. When pin 13 of the ON/OFF FLIP FLOP goes low, the output from the ERASE CONTROL ƆR" GATE also goes low (assuming the RE GATE +12 V IN line is also low, which it should be for editing operation). This immediately enables the erase gate, allowing erase current to flow in the rotary erase heads. Toggling of the ON/OFF FLIP FLOP sets the IN and OUT NAND GATES so that the IN NAND GATE is enabled and the OUT NAND GATE is inhibited. The IN NAND GATE now waits for a positive-going logic level transition to occur at its other input.

After a delay of 3.51 milliseconds following the toggling of the ON/OFF FLIP FLOP, the output of the CUT IN DELAY ONE SHOT goes high. This is inverted to a negative going transition at output pin 11 of the IN NAND GATE which, applied to input pin 7 of the IN/OUT FLIP FLOP, causes it to toggle. The 3.51 millisecond delay allows sufficient time for the rotary video head to reach the edit point on the tape.

When the IN/OUT FLIP FLOP toggles, its output at pin 8 goes high. This signal, passing through two serially connected inverters between pins 2 and 12 in IC2402, appears as a high logic level at pin 18 of IC2101, the control input to the RECORD INHIBIT GATE. When the control input to the RECORD INHIBIT GATE goes high, the gate is enabled and the Y-FM signal passes to the Y-RECORD AMPLIFIERS and on to the video heads. The low-to-high level transition at output pin 8 of the IN/OUT FLIP FLOP also opens the CHROMA GATE, through inverter Q2406, and applies coil current to the two head switching relays by way of the RELAY DRIVE AMPLIFIER.

The system is now in the RECORD mode.

When the insert edit is terminated, the INSERT "CUT OUT" pushbutton is pressed. This causes the EDIT LINE to switch from +24 V to zero. When this occurs, the ON DELAY ONE SHOT output immediately switches from a high to low state. After a 12 millisecond delay, the OFF DELAY ONE SHOT output switches from low to high. This sets up the ON and OFF NAND GATES so that the ON NAND GATE is inhibited and the OFF NAND GATE is enabled. The system now waits for the next EDIT 30 PG PULSE.

At the end of the next EDIT 30 PG pulse, supplied to pin 1 of the OFF NAND GATE from pin 12 of the EDIT 30 PG DELAY ONE SHOT, a negative-going spike is coupled from output pin 3 of the OFF NAND GATE to input pin 2 of the ON/OFF FLIP FLOP. This causes the ON/OFF FLIP FLOP to toggle, inhibiting the rotary erase gate and cutting off erase current in the rotary erase heads. The ON/OFF FLIP FLOP also sets up the IN and OUT NAND gates so that the OUT NAND GATE is enabled and the IN NAND gate disabled. The system now waits for the next positive-going transition of the output from the CUT OUT DELAY ONE SHOT.

The CUT OUT DELAY ONE SHOT makes a positive transition 3.89 milliseconds after the ON/OFF FLIP FLOP toggles

off. This pulse, inverted by the OUT NAND GATE, toggles the IN/OUT FLIP FLOP so that its output at pin 8 of IC2404 goes low. This inhibits the RECORD INHIBIT GATE and the CHROMA GATE.

From the time the EDIT +24 V IN LINE went to zero, all coil current to the two head switching relays was supplied from the RELAY DRIVE AMPLIFIER. The high to low transition at the output of the IN/OUT FLIP FLOP causes the input level to the RELAY DRIVE AMPLIFIER TO GO HIGH. Since the RELAY DRIVE AMPLIFIER is an inverting amplifier, its output goes low, removing coil current from the relays. The relays drop back into the playback state.

The machine is now in the Playback mode once again.

#### ASSEMBLE MODE

The above description covers the INSERT EDIT mode for both CUT IN and CUT OUT. The ASSEMBLE mode is, in essence, a CUT IN operation only. The rotary erase and video heads are engaged just as in the INSERT, CUT IN operation. When the ASSEMBLE mode is initiated, the fixed erase head is also powered. The rotary erase heads are left on only long enough to erase any signal which might be on the un-erased length of tape between the fixed erase head and the head drum.

#### NOMENCLATURE

In this circuit description of the Blanking Switcher and Rotary Erase circuit, several circuit components are shown in Fig. 2-25, and described herein, with different names than those which appear on the block diagram on pp. 4 and 5 of volume Two of this manual. The purpose was to use terminology more descriptive of component function than is used in the block diagram in Volume Two. Where terms differ, they are cross-referenced below.

| TERM USED IN CKT. DESCRIPTION: | TERM USED IN VOL. 2: |
|---|---|
| Record Inhibit Gate | Buffer & Gate |
| Off Delay One Shot | Off Delay Circuit |
| On Delay One Shot | On Delay Circuit |
| Edit 30 PG AMP | 30 PG (A) AMP |
| Edit 30 PG Delay One Shot | Edit PG Delay M.M. |
| Cut Out Delay One Shot | Cut Out Delay M.M. |
| Cut In Delay One Shot | Cut In Delay M.M. |
| Off NAND Gate | NAND Gate 1 |
| On NAND Gate | NAND Gate 2 |
| ON/OFF Flip Flop | FF2 |
| "Out" NAND Gate | NAND Gate 3 |
| "In" NAND Gate | NAND Gate 4 |
| IN/OUT Flip Flop | FF3 |
| Power On Reset | Orientation Circuit |
| Erase Control OR Gate | (Not shown in Vol. 2) |

## 2-6. SYSTEM CONTROL

The system control controls all functional operations in the machine such as STOP, FORWARD, REWIND, FAST FORWARD, SLOW, etc. Much of the system control is mechanical, being actuated by the FUNCTION SELECTOR. Another portion of the system control is electromechanical, such as the MODE SELECT switch and the REC and EDIT pushbutton switches. The remainder of the system control is electronic, and the electronic circuitry is contained on the SYS circuit board.

Most of the circuits on the SYS board perform gating and switching functions. All the diodes are switching gates of one type or another. Transistor Q5 controls the VIDEO MUTING line. Q5 cuts off when the VIDEO EE line is low, causing the VIDEO MUTING line to go high. This mutes the playback video by saturating muting switch Q3005 on the Y-DEM board. Since the collector supply for Q5 comes from the +STOP line however, video muting can only take place when the +STOP line is high. Transistors Q6 – Q8 comprise the dropout compensator gate which controls the DOC MUTING line. The DOC GATE is also controlled by the state of the VIDEO EE line. When the VIDEO EE line is low, Q6 cuts off saturating Q7 and Q8. This causes the DOC MUTING line to go high, inhibiting the dropout compensator.

AUDIO MUTING is controlled by transistors Q9 and Q10, which are in turn controlled by the AUDIO EE line. Assuming the AUDIO EE line is low, the AUDIO MUTING line will go high when the +STOP line is high (through R25, D20, and D22) or when the REW FF PAUSE line is high (through D27, R24, D20, and D22). When the AUDIO MUTING line is high, the audio channel is muted. When AUDIO EE operation is intiated, while the machine is in the STOP mode, the AUDIO EE line goes high. This saturates Q9, dropping the voltage at the anode of D22 to zero. This causes the AUDIO MUTING line to go low, enabling the audio channel. When the AUDIO EE function is terminated, the AUDIO EE line goes low. The subsequent cutoff of Q9 allows the AUDIO MUTING line to go high. The function of Q10 is to force the AUDIO MUTING line to go high quickly. While the AUDIO EE line is high there is no charge on C2, since both ends are at +24 V. When the AUDIO EE line switches low, charging of C2 through R22 and the base-emitter junction of Q10 causes Q10 to turn on briefly. This supplies a pulse from Q10's collector, through R29 and D23, which kicks the AUDIO MUTING line up to +24 V quickly. After C2 is charged Q10 cuts off.

Transistor Q11 is an inverter which keeps the logic state of the AUD P/B line opposite to that of the AUDIO EE line.

The VIDEO EE line is controlled by the OFF DELAY circuit. In the ASSEMBLE and INSERT editing modes, and in the RECORD mode, base drive is applied to Q12 through R35 and R36. R35 is connected to +24 V and, since its value is low, C4 charges rapidly immediately saturating Q12. This forward biases Q13 so it also saturates and the VIDEO EE line goes high. When the machine is taken out of one of these modes, R35 is disconnected from the +24 V line. The off delay is introduced by the fact that C4 must discharge through R36. As C4 discharges, it continues to supply base current to Q12, holding the VIDEO EE line high for about 20 milliseconds.

In the preceeding section, it was mentioned that in the ASSEMBLE edit mode, the rotary erase heads are energized briefly, following initiation of that mode, to allow them to clear

the tape of any recorded material between the fixed erase head and the head drum. Following a short delay, the rotary erase heads are turned off. This turn off of the rotary erase heads is the function of the ON DELAY circuit.

When the RE line is high, the rotary erase gate is inhibited. This is because forward current through D2501 and R2525 drives Q2504 into saturation. The RE line is controlled by the conducting state of Q4 in the ON DELAY circuit. When the machine is first placed in the ASSEMBLE edit mode, Q4 is cut off. This keeps the RE line low, enabling the rotary erase gate. As the ASSEMBLE edit mode is initiated, R1 is connected to +24 V. This saturates Q1 removing base drive from Q2. Q2 cuts off, allowing C1 to charge through R5. The emitter of Q3 is biased at +7.6 V, so Q3 does not conduct until the charge on C1 gets high enough to forward bias it. This is what provides the delay. When the charge on C1 gets to about +8 V, Q3 turns on forward biasing Q4. When Q4 saturates, the RE line goes to +24 V, inhibiting the rotary erase gate.

IC1 contains a flip flop whose output, buffered by Q15, and Q16, controls the SLOW mode. Q17 and Q18 are reset switches for the flip flop. On (p-p) 10 – 13 of Vol. 2 of this manual are four block diagrams which illustrate the switching logic for this, as well as all other modes of system control operation.

## 2-7. POWER SUPPLY

The power supply consists of transformer T15001, the rectifier bridges, and the circuitry on the REG board.

Power transformer T15001 has separate secondary windings for each of three power supplies. An unregulated supply provides 12 vdc to the capstan motor. Regulator circuits on the REG board provide regulated +24 V and +12 V to the various electronic circuits in the machine. With the exception of component values and operating voltages, the two regulator circuits are identical. For this reason only the +24 V regulator is described.

Power, supplied from the 31 volt winding on the transformer, is rectified by the full wave bridge and pre-filtered by capacitors C1 and C2. Transistors Q1 and Q101, connected in a darlington configuration, provide the series-pass regulator element. Zener diode D4 provides a fixed 6.2 V reference, against which the supply regulates. Transistor Q2 is the control element which compares the zener voltage, at its emitter, against a sample of the output voltage, supplied to its base through voltage divider action by R4, R5, and R6. Q2 controls the regulated output by adjusting the base drive applied to the darlington element. The exact output voltage from the regulator is set by adjustment of pot R5.

# SECTION 3
# DISASSEMBLY

## 3-1. CABINET REMOVAL

With the top cover in place, place the unit upside down and remove the six screws shown in Fig. 3-1. Lift off the cabinet.

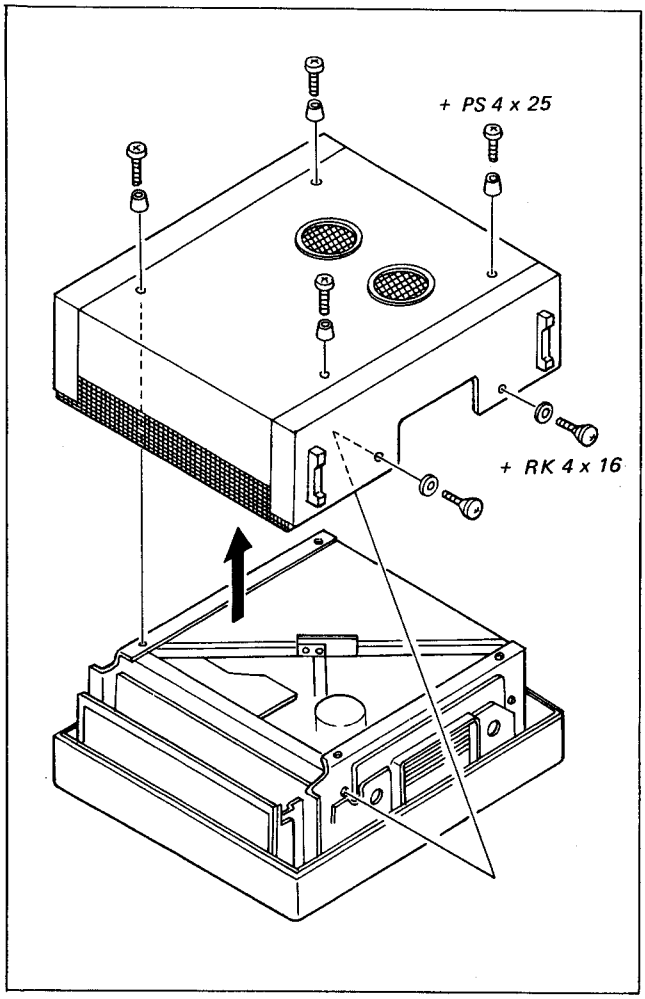



*Fig. 3-1. Cabinet removal*

## 3-2. REEL PANEL REMOVAL

Remove the seven screws shown in Fig. 3-2 after the cabinet removal.

1. Remove the guard assembly.
2. Remove the control panel section.
3. Remove the reel panel section.

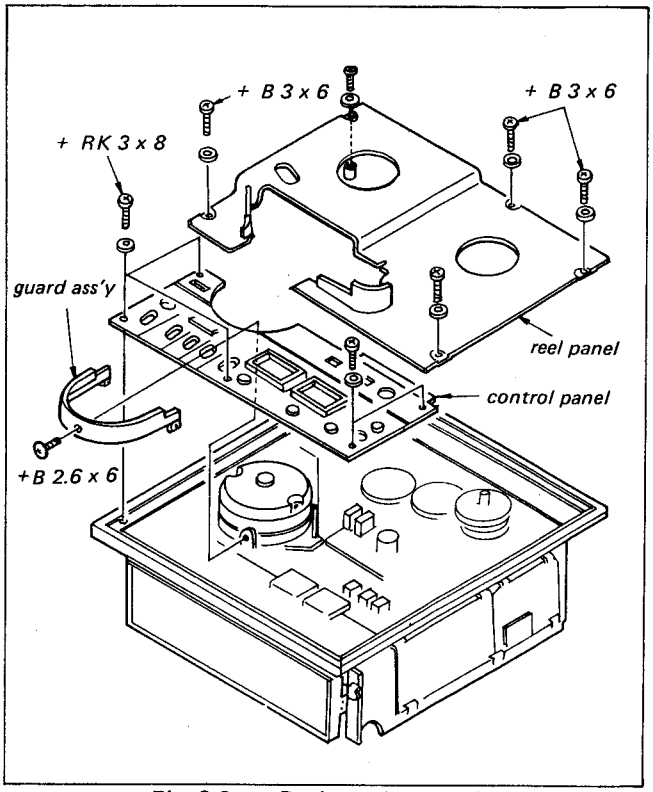



*Fig. 3-2. Reel panel removal*

## 3-3. CONNECTOR PANEL REMOVAL

For maintenance of VOA and MIC Boards, the connector panel must be removed as follows.

The connector panel is removed by removing the five screws shown in the figure below so that maintenance of the VOA and MIC Boards may be performed easily.

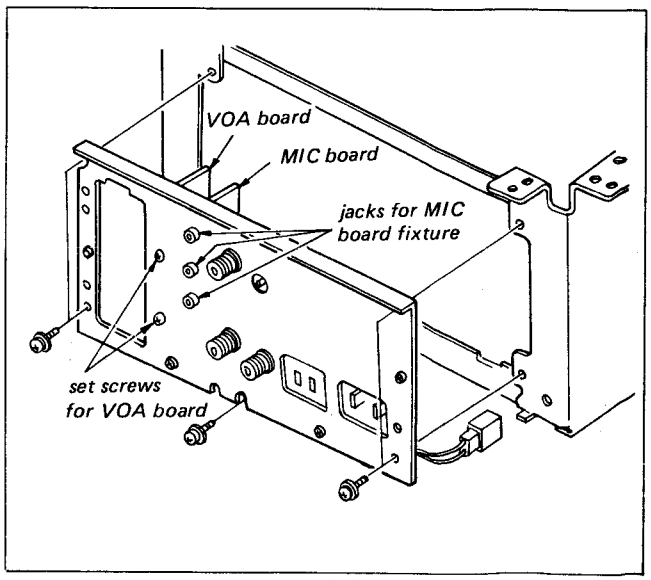



*Fig. 3-3.*

# SECTION 4
# MECHANICAL MAINTENANCE

## 4-1. PRECAUTIONS

Machine compatibility (interchangeability of tapes between machines) depends upon very close mechanical tolerances in the tape path. The tape path is factory-adjusted and should not require realignment under normal circumstances. Do not attempt adjustment of the tape guides or the tapered guides. If mechanical damage requires replacement and/or adjustment of the guides in the tape path, return the unit to a SONY FACTORY SERVICE CENTER for repair.

## 4-2. SPECIAL MECHANICAL ALIGNMENT TOOLS

The following special mechanical alignment tools are required in performing the adjustments outlined in this procedure.

| | |
|---|---|
| Dihedral adj. screw . . . . . | Part No. 3-618-904-01 |
| Torque measurement spring scale A . . . . | Part No. 9-911-043-01 |
| Torque measurement spring scale B . . . . | Part No. 9-911-042-01 |
| Drum . . . . . | Part No. 9-911-041-01 |

## 4-3. CLEANING HEADS AND SLIP RINGS

Noise in the picture during playback is usually caused by an accumulation of debris in the video heads. In some cases, half the picture may be noisy (split screen); in severe cases, video output may be lost.

To clean the heads, stop the machine, remove the tape and move one of the heads to the cleaning position near the left tapered guide. See Fig. 4-1.

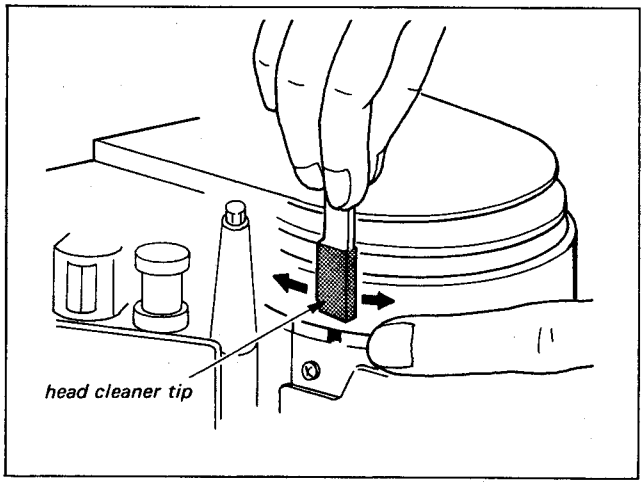



*Fig. 4-1. Video head placed at the cleaning position*

**CAUTION**

NEVER TRY TO CLEAN THE HEADS WITH THE MOTOR RUNNING

It is difficult to move the rotary heads into the cleaning position without first removing the head drum cover. To remove the head drum cover, the molded plastic cover which houses the drum and stationary heads must first be removed. To remove this plastic cover, loosen the locking screw located near the supply reel just behind the head drum. Do not remove this screw, turn it counter-clockwise about $1\frac{1}{2}$ turns. The plastic cover will then pull straight off. Once the plastic cover is removed, the round aluminum head drum cover may easily be removed by removing the three phillips head screws holding it in place.

Once the head drum cover has been removed, the rotary heads can easily be indexed into the cleaning position using a finger. (Be careful, do not touch the heads themselves, touch only the disc to which they are attached.)

To clean the heads, use either a SONY cleaning tip (provided packed with the machine) or a piece of lint free chamois. Saturate it with SONY head cleaning fluid or methanol. (Spray cleaner, such as M/S brand magnetic head cleaner, gives excellent results.) Rub the cleaning tip across the head tip from side to side. Avoid vertical motion, which might damage the video heads. There are four video heads in the AV-8650, two are the actual video heads, the other two are the rotary erase heads. Be sure to clean all of them.

While the head drum cover is off, the slip rings should also be cleaned. Noisy, dirty slip rings cause intermittant dark horizontal lines in the playback picture. To clean them, apply a few drops of SONY cleaning fluid and turn on the motor for 10 to 20 seconds. Carefully wipe any excess fluid from the tape path around the rotary head drum assembly.

If the slip rings are quite dirty and noise persists, clean them directly using a cleaning tip saturated with SONY cleaning fluid. Rotate the head assembly by hand to avoid contacting the brushes.

## 4-4. LUBRICATION

Five major lubrication points are:

1. Supply-Reel Table Spindle.
2. Take-Up Reel Table Spindle.
3. Capstan Bearing
4. Take-Up Reel Idler Bearing.
5. Pinch Roller Bearing.

To lubricate the reel table spindle, remove the screw and washer at the top of the spindle. Lift the reel table slightly so that the hollow shaft of the table rises above the spindle. Apply one or two drops of SONY oil, OL-1K, to the inner surface of the reel table spindle. Seat the reel table in its proper position and replace the screw and washers.

To lubricate the capstan bearing, remove the capstan bearing cap and apply a few drops of oil to the oil ring of the capstan bearing. See Fig. 4-2. To lubricate the pinch roller bearing, remove the pinch roller retainer. Apply a drop of oil to the oil ring of the pinch roller . Be careful not to get oil on the surface of the pinch roller. Wipe off excess oil.

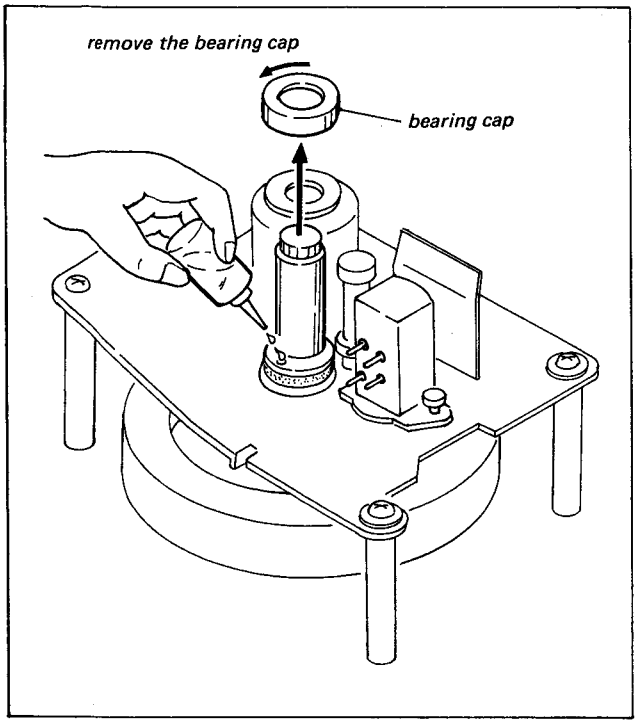



*Fig. 4-2. Lubrication of capstan bearing*

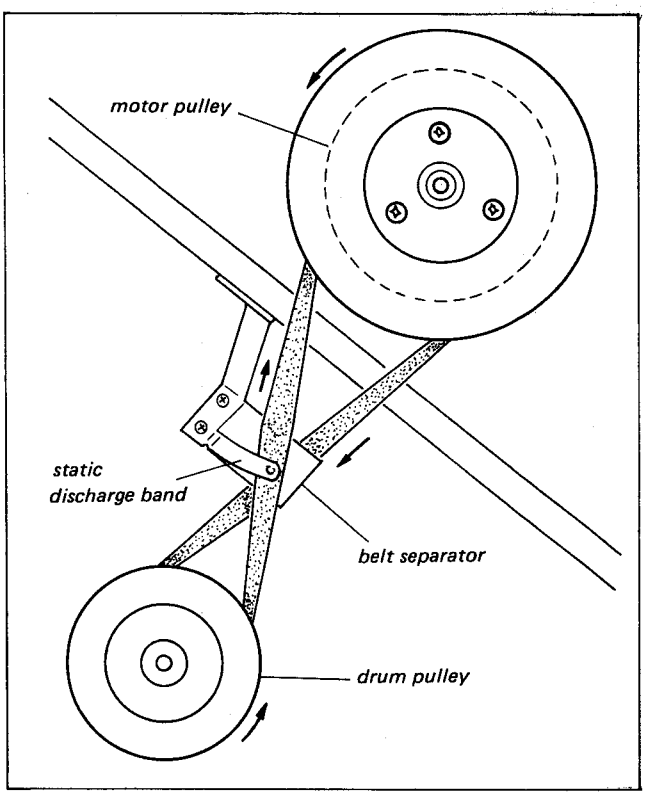



*Fig. 4-3. Drive belt installation*

To lubricate the take-up reel idler, remove the take-up idler cap. Apply a drop of oil to the shaft of the idler. Wipe away excess oil from the rubber driving surface.

**Note:** A lack of oil on this part sometimes causes bearing noise in Play and Fast-Forward modes.

Sliding parts: All sliding parts of the tape transport mechanism are lubricated with grease which, in normal use, need not be replenished. However, if new parts are installed or lubrication is obviously needed, apply a high-temperature grease at points of contact. Avoid excessive lubrication.

## 4-5. DRIVE BELT REPLACEMENT

A worn or stretched drum drive belt results in excessive slippage and loss of servo control.

Check the belt by inspecting the inner (bearing) surface. Look for cracks and streaks along the long dimension of the belt. Replace the belt if it is badly scored along its length. To check belt length, remove the belt from the machine and compare its total length (flattened) with that of a new belt from stock. Replace the belt if it is 1/4-inch or more longer than a new belt.

To install the head-drum belt, stand the VTR on its left side. Loop the belt over the motor pulley, with the shiny side of the belt inside (against the pulley). Grasp the bottom of the loop, turn it one-half turn clockwise, and wrap around the pulley of the rotary head drum assembly.

Insert the belt separator between the two belts in the center of belt crossing point. Adjust the convex part on the discharge band cam to slightly contact the belt See Fig. 4-3.

## 4-6. DRIVE PULLEY ADJUSTMENT

The motor pulley requires adjustment if the head-drum drive belt slips off the pulley or rides against the upper or lower shoulder of the pulley. Adjust the pulley as follows: Remove the drive belt. Loosen the set screw on the motor pulley and adjust its height by eye until it is parallel to the pulley on the rotary-head drum assembly. Reinstall the belt. (See Section 4-4). Place the VTR in the normal horizontal position. Thread and play the tape. Observe the position of the belt on the pulleys. Stop the machine and readjust pulley position to make the belt run in the center of the pulleys.

Check final pulley position by strating and stopping the tape several times. Rewind the tape and try the fast-forward mode a few times. Make sure that the belt does not drift towards the edge of the pulley or slip off when changing speeds.

## 4-7. VIDEO HEAD REPLACEMENT

Video head replacement is required when the heads are damaged or have open coils. In addition, insufficient tape peneration, resulting from head wear after long periods of operation, may necessitate replacement. To remove and replace the rotary head assembly (the disc on which the video heads and the slip-rings are mounted), proceed as follows.

### CAUTION

The video head assembly and the surrounding machined parts are very precisely made. Use utmost care when performing any work on the rotary head-drum assembly.

*Removal*

1. Turn off the power. Loosen the screw that holds the plastic head-drum cover. Loosen only half a turn; do not try to back the screw all the way out. Lift off the head-drum cover.
2. Remove the three Phillips-head screws that hold down the cover plate. Scribe a reference mark on the upper drum as shown in Fig. 4-4.

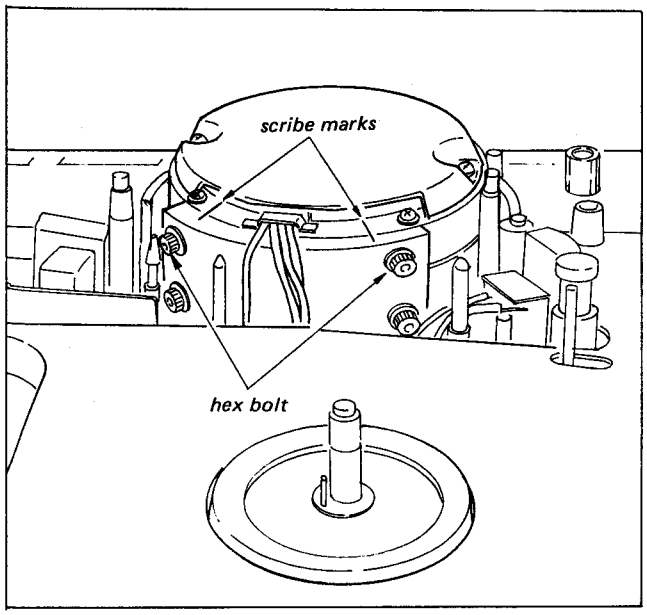



*Fig. 4-4. Upper drum removal*

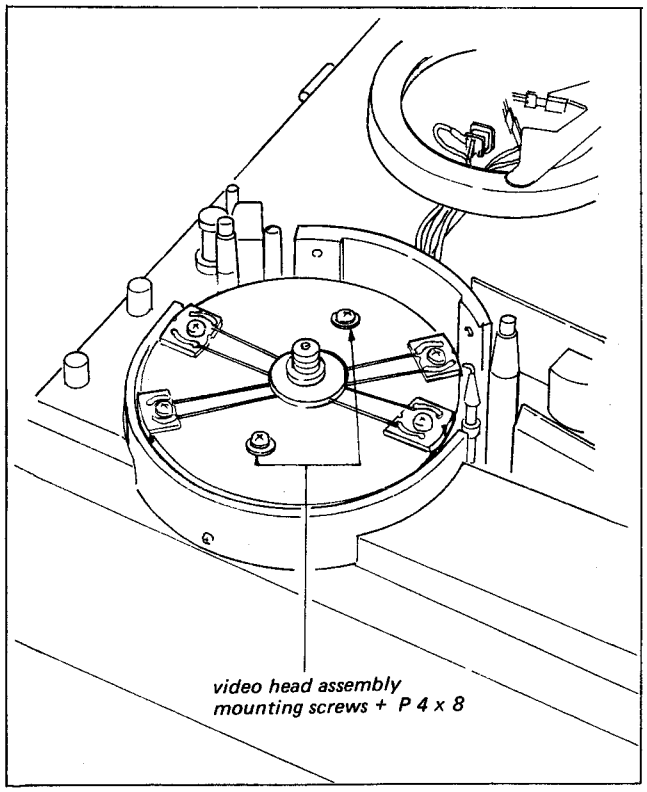



*Fig. 4-5. Video head assembly removal*

3. Remove the two upper 5 x 20 hex-head bolts and washers with a 4 mm Allen wrench. Hold the upper drum with one hand so that it does not fall as you withdraw the two screws. See Fig. 4-4.
4. Carefully lift the top of the drum assembly and fold it back, gently removing the brushes from the slip rings. Place the drum top carefully on the reel panel. See Fig. 4-5.

**CAUTION**

Do not touch the PG pole pieces.

Position the rotary head platform by turning the aluminum disc on which the heads are mounted. Slight pressure on the pole pieces can affect pole piece alignment.

5. Hold the video head assembly to keep the platform from rotating and loosen the screws that hold the head assembly to the platform. Do not exert too much downward pressure on these screws; loosen the locking compound with Methyl Ethyl Ketone. Remove the screws and the washers.
6. Using both hands, carefully lift the video head assembly off the platform. There are height correction spacers between the disc ass'y and the flange. Be sure not to disturb there spacers.

*Replacement*

7. Clean the bottom side of the new video head disc assembly. Attach the new head disc assembly with spacer, to the flange.
8. Install the P 4 x 8 screws and washers. Rotate the head ass'y gently to the left and right until it is approximately in the center of the angular "play" permitted by the mounting screws. Tighten the screws alternately, applying torque gradually until the screws are tight.
9. Carefully swing the top of the rotary head drum ass'y back into place. Support the top with one hand while inserting the two hex head bolts and washers. Do not tighten the screws all the way.
10. Grasp the top of the rotary head drum ass'y and push it back and down against the drum holder, so that the top surface of the upper drum is even with that of the drum holder.
11. Tighten the two bolts alternately, applying torque gradually until all are tight.
12. Tighten the brush pressure adjsuting screws to obtain a 1 mm bend (approximately), as shown in Fig. 4-6. Inspect the brush and slip ring ass'y to make sure that the brushes are centered in the slip rings.
13. After completion of the above head replacement, video head paring should be checked as outlined below:
    a) Set the TAPE SELECT to REGULAR and the VIDEO MODE to B/W, then fix the TRACKING control knob to its center, preset position.
    b) Play back the monoscope segment of the alignment tape.
    c) Set the FUNCTION knob to the STILL mode so that the guard band noise falls approximately one-third of the way inside the raster. See Fig. 4-7.
    d) The paring gap should be within one-half the vertical distance between two adjacent horizotnal crosshatch lines on the monoscope test pattern.

e) If the paring gap is out of specification, try re-tightening the video head disc mounting screws.

14. Following completion of video head replacement, all of the following mechanical and electrical alignment steps must be checked:
    a) 4-8 VIDEO HEAD DIHEDRAL ADJUSTMENT
    b) 7-1-6 Y-Signal Record Current & Freq. Characteristic Adjustment
    c) Playback RF Freq. Characteristic Adjustment
    d) 7-2-20 Chroma Record Current Adjustment

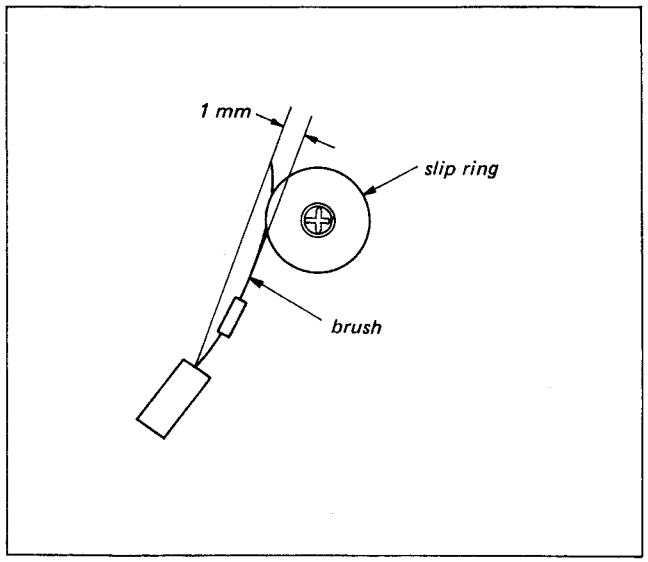



*Fig. 4-6. Brush pressure adjustment*

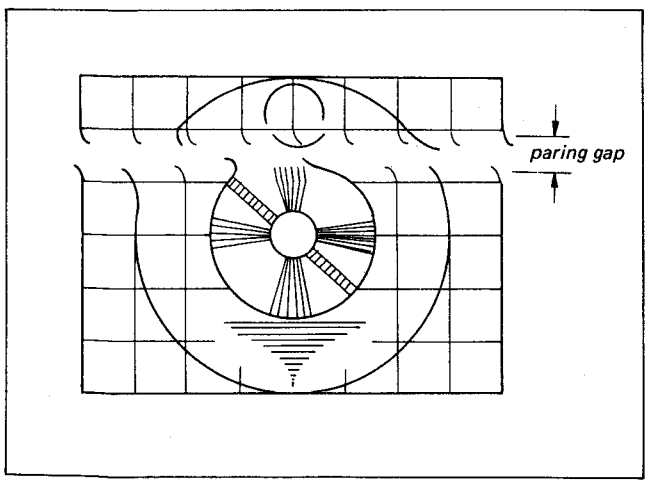



*Fig. 4-7. Head paring adjustment*

## 4-8. VIDEO HEAD DIHEDRAL ADJUSTMENT

Normally, if the video heads have been replaced according to the foregoing procedure, dihedral need not be adjusted. If the dihedral setting has been disturbed, however, or readjustment is otherwise indicated, proceed as follows.

The two video heads should be displaced exactly 180° apart measured at the head gap. If they are not, tape interchangeability can not be maintained. Video Head B (not A) should be adjusted so that it is correctly aligned with respect to Video Head A.

This adjustment requires the use of the SONY alignment tape and the four adjusting screws shown in Fig. 4-8. The adjusting screw has a tapered head which bears against the base of the head when turned clockwise, thus forcing the head to move laterally. The thread of this screw is different from that of any conventional screw.

### CAUTION

Do not use conventional screws for the dihedral adjustment as damage to the thread in the head disc will result. Adjusting screws for the video head are available for all AV-series Videocorders.

*Proceed as follows:*

1. Thread a SONY alignment tape onto the Videocorder.
2. Play back the tape with a monitor connected.
3. Observe the picture on the monitor. (Do not use a monitor set for a short horizontal AFC time constant.) If the top of the picture is as shown by "A" in Fig. 4-9 (it appears as horizontal jitter), adjust Video Head B as follows.
4. Stop the Videocorder and remove the tape.
5. Position the B head so that the threaded adjusting-screw holes are accessible through the cutout in the upper drum. See Fig. 4-8.
6. Install the adjusting screws into the threaded holes at either side of the head base until the tapered part just touches the head base.
7. Similarly, install adjusting screws into the two threaded holes at either side of the A head. These two screws serve only as weights to counterbalance the head-mounting beam.
8. Play back the tape and observe the top of the picture shown in Fig. 4-9.
9. Stop the Videocorder. Position video head B (indentified by red paint on the outer edge of the disc) to the adjusting position shown in step 5.
10. First, loosen the (a) adjusting screw about a quarter turn counterclockwise and tighten the (b) adjusting screw a quarter turn clockwise. See Fig. 4-8.
11. Play back the tape. Check the picture on the monitor screen.
12. If the dihedral error does not change, repeat steps 9, 10, and 11 until a change is visible.
13. If the dihedral error decreases, repeat steps 9, 10, and 11 until a normal picture is obtained.

14. If the dihedral error increases, reverse the direction of rotation of the adjusting screws and repeat Steps 9 to 12 until the distortion in the picture is minimized.

15. Thread a blank tape and make a recording using a video camera focused on a test pattern (or using a stair step test pattern).

16. Check the dihedral error in the picture and trim up the position of Video Head B as described in Steps 9 to 14.

17. Remove the four adjusting screws from the head assembly.

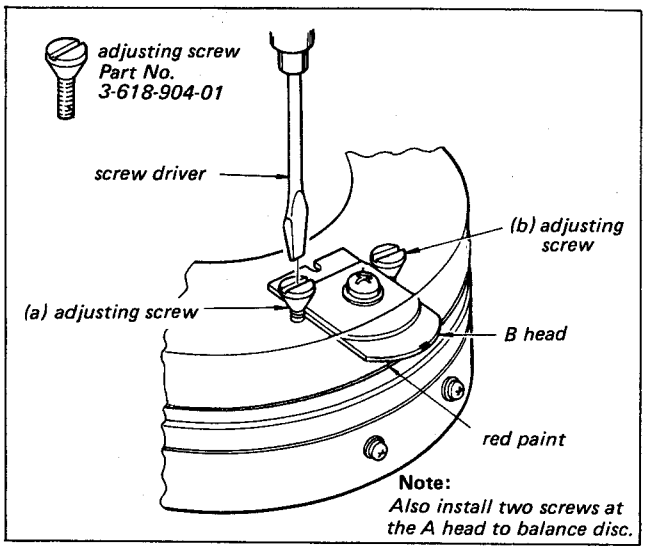



*Fig. 4-8. Video head dihedral adjustment*

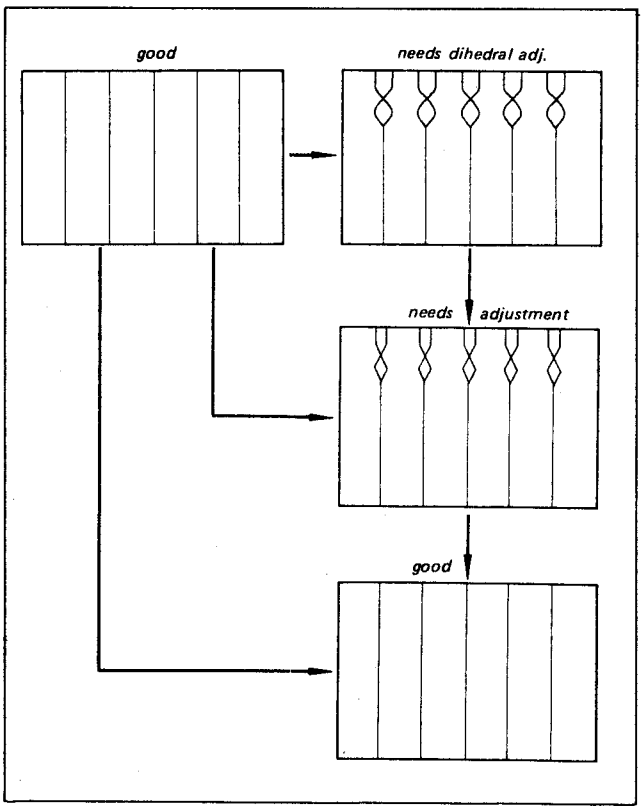



*Fig. 4-9. Head dihedral adjustment*

## 4-9. TAPE TENSION CHECKS AND ADJUSTMENTS

1. Confirm that the supply reel table, in the area of the brake band, is clean and free of dust and grease.

2. Place the FUNCTION selector in the FORWARD position and confirm that the distance between the extended center line of the tape guide pin on the tension arm and the top of the head base is 1 mm.

3. If the distance is not correct, loosen the brake band locking screw and re-position the brake band to adjust for the proper distance. See Fig. 4-10.

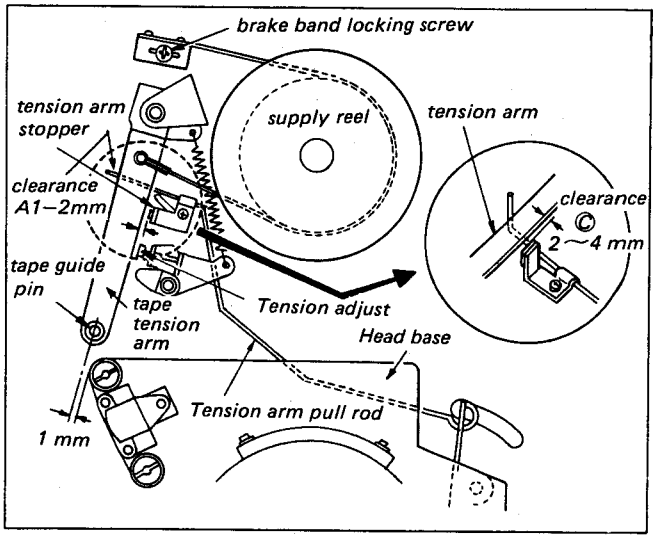



*Fig. 4-10. Tension arm adjustment*

4. Check the clearance Ⓐ between the tension arm and the tension arm pull rod. Verify that it is 1 to 2 mm when the machine is set to the FORWARD mode.

5. If the clearance in step 4, above, is not correct, bend part Ⓑ slightly, as needed to set the clearance to the correct amount.

6. Verify that clearance Ⓒ, between the tension arm and the tension arm stopper, is 2-4 mm. If it is not, bend the tension arm stopper as necessary to set the proper clearance.

7. Verify that the SKEW control is set to neutral and set up the RECORD mode (the RECORD button stays locked).

**Note:** Refer to Fig. 4-11 in the following two steps.

8. Adjust screw (1) so that the SC clutch plate (2) is clear of (3) by 0.5 to 1 mm.

9. Place the machine in the STOP mode and then turn the SKEW control fully clockwise.

10. Run the FUNCTION selector through all of its positions and verify that the SKEW control remains in the fully clockwise position.

11. Depress the RECORD button and verify that the SKEW control snaps back into the neutral position.

12. Index the FUNCTION control to the FORWARD and then back to the STOP position to release the RECORD button.

13. Turn the SKEW control fully counterclockwise and repeat steps 10 – 12 (above) to verify that the SKEW control automatically returns to the neutral position whenever the RECORD button is depressed, but that it does not move unless the RECORD button is depressed.

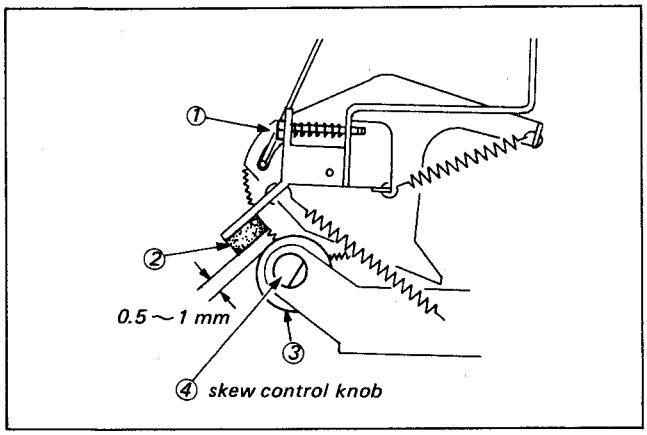



*Fig. 4-11. Skew adjustments*

14. Place a reel containing 5 inches (diameter) of tape on the supply reel turntable. Set the FUNCTION selector to the FORWARD position and the SKEW control to neutral.

15. Make a loop in the tape and attach a spring scale as shown in Fig. 4-12.

16. Pull the scale in the direction indicated. A steady pull at approximately the correct tape speed should give a reading of 40 to 45 grams. Verify that the reading is within these limits.

17. If the reading is outside the 40 – 45 gram limits, adjust the tape tension adjustment screw (See Fig. 4-12.) to bring it within specification.

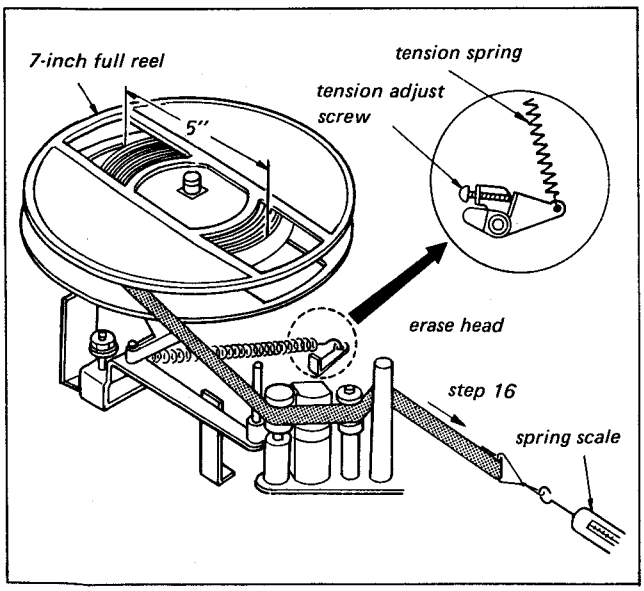



*Fig. 4-12. Tape tension check*

## 4-10. REEL TABLE HEIGHT

1. Run a tape in the FORWARD mode.
2. Check both reels to see that tape does not rub against the edges of the reels.
3. If the tape is not centered in either reel, adjust reel height by adding or removing the fiber washers (Thrust Bearing Washers, Part Number 3-005-074-51, 52, 53) beneath the reel-table assembly.

## 4-11. COMBINATION HEAD REPLACEMENT

A malfunctioning combination head can be replaced, without disturbing servo tracking, by the following procedure:

1. Unsolder the leads at the rear of the combination head.
2. Remove screws (A) and (B) in Fig. 4-13. Do not remove screws(C). Be sure not to lose the spring under screw (A).
3. Remove the defective head ass'y from the head base. See Fig. 4-14. Also remove screws (D) and (E), shown in Fig. 4-14.
4. Install the new head ass'y by reversing the order of the disassembly outlined above.
5. When the new head ass'y is installed, turn screw (A) until it is tight. Adjust screw (B) so that the head gaps appear (by eye) to be perpendicular to the deck.
6. Play a tape and check that the core of the head extends an equal amount above and below the edges of the tape. See Fig. 4-15. Adjust height and tilt screws (D) and (E) as necessary until this condition is achieved.
7. Terminate the LINE OUT connector with a 100 k ohm load and connect an AC VTVM across this load.
8. Play back the 7 kHz segment of a SONY alignment tape and adjust the azimuth screw (B) and the tilt screw (E) for maximum output as indicated on the VTVM (maximum output at 7 kHz).
9. Check the audio bias current adjust. Refer to section 9-7.

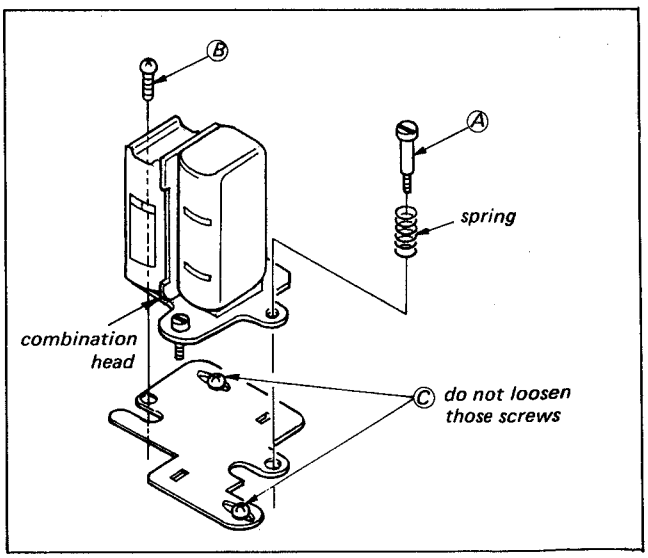



*Fig. 4-13. Combination head replacement*

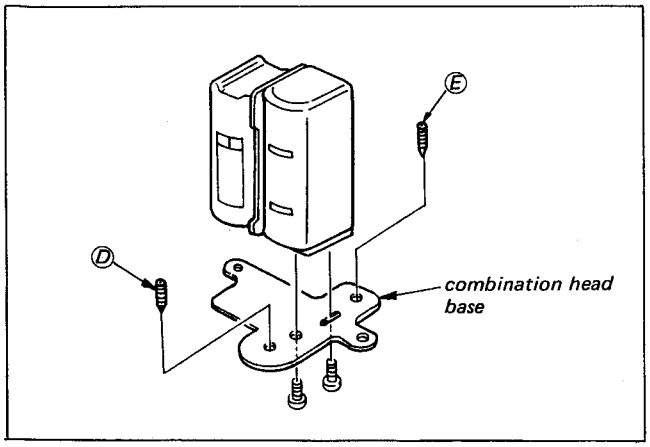



*Fig. 4-14. Combination head replacement*

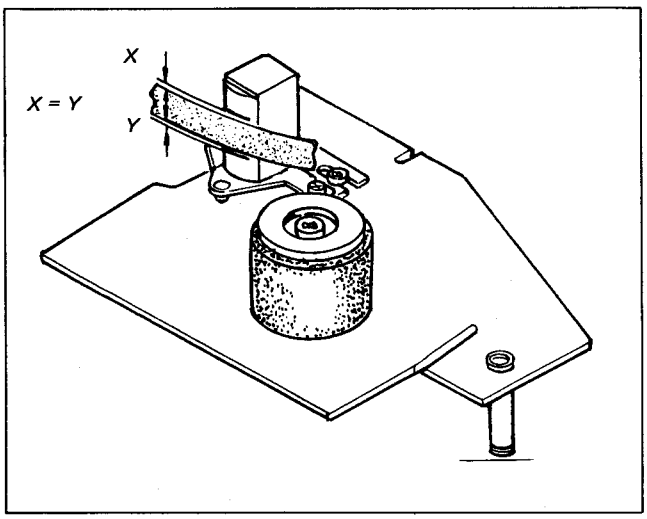



*Fig. 4-15. Combination head height check*

## 4-12. TAKE-UP IDLER HEIGHT ADJUSTMENT (FAST FORWARD MODE)

1. Set the function lever to the FAST FORWARD position. The take-up idler is lifted by the take-up cam. Make sure that the lower surfaces of the take-up idler and the take-up reel table (upper) are in line or that the lower surface of the take-up idler is slightly higher.
2. If this condition does not exist, place the function lever in the FORWARD position. Bend finger A with a pair of pliers as shown in Fig. 4-16 to obtain the correct take-up idler height.

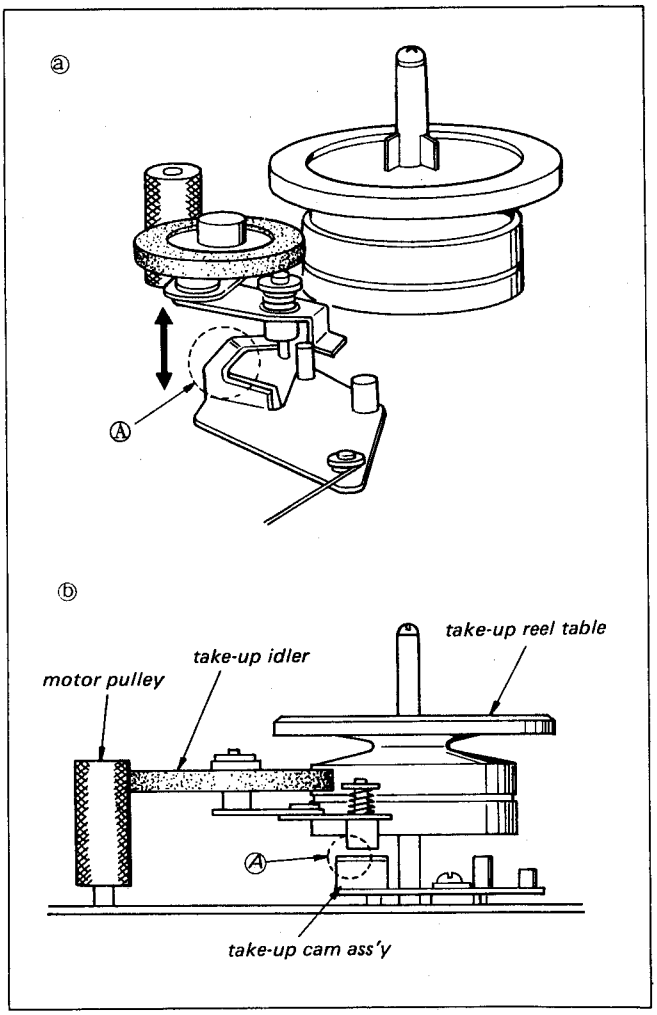



*Fig. 4-16. Take-up idler height*

## 4-13. REWIND IDLER REPLACEMENT

### 4-13-1. Rewind Idler Replacement

1. Check the rewind idlers if the machine is noisy or does not wind tape smoothly and rapidly during rewind, or if the supply reel is not braked properly when going from FORWARD to STOP.
2. Inspect the driving surfaces of both rewind idlers for excessive or uneven wear. Inspect the driving surface of the supply reel assembly. Clean away any oil or debris from all driving surfaces.
3. Set the function lever to STOP. Check that the right rewind idler is clear of the idler stopper by 0.5 to 1 mm. See Fig. 4-17. If this condition does not exist, bend the idler stopper with a pair of pliers.
4. Check that the contacting surfaces of the right and left rewind idlers are parallel. If they are not, bend them by hand.
5. Check that the supply reel table, left rewind idler, and right rewind idler are contacting securely. Make sure at this time that the right rewind idler is disengaged from the take-up reel table by more than 1 mm.

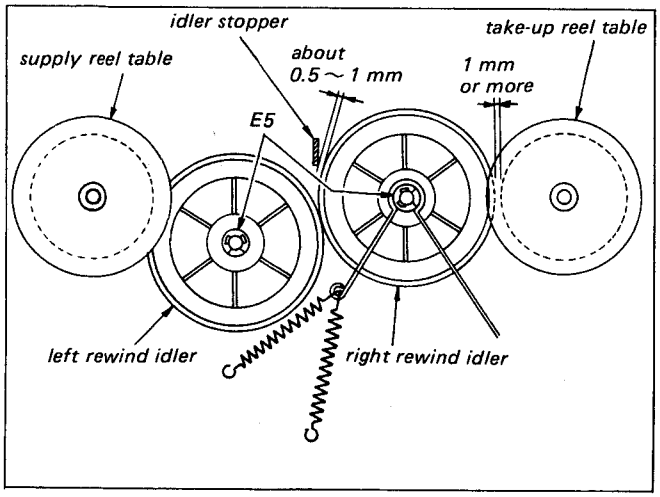



*Fig. 4-17. Rewind idler adjustment*

6. To replace the rewind idlers proceed as follows.
7. Set the function lever to FORWARD. Pry the retaining ring (E5) from the top of the left rewind idler shaft using a screwdriver. Remove the fiber washer. Lift the left rewind idler off its shaft. The directional brake will spring back counterclockwise when the idler is removed.
8. Place one drop of oil on the idler shaft. Rotate the directional brake clockwise until the point faces to the right (3 o'clock). Position the idler shaft so that the idler can be dropped onto the shaft. (Before dropping the idler, identify its top and bottom so that it is installed correct side up.) Release the directional brake. Install the fiber washer and retaining ring (E5).
9. Pry the retaining ring (E5) from the top of the right rewind idler. Remove the fiber washer and push rod. Lift the right rewind idler off its shaft.
10. Place a drop of oil on the shaft of the right rewind idler. Install the right rewind idler, the fiber washer, the push rod, and the retaining ring, in that order.

### 4-13-2. Rewind Idler Adjustment

1. Set the Function Lever to STOP. Check that the right rewind idler is clear of the idler stopper by 0.5 to 1 mm. See Fig. 4-17.
2. Set the function lever to STOP. Check that the supply reel table, left rewind idler and right rewind idler are contacting securely.
3. Set the function lever to STOP. Check for a clearance of 2 to 2.5 mm between the rewind idler and the motor pulley.

## 4-14. BRAKE-SYSTEM ADJUSTMENT

System braking requires attention if:

a. The supply reel exerts too much back tension during FORWARD and FAST FORWARD operations.

b. The supply reel pays out and slackens tape when going from FORWARD or FAST FORWARD to STOP.

c. The take-up reel exerts too much back tension during rewind.

d. The take-up reel pays out too much tape when going from REWIND to STOP.

e. The supply reel rotates during pause operation.

*Brake Torque Adjustment*

1. Set the function lever to STOP.
2. Place an empty reel (RH-7 V), with several turns of string wrapped around the hub, onto the supply reel table as shown in Fig. 4-18. Tie the reel to the spring scale. Pull the scale at a speed of approximately 100 mm/sec (4 inches/sec). Check the reading for brake torque. It should be more than 800 g-cm.
3. Repeat the above brake-torque checks for B , C and D as indicated in Fig. 4-18. The brake torques should be less than 400 g-cm for the direction of B , less than 400 g-cm for the direction of C and more than 800 g-cm for the direction of D .

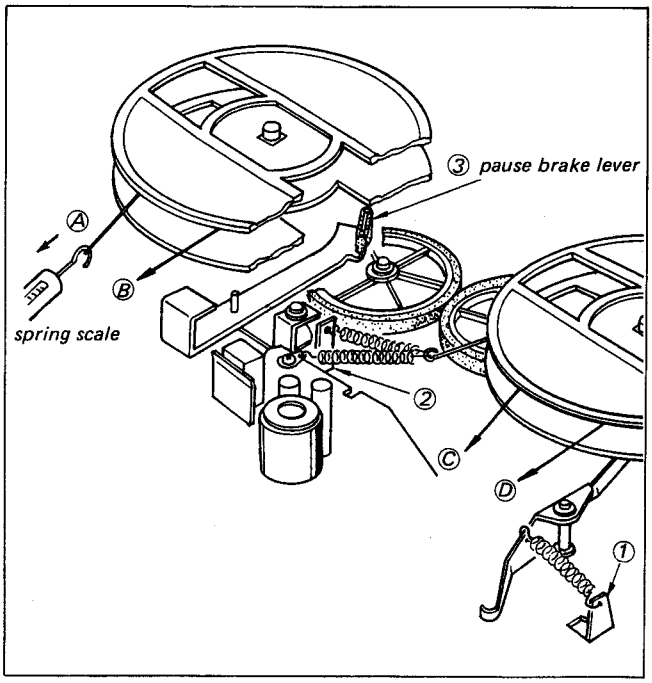



*Fig. 4-18. Brake torque adjustment*

4. Bend spring supporting brackets 1 and 2 with a pair of pliers, if necessary, to obtain the correct brake torques.
5. Set the function lever to PAUSE.
6. Repeat the procedure described in Step 2 for the direction indicated by A in Fig. 4-18. It should be more than 800 g-cm.
7. If necessary, bend the portion of the pause brake lever identified by 3 with a pair of pliers.

*Take-Up Brake Lever Check*

1. Set the function lever to STOP.
2. Check that the top end of the brake lever is disengaged from the function selector cam by approximately 1 mm. Refer to Fig. 4-19.

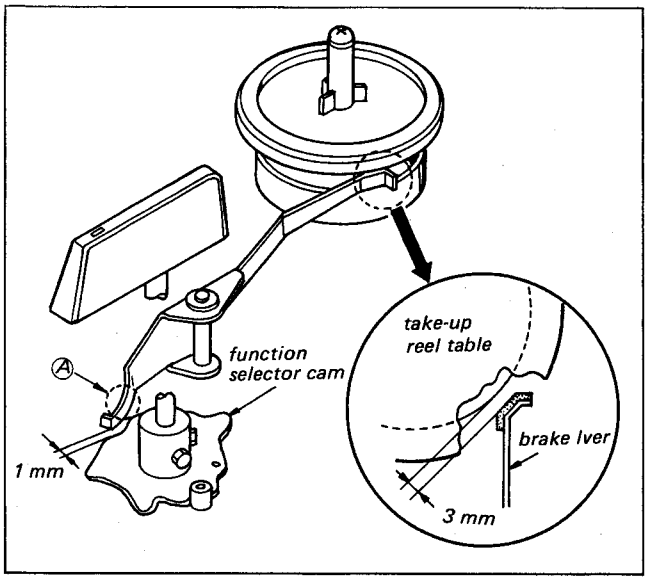



*Fig. 4-19. Take-up brake lever check*

3. Set the function lever to REWIND.
4. Check for a clearance of approximately 3 mm between the brake lever and the take-up reel table.
5. If necessary, bend the portion of the brake lever identified by "A" with a pair of pliers.

*Puase Brake Lever Check*

1. Set the function lever to REWIND
2. Check for a clearance of approximately 1 mm between the pause brake lever and the supply reel table.
3. If this condition does not exist, turn nut "A" shown in Fig. 4-20.

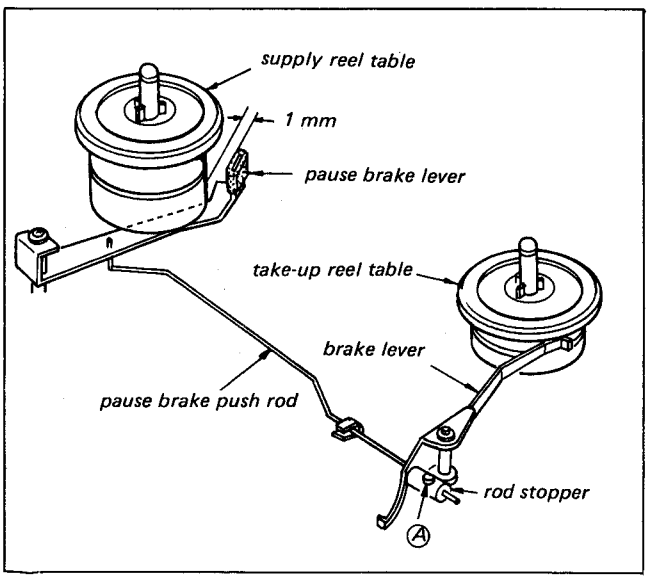



*Fig. 4-20. Puase brake lever check*

4. Advance the tape. Check that the tape stops running in the PAUSE mode.
5. In the PAUSE mode, verify that there is play between the brake lever and the nut.
6. Place the function lever in all the modes except PAUSE. Check for clearance between the pause brake lever and the supply reel table. The clearance should be more than 0.5 mm.

*Brake Timing Adjustment*

1. Set the function lever to STOP. Check for a 2 – 2.5 mm clearance between the motor pulley and the right rewind idler. Bend take-up cam push rod A with a pair of pliers as needed to obtain the correct spacing. See Fig. 4-21.

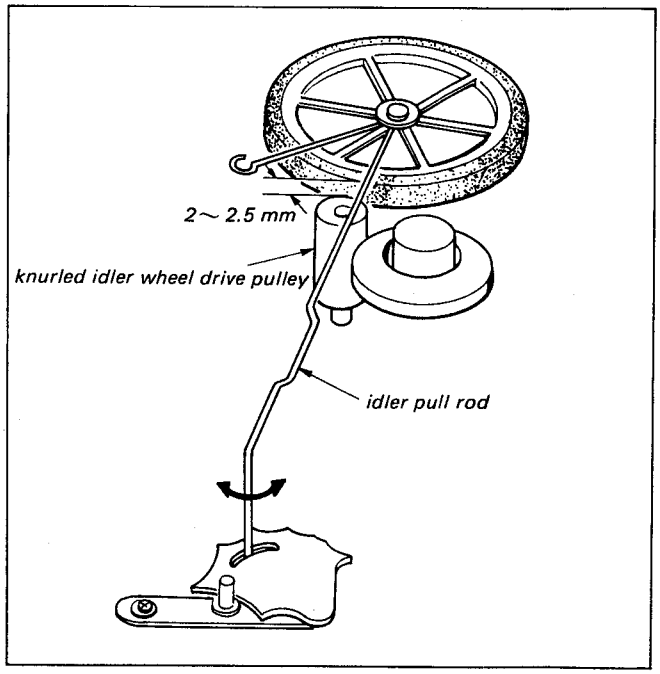



*Fig. 4-21. Brake timing adjustment*

2. Move the function lever from REWIND to STOP very slowly. Check that the take-up reel table braking is applied before the right rewind idler stops rotating.
3. Move the function lever from FAST FORWARD to PAUSE very slowly. Check that supply reel table braking is applied before the take-up reel table stops running.
4. Thread a tape on the VTR and advance it until all the tape is on the take-up reel table. Move the function lever from REWIND to STOP. Check that the tape stops without excess slack. If it does not, bend the brake lever with a pair of pliers. There should still be at least 0.5 mm clearance between the brake lever and the take-up reel table.
5. Place a full reel of tape on the supply reel table and thread the tape. Move the function lever from FAST FORWARD to PAUSE. Repeat the procedure described in Step **4**. If necessary, bend the pause brake lever with a pair of pliers. Refer to "Pause Brake Lever Check" on page 19.

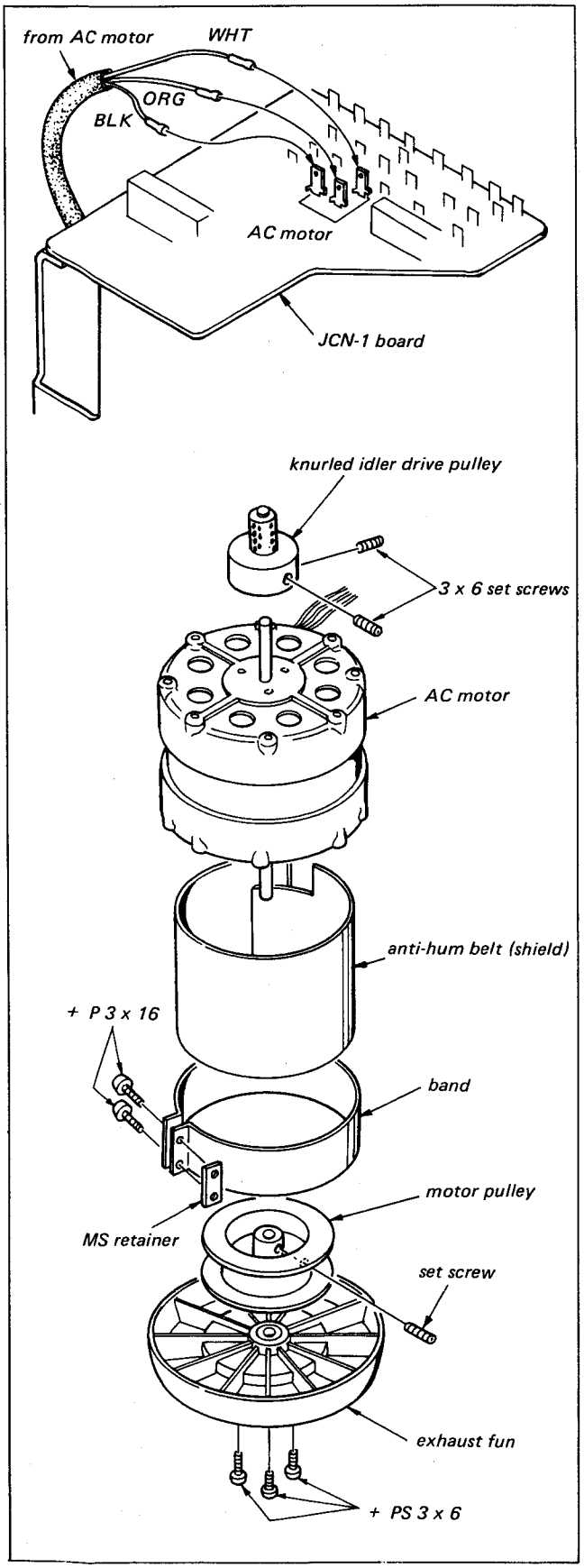



Fig. 4-22. Drum motor replacement

## 4-15. DRUM MOTOR REPLACEMENT

If the motor is suspected to be defective, check the mechanical load on the motor to make sure that the rotary head drum assembly turns freely. Check for line voltage between the black and white leads of the motor (set the funciton lever to FORWARD). Also check phasing capacitor C16001 on the JCN-1 board.If line voltage is present and the phasing circuit is correct, but the motor does not turn, replace the motor as follows:

1. Place the machine in a vertical position.
2. Pull the three motor leads (WHT., BLK., & ORG.) off the JCN-1 board.
3. Remove the drum drive belt.
4. Remove the 3 screws which secure the fan to the motor and remove the fan from the motor section.
5. Hold the motor with one hand and back out the four screws (P 4 x 8) from the reel panel. Remove the motor.

   **Note:** The reel panel and the right rewind idler must be removed.
6. Remove the upper (knurled) idler wheel drive pulley.
7. Note the position of the anti-hum belt which surrounds the motor. Remove this belt.
8. Install the anti-hum belt on the new motor in the same position it occupied on the old motor.
9. Install the knurled idler wheel drive pulley on the upper motor shaft and the motor drive pulley on the lower motor shaft as shown in Fig. 4-23.
10. Mount the motor in place on the chassis and re-connect the motor power leads to the JCN-1 board.
11. Install the drum drive belt as outlined in section 4-5.
12. Operate the motor and check the position of the drum belt in the drum belt pulley on the motor shaft. If necessary, reposition the drum belt pulley so that the belt is centered in it.
13. Re-install the motor fan on the lower motor shaft.

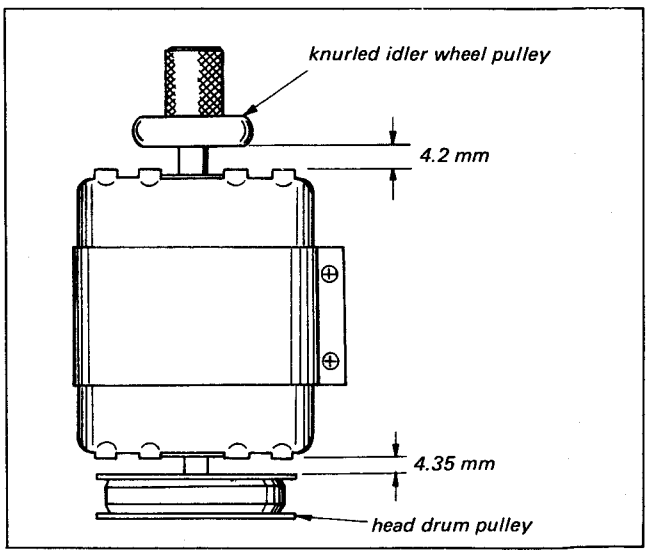



Fig. 4-23. Position of pulleys on motor shaft

## 4-16. CAPSTAN MOTOR REPLACEMENT

As with the main (head drum) motor, verify that the cause of trouble is a defective motor, and not absense of drive voltage or a stalled load condition. If the capstan motor is found to be defective, replace it as follows:

1. Pull the four capstan motor leads (WHT., RED, VLT, and VLT) off the lugs on the JCN-1 board. See Fig. 4-24.

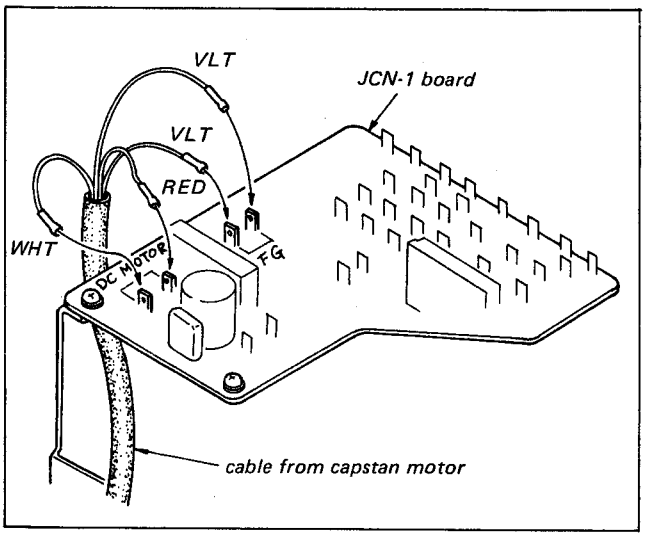



*Fig. 4-24. Capstan motor power connections*

2. Hold the motor with one hand and back out the three P 3 x 16 screws. The capstan motor should now be free.
3. Install the capstan pulley and the three mounting collars on the new motor. See Fig. 4-25. The capstan pulley should be even with the top of the motor shaft.

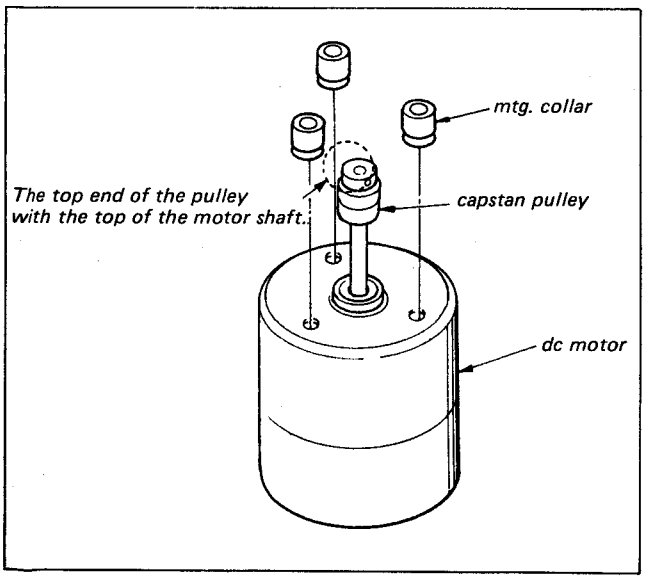



*Fig. 4-25. Capstan motor replacement*

4. Re-connect the four motor power leads to the terminals on the JCN-1 board. See Fig. 4-24.
5. Operate the motor and verify that the capstan belt is properly seated in the capstan pulley on the motor shaft.
6. Following replacement of the capstan motor, perform alignment step 3-2-2, Vol. 1, "Capstan Free Speed Adjustment".

## 4-17. RECORD BUTTON RELEASE LEVER ADJUSTMENT

1. Set the FUNCTION selector to FORWARD.
2. Refer to Fig. 4-26. Loosen screw A and fix part F so that it is in contact with the three slide plates of the record button section.
3. Verify that there is no clearance (at part B) between the mode select cam and the roller.
4. Verify that in the STOP and PAUSE modes:
   a) Record button C locks;
   b) Edit button D cannot be depressed, and;
   c) Cut out button E can be depressed but it does not lock.
5. Verify that in the FORWARD, REWIND, and FAST FORWARD modes:
   a) D and C lock, in that order, and;
   b) C and D are released by depressing E.
6. Verify that in the FORWARD, REWIND, and FAST FORWARD modes:
   a) D and C lock, in that order;
   b) C and D are released by depressing E;
   c) Both C and E can be depressed, and;
   d) C and D, locked in the FORWARD mode, are not released when the mode is changed to PAUSE.

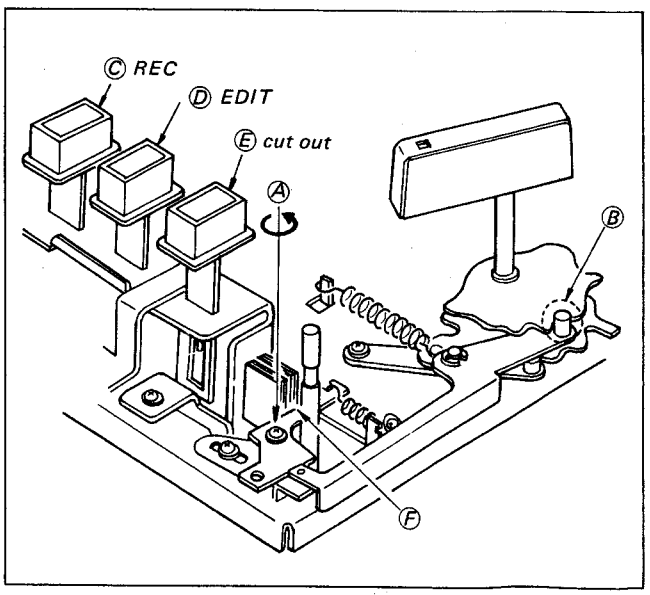



*Fig. 4-26. Record button release lever adjustment*

## 4-18. AUTOMATIC SHUTOFF SWITCH ADJUSTMENT

To check the operation of the Automatic Shut-Off Switch, turn on the power and proceed as follows.

1. Remove the tape from the normal tape path. Set the function lever first to FORWARD, then to PAUSE, FAST FORWARD, and REWIND. The motor should shut off in each position after about 1 second. Repeat this check with tape threaded properly. The motor should remain on when the function lever is set to FORWARD, PAUSE, FAST FORWARD, and REWIND.
2. Set the function lever to STOP, and depress the RECORD button. The motor should turn on.
3. Thread the tape on the VTR. Make sure that the motor is not shut off by a slight overshoot of the tape sensing wire 91. If the aforementioned conditions are not met, proceed to the following steps.
   a) Adjust screw A so that the top end of the actuator is clear of the tape's running surface by 4.5 to 8 mm in the FORWARD operating mode. See Fig. 4-27.

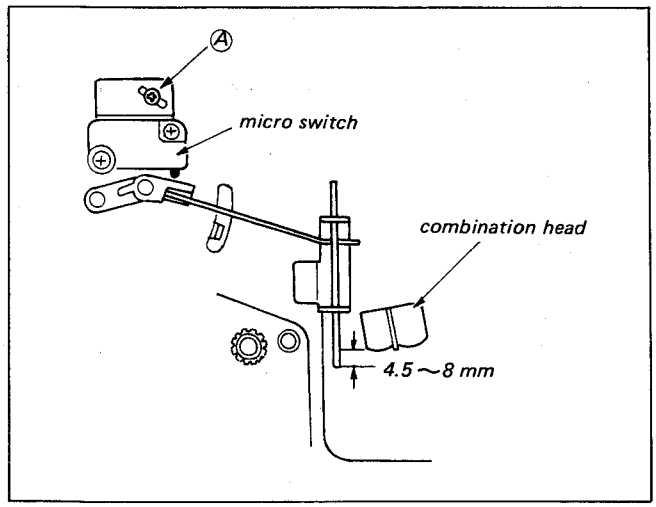



*Fig. 4-27. Automatic shutoff actuator adjustment*

   b) Bend the lower part B of the actuator so that the top end of the actuator is 4 to 8 mm apart from the tape's running surface in the STOP mode. See Fig. 4-28.

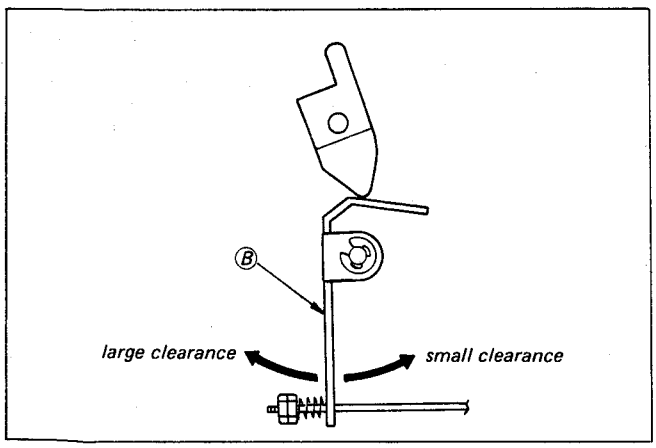



*Fig. 4-28. Automatic shutoff actuator adjustment*

## 4-19. CAPSTAN BEARING AND SHAFT REPLACEMENT

A worn capstan bearing results in noisy operation (a squealing sound from the capstan). When it becomes necessary to replace the capstan bearing, the capstan shaft (assembly including the flywheel must be replaced as well.

*Proceed as follows.*

1. Remove the reel panel.
2. Remove the screw securing the capstan and pry off the capstan.
3. Remove the retaining washer holding the pull rod to the right rewind idler shaft. Remove the pull rod from the idler shaft.
4. Remove the two springs from the rewind idler push rod.
5. Remove the four screws securing the capstan deck ass'y to the support on the chassis.
6. Lift up the capstan deck ass'y. Take the drive belt off the flywheel.
7. Pull the capstan shaft ass'y (flywheel) off the capstan bearing on the capstan deck.
8. Fold the capstan deck ass'y back and remove the capstan bearing retainer by removing the three screws.
9. Remove the capstan bearing cap from the capstan bearing oil ring and oil ring retainer using a pair of pliers. Remove the capstan bearing.
10. Before installing the new capstan bearing inspect the replacement. Pass a clean lint-free cloth through the capstan hole, and inspect the inner surfaces for dirt or foregin matter.
11. Inspect the new capstan shaft ass'y. Handle the capstan shaft carefully to avoid scratches or nicks on the bearing surface.
12. Insert the capstan bearing into the capstan deck and put the capstan bearing retainer on the capstan bearing. Tighten the three screws that secure the retainer to the chassis.
13. Place a few drops of oil on the inner surface of the bearing.
14. Put the spacer on the capstan shaft. Insert the shaft into the capstan bearing.
15. Hold the flywheel with one hand and slip the oil ring retainer and oil ring onto the shaft. Place a few drops of oil on the oil ring, then install the bearing cap on the capstan bearing.
16. Reinstall the capstan drive belt. Install the new capstan and replace the mounting screw.
17. Put the capstan deck ass'y with flywheel on the four posts of the chassis. Position the pinch lever, with relation to the tension release lever, as shown in Fig. 4-29.
18. Tighten the four screws that secure the capstan deck ass'y to the capstan deck supports.
19. Reconnect the pull rod spring to the pull rod.
20. Install the pull rod and retainer onto the rewind idler shaft.
21. Operate the machine. Check servo tracking and combination head adjustment. See Section 4-11.

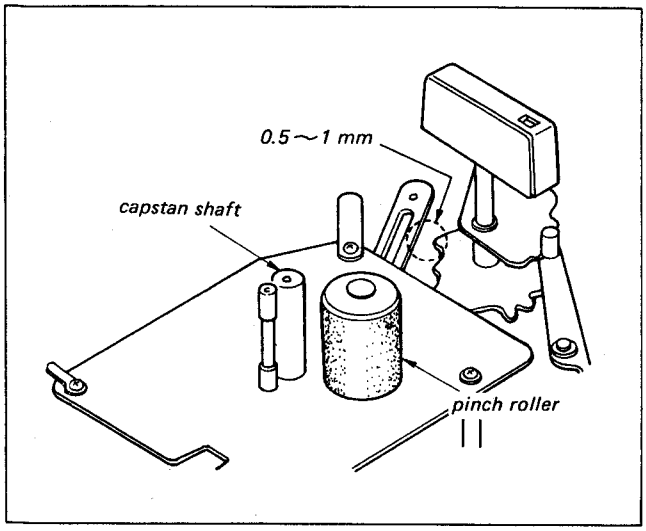



*Fig. 4-29. Capstan deck adjustment*

## 4-20. CAPSTAN DECK ASSEMBLY ADJUSTMENT

1. Set the function lever to FORWARD. Check that the clearance between the pinch lever and the function selector cam is 0.5 to 1 mm. If necessary, readjust the position of the capstan deck ass'y. See Fig. 4-29.
2. Set the function lever to PAUSE. Make sure that the clearance between the capstan shaft and the pinch roller is more than 0.5 mm. If necessary, recheck Step 1. See Fig. 4-30.
3. Set the function lever to FORWARD. Check that the clearance between the upper end of the pinch lever and the lower end of the drum mounting deck is more than 1.5 mm. See Fig. 4-31. If it needs adjustment, bend "A" in Fig. 4-31 with a pair of pliers. Recheck pinch roller pressure as described in Section 4-20.
4. Switch the function lever through all modes. Check the tape motion.

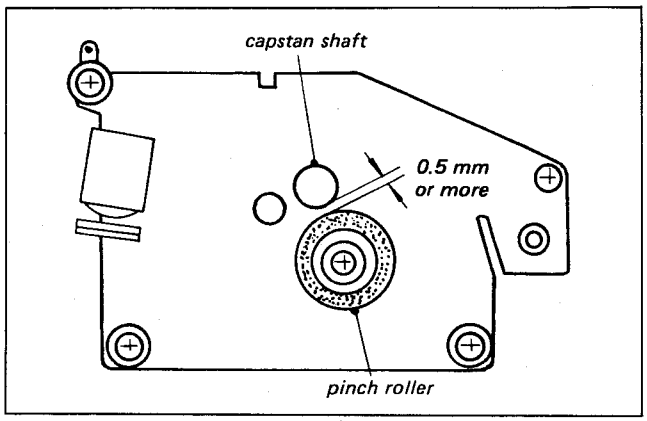



*Fig. 4-30. Capstan deck adjustment*

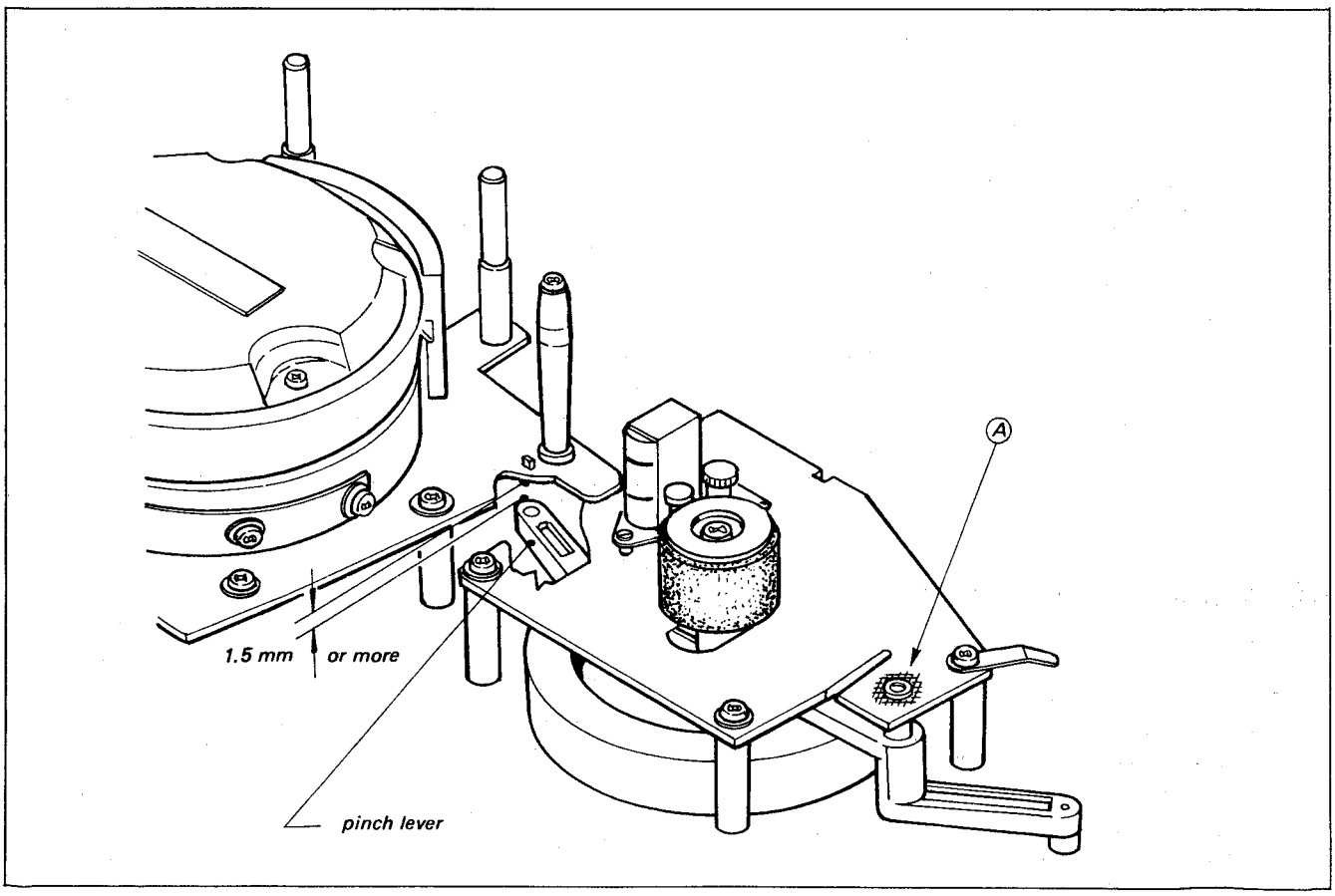



*Fig. 4-31. Pinch lever adjustment*

## 4-21. PINCH ROLLER

*Pinch Roller Replacement*

Replace a worn or damaged Pinch Roller as follows.

1. Place the VTR in the STOP mode.
2. Remove the pinch roller retainer and mounting screw from the top of the pinch roller.
3. Lift off the pinch roller.
4. Remove the pinch roller spacer and the pinch roller oil ring from the top of the pinch roller.
5. Install the pinch roller spacer and the pinch roller oil ring on the top of the replacement pinch roller.
6. Place the pinch roller ass'y on the pinch roller shaft.
7. Install the pinch roller retainer and mounting screw.
8. Test the pinch roller to see that it spins freely.

*Pinch Roller Pressure Adjustment*

1. Set the FUNCTION selector to FORWARD. Make a loop in a piece of string and loop the string around the base of the pinch roller shaft. See Fig. 4-32. Attach the spring scale to the loop of string and pull the scale in the direction indicated by the arrow.
2. Check the reading on the spring scale at the point where the pinch roller just leaves the capstan shaft. Verify that it is between 1.5 and 2.2 kg. If it is out of specification, replace the pinch roller pressure spring.

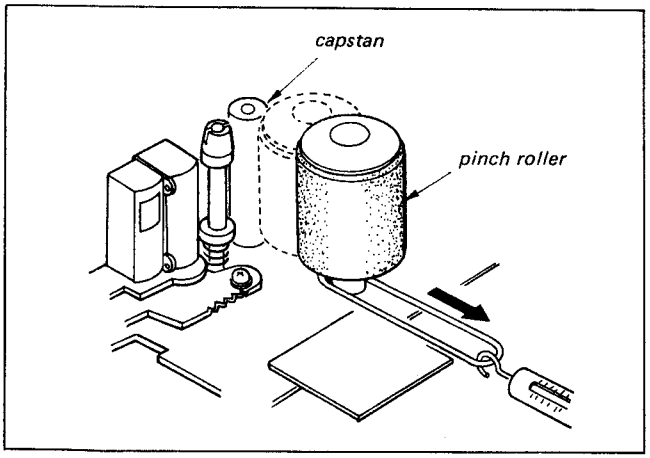



*Fig. 4-32. Pinch roller pressure test*

## 4-22. BELT SEPARATOR ADJUSTMENT

The belt separator prevents electrical noise by grounding static electricity built up due to contact friction between the belt and pulleys.

1. The belt separator should be situated so that in its free standing position it fits naturally between the belt surfaces at the crossover point. See Fig. 4-33.
2. Rotate the motor fan a few times to center the belt on the pulleys. Adjust the position of the static discharge plate so that its extruded convex surface lightly rides the middle of the drum belt.

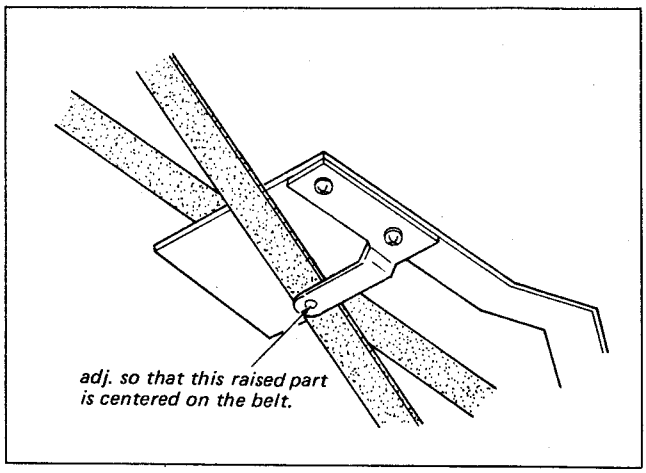



*Fig. 4-33. Belt separator adjustment*

## 4-23. POWER LINE FREQUENCY CHANGE

As supplied for sale in the U.S. market, the AV-8650 is set up for 60 Hz power operation. It may be converted, when necessary, for operation off 50 Hz power. To do this, both the drum pulley and motor pulley must be changed.

The part numbers for the two different size motor pulleys are:

50 Hz . . . . . 3-613-408-01
60 Hz . . . . . 3-613-217-01

There are two families of head drum pulleys; one for 50 Hz and the other for 60 Hz operation. The correct head drum pulley for a given machine is selected from among the pulleys in a given family as part of the "Drum Free Speed Check." Refer to section 7-1-2. The two pulley families are listed in the tables below:

50 Hz family

| Part number | Mark No. | Diameter (mm) |
|---|---|---|
| 3-612-925-01 | 5.15 | 42.15 |
| 3-612-925-11 | 5.30 | 42.30 |
| 3-612-925-21 | 5.45 | 42.45 |
| 3-612-925-31 | 5.60 | 42.60 |
| 3-612-925-41 | 5.75 | 42.75 |

60 Hz family

| Part number | Mark No. | Diameter (mm) |
|---|---|---|
| 3-612-926-01 | 6.15 | 44.15 |
| 3-612-926-11 | 6.30 | 44.30 |
| 3-612-926-21 | 6.45 | 44.45 |
| 3-612-926-31 | 6.60 | 44.60 |
| 3-612-926-41 | 6.75 | 44.75 |

In addition to changing the two pulleys. it is necessary to make two electrical connection changes on the JCN-1 circuit board. Lugs with push-on connectors are provided to facilitate this change.

1. Select the position of jumper A in Fig. 4-34 according to the frequency desired.
2. Select the connection to the motor phasing capacitor C16001, (B in Fig. 4-34) so that both C16001a and C16001b are in parallel for 50 Hz operation, but so that only C16001a is in circuit for 60 Hz operation.

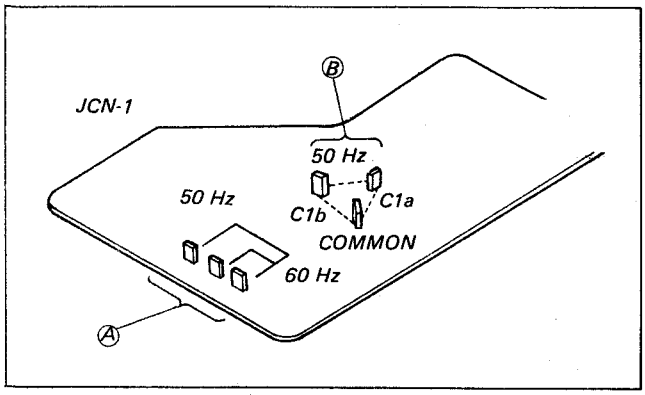



*Fig. 4-34. Electrical connection changes to change power line operating frequency*

# SECTION 5
# POWER SUPPLY ADJUSTMENT

## 5-1. +12 VOLT REGULATOR ADJUSTMENT

1. Turn the power ON and place the machine in the STOP mode.
2. Measure the dc voltage at TP-10001 on the REG board, using a VOM. Verify that the voltage is +12 ±0.1 volts.
3. If the voltage is not within specification, adjust pot R10011 on the REG board to bring it within tolerence.

## 5-2. +24 VOLT REGULATOR ADJUSTMENT

1. Turn on the power and place the machine in the STOP mode.
2. Measure the dc voltage at TP-10002 on the REG board, using a VOM. Verify that the voltage is within +24 ±0.1 volts.
3. If the voltage is not within specification, adjust pot R10005 on the REG board to bring it within tolerence.

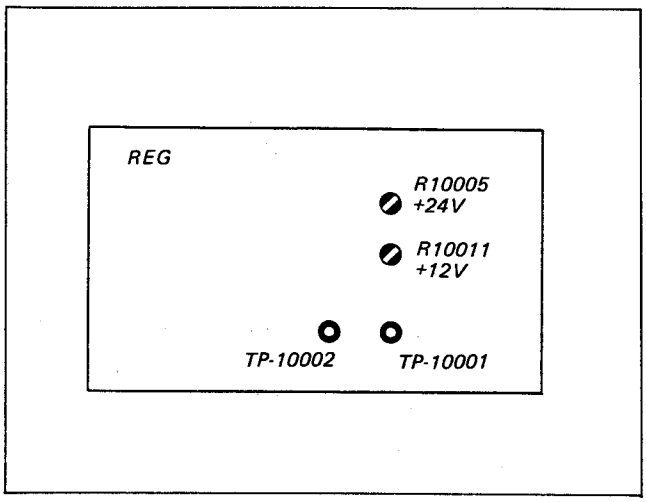



*Fig. 5-1. Power supply adjustment*

# SECTION 6
# SERVO AND PULSE SYSTEM ALIGNMENT

## 6-1. DRUM SERVO SYSTEM ADJUSTMENT

### 6-1-1. Drum Brake OFF Check

1. Place the machine in either the fast forward or rewind mode and turn on the actuator.
2. Measure the dc voltage at TP-9004 on the SVO board using a VOM.
3. Confirm a VOM reading of less than 1 V.

### 6-1-2. Drum Free Speed Check

Prior to this check, perform "Drum Brake Off Check: (paragraph 6-1-1).

1. Turn on the power switch and set the machine in the rewind mode.
2. Connect a frequency counter to TP-9013 on the SVO Board via a capacitor (1 μF, 50 V). See Fig. 6-1.
3. Confirm a frequency counter reading of 30.38 – 30.45 Hz (time: 32.92 to 32.84 msec.).
4. If the frequency is not correct, inspect wear and extension of the drum belt. If there is no problem, substitute the drum pulley with a different diameter pulley. (Refer to section 4-23).

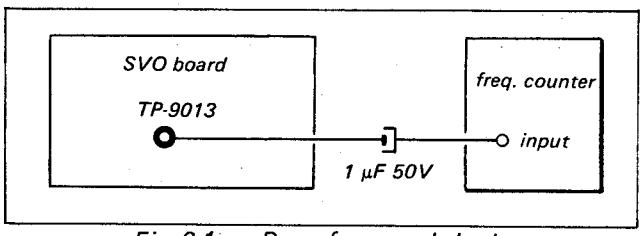



*Fig. 6-1. Drum free speed check*

### 6-1-3. Phase Lock Adjustment

1. Apply a video signal to the video input connector.
2. Place the machine in the E to E mode.
3. Connect CH-1 of a dual-trace scope to TP-9013 on the SVO Board and CH-2 to TP-8003 on the VOA Board. Trigger the scope externally from TP-9013 and set the scope to the CHOP mode.
4. Adjust R9202 on the SVO Board so that the phase relationship of the leading edge of the vertical sync to the trailing edge of the 30 PG signal at TP-9013 is within 7 H ±0.5 H. See Fig. 6-2.

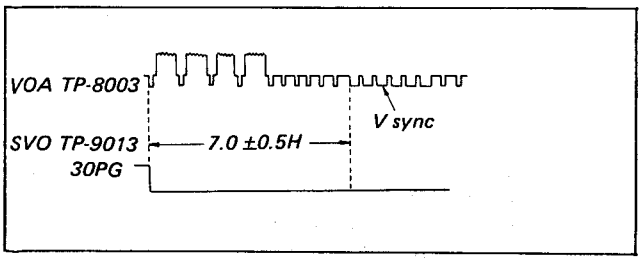



*Fig. 6-2. Phase lock adjustment*

### 6-1-4. Playback Switching Position Adjustment

1. Play back the stairstep segment of the alignment tape.
2. Adjust the TRACKING control for the best tracking.
3. Connect CH-1 of the dual-trace scope to TP-8002 on the VOA Board and CH-2 to TP-2206 on the RP Board. Trigger the scope externally from TP-2206 and set the scope to the CHOP mode.
4. Adjust R2315 on the RP Board so that the phase relationship of the leading edge of the vertical sync to the trailing edge of the switching signal at TP-2206 is within 7.0 ±0.5 H. See Fig. 6-3.
5. Connect the CH-2 probe to TP-2205 on the RP Board.
6. Adjust R2308 so that the phase relationship of the leading edge of the vertical sync to the trailing edge of the switching signal is 7.0 ±0.5 H. See Fig. 6-3.

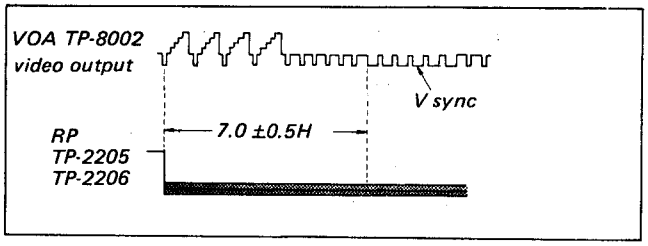



*Fig. 6-3. Playback switching position adjustment*

## 6-2. CAPSTAN SERVO SYSTEM ADJUSTMENT

### 6-2-1. Tape Speed Adjustment

1. Connect the frequency counter to TP-9016 on the SVO board via a capacitor (1 μF, 50 V). See Fig. 6-4.
2. Play back a segment of the alignment tape and confirm that the frequency of the tone generator in the capstan motor is within 981.5 to 985.3 Hz. (1018.8 to 1014.9 μsec). If the frequency is not within tolerence, troubleshoot the servo system to determine the cause of the malfunction. If the frequency is within tolerence, proceed to step 3.
3. If the frequency is correct, proceed to section 6-2-2, if not, check the condition of the capstan belt. If the belt is OK, substitute the capstan pulley with a different diameter pulley selected from the family of different diameter capstan pulleys provided for this purpose. Regarding capstan pulley replacement, refer to section 4.

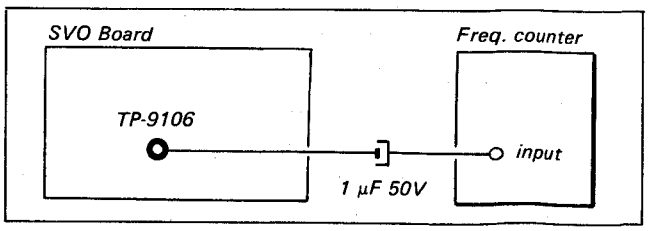



*Fig. 6-4. Tape speed adjustment*

### 6-2-2. Capstan Free Speed Adjustment

Turn the power on and allow five minutes warmup before performing this adjustment.

1. Connect TP-9018 on the SVO Board to ground with a jumper.
2. Set the machine to the E to E mode.
3. Connect the frequency counter to TP-9016 on the SVO Board via a capacitor (1 μF, 50 V). See Fig. 6-4.
4. Adjust R9203 for a counter reading of 976 to 979.8 Hz (1023 μsec to 1020 μsec).
5. After the adjustment, remove the jumper connected in Step 1.

### 6-2-3. Lock Time Check

1. Connect the scope to TP-9011 on the SVO Board.
2. Thread up the tape and place the machine in the RECORD mode.
3. Confirm that the gate pulse locks within 5 seconds after the comparison wave appears on the scope. See Fig. 6-5.

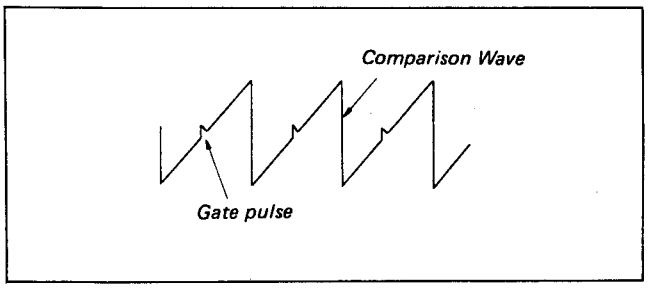



*Fig. 6-5. Lock time check*

### 6-2-4. Tracking Control Calibration

1. Set the TRACKING Control to its center position.
2. Thread the tape and set up the RECORD mode with no signal applied.
3. Rewind the recorded section and play it back.
4. Connect CH-1 of the dual-trace scope to TP-9001 on the SVO Board and CH-2 to TP-9007. Set the scope to the CHOP mode and trigger externally from TP-9001.
5. Adjust R9201 so that the trailing edges of the waves at TP-9001 and TP-9007 are coincident, as shown in Fig. 6-6.

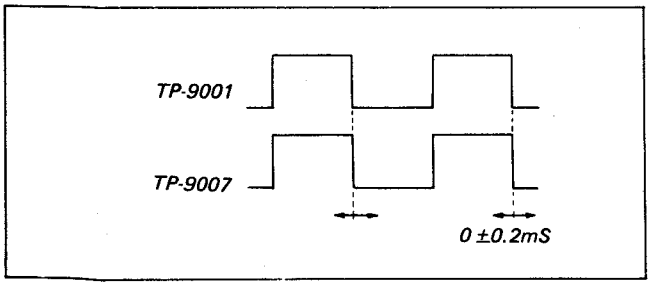



*Fig. 6-6.*

### 6-2-5. Slow Speed Check

1. Connect the frequency counter to TP-9016 on the SVO Board via a capacitor (1 μF, 50 V). See Fig. 6-4.
2. Play back a tape, upon which some signal has previously been recorded, checking the frequency indicated on the counter with the SLOW SPEED control at each end of its rotation.
3. Verify that the indicated frequency is within 60 ±2 Hz for SLOW MINIMUM, and greater than 330 Hz for SLOW MAXIMUM.

## 6-3. D.O.C. KILLER PULSE WIDTH ADJUSTMENT

1. Play back the prerecorded tape.
2. Connect the scope to TP-2309 on the RP Board. Trigger the scope externally at TP-2306.
3. Adjust R2318 for a pulse width of 2.0 ±0.1 msec. See Fig. 6-7.
4. Set the scope time base to 2 msec/cm. Adjust R2319 so that wave shift at TP-2309 is within 20 μs when the trigger slope of the scope is changed to (+) and (−).

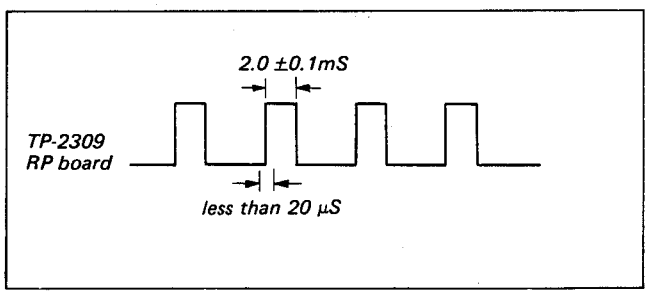



*Fig. 6-7.*

## 6-4. SLOW VD MULTIVIBRATOR ADJUSTMENT

1. Connect both vertical inputs of the dual-trace oscilloscope as follows:

   Channel 1 . . . . . To TP-2309 on the RP board
   Channel 2 . . . . . To TP-3015 on the Y-DEM board

2. Adjust the oscilloscope controls as follows:

   Vertical mode . . . . . Alternate
   Vertical inputs . . . . . AC coupled
   Channel 1 . . . . . 2 V/division
   Channel 2 . . . . . 0.2 V/division
   Triggering . . . . . From the Ch. 1 signal (int. or ext.)
   Coupling (trig.) . . . . . AC
   Slope . . . . . Minus
   Mode . . . . . Normal triggering (not in automatic mode)
   Time/division . . . . . 50 μsec/division

3. Adjust the trigger level control on the scope so that the sweep is triggered on the negative slope of the channel 1 signal (the pulse at TP-2309). Adjust the vertical and horizontal positioning controls of the scope to view the channel 2 signal. The signal displayed is the playback video signal during the first part of the vertical interval. The signal consists of two signals superimposed upon each other.

4. Adjust R2319 (DOC KILLER DELAY) on the RP board so that all the vertical serrations from the two signals are exactly superimposed (in phase) in the same time frame. See Fig. 6-8.

5. Adjust R2318 (DOC KILLER PULSE WIDTH) on the RP board so that the time between the leading edge of vertical sync at TP-3015 and the trailing edge of the pulse at TP-2309 is 2 H ±0.5 H. See Fig. 6-9.

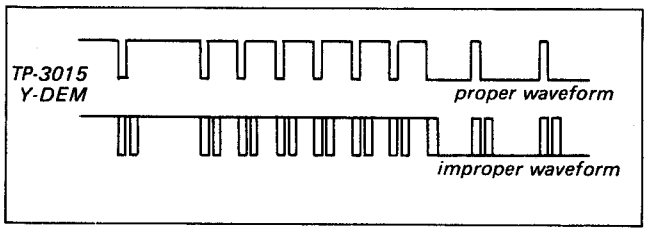



*Fig. 6-8.*

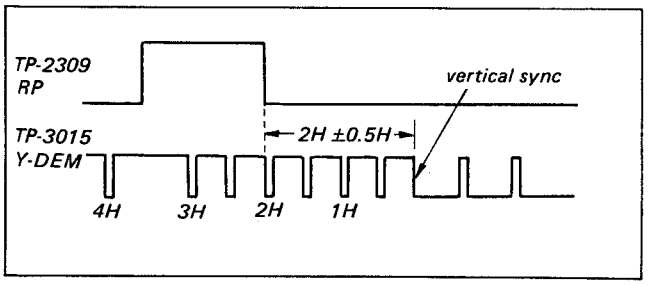



*Fig. 6-9.*

# SECTION 7
# VIDEO SYSTEM ALIGNMENT

*Equipment Required*

1. Color TV Monitor
2. Oscilloscope
3. Video Signal Generator
4. Standard Signal Generator (S.S.G.)
5. Video Sweep Generator
6. Frequency Counter
7. VOM (dc 20 kΩ/V)
8. Alignment Tape: (monochrome) Part code 8-943-508-40
   (color) Part code 8-943-508-20

*Signals*

Stairstep signal

A stairstep signal is used for alignment of the AV-8650. The ratio of the video signal and the sync signal must be 7 : 3. See Fig. 7-1.

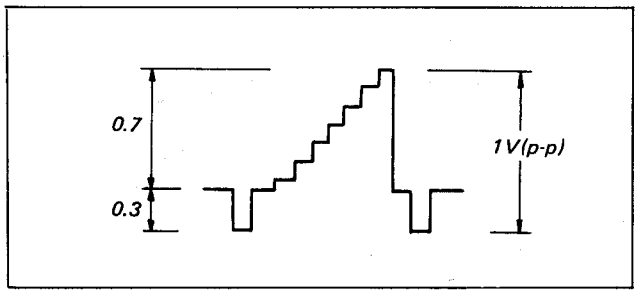



*Fig. 7-1. Stairstep signal*

Color bar signal

A 75% color bar signal is used for the alignment. See Fig. 7-2.

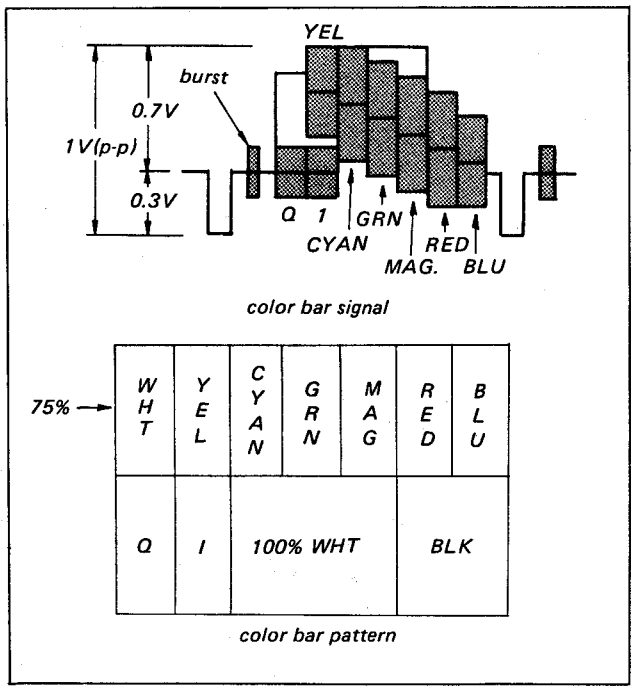



*Fig. 7-2. 75% color bar signal*

*Alignment tapes*

The contents of the alignment tapes are as follows:

(monochrome) 8-943-508-40

| Video signals | Audio signals |
|---|---|
| Stairstep signal (5 min.) | 1 kHz |
| Flying spot signal (3 min.) | 7 kHz |
| RF Sweep signal (3 min.) | 7 kHz |

(color) 8-943-508-20

| Video signals | Audio signals |
|---|---|
| Color bar signal (6 min.) | 1 kHz |
| Flying spot signal (4 min.) | 7 kHz |

## 7-1. LUMINANCE SIGNAL SYSTEM ALIGNMENT

Procedure and sequence are shown below.

7-1-1. AGC Adjustment
7-1-2. Manual Level Adjustment
7-1-3. Comb Filter Adjustment
7-1-4. Equalizer Adjustment
7-1-5. Maximum Frequency Deviation Adjustment
- Sync Tip Carrier Frequency Adjustment
- Maximum Frequency Deviation Adjustment
- Video Output Level Adjustment
- Level Meter Adjustment
- White Clip Adjustment

7-1-6. Y Signal Record Current Frequency Characteristic Adjustment
7-1-7. Playback RF System Frequency Characteristic Adjustment
7-1-8. Y-RF Output Balance Adjustment
7-1-9. D.O.C. RF Input Level Adjustment
7-1-10. D.O.C. Sensitivity Adjustment
7-1-11. Carrier Leak Adjustment
7-1-12. 3.58 MHz Trap Adjustment
7-1-13. Noise Eliminator Adjustment
7-1-14. Video Output Level Adjustment
7-1-15. Tracking Meter Adjustment
7-1-16. D.O.C. Muting Check
7-1-17. Video Muting Check
7-1-18. Playback System Y Delay Time Check
7-1-19. Record System Y Delay Time Check
7-1-20. Overall Y S/N Ratio Check
7-2-21. Y Signal Frequency Characteristic Check

### 7-1-1. AGC Adjustment

1. Set the TV/LINE Selector to LINE, AUTO/MANUAL Selector to AUTO, VIDEO MODE Selector to BW and place the VTR in the E-to-E mode.
2. Supply a stairstep signal of 1 V(p-p) to the VIDEO IN terminal.
3. Connect the scope to TP-1103 on the MOD Board.

4. Adjust R1144 so that the level difference between the white peak and the inserted pulse for AGC is 0.05 ±0.05 V(p-p). See Fig. 7-3.

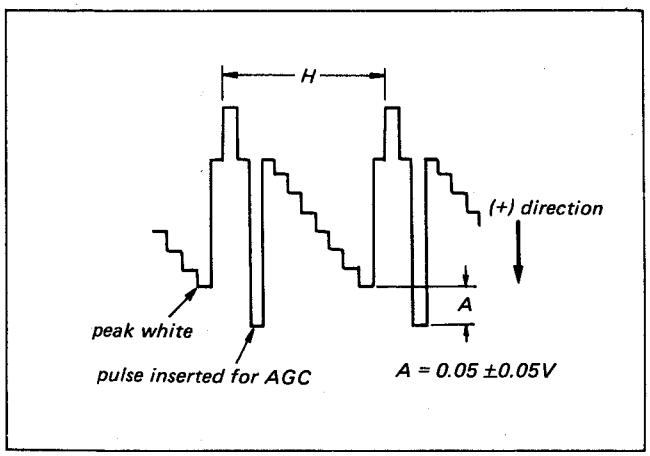



*Fig. 7-3. AGC adjustment*

### 7-1-2. Manual Level Adjustment

1. Set the TV/LINE Selector to LINE, AUTO/MANUAL Selector to MANUAL, VIDEO MODE Selector to BW and place the VTR in the E-to-E mode.
2. Apply a stairstep signal of 1 V(p-p) to the VIDEO IN terminal.
3. Connect the scope to TP-1103 on the MOD Board. Turn the VIDEO LEVEL Control on the control panel fully counterclockwise.
4. Adjust R1152 for 2.5 ±5 mV(p-p). See Fig. 7-4 (a).
5. Connect the scope to TP-1102 and turn the VIDEO LEVEL Control fully clockwise.
6. Adjust R1155 for 2 $^{+0.1}_{-0}$V(p-p). See Fig. 7-4 (b).

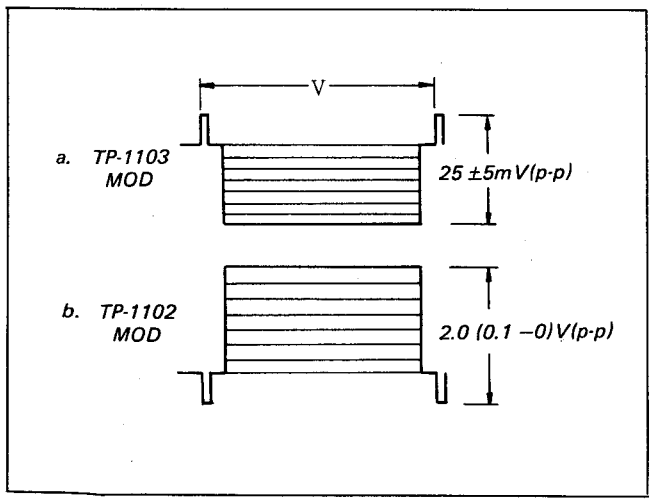



*Fig. 7-4. Manual level adjustment*

### 7-1-3. Comb Filter Adjustment

1. Set the TV/LINE Selector to LINE, AUTO/MANUAL Selector to AUTO, VIDEO MODE Selector to BW and place the VTR in the E-to-E mode.
2. Apply a color bar signal of 1 V(p-p) to the VIDEO IN terminal.
3. Connect the scope to TP-1203 on the MOD Board.
4. Adjust R1214 and L1202 for minimum color subcarrier leak. See Fig. 7-5.
5. Connect the scope to TP-1204.
6. Confirm that the level of the color subcarrier is less than 15 mV(p-p) against a 1.6 V(p-p) video signal. See Fig. 7-5.

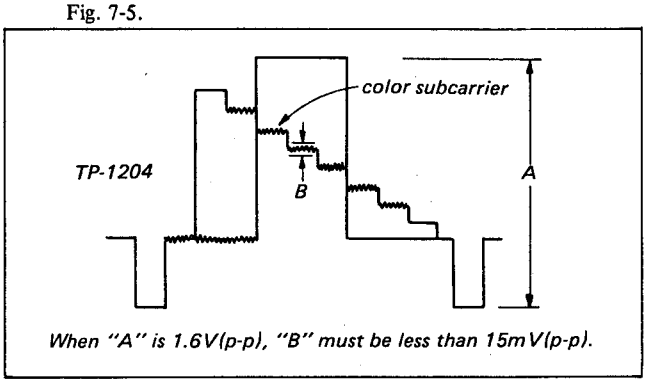



*Fig. 7-5. Comb filter adjustment*

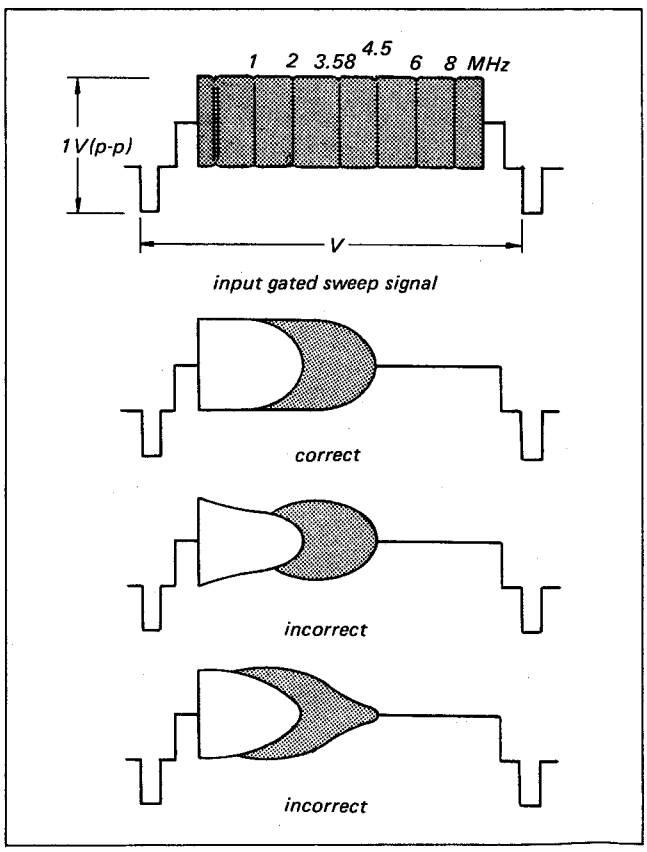



*Fig. 7-6. Equalizer adjustment*

### 7-1-4. Equalizer Adjustment

1. Connect a video sweep generator to the VIDEO IN terminal. Set the bandwidth of gated sweep signal to 8 MHz and adjust the level to 1.0 V(p-p). See Fig. 7-6.
2. Set the AUTO/MANUAL Selector to AUTO and place the VTR in the E-to-E mode.
3. Connect the scope to TP-1203 on the MOD Board.
4. Adjust L1203 so that the amplitude at around 3 MHz is flat as shown in Fig. 7-6.

### 7-1-5. Maximum Frequency Deviation Adjustment

*Sync Tip Carrier Adjustment*

1. Do not connect any signal to the VIDEO IN terminal. Set the VTR to the E-to-E mode. Set the AUTO/MANUAL Selector to MANUAL and turn the VIDEO LEVEL Control fully counterclockwise.
2. Connect the frequency counter to TP-1302 on the MOD board.
3. Place the TAPE SELECT switch in the REGULAR position and adjust R1257/MOD for a counter reading of 3.4 MHz. Now place the TAPE SELECT switch in HIGH DENSITY and adjust R1252/MOD for 4.3 MHz.
4. Connect CH-1 and CH-2 of the dual trace scope to TP-1301 on the MOD Board. Set CH-2 to INVERT.
5. Set the scope to ALTERNATE and overlap waveforms of CH-1 and CH-2. Adjust R1305 so that the pulse widths of the overlapped wave forms are equal as shown in Fig. 7-7.

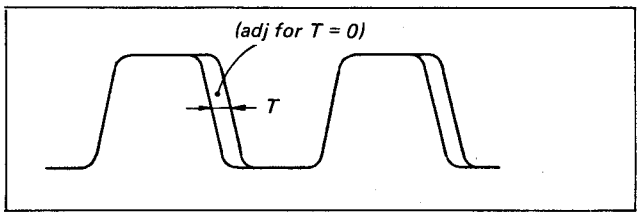



*Fig. 7-7. Carrier balance adjustment*

*Maximum Frequency Deviation Adjustment*

6. Connect a stairstep signal to the VIDEO IN terminal. Set the AUTO/MANUAL Selector to AUTO, the VIDEO MODE Selector to AUTO, place the VTR in the E-to-E mode, and the TAPE select switch to REGULAR.
7. Connect the CH-1 probe of the scope to TP-1301 and the CH-2 probe to the output of the standard signal generator. Set the frequency of the generator to 4.8 MHz and the output level to 0.1 V(p-p). Turn R1254 and R1259 fully clockwise.
8. Set the scope to the ADD mode and trigger the scope externally at TP-1104. Set the horizontal time base to 20 μs/cm and observe a horizontal section. The RF signal at TP-1301 and the pilot signal from the SSG make a beat signal, wihch appears on the envelope. See Fig. 7-8. Adjust R1204 so that the beat is zero beat at the white peak.
9. Re-set the generator frequency to 5.7 MHz and place the TAPE SELECT switch in the HIGH DENSITY position. Verify that the white peak zero beat is now at 5.7 MHz.
10. Return the signal generator frequency to 4.8 MHz and the TAPE SELECT switch to REGULAR.
11. Connect TP-1408 and TP-1409 together, using a clip lead, and place the VTR in the COLOR mode.
12. Adjust R1229 in the same manner as in Step 8 for zero beat at the white peak. After the adjustment, remove the lead wire connected in Step 9.

*(White Clip Adjustment)*

13. Connect a color bar signal to the VIDEO IN terminal.
14. Connect the scope to TP-1205. Adjust R1259 so that the ratio of B to A, in Fig. 7-9 is such that $\frac{B}{A} \times 100 = 50 \pm 10\%$.

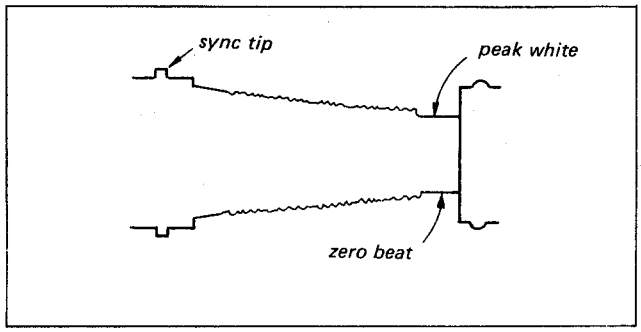



*Fig. 7-8. Maximum frequency deviation adjustment*

*White Clip Adjustment*

15. Connect a color bar signal to the VIDEO IN terminal.
16. Connect the scope to TP-1205. Adjust R1254 so that the ratio of B to A, in Fig. 7-9 is such that $\frac{B}{A} \times 100 = 50 \pm 10\%$.

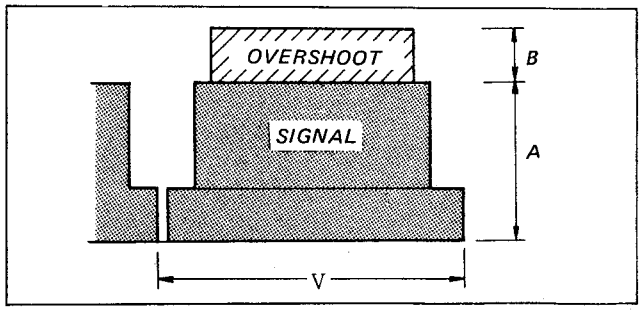



*Fig. 7-9. White clip adjustment*

17. Set the TAPE SELECT switch to REGULAR and the VIDEO MODE selector to COLOR. Connect a color bar signal to the VIDEO IN connector and an oscilloscope to the VIDEO OUT terminal at the point where it is terminated in a 75 ohm resistor.

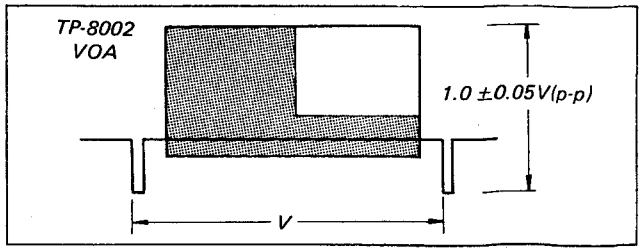



*Fig. 7-10. Video output level adjustment (color)*

18. Adjust R3034, on the Y-DEM board for 1.0 ±0.05 V(p-p), as seen on the oscilloscope. See Fig. 7-10.

19. Set the TAPE SELECT switch to HIGH DENSITY and the VIDEO MODE selector to B/W.

20. Adjust R3059, on the Y-DEM board for 1.0 ±0.05 V(p-p), as seen on the oscilloscope. See Fig. 7-11.

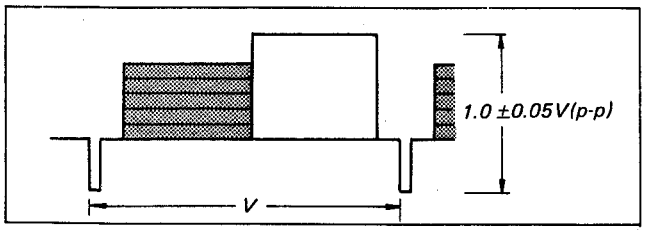



*Fig. 7-11. Video output level adjustment (B/W)*

21. Adjust R3069 on the Y-DEM board so that the pointer of the video level meter is as shown in Fig. 7-12.

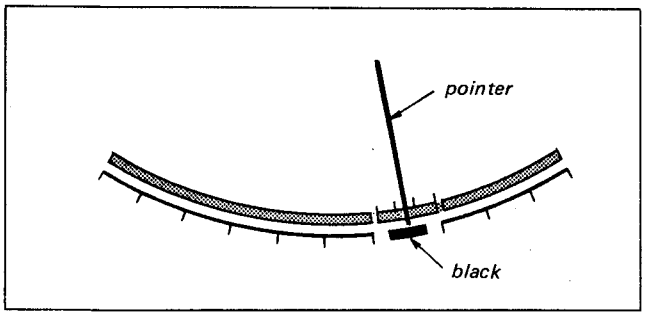



*Fig. 7-12. Level meter set*

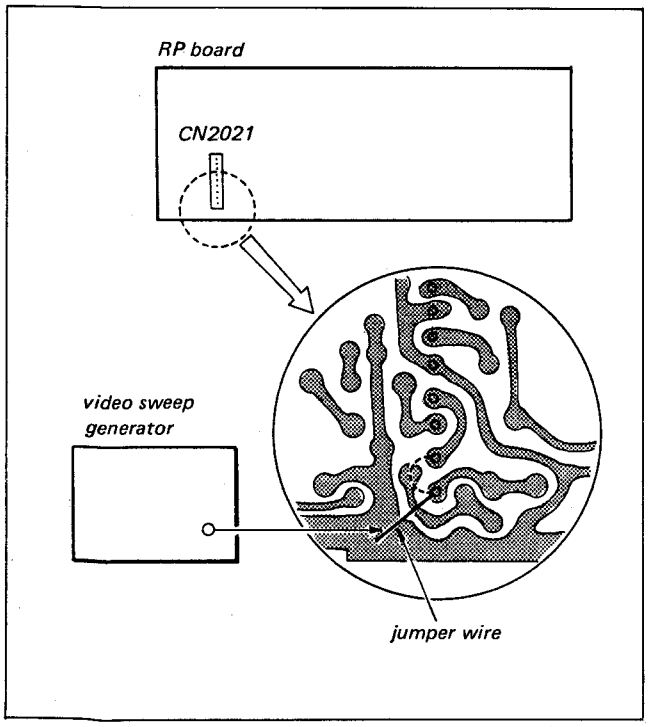



*Fig. 7-13. Jumper location*

## 7-1-6. Y Signal Record Current and Frequency Characteristic Adjustment

*Perform the adjustments for both channel A and channel B. B channel adjustments are shown in parenthesis.*

1. Place the TAPE SELECT switch in the REGULAR position and connect a stairstep signal to the VIDEO IN connector.

2. Connect the vertical input of the oscilloscope to TP-2201 on the RP board and place the machine in the RECORD mode. Note the FM signal level at sync tip, as seen on the oscilloscope.

3. Turn off the power and remove the jumper between pin 9 of connector CN2021 and C2115 on the RP board from pin 9 of the connector. Connect the output of the video sweep generator to the jumper at C2115.

4. Set the sweep generator to line lock, set the sweep signal bandwidth to 8 MHz, and adjust the output signal level of the generator to obtain the same video level measured in step 2, above.

5. Place the TAPE SELECT switch in the HIGH DENSITY position and connect the scope to TP-2201 (TP-2202) on the RP board.

6. Place the VTR in the RECORD mode and adjust R2112 (R2136) and R2116 (R2140) so that the sweep signal seen on the oscilloscope conforms to Fig. 7-14. R2112 (R2136) adjusts the 1 MHz response and R2116 (R2140) adjusts the response at 6 MHz.

7. Place the TAPE SELECT switch in the REGULAR position and confirm that the sweep signal seen on the oscilloscope conforms to Fig. 7-15, within the tolerence given.

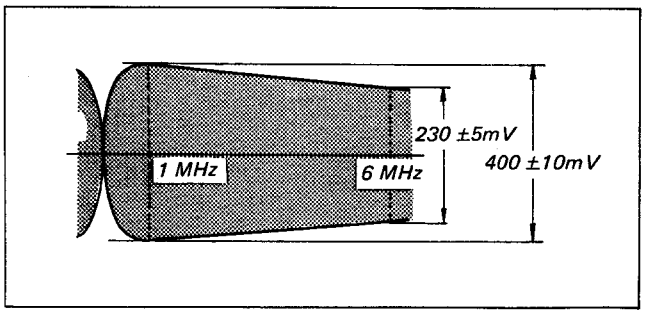



*Fig. 7-14. Record current adj. HIGH DENSITY mode.*

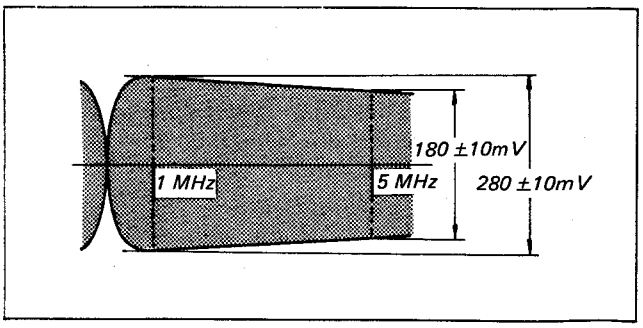



*Fig. 7-15. Record current check REGULAR mode.*

## 7-1-7. Playback RF Frequency Characteristic Adjustment

*Perform these adjustments for both channel A and channel B. The B channel adjustments are shown in parenthesis.*

A. Head resonance frequency adjustment

1. Thread up the VTR with HIGH DENSITY tape and place the TAPE SELECT switch in the HIGH DENSITY position.
2. Disconnect the jumper between pin 9 of connector CN2021 and C2115 on the RP board from pin 9 of the connector. Connect the video sweep generator to the jumper at C2115 and record the RF sweep signal in the same manner as in step 7-1-6. Record about 5 minutes of this signal.
3. Turn R2206 (R2230) fully clockwise and play back the sweep signal just recorded.
4. Adjust R2207 (R2208) so that the resonant frequency of the head is at 6 MHz. See Fig. 7-16 (A).
5. Switch the TAPE SELECT switch to the REGULAR position and adjust R2208 (R2232) and R2206 (R2230) for head resonance at 5 MHz. R2206 (R2230) adjusts the high range. See Fig. 7-16 (B) & (C).

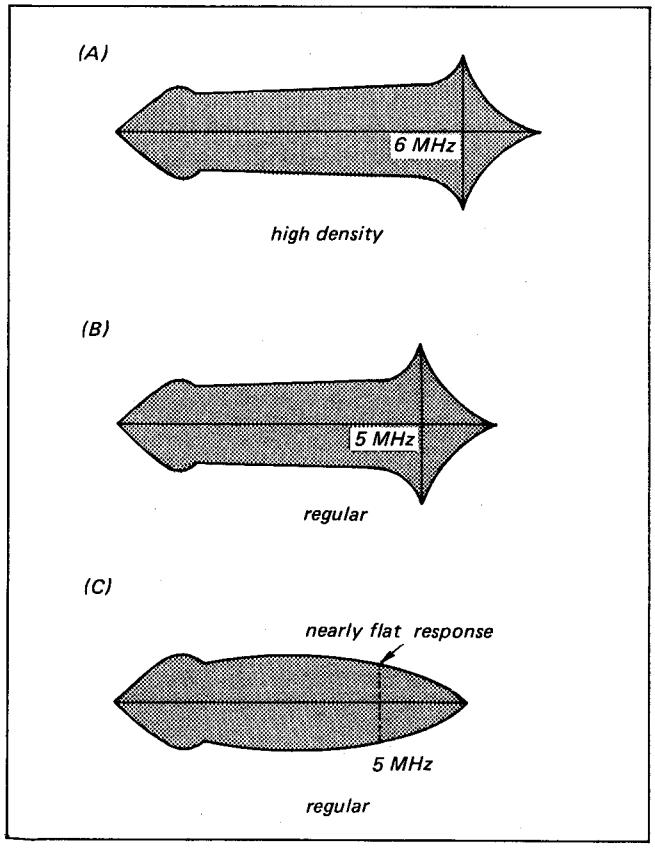
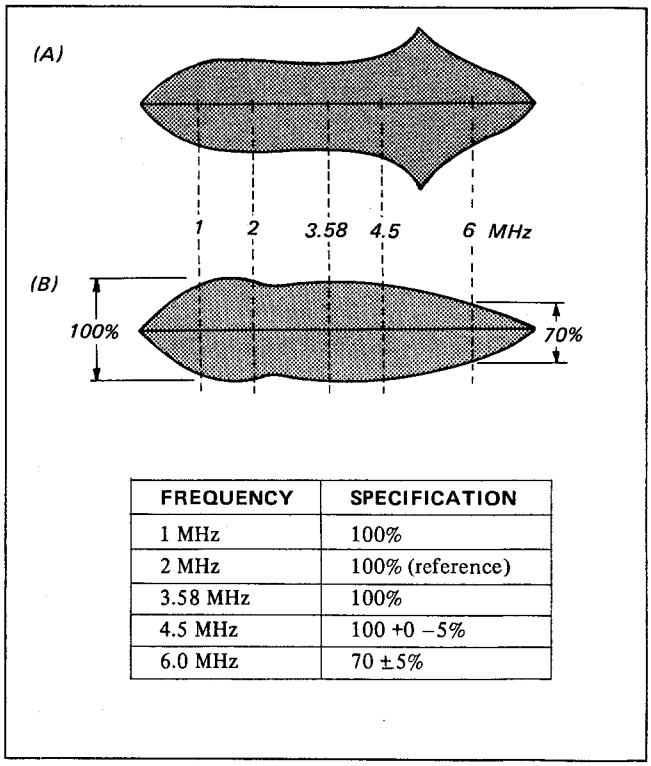



*Fig. 7-16. Head resonance frequency adjustment*

B. Equalizer Adjustment (High Density Mode)

1. Connect the oscilloscope to TP-2207 (TP-2208) on the RP board and play back the RF sweep signal recorded in step 2 of part A, above. Turn R2218 (R2242) on the RP board fully clockwise.
2. Adjust L2202 (L2205) so that the resonant peak, seen on the oscilloscope, is between 4.5 and 6 MHz. See Fig. 7-17 (A). Adjust so that the amplitude at 6 MHz is 70% of the 2 MHz amplitude. See Fig. 7-17 (B). Confirm that the frequency response conforms to the specifications given in the table in Fig. 7-17.




| FREQUENCY | SPECIFICATION |
|---|---|
| 1 MHz | 100% |
| 2 MHz | 100% (reference) |
| 3.58 MHz | 100% |
| 4.5 MHz | 100 +0 −5% |
| 6.0 MHz | 70 ±5% |

*Fig. 7-17. Equalizer adjustment (HIGH DENSITY mode)*

C. Equalizer Adjustment (Regular Mode)

1. Thread up the machine with regular video tape, place the TAPE SELECT switch in the REGULAR position and record about 5 minutes of the RF sweep signal in the same manner outlined in step 2 of part (A), above.
2. Connect the oscilloscope to TP-2207 (TP-2208) on the RP board and play back the RF sweep signal just recorded.
3. Verify that the playback waveform envelope for each channel is as shown in Fig. 7-18 (A).
4. Connect the oscilloscope to TP-2503 on the RP board and trigger the scope internally.
5. Overlap the waveforms of the two channels using the oscilloscope vertical positioning controls and adjust R2253 so that their overall amplitudes are equal. Adjust R2208 and R2231 to equalize the amplitudes between points X and Y in Fig. 7-18 (B).

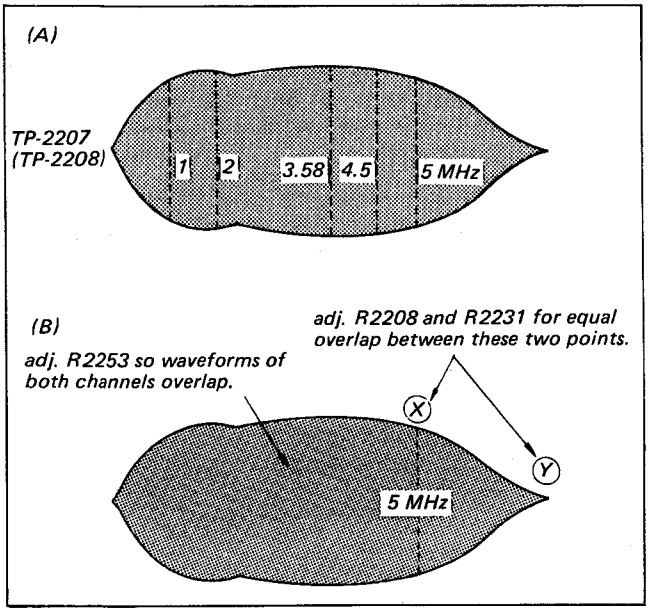



*Fig. 7-18. Equalizer adjustment (Regular Mode)*

### 7-1-8. Y-RF Output Balance Adjustment

1. Connect the scope to TP-2504 on the RP Board. Trigger the scope externally from TP-2302.
2. Play back the color bar segment of the alignment tape. Adjust the TRACKING control for maximum amplitude.
3. Adjust R2253 for equal amplitudes of CH-A and CH-B. See Fig. 7-19.
4. Confirm an output level of 0.6 ±0.2 V(p-p). The level difference between the channels must be within 0.02 V.

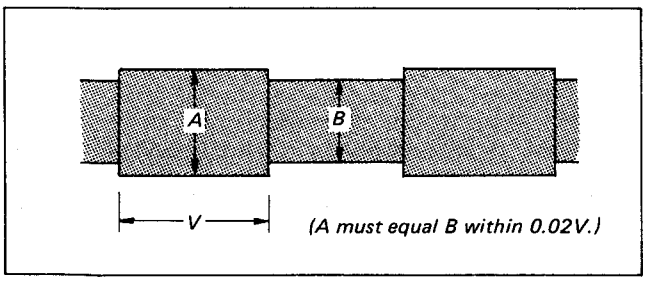



*Fig. 7-19. Y-RF output balance adjustment*

### 7-1-9. D.O.C. RF Input Level Adjustment

1. Connect the scope to TP-3002 on the Y-DEM Board.
2. Play back the color bar segment of the alignment tape and adjust the TRACKING control for maximum amplitude.
3. Adjust R3003 on the Y-DEM Board for 0.2 ±0.02 V(p-p).

### 7-1-10. D.O.C. Sensitivity Adjustment

Prior to this adjustment, perform "D.O.C. RF input level adjustment" (paragraph 7-1-9).

1. Play back a section of tape known to have dropouts.
2. Turn R3005 on the Y-DEM Board fully counterclockwise; dropouts should appear on the monitor screen.
3. Turn R3005 clockwise until the dropouts disappear.
4. Recheck the earlier part of the tape where dropouts had been visible in Step 2, and confirm that the dropouts no longer appear.

### 7-1-11. Carrier Leak Adjustment

1. Play back the color bar segment of the alignment tape.
2. Connect the scope to TP-3009 on the Y-DEM Board.
3. Adjust R3013 and R3019 for minimum carrier leak level on the sync tip.
4. After completing the above adjustments, place the TAPE SELECT switch in the HIGH DENSITY position and confirm that the carrier leak no longer appears on the oscilloscope screen.

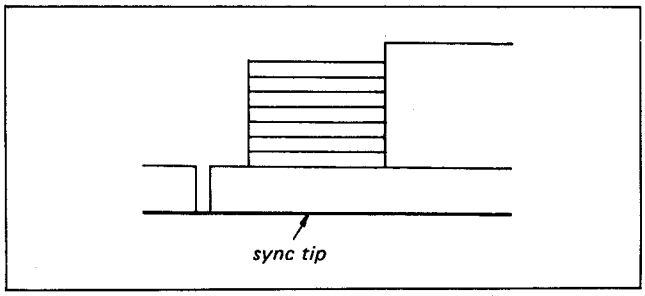



*Fig. 7-20. Carrier leak adjustment*

### 7-1-12. 3.58 MHz Trap Adjustment

1. Connect a color bar signal to the VIDEO IN terminal. Set the VIDEO MODE Selector to B/W and place the machine in the E-to-E mode.
2. Connect TP-4006 and TP-4007 on the C-DEM Board together, using a clip lead, in order to place only the playback system in the color mode.
3. Connect the scope to TP-3011 on the Y-DEM Board.
4. Adjust L3009 on the Y-DEM Board for minimum color subcarrier component. See Fig. 7-21.
5. After the adjustment, remove the clip lead connected in Step 2.

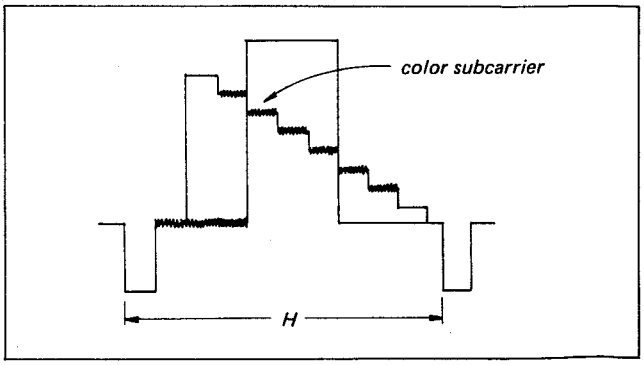
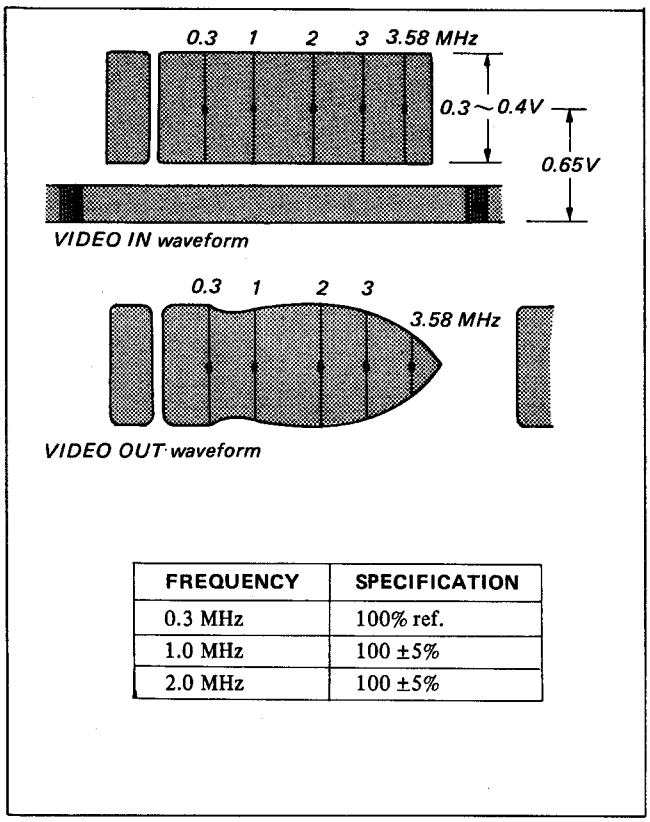



*Fig. 7-21. 3.58 MHz trap adjustment*

### 7-1-13. Noise Eliminator Adjustment

1. Set the TAPE SELECT switch to the REGULAR position, the VIDEO MODE switch to the B/W position, and the AUTO/MANUAL switch to the AUTO position.
2. Connect a gated sweep signal to the VIDEO IN terminal and terminate the VIDEO OUT terminal with a 75 ohm load. Connect the oscilloscope to the VIDEO OUT terminal at the point where the 75 ohm load is connected.
3. Place the machine in the E to E mode and adjust the frequency response, using R3046, so that it is as shown in Fig. 7-22.




| FREQUENCY | SPECIFICATION |
|---|---|
| 0.3 MHz | 100% ref. |
| 1.0 MHz | 100 ±5% |
| 2.0 MHz | 100 ±5% |

*Fig. 7-22. Noise eliminator adjustment*

### 7-1-14. Video Output Level Adjustment

*REGULAR mode*

1. Place the VIDEO MODE switch in the COLOR position and the TAPE SELECT switch in the REGULAR position. Connect the color bar signal to the VIDEO IN terminal and set the machine in the E to E mode.
2. Connect the oscilloscope to the VIDEO OUT terminal at the point where it is terminated in the 75 ohm load.
3. Adjust R3034 on the Y-DEM board for an output video level of 1.0 ±0.05 V(p-p), as seen on the oscilloscope. See Fig. 7-23.

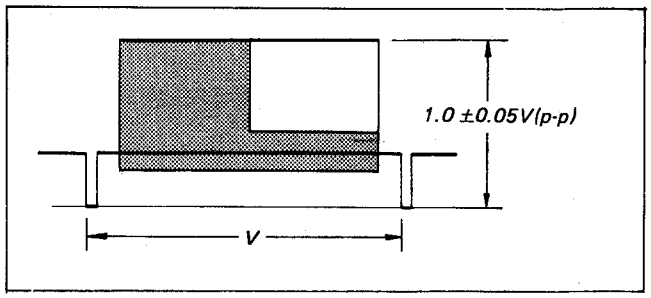



*Fig. 7-23.*

*HIGH DENSITY mode*

4. Set the VIDEO MODE switch to B/W and place the TAPE SELECT switch in the HIGH DENSITY position. (Keep the machine in the E to E mode.)
5. Connect the color bar signal to the input and the oscilloscope to the output, as above.
6. Adjust R3059 on the Y-DEM board for an output video level of 1.0 ±0.05 V(p-p), as seen on the oscilloscope.

### 7-1-15. Tracking Meter Adjustment

1. Play back the color bar segment of the alignment tape. Adjust the TRACKING control for maximum amplitude of the pointer of tracking control meter.
2. Adjust R3084 on the Y-DEM Board so that the pointer of the tracking meter indicates on the thrid mark up from zero ±0.5 division.

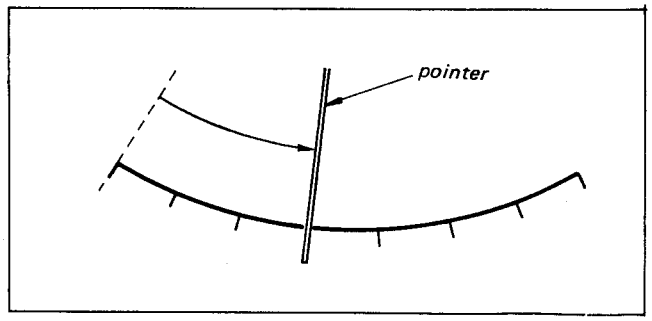



*Fig. 7-24.*

### 7-1-16. D.O.C. Muting Check

1. Play back a prerecorded tape.
2. Connect the scope to TP-3003 on the Y-DEM Board and set the scope to the dc range.
3. Depress the PAUSE button to set up the PAUSE mode. Confirm that the dc potential at TP-3003 is 0.6 V. See Fig. 7-25 (A).
4. Depress the PAUSE button again to release the PAUSE mode. Confirm that the signal shown in Fig. 7-25 (B) is applied to TP-3003.

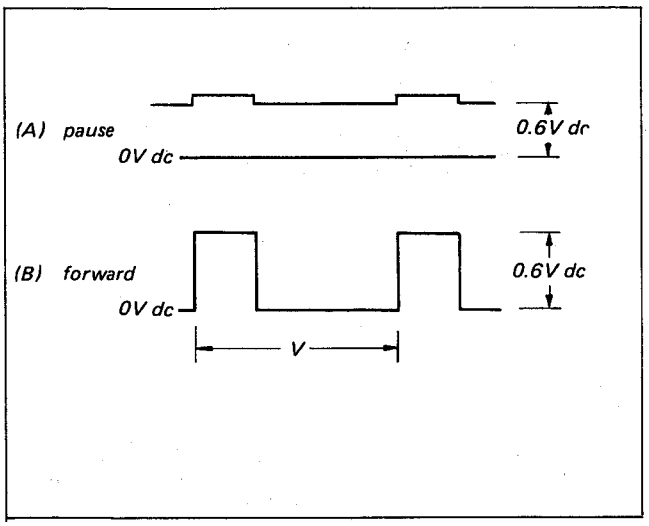



*Fig. 7-25.*

### 7-1-17. Video Muting Check

1. Terminate the VIDEO OUT connector of the VTR with a 75 ohm load and connect the oscilloscope to the VIDEO OUT connector at the point where the 75 ohm load is connected.
2. Place the machine in the STOP mode and verify that the output signal level is less than 0.15 V(p-p).

### 7-1-18. Playback System Y Delay Time Check

1. Play back the color bar segment of the alignment tape.
2. Connect CH-1 of the dual-trace scope to TP-4008 and CH-2 to TP-4004 on the C-DEM Board. Set the scope to ALTERNATE, and trigger the scope externally from TP-4017.
3. Observe the border of green and magenta of the color bar. See Fig. 7-26.
4. Check time difference between the Y and Chroma signals. If there is a time difference, change the connection of the tap on delay line DL-3002 on the Y-DEM Board for no time difference. See Fig. 7-27.

### 7-1-19. Record System Y Delay Time Check

1. Perform Procedure 4-1-18 "Playback Y Delay Time Check" prior to making this check.
2. Connect a color bar signal to the VIDEO IN terminal and record and play back the color bar signal.
3. Connect CH-1 of the dual-trace scope to TP-4008 on the C-DEM Board and CH-2 to TP-4004. Set the scope to ALTERNATE. Trigger the scope externally from TP-4107.
4. Observe the border between the green and magenta color bars. See Fig. 7-26.
5. Check time difference between the Y and chroma signals. If there is a time difference, change the connection of taps on delay line DL1202 on the MOD Board for no time difference. See Fig. 7-28.

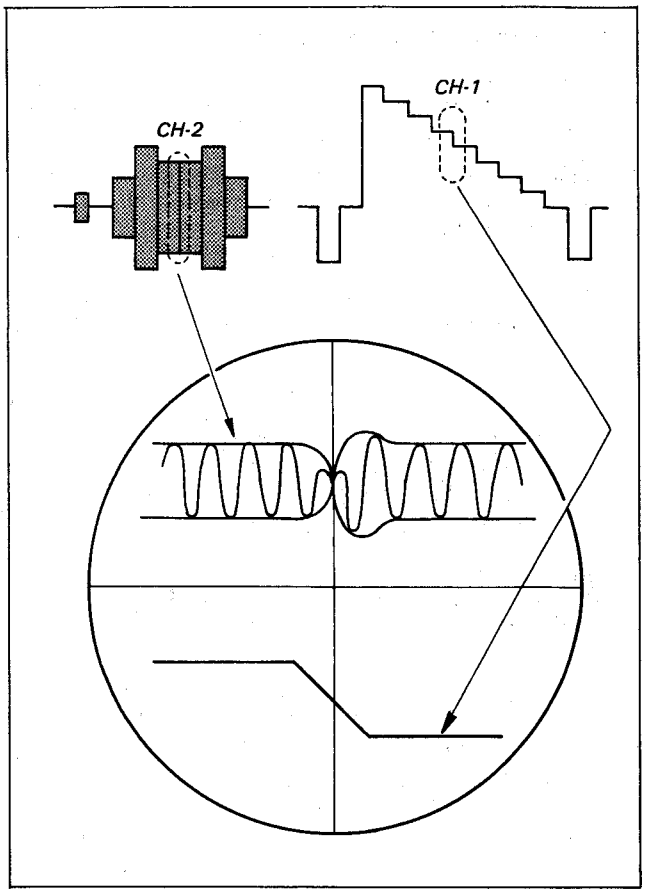



*Fig. 7-26. Delay time check*

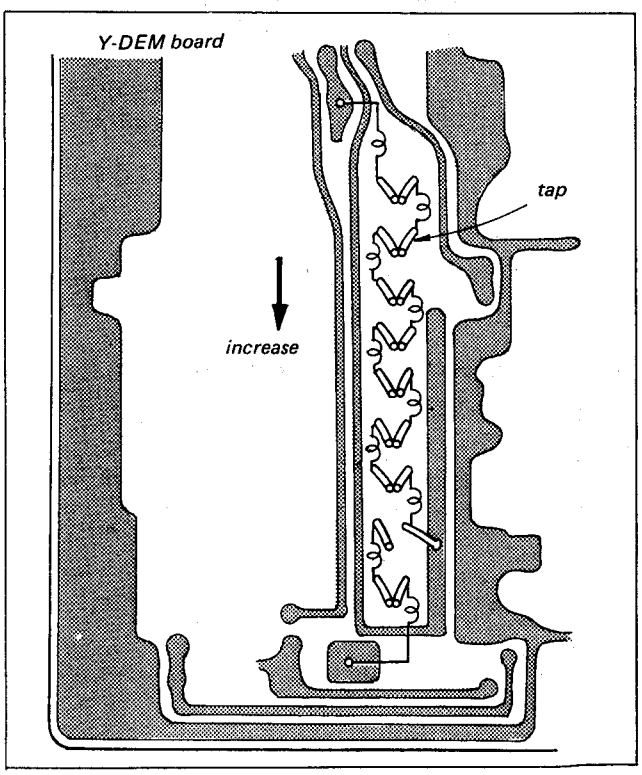



*Fig. 7-27. Delay line*

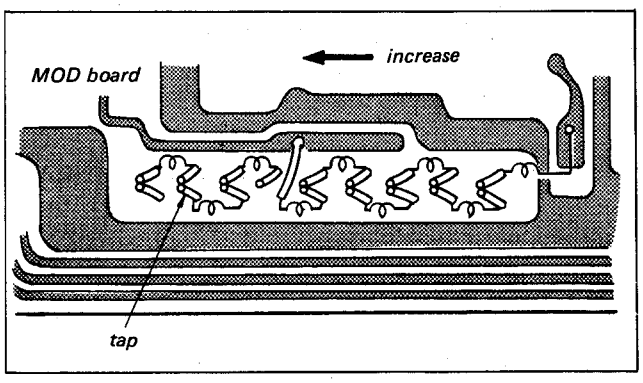



*Fig. 7-28. Delay Line*

### 7-1-20. Overall Y S/N Ratio Check

1. Connect a video signal to the VIDEO IN terminal.
2. Remove the jumper between pin 9 of connector CN2021 and C2115 on the RP board. See Fig. 7-29.
3. Connect the standard signal generator to the jumper removed in step 2.
4. Connect the oscilloscope to the jumper where the signal generator is connected and, using the scope, adjust the output signal level of the generator to 0.7 V(p-p) at a frequency of 4.3 MHz.
5. Thread the machine with regular video recording tape and place the TAPE SELECT switch in the REGULAR position.
6. Record about one minute of the RF signal from the generator and rewind the tape.
7. Terminate the VIDEO OUT connector with a 75 ohm load and connect the AC VTVM to the video output at the place where the 75 ohm load is connected.

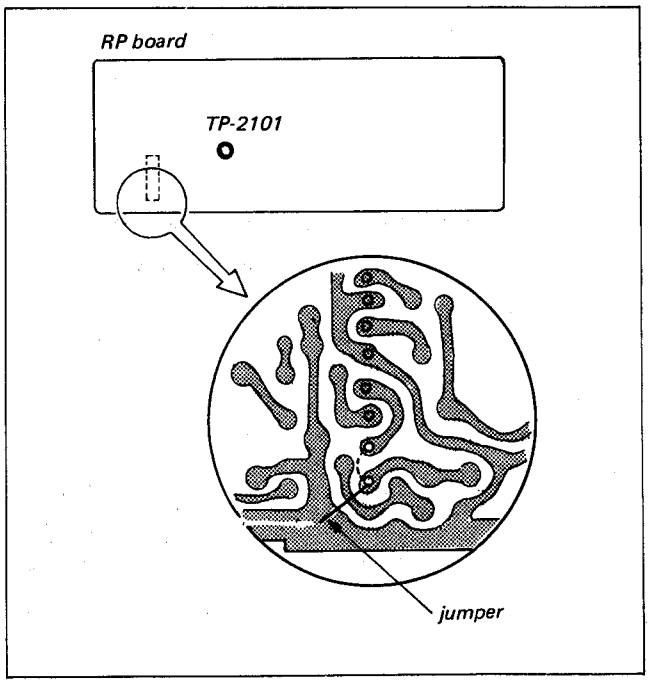



*Fig. 7-29. Jumper removal*

8. Play back the segment of RF signal just recorded and confirm that the voltage measured on the VTVM is less than 5.6 mV rms.
9. Re-set the output signal level of the signal generator to 0.6 V(p-p) at a frequency of 5.2 MHz, re-thread the machine with HIGH DENSITY video recording tape, place the TAPE SELECT switch in the HIGH DENSITY position, and record about a one minute segment of the RF signal.
10. Rewind and play back the segment of tape just recorded and measure the ac signal level at the VIDEO OUTPUT in the same manner as in step 8, above. Confirm that the output ac level is less than 7 mV rms.

### 7-1-21. Y Signal Freqeuncy Characteristic Check

1. Connect a gated video sweep signal (See Fig. 7-30) to the VIDEO IN terminal of the VTR.
2. Terminate the VIDEO OUTPUT with a 75 ohm load and connect the oscilloscope to the VIDEO OUTPUT at the point where the 75 ohm load is connected.

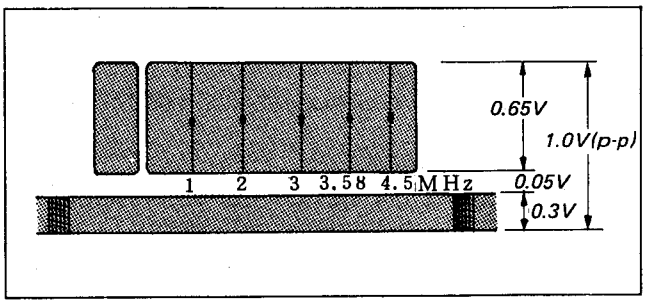
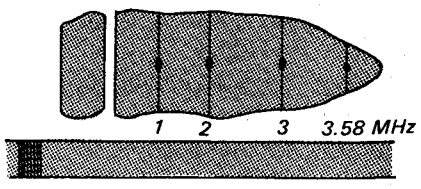



*Fig. 7-30. Video input waveform*

3. Place the TAPE SELECT switch in the REGULAR mode and the VIDEO MODE switch to B/W.
4. Place the machine in the E to E mode and confirm that the video output waveform conforms to the specifications given in Fig. 7-30.
5. Thread the VTR with regular video recording tape, record a segment of the video sweep signal, play back this recording and verify that the playback waveform also conforms to Fig. 7-31.

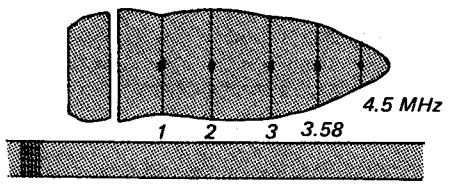



| FREQUENCY | SPECIFICATION |
|---|---|
| 1.00 MHz | 100% (reference) |
| 2.00 MHz | 70 – 100% |
| 3.00 MHz | 56 – 88% |
| 3.58 MHz | 30 – 80% |

*Fig. 7-31. Video output REGULAR mode*

6. Now thread the VTR with HIGH DENSITY video recording tape and place the TAPE SELECTOR switch in the HIGH DENSITY position. Leave the VIDEO MODE selector in the B/W position.

7. Place the VTR in the E to E mode and confirm that the video output waveform conforms to the specifications given in Fig. 7-32.




| FREQUENCY | REPCIFICATION |
|---|---|
| 1.00 MHz | 100% (reference) |
| 2.00 MHz | 88 – 100% |
| 3.00 MHz | 80 – 100% |
| 3.58 MHz | 60 – 100% |
| 4.50 MHz | 18 – 35% |

*Fig. 7-32. Video output HIGH DENSITY mode*

8. Record a segment of the video sweep signal on the HIGH DENSITY tape, play this recording back, and verify that playback video waveform also conforms to Fig. 7-32.

9. If the video output signal fails to meet specification in any of the above steps, re-check step 7-1-6, Y Signal Record Current Adjustment, and step 7-1-7, Playback RF Frequency Characteristic Adjustment.

## 7-2. CHROMA SIGNAL SYSTEM ALIGNMENT

Procedure and sequence are shown below.

7-2-1. 4.34 MHz Oscillator Adjustment
7-2-2. Record Color killer Adjustment
7-2-3. Record A.C.C. Level Adjustment
7-2-4. Chroma RF Output Balance Adjustment
7-2-5. 3.58 MHz Oscillator Adjustment
7-2-6. 767 kHz Chroma Input Level Adjustment
7-2-7. Converter Balance Adjustment
7-2-8. PB A.C.C. and Chroma Output Level Adjustment
7-2-9. PB Color Killer Adjustment
7-2-10. A.P.C. Input Level Adjustment
7-2-11. FET Bias Voltage Adjustment
7-2-12. 15,734 kHz Tuned Amp Adjustment
7-2-13. A.F.C. Operating Point Adjustment
7-2-14. 767 kHz V.C.O. Adjustment
7-2-15. Converter Balance Adjustment
7-2-16. 4.34 MHz Tuned Amp Adjustment
7-2-17. Color Lock Control Check
7-2-18. Phase Detector Balance Adjustment
7-2-19. A.P.C. Performance Check
7-2-20. Chroma Record Current Adjustment

### 7-2-1. 4.34 MHz Oscillator Adjustment

Allow at least five minutes, after the power is turned on, before performing this adjustment.

1. Connect the scope to TP-1406 on the MOD Board, and connect the frequency counter to the Vertical Signal Out of the scope.
2. Set up the E-to-E mode.
3. Adjust C1420 for a counter reading of 4,346,590 Hz ±5 Hz.

### 7-2-2. Record Color Killer Adjustment

1. Connect the color bar signal to the VIDEO IN terminal and set the VTR to the E-to-E mode. Set the VIDEO MODE selector to COLOR and the AUTO/MANUAL selector to AUTO,
2. Connect the scope to TP-1402 on the MOD Board and set the scope to the dc range.
3. Adjust R1422 for a dc potential of 4.0 ±0.1 V.

### 7-2-3. Record A.C.C. Level Adjustment

1. Connect the color bar signal to the VIDEO IN terminal and place the VTR in the E-to-E mode. Set the VIDEO MODE selector to COLOR and AUTO/MANUAL selectors to AUTO.
2. Connect the scope to TP-1407 on the MOD Board.
3. Adjust R1414 for 300 ±20 mV(p-p). See Fig. 7-33.

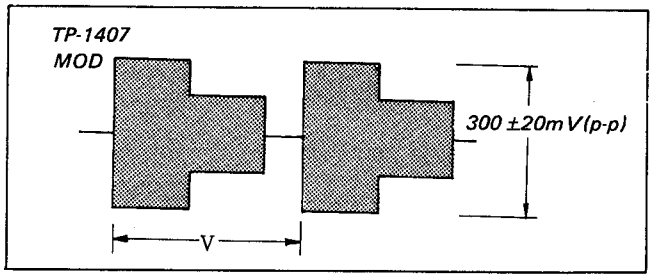



*Fig. 7-33.*

### 7-2-4. Chroma RF Output Balance Adjustment

1. Connect the scope to TP-4011 on the C-DEM Board.
2. Play back the color bar segment of the alignment tape and adjust the TRACKING control for maximum amplitude.
3. Adjust R2254 on the RP Board for equal amplitudes of CH-A and CH-B. See Fig. 7-34.

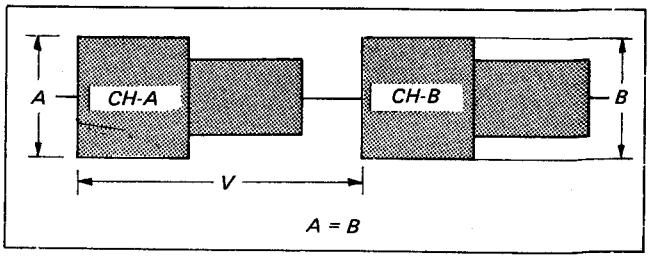



*Fig. 7-34. Chroma RF output balance adjustment*

### 7-2-5. 3.58 MHz Oscillator Adjustment

1. Connect the scope to TP-4111 on the C-DEM Board and connect the frequency counter to the vertical signal output of the scope.
2. Adjust C4153 for a counter reading of 3,579,545 Hz ±2 Hz.

### 7-2-6. 767 kHz Chroma Input Level Adjustment

1. Connect the scope to TP-4011 on the C-DEM Board and trigger the scope externally from TP-4002.
2. Play back the color bar segment of the alignment tape and adjust the TRACKING control for maximum amplitude.
3. Adjust R4048 for 0.15 ±0.01 V(p-p).

### 7-2-7. Converter Balance Adjustment

1. Connect the scope to TP-4012 on the C-DEM Board and trigger the scope externally from TP-4002.
2. Play back the color bar segment of the alignment tape.
3. Adjust R4047 for minimum carrier leak level. See Fig. 7-35.

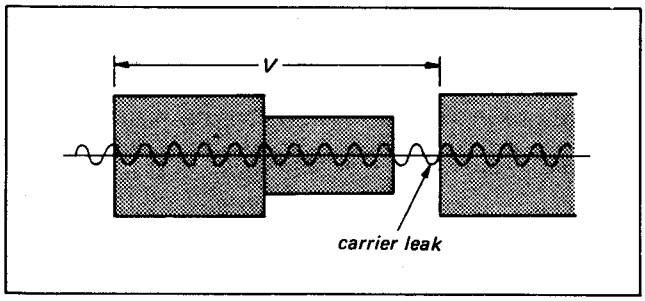



*Fig. 7-35. Converter balance adjustment*

### 7-2-8. PB A.C.C. and Chroma Output Level Adjustment

1. Play back the color bar segment of the alignment tape.
2. Connect the scope to TP-4015 on the C-DEM Board and adjust the TRACKING control for maximum amplitude.
3. Adjust R4067 for 0.27 ±0.03 V(p-p). See Fig. 7-36 (a).
4. Connect the scope to TP-4009. Turn R4013 fully clockwise for maximum chroma signal level.
5. Adjust R4029 so that the level of the chroma signal is 1.20 ±0.04 V(p-p). See Fig. 7-36 (b).
6. Adjust R4013 for equal level at chroma peak and white peak signal in Fig. 7-36 (c).

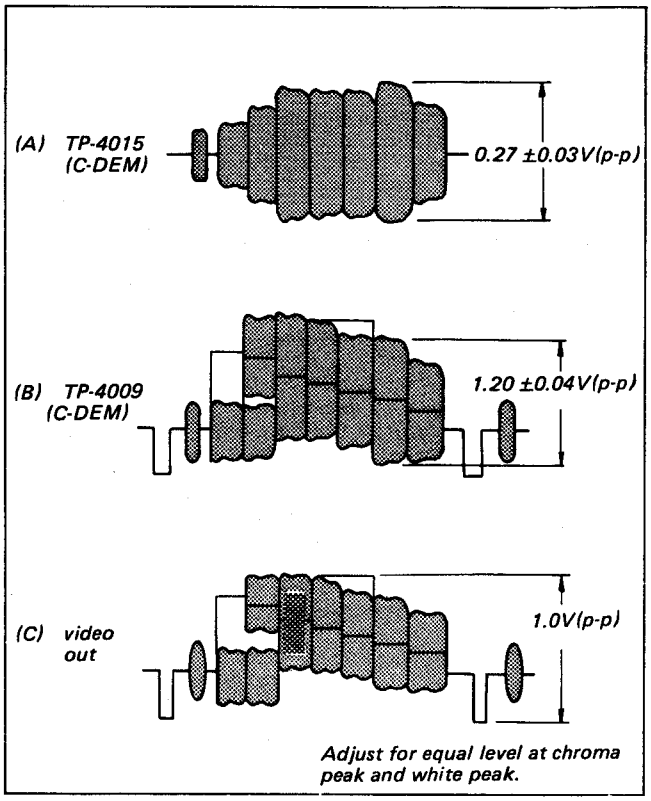



*Fig. 7-36. PB A.C.C. and chroma output level adjustment*

### 7-2-9. PB Color Killer Adjustment

1. Play back the color bar segment of the alignment tape. Set the VIDEO MODE selector to B/W.
2. Connect the scope to TP-4008 on the C-DEM Board.
3. Set R4067 fully clockwise.
4. Turn R4067 counterclockwise slowly and stop when color noise appears on the waveform at TP-4008. See Fig. 7-37.
5. Connect the scope to TP-4015 and measure the signal level.
6. Adjust R4067 so that the signal level at TP-4015 is 4 times the level measured in Step 5.

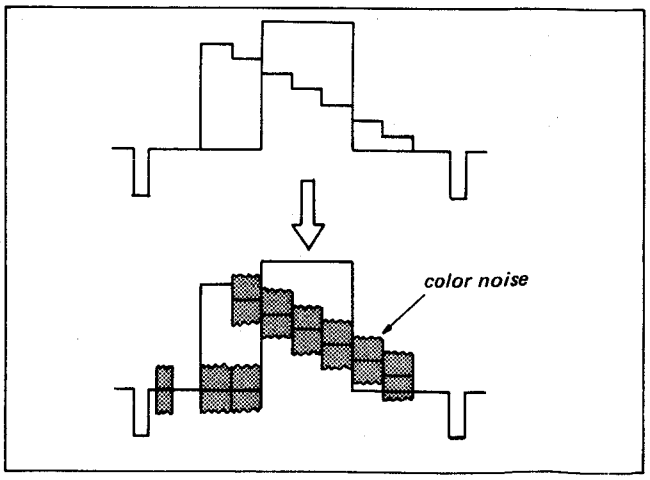



*Fig. 7-37. PB color killer adjustment*

### 7-2-10. A.P.C. Input Level Adjustment

1. Connect the scope to TP-4111 on the C-DEM Board.
2. Play back the color bar segment of the alignment tape.
3. Adjust R4171 for 2.0 ±0.1 V(p-p).

### 7-2-11. FET (Q4102) Bias Voltage Adjustment

1. Set the COLOR LOCK control on the connector panel to the center preset point.
2. Connect a 0.1 μF, 50 V capacitor between TP-4101 on the C-DEM Board and ground, a 100 μF, 50 V capacitor between TP-4109 and ground, and a 0.1 μF, 50 V capacitor between TP-4111 and ground. See Fig. 7-38. (The lead length on the capacitor connected between TP-4101 and ground should be kept as short as possible.)

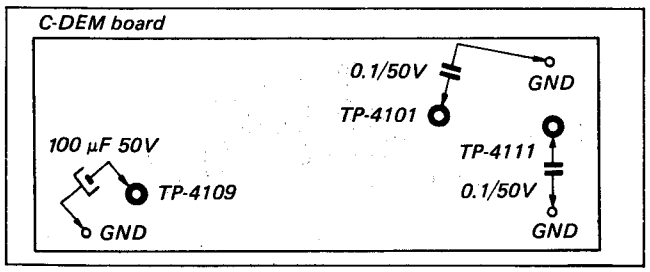



*Fig. 7-38. FET bias voltage adjustment*

3. Connect the color bar signal to the VIDEO IN terminal and place the VTR in the E-to-E mode. Set the VIDEO MODE selector to COLOR.
4. Connect the scope to TP-4102 and set it to the dc range.
5. Adjust R4155 so that the dc potential at TP-4102 is 2.0 ±0.05 V.
6. After the adjustment, remove the capacitors connected in step 2.

### 7-2-12. 15,734 kHz Tuned Amp Adjustment

1. Connect the color bar signal to the VIDEO IN terminal and set the VTR to the E-to-E mode.
2. Connect the scope to TP-4109 on the C-DEM Board.
3. Adjust L4107 for maximum amplitude.
4. Adjust R4146 for 12 ±0.5 V(p-p).

### 7-2-13. A.F.C. Operating Point Adjustment

1. Set the COLOR LOCK control on the connector panel to the center preset point.
2. Connect a 0.1 μF, 50 V capacitor between TP-4101, on the C-DEM board, and ground. Keep the leads as short as possible.
3. Connect the scope to TP-4102 and set the scope to the dc range.
4. Play back the color bar segment of the alignment tape.
5. Adjust L4109 so that the dc potential at TP-4102 is 2.0 ±0.05 V.
6. After the adjustment, remove the capacitors connected in step 2.

### 7-2-14. 767 kHz V.C.O. Adjustment

1. Set the COLOR LOCK control on the connector panel to the center preset point.
2. Connect a TP-4101 on the C-DEM Board to ground with a 0.1 μF, 50 V capacitor.
3. Connect the color bar signal to the VIDEO IN terminal and place the VTR in the E-to-E mode.
4. Connect the scope to TP-4103.
5. Adjust R4124 for 1.7 ±0.05 V(p-p).
6. Connect the scope to TP-4106 and connect the frequency counter to the vertical signal output of the scope.
7. Adjust L4102 for a counter reading of 4,346,590 Hz ±200 Hz.
8. After the adjustment, remove the capacitor connected in step 2.

### 7-2-15. Converter Balance Adjustment

1. Connect the color bar signal to the VIDEO IN terminal and place the VTR in the E-to-E mode.
2. Connect the scope to TP-4105 on the C-DEM Board.
3. Adjust R4129 for minimum amplitude.

### 7-2-16. 4.34 MHz Tuned Amp Adjustment

1. Connect the color bar signal to the VIDEO IN terminal and place the VTR in the E-to-E mode.
2. Connect the scope to TP-4106 on the C-DEM Board.
3. Adjust L4105 for maximum amplitude.

### 7-2-17. Color Lock Control Check

1. Connect TP-4101 on the C-DEM Board to ground through a 0.1 μF, 50 V capacitor.
2. Connect the color bar signal to the VIDEO IN terminal and set the VTR to the E-to-E mode.
3. Connect the scope to TP-4106 and connect the frequency counter to the vertical signal output of the scope.
4. Set the COLOR LOCK control output fully clockwise and confirm that the frequency at TP-4106 is less than 4.330 MHz.
5. Set the COLOR LOCK control fully counterclockwise and confirm that the frequency is more than 4.364 MHz.
6. Set the COLOR LOCK control to the center preset position after the adjustment.

### 7-2-18. Phase Detector Balance Adjustment

1. Connect the color bar signal to the VIDEO IN terminal and place the VTR in the E-to-E mode. Set the VIDEO LEVEL selector to AUTO and VIDEO MODE selector to COLOR.
2. Connect the scope to TP-4111 on the C-DEM Board and trigger the scope externally from TP-4107. Set the horizontal time base of the scope to 10 μs/cm.
3. Adjust C4105 so that the burst component is at the center of the amplitude as shown in Fig. 7-39.

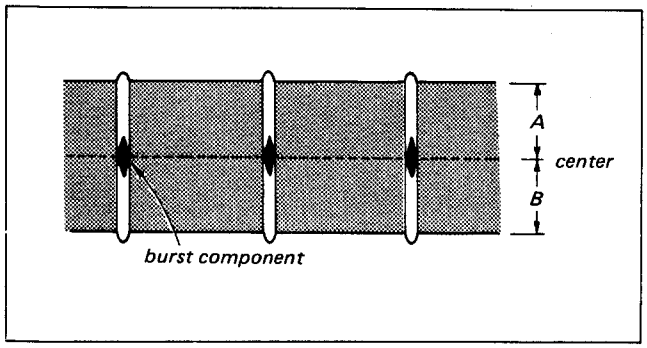



*Fig. 7-39. Phase detector balance adjustment*

### 7-2-19. A.P.C. Performance Check

1. Connect the color bar signal to the VIDEO IN terminal and set the VTR to the E-to-E mode.
2. Set the COLOR LOCK control to the center preset point.
3. Connect the scope to TP-4102 on the C-DEM Board and set the scope to the dc range.
4. Confirm a dc level of 2.0 ±0.05 V.

### 7-2-20. Chroma Record Current Adjustment

1. Remove the jumper between pin 9 of connector CN2021 and C2115 on the RP board from pin 9. This removes the Y signal input to the RP board. Refer back to Fig. 7-13 for the location of the jumper.
2. Connect the oscilloscope to TP-2103 on the RP board and the color bar signal to the VIDEO IN connector.
3. Set the TAPE SELECTOR switch to REGULAR and the VIDEO MODE switch to COLOR.
4. Place the VTR in the RECORD mode and adjust R2106 on the RP board so that the peak to peak chroma signal measured on the oscilloscope is 400 mV ±20 mV.
5. Now place the TAPE SELECT switch in the HIGH DENSITY position and verify that the peak to peak chroma signal on the oscilloscope is 600 mV ±40 mV.

# SECTION 8
# EDITING SYSTEM ALIGNMENT

## 8-1. EDIT 30 PG DELAY MULTIVIBRATOR ADJUSTMENT

1. Connect a jumper between TP-2408 on the RP Board and the base of Q2403. See Fig. 8-1.
2. Connect the Standard Signal Generator to Pin 9 of connector CN2021. Set the frequency of the generator to 5 MHz, and its output level to 0.6 V(p-p).
3. Play back a tape, upon which an NTSC color bar signal has previously been recorded. (Do not use an alignment tape.) Play this tape for about two minutes.
4. Remove the jumper wire and the Standard Signal Generator connected in Steps 1 and 2.
5. Rewind the section of the tape which was played back for 2 minutes in Step 3, and play back the section again. Connect a video signal to the VIDEO IN terminal.
6. Connect the CH-1 probe of the dual-trace scope to TP-8003 on the VOA Board, and the CH-2 probe to TP-8002. Trigger the scope from TP-4002 on the C-DEM Board and set the scope to CHOP mode.
7. A section of the vertical blanking in the output waveform at TP-8002 appears and other sections turn to noise. Confirm that the phase relationship between the leading edge of the vertical sync of the video input signal and the signal at TP-8002 is 9 ±0.5 H.

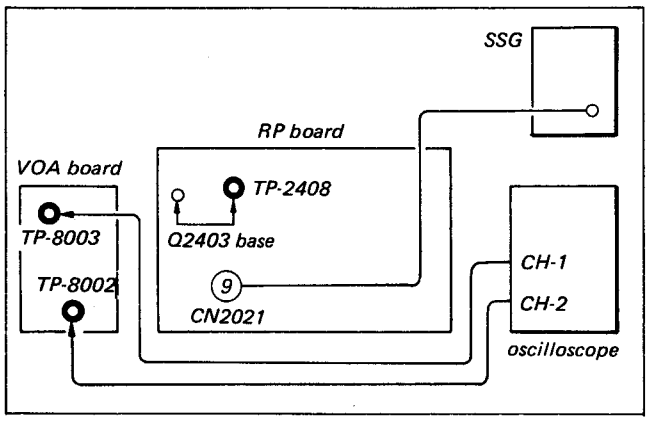



*Fig. 8-1. Test set up*

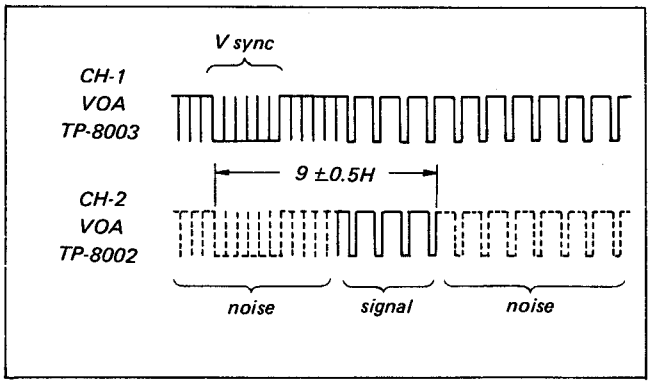



*Fig. 8-2. Edit 30PG delay multivibrator adjustment*

8. If the phase relationship is not within the specification, repeat Steps 1 to 7 and adjust R2415 on the RP Board.

## 8-2. CUT-IN DELAY MULTI ADJUSTMENT

Perform Procedure 8-1 "Edit 30PG Delay Multivibrator Adjustment" prior to making this adjustment.

1. Connect a video signal to the VIDEO IN terminal.
2. Set the machine in the E to E mode.
3. Connect the CH-1 probe of the dual-trace scope to TP-8003 on the VOA Board and the CH-2 probe to TP-2409 on the RP Board. Trigger the scope externally from TP-2409 and set up the CHOP mode.
4. Adjust R2420 on the RP Board so that the phase relationship between the leading edge of vertical sync at TP-8003 and the leading edge of the signal at TP-2409 is as shown in Fig. 8-3.

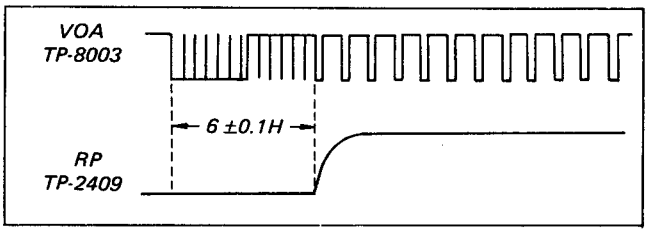



*Fig. 8-3. Cut-in delay multi adjustment*

## 8-3. CUT-OUT DELAY MULTI ADJUSTMENT

Perform Procedure 8-1 "Edit 30PG Delay Multi Adjustment" prior to making this adjustment.

1. Connect a video signal to the VIDEO IN terminal.
2. Set the machine in the E to E mode.
3. Connect the CH-1 probe of the dual-trace scope to TP-8003 on the VOA Board and the CH-2 probe to TP-2410 and set the CHOP mode.
4. Adjust R2418 on the RP Board so that the phase relationship between the leading edge of vertical sync at TP-8003 and the leading edge of the signal at TP-2410 is as shown in Fig. 8-4.

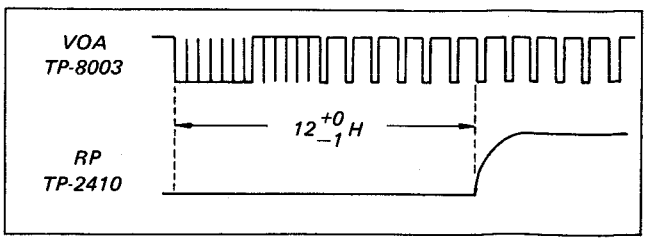



*Fig. 8-4. Cut-out delay multi adjustment*

## 8-4. ROTARY ERASE BALANCE ADJUSTMENT

1. Connect a VOM between the collector of Q5103 on the RE Board and ground. Measure the voltage.

2. Connect the VOM between the connecting point of R5109 and R5110 and ground.
3. Adjust R5104 so that the VOM reading is 1/2 of the voltage measured in step 1.

## 8-5. ROTARY ERASE HEAD CURRENT ADJUSTMENT

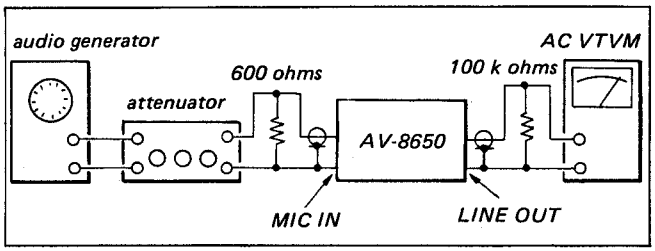
1. Connect the color bar signal to the VIDEO IN terminal.
2. Connect the scope to TP-5101 on the RE Board.
3. Place the VTR in the VIDEO INSERT mode.
4. Adjust R5102 for 1.1 +0.1 −0 V(p-p).

# SECTION 9
# AUDIO SYSTEM ALIGNMENT

Equipment requred:

1. Audio Generator
2. AC VTVM
3. Frequency Counter
4. Scope
5. Attenuator
6. Resistor ..... 600 Ω (1/4W), 10 kΩ (1/4W)
7. SONY Alignment Tape ..... 8-984-508-40

Set up for Alignment:




*Connections*

Adjustment sequence:

9-1. Azimuth Adjustment
9-2. Playback Output Level Adjustment
9-3. Audio Level Meter Adjustment
9-4. Audio Ljmiter Adjustment
9-5. Bias/Erase Frequency Check
9-6. Bias Trap Adjustment
9-7. Bias Current Adjustment
9-8. Record Level Adjustment
9-9. Playback Equalizer Adjustment
9-10. Dummy Coil Adjustment
9-11. Overall Frequency Characteristic Check
9-12. Overall Signal-to-noise Ratio Check

**Note:** These adjustments must all be performed in the sequence given.

## 9-1. AZIMUTH ADJUSTMENT

1. Connect the AC VTVM to the LINE OUT connector.
2. Thread the machine with the alignment tape and play back the 7 kHz segment.
3. Adjust the audio head azimuth adjustment screw (See Fig. 9-1) to obtain maximum output level of the 7 kHz playback signal.

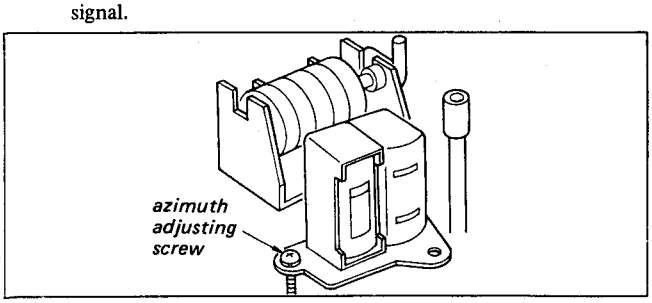



*Fig. 9-1. Azimuth adjustment*

## 9-2. PLAYBACK OUTPUT LEVEL ADJUSTMENT

1. With the AC VTVM connected to the LINE OUT connector, play back the 1 kHz segment of the alignment tape.
2. Adjust R7030 on the AUD board to obtain a playback output level of 0 dB, as measured on the VTVM. See Fig. 9-2. The specification is 0 dB ±0.5 dB.

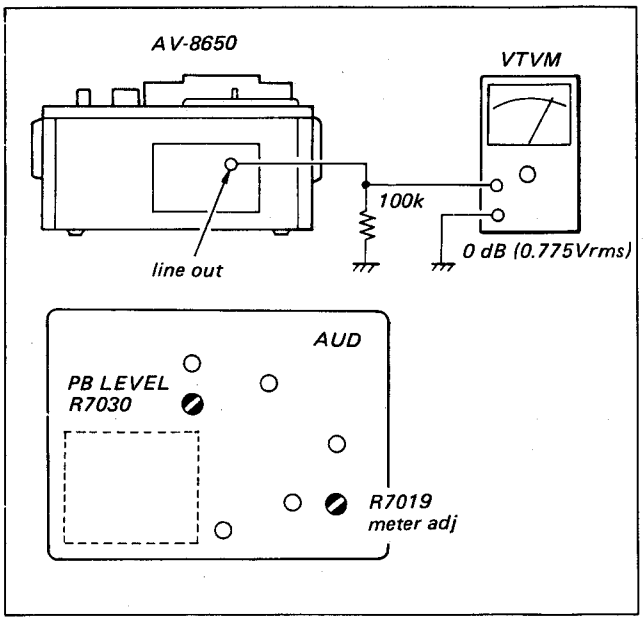



*Fig. 9-2. Playback output level adjustment*

## 9-3. AUDIO LEVEL METER ADJUSTMENT

1. Connect a 1 kHz input signal of −60 dB level to the MIC IN jack of the machine. Use the VTVM and attenuator to set this level.
2. Connect the AC VTVM to the LINE OUT connector.
3. Place the VTR in the E to E mode and adjust the AUDIO LEVEL control to obtain an output of 0 dB level measured on the VTVM.
4. Adjust pot R7019 (METER ADJ.) on the AUD board so that the audio level meter indicates 0 dB. See Fig. 9-3.

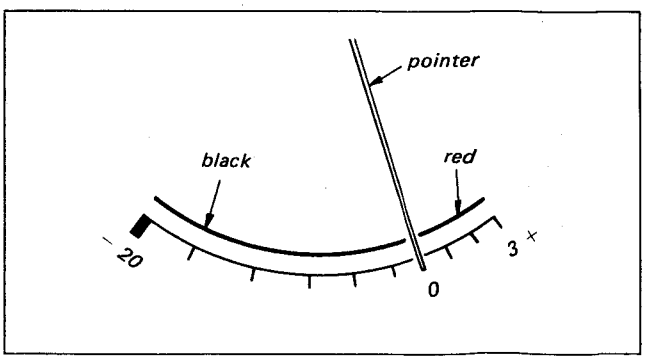



*Fig. 9-3. Audio level meter adjustment*

## 9-4. AUDIO LIMITER ADJUSTMENT

1. Set the audio LIMITER switch on the VTR to ON.
2. Connect a 1 kHz input signal of −30 dB level to the MIC IN jack and set the machine in the E to E mode.
3. With the AC VTVM connected to the LINE OUT connector, adjust pot R7017 on the AUD board so that the output signal, measured on the VTVM is +3 dB ±0.2 dB.

## 9-5. BIAS ERASE FREQUENCY CHECK

1. Connect a frequency counter to TP-7004 on the AUD board and set the machine in the RECORD mode.
2. Verify that the frequency of the bias oscillator is 67 kHz ±5 kHz.

## 9-6. BIAS TRAP ADJUSTMENT

1. Connect the oscilloscope to TP-7003 on the AUD board and set the machine in the RECORD mode.
2. Adjust L7001 on the AUD board for minimum bias leak level.

## 9-7. BIAS CURRENT ADJUSTMENT

1. Connect a 1 kHz input signal of −60 dB level to the MIC IN jack.
2. Connect the AC VTVM to TP-7004 on the AUD board.
3. Set the VTR in the RECORD mode and record a 10 second segment of the 1 kHz signal.
4. Play back the 10 second segment recorded in step 3 and note the playback signal level measured on the VTVM.
5. Adjust C7032 on the AUD board slightly clockwise and repeat steps 3 and 4 above. Note whether the new playback signal level is greater or less than that noted in step 4, if it is greater, you are adjusting C7032 in the right direction, if it is less, you are going in the wrong direction.
6. Again adjust C7032 in the direction which produces an increased playback signal level, play back the recording and note the new signal level. By means of this trial and error procedure, the object is to find that setting of C7032 which affords the greatest playback signal level.

## 9-8. RECORD LEVEL ADJUSTMENT

1. Connect a 1 kHz input signal of −60 dB level to the MIC IN connector and connect the AC VTVM to the LINE OUT connector.
2. Place the VTR in the E to E mode and adjust the front panel audio level control for an output signal of 0 dB, measured on the VTVM. (The LIMITER switch should be out.)
3. Record a 10 second segment of the 1 kHz signal and play it back. Note the output signal level on the VTVM. Verify that it is 0 dB ±0.5 dB.
4. If the output level of the playback signal of the self recorded tape is not within the above limits, pot R7012 on the AUD board must be re-adjusted. This is done through a trial and error process of making a series of trial recordings to find the setting of R7012 which gives the correct playback level of a self recorded tape.

## 9-9. PLAYBACK EQUALIZER ADJUSTMENT

1. Connect a 10 kHz input signal of −60 dB level to the MIC IN connector. Leave the AC VTVM connected to the LINE OUT connector.
2. Place the VTR in the E to E mode and adjust the front panel audio level control for an output signal level of 0 dB, measured on the VTVM (The LIMITER switch should be out.)
3. Record a 10 second segment of the 10 kHz and play it back. Note the output signal level on the VTVM. Verify that it is 0 dB ±0.5 dB.
4. If the output level of the playback signal of the self recorded 10 kHz signal on the tape is not within the above limits, pot R7028 must be re-adjusted. This is done through a trial and error process which is essentially the same as that outlined for the record level adjustment in step 6-8, above.
5. When both the record level and playback equalizer adjustments have been properly completed, the playback levels of self recorded 1 kHz and 10 kHz signals (each recorded at 0 dB) will be within 0.5 dB of each other.

## 9-10. DUMMY COIL ADJUSTMENT

1. Set the VTR in the FORWARD mode and connect the frequency counter to TP-7004 on the AUD board.
2. Set the MODE SELECT to ASSEMBLE so that the machine will go into the EDIT mode when the EDIT and REC buttons are simultaneously depressed.
3. Write down the bias frequency measured on the counter.
4. Switch the MODE SELECT to the VIDEO/AUDIO INSERT mode and adjust L7005 so that the bias frequency is within ±1 kHz of that noted in step 3, above.

## 9-11. OVERALL FREQUENCY CHARACTERISTIC CHECK

1. Thread the VTR with regular video recording tape and place the TAPE SELECT switch in the REGULAR position.
2. Make three 10 second long test recordings with an input signal of −60 dB level at frequencies of 100 Hz, 1 kHz, and 10 kHz. (For each freqeuncy, the audio level control should be adjusted so that the output signal level from the LINE OUT connector measures 0 dB on an AC VTVM connected across a 10 k termination resistor. This adjustment should be made with the machine in the E to E mode just prior to making each of the three 10 second test recordings.) The limiter switch must be OFF when these recordings are made.
3. Play back the three 10 second test recordings and measure the playback signal level on the VTVM connected across the 10 k termination resistor. Verify that the playback signal levels are all 0 dB ±2 dB.
4. Now thread up the VTR with HIGH DENSITY video recording tape and place the TAPE SELECT switch in the

HIGH DENSITY position.

5. In exactly the same manner as outlined in step 2, above, make two 10 second long test recordings at frequencies of 1 kHz and 10 kHz.
6. Play back these two test recordings and verify that the output level of the playback signals 0 dB ±1 dB for each freqeuncy.

## 9-12. OVERALL SIGNAL TO NOISE RATIO CHECK

1. In the same manner as outlined in step 9-11-2, record a 20 second test recording of a 1 kHz signal. (This signal must be recorded at a 0 dB level.)
2. Play back the 20 second test recording and verify that the playback signal level is 0 dB ±0.5 dB.
3. Remove all input signals from the MIC IN jack.
4. Beginning at the point halfway through the 20 second long recording just made, re-record over the second half of it with no input signal.
5. Play back the entire 20 second long test recording, comparing the playback output level of the recording of the 1 kHz signal to that of no signal. Verify that the output level of the no signal portion of the tape is at least 41 dB lower than the 1 kHz signal.

SONY CORPORATION

8-966-150-01

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# AV-8650

## COLOR VIDEOCORDER

**VOL. 2**



## SPECIFICATIONS

| | |
|---|---|
| **Power requirement:** | AC 120 V, 60 Hz |
| **Power consumption:** | 95 watts |
| **Dimensions:** | 17-1/2"(W) x 10-3/4"(H) x 18-5/16"(D) |
| **Weight:** | 55 lb |
| **Operating temperature:** | 32°~104°F |
| **Recording system:** | Rotary two-head slant-track scanning |
| **Color recording system:** | Converted subcarrier direct recording |
| **Recording signal:** | NTSC color signal or monochrome 2 : 1 interace composite video signal based on American TV standard using EIA or industrial sync. |
| **Video input signal:** | 0.5~2 V(p-p), 75-ohm, unbalanced, sync negative |
| **Video output signal:** | 1.0 V(p-p), 75-ohm, unbalanced sync negative |
| **Horizontal resolution:** | B/W REGULAR .... 300 lines<br>H. D. .... 350 lines<br>COLOR<br>REGULAR .... 240 lines<br>H. D. .... 250 lines |
| **Video S/N:** | REGULAR .... 40 dB<br>H. D. .... 44 dB |
| **Audio input signal:** | MIC .... high-impedance −60 dB<br>LINE .... high-impedance 0 dB<br>MONITOR .... high-impedance −20 dB |
| **Audio output signal:** | LINE .... 2 k ohm 0 dB<br>MONITOR .... 2 k ohm 0 dB<br>HEADPHONE .... 8 ohm |
| **Audio S/N:** | 40 dB |
| **Audio frequency characteristics:** | REGULAR 80 to 10,000 Hz<br>H. D. 80 to 12,000 Hz |
| **Tape speed:** | 19.05 cm/sec |
| **F-F/REW time:** | 6 minutes (using V-32 tape) |
| **Flutter and wow:** | 0.2% rms |
| **Tape:** | V-31, V-32, V-71, V-72 |
| **Empty reel:** | RH-7 V(supplied) |
| **Edditing:** | ASSEMBLE<br>INSERT a. VIDEO AND AUDIO<br>b. VIDEO ONLY<br>c. AUDIO ONLY |
| **Slow motion speed:** | 1/5~1/16 variable |
| **Still:** | Possible |
| **Blanking switcher:** | Built-in |
| **Dropout compensator:** | Built-in |
| **Accessories:** | Empty reel (RH-7 V)<br>Power code (DK-42 for USA, DK-43 for CND)<br>Tape (V-32)<br>Cleaning sets<br>Instruction manual |

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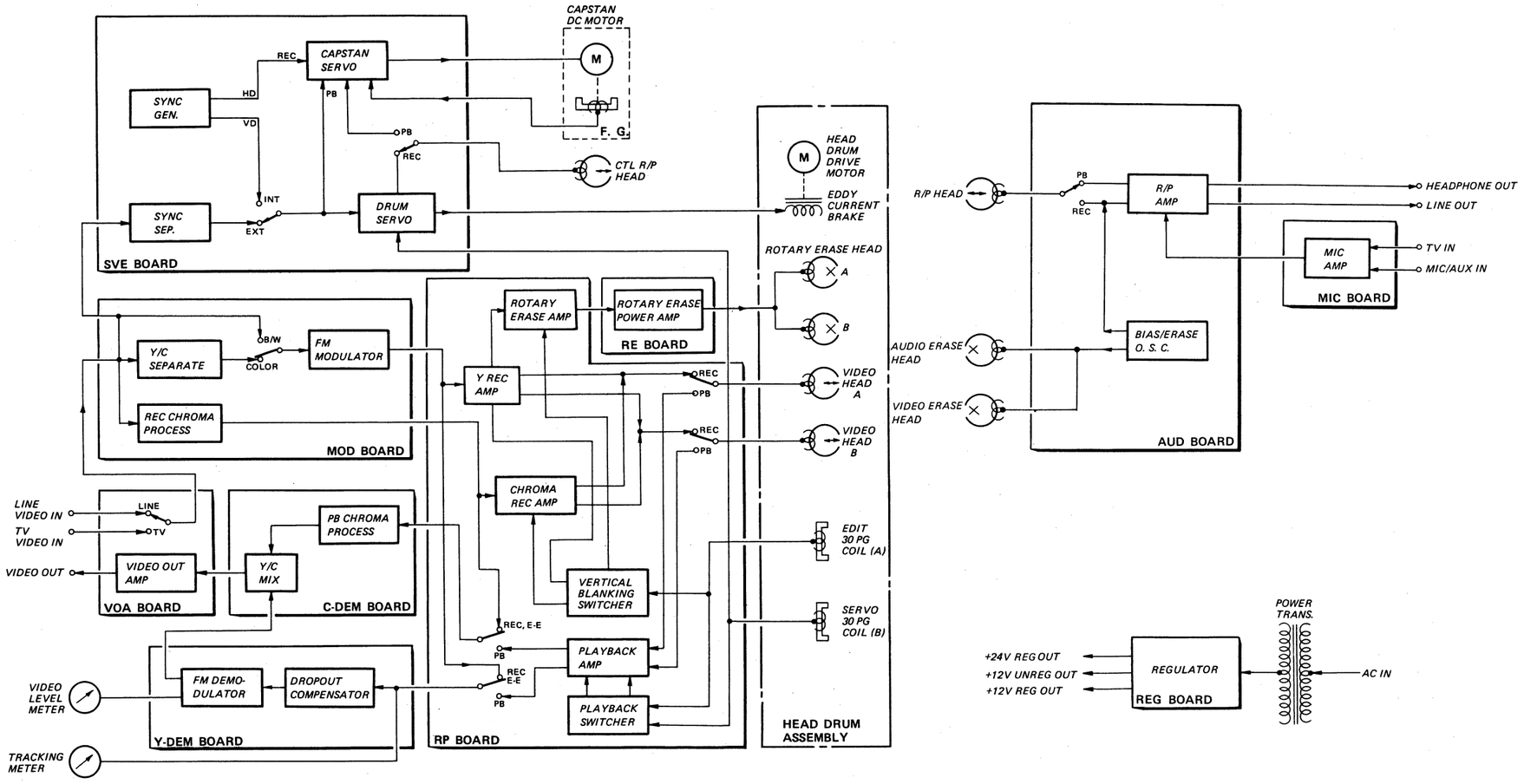
SERVICE MANUAL

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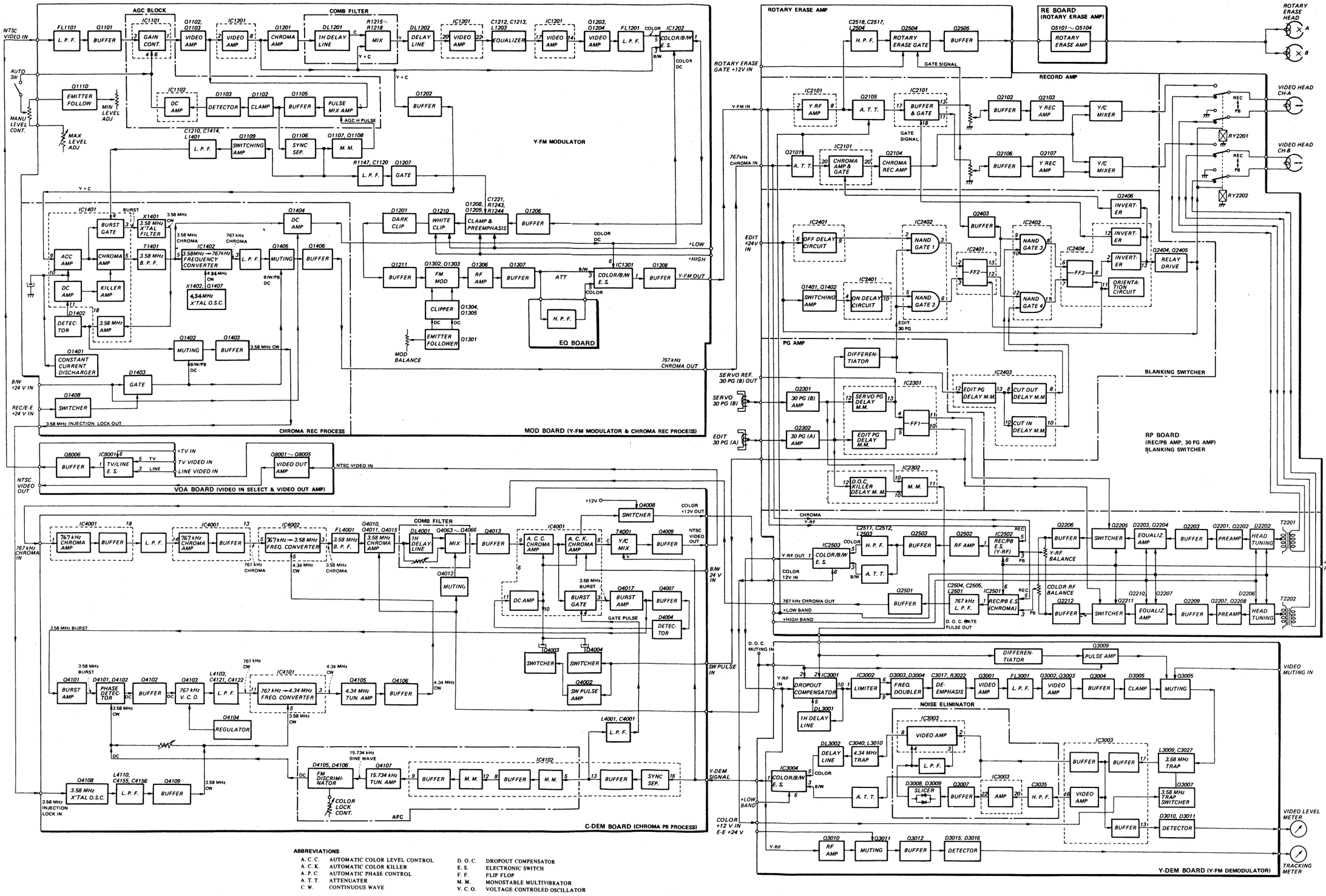

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# MOUNTING DIAGRAMS AND SCHEMATIC DIAGRAMS

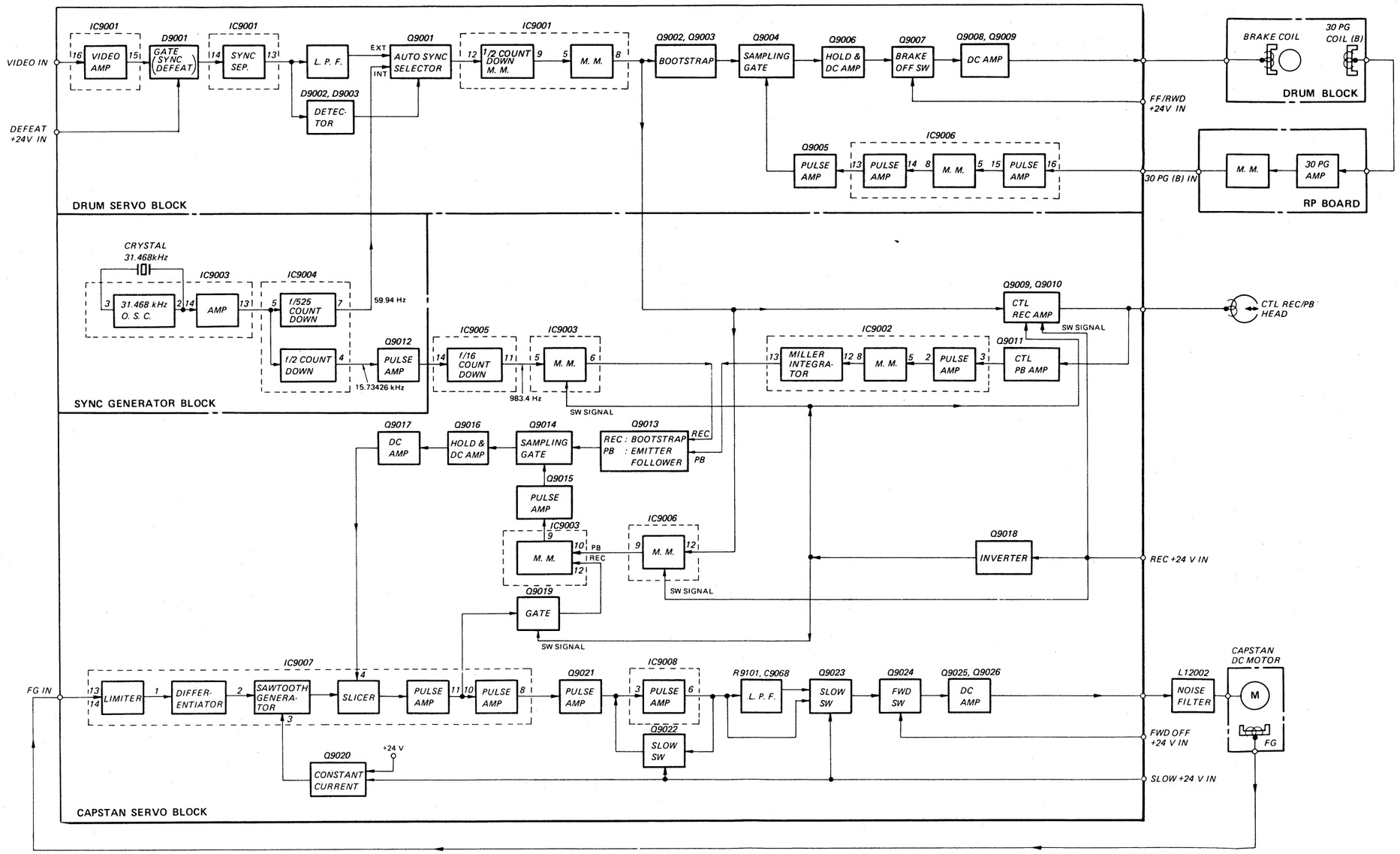
## OVERALL BLOCK DIAGRAM



## VIDEO SYSTEM BLOCK DIAGRAM

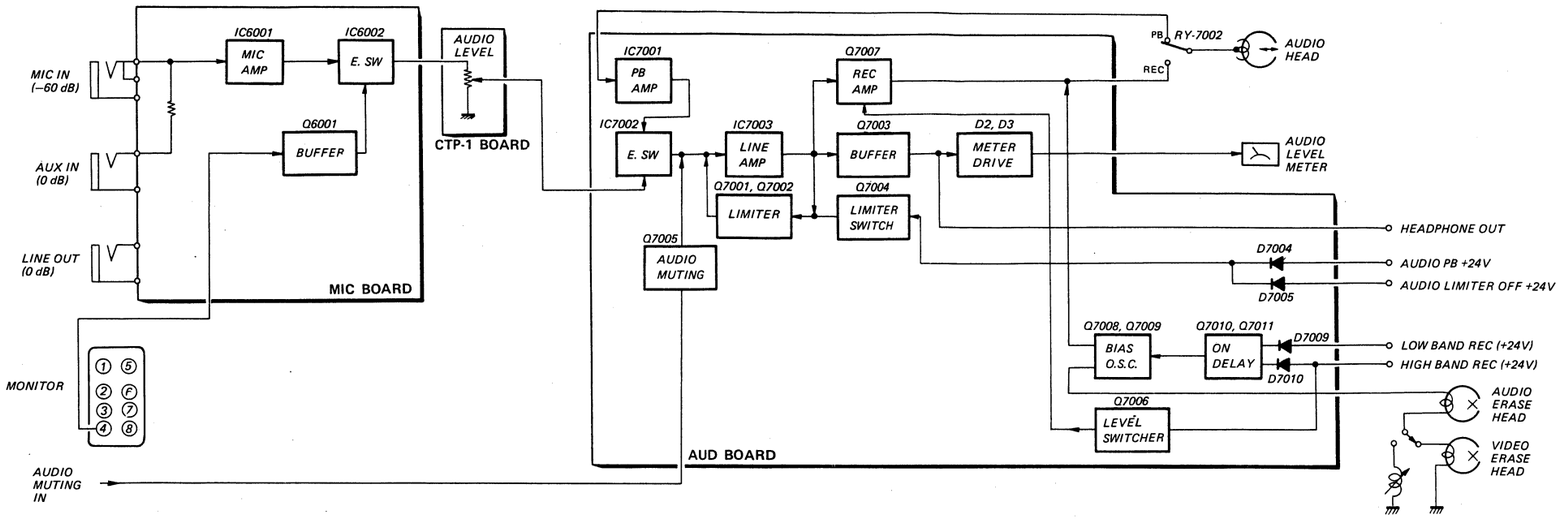


## SERVO SYSTEM BLOCK DIAGRAM

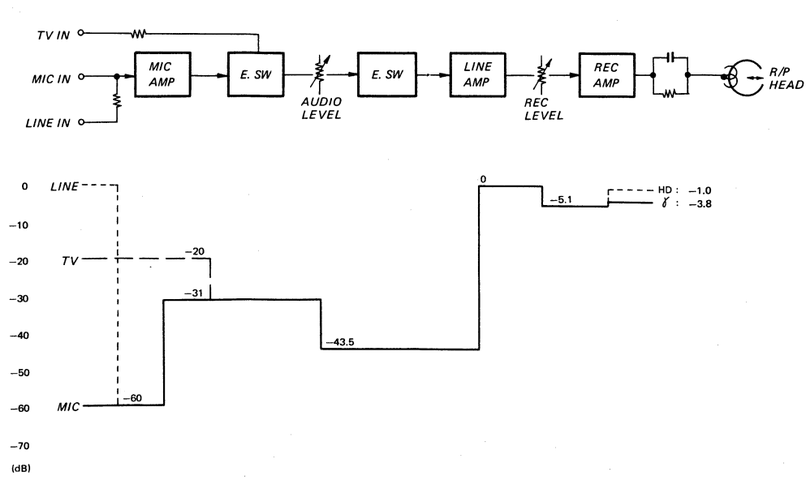



**NOTE:**
M. M. : MONOSTABLE MULTIVIBRATOR

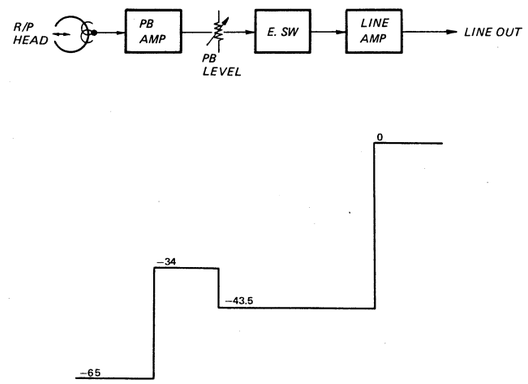
## AUDIO SYSTEM BLOCK DIAGRAM




### RECORD MODE LEVEL DIAGRAM

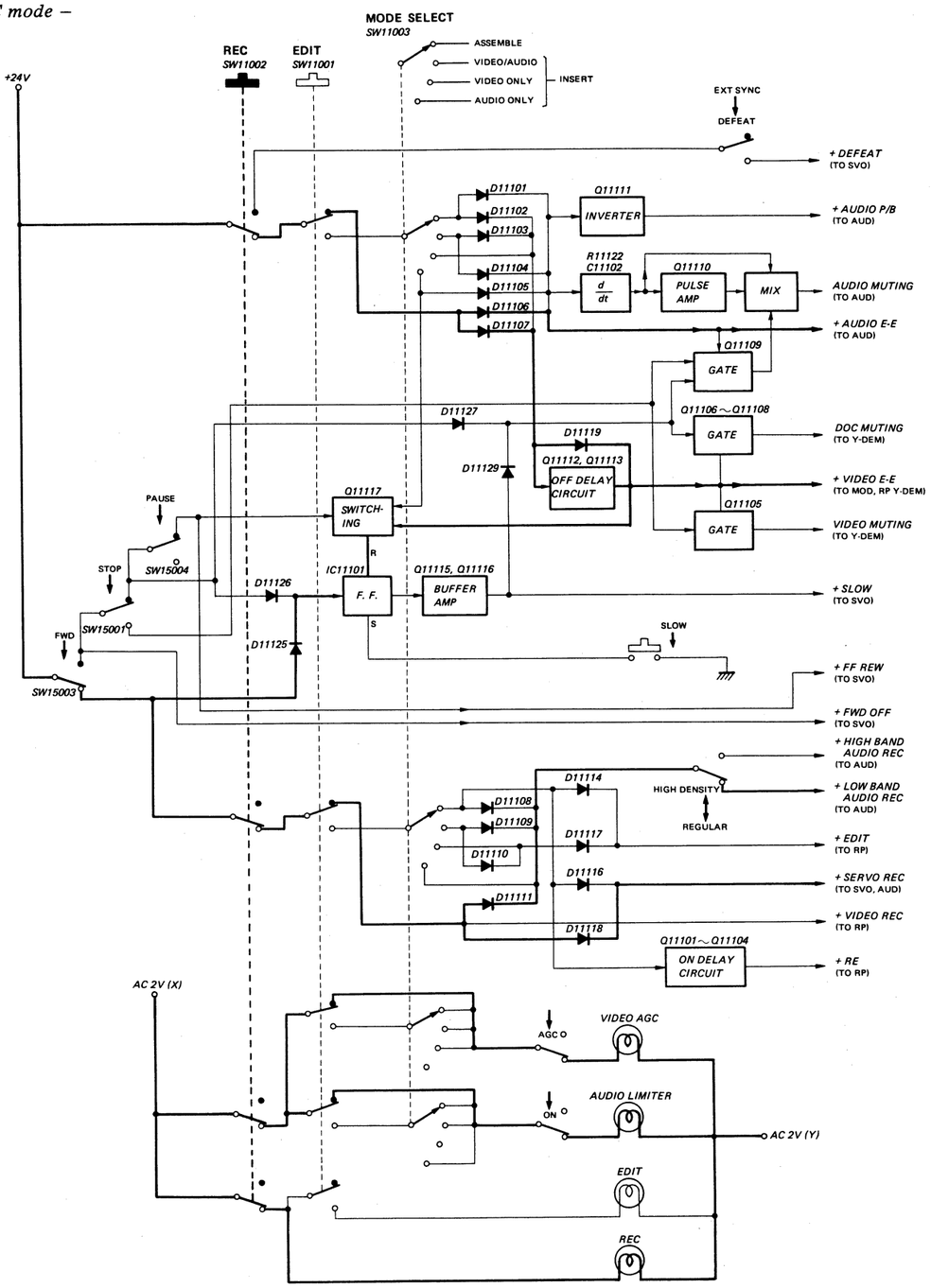



### PLAYBACK MODE LEVEL DIAGRAM



## SYSTEM CONTROL BLOCK DIAGRAM (1)

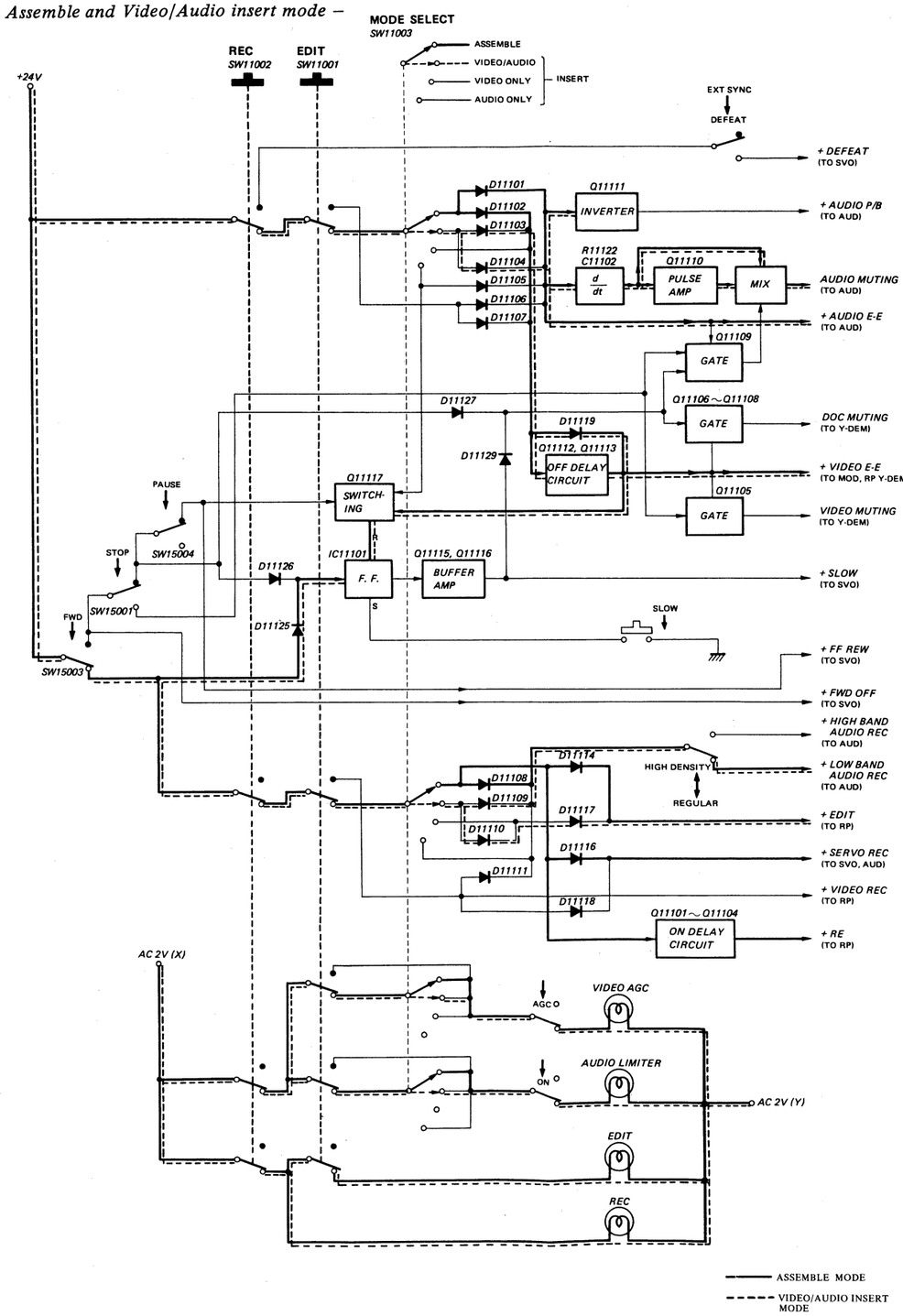
*– REC mode –*





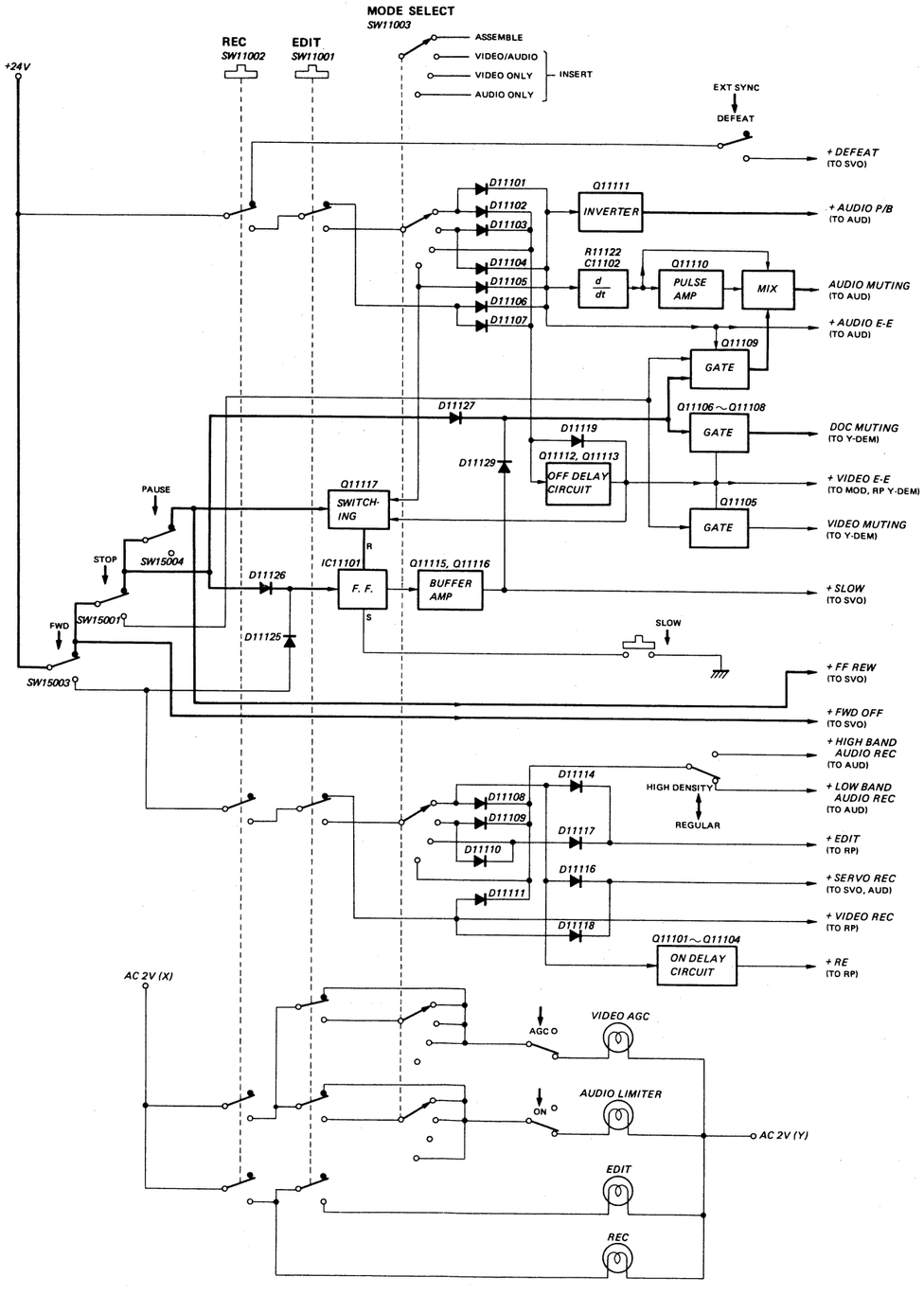

## SYSTEM CONTROL BLOCK DIAGRAM (2)

*– Assemble and Video/Audio insert mode –*



## SYSTEM CONTROL BLOCK DIAGRAM (3)

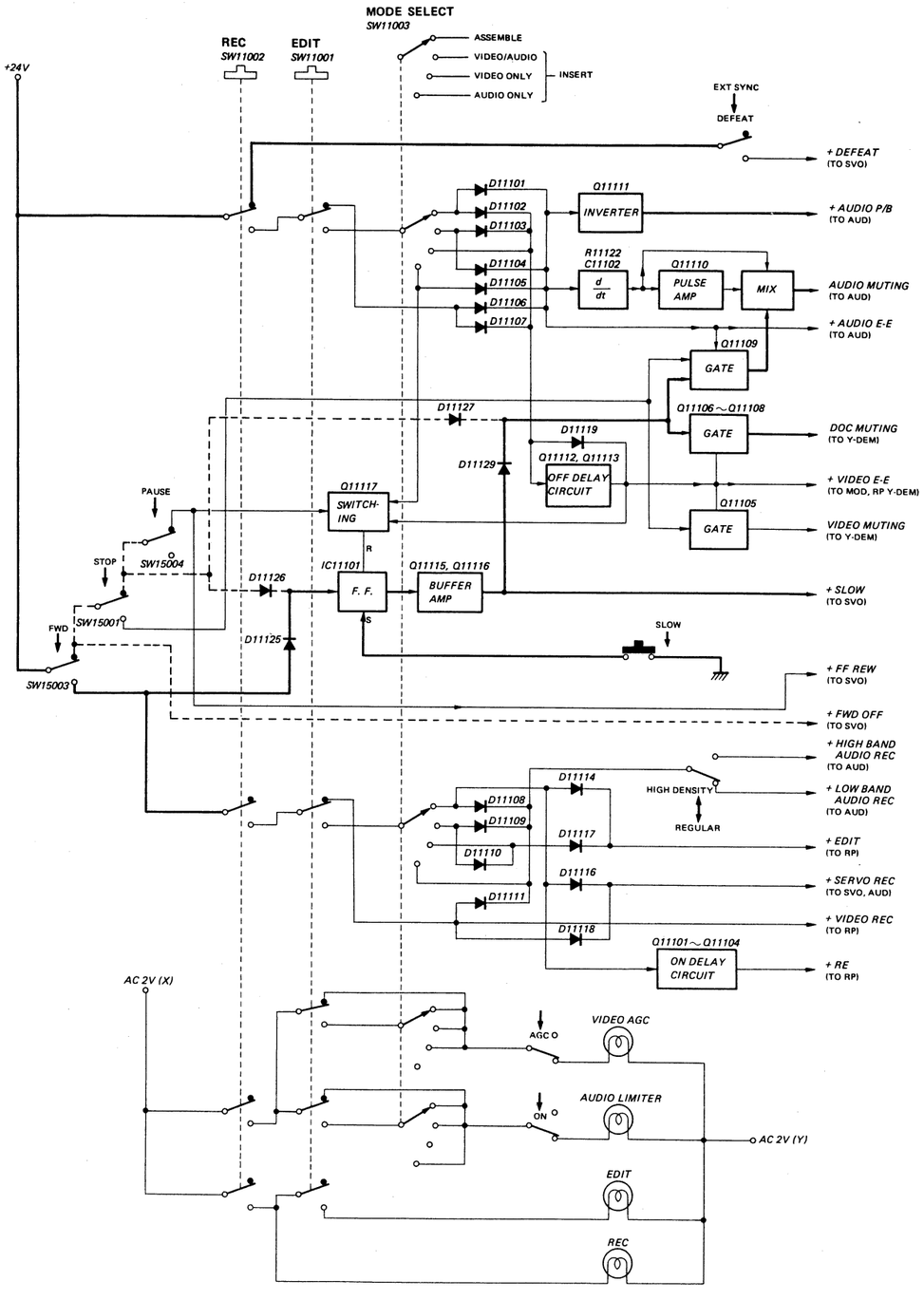
*– FF/REW mode –*





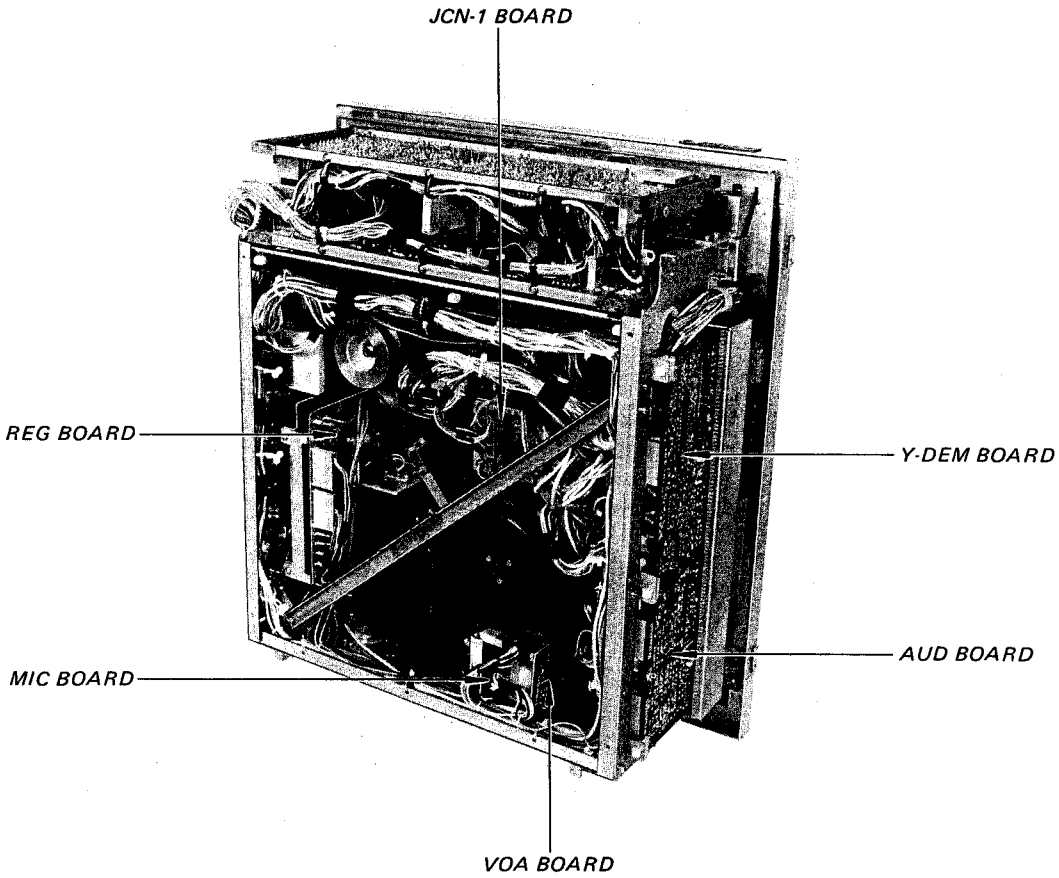

## SYSTEM CONTROL BLOCK DIAGRAM (4)

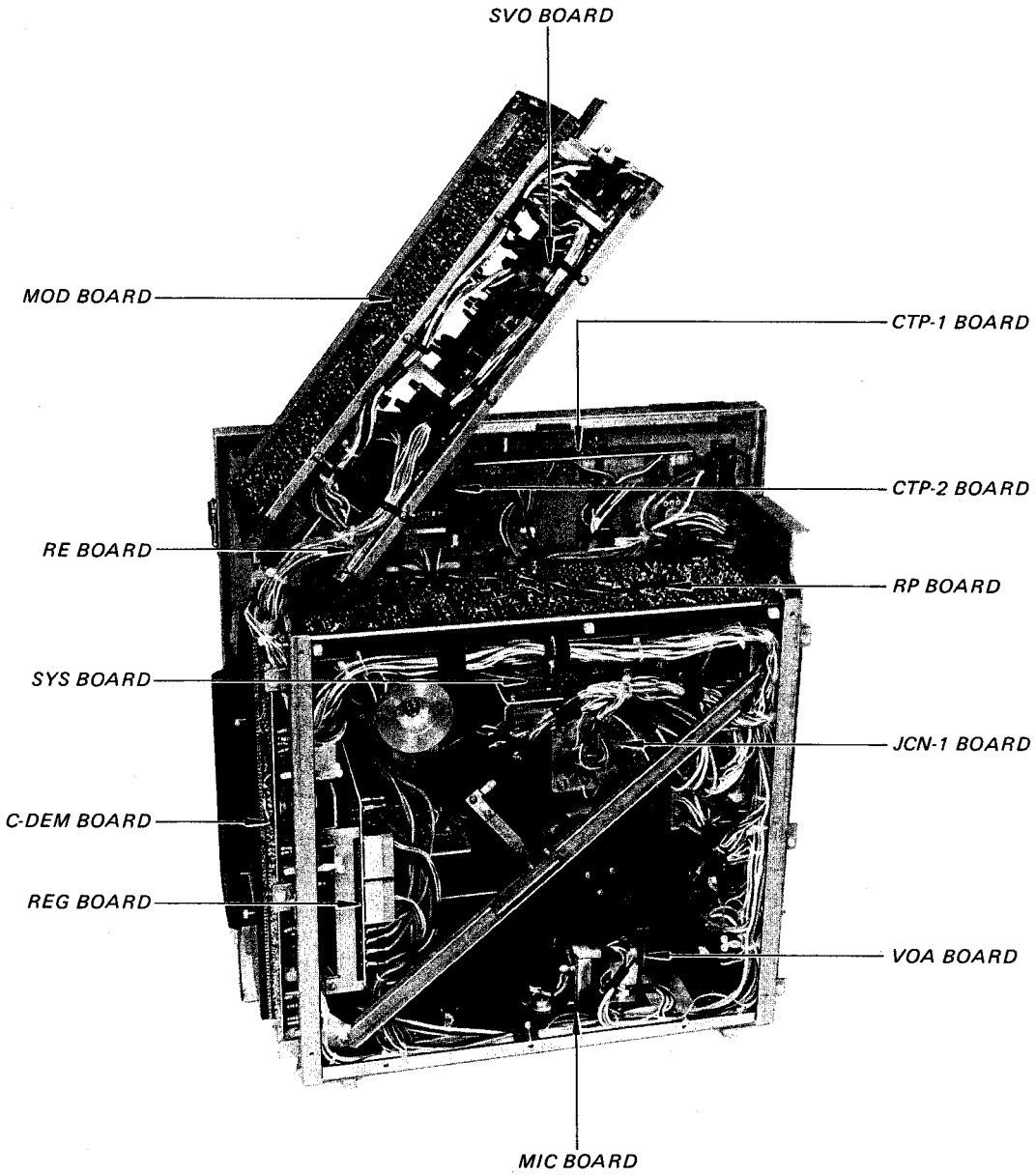
*– Slow and Pause mode –*




SLOW MODE
PAUSE MODE

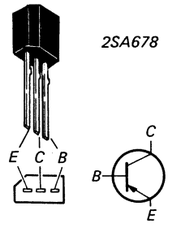
## MOUNTED BOARD LOCATION



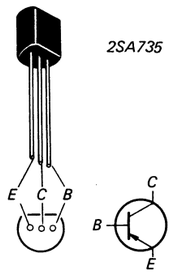

SVO BOARD
MOD BOARD
CTP-1 BOARD
CTP-2 BOARD
RE BOARD
RP BOARD
SYS BOARD
JCN-1 BOARD
C-DEM BOARD
REG BOARD
VOA BOARD
MIC BOARD

## SEMICONDUCTOR ELECTRODES

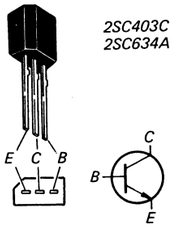
2SA678



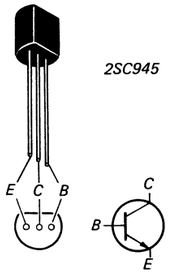

2SA735

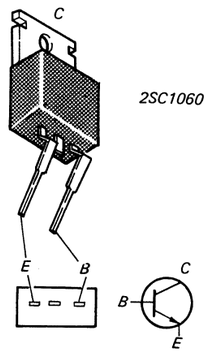



2SC403C
2SC634A

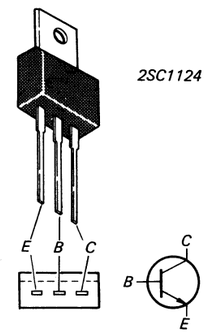



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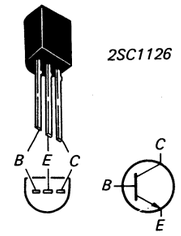


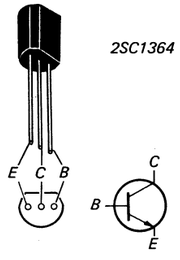

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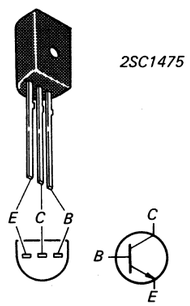



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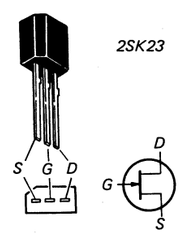



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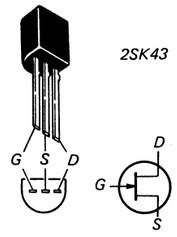


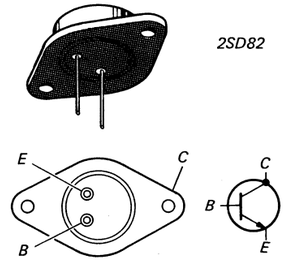

2SK23



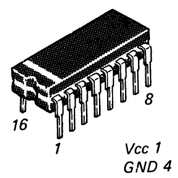

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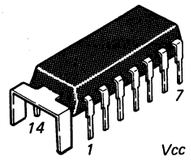

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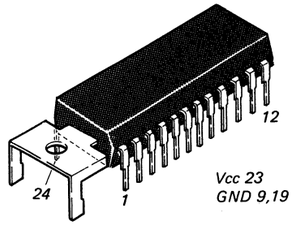

AN301



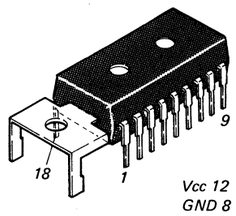

CX-034



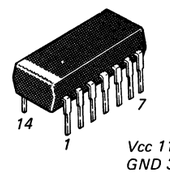

CX-087B
CX-146



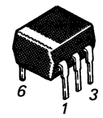

CX-103D



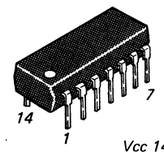

CX-121A



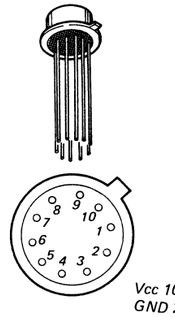

CX-130
TX-429



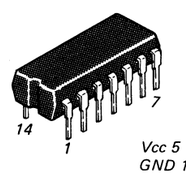

CX-032B
CX-506



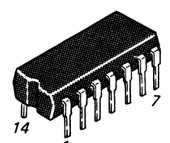

CX-732



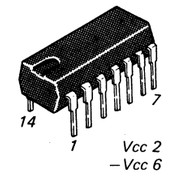

M53293



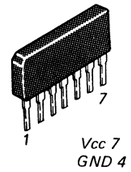

M5373P
M5946P



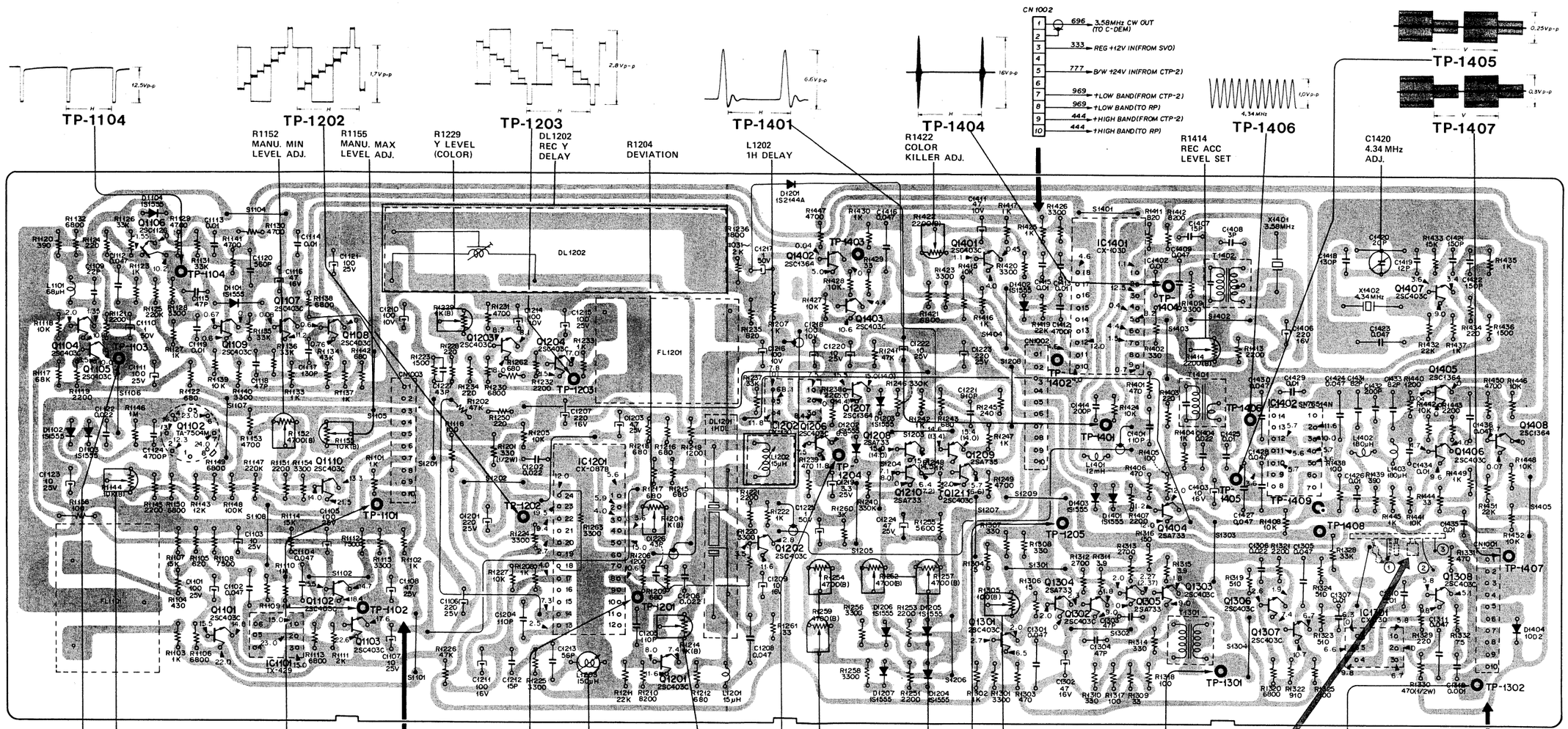

SN76514N



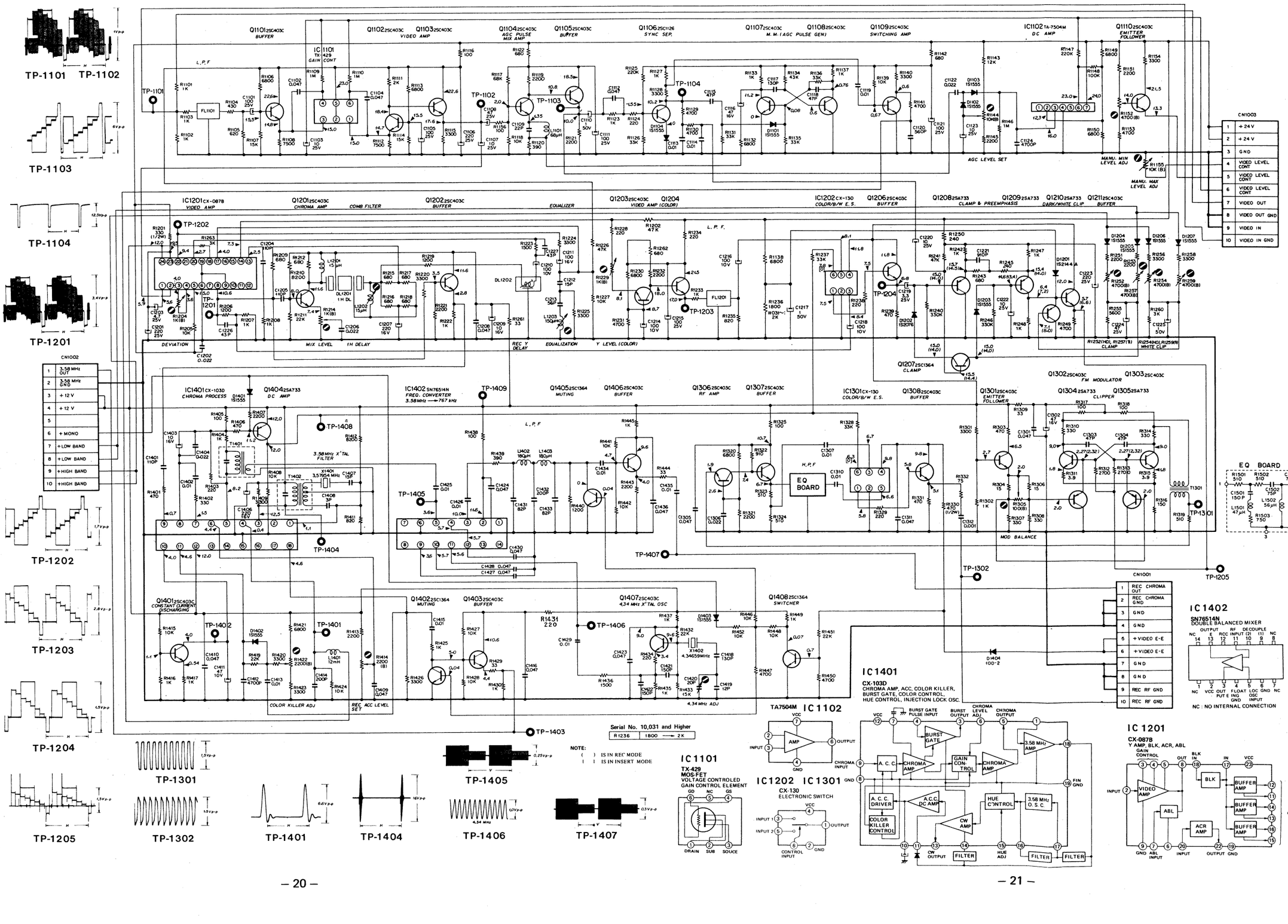

TA7122AP
TA7504M



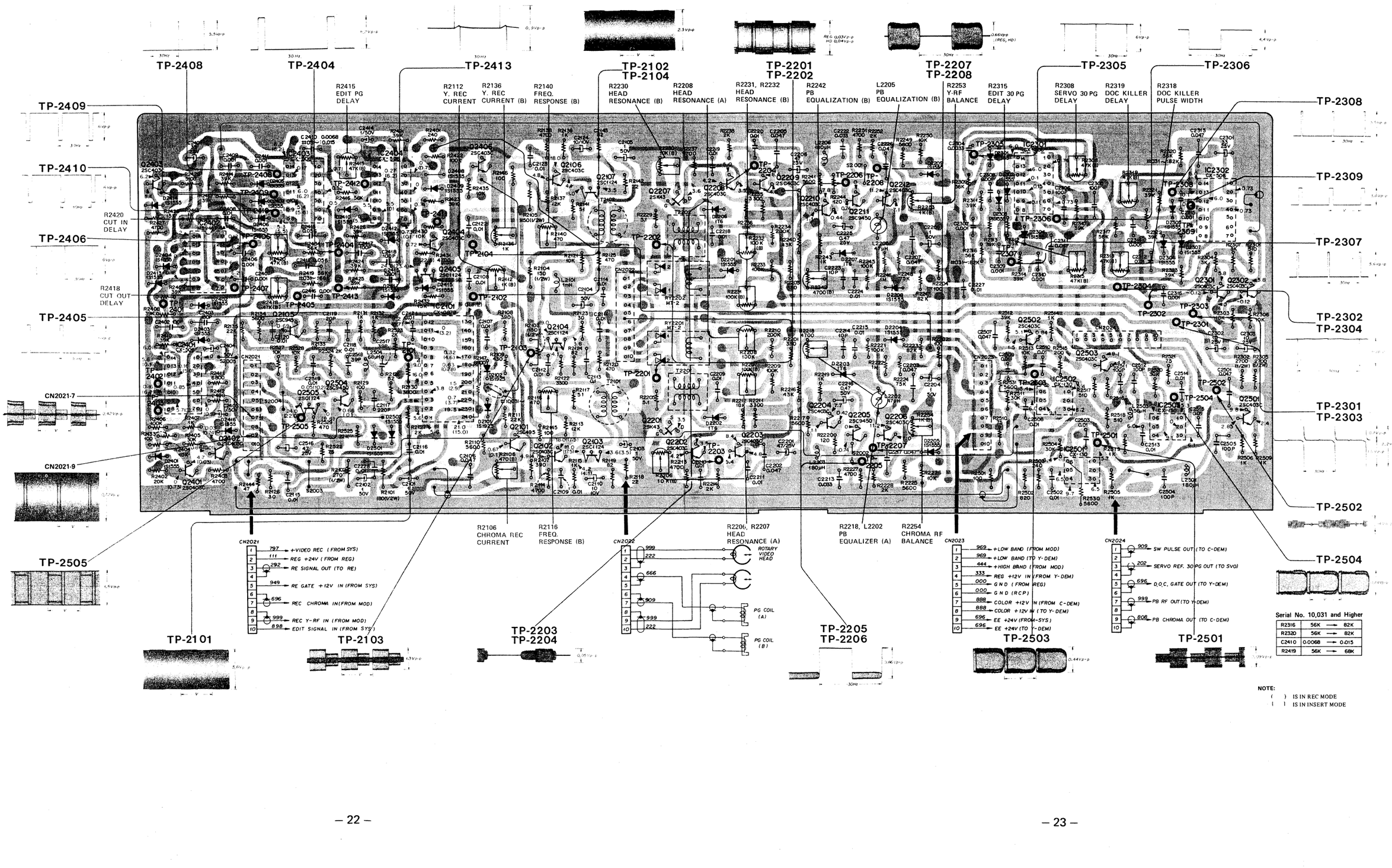
## MOD & EQ BOARD (MODULATOR) MOUNTING DIAGRAM



## MOD & EQ BOARD (MODULATOR) SCHEMATIC DIAGRAM



## RP BOARD (REC/PB AMP, BLANKING SWITCHER) MOUNTING DIAGRAM

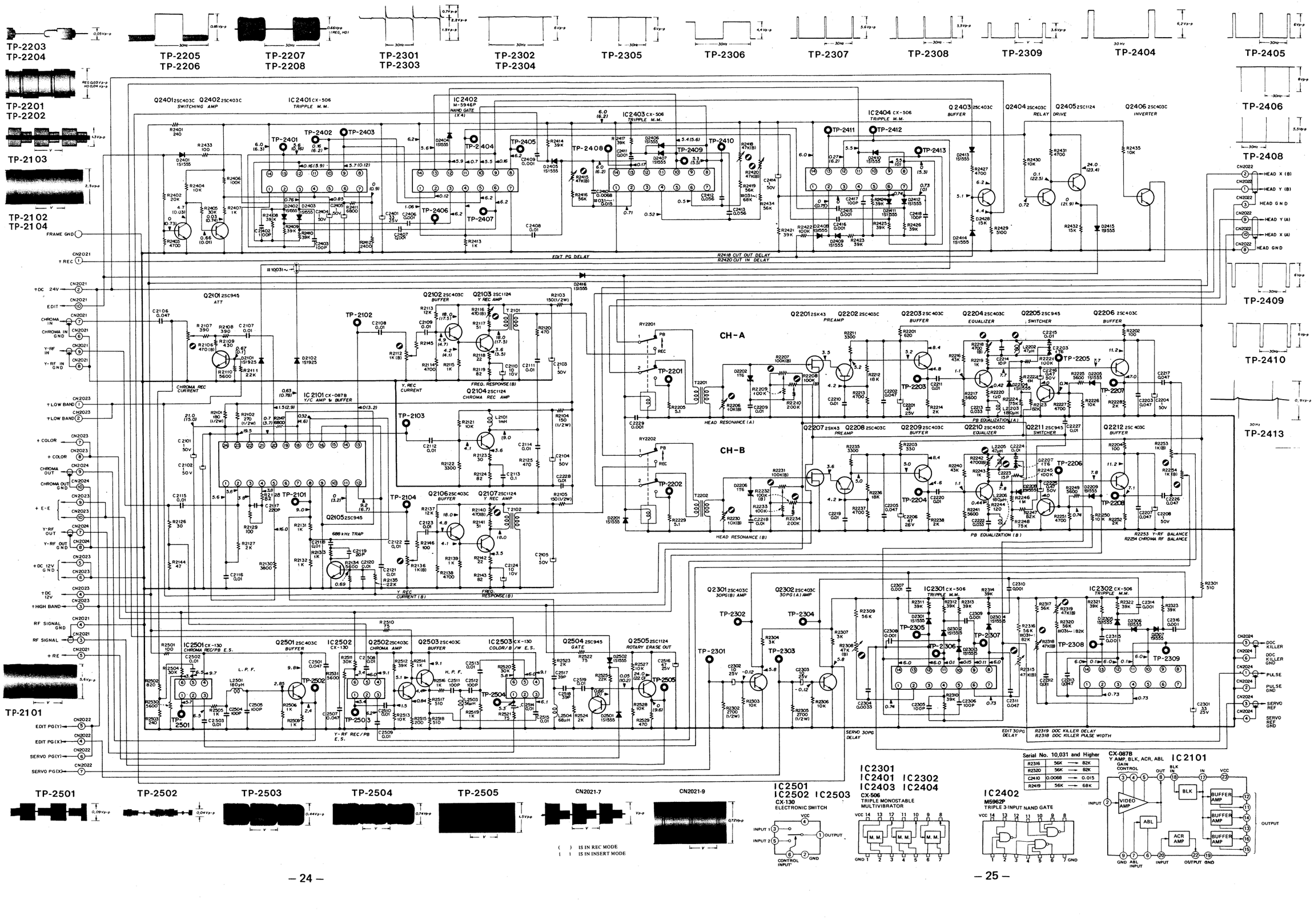



Serial No. 10,031 and Higher

| | | | |
|---|---|---|---|
| R2316 | 56K | → | 82K |
| R2320 | 56K | → | 82K |
| C2410 | 0.0068 | → | 0.015 |
| R2419 | 56K | → | 68K |

NOTE:
( ) IS IN REC MODE
[ ] IS IN INSERT MODE

## RP BOARD (REC/PB AMP, BLANKING SWITCHER) SCHEMATIC DIAGRAM




Serial No. 10,031 and Higher

| | | |
|---|---|---|
| R2316 | 56K → | 82K |
| R2320 | 56K → | 82K |
| C2410 | 0.0068 → | 0.015 |
| R2419 | 56K → | 68K |

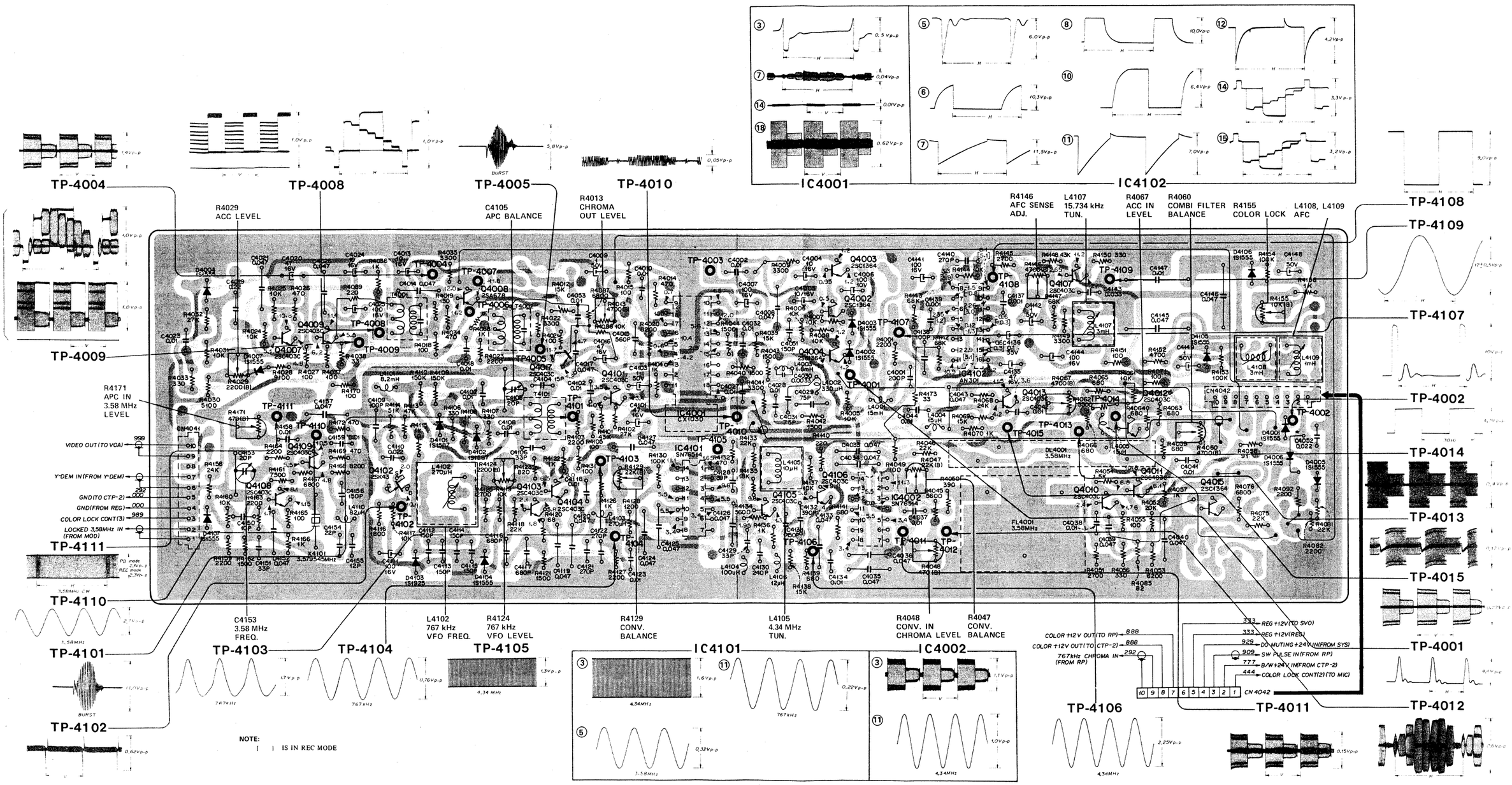
### IC2501 IC2502 IC2503
CX-130
ELECTRONIC SWITCH

### IC2301 IC2401 IC2302 IC2403 IC2404
CX-506
TRIPLE MONOSTABLE MULTIVIBRATOR

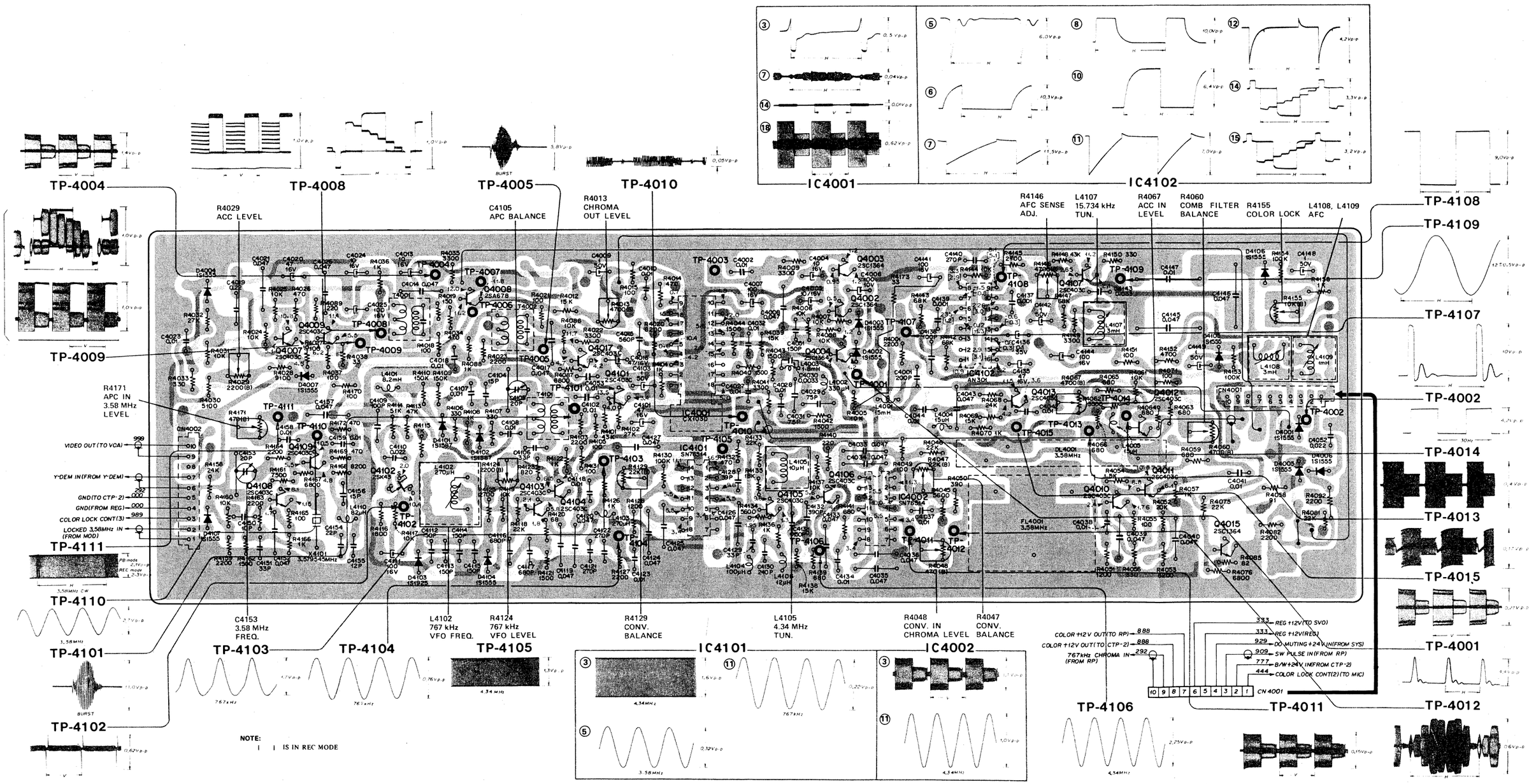
### IC2402
M5962P
TRIPLE 3-INPUT NAND GATE

### IC2101
CX-087B
Y AMP, BLK, ACR, ABL

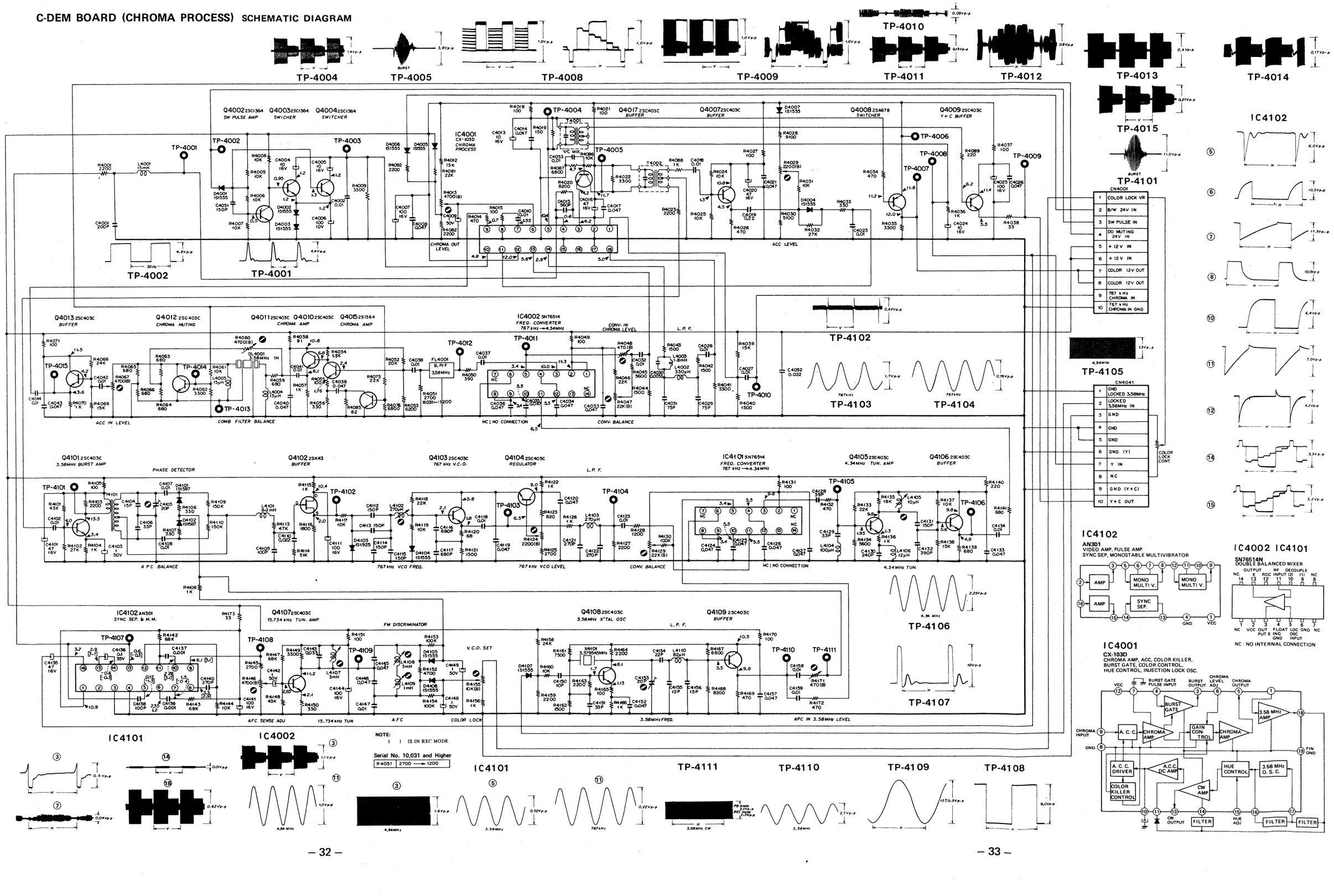
## C-DEM BOARD (CHROMA PROCESS) MOUNTING DIAGRAM



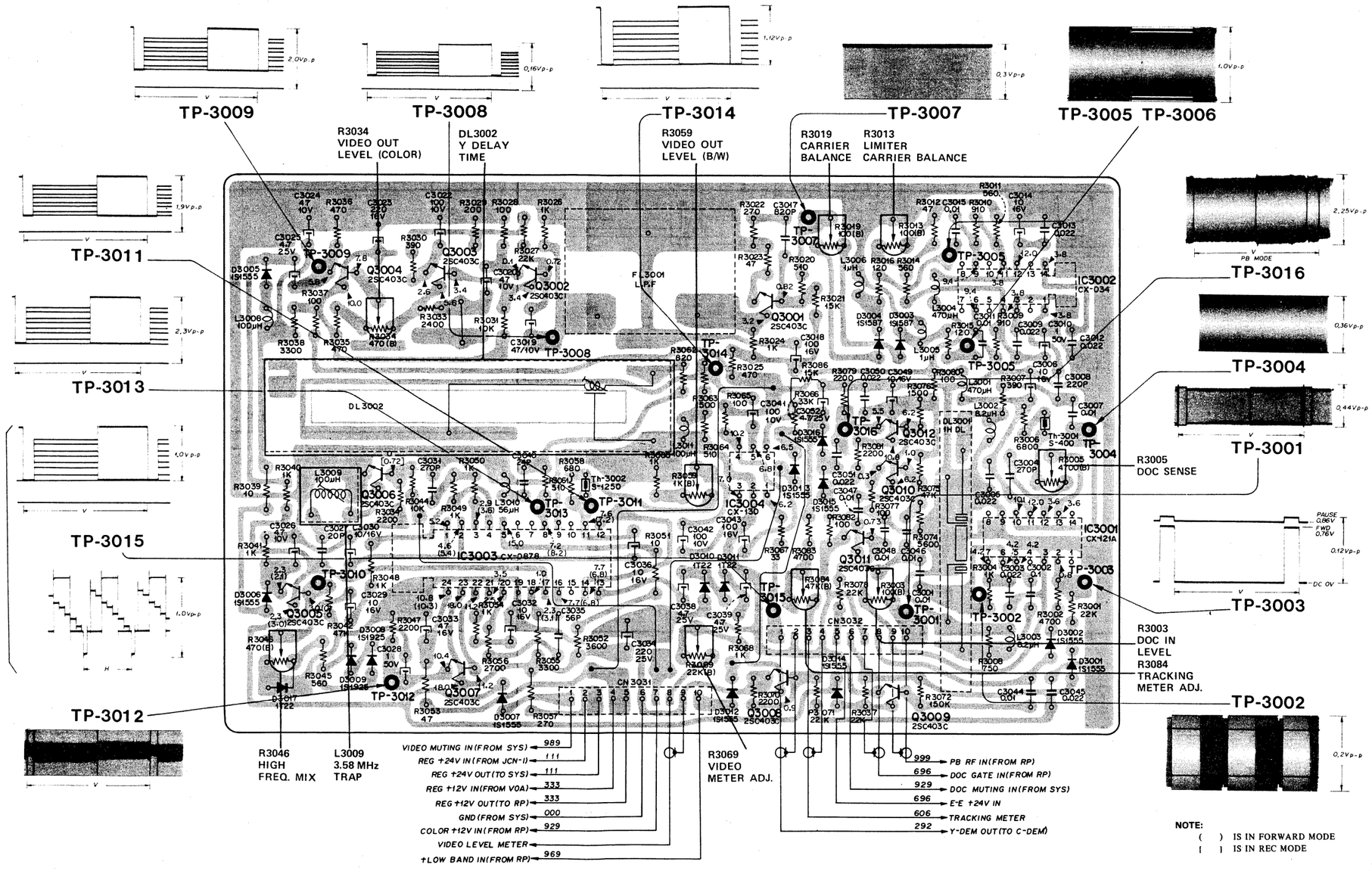
## C-DEM BOARD (CHROMA PROCESS) MOUNTING DIAGRAM Seiral No. 10,031 and Higher



## C-DEM BOARD (CHROMA PROCESS) SCHEMATIC DIAGRAM

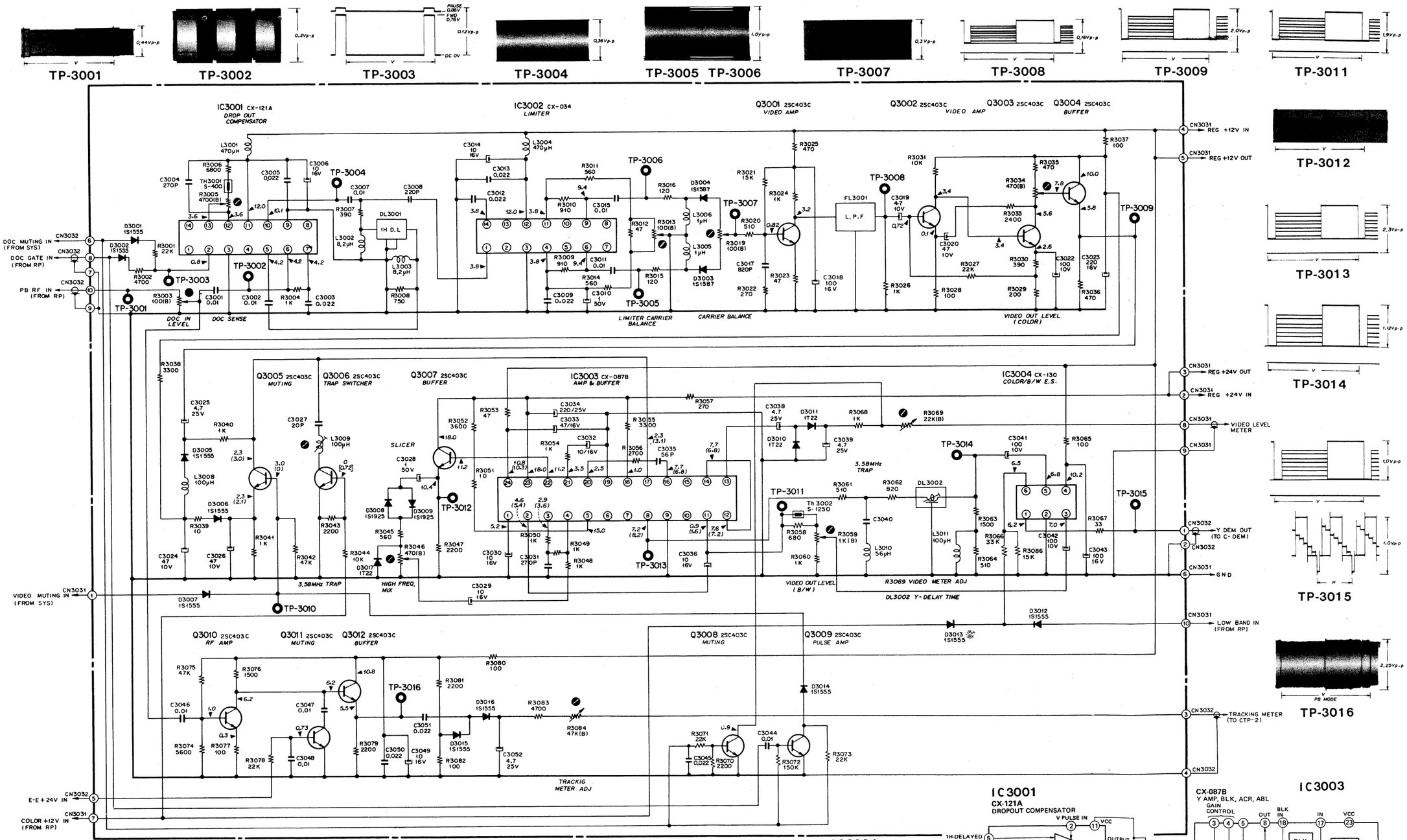


## Y-DEM BOARD (Y-FM DEMODULATOR) MOUNTING DIAGRAM



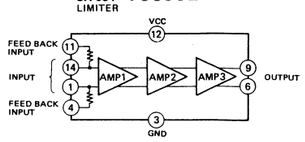

NOTE:
( ) IS IN FORWARD MODE
[ ] IS IN REC MODE

## Y-DEM BOARD (Y-FM DEMODULATOR) SCHEMATIC DIAGRAM

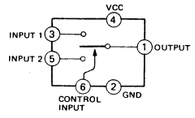



NOTE:
( ) IS IN FORWARD MODE
[ ] IS IN REC MODE

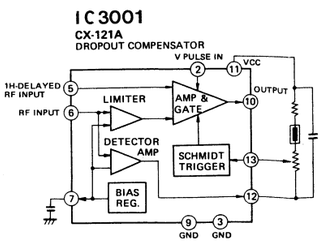
### IC3002 CX-034 LIMITER



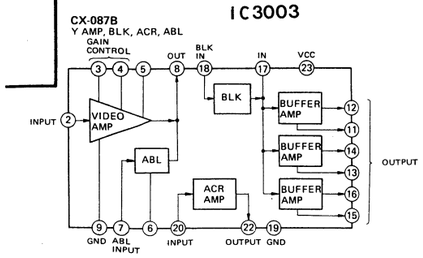

### IC3004 CX-130 ELECTRONIC SWITCH



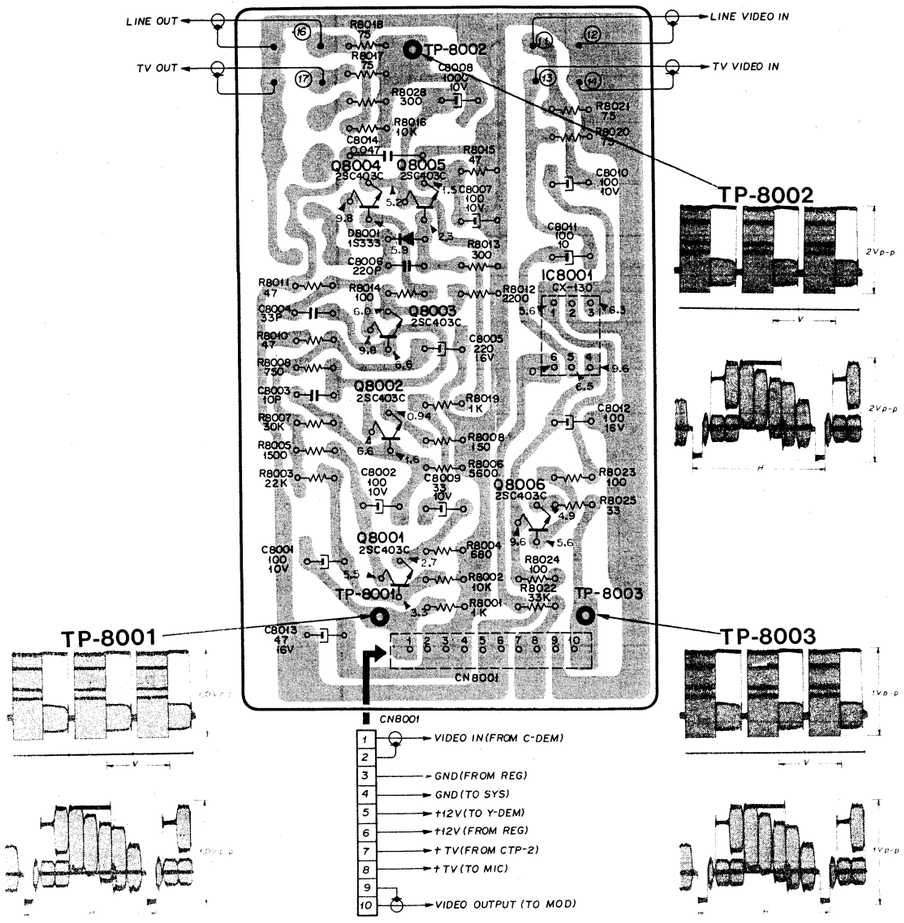

### IC3001 CX-121A DROPOUT COMPENSATOR




### IC3003 CX-087B Y AMP, BLK, ACR, ABL

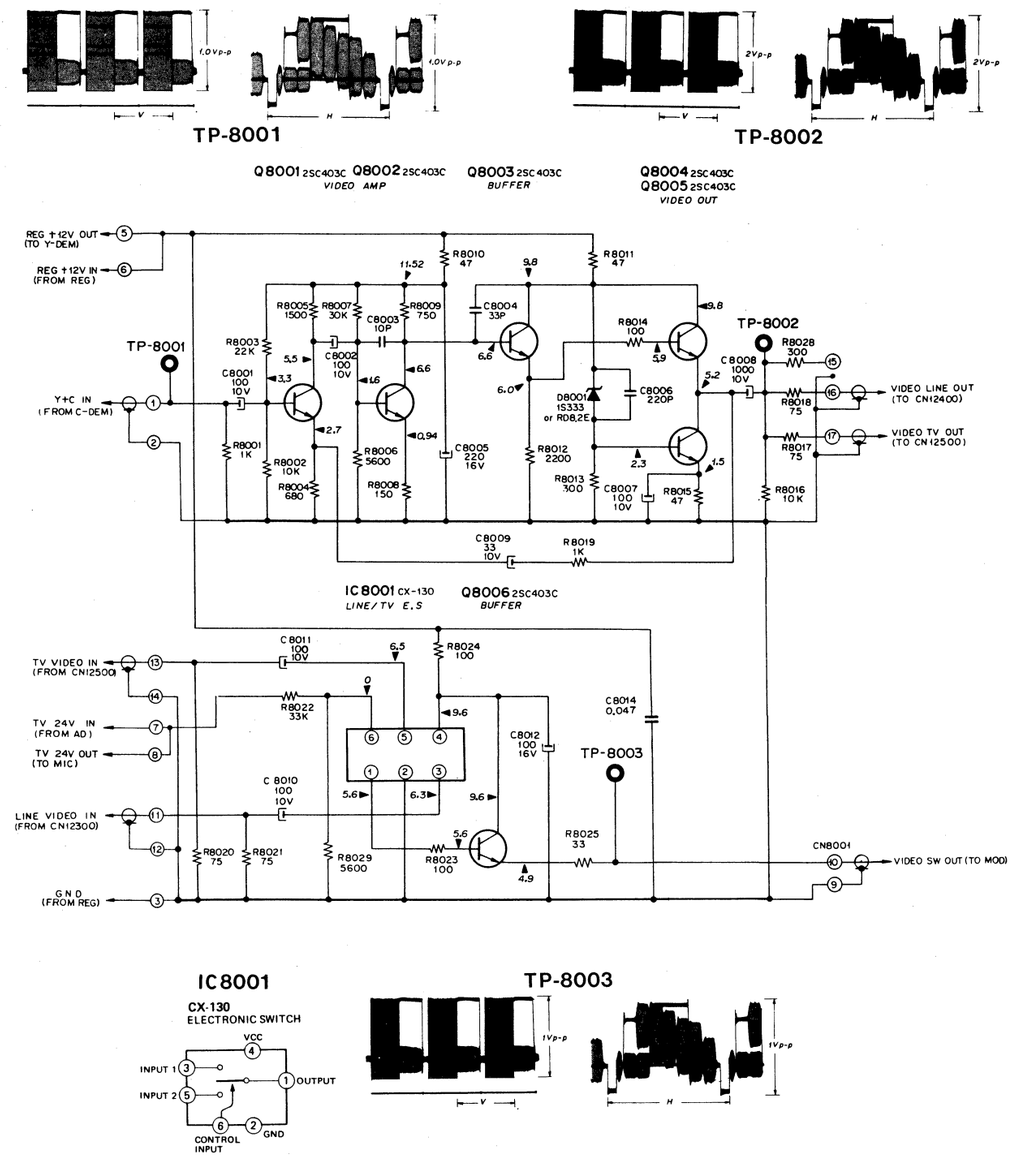


## VOA BOARD (VIDEO INPUT SELECT, OUTPUT AMP) MOUNTING DIAGRAM






## VOA BOARD (VIDEO INPUT SELECT, OUTPUT AMP) SCHEMATIC DIAGRAM



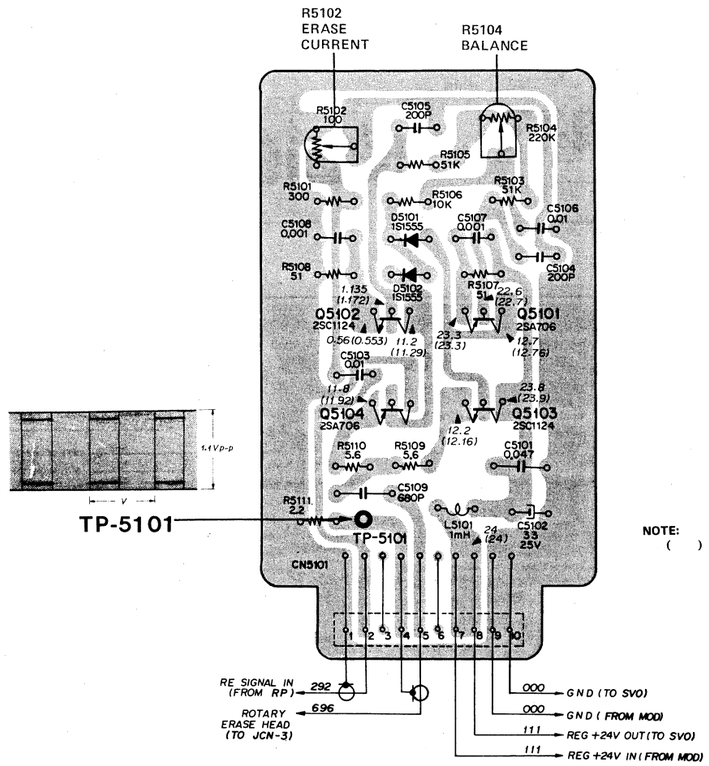

## IC8001

**CX-130**
ELECTRONIC SWITCH

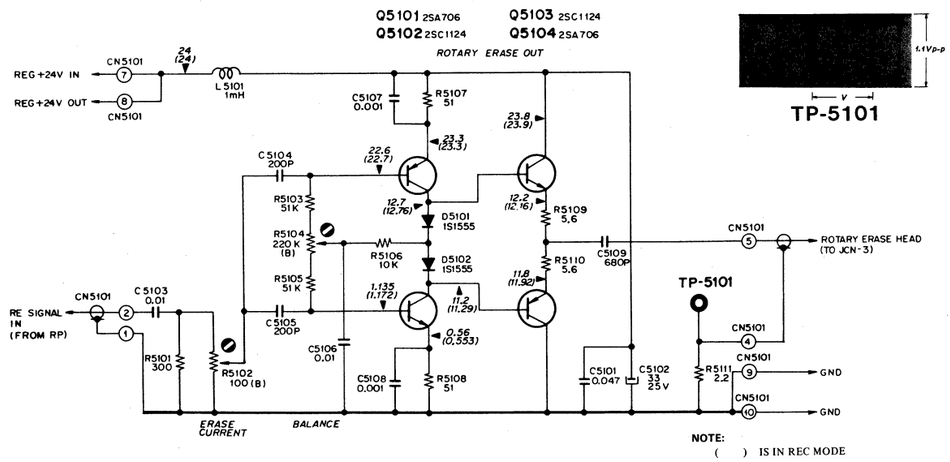



## TP-8003

## RE BOARD (ROTARY ERASE) MOUNTING & SCHEMATIC DIAGRAM



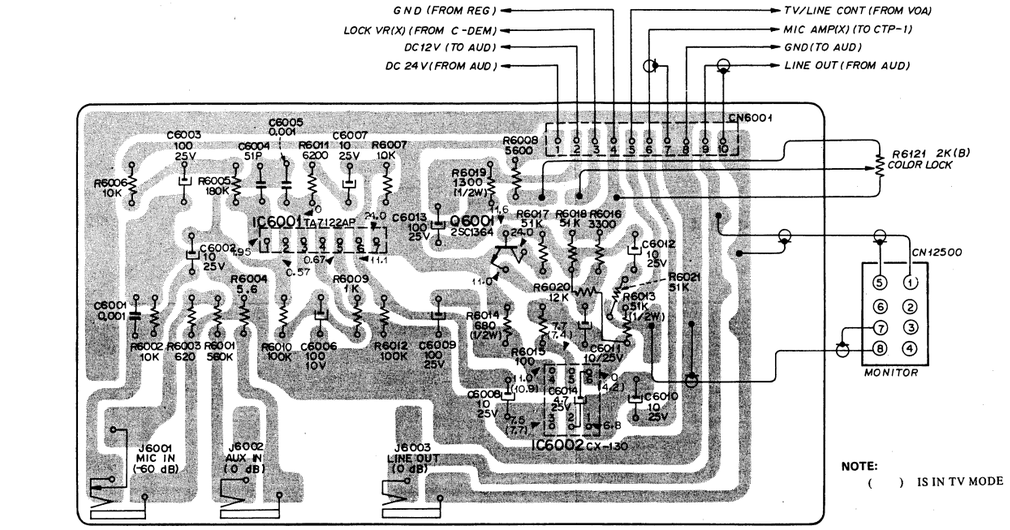

NOTE:
( ) IS IN REC MODE



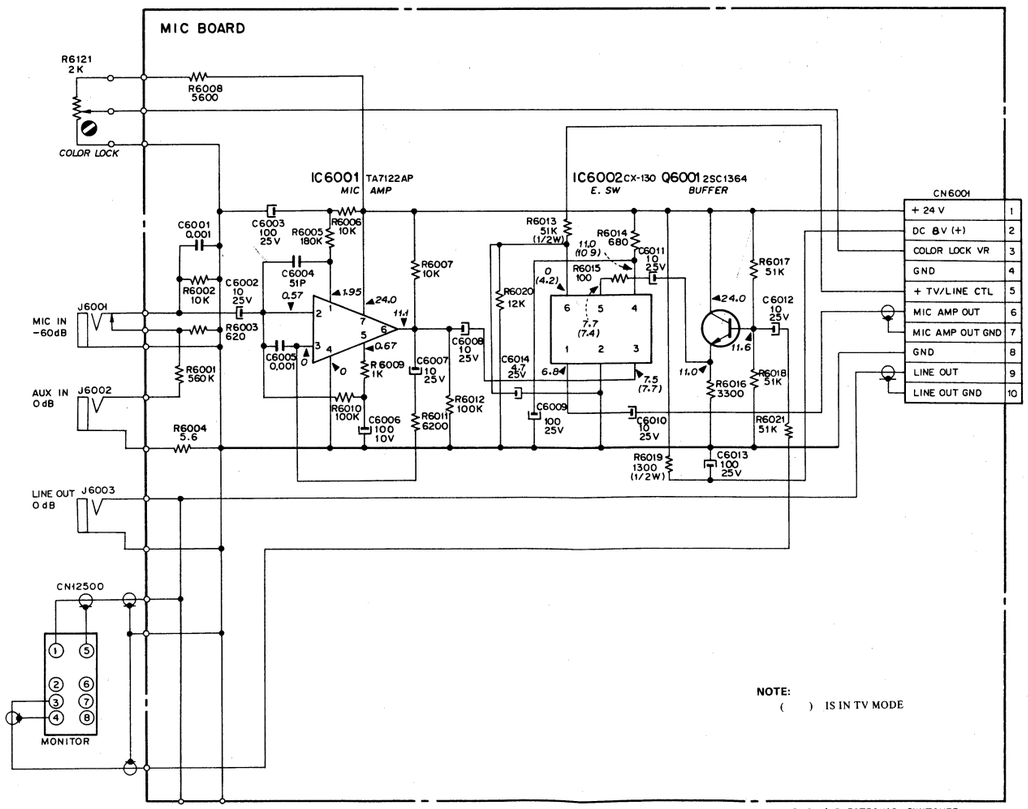

NOTE:
( ) IS IN REC MODE



## MIC BOARD (MIC AMP) MOUNTING & SCHEMATIC DIAGRAM

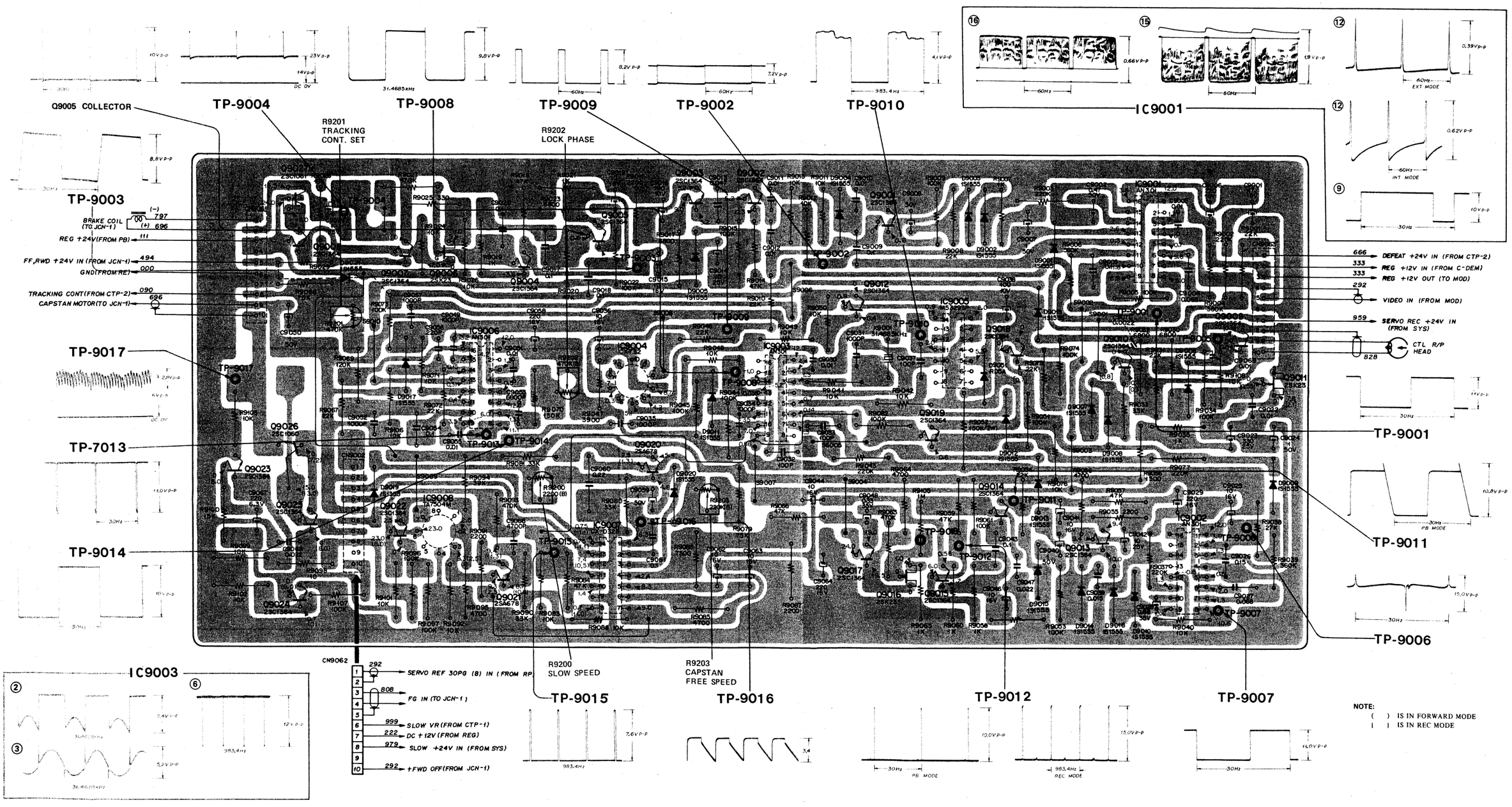



NOTE:
( ) IS IN TV MODE



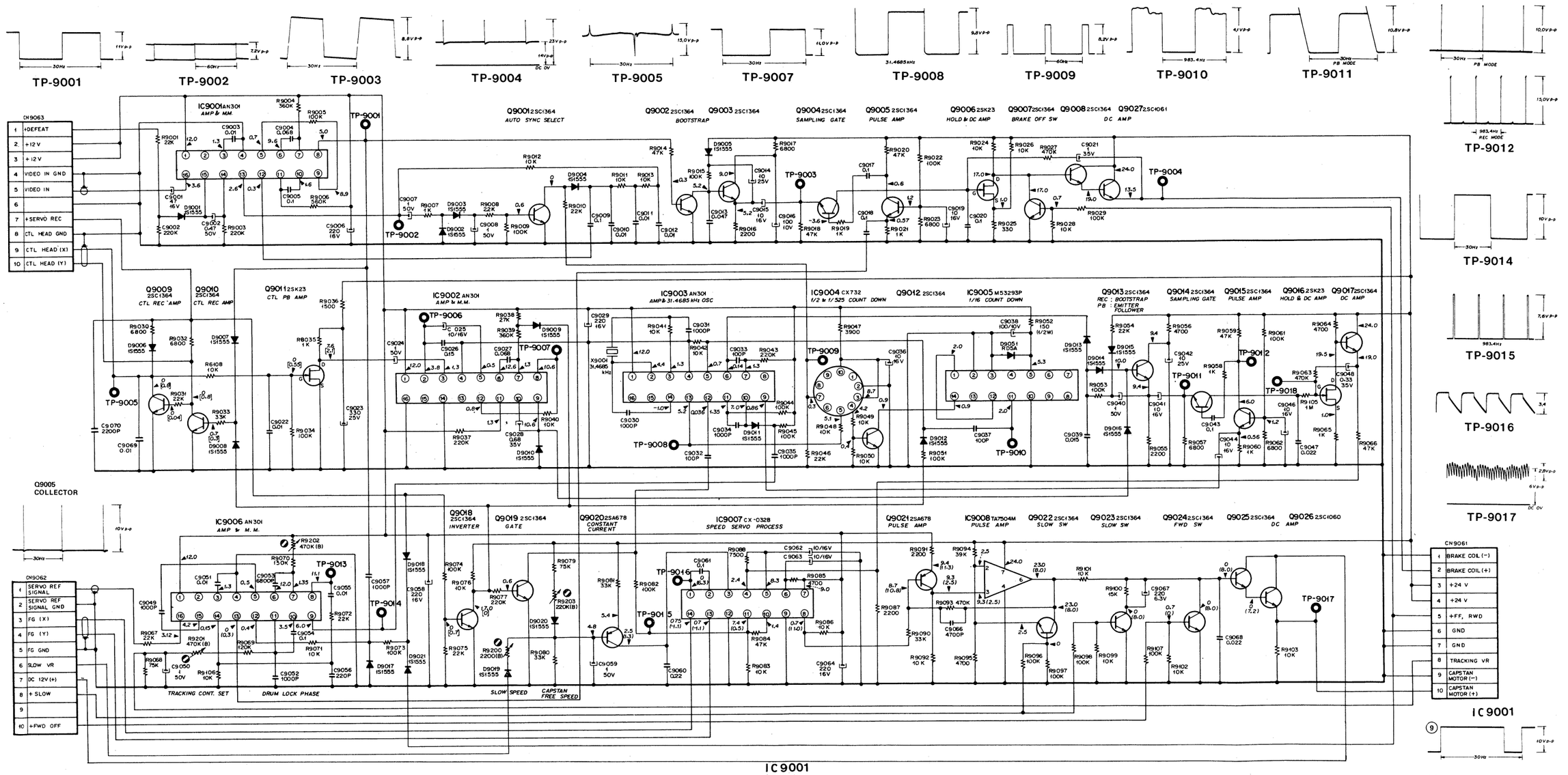

NOTE:
( ) IS IN TV MODE

## SVO BOARD (SERVO) MOUNTING DIAGRAM

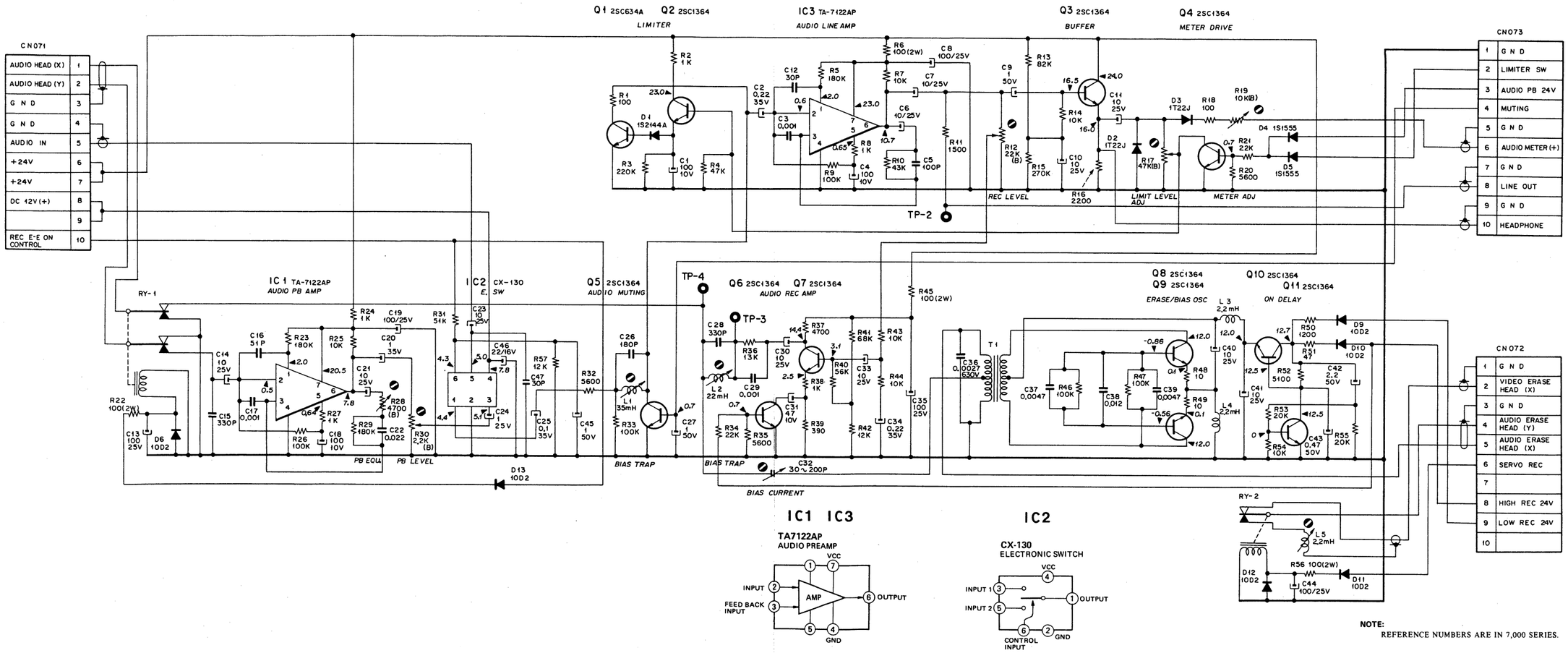



NOTE:
( ) IS IN FORWARD MODE
[ ] IS IN REC MODE

## SVO BOARD (SERVO) SCHEMATIC DIAGRAM

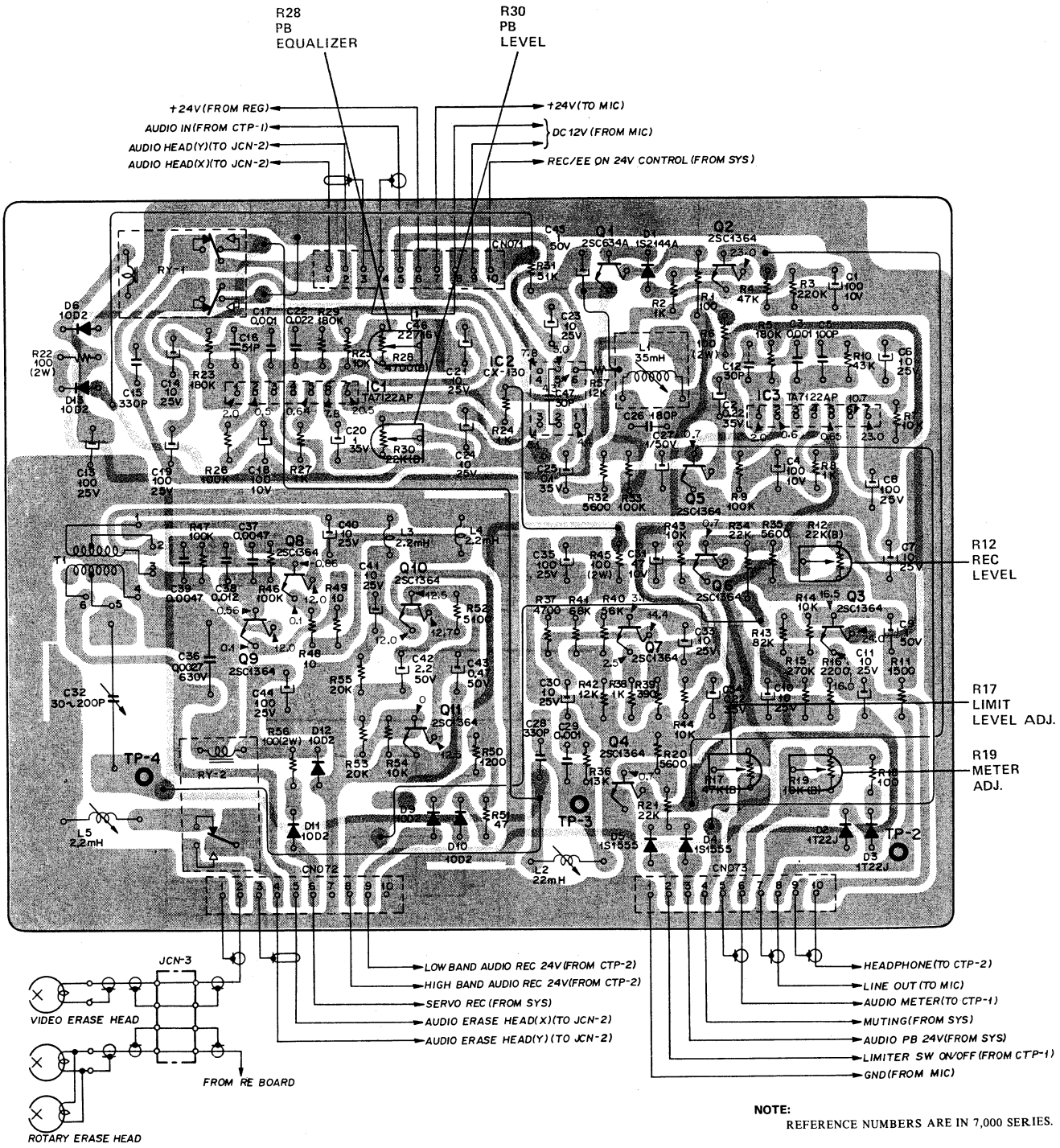


## AUD BOARD (AUDIO) SCHEMATIC DIAGRAM



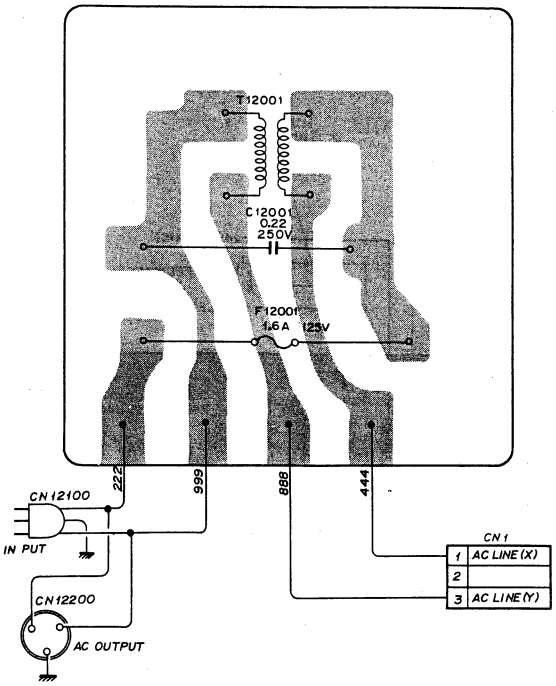

**NOTE:**
REFERENCE NUMBERS ARE IN 7,000 SERIES.

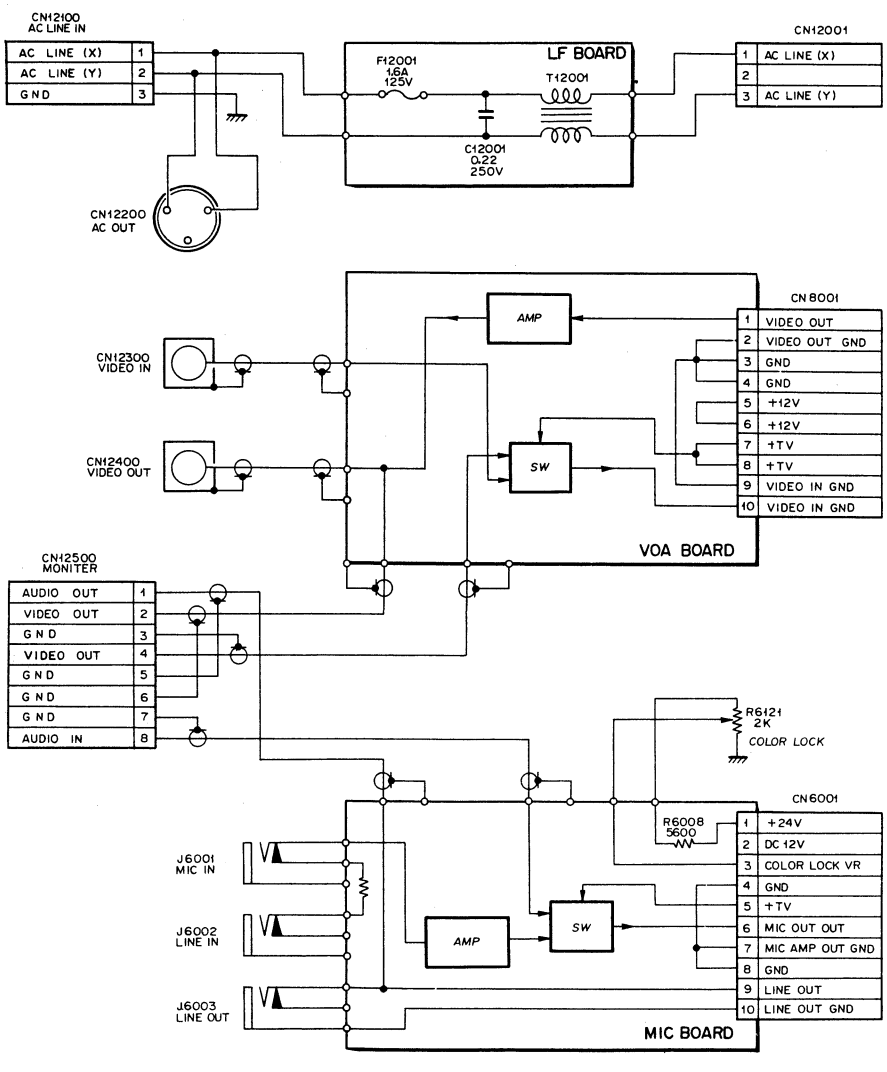
## AUD BOARD (AUDIO) MOUNTING DIAGRAM



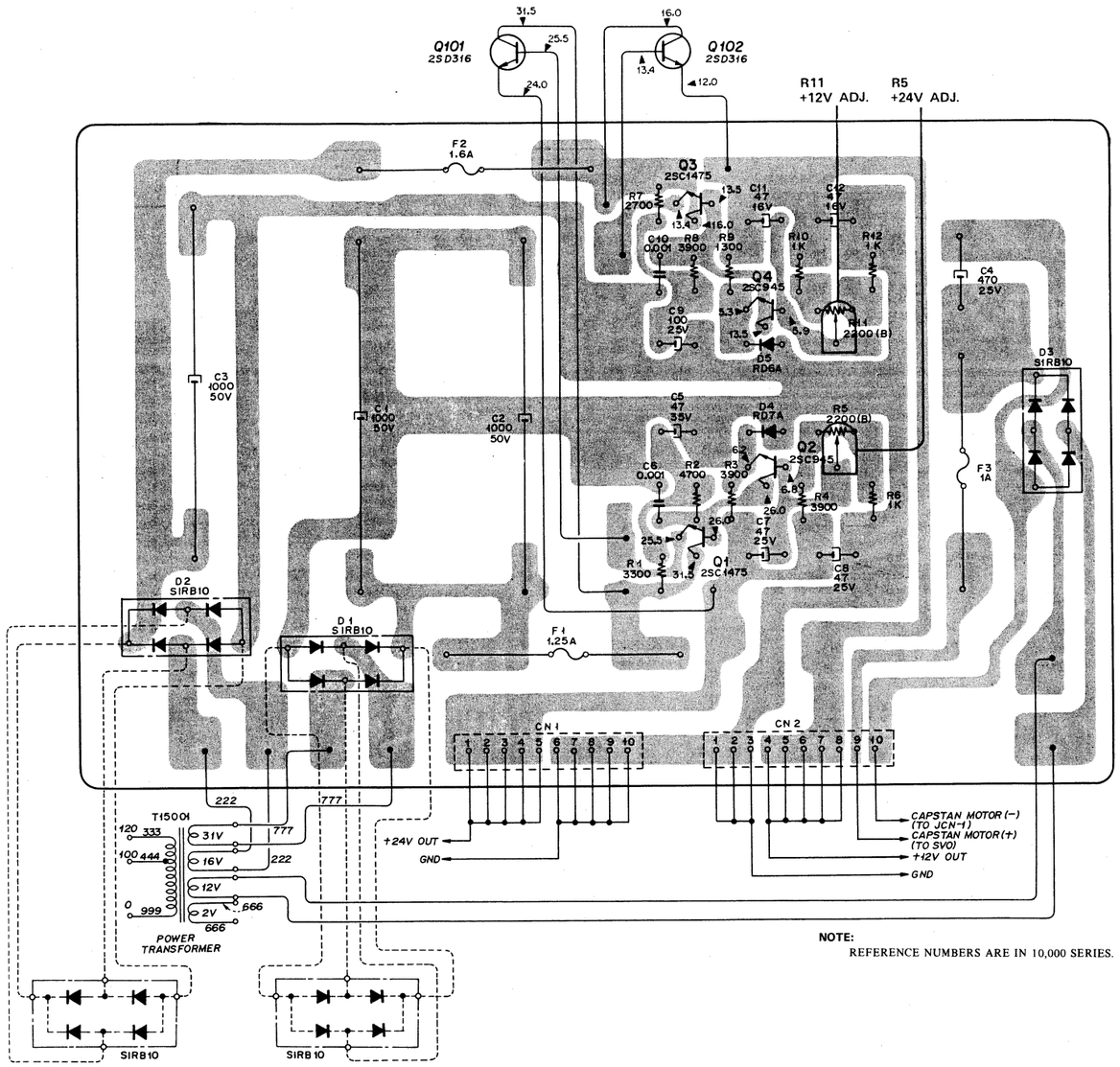

**NOTE:**
REFERENCE NUMBERS ARE IN 7,000 SERIES.

## LF BOARD (LINE FILTER)/CONNECTOR PANEL MOUNTING & SCHEMATIC DIAGRAM



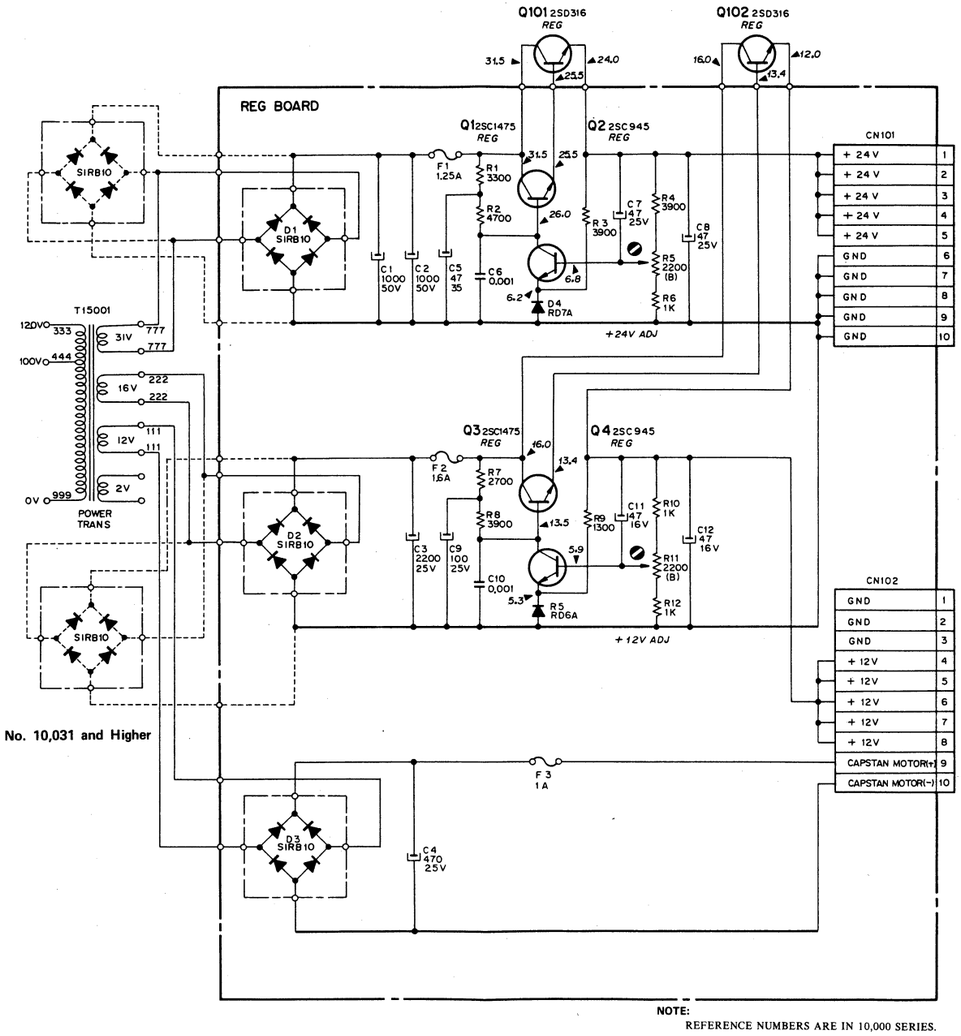
## REG BOARD (REGULATOR) MOUNTING DIAGRAM




NOTE:
REFERENCE NUMBERS ARE IN 10,000 SERIES.

Serial No. 10,031 and Higher

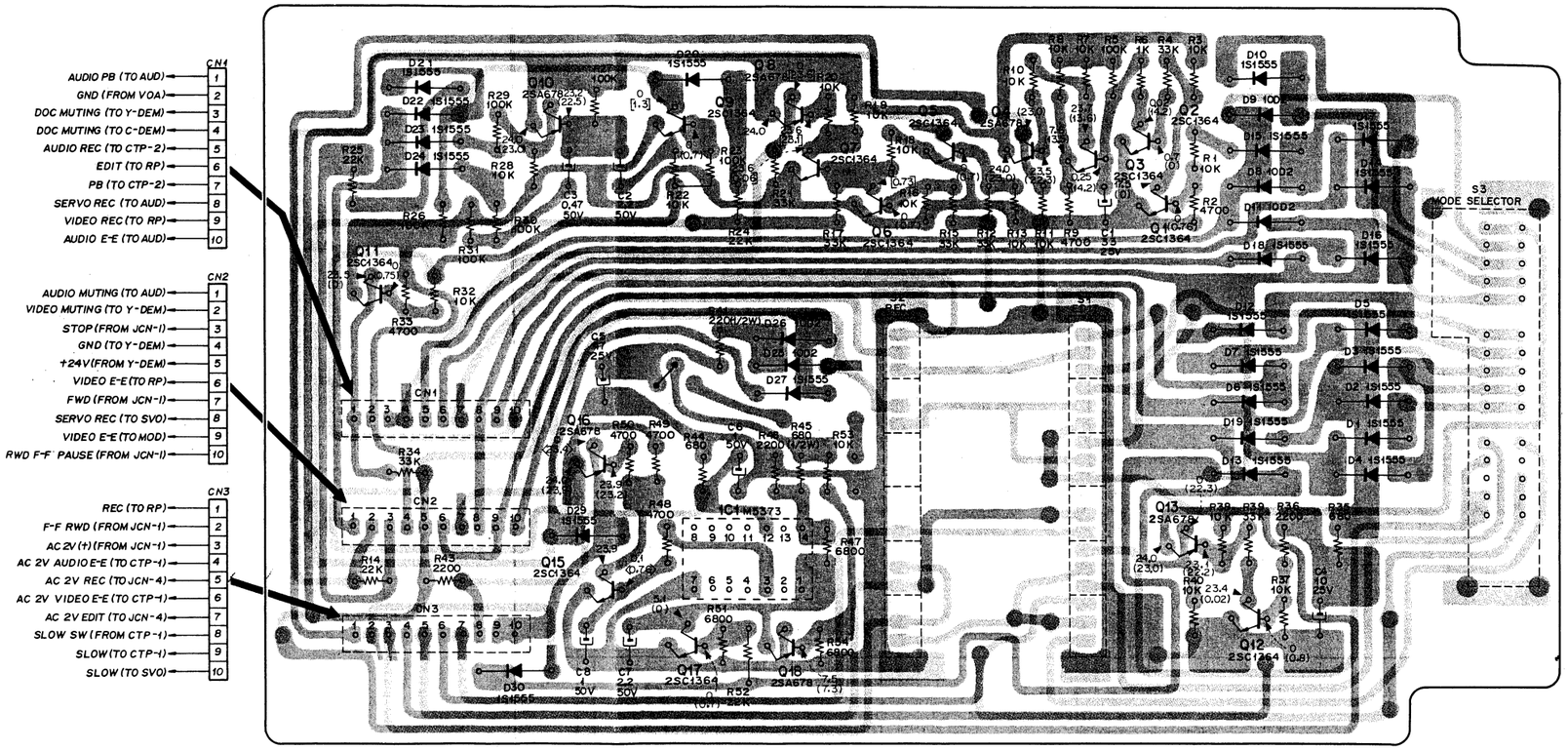
## REG BOARD (REGULATOR) SCHEMATIC DIAGRAM




Serial No. 10,031 and Higher

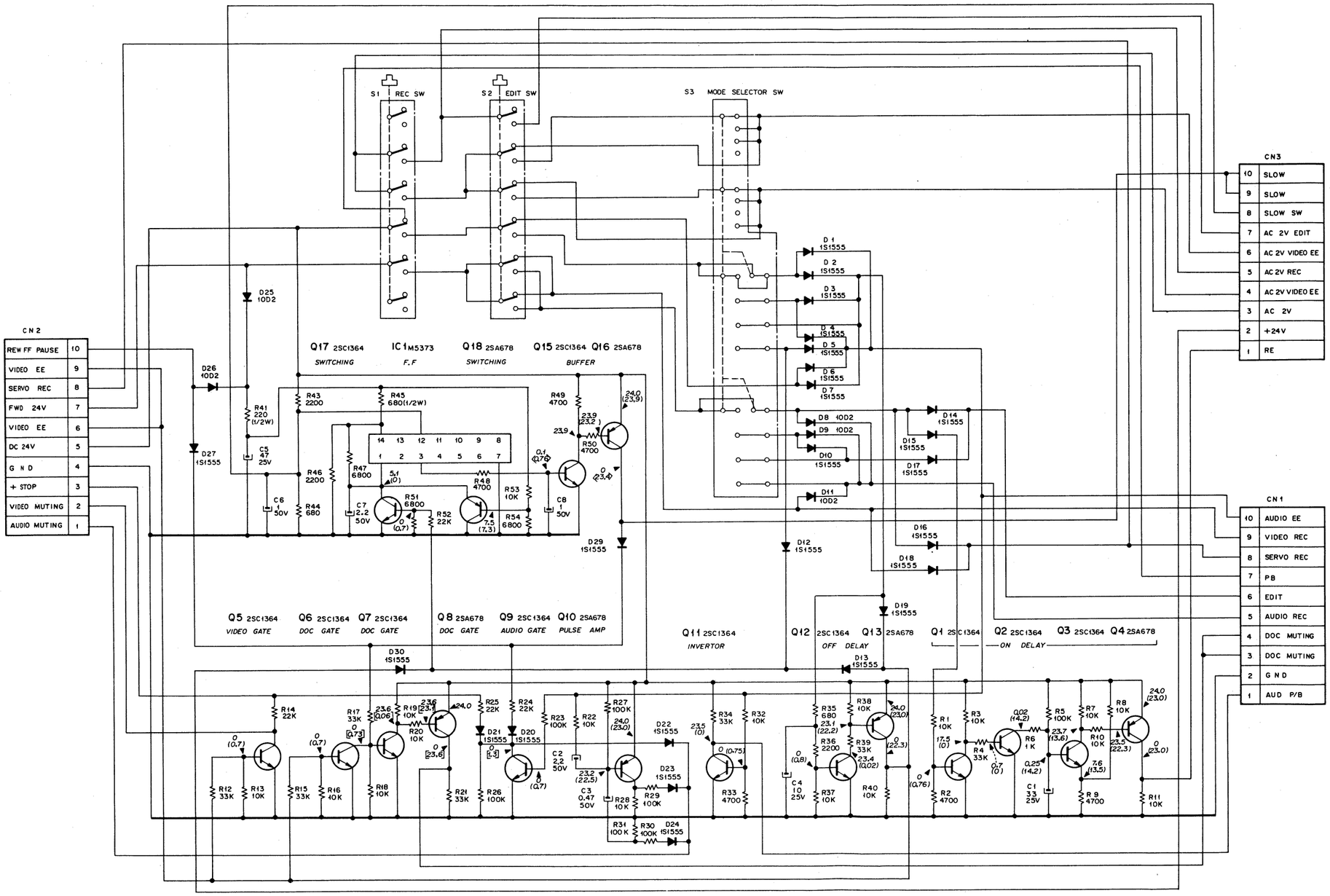
NOTE:
REFERENCE NUMBERS ARE IN 10,000 SERIES.

## SYS BOARD (SYSTEM CONTROL) MOUNTING DIAGRAM




NOTE:
REFERENCE NUMBERS ARE IN 11,000 SERIES.
( ) IS IN EDIT MODE
[ ] IS IN REW/F-F/PAUSE MODE
< > IS IN SLOW SW ON

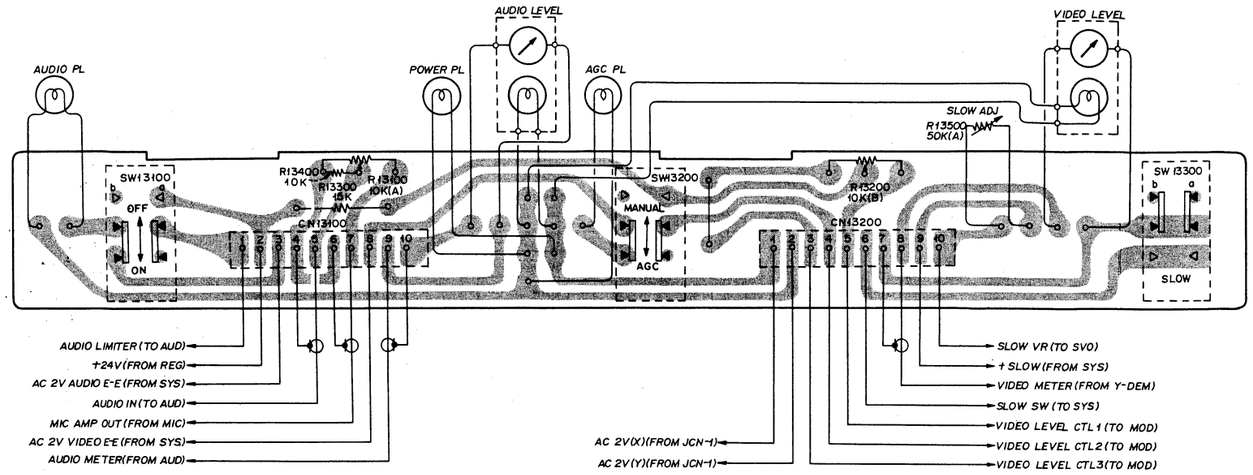
## SYS BOARD (SYSTEM CONTROL) SCHEMATIC DIAGRAM

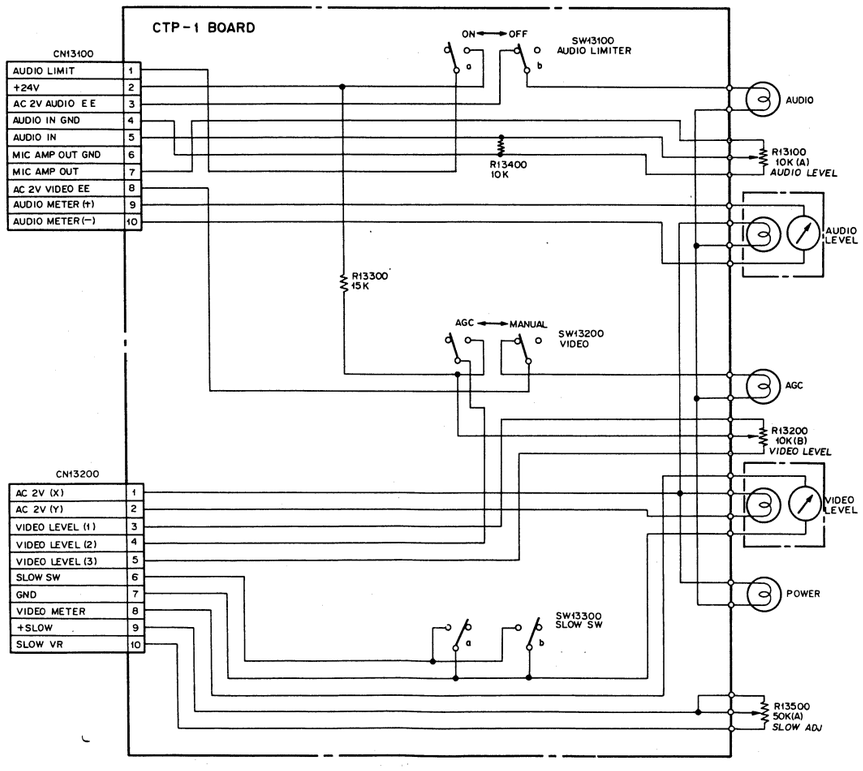



**NOTE:**

REFERENCE NUMBERS ARE IN 11,000 SERIES.
( ) IS IN EDIT MODE
[ ] IS IN REW/F-F/PAUSE MODE
< > IS IN SLOW SW ON

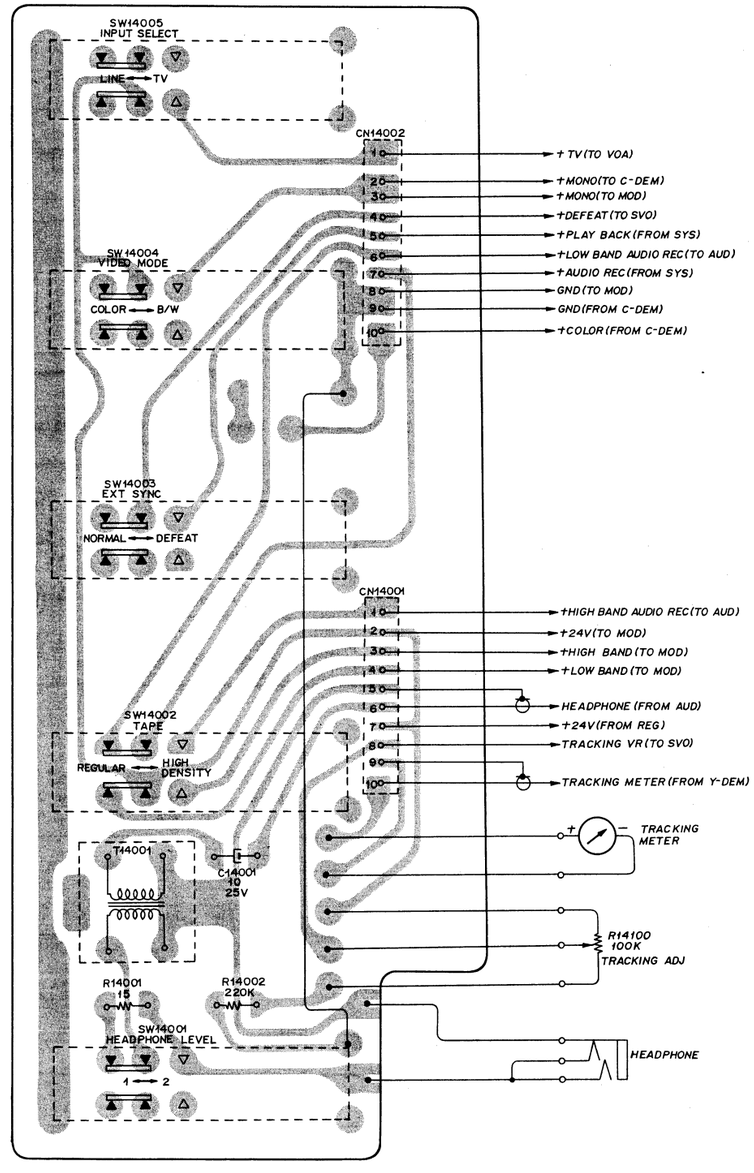
## CTP-1 BOARD MOUNTING & SCHEMATIC DIAGRAM



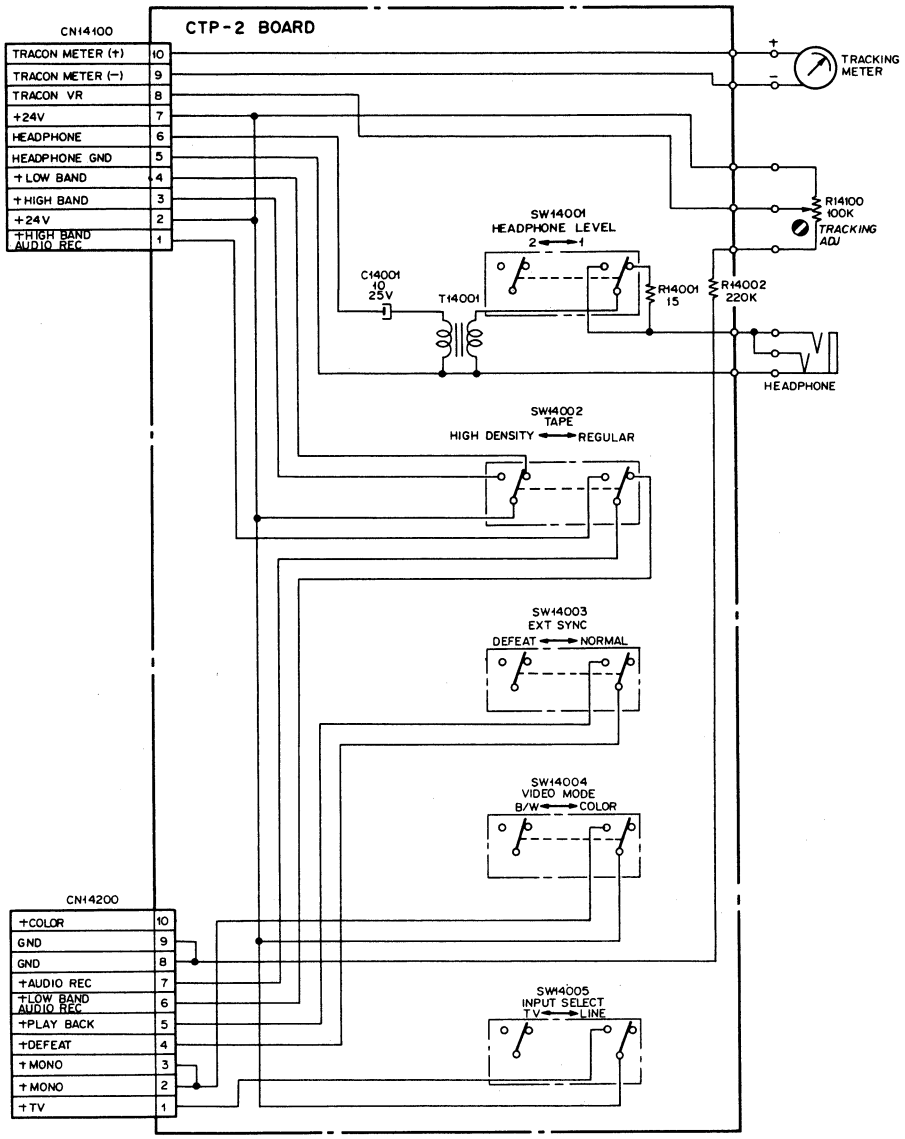





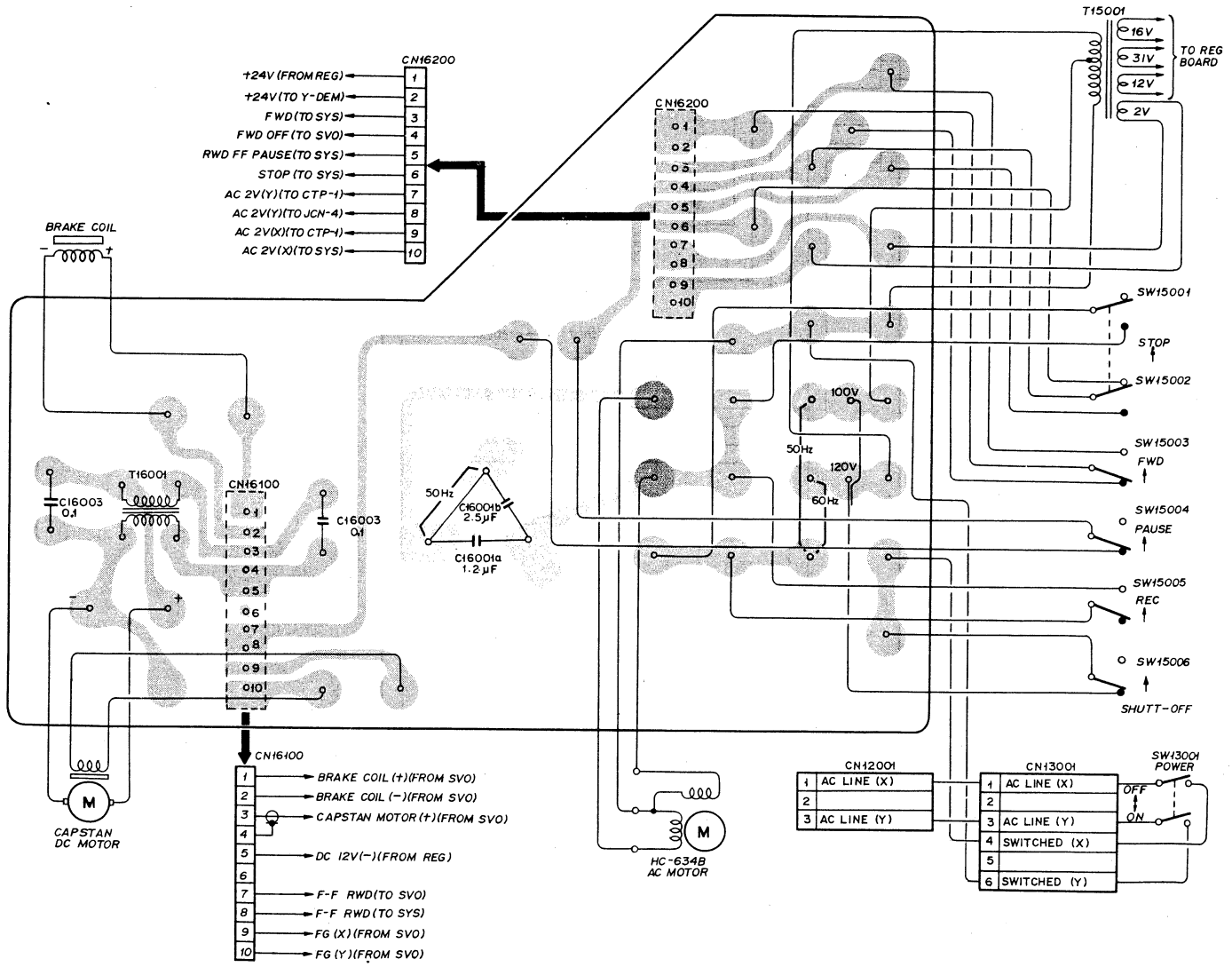

## CTP-2 BOARD (INPUT SELECT) MOUNTING DIAGRAM



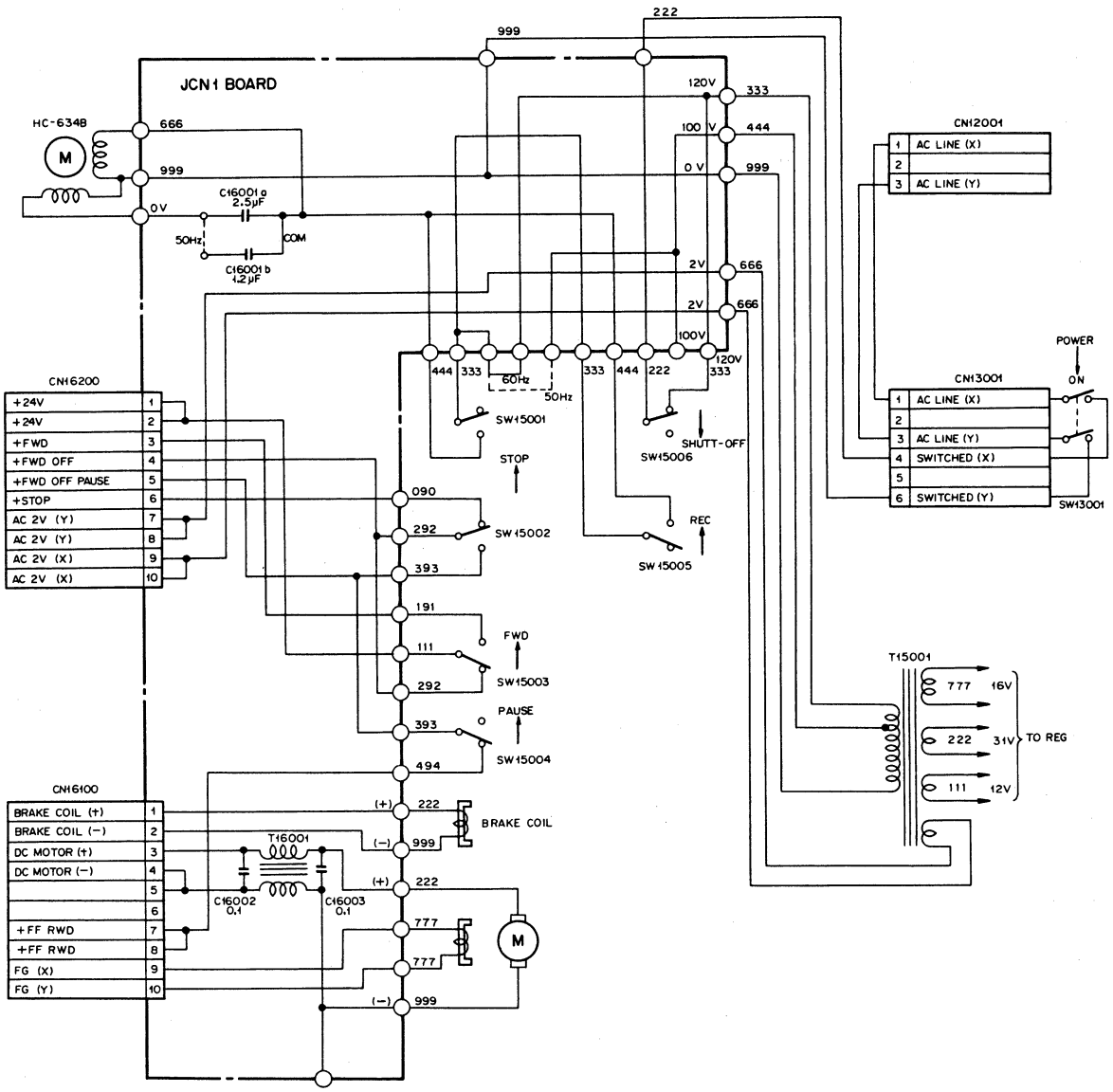
## CTP-2 BOARD (INPUT SELECT) SCHEMATIC DIAGRAM



## JCN-1 BOARD (LINE VOLTAGE/FREQUENCY) MOUNTING DIAGRAM

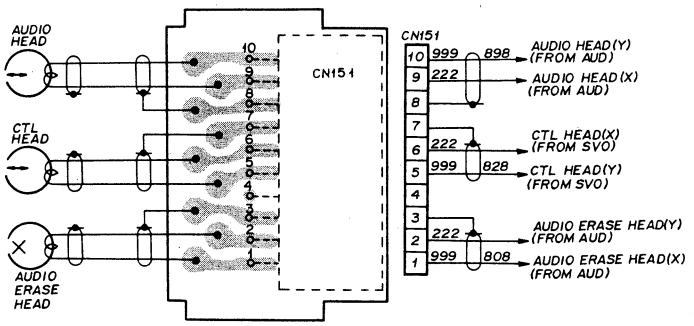


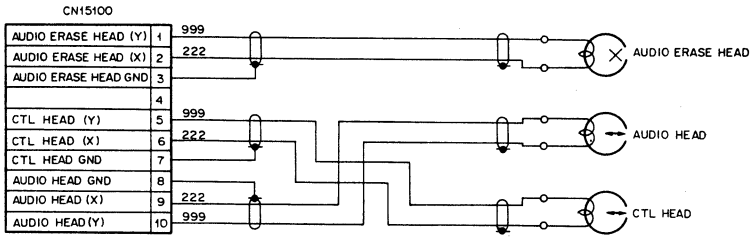
## JCN-1 BOARD (LINE VOLTAGE/FREQUENCY) SCHEMATIC DIAGRAM



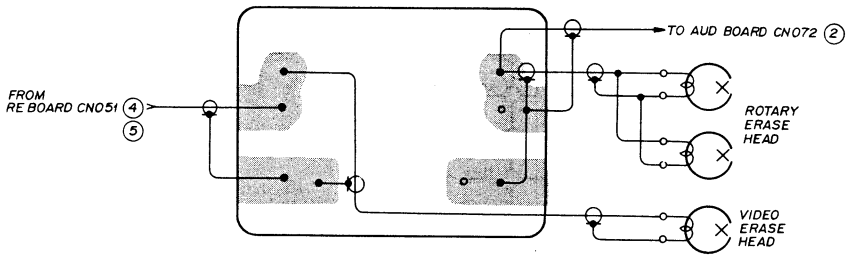
# JCN-2,3,4 Board

## JCN-2 BOARD MOUNTING & SCHEMATIC DIAGRAM

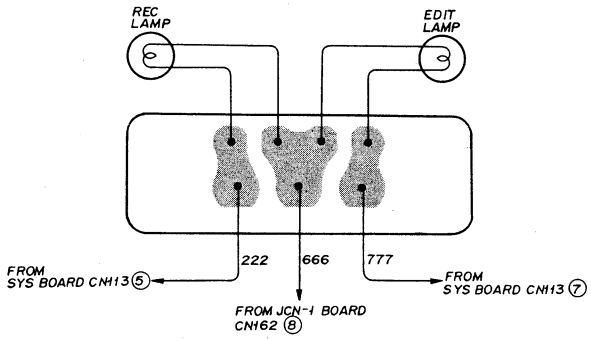



## JCN-3 BOARD MOUNTING DIAGRAM




## JCN-4 BOARD MOUNTING DIAGRAM



# FRAME WIRING

PG COIL B — 909
PG COIL A — 606
ROTARY VIDEO HEAD — 2 808, 9 808
ROTARY ERASE HEAD
ROTARY VIDEO HEAD — 2 898, 9 898
ROTARY ERASE HEAD

**Y-DEM** CN031

| | | |
|---|---|---|
| 1 | +VIDEO MUTING | 989 SYS CN112-2 |
| 2 | + 24 V | 111 JCN-1 CN162-2 |
| 3 | + 24 V | 111 SYS CN112-5 |
| 4 | + 12 V | 333 VOA CN081-6 |
| 5 | + 12 V | 333 RP CN023-4 |
| 6 | GND | 000 SYS CN112-4 |
| 7 | + COLOR | 888 RP CN023-8 |
| 8 | VIDEO METER (+) | 999 CTP-1 CN132-7,8 |
| 9 | VIDEO METER (-) | RP CN023-2 |
| 10 | + LOW BAND | 969 |

CN032

| | | |
|---|---|---|
| 1 | Y-DEM OUT | C-DEM CN041-6,7 292 |
| 2 | Y-DEM OUT GND | |
| 3 | TRACKING METER(+) | CTP-2 CN141-9,10 606 |
| 4 | TRACKING METER(-) | |
| 5 | +VIDEO E-E | RP CN021-8,9 |
| 6 | DOC MUTING | CN011-3 929 |
| 7 | DOC GATE GND | SYS |
| 8 | DOC GATE | CN084-5,6 696 RP |
| 9 | PB RF GND | |
| 10 | PB RF | CN024-7,8 999 RP |

**C-DEM** CN041

| | | |
|---|---|---|
| 1 | 3.58MHz GND | |
| 2 | 3.58MHz | MOD CN012-1,2 696 |
| 3 | COLOR LOCK VR-3) | REG CN102-1 |
| 4 | GND | CTP-2 CN142-9 000 |
| 5 | GND | |
| 6 | Y IN GND | Y-DEM CN032-1,2 292 |
| 7 | Y IN | |
| 8 | COLOR LOCK VR+) | |
| 9 | VIDEO OUT GND | |
| 10 | VIDEO OUT | VOA CN081-1,2 999 |

CN042

| | | |
|---|---|---|
| 1 | COLOR LOCK VR | MIC CN091-3 444 |
| 2 | + MONO | CTP-2 CN142-2 777 |
| 3 | SWITCHING PULSE | RP CN024-1 909 |
| 4 | DOC MUTING | SYS CN111-4 929 |
| 5 | + 12 V | REG CN102-6 333 |
| 6 | + 12 V | SVO CN063-2 333 |
| 7 | + COLOR | RP CN023-7 888 |
| 8 | + TV | CTP-2 CN142-10 888 |
| 9 | VIDEO INPUT GND | RP CN024-9,10 292 |
| 10 | VIDEO INPUT | |

**VOA** CN081

| | | |
|---|---|---|
| 1 | VIDEO OUTPUT | C DEM CN041-9,10 999 |
| 2 | VIDEO OUTPUT GND | |
| 3 | GND | REG CN102-2 000 |
| 4 | GND | SYS CN111-2 000 |
| 5 | +12 V | REG CN102-7 333 |
| 6 | +12 V | Y-DEM CN031-4 333 |
| 7 | + TV | CTP-2 CN142-10 999 |
| 8 | + TV | MIC CN091-5 999 |
| 9 | VIDEO INPUT GND | MOD CN013-9,10 |
| 10 | VIDEO INPUT | |

**RE** CN051

| | | |
|---|---|---|
| 1 | RE SIG. GND | |
| 2 | RE SIG. | RP CN021-3,4 292 |
| 3 | | |
| 4 | ROTARY ERASE HEAD(Y) | JCN-3 CN152-4 696 |
| 5 | ROTARY ERASE HEAD(X) | |
| 6 | | MOD CN013-2 111 |
| 7 | + 24 V | SVO CN061-3 111 |
| 8 | + 24 V | MOD CN011-7 000 |
| 9 | GND | SVO CN061-6 000 |
| 10 | GND | |

**REG** CN101

| | | |
|---|---|---|
| 1 | + 24 V | RP CN021-2 111 |
| 2 | + 24 V | CTP-2 CN141-4 111 |
| 3 | + 24 V | AUD CN071-6 111 |
| 4 | + 24 V | JCN-1 CN162-1 111 |
| 5 | + 24 V | CTP-1 CN131-2 111 |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | MIC CN091-4 000 |
| 10 | GND | |

CN102

| | | |
|---|---|---|
| 1 | GND | C-DEM CN041-4 000 |
| 2 | GND | VOA CN081-3 000 |
| 3 | GND | RP CN023-5 000 |
| 4 | | |
| 5 | + 12 V | C-DEM CN042-5 333 |
| 6 | + 12 V | VOA CN081-5 333 |
| 7 | | |
| 8 | | SVO CN062-7 222 |
| 9 | DC 12 V (+) | JCN1 CN161-5 898 |
| 10 | DC 12 V (-) | |

VIDEO ERASE HEAD — JCN-3: 999, 696
REC LAMP, EDIT LAMP — JCN-4: 222, 666, 777

**RP**
CNO21

| | | |
|---|---|---|
| 1 | +VIDEO REC | 797 — SYS CN111-9 |
| 2 | + 24 V | 111 — REG CN101-1 |
| 3 | RE SIG | 292 — RE CN051-1,2 |
| 4 | RE SIG GND | |
| 5 | + RE | 999 — SYS CN113-1 |
| 6 | REC CHROMA GND | |
| 7 | REC CHROMA | 696 — MOD CN011-1,2 |
| 8 | REC RF GND | |
| 9 | REC RF | 999 — MOD CN011-9,10 |
| 10 | + EDIT | 898 — SYS CN111-6 |

CNO22

| | | |
|---|---|---|
| 1 | VIDEO HEAD (Y) | 9 898 |
| 2 | VIDEO HEAD (X) | 2 898 |
| 3 | VIDEO HEAD GND | |
| 4 | PG A (X) | 606 |
| 5 | PG A (Y) | |
| 6 | PG B (Y) | |
| 7 | PG B (X) | 909 |
| 8 | VIDEO HEAD GND | |
| 9 | VIDEO HEAD (Y) | 9 808 |
| 10 | VIDEO HEAD (X) | 2 808 |

CNO23

| | | |
|---|---|---|
| 1 | +LOW BAND | 969 — MOD CN012-8 |
| 2 | +LOW BAND | 969 — Y-DEM CN031-10 |
| 3 | +HIGH BAND | 444 — MOD CN012-10 |
| 4 | +12 V | 333 — Y-DEM CN031-5 |
| 5 | GND | 000 — REG CN102-3 |
| 6 | GND | |
| 7 | +COLOR | 888 — C-DEM CN042-7 |
| 8 | +COLOR | 888 — Y-DEM CN031-7 |
| 9 | +VIDEO E-E | 696 — SYS CN112-6 |
| 10 | +VIDEO E-E | 696 — Y-DEM CN032-5 |

CNO24

| | | |
|---|---|---|
| 1 | SWITCHING PULSE | 909 — C-DEM CN042-3 |
| 2 | SWITCHING PULSE GND | |
| 3 | SERVO REF SIGNAL | 202 — SVO CN062-1,2 |
| 4 | SERVO REF SIGNAL GND | |
| 5 | D·O·C GATE | 696 — Y-DEM CN032-7,8 |
| 6 | D·O·C GATE GND | |
| 7 | PB RF | 999 — Y-DEM CN032-9,10 |
| 8 | PB RF GND | |
| 9 | PB CHROMA | 292 — C-DEM CN042-9,10 |
| 10 | PB CHROMA GND | |

**MOD** CN011

| | | |
|---|---|---|
| 1 | REC CHROMA OUT | RP CN021-6,7 |
| 2 | REC CHROMA GND | |
| 3 | GND | |
| 4 | (+PB) | |
| 5 | +VIDEO E-E | SYS CN112-9 |
| 6 | +VIDEO E-E | RE CN051-9 |
| 7 | GND | |
| 8 | GND | |
| 9 | REC RF GND | RP CN021-8,9 |
| 10 | REC RF | |

CN012

| | | |
|---|---|---|
| 1 | 3.58 MHz OUT | C DEM CN041-12 |
| 2 | 3.58 MHz GND | |
| 3 | + 12 V | SVO CN063-3 333 |
| 4 | + 12 V | |
| 5 | + MONO | CTP-2 CN142-3 777 |
| 6 | | |
| 7 | + LOW BAND | CTP-2 CN141-4 969 |
| 8 | + LOW BAND | RP CN023-1 969 |
| 9 | + HIGH BAND | CTP-2 CN141-3 444 |
| 10 | + HIGH BAND | RP CN023-3 444 |

CNO13

| | | |
|---|---|---|
| 1 | + 24 V | CTP-2 CN141-2 111 |
| 2 | + 24 V | RE CN051-7 111 |
| 3 | GND | |
| 4 | VIDEO LEVEL CTL(3) | CTP-1 CN132-5 393 |
| 5 | VIDEO LEVEL CTL(1) | CTP-1 CN132-3 191 |
| 6 | VIDEO LEVEL CTL(2) | CTP-1 CN132-4 292 |
| 7 | VIDEO OUT | SVO CN063-4,5 292 |
| 8 | VIDEO OUT GND | |
| 9 | VIDEO IN GND | VOA CN081-9,10 696 |
| 10 | VIDEO IN | |

**CTP-2** CN141

| | | |
|---|---|---|
| 1 | + HIGH BAND AUDIO REC | AUD CN072-8 929 |
| 2 | + 24 V | MOD CN013-1 111 |
| 3 | + HIGH BAND | MOD CN012-9 444 |
| 4 | + LOW BAND | MOD CN012-7 969 |
| 5 | HEADPHONE GND | |
| 6 | HEADPHONE | AUD CN073-9,10 999 |
| 7 | + 24 V | REG CN101-2 111 |
| 8 | TRACKING VR | SVO CN061-8 090 |
| 9 | TRACKING METER(-) | |
| 10 | TRACKING METER(+) | Y-DEM CN032-3,4 696 |

CN142

| | | |
|---|---|---|
| 1 | + TV | VOA CN081-7 999 |
| 2 | + MONO | C-DEM CN042-2 777 |
| 3 | + MONO | MOD CN012-5 777 |
| 4 | + DEFEAT | SVO CN063-1 666 |
| 5 | + PLAY BACK | SYS CN111-7 666 |
| 6 | + LOW BAND AUDIO REC | AUD CN072-9 939 |
| 7 | + AUDIO REC | SYS CN111-5 919 |
| 8 | GND | MOD CN011-8 000 |
| 9 | GND | C-DEM CN041-5 000 |
| 10 | + COLOR | C-DEM CN042-8 888 |

**CTP-1** CN131

| | | |
|---|---|---|
| 1 | +AUDIO LIMITER | 090 — AUD CN073-2 |
| 2 | + 24 V | 111 — REG CN101-5 |
| 3 | AC 2V AUDIO E-E | 939 — SYS CN113-4 |
| 4 | AUDIO IN GND | |
| 5 | AUDIO IN | 292 — AUD CN071-4,5 |
| 6 | MIC AMP OUT GND | |
| 7 | MIC AMP OUT | 999 — MIC CN091-6,7 |
| 8 | AC 2V VIDEO E-E | 888 — SYS CN113-6 |
| 9 | AUDIO METER (+) | 696 — AUD CN073-5,6 |
| 10 | AUDIO METER (-) | |

CN132

| | | |
|---|---|---|
| 1 | AC 2V (X) | 444 — JCN-1 CN162-9 |
| 2 | AC 2V (Y) | 666 — JCN-1 CN162-7 |
| 3 | VIDEO LEVEL CTL(1) | 191 — MOD CN013-5 |
| 4 | VIDEO LEVEL CTL(2) | 292 — MOD CN013-6 |
| 5 | VIDEO LEVEL CTL(3) | 393 — MOD CN013-4 |
| 6 | SLOW SW | 969 — SYS CN113-8 |
| 7 | VIDEO METER (-) | |
| 8 | VIDEO METER (+) | 999 — Y-DEM CN031-8,9 |
| 9 | + SLOW | 979 — SYS CN113-9 |
| 10 | SLOW VR | 999 — SVO CN062-6 |

**SYS** CN111

| | | |
|---|---|---|
| 1 | + AUDIO PB | AUD CN073-3 949 |
| 2 | GND | VOA CN081-4 000 |
| 3 | DOC MUTING | Y-DEM CN032-6 929 |
| 4 | DOC MUTING | C-DEM CN042-4 929 |
| 5 | +AUDIO REC | CTP-2 CN142-7 919 |
| 6 | + EDIT | RP CN021-10 898 |
| 7 | + PLAY BACK | CTP-2 CN142-5 666 |
| 8 | + SERVO REC | AUD CN072-6 959 |
| 9 | + VIDEO REC | RP CN021-1 797 |
| 10 | + AUDIO E-E | AUD CN071-10 909 |

CN112

| | | |
|---|---|---|
| 1 | + AUDIO MUTING | AUD CN073-4 292 |
| 2 | + VIDEO MUTING | Y-DEM CN031-1 989 |
| 3 | + STOP | JCN-1 CN162-6 090 |
| 4 | GND | Y-DEM CN031-6 000 |
| 5 | + 24 V | Y-DEM CN031-3 111 |
| 6 | + VIDEO E-E | RP CN023-9 696 |
| 7 | + FWD | JCN-1 CN162-3 191 |
| 8 | + SERVO REC | SVO CN063-7 959 |
| 9 | +VIDEO E-E | MOD CN011-5 696 |
| 10 | + RWD·FF·PAUSE | JCN-1 CN162-5 393 |

CN113

| | | |
|---|---|---|
| 1 | + RE | RP CN021-5 999 |
| 2 | + F·FWD, RWD | JCN-1 CN161-8 494 |
| 3 | AC 2 V (X) | JCN-1 CN162-10 444 |
| 4 | AC 2 V AUDIO E-E | CTP-1 CN131-3 939 |
| 5 | AC 2 V REC | JCN4 222 |
| 6 | AC 2 V VIDEO E-E | CTP-1 CN131-8 888 |
| 7 | AC 2 V EDIT | JCN4 777 |
| 8 | SLOW SW | CTP-1 CN132-6 969 |
| 9 | + SLOW | CTP-1 CN132-9 979 |
| 10 | + SLOW | SVO CN062-8 979 |

**JCN-1** CN161

| | | |
|---|---|---|
| 1 | BRAKE COIL (+) | SVO CN061-2 696 |
| 2 | BRAKE COIL (-) | SVO CN061-1 797 |
| 3 | CAPSTAN MOTOR(+) | SVO CN061-9,10 696 |
| 4 | CAPSTAN MOTOR(-) | |
| 5 | DC 12 V (-) | REG CN102-10 898 |
| 6 | | |
| 7 | + F·FWD, RWD | SVO CN061-5 494 |
| 8 | + F·FWD, RWD | SYS CN113-2 494 |
| 9 | FG (X) | SVO CN062-3 808 |
| 10 | FG (Y) | SVO CN062-4 808 |

CN162

| | | |
|---|---|---|
| 1 | + 24 V | REG CN101-4 111 |
| 2 | + 24 V | Y-DEM CN031-2 111 |
| 3 | + FWD | SYS CN112-7 191 |
| 4 | + FWD OFF | SVO CN062-10 292 |
| 5 | + RWD·FF·PAUSE | SYS CN112-10 393 |
| 6 | + STOP | SYS CN112-3 090 |
| 7 | AC 2 V (Y) | CTP-1 CN132-2 666 |
| 8 | AC 2 V (Y) | JCN4 CN153-3 666 |
| 9 | AC 2 V (X) | CTP-1 CN132-1 444 |
| 10 | AC 2 V (X) | SYS CN113-3 444 |

**SVO** CN061

| | | |
|---|---|---|
| 1 | BRAKE COIL (-) | 797 — JCN1 CN161-2 |
| 2 | BRAKE COIL (+) | 696 — JCN1 CN161-1 |
| 3 | + 24 V | 111 — RE CN051-8 |
| 4 | + 24 V | JCN1 CN161-7 |
| 5 | +F·FWD RWD | 494 — |
| 6 | GND | 000 — RE CN051-10 |
| 7 | GND | |
| 8 | TRACKING VR | 090 — CTP-2 CN141-8 |
| 9 | CAPSTAN MOTOR(-) | |
| 10 | CAPSTAN MOTOR(+) | 696 — JCN-1 CN161-3,4 |

CNO62

| | | |
|---|---|---|
| 1 | SERVO REF SIGNAL | 202 — RP CN024-3,4 |
| 2 | SERVO REF SIGNAL GND | |
| 3 | FG (X) | 2 808 — JCN1 CN161-9 |
| 4 | FG (Y) | 9 808 — JCN1 CN161-10 |
| 5 | FG GND | |
| 6 | SLOW VR | 999 — CTP-1 CN132-10 |
| 7 | DC 12 V (+) | 222 — REG CN102-9 |
| 8 | + SLOW | 979 — SYS CN113-10 |
| 9 | | |
| 10 | + FWD OFF | 292 — JCN1 CN162-4 |

CN063

| | | |
|---|---|---|
| 1 | + DEFEAT | 666 — CTP-2 CN142-4 |
| 2 | + 12 V | 333 — C DEM CN042-6 |
| 3 | + 12 V | 333 — MOD CN012-3 |
| 4 | VIDEO IN GND | |
| 5 | VIDEO IN | 292 — MOD CN013-7,8 |
| 6 | | |
| 7 | + SERVO REC | 959 — SYS CN112-8 |
| 8 | CTL HEAD GND | 959 — SYS CN112-5 |
| 9 | CTL HEAD (Y) | 2 828 — JCN2 CN151-5,7 |
| 10 | CTL HEAD (X) | 2 828 — JCN2 CN151-6 |

**AUD** CN071

| | | |
|---|---|---|
| 1 | AUDIO HEAD (X) | 2 898 — JCN2 CN151-9 |
| 2 | AUDIO HEAD (Y) | 9 898 — JCN2 CN151-8,10 |
| 3 | AUDIO HEAD GND | |
| 4 | AUDIO IN GND | |
| 5 | AUDIO IN | 292 — CTP-1 CN131-4,5 |
| 6 | + 24 V | 111 — REG CN101-3 |
| 7 | + 24 V | 111 — MIC CN091-1 |
| 8 | DC 8V (+) | 222 — MIC CN091-2 |
| 9 | +AUDIO E-E | 909 — SYS CN111-10 |

CN072

| | | |
|---|---|---|
| 1 | AUDIO ERASE HEAD (X) | 999 — JCN3 CN153-2 |
| 2 | GND | |
| 3 | AUDIO ERASE HEAD (Y) | 2 808 — JCN2 CN151-1 |
| 4 | AUDIO ERASE HEAD GND | |
| 5 | AUDIO ERASE HEAD (X) | 2 808 — JCN2 CN151-2 |
| 6 | + SERVO REC | 959 — SYS CN111-8 |
| 7 | | |
| 8 | + AUDIO PB | 929 — CTP-2 CN141-1 |
| 9 | + AUDIO ERASE HEAD | 939 — CTP-2 CN142-6 |
| 10 | + AUDIO ERASE HEAD | |

CN073

| | | |
|---|---|---|
| 1 | GND | 000 — MIC CN091-8 |
| 2 | +AUDIO LIMITER OFF | 090 — CTP-1 CN131-1 |
| 3 | + AUDIO PB | 949 — SYS CN111-1 |
| 4 | + AUDIO MUTING | 292 — SYS CN112-1 |
| 5 | AUDIO METER(-) | |
| 6 | AUDIO METER(+) | 696 — CTP-1 CN131-9,10 |
| 7 | LINE OUT GND | |
| 8 | LINE OUT | 292 — MIC CN091-9,10 |
| 9 | HEADPHONE GND | |
| 10 | HEADPHONE | 999 — CTP-2 CN141-5,6 |

**MIC** CN091

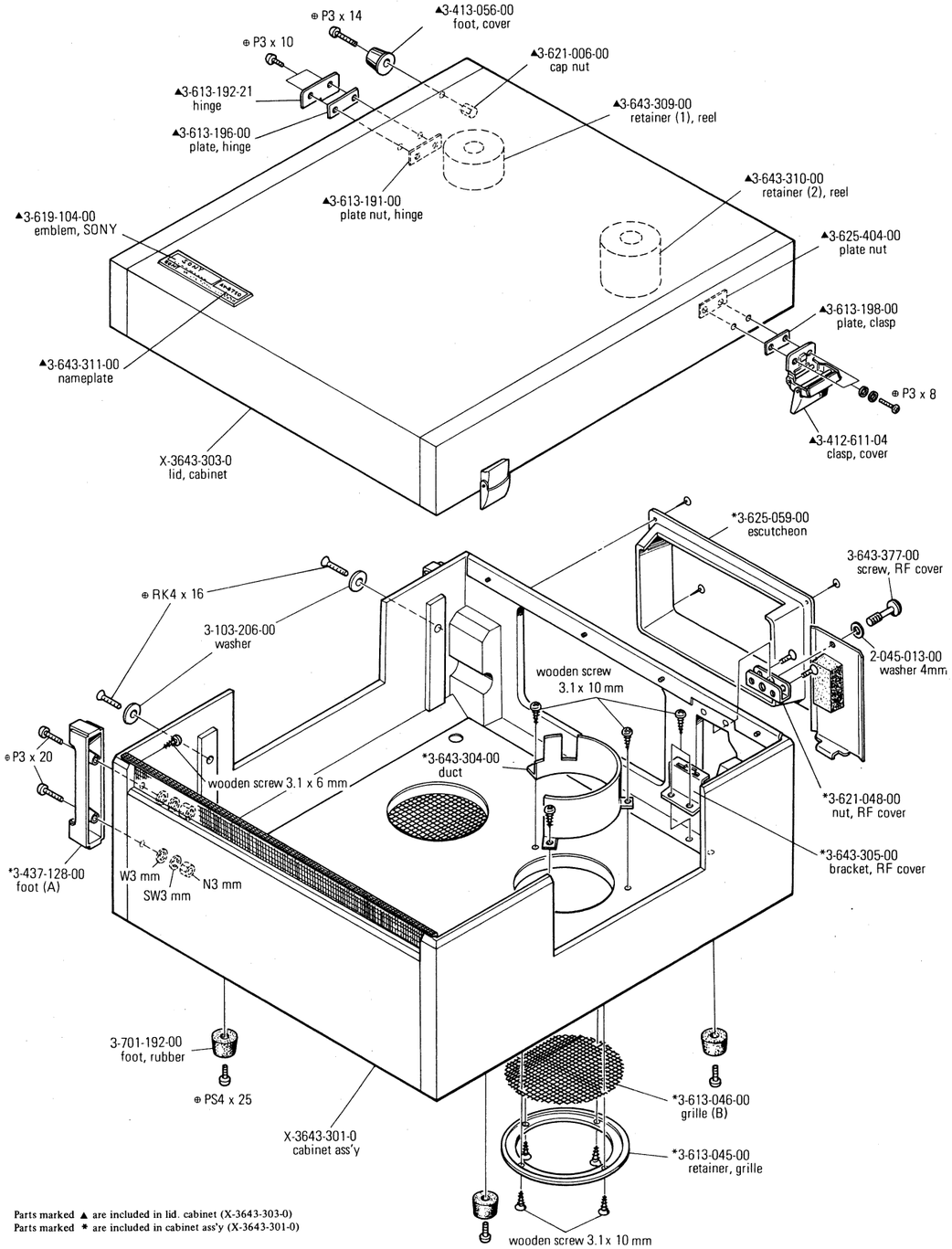
| | | |
|---|---|---|
| 1 | + 24 V | 111 — AUD CN071-7 |
| 2 | DC 8V (+) | 222 — AUD CN071-8 |
| 3 | COLOR LOCK VR | 444 — C DEM CN042-1 |
| 4 | GND | 000 — REG CN101-10 |
| 5 | + TV | 999 — VOA CN081-8 |
| 6 | MIC AMP OUT | 999 — CTP-1 CN131-6,7 |
| 7 | MIC AMP OUT GND | 000 — AUD CN073-1 |
| 8 | GND | AUD CN073-7,8 |
| 9 | LINE OUT | 292 |
| 10 | LINE OUT GND | |

**JCN-2** CN 151

| | | |
|---|---|---|
| 1 | AUDIO ERASE HEAD(Y) | AUD CN072-4 808 9 |
| 2 | AUDIO ERASE HEAD(X) | AUD CN072-5 808 2 |
| 3 | AUDIO ERASE HEAD GND | -3 |
| 4 | | |
| 5 | CTL HEAD (Y) | SVO CN063-9 828 9 |
| 6 | CTL HEAD (X) | SVO CN063-10 828 2 |
| 7 | CTL HEAD GND | -8 |
| 8 | AUDIO HEAD GND | |
| 9 | AUDIO HEAD (X) | AUD CN071-1 898 -3 |
| 10 | AUDIO HEAD (Y) | AUD CN071-2 898 9 |

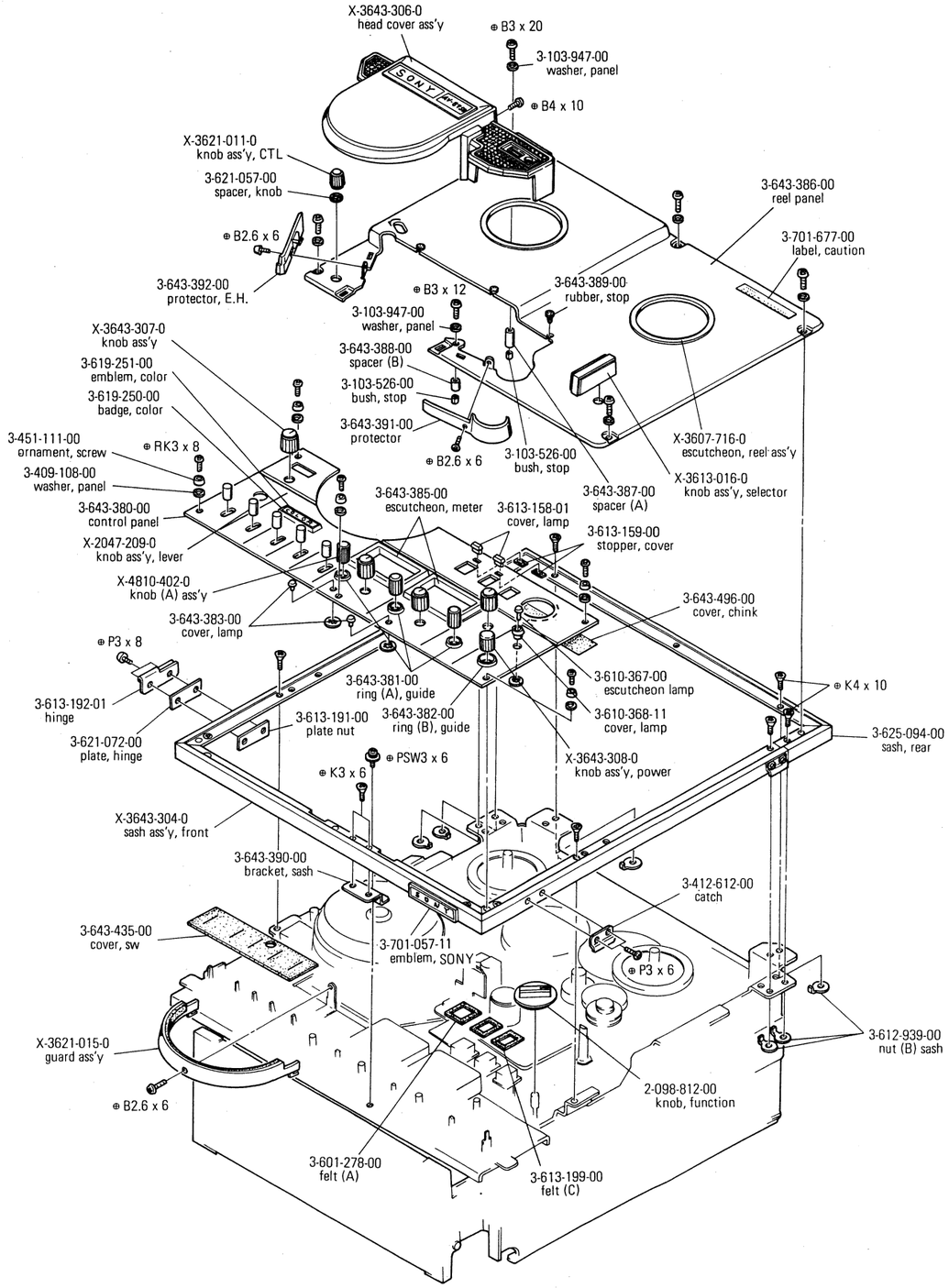
AUDIO/ERASE HEAD; CTL HEAD; AUDIO HEAD

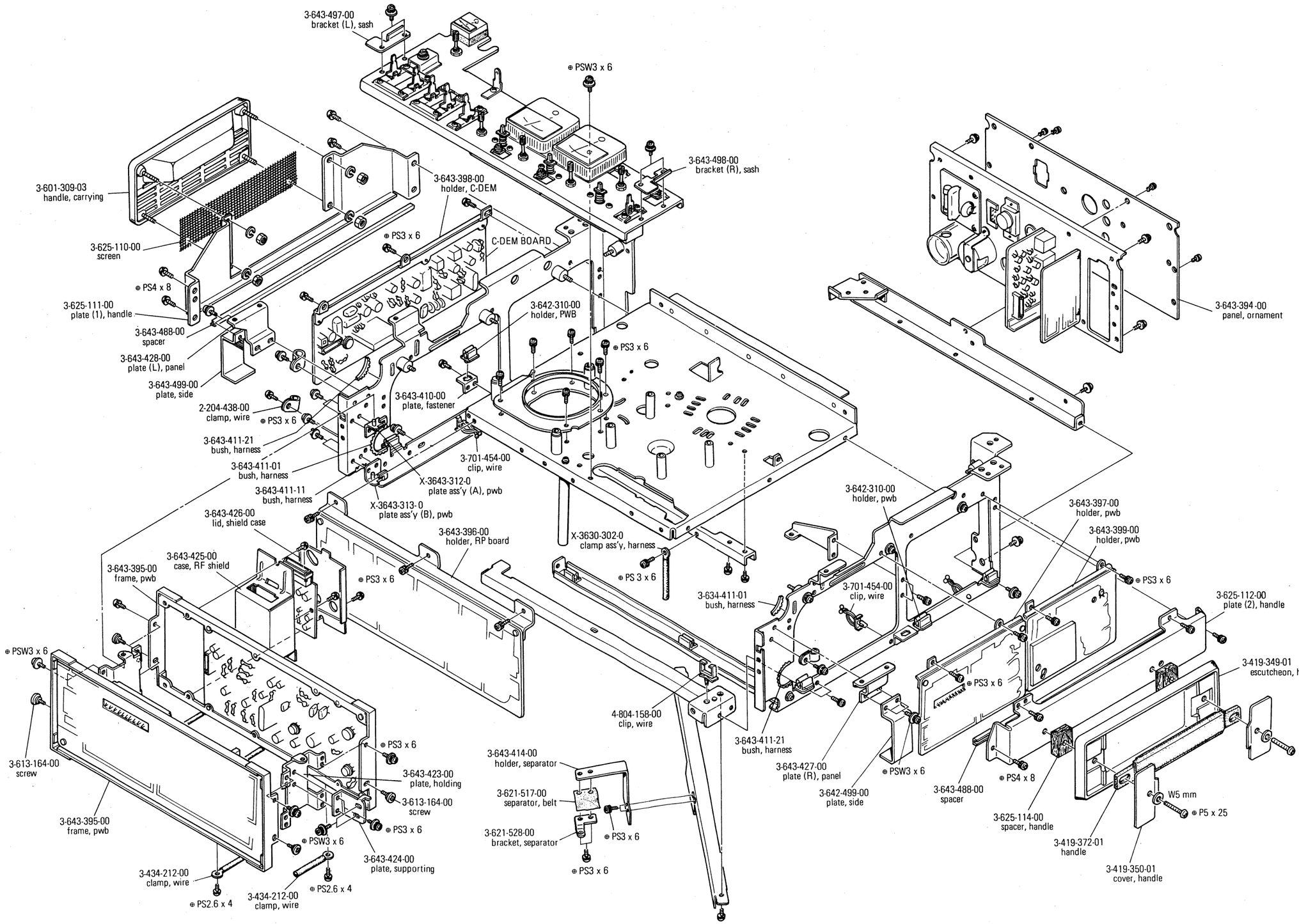
# EXPLODED VIEWS WITH PART NUMBERS

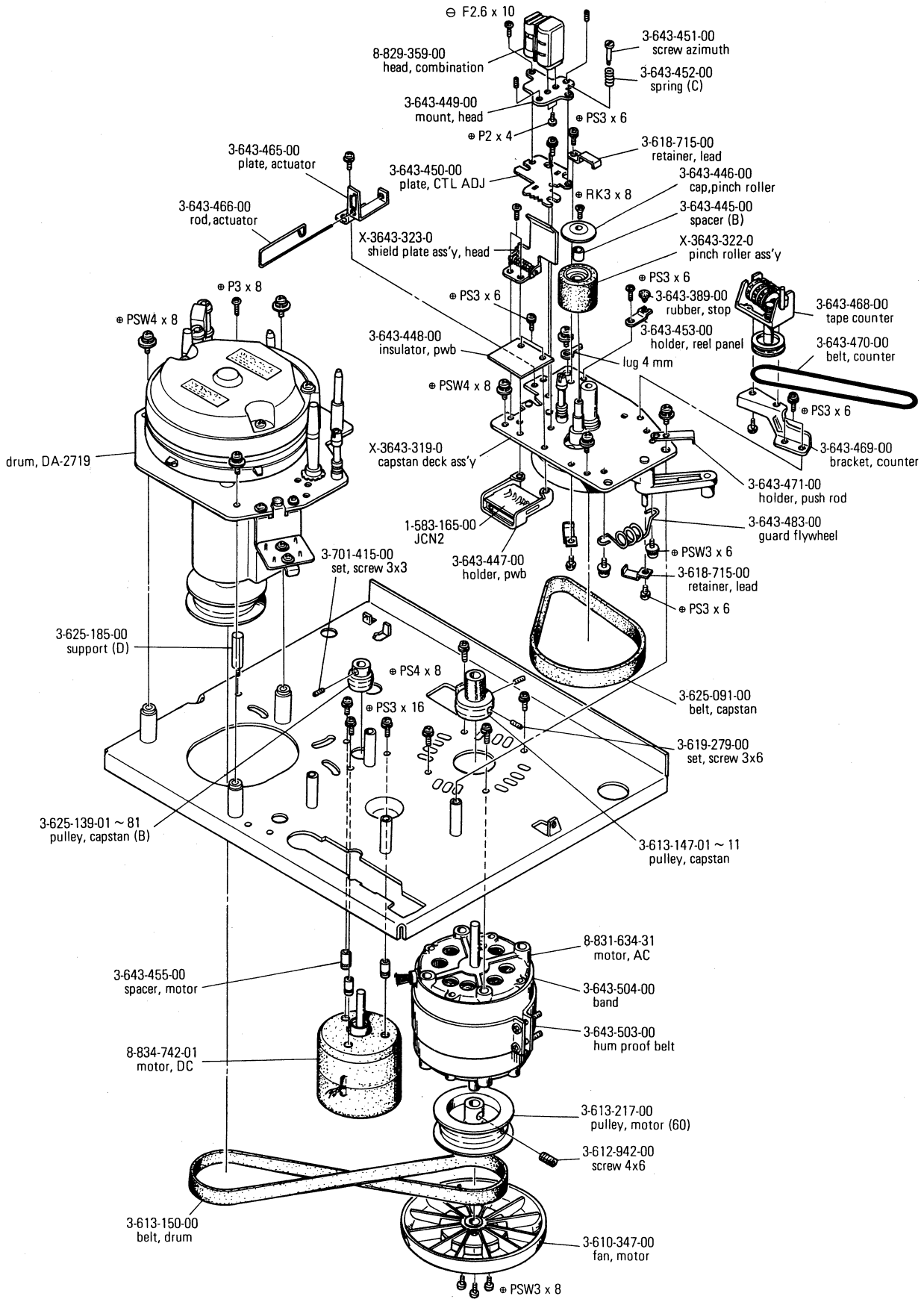


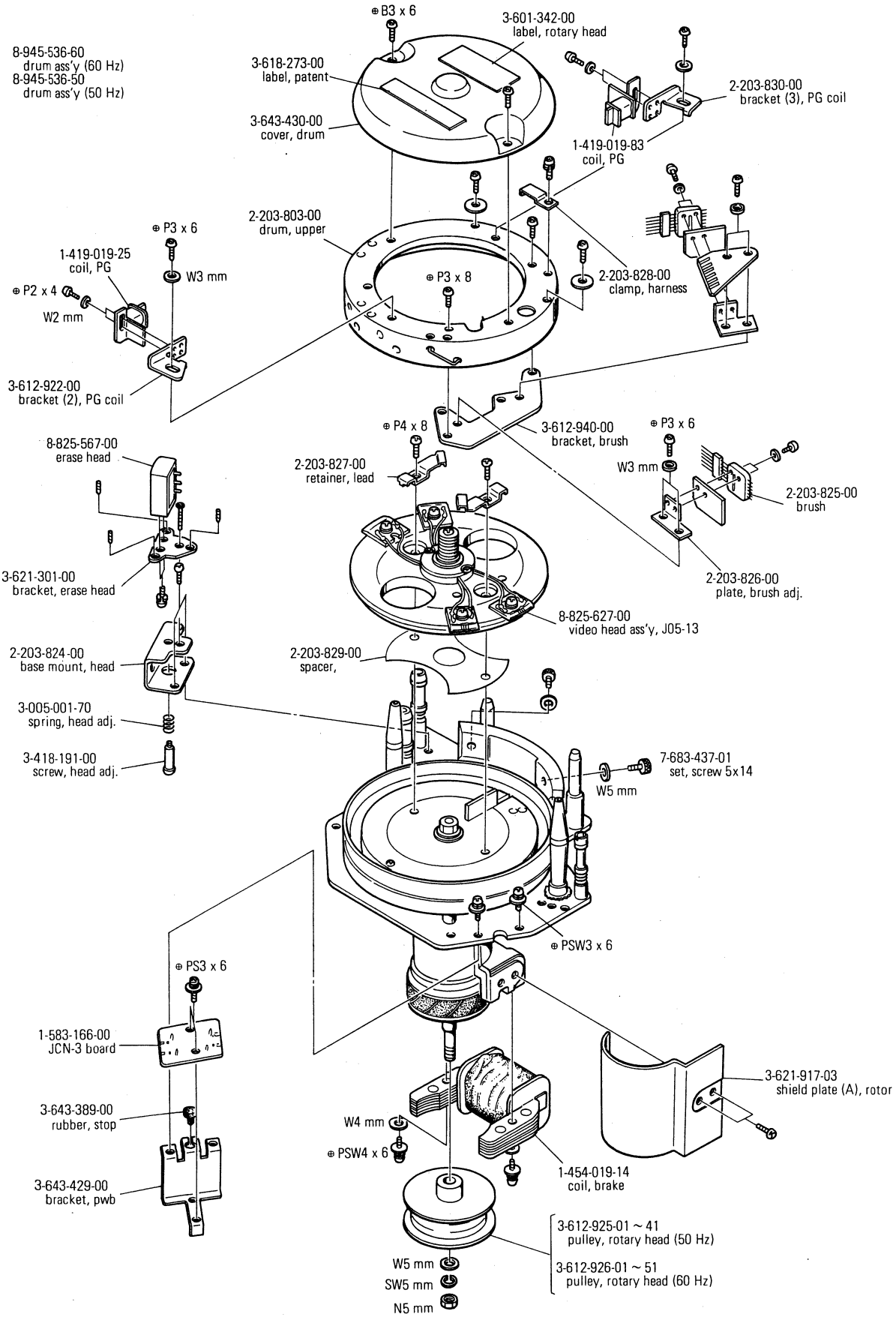

Parts marked ▲ are included in lid. cabinet (X-3643-303-0)
Parts marked * are included in cabinet ass'y (X-3643-301-0)

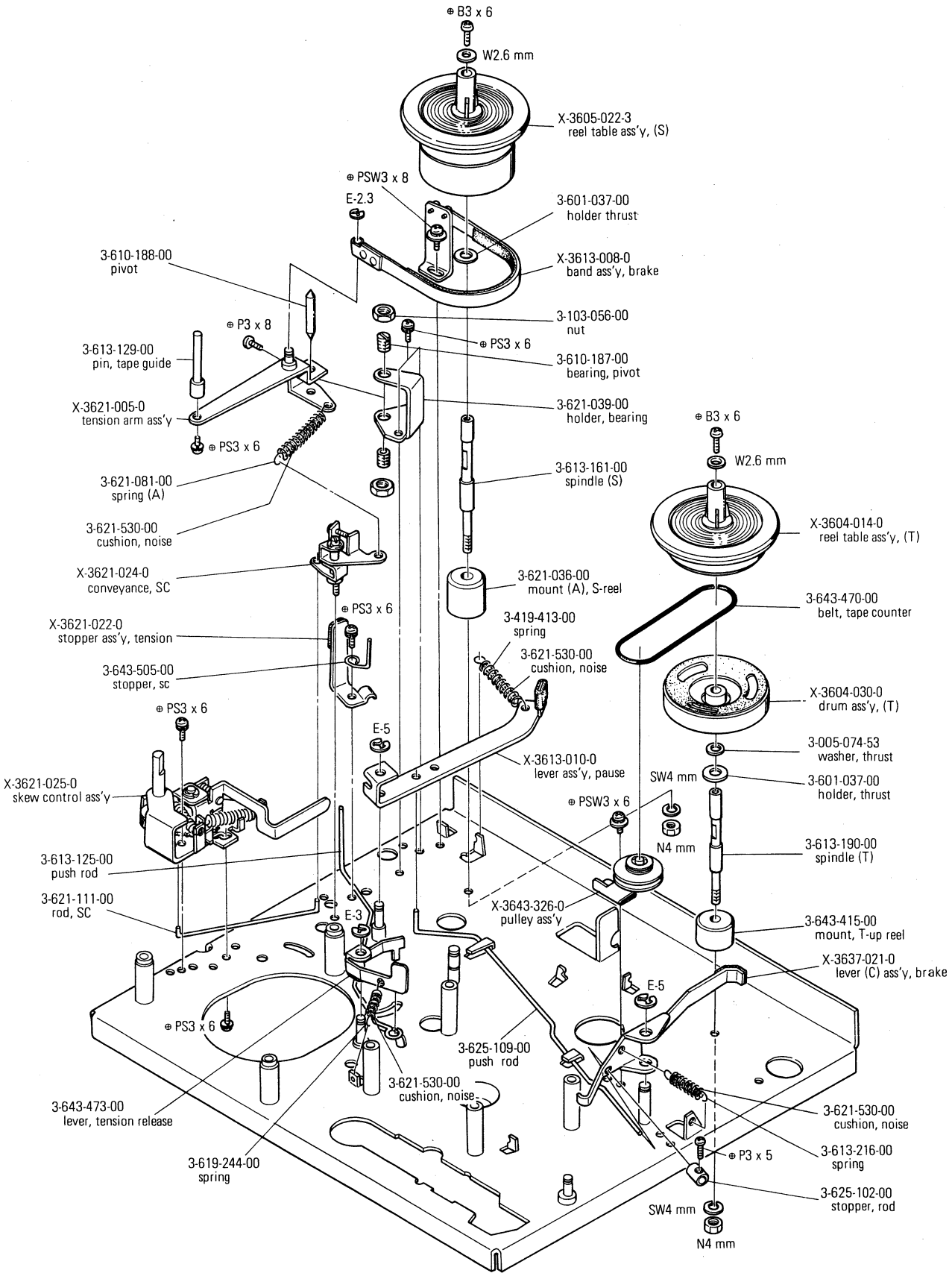


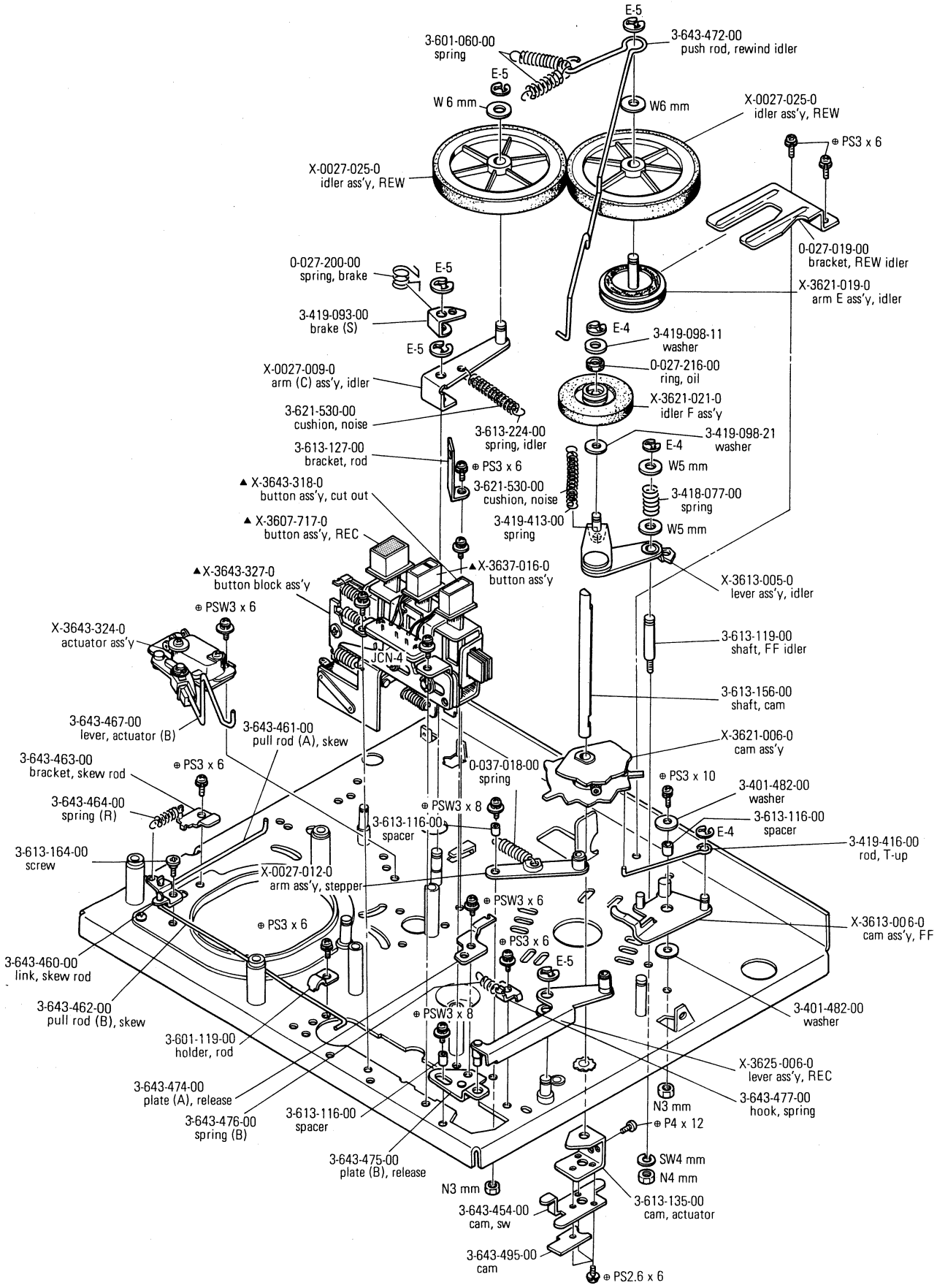


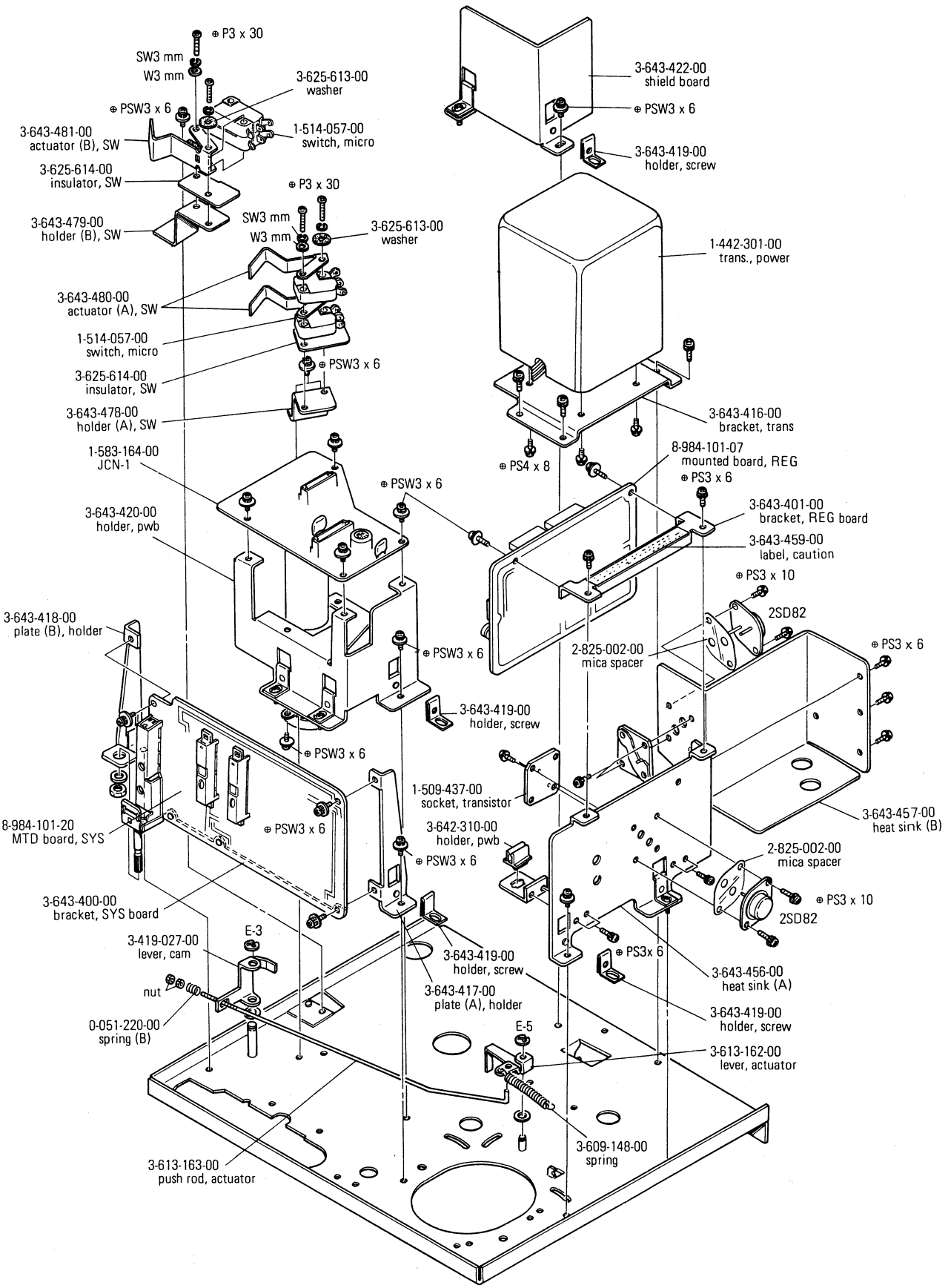

3-643-497-00
bracket (L), sash
⊕ PSW3 x 6
3-643-498-00
bracket (R), sash
3-601-309-03
handle, carrying
3-643-398-00
holder, C-DEM
⊕ PS3 x 6
C-DEM BOARD
3-625-110-00
screen
⊕ PS4 x 8
3-625-111-00
plate (1), handle
3-643-488-00
spacer
3-643-428-00
plate (L), panel
3-643-499-00
plate, side
3-642-310-00
holder, PWB
⊕ PS3 x 6
3-643-410-00
plate, fastener
2-204-438-00
clamp, wire
⊕ PS3 x 6
3-643-411-21
bush, harness
3-643-411-01
bush, harness
3-643-411-11
bush, harness
3-701-454-00
clip, wire
X-3643-312-0
plate ass'y (A), pwb
X-3643-313-0
plate ass'y (B), pwb
3-643-426-00
lid, shield case
3-643-396-00
holder, RP board
X-3630-302-0
clamp ass'y, harness
⊕ PS 3 x 6
3-643-425-00
case, RF shield
3-643-395-00
frame, pwb
⊕ PS3 x 6
3-643-394-00
panel, ornament
3-642-310-00
holder, pwb
3-643-397-00
holder, pwb
3-643-399-00
holder, pwb
⊕ PS3 x 6
3-701-454-00
clip, wire
3-634-411-01
bush, harness
3-625-112-00
plate (2), handle
3-419-349-01
escutcheon, handle
⊕ PSW3 x 6
3-613-164-00
screw
⊕ PS3 x 6
3-643-423-00
plate, holding
3-613-164-00
screw
⊕ PS3 x 6
3-643-395-00
frame, pwb
⊕ PSW3 x 6
3-643-424-00
plate, supporting
3-434-212-00
clamp, wire
⊕ PS2.6 x 4
3-434-212-00
clamp, wire
⊕ PS2.6 x 4
4-804-158-00
clip, wire
3-643-414-00
holder, separator
3-621-517-00
separator, belt
3-621-528-00
bracket, separator
⊕ PS3 x 6
⊕ PS3 x 6
3-643-411-21
bush, harness
3-643-427-00
plate (R), panel
3-642-499-00
plate, side
⊕ PSW3 x 6
3-643-488-00
spacer
⊕ PS4 x 8
3-625-114-00
spacer, handle
3-419-372-01
handle
W5 mm
⊕ P5 x 25
3-419-350-01
cover, handle

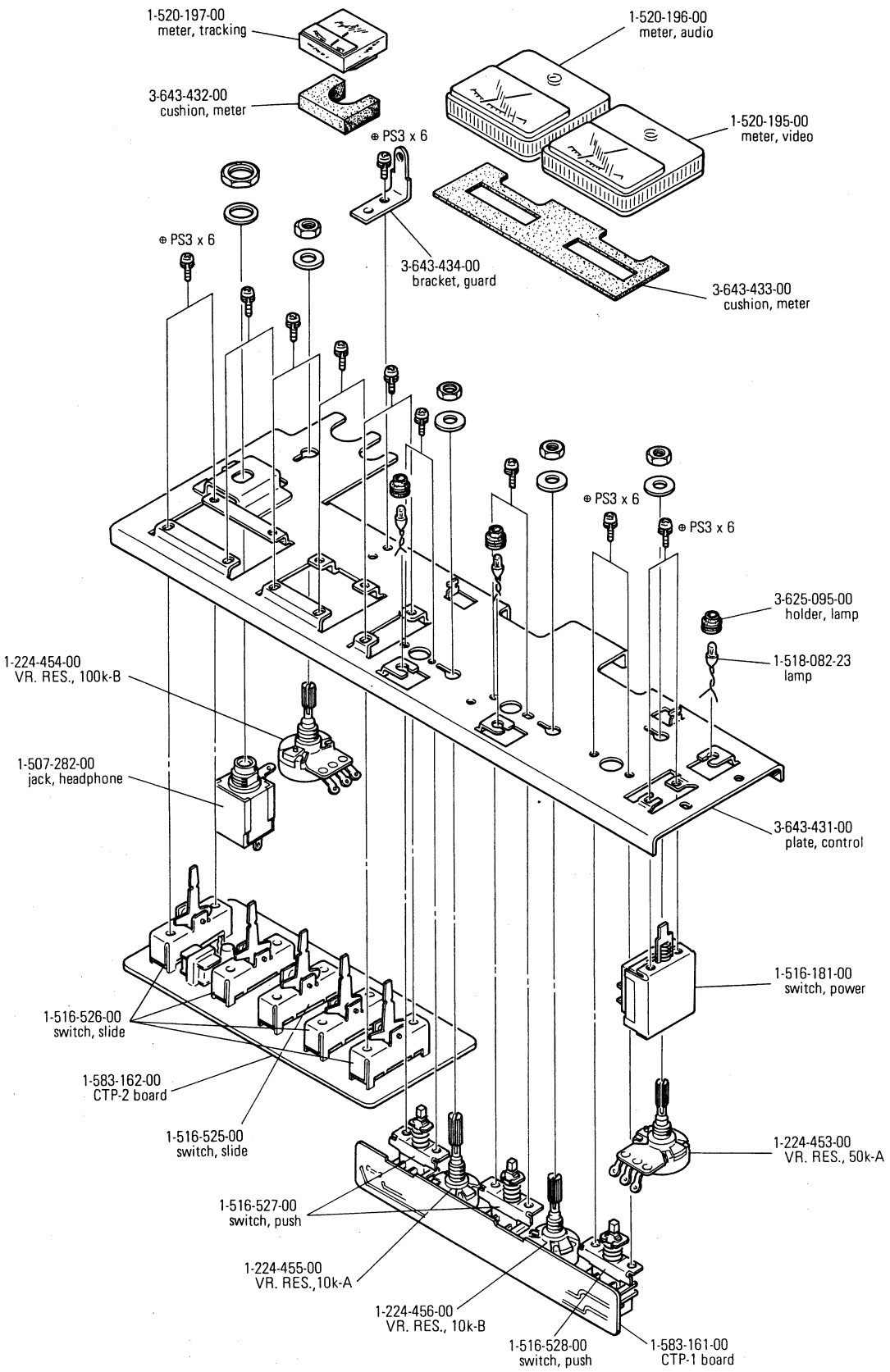

⊖ F2.6 x 10
8-829-359-00
head, combination
3-643-451-00
screw azimuth
3-643-452-00
spring (C)
3-643-449-00
mount, head
⊕ PS3 x 6
⊕ P2 x 4
3-643-465-00
plate, actuator
3-643-450-00
plate, CTL ADJ
3-618-715-00
retainer, lead
3-643-446-00
cap,pinch roller
⊕ RK3 x 8
3-643-466-00
rod, actuator
3-643-445-00
spacer (B)
X-3643-323-0
shield plate ass'y, head
X-3643-322-0
pinch roller ass'y
⊕ PS3 x 6
⊕ P3 x 8
⊕ PS3 x 6
3-643-389-00
rubber, stop
3-643-468-00
tape counter
⊕ PSW4 x 8
3-643-453-00
holder, reel panel
3-643-470-00
belt, counter
3-643-448-00
insulator, pwb
lug 4 mm
⊕ PSW4 x 8
⊕ PS3 x 6
drum, DA-2719
X-3643-319-0
capstan deck ass'y
3-643-469-00
bracket, counter
3-643-471-00
holder, push rod
1-583-165-00
JCN2
3-643-483-00
guard flywheel
3-643-447-00
holder, pwb
⊕ PSW3 x 6
3-701-415-00
set, screw 3x3
3-618-715-00
retainer, lead
⊕ PS3 x 6
3-625-185-00
support (D)
⊕ PS4 x 8
3-625-091-00
belt, capstan
⊕ PS3 x 16
3-619-279-00
set, screw 3x6
3-625-139-01 ~ 81
pulley, capstan (B)
3-613-147-01 ~ 11
pulley, capstan
8-831-634-31
motor, AC
3-643-455-00
spacer, motor
3-643-504-00
band
3-643-503-00
hum proof belt
8-834-742-01
motor, DC
3-613-217-00
pulley, motor (60)
3-612-942-00
screw 4x6
3-613-150-00
belt, drum
3-610-347-00
fan, motor
⊕ PSW3 x 8

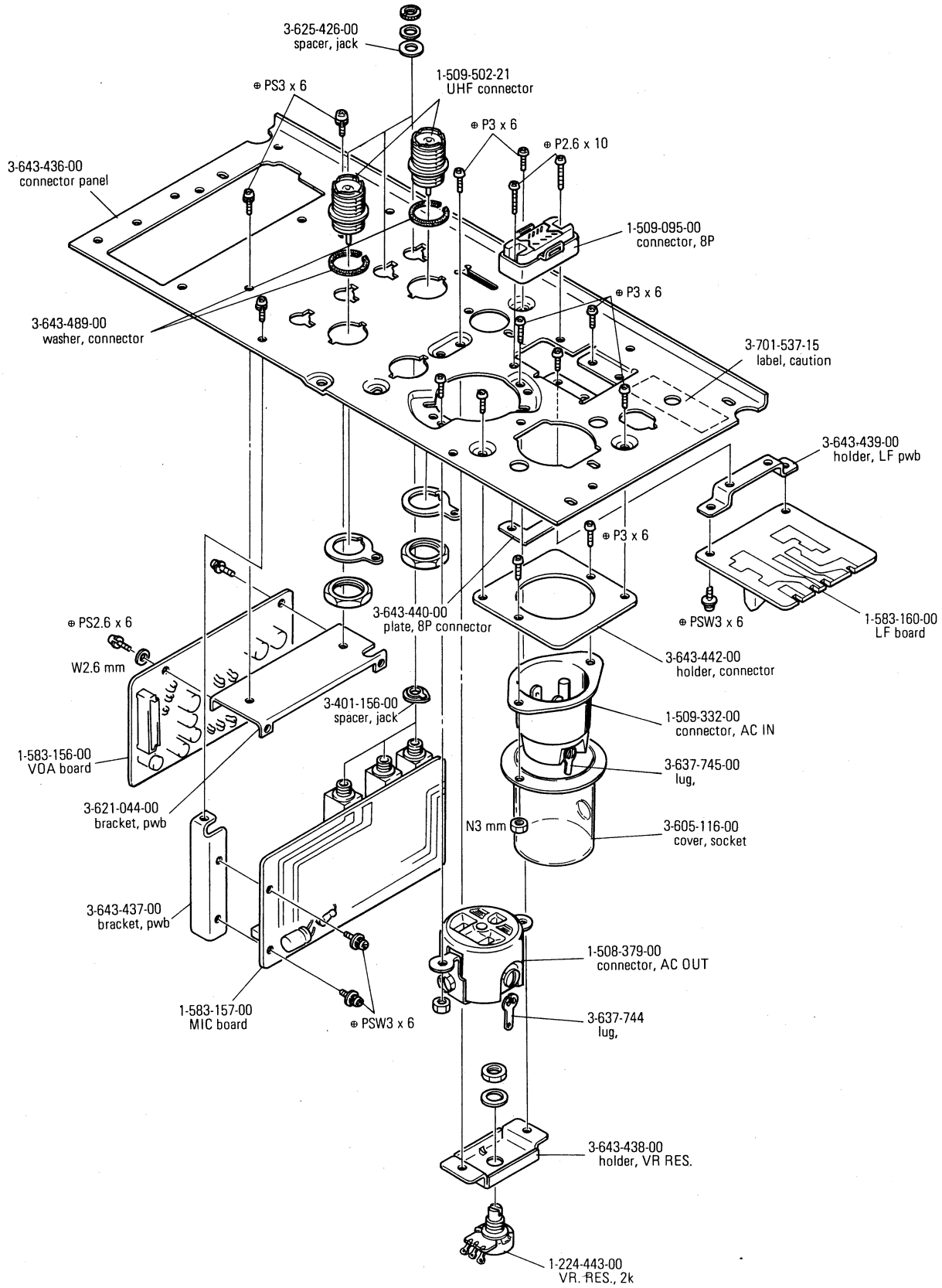

8-945-536-60
drum ass'y (60 Hz)
8-945-536-50
drum ass'y (50 Hz)
⊕B3 x 6
3-601-342-00
label, rotary head
3-618-273-00
label, patent
3-643-430-00
cover, drum
2-203-830-00
bracket (3), PG coil
1-419-019-83
coil, PG
2-203-803-00
drum, upper
⊕P3 x 6
1-419-019-25
coil, PG
W3 mm
⊕P2 x 4
W2 mm
⊕P3 x 8
2-203-828-00
clamp, harness
3-612-922-00
bracket (2), PG coil
⊕P4 x 8
3-612-940-00
bracket, brush
⊕P3 x 6
W3 mm
2-203-825-00
brush
8-825-567-00
erase head
2-203-827-00
retainer, lead
2-203-826-00
plate, brush adj.
3-621-301-00
bracket, erase head
8-825-627-00
video head ass'y, J05-13
2-203-824-00
base mount, head
2-203-829-00
spacer,
3-005-001-70
spring, head adj.
3-418-191-00
screw, head adj.
7-683-437-01
set, screw 5x14
W5 mm
⊕PSW3 x 6
⊕PS3 x 6
1-583-166-00
JCN-3 board
3-621-917-03
shield plate (A), rotor
3-643-389-00
rubber, stop
W4 mm
⊕PSW4 x 6
1-454-019-14
coil, brake
3-643-429-00
bracket, pwb
3-612-925-01 ~ 41
pulley, rotary head (50 Hz)
3-612-926-01 ~ 51
pulley, rotary head (60 Hz)
W5 mm
SW5 mm
N5 mm


⊕ B3 x 6
W2.6 mm
X-3605-022-3
reel table ass'y, (S)
⊕ PSW3 x 8
E-2.3
3-601-037-00
holder thrust
3-610-188-00
pivot
X-3613-008-0
band ass'y, brake
3-103-056-00
nut
⊕ P3 x 8
⊕ PS3 x 6
3-613-129-00
pin, tape guide
3-610-187-00
bearing, pivot
X-3621-005-0
tension arm ass'y
3-621-039-00
holder, bearing
⊕ B3 x 6
⊕ PS3 x 6
W2.6 mm
3-621-081-00
spring (A)
3-613-161-00
spindle (S)
3-621-530-00
cushion, noise
X-3604-014-0
reel table ass'y, (T)
X-3621-024-0
conveyance, SC
3-621-036-00
mount (A), S-reel
3-643-470-00
belt, tape counter
⊕ PS3 x 6
X-3621-022-0
stopper ass'y, tension
3-419-413-00
spring
3-621-530-00
cushion, noise
3-643-505-00
stopper, sc
X-3604-030-0
drum ass'y, (T)
⊕ PS3 x 6
E-5
3-005-074-53
washer, thrust
X-3613-010-0
lever ass'y, pause
SW4 mm
3-601-037-00
holder, thrust
X-3621-025-0
skew control ass'y
⊕ PSW3 x 6
N4 mm
3-613-190-00
spindle (T)
3-613-125-00
push rod
3-621-111-00
rod, SC
E-3
X-3643-326-0
pulley ass'y
3-643-415-00
mount, T-up reel
X-3637-021-0
lever (C) ass'y, brake
E-5
⊕ PS3 x 6
3-625-109-00
push rod
3-621-530-00
cushion, noise
3-643-473-00
lever, tension release
3-621-530-00
cushion, noise
3-613-216-00
spring
⊕ P3 x 5
3-619-244-00
spring
3-625-102-00
stopper, rod
SW4 mm
N4 mm


E-5
3-601-060-00
spring
3-643-472-00
push rod, rewind idler
E-5
W 6 mm
W6 mm
X-0027-025-0
idler ass'y, REW
⊕ PS3 x 6
X-0027-025-0
idler ass'y, REW
0-027-019-00
bracket, REW idler
X-3621-019-0
arm E ass'y, idler
0-027-200-00
spring, brake
E-5
3-419-093-00
brake (S)
E-5
E-4
3-419-098-11
washer
X-0027-009-0
arm (C) ass'y, idler
0-027-216-00
ring, oil
X-3621-021-0
idler F ass'y
3-621-530-00
cushion, noise
3-613-224-00
spring, idler
3-419-098-21
washer
E-4
3-613-127-00
bracket, rod
⊕ PS3 x 6
W5 mm
▲ X-3643-318-0
button ass'y, cut out
3-621-530-00
cushion, noise
3-418-077-00
spring
▲ X-3607-717-0
button ass'y, REC
3-419-413-00
spring
W5 mm
▲X-3643-327-0
button block ass'y
▲X-3637-016-0
button ass'y
X-3613-005-0
lever ass'y, idler
⊕ PSW3 x 6
X-3643-324-0
actuator ass'y
JCN-4
3-613-119-00
shaft, FF idler
3-613-156-00
shaft, cam
3-643-467-00
lever, actuator (B)
3-643-461-00
pull rod (A), skew
X-3621-006-0
cam ass'y
3-643-463-00
bracket, skew rod
⊕ PS3 x 6
0-037-018-00
spring
⊕ PS3 x 10
3-401-482-00
washer
3-643-464-00
spring (R)
⊕ PSW3 x 8
3-613-116-00
spacer
3-613-116-00
spacer
E-4
3-613-164-00
screw
3-419-416-00
rod, T-up
X-0027-012-0
arm ass'y, stepper
⊕ PSW3 x 6
⊕ PS3 x 6
X-3613-006-0
cam ass'y, FF
⊕ PS3 x 6
E-5
3-643-460-00
link, skew rod
3-643-462-00
pull rod (B), skew
⊕ PSW3 x 8
3-401-482-00
washer
3-601-119-00
holder, rod
X-3625-006-0
lever ass'y, REC
3-643-474-00
plate (A), release
3-643-477-00
hook, spring
N3 mm
3-643-476-00
spring (B)
3-613-116-00
spacer
⊕ P4 x 12
3-643-475-00
plate (B), release
SW4 mm
N4 mm
N3 mm
3-643-454-00
cam, sw
3-613-135-00
cam, actuator
3-643-495-00
cam
⊕ PS2.6 x 6


⊕ P3 x 30
SW3 mm
W3 mm
3-625-613-00
washer
⊕ PSW3 x 6
3-643-481-00
actuator (B), SW
1-514-057-00
switch, micro
3-625-614-00
insulator, SW
3-643-479-00
holder (B), SW
⊕ P3 x 30
SW3 mm
W3 mm
3-625-613-00
washer
3-643-480-00
actuator (A), SW
1-514-057-00
switch, micro
⊕ PSW3 x 6
3-625-614-00
insulator, SW
3-643-478-00
holder (A), SW
1-583-164-00
JCN-1
⊕ PSW3 x 6
3-643-420-00
holder, pwb
3-643-418-00
plate (B), holder
⊕ PSW3 x 6
⊕ PSW3 x 6
3-643-419-00
holder, screw
⊕ PSW3 x 6
8-984-101-20
MTD board, SYS
⊕ PSW3 x 6
⊕ PSW3 x 6
3-643-400-00
bracket, SYS board
3-419-027-00
lever, cam
E-3
nut
0-051-220-00
spring (B)
3-643-419-00
holder, screw
3-643-417-00
plate (A), holder
3-613-163-00
push rod, actuator
3-643-422-00
shield board
⊕ PSW3 x 6
3-643-419-00
holder, screw
1-442-301-00
trans., power
3-643-416-00
bracket, trans
⊕ PS4 x 8
8-984-101-07
mounted board, REG
⊕ PS3 x 6
3-643-401-00
bracket, REG board
3-643-459-00
label, caution
⊕ PS3 x 10
2SD82
2-825-002-00
mica spacer
⊕ PS3 x 6
1-509-437-00
socket, transistor
3-643-457-00
heat sink (B)
3-642-310-00
holder, pwb
⊕ PSW3 x 6
2-825-002-00
mica spacer
⊕ PS3 x 10
2SD82
⊕ PS3x 6
3-643-456-00
heat sink (A)
3-643-419-00
holder, screw
E-5
3-613-162-00
lever, actuator
3-609-148-00
spring


1-520-197-00
meter, tracking
3-643-432-00
cushion, meter
1-520-196-00
meter, audio
1-520-195-00
meter, video
⊕ PS3 x 6
3-643-434-00
bracket, guard
3-643-433-00
cushion, meter
⊕ PS3 x 6
⊕ PS3 x 6
⊕ PS3 x 6
3-625-095-00
holder, lamp
1-518-082-23
lamp
1-224-454-00
VR. RES., 100k-B
1-507-282-00
jack, headphone
3-643-431-00
plate, control
1-516-181-00
switch, power
1-516-526-00
switch, slide
1-583-162-00
CTP-2 board
1-516-525-00
switch, slide
1-224-453-00
VR. RES., 50k-A
1-516-527-00
switch, push
1-224-455-00
VR. RES., 10k-A
1-224-456-00
VR. RES., 10k-B
1-516-528-00
switch, push
1-583-161-00
CTP-1 board


3-625-426-00
spacer, jack
⊕ PS3 x 6
1-509-502-21
UHF connector
⊕ P3 x 6
⊕ P2.6 x 10
3-643-436-00
connector panel
1-509-095-00
connector, 8P
⊕ P3 x 6
3-643-489-00
washer, connector
3-701-537-15
label, caution
3-643-439-00
holder, LF pwb
⊕ P3 x 6
3-643-440-00
plate, 8P connector
⊕ PSW3 x 6
1-583-160-00
LF board
⊕ PS2.6 x 6
W2.6 mm
3-643-442-00
holder, connector
3-401-156-00
spacer, jack
1-509-332-00
connector, AC IN
1-583-156-00
VOA board
3-637-745-00
lug,
3-621-044-00
bracket, pwb
N3 mm
3-605-116-00
cover, socket
3-643-437-00
bracket, pwb
1-508-379-00
connector, AC OUT
1-583-157-00
MIC board
⊕ PSW3 x 6
3-637-744
lug,
3-643-438-00
holder, VR RES.
1-224-443-00
VR. RES., 2k

| Ref. No. | Part No. | Description |
|---|---|---|
| | | ELECTRICAL PARTS |
| | 8-984-100-10 | MTD BOARD, MOD |
| | 8-984-100-20 | MTD BOARD, RP |
| | 8-984-100-30 | MTD BOARD, Y-DEM |
| | 8-984-100-40 | MTD BOARD, C-DEM |
| | 8-984-100-50 | MTD BOARD, RE |
| | 8-984-100-60 | MTD BOARD, SVO |
| | 8-984-100-70 | MTD BOARD, AUD |
| | 8-984-101-07 | MTD BOARD, REG |
| | 8-984-101-20 | MTD BOARD, SYS |
| | 1-583-156-00 | PWB, VOA |
| | 1-583-157-00 | PWB, MIC |
| | 1-583-160-00 | PWB, LF |
| | 1-583-161-00 | PWE, CTP-1 |
| | 1-583-162-00 | PWB, CTP-2 |
| | 1-583-164-00 | PWB, JCN-1 |
| | 1-583-165-00 | PWB, JCN-2 |
| | 1-583-166-00 | PWB, JCN-3 |
| | 1-583-167-00 | PWB, JCN-4 |
| | 1-583-652-00 | PWB, EQ |
| | | Capacitors |

Standard capacitors of Electrolytic, Mylar (Less than 200 WV) and Ceramic (Less than 50 WV) are abridged. All capacitors in micro farads unless otherwise indicated.

| Ref. No. | Part No. | Description | | |
|---|---|---|---|---|
| C1408 | 1-107-100-51 | Mica | 3 pF | |
| C1212,1407 | 1-107-065-51 | Mica | 15 pF | |
| C1109, | 1-107-069-51 | Mica | 22 pF | |
| C1226,1227 | 1-107-076-51 | Mica | 43 pF | |
| C1115,1118 | 1-107-077-51 | Mica | 47 pF | |
| C1213 | 1-107-079-51 | Mica | 56 pF | |
| C1502,1503 | 1-107-082-51 | Mica | 75 pF | |
| C1431,1433 | 1-107-083-51 | Mica | 82 pF | |
| C1204,1205, 1401 | 1-107-086-51 | Mica | 110 pF | |
| C1117,1418 | 1-107-088-51 | Mica | 130 pF | |
| C1501 | 1-107-089-51 | Mica | 150 pF | |
| C1414,1432 | 1-107-092-51 | Mica | 200 pF | |
| C1120 | 1-107-236-51 | Mica | 560 pF | |
| C1221 | 1-109-169-11 | Mica, | 910 pF | |
| C1303,1304 | 1-129-612-11 | Mica | 47 pF | |
| C1420 | 1-141-166-00 | Trimmer | 20 pF | |
| C2214,2223 | 1-107-061-51 | Mica | 10 pF | |
| C2119 | 1-107-068-51 | Mica | 20 pF | |
| C2517,2518 | 1-107-075-51 | Mica | 39 pF | |
| C2305,2306, C2402,2403, C2417,2418, C2504,2505, C2511,2512 | 1-107-085-51 | Mica | 100 pF | |
| C2117 | 1-107-093-51 | Mica | 220 pF | |
| C2110,2124 | 1-131-193-61 | Tantalum | 10 | 10 V |
| C3044 | 1-105-673-51 | Poly | 0.01 | |
| C3017 | 1-109-168-11 | Mica | 820 pF | |
| C3027 | 1-107-068-51 | Mica | 20 pF | |
| C3040 | 1-107-070-51 | Mica | 24 pF | |
| C3035 | 1-107-082-51 | Mica | 75 pF | |
| C3008 | 1-107-093-51 | Mica | 220 pF | |
| C3004,3031 | 1-107-095-51 | Mica | 270 pF | |
| C3017 | 1-109-168-11 | Mica | 820 pF | |
| C4150 | 1-107-061-51 | Mica | 10 pF | |
| C4155 | 1-107-063-51 | Mica | 12 pF | |
| C4104,4156 | 1-107-065-51 | Mica | 15 pF | |
| C4106,4129 | 1-107-073-51 | Mica | 33 pF | |
| C4128 | 1-107-075-51 | Mica | 39 pF | |
| C4029,4031 | 1-107-082-51 | Mica | 75 pF | |
| C4109,4138 | 1-107-085-51 | Mica | 100 pF | |
| C4051,4131 | 1-107-089-51 | Mica | 150 pF | |
| C4001 | 1-107-092-51 | Mica | 200 pF | |
| C4130 | 1-107-094-51 | Mica | 240 pF | |
| C4121,4122, C4140 | 1-107-095-51 | Mica | 270 pF | |
| C4132 | 1-107-232-51 | Mica | 390 pF | |
| C4015 | 1-107-236-51 | Mica | 560 pF | |
| C4116,4117 | 1-109-166-11 | Mica | 680 pF | |
| C4147 | 1-129-876-11 | Poly | 0.01 | |
| C4145,4146 | 1-129-879-11 | Poly | 0.047 | |
| C4136 | 1-131-209-61 | Tantalum | 0.1 | 35 V |
| C5104,5105 | 1-107-092-51 | Mica | 200 pF | |
| C5109 | 1-109-166-11 | Mica | 680 pF | |
| C6004 | 1-107-078-51 | Mica | 51 pF | |
| C7012 | 1-107-072-51 | Mica | 30 pF | |
| C7006 | 1-107-078-51 | Mica | 51 pF | |
| C7005 | 1-107-085-51 | Mica | 100 pF | |
| C7026 | 1-107-091-51 | Mica | 180 pF | |
| C7015,7028 | 1-107-097-51 | Mica | 330 pF | |
| C7020 | 1-131-215-61 | Tantalum | 1.0 | 35 V |

| Ref. No. | Part No. | Description | | |
|---|---|---|---|---|
| C7012 | 1-107-072-51 | Mica | 30 pF | |
| C7036 | 1-129-707-11 | Poly | 0.0027 | 630 V |
| C7025 | 1-131-209-61 | Tantalum | 0.1 | 35 V |
| C7002,7024) C7034 | 1-131-211-61 | Tantalum | 0.22 | 35 V |
| C7014 | 1-131-238-61 | Tantalum | 10 | 25 V |
| C7032 | 1-141-034-11 | Trimmer | 30 ∿ 200 pF | |
| C8003 | 1-107-061-51 | Mica | 10 pF | |
| C8004 | 1-107-119-51 | Mica | 33 pF | |
| C8006 | 1-107-139-51 | Mica | 220 pF | |
| C9031,9034) C9052 | 1-105-821-51 | Poly | 0.001 | |
| C9066 | 1-105-669-51 | Poly | 0.0047 | |
| C9039 | 1-105-675-51 | Poly | 0.015 | |
| C9013 | 1-105-681-51 | Poly | 0.047 | |
| C9004,9027 | 1-105-683-51 | Poly | 0.068 | |
| C9005,9009) C9017,9018) C9020,9043) C9054,9061) | 1-105-685-51 | Poly | 0.1 | |
| C9070 | 1-105-825-51 | Poly | 0.0022 | |
| C9053 | 1-105-831-51 | Poly | 0.0068 | |
| C9010∿9012) C9022,9055) C9069 | 1-105-833-51 | Poly | 0.01 | |
| C9047,9068 | 1-105-837-51 | Poly | 0.022 | |
| C9026 | 1-105-847-51 | Poly | 0.15 | |
| C9032,9033) C9037 | 1-107-085-51 | Mica | 100 pF | |
| C9056 | 1-107-093-51 | Mica | 220 pF | |
| C9060,9071 | 1-130-009-11 | Poly | 0.22 | 200 V |
| C9048 | 1-131-212-61 | Tantalum | 0.33 | |
| C9028 | 1-131-214-61 | Tantalum | 0.68 | |
| C9021 | 1-131-215-61 | Tantalum | 1.0 | |
| C10003 | 1-119-448-11 | Elect | 2200 | 25 V |
| C10001) 10002) | 1-119-449-11 | Elect | 1000 | 25 V |
| | 1-113-069-11 | Elect | 2.5 + 1.2 | 250 V |

## Connectors

| | | | |
|---|---|---|---|
| CN1001∿1003) CN2021∿2024) CN3031∿3032) CN4001, 4002) CN6001, 7001∿) 7003) | 1-509-634-00 | 10 pin | |
| CN8081, 10001) 10002, 11001) | | | |

| Ref. No. | Part No. | Description | |
|---|---|---|---|
| CN5051 | 1-509-636-00 | 10 pin | |
| | 1-507-080-00 | Fasten Receptacle | |
| | 1-507-275-12 | Mini Jack | |
| | 1-507-282-21 | Headphone Jack | |
| | 1-507-290-00 | 6 pin | |
| | 1-508-379-00 | AC Outlet | |
| | 1-509-095-00 | 8 pin | |
| | 1-509-332-00 | AC Inlet | |
| | 1-509-437-00 | Power Tr, socket | |
| | 1-509-502-21 | UHF connector | |
| 128 | 1-509-632-00 | 14 pin | |
| | 1-509-636-00 | 10 pin | |
| | 1-535-085-00 | Fasten tab | |

## Diodes

| | |
|---|---|
| D1101∿1104,1202∿1207,) 1401∿1403,2201,2204,) 2205,2208,2209,2301∿) 2307,2401∿2416,2501,) 2502,3001,3002,3005∿) 3007,3013∿3016,4001∿) 4006,4104∿4107,5101,) 5102,7004,7005,9001∿) 9021,11001∿11007,) 11010,11012∿11024,) 11027,11029,11030 | 1S1555 |
| D1404,7006,7009∿7013) 11008,11009,11011,) 11025,11026 | 10D2 |
| D2101,2102,3008,3009,4103 | 1S1925 |
| D2202,2203,2206,2207 | 1T6 |
| D3003,3004,4101,4102 | 1S1587 |
| D3010,3011,3017 | 1T22A |
| D7002,7003 | 1T22J |
| D1201, 7001 | 1S2144A |
| D8001 | 1S333 |
| D9051 | RD5A |
| D10005 | RD6A |
| D10004 | RD7A |
| D11001∿11003 | S1RB10 |
| D1201 | 1S2144A |

| Ref. No. | Part No. | Description |
|---|---|---|
| | | **Delay Line** |
| DL1202, 3002 | 1-415-015-00 | Delay Line |
| DL1201, 4001 | 1-415-065-00 | 3.58 mHz |
| DL3001 | 1-415-048-21 | Delay Line |
| | | **Filters** |
| FL1101 | 1-231-275-00 | Low Pass Filter |
| FL1201 | 1-231-187-00 | Low Pass Filter |
| FL3001 | 1-231-183-00 | Low Pass Filter |
| FL4001 | 1-231-178-00 | Band Pass Filter |
| | 1-421-225-00 | Line Filter Coil |
| | 1-427-265-00 | Line Filter --- |
| | | **Fuse** |
| | 1-532-265-00 | 1.0 A |
| | 1-532-267-00 | 1.2 A |
| | 1-532-402-00 | 1.6 A |
| | | **IC** |
| IC1101 | | TX-429D |
| IC1401,4001 | | CX-103D |
| IC1201,2101, 3003 | | CX-146 |
| IC1202,2501~2503,3004, 1301,6002, 8002,8001 | | CX-130 |
| IC1102,9008 | | TA-7504M |
| IC1402,4002, 4101 | | SN76514N |
| IC2301,2302, 2401,2403, 2404 | | CX-506 |
| IC2402 | | M-5946P |
| IC3001 | | CX-121A |
| IC3002 | | CX-034 |
| IC3003 | | CX-087B |
| IC6001,8001, 8003 | | TA7122AP |

| Ref. No. | Part No. | Description |
|---|---|---|
| IC9007 | | CX-032 |
| IC9004 | | CX-732 |
| IC9001~9003, 9006,4102 | | AN301 |
| IC9005 | | M53293 |
| IC11001 | | M5373 |
| | | **Inductors** |
| L1201,4004, 4005 | 1-407-159-00 | Micro 15 µH |
| L1502,2503, 3010 | 1-407-166-00 | Micro 56 µH |
| L1101,2504 | 1-407-167-00 | Micro 6.8 µH |
| L1402,1403, 2203,2206, 2501 | 1-407-172-00 | Micro 180 µH |
| L1401 | 1-407-207-00 | Micro 12 mH |
| L1204,3007 | 1-407-163-00 | Micro 33 µH |
| L1203 | 1-407-258-00 | Variable 150 µH |
| L1202 | 1-407-570-00 | Variable 15 µH |
| L2101 | 1-407-492-21 | Micro 1 mH |
| L2202,2205 | 1-407-255-00 | Variable 4.7 µH |
| L3009 | 1-407-575-00 | Variable 100 µH |
| L3005,3006 | 1-407-178-00 | Micro 1 µH |
| L3002,3003 | 1-407-189-00 | Micro 8.2 µH |
| L3008,3011, 4104 | 1-407-169-00 | Micro 100 µH |
| L3001,3004 | 1-407-177-00 | Micro 470 µH |
| L4102 | 1-407-583-12 | Variable 270 µH |
| L4105 | 1-407-569-00 | Variable 10 µH |
| L4107,4108 | 1-407-826-00 | Variable 3 mH |
| L4109 | 1-407-579-00 | Variable 1 mH |
| L4106 | 1-407-158-00 | Micro 12 µH |
| L4110 | 1-407-168-00 | Micro 82 µH |
| L4103 | 1-407-174-00 | Micro 270 µH |
| L4002 | 1-407-175-00 | Micro 330 µH |
| L4101 | 1-407-205-21 | Micro 8.2 mH |
| L4001 | 1-407-506-21 | Micro 15 mH |
| L5101 | 1-407-195-21 | Micro 1 mH |
| L7002 | 1-407-240-00 | Variable 22 mH |
| L7005 | 1-407-286-00 | Variable 2.2 mH |
| L7003,7004 | 1-407-496-21 | Micro 2.2 mH |
| L7001 | 1-407-658-00 | Variable 35 mH |
| L1501 | 1-407-165-41 | Micro 47 µH |

| Ref. No. | Part No. | Description |
|---|---|---|
| | | **Transistors** |
| Q1101,1102,1203,1302, 1303,1306,1107,1201, 1407,1103∿1105,1108∿ 1110,1202,1204,1206, 1211,1301,1307,1308, 1401,1403,1406,3001, 3012,4007,4009 4013, 4101,4103∿4109,8001∿ 8006 | 2SC403C | ---------- |
| Q1106 | 2SC1126 | ---------- |
| Q1208,1209,1210, 1304,1305,1404 | 2SA735 | ---------- |
| Q1207,1402,1405,1408, 2102,2106,2202,2203, 2204,2206,2208,2210, 2212,2301,2302,2401, 2402,2403,2405,2406, 2501∿2503,4002∿4004, 4015,6001,7002∿7011, 9001∿9003,9005,9007∿ 9010,9012,9013,9015, 9017,9019,9022,9025, 9004,9014,11001∿11003, 11005∿11007,11009, 11011,11012,11015, 11017, | 2SC1364 | ---------- |
| Q2103,2104,2505,5102, 5103,2107,2405 | 2SC1124 | ---------- |
| Q2101,2105,2205,2211, 2504,10002,10004 | 2SC945 | ---------- |
| Q2201,2207,4102 | 2SK43 | ---------- |
| Q4008,9020,9021,11004, 11008,11010,11013, 11016,11018 | 2SA678 | ---------- |
| Q5101,5104 | 2SA706 | ---------- |
| Q7001 | 2SC634A | ---------- |
| Q8007,10001,10003 | 2SC1475 | ---------- |
| Q9006,9011,9016 | 2SK23 | ---------- |
| Q9026 | 2SC1060 | ---------- |
| Q9027 | 2SC1061 | ---------- |
| Q10101,10102 | 2SD82 | ---------- |

| Ref. No. | Part No. | Description |
|---|---|---|
| | | **Relays** |
| RY2201,2202, 7001,7002 | 1-515-148-00 | MT-2, DC24V ---------- |
| | | **Resistors** |
| | | Carbon resistors in ohm, ±5 %, 1/2 W, 1/4 W are omitted. |
| R1312,1313 | 1-210-880-11 | Carbon 2700Ω 1/4 W ±2 % ---------- |
| R1305 | 1-224-247-00 | VR RES B-100 ---------- |
| R1204,1214, 1229 | 1-224-249-00 | VR RES B-1000 ---------- |
| R1414,1422 | 1-224-250-00 | VR RES B-2200 ---------- |
| R1152,1252, 1254,1257, 1259 | 1-224-251-00 | VR RES B-4700 ---------- |
| R1144,1155 | 1-224-252-00 | VR RES B-10 k ---------- |
| R2106,2116, 2140 | 1-224-248-00 | VR RES B-470 ---------- |
| R2112,2136, 2253,2254 | 1-224-249-00 | VR RES B-1000 ---------- |
| R2218,2242 | 1-224-251-00 | VR RES B-4700 ---------- |
| R2206,2230 | 1-224-252-00 | VR RES B-10 k ---------- |
| R2308,2315, 2318,2319, 2415,2418, 2420 | 1-224-254-00 | VR RES B-47 k ---------- |
| R2207,2208, 2231,2232 | 1-224-255-00 | VR RES B-100 k ---------- |
| R3003,3013, 3019 | 1-224-247-00 | VR RES B-100 ---------- |
| R3034,3046 | 1-224-248-00 | VR RES B-470 ---------- |
| R3059 | 1-224-249-00 | VR RES B-1000 ---------- |
| R3005 | 1-224-251-00 | VR RES B-4700 ---------- |
| R3069 | 1-224-253-00 | VR RES B-22 k ---------- |
| R3084 | 1-224-254-00 | VR RES B-47 k ---------- |
| R4048,4171 | 1-224-248-00 | VR RES B-470 ---------- |
| R4029,4124 | 1-224-250-00 | VR RES B-2200 ---------- |
| R4013,4060, 4067,4146 | 1-224-251-00 | VR RES B-4700B ---------- |
| R4155 | 1-224-252-00 | VR RES B-10 k ---------- |
| R4147,4129 | 1-224-253-00 | VR RES B-22 k ---------- |
| R5104 | 1-224-256-00 | VR RES B-220 k ---------- |
| R5102 | 1-224-247-00 | VR RES B-100 ---------- |

| Ref. No. | Part No. | Description |
|---|---|---|
| R7028 | 1-224-251-00 | VR RES B-4.7 k |
| R7019 | 1-224-252-00 | VR RES B-10 k |
| R7012,7030 | 1-224-253-00 | VR RES B-22 k |
| R7017 | 1-224-254-00 | VR RES B-47 k |
| R9201,9202 | 1-224-134-00 | VR RES 470 k |
| R9200 | 1-224-250-00 | VR RES 2.2 k |
| R9203 | 1-224-256-00 | VR RES 220 k |
| R9080,9081 | 1-213-179-11 | Metal film 33 k ±2 % |
| R9079 | 1-213-180-11 | Metal film 7.5 k |
| R10005,) 10011 | 1-224-250-00 | VR RES 2200 |
| | 1-224-453-00 | VR RES B-50 k, SLOW |
| | 1-224-454-00 | VR RES B-100 k, TRACON |
| R131 | 1-224-455-00 | VR RES A-10 k |
| R132 | 1-224-456-00 | VR RES B-10 k |
| R121 | 1-224-443-00 | VR RES 2 k |

## Switches

| | | |
|---|---|---|
| S1001∿1027 | 1-217-358-51 | Short res. 20 mΩ |
| S2001∿2005 | 1-217-358-11 | Short res. 20 mΩ |
| S9001∿9010 | 1-217-358-51 | Short res. 20 mΩ |
| S11001,11003 | 1-514-978-21 | Slide SW |
| S11003 | 1-516-524-00 | Rotary SW |
| | 1-516-181-00 | Power SW |
| | 1-516-525-00 | Lever Slide SW |
| | 1-516-526-00 | Lever Slide SW |
| S131,132 | 1-516-527-00 | Push SW |
| S133 | 1-516-528-00 | Push SW |
| | 1-514-057-00 | Micro SW |
| | 1-514-881-00 | Micro SW |

## Transformers

| | | |
|---|---|---|
| T1301 | 1-425-384-00 | Trans, MOD |
| T1401 | 1-425-844-00 | Trans, RF |
| T1402 | 1-425-845-00 | Trans, RF |
| T2101,2102 | 1-425-714-00 | Trans, RF (REC) |
| T2201,2202 | 1-425-782-00 | Trans, RF (PB) |
| T4001 | 1-425-844-00 | Trans, RF |
| T4002 | 1-425-845-00 | Trans, RF |
| T4101 | 1-459-048-00 | Trans, BM |
| T7001 | 1-433-135-00 | Trans, osc |
| | 1-427-284-00 | Trans, headphone |
| | 1-442-301-00 | Trans, power |

| Ref. No. | Part No. | Description |
|---|---|---|

## X'tals

| | | |
|---|---|---|
| X1401,4101 | 1-527-154-00 | 3.579545 mHz |
| X1402 | 1-527-195-00 | 4.346590 mHz |
| X9001 | 1-527-238-00 | 31.4685 kHz |

## MISCELLANEOUS

| | | |
|---|---|---|
| | 1-518-082-23 | Pilot Lamp |
| | 1-520-195-00 | Level Meter (video) |
| | 1-520-196-00 | Level Meter (audio) |
| | 1-520-197-00 | Level Meter (tracking) |
| | 1-800-197-00 | Thermistor S-400 |
| | 1-800-199-00 | Thermistor S-1250 |
| | 8-825-627-00 | Video Head, J05-13 |
| | 8-825-567-00 | Erase Head, EH18-2102 |
| | 8-829-359-00 | Head EEP-150-2102A |
| | 8-831-634-31 | AC Motor HC634B |
| | 8-834-742-01 | DC Motor D-742F |
| | 1-419-019-25 | Coil, PG |
| | 1-419-019-83 | Coil, PG |
| | 1-454-019-14 | Coil, Brake |

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SONY®
SERVICE MANUAL

# AV-8650

May, 1975

# SUPPLEMENT No. 1

**SUBJECT : Change notice for the following circuits**
**EFFECTIVE SERIAL NUMBERS:**


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|---|---|---|---|
| MOD/EQ Board | : | USA S/N 10,281 and higher<br>CND S/N 10,051 and higher | 2 |
| RP Board | : | USA S/N 10,281 and higher<br>CND S/N 10,051 and higher | 6 |
| C-DEM Board | : | USA S/N 10,281 and higher<br>CND S/N 10,051 and higher | 10 |
| Y-DEM Board | : | USA S/N 10,281 to 11,005<br>CND S/N 10,051 to 10,225 | 14 |
| VOA Board | : | USA S/N 10,281 to 11,005<br>CND S/N 10,051 to 10,225 | 18 |
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| JCN-1 Board | : | USA S/N 10,001 to 10,280<br>CND S/N 10,001 to 10,050 | 34 |
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6. Servo Temperature Characteristic Modification
7. Capstan Servo Time Constant Change
8. Component Changes to Meet U.L. Requirements


**1. Servo 30 PG Delay One Shot Time Constant Change**
**RP Board**

| | WAS | | NOW |
|---|---|---|---|
| R2309 | 56 k carbon | → | 47 k carbon |
| C2304 | 0.0033 μF mylar | → | 0.0047 μF mylar |

**2. PG Output Level Increase**
**RP Board**

| | WAS | | NOW |
|---|---|---|---|
| R2302<br>R2305 | 2700 carbon | → | 2 k carbon |

**3. PB RF Frequency Characteristics Change**
**RP Board : USA S/N 10,806 and higher**
**CND S/N 10,226 and higher**

| | WAS | | NOW |
|---|---|---|---|
| L2202<br>L2205 | 47 μH | → | 33 μH |

**4. Servo VD Delay One Shot Thermal Stability Modification**
**SVO Board**

| | WAS | | NOW |
|---|---|---|---|
| C9035 | 0.001 μF ceramic | → | 0.001 μF mylar |

**5. Servo VD Delay One Shot Time Constant Change**
**SVO Board : USA S/N 10,806 and higher**
**CND S/N 10,226 and higher**

| | WAS | | NOW |
|---|---|---|---|
| C9035 | 0.001 mylar | → | 0.0022 mylar |

**6. Servo Temperature Characteristic Modification**
**SVO Board : USA S/N 10,806 and higher**
**CND S/N 10,226 and higher**

| | WAS | | NOW |
|---|---|---|---|
| R9003 | 220 k carbon | → | 100 k carbon |

**7. Capstan Servo Time Constant Change**
**SVO Board : USA S/N 10,806 and higher**
**CND S/N 10,226 and higher**

| | WAS | | NOW |
|---|---|---|---|
| R9203 | 220 k-B VR RES | → | 100 k-B VR RES<br>(1-224-247-00) |
| R9079 | 75 k metal oxide | → | 33 k metal oxide<br>(1-213-179-11) |

**8. Component Changes to Meet U.L. Requirements**
**RE Board**

| | WAS | | NOW |
|---|---|---|---|
| R5109<br>R5110 | 5.6 carbon | → | 5.6 1/4W Fusible<br>(1-217-384-11) |
| R5107 | 51 carbon | → | 47 1/4W<br>(1-217-395-11) |

**Y-DEM Board**

| | WAS | | NOW |
|---|---|---|---|
| R3053 | 47 carbon | → | 47 2W Nonflammable<br>(1-207-632-11) |
| R3037<br>R3045<br>R3080 | 100 carbon | → | 100 2W Nonflammable<br>(1-207-636-11) |
| R3057 | 270 carbon | → | 270 2W Nonflammable<br>(1-207-914-11) |

**C-DEM Board**

| | WAS | | NOW |
|---|---|---|---|
| R4173 | 33 carbon | → | 33 1/4W Fusible<br>(1-217-393-11) |
| R4058 | 91 carbon | → | 91 2W Nonflammable<br>(1-206-486-11) |
| R4018<br>R4021<br>R4027<br>R4037<br>R4049<br>R4071<br>R4105<br>R4131<br>R4151<br>R4170 | 100 carbon | → | 100 2W Nonflammable<br>(1-207-636-11) |

**RP Board**

| | WAS | | NOW |
|---|---|---|---|
| R2510 | 75 carbon | → | 75 2W Nonflammable<br>(1-206-484-11) |
| R2522 | 75 carbon | → | 220 2W Nonflammable<br>(1-207-638-11) |
| R2501<br>R2202<br>R2204 | 100 carbon | → | 100 2W Nonflammable<br>(1-207-636-11) |
| R2433 | 100 carbon | → | 100 1/4W Fusible<br>(1-217-399-11) |
| R2201<br>R2203 | 330 carbon | → | 330 2W Nonflammable<br>(1-207-639-11) |
| R2103<br>R2104<br>R2105 | 150 carbon | → | 100 1/2W Fusible<br>(1-217-446-11) |
| R2101 | 180 carbon | → | 180 2W Nonflammable<br>(1-207-950-11) |
| R2102 | 270 carbon | → | 270 2W Nonflammable<br>(1-207-914-11) |

**VOA Board**

| | WAS | | NOW |
|---|---|---|---|
| R8010<br>R8011 | 47 carbon | → | 47 2W Nonflammable<br>(1-207-632-11) |
| R8024 | 100 carbon | → | 100 2W Nonflammable<br>(1-207-636-11) |

**AUD Board**

| | WAS | | NOW |
|---|---|---|---|
| R51 | 47 carbon | → | 47 1/4W Fusible<br>(1-217-395-11) |
| R6<br>R22<br>R45<br>R56 | 100 carbon | → | 100 1/4W Fusible<br>(1-217-399-11) |

**SYS Board**

| | WAS | | NOW |
|---|---|---|---|
| R41 | 220 carbon | → | 220 2W Nonflammable<br>(1-207-638-11) |

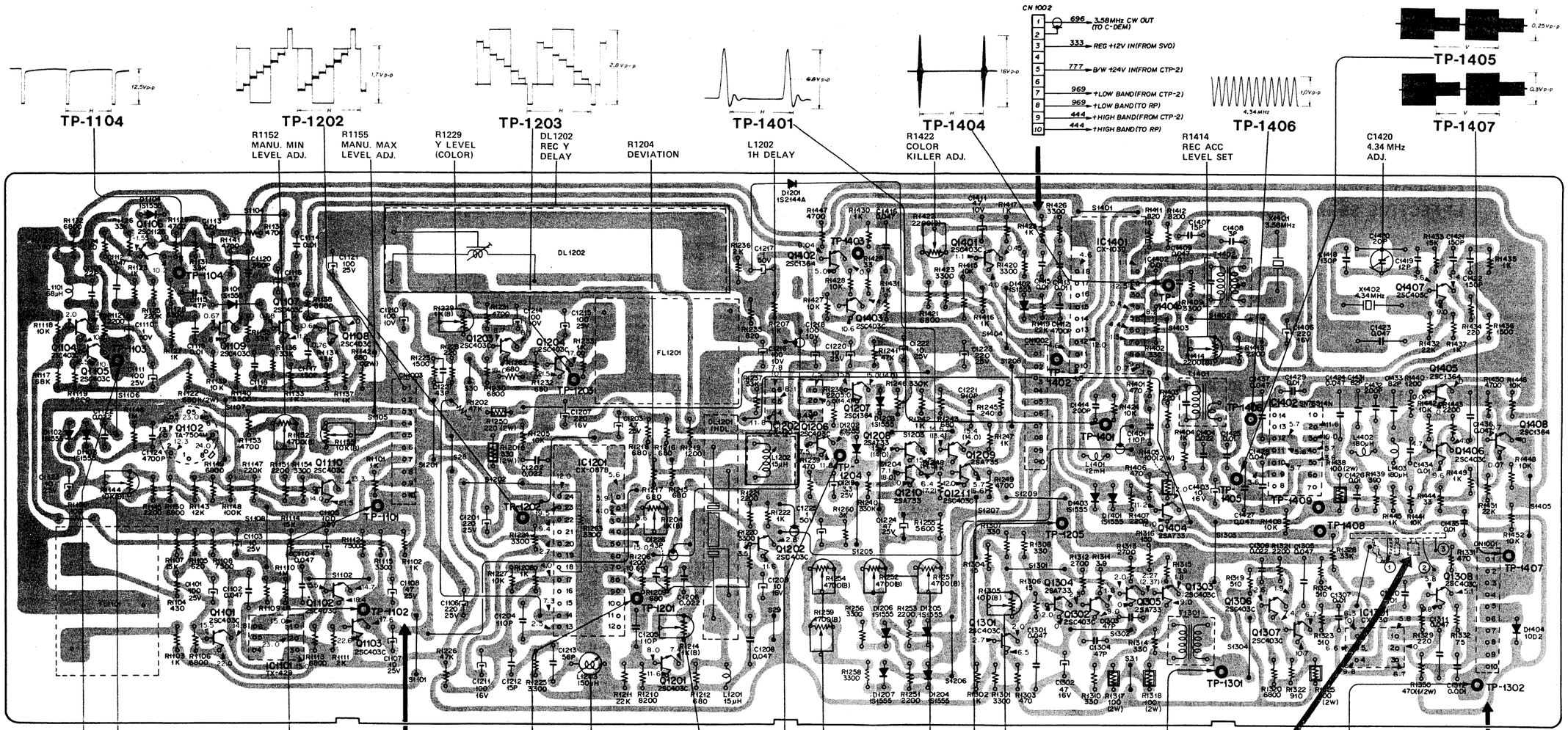
**MOD Board**

| | WAS | | NOW |
|---|---|---|---|
| R1325<br>R1317<br>R1318<br>R1405<br>R1438 | 220 carbon | → | 100 2W Nonflammable<br>(1-207-636-11) |
| R1250 | 220 carbon | → | 220 2W Nonflammable<br>(1-207-638-11) |
| R1201 | 330 carbon | → | 330 2W Nonflammable<br>(1-207-639-11) |
| R1431 | 220 carbon | → | 1 k carbon |

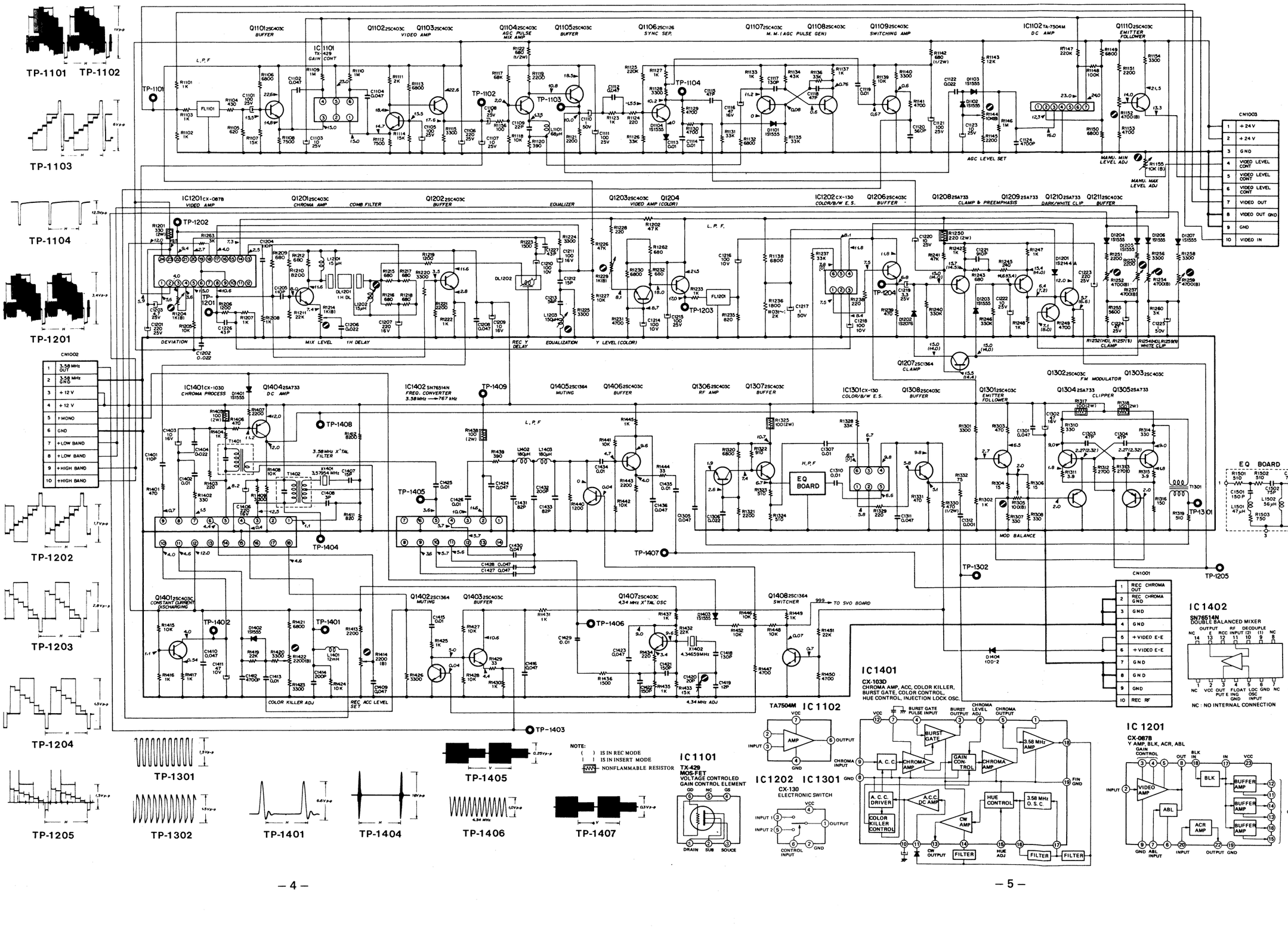
**Service Note:**
All the adjustment procedures and their values remain unchanged.
All printed circuit boards of the same type number have complete interchangeability with each other regardless of changes.

## MOD & EQ BOARD (MODULATOR) MOUNTING DIAGRAM

Serial No. USA : 10,281 and Higher
CND : 10,051 and Higher

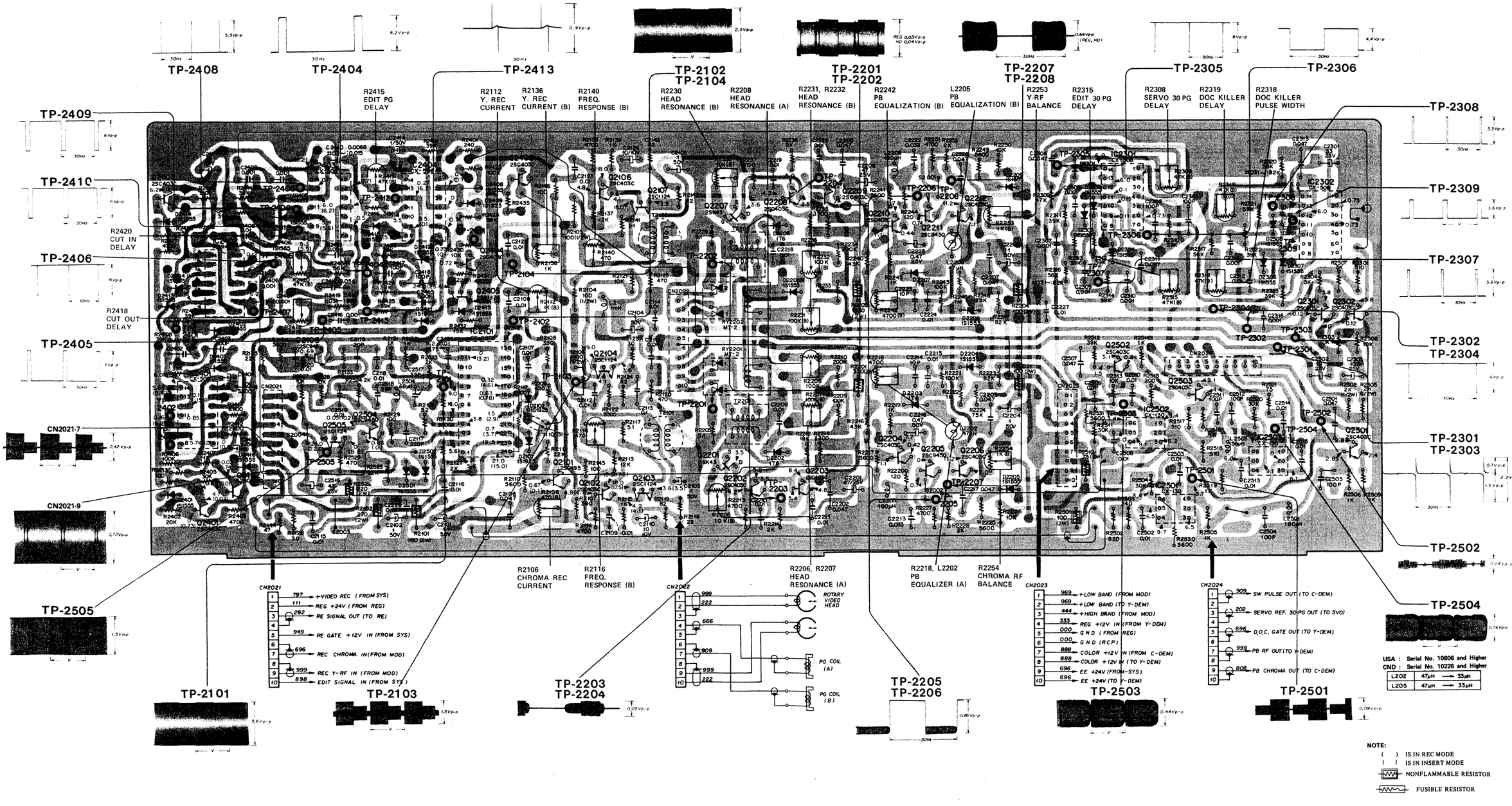


## MOD & EQ BOARD (MODULATOR) SCHEMATIC DIAGRAM

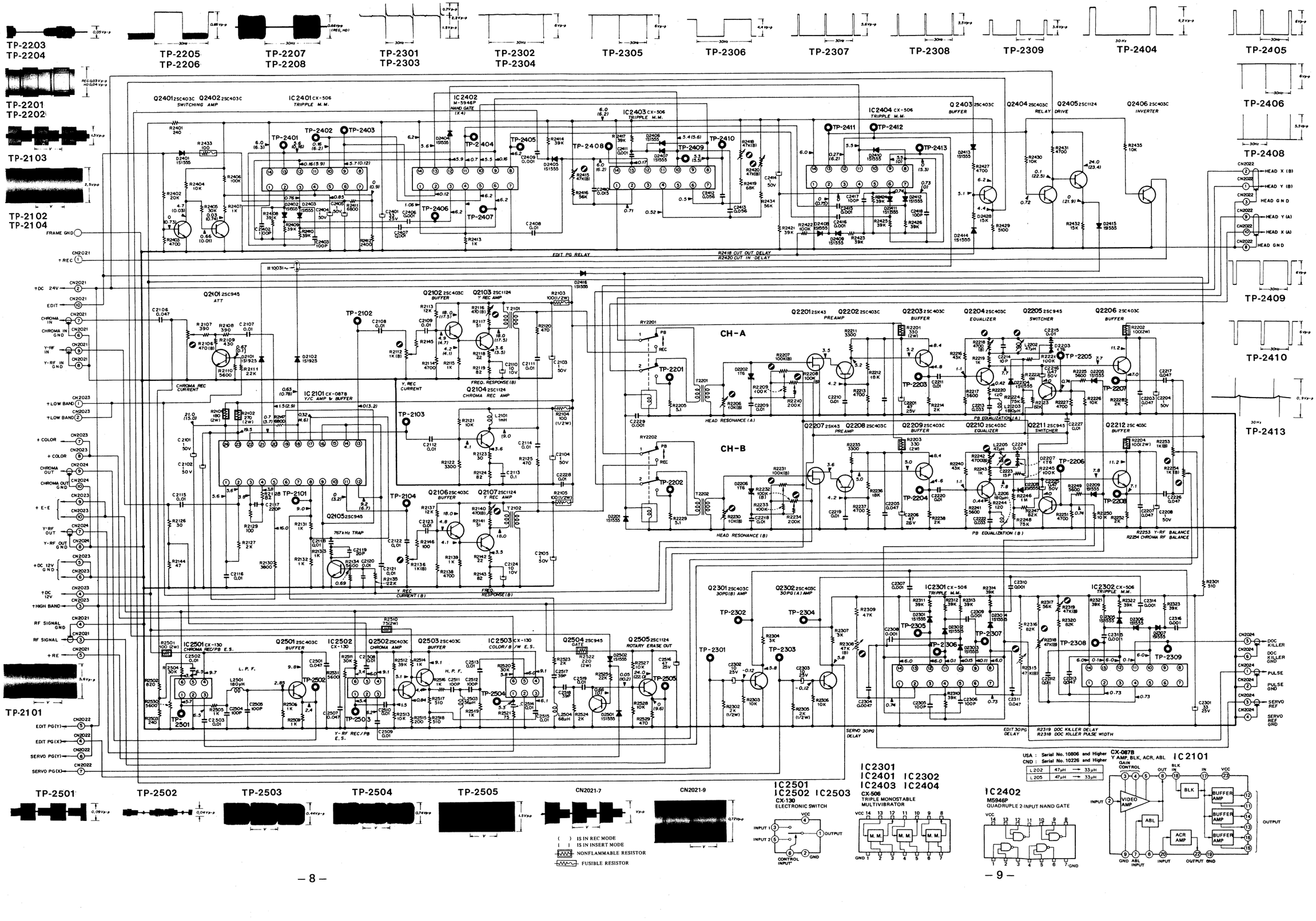


## RP BOARD (REC/PB AMP, BLANKING SWITCHER) MOUNTING DIAGRAM

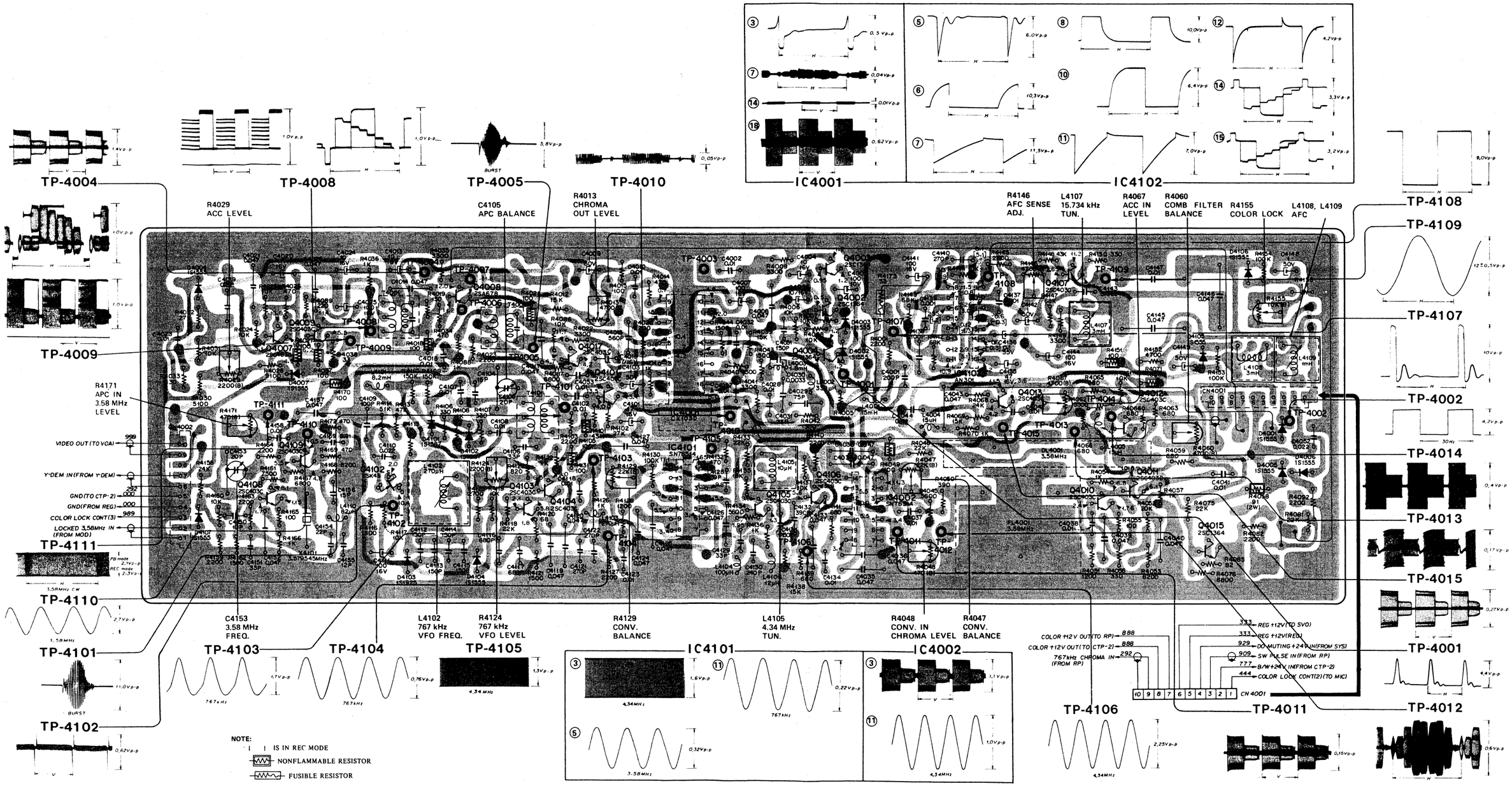
Serial No. USA : 10,281 and Higher
CND : 10,051 and Higher



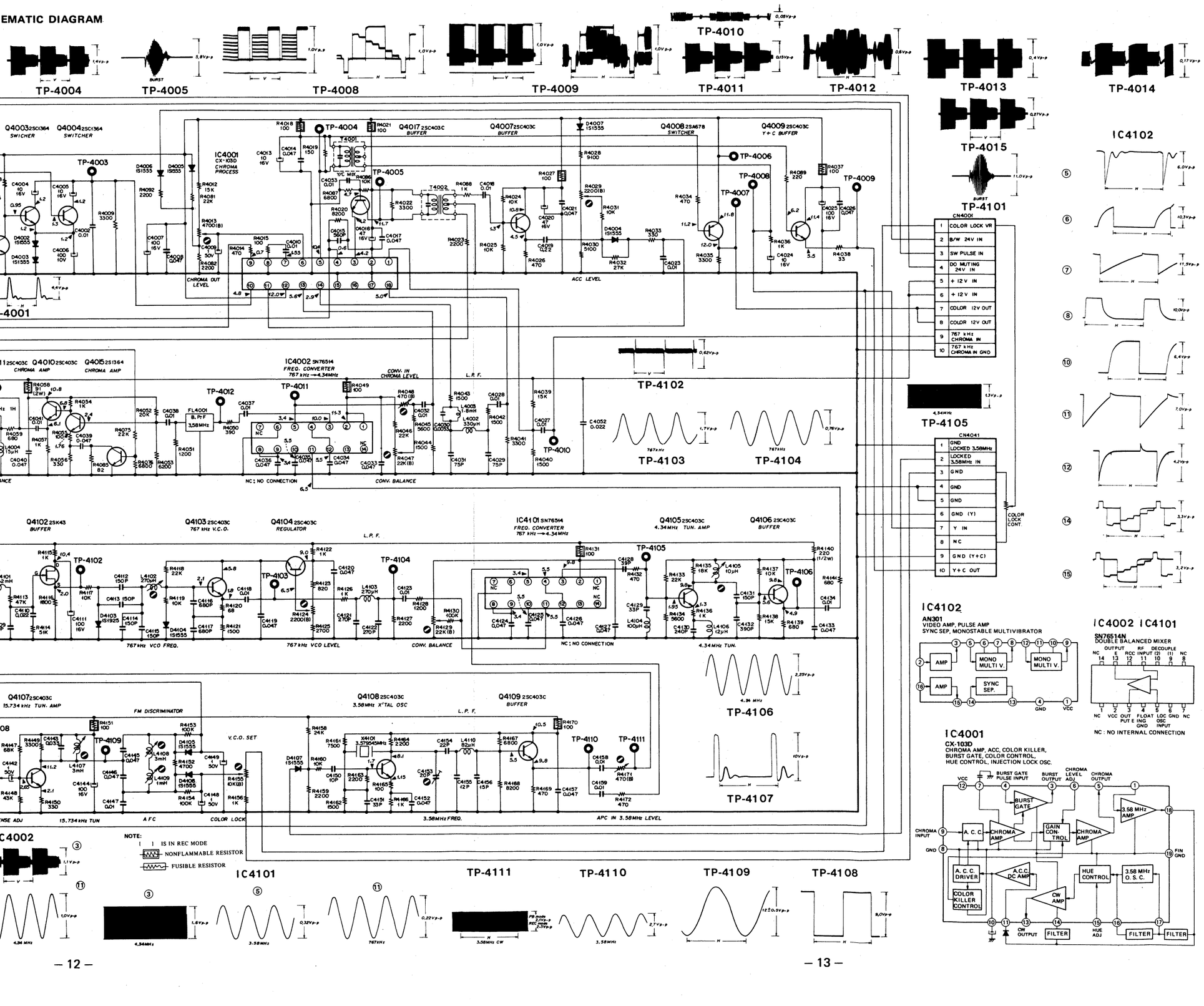
## RP BOARD (REC/PB AMP, BLANKING SWITCHER) SCHEMATIC DIAGRAM



**C-DEM BOARD (CHROMA PROCESS) MOUNTING DIAGRAM** Serial No. USA : 10,281 and Higher
CND : 10,051 and Higher

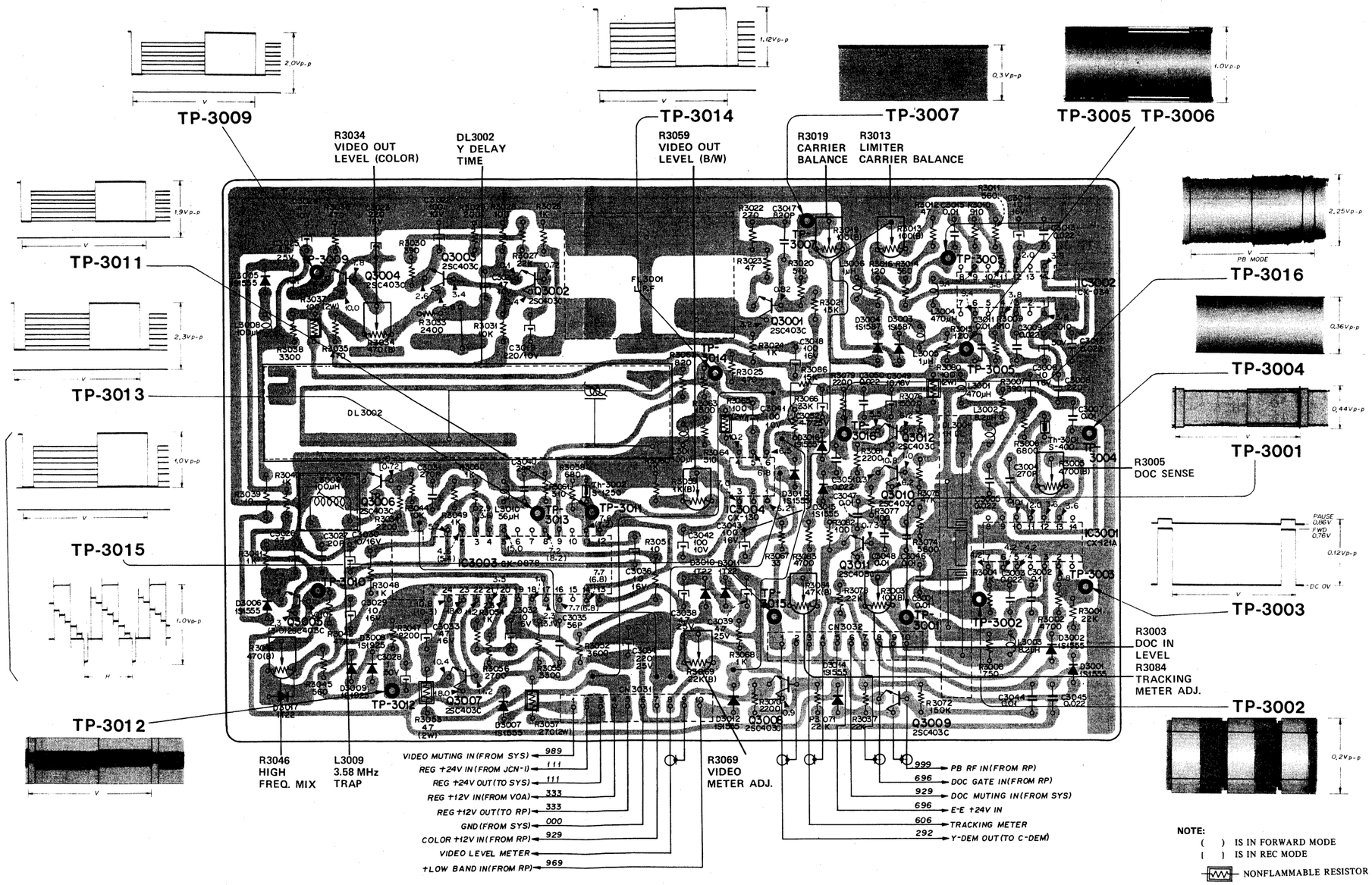


## C-DEM BOARD (CHROMA PROCESS) SCHEMATIC DIAGRAM

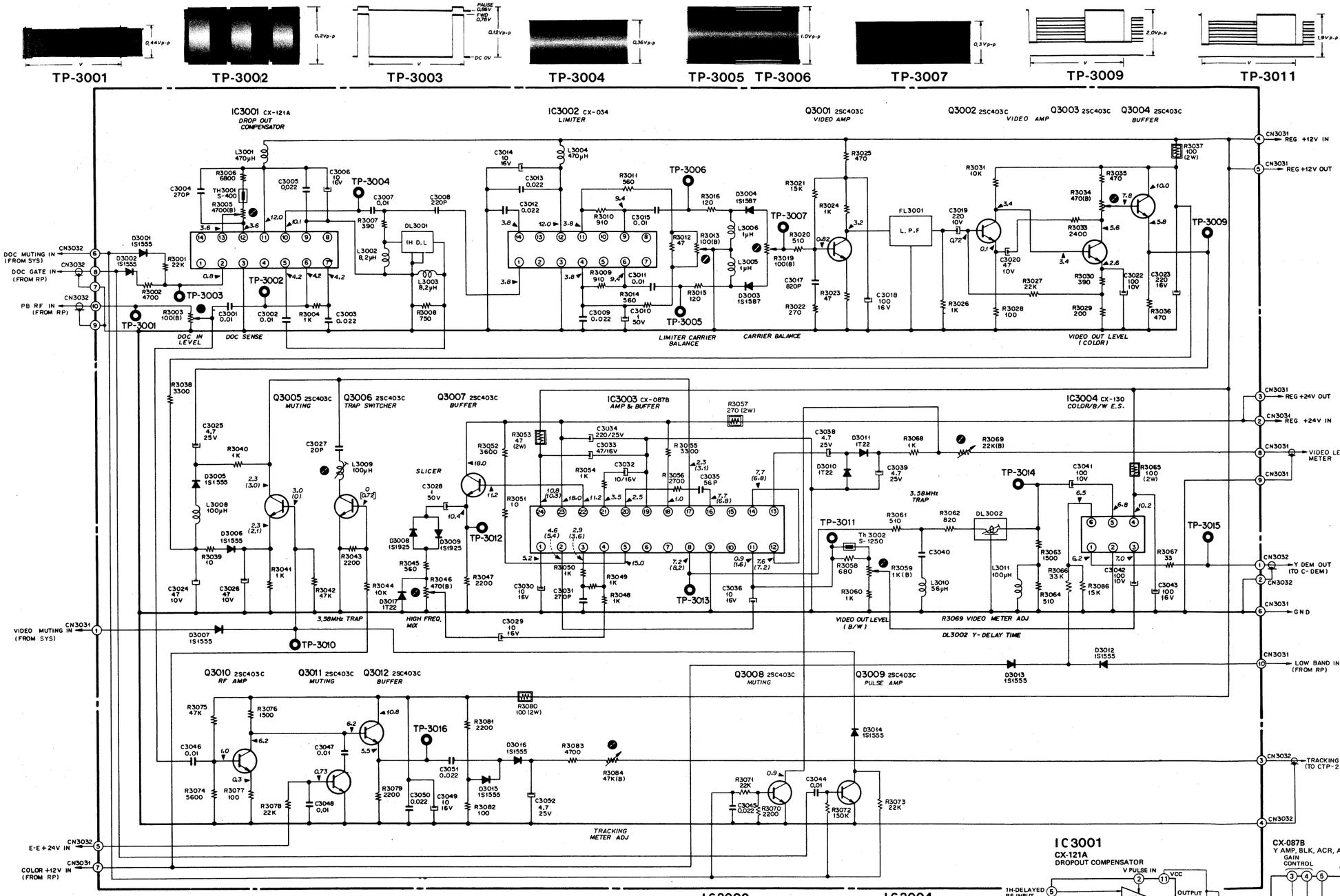


## Y-DEM BOARD (Y-FM DEMODULATOR) MOUNTING DIAGRAM

Serial No. USA : 10,281 to 11,005
CND : 10,051 to 10,225

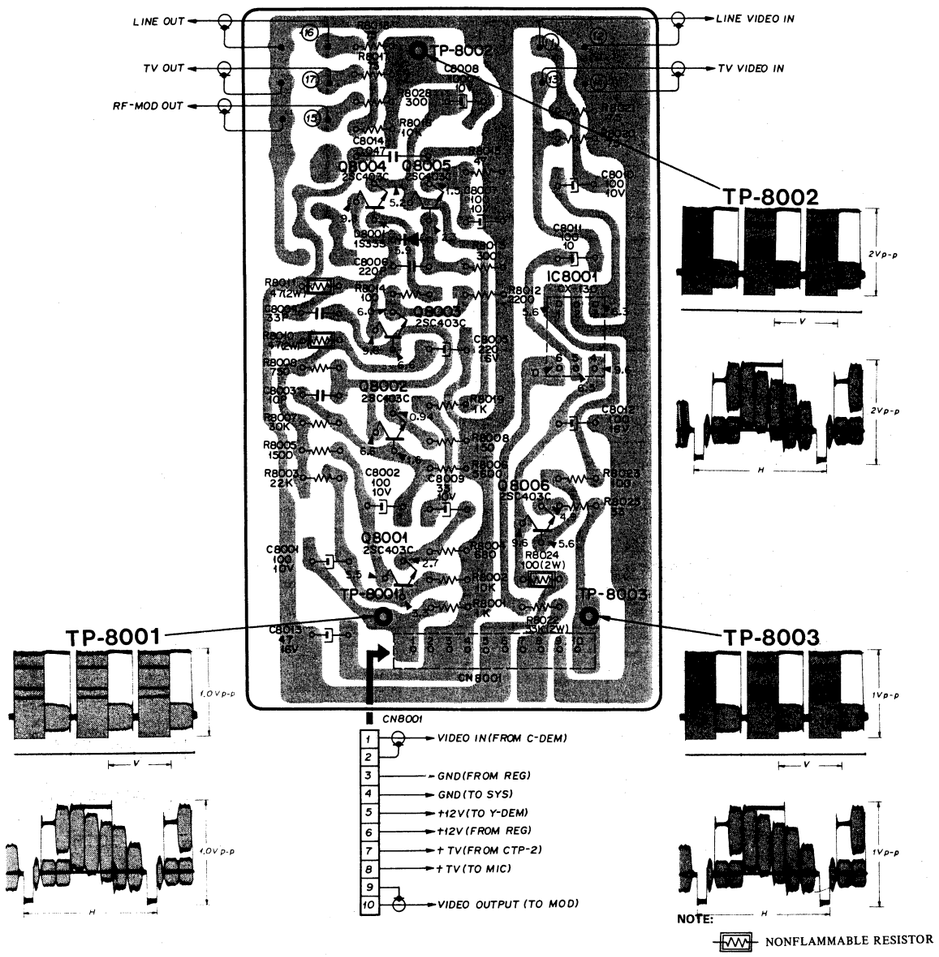


## Y-DEM BOARD (Y-FM DEMODULATOR) SCHEMATIC DIAGRAM

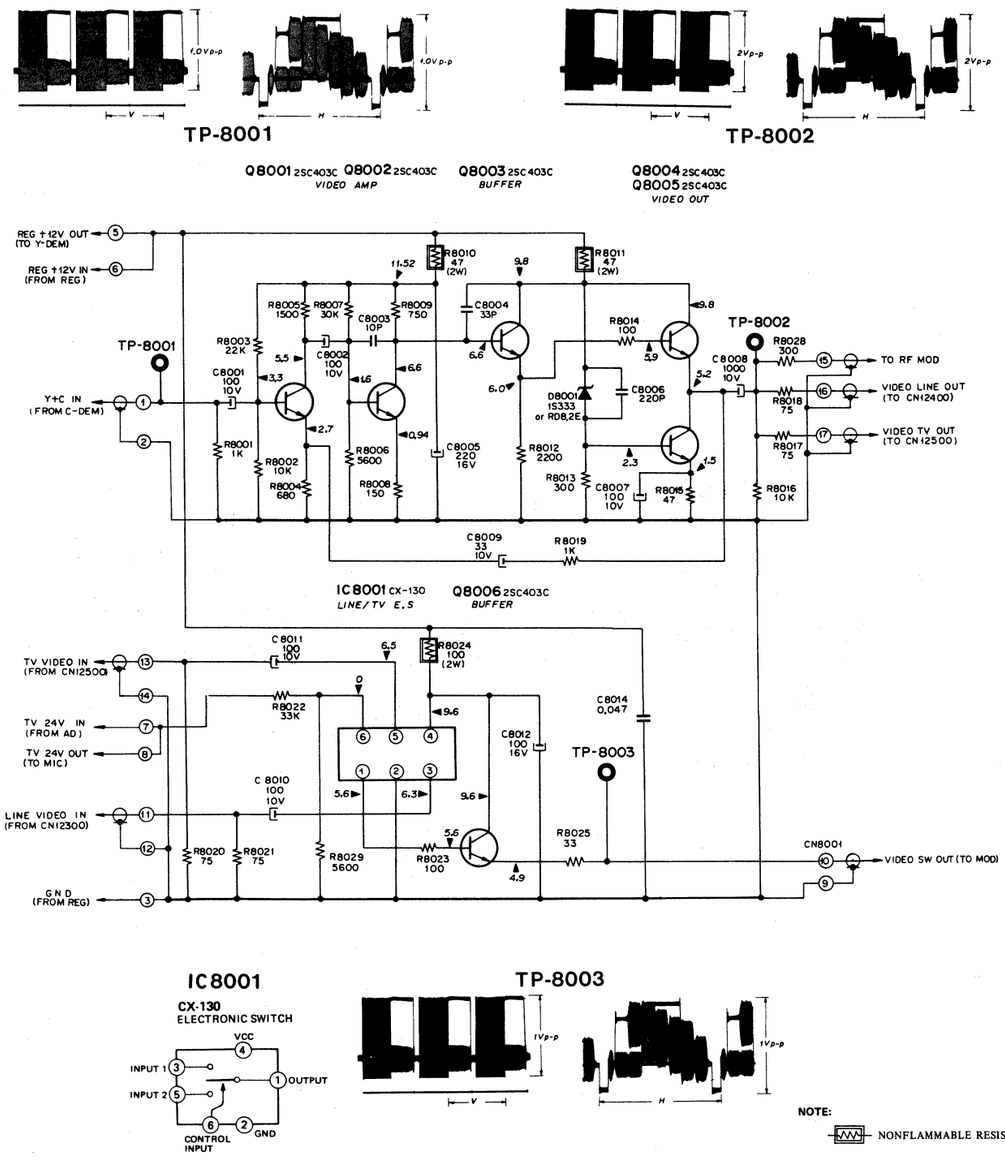


## VOA BOARD (VIDEO INPUT SELECT, OUTPUT AMP) MOUNTING DIAGRAM

Serial No. USA : 10,281 to 11,005
CND : 10,051 to 10,225

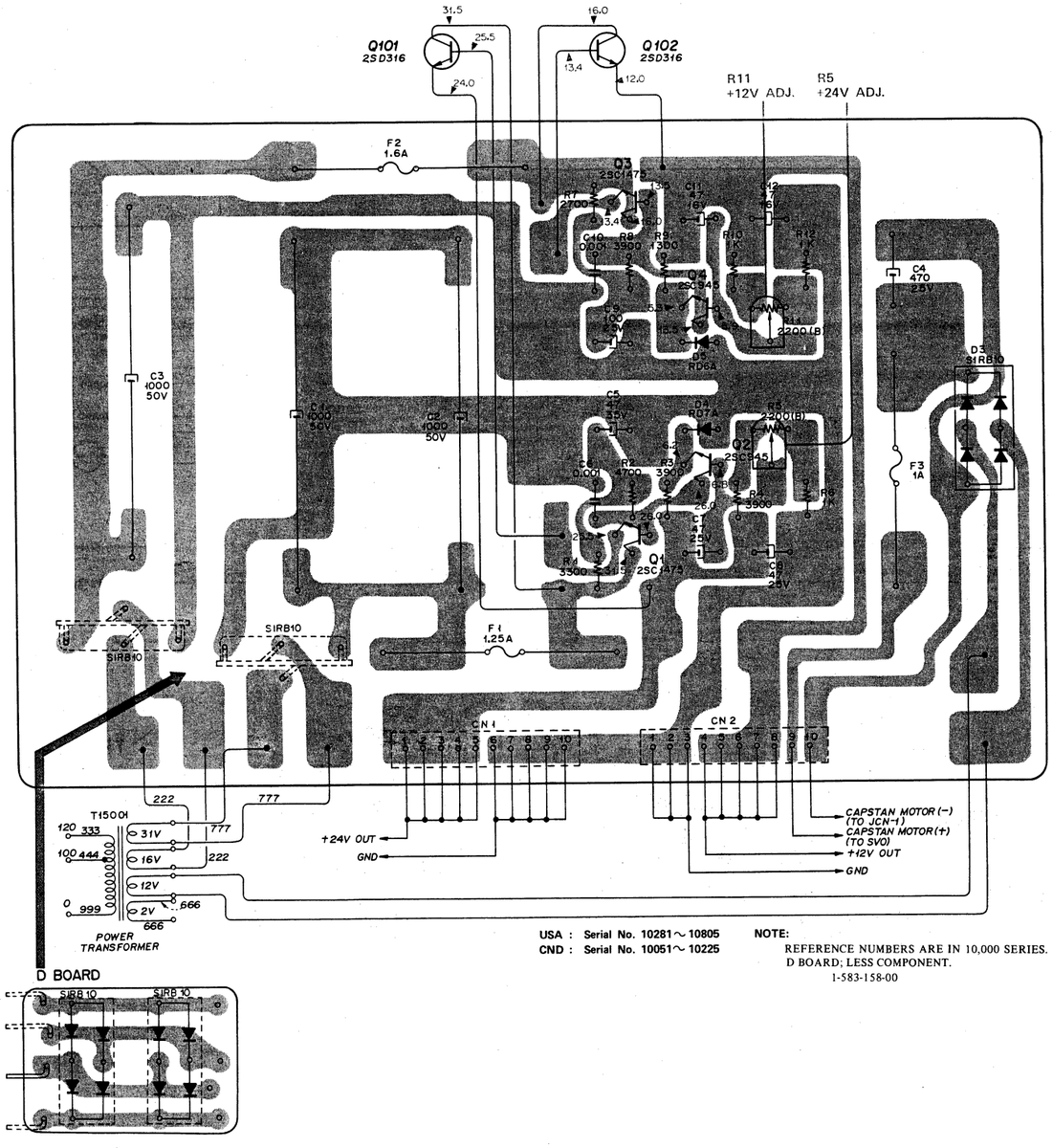



## VOA BOARD (VIDEO INPUT SELECT, OUTPUT AMP) SCHEMATIC DIAGRAM



## REG BOARD (REGULATOR) MOUNTING DIAGRAM

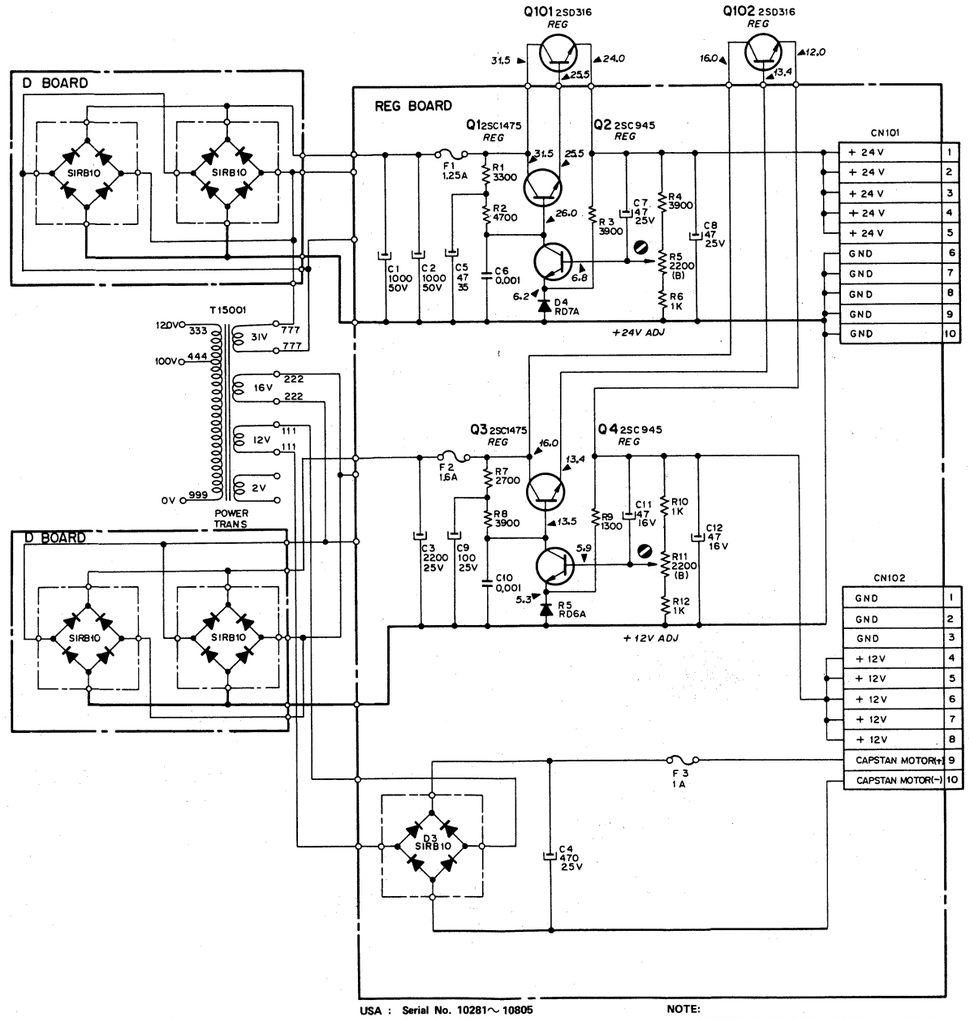
Serial No. USA : 10,281 to 10,805
CND : 10,051 to 10,225




USA : Serial No. 10281～10805
CND : Serial No. 10051～10225

NOTE:
REFERENCE NUMBERS ARE IN 10,000 SERIES.
D BOARD; LESS COMPONENT.
1-583-158-00

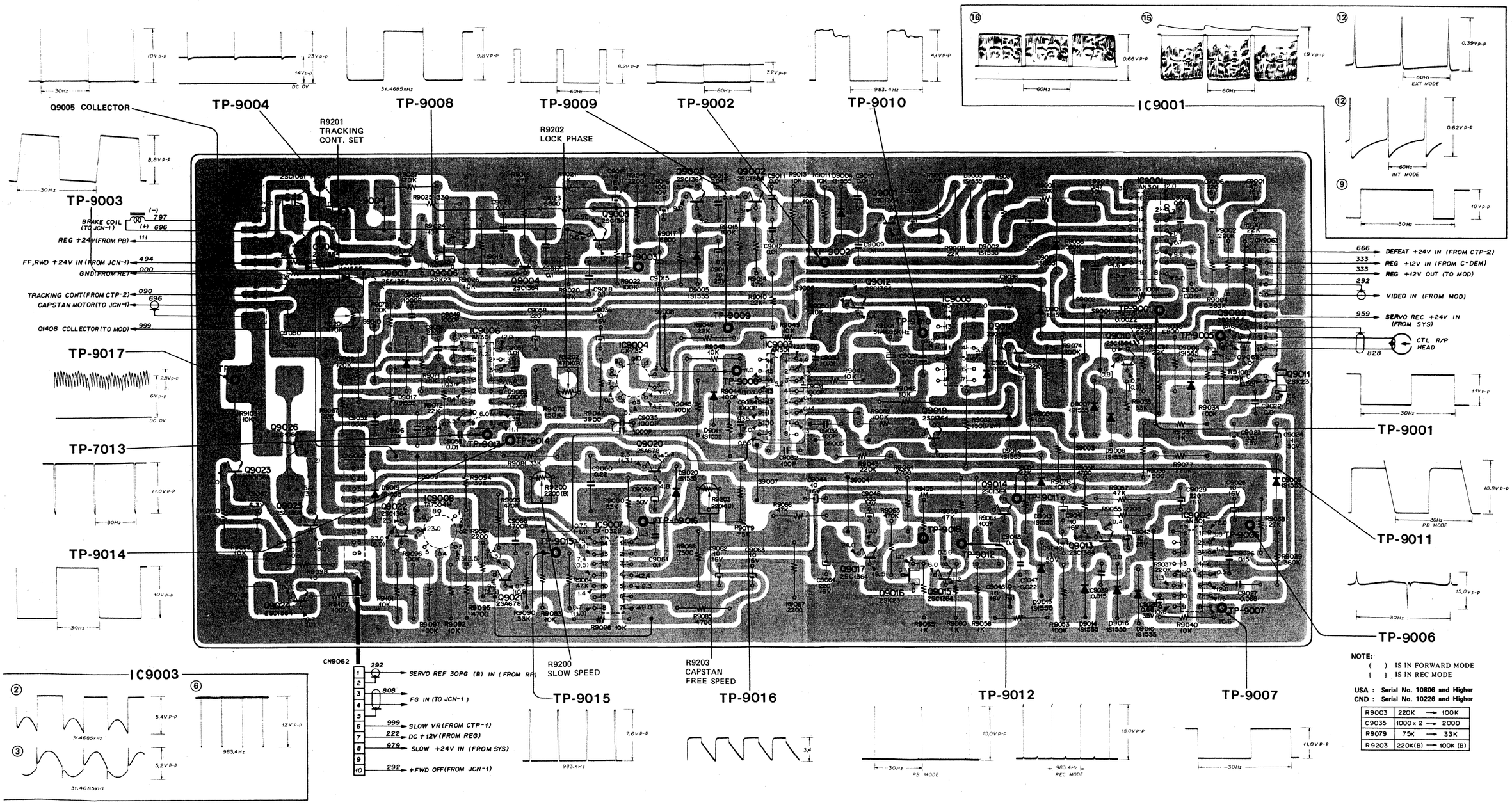
## REG BOARD (REGULATOR) SCHEMATIC DIAGRAM




USA : Serial No. 10281～10805
CND : Serial No. 10051～10225

NOTE:
REFERENCE NUMBERS ARE IN 10,000 SERIES.
D BOARD; LESS COMPONENT.
1-583-158-00

**SVO BOARD (SERVO) MOUNTING DIAGRAM** Serial No. USA : 10,281 to 11,005
CND : 10,051 to 10,225

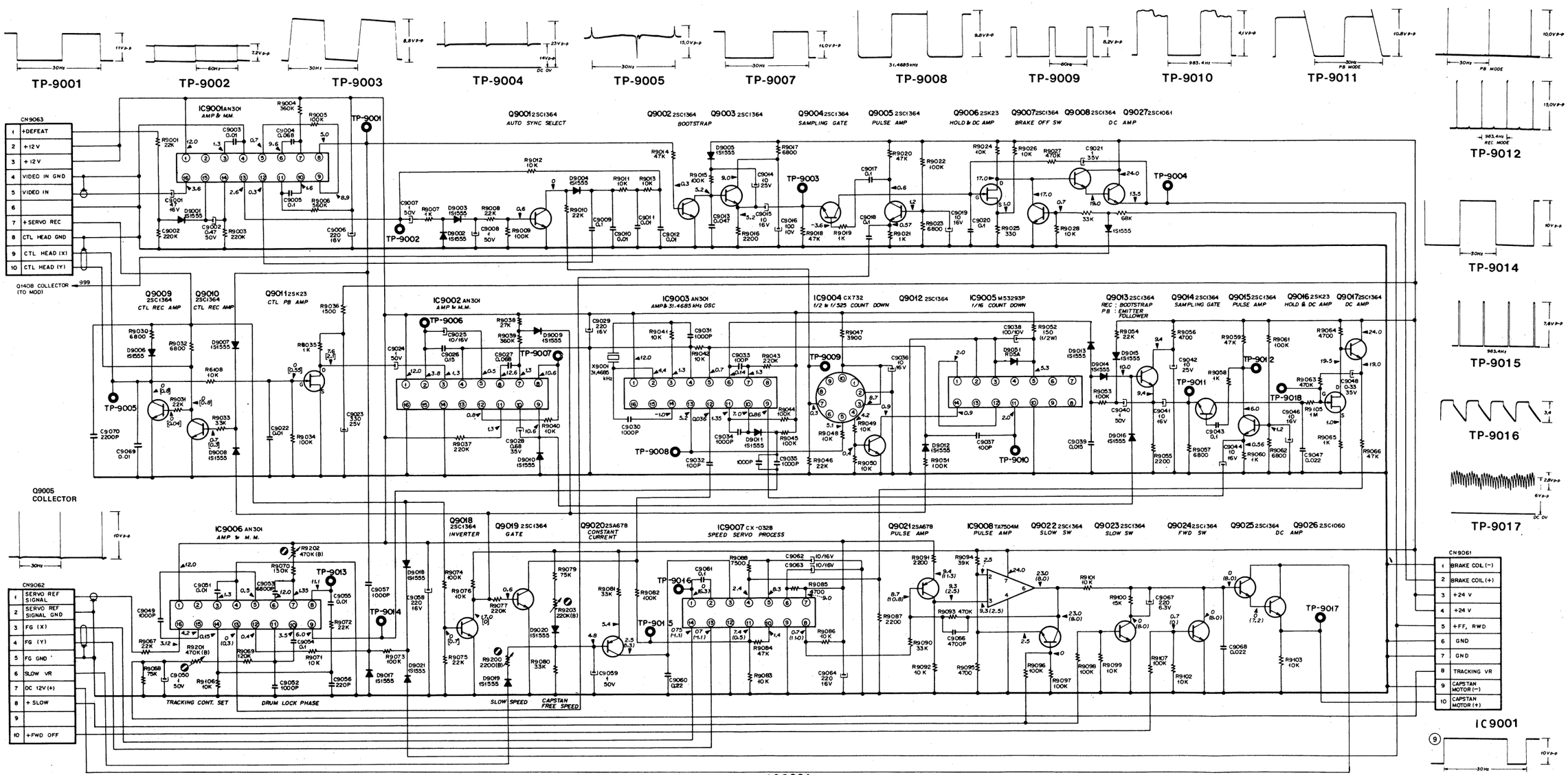



NOTE:
( ) IS IN FORWARD MODE
[ ] IS IN REC MODE

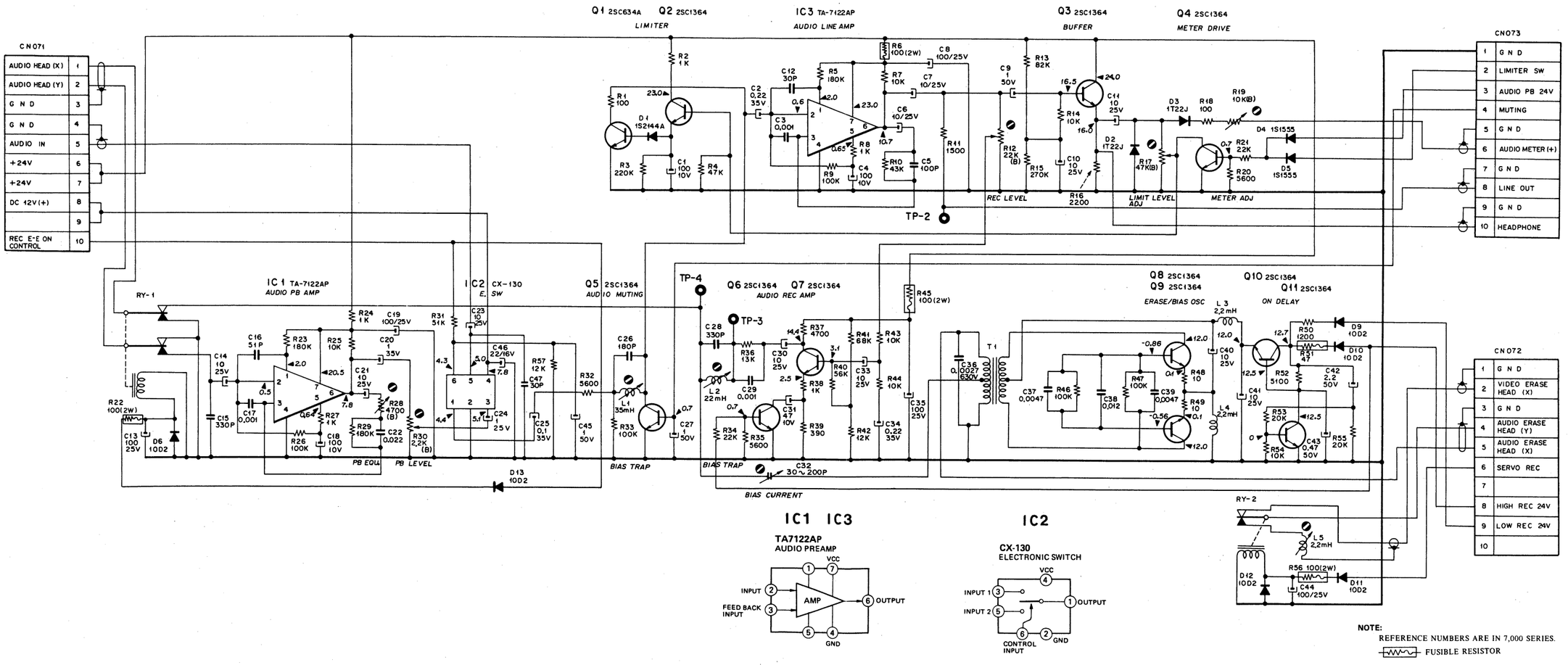
**USA : Serial No. 10806 and Higher**
**CND : Serial No. 10226 and Higher**

| | | |
|---|---|---|
| R9003 | 220K | → 100K |
| C9035 | 1000 x 2 | → 2000 |
| R9079 | 75K | → 33K |
| R9203 | 220K(B) | → 100K (B) |

## SVO BOARD (SERVO) SCHEMATIC DIAGRAM



## AUD BOARD (AUDIO) SCHEMATIC DIAGRAM




**IC1 IC3**

**TA7122AP**
AUDIO PREAMP




**IC2**

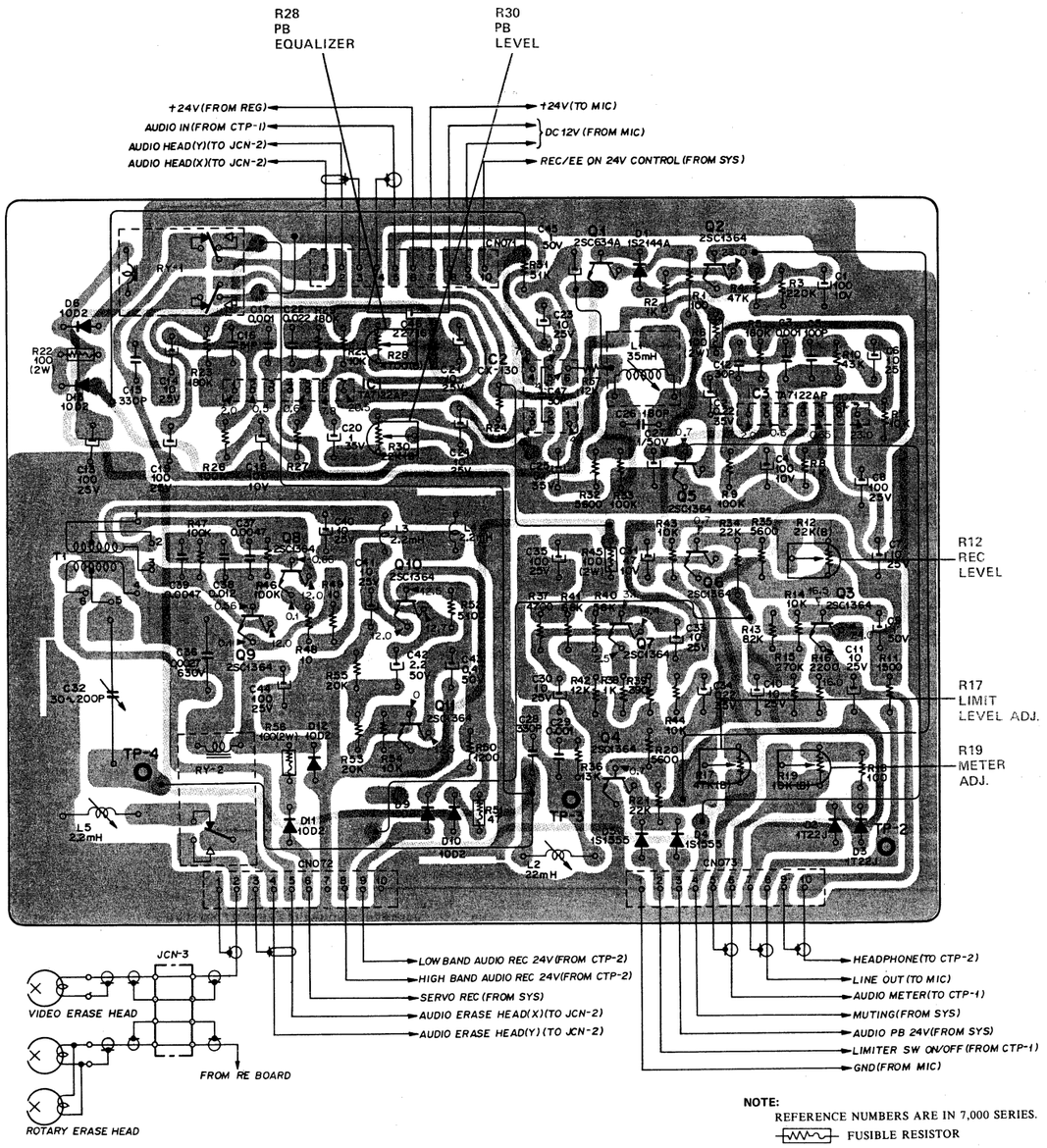
**CX-130**
ELECTRONIC SWITCH




**NOTE:**
REFERENCE NUMBERS ARE IN 7,000 SERIES.
FUSIBLE RESISTOR

## AUD BOARD (AUDIO) MOUNTING DIAGRAM

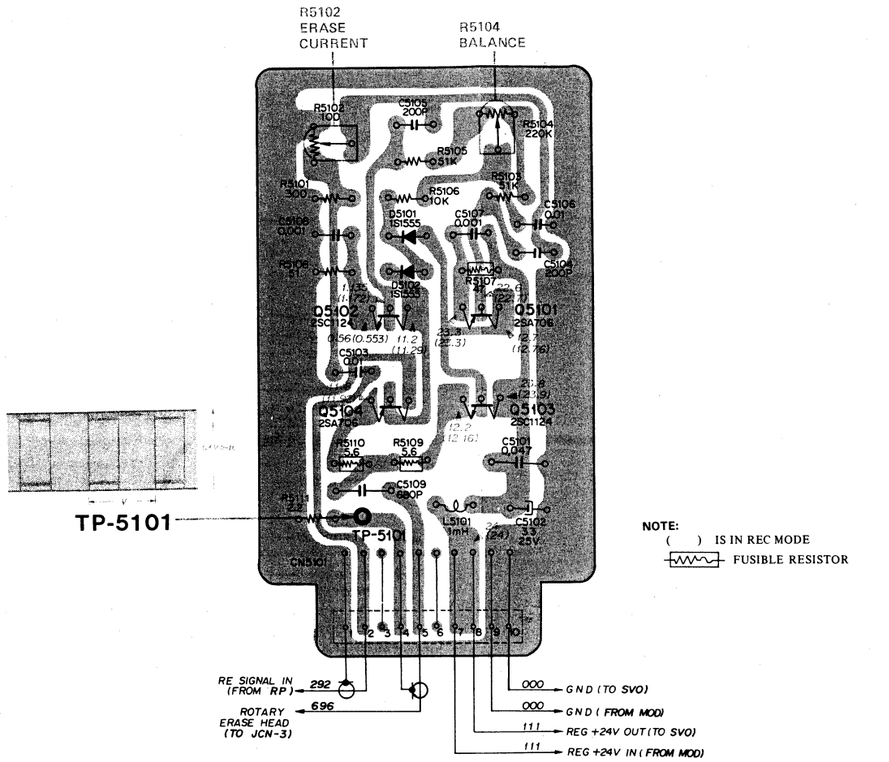
Serial No. USA : 10,281 and Higher
CND : 10,051 and Higher



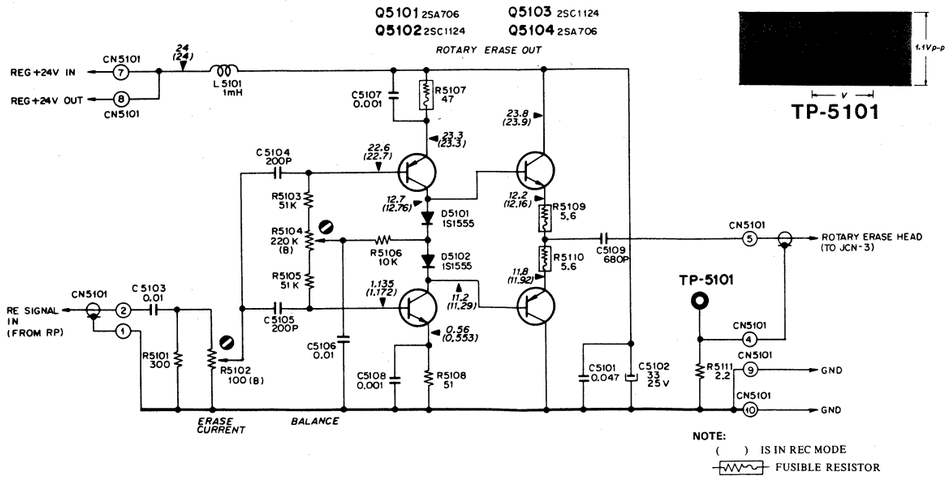

NOTE:
REFERENCE NUMBERS ARE IN 7,000 SERIES.
FUSIBLE RESISTOR

## RE BOARD (ROTARY ERASE) MOUNTING & SCHEMATIC DIAGRAM

Serial No. USA : 10,281 and Higher
CND : 10,051 and Higher

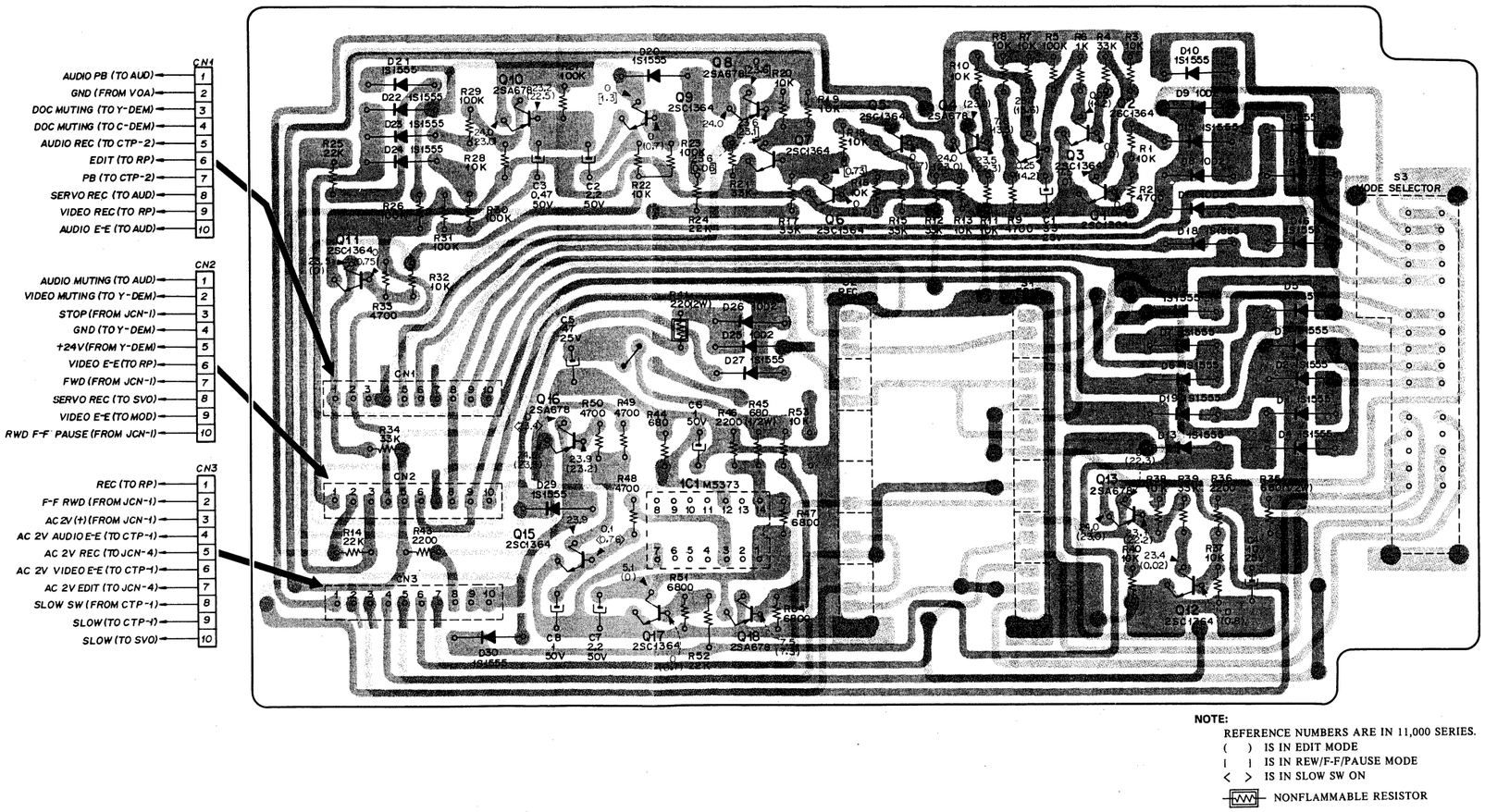



NOTE:
( ) IS IN REC MODE
FUSIBLE RESISTOR



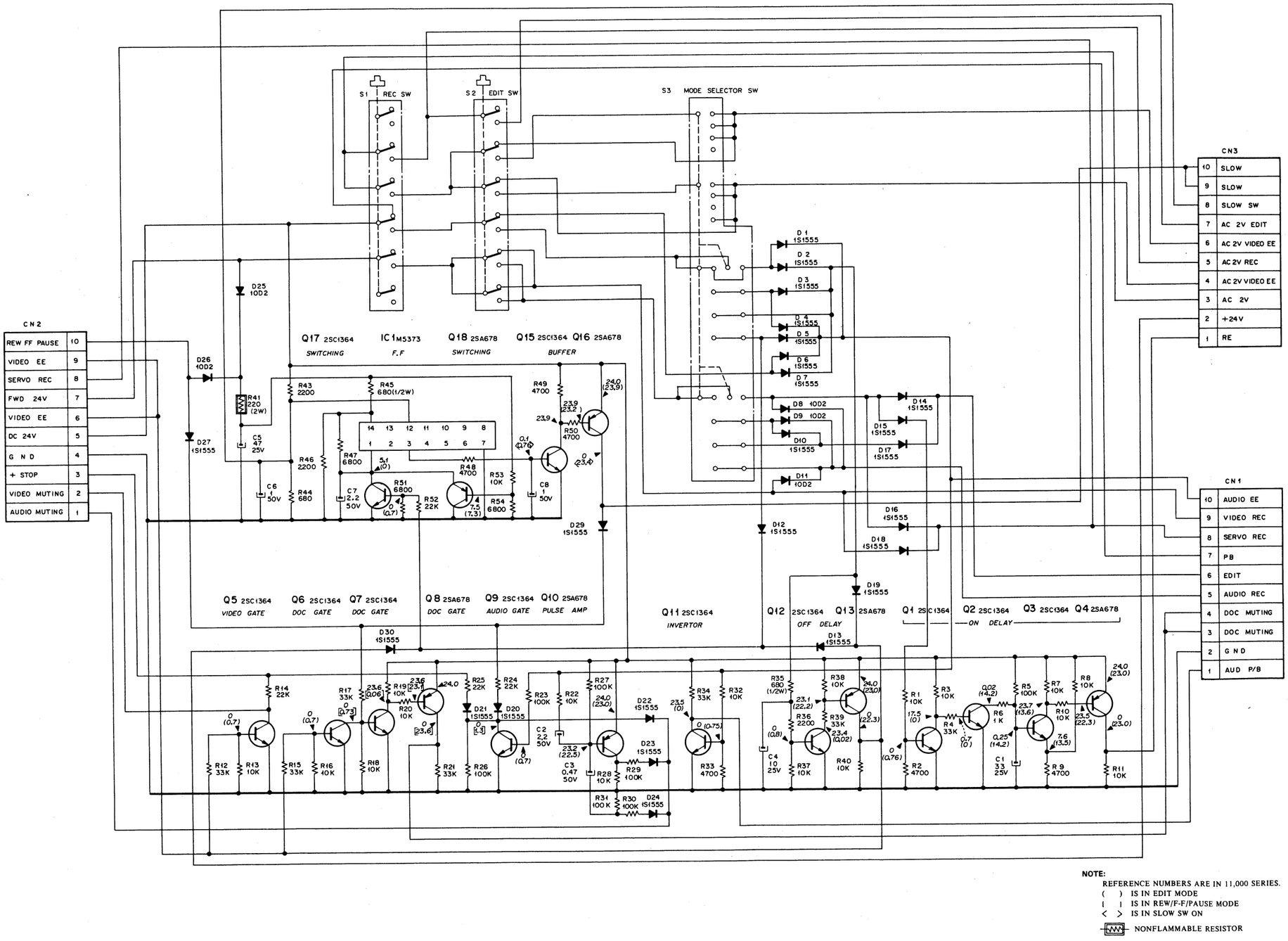

NOTE:
( ) IS IN REC MODE
FUSIBLE RESISTOR

**SYS BOARD (SYSTEM CONTROL) MOUNTING DIAGRAM** Serial No. USA : 10,281 and Higher
CND : 10,051 and Higher




**NOTE:**
REFERENCE NUMBERS ARE IN 11,000 SERIES.
( ) IS IN EDIT MODE
| | IS IN REW/F-F/PAUSE MODE
< > IS IN SLOW SW ON
NONFLAMMABLE RESISTOR

## SYS BOARD (SYSTEM CONTROL) SCHEMATIC DIAGRAM

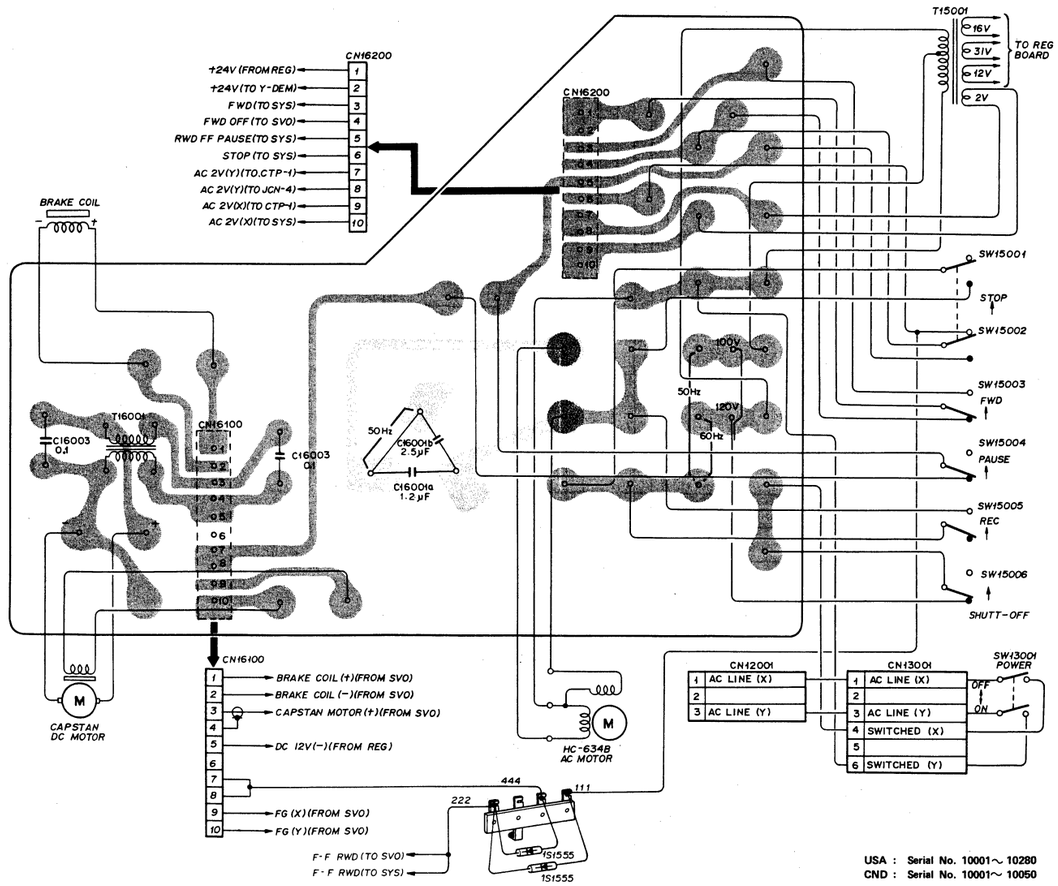



**NOTE:**

REFERENCE NUMBERS ARE IN 11,000 SERIES.
( ) IS IN EDIT MODE
| | IS IN REW/F-F/PAUSE MODE
< > IS IN SLOW SW ON
NONFLAMMABLE RESISTOR

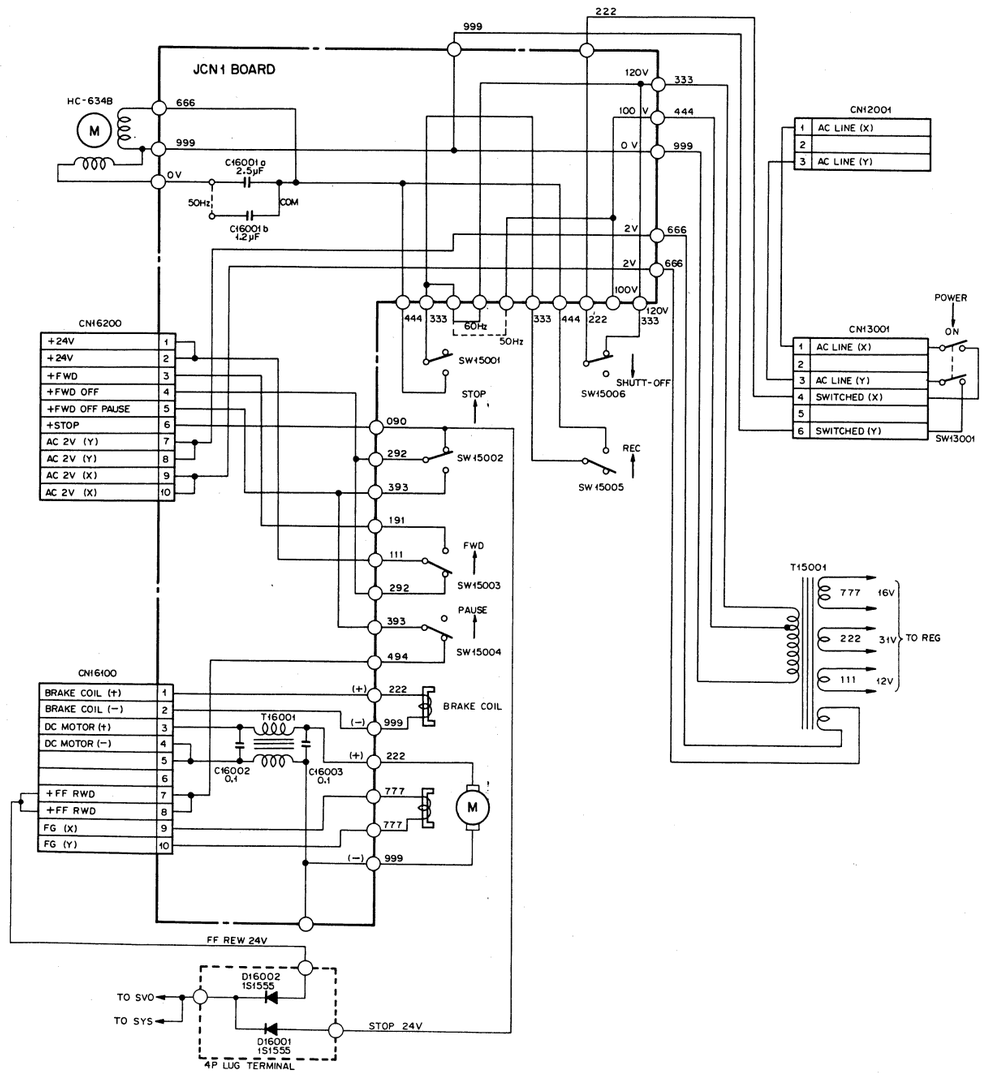
## JCN-1 BOARD (LINE VOLTAGE/FREQUENCY) MOUNTING DIAGRAM

Serial No. USA : 10,001 to 10,280
CND : 10,001 to 10,050



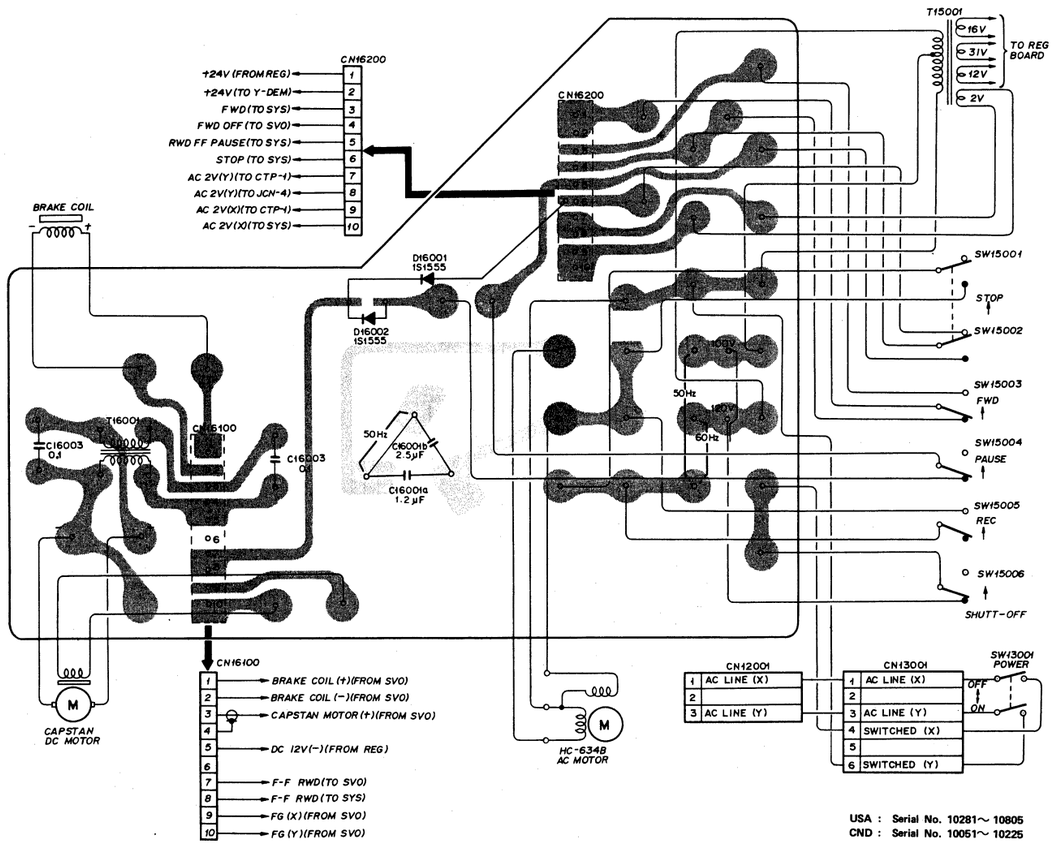

USA : Serial No. 10001～10280
CND : Serial No. 10001～10050

## JCN-1 BOARD (LINE VOLTAGE/FREQUENCY) SCHEMATIC DIAGRAM



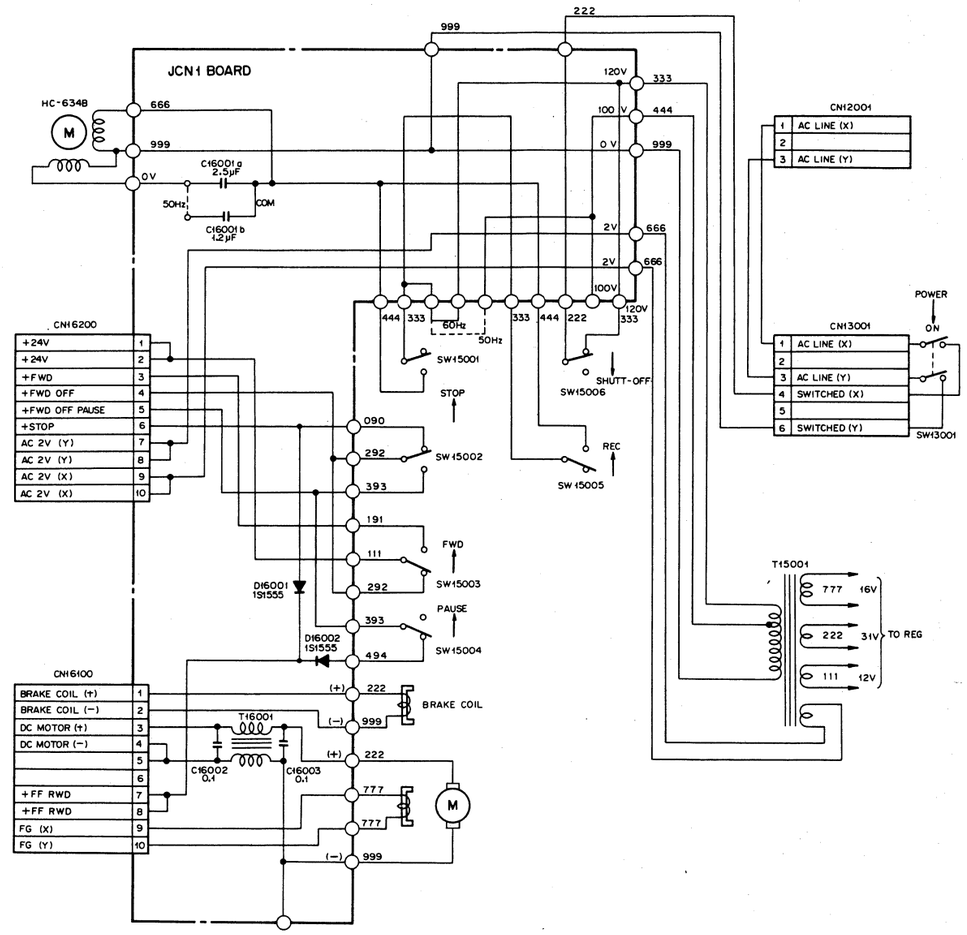
## JCN-1 BOARD (LINE VOLTAGE/FREQUENCY) MOUNTING DIAGRAM

**Serial No.** USA : 10,281 to 10,805
CND : 10,051 to 10,225



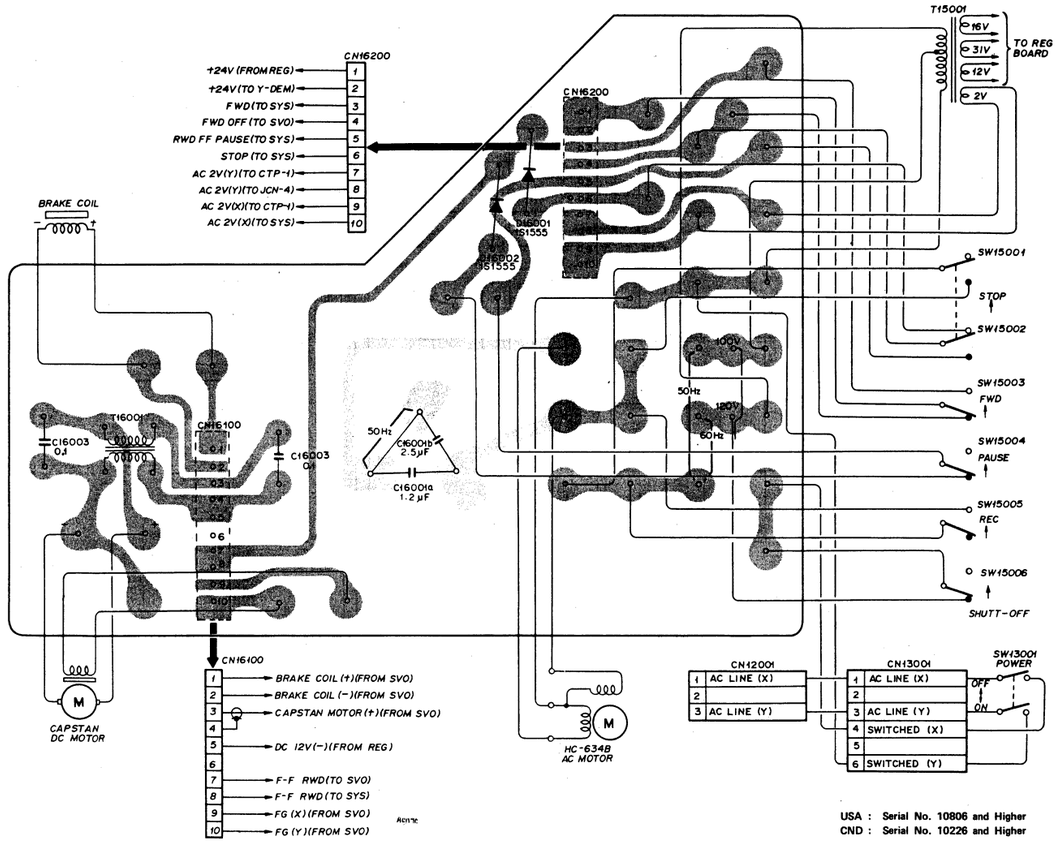

USA : Serial No. 10281～ 10805
CND : Serial No. 10051～ 10225

## JCN-1 BOARD (LINE VOLTAGE/FREQUENCY) SCHEMATIC DIAGRAM



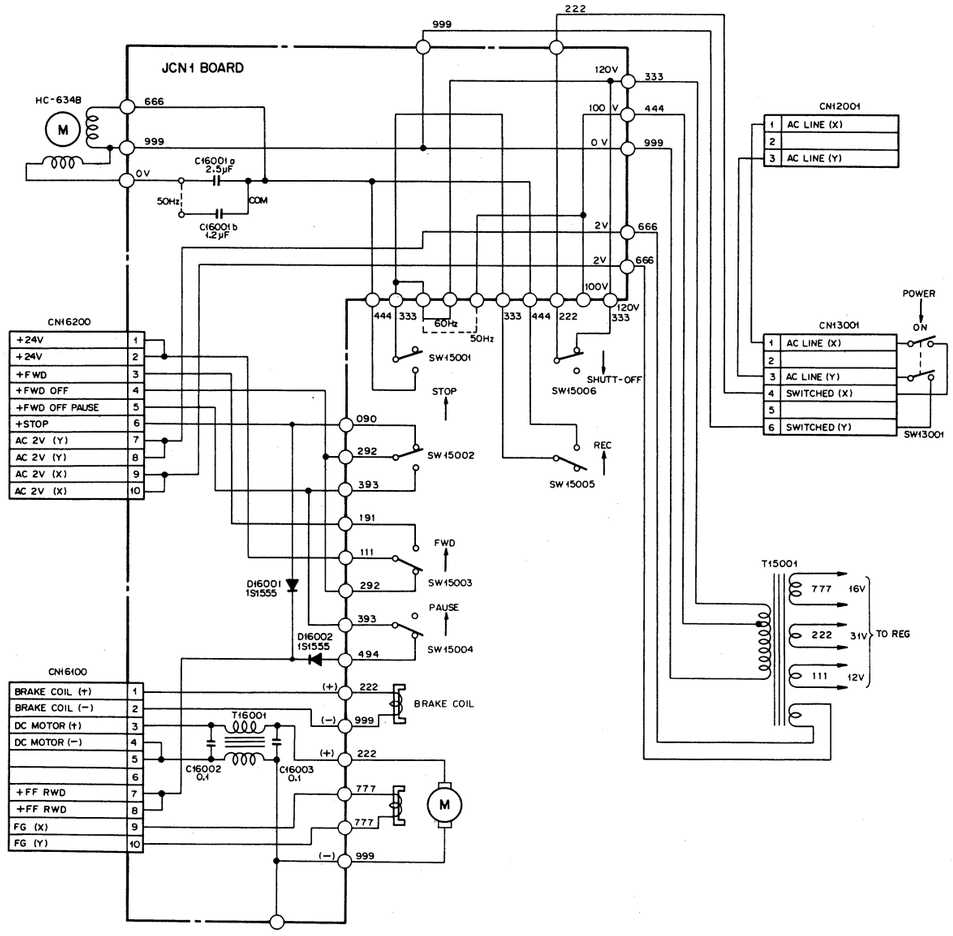
## JCN-1 BOARD (LINE VOLTAGE/FREQUENCY) MOUNTING DIAGRAM

Serial No. USA : 10,806 and Higher
CND : 10,226 and Higher




USA : Serial No. 10806 and Higher
CND : Serial No. 10226 and Higher

## JCN-1 BOARD (LINE VOLTAGE/FREQUENCY) SCHEMATIC DIAGRAM






9-966-150-81

SONY CORPORATION

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