

Service Manual

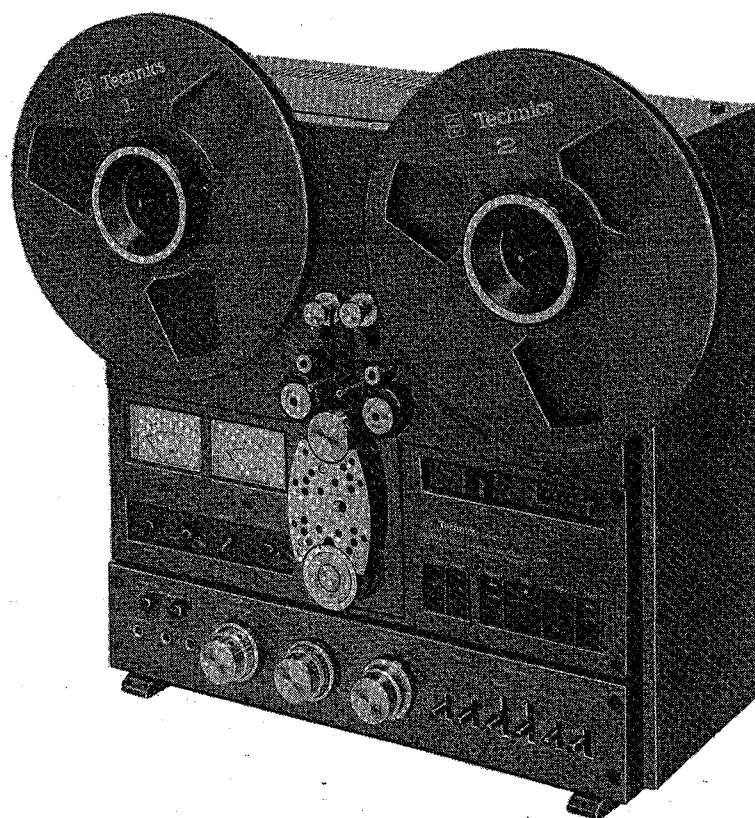
Open Deck

RS-1500US
RS-1506US

Vol. 2

"Isolated Loop" Three-Motor, Direct-Drive Tape Deck

MEASUREMENTS & ADJUSTMENTS



Professional Series

RS-1500U MECHANISM SERIES

Specifications (Catalog specifications for sales)

Track system:	4-heads system 2-track 2-channel recording, playback, erasing and 4-track 2-channel playback
Motors:	3 direct-drive motors system
Capstan;	Quartz control phase-locked DC brushless servo direct-drive motor
Reel tables;	2 tape tension controlled DC brushless direct-drive motors
Reel size:	5" to 10-1/2" (13 cm to 26.5 cm) outside diameter
Tape tension control:	Automatic control for above size of reel
Tape speed:	15 ips, 7-1/2 ips and 3-3/4 ips (38 cm/s, 19 cm/ and 9.5 cm/s)
Speed deviation:	± 0.1% at 15 ips (38 cm/s)
Speed fluctuation:	0.05% at 15 ips (38 cm/s)
Pitch control:	± 6% (recording and playback)
Wow and flutter:	Recording and playback
15 ips (38 cm/s);	0.018% (WRMS), ± 0.035% (DIN)
7-1/2 ips (19 cm/s);	0.03% (WRMS), ± 0.06% (DIN)
Time counter accuracy:	± 1% at 15 ips (38 cm/s)
Fast winding time:	150 sec. for 2500 ft (1.5 mil to 762 m) tape
Auto-Stop sensing:	
End of tape;	Tension roller switches
During running;	Within 3 sec. after accidental stop of takeup reel table
Frequency response:	
15 ips (38 cm/s);	30—30,000 Hz ± 3 dB (recording level = -10 dB from 0VU)
7-1/2 ips (19 cm/s);	20—25,000 Hz ± 3 dB (recording level = -20 dB from 0VU)
3-3/4 ips (9.5 cm/s);	20—15,000 Hz ± 3 dB (recording level = -20 dB from 0VU)
Signal-to-noise ratio:	NAB weighted (185 nWb/m + 6 dB)
15 ips (38 cm/s);	60 dB
7-1/2 ips (19 cm/s);	60 dB
3-3/4 ips (9.5 cm/s);	58 dB
Distortion (THD):	Measured via tape at 400 Hz (at any speed) Less than 2% peak level (185 nWb/m + 6 dB) Less than 0.8% operating level (0VU)
Channel separation:	Better than 50 dB
Erasing ratio:	Better than 65 dB (recording level = +10 dB at 1 kHz)
Recording bias:	120 kHz
Bias level;	BIAS selector at "1" 90%, BIAS selector at "2" 100%, BIAS selector at "3" 110%
Equalization:	NAB standard Position "2" of "EQ" and "BIS" selector set for Technics RT-10B218 (scotch #207) tape
Recording level	
calibration:	Reference to 185 nWb/m
Inputs:	
MIC;	Unbalanced phone type jack Sensitivity 0.25 mV (-72 dB), input impedance 4.7 K Ω (at 0VU, microphone level control at maximum position) 2.5 mV (-52 dB/4.7 K Ω with 20 dB microphone attenuator switch on overload margin 55 dB (75 dB with 20 dB microphone attenuator) Applicable microphone impedance 200 Ω —10 K Ω
LINE;	Phono type jack Sensitivity 60 mV (-24 dB), input impedance 150 K Ω Overload margin = infinity (line input connected to LINE IN level control before pass through the amplifier)
THROUGH OUT;	Same as LINE IN (connected in parallel to LINE IN)
Outputs:	
LINE;	2 pair of phono type jack Output level 0.55 V at 0VU (output level control at "8") 0.77 V or more at output level control maximum output impedance less than 3 K Ω Load impedance 22 K Ω over
HEADPHONE;	Stereo phone type jack Output level 80 mV at 0.55 V line output, load impedance 8 Ω
Power requirements:	AC 110/125/220/240 V, 50/60 Hz DC 24 V, 4.5 A (with RP-086 optional battery adaptor)
Power consumption:	120 W
Weight:	55 lbs (25 kg)
Dimensions (H x W x D):	17-1/2" x 18" x 10-1/8" (44.6 cm x 45.6 cm x 25.8 cm)

Specifications base on use of Technics RT-10B218 (Scotch #207) tape.
Specifications are subject to change without notice.

LOCATION OF CONTROLS AND COMPONENTS

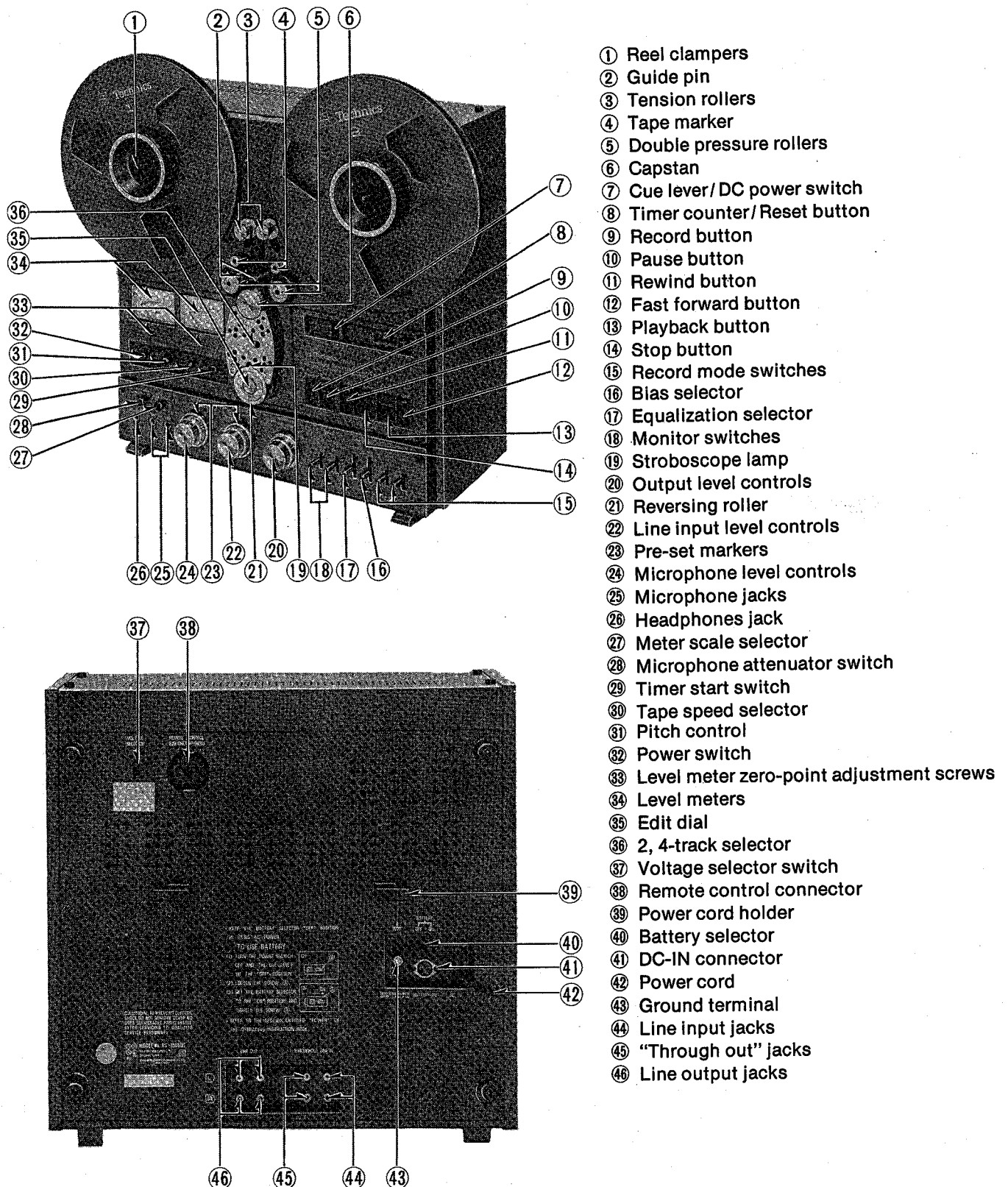
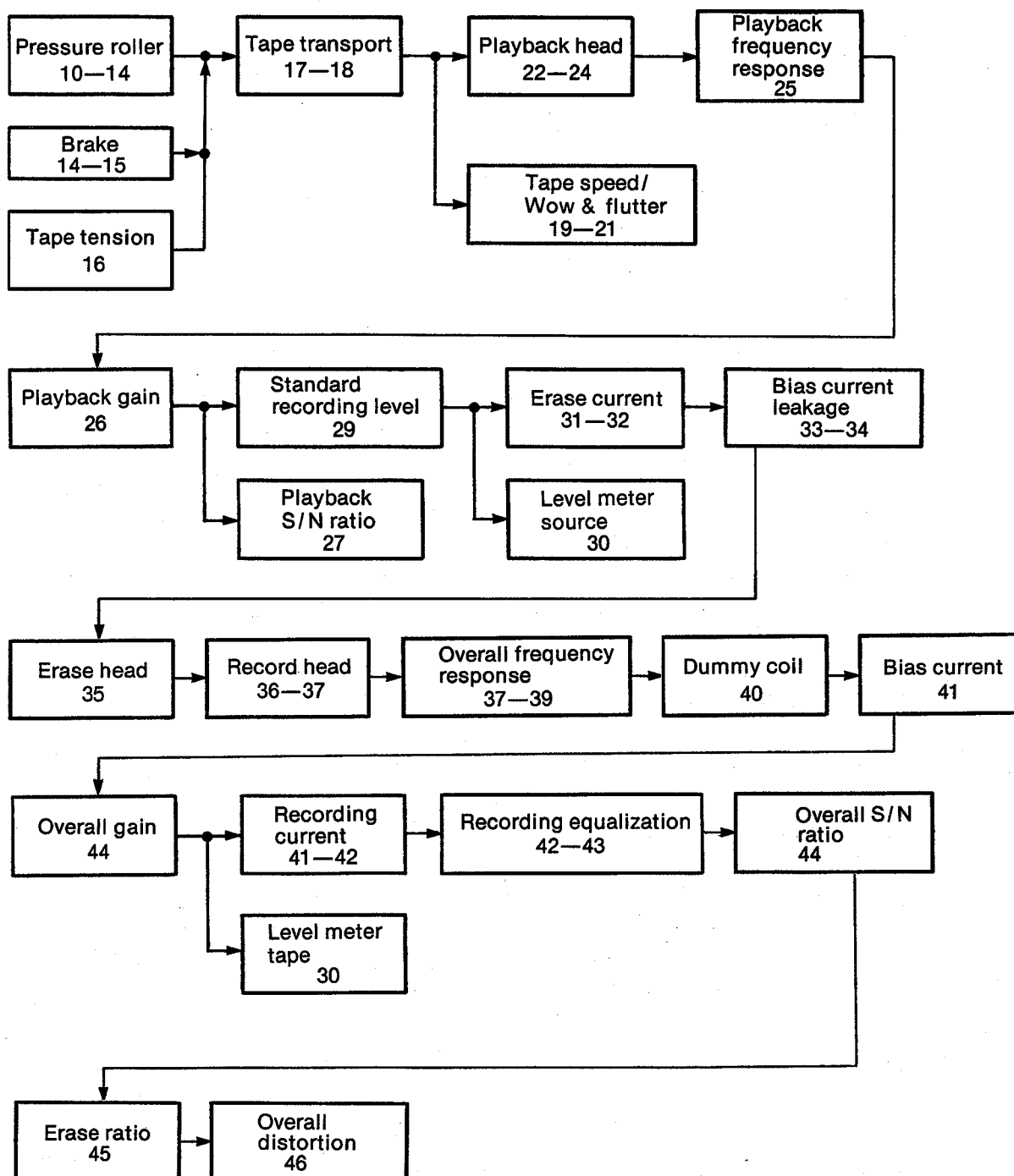


Fig. 1

BLOCK DIAGRAM OF MEASUREMENTS & ADJUSTMENTS

Before making each measurement and adjustment, be sure that all adjustments of previous steps have been completed.

The figures shown in each block indicate the page on which the adjustment or measurement is explained.



The following chart summarizes the necessary measurement and adjustment of items according to symptoms. Please be sure to refer to this chart when attempting any measurement or adjustment on this unit.

Symptomatic Check List

Symptoms	Check Points	Parts requiring adjustment	Page
Wow and flutter	Insufficient pressure between pressure roller and capstan on playback.	- Pressure roller/ plunger position adjustment - Pressure roller pressure measurement.	10—12 12
A. High wow and flutter.	Brakes in contact with supply reel table on playback.	Brakes.	14—15
B. Longer "Built up time" at 9.5 cm/s Tape speed and at changing tape speed.	Insufficient control operation of capstan motor on playback.	Measurement of tape speed, wow and flutter.	19—21
Spoilt tape A. Stretched tape.	Tape takeup torque or back tension is too strong on playback.	Tape tension adjustment.	16
B. Tape with spoilt edges	Tape does not travel in center of reel.	Tape transport.	17—18
	Tape does not travel in center of tape guide (A).	Tape transport.	17—18
	Tape does not travel in center of tape guide (C).	Tape transport.	17—18
	Tape does not travel in center of pressure roller.	Pressure roller height adjustment.	14
Tape travels with cue on even in stop mode.	Pressure roller in contact with capstan when cue is on.	Cue lever adjustment.	12
Low playback sound with cue on.	Too big a space between pressure roller and capstan when cue is turned on.	Cue lever adjustment.	12
Tape stops running during playback.	Too strong a pressure between pressure roller and capstan.	Pressure roller pressure adjustment.	12—13
Tape does not run when PLAY button is again pushed after tape travel has stopped. Tension roller moves up (shut-off condition).	Weak brake torque on reel tables at stop	Brakes.	14—15
Tape in contact with head in stop mode.	Tape shifter is positioned behind head surface at stop position.	Stopper position adjustment.	13

Symptoms	Check Points	Parts requiring adjustment	Page
Level fluctuation	• Playback head position incompletely adjusted.	• Playback heads.	22—23
	• Pressure roller on one side is not in contact with capstan on playback.	• Pressure roller position adjustment.	11
Low level of playback sound.	• Playback head position incompletely adjusted.	• Playback heads.	22—23
	• Insufficient tape shifter position.	• Stopper position adjustment.	13
	• Amplifier playback gain incompletely adjusted.	• Playback gain	23
Poor playback frequency response.	• Playback head position incompletely adjusted.	• Playback heads	22—23
	• Amplifier playback equalizer incompletely adjusted.	• Playback frequency response.	26
Playback S/N ratio.		• Playback S/N ratio. • Playback Head	27 22—23
Poor overall frequency response.	• Poor playback frequency response.	• Playback heads. • Playback frequency response.	22—23 26
	• Record head position incompletely adjusted.	• Record head	36—37
	• Bias current incompletely adjusted.	• Bias current.	41
	• Recording equalizer incompletely adjusted.	• Recording equalization	42—43
	• Too much bias current leakage.	• Bias current leakage.	33—34
When recording, and playing back with REC mode selector off on single channel, playback level lowers.	• Dummy coil incompletely adjusted. • Insufficient overall frequency response at high frequency range when monoral recording (with REC mode selector turned off on signal channel).	• Dummy coil	40
Overall S/N ratio.	• Playback S/N ratio.	• Playback S/N ratio.	27
	• Erasing is incomplete.	• Overall S/N ratio. • Erase head. • Erase current	44 35 31—32
Insufficient overall gain.	• Playback level.	• Playback heads. • Playback gain	22—24 26
	• Standard recording level.	• Standard recording level.	29
	• Recording current.	• Recording current.	41

Symptoms	Check Points	Parts requiring adjustment	Page
Level meter		- Level meter for source monitor - Level meter for tape monitor.	30
High overall distortion.	Poor contact between head and tape.	- Playback heads. - Erase head. - Record head.	22—24 35 36—37
	Bias current incompletely adjusted.	- Bias current. - Bias current leakage.	41 33—34
Erase ratio		- Erase ratio. - Erase head. - Erase current.	45 35 31—32

Before measuring and adjusting “Overall frequency response”, “Overall distortion” and “Overall S/N ratio”, confirm that the characteristics of 5 items below are within standard which have much relation to or influence on electrical performances above.

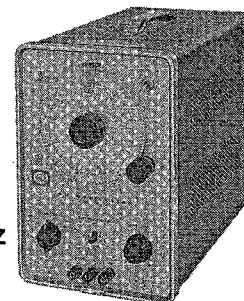
1. Head azimuth adjustment.
2. Bias current.
3. Playback gain.
4. Overall gain.
5. Playback frequency response.

I. TEST INSTRUMENTS

1. Prepare test instruments which are equivalent in accuracy to those shown below.
2. The test instruments should be inspected and corrected by specialists once every 6 months, because a long period of use without maintenance may increase errors in indication.
3. Warm-up the test instruments for 30 minutes and the set to be measured for 10 minutes before taking the measurements. If not, there may arise an error or difference between the initial value and the stabilized value measured after “aging”.
4. Specifications of test instruments.

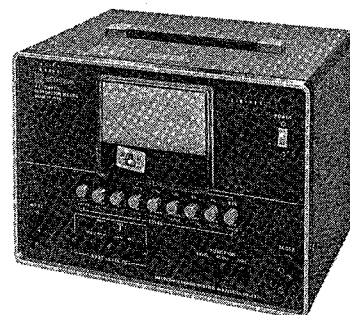
(1) Audio frequency oscillator

- | | |
|-------------------------------|--|
| a. Oscillation frequency: | 5 Hz—500 kHz (5 ranges) |
| b. Frequency tolerance: | $\pm (3\% + 1 \text{ Hz})$ |
| c. Sine wave | |
| * Output voltage (at 25°C): | 5 Vrms $\pm 10\%$ (without load)
2.5 Vrms $\pm 10\%$ (with 600 Ω load) |
| * Output frequency response: | Within $\pm 0.2 \text{ dB}$, 20 Hz—20 kHz
Within $\pm 0.5 \text{ dB}$, 5 Hz—500 kHz |
| * Distortion factor: | Not more than 0.5%, 200 Hz—20 kHz
Not more than 0.5%, 5 Hz—500 kHz |
| * Output impedance: | 600 Ω unbalanced, within $\pm 15\%$ |
| * Output attenuator: | 0 dB, 20 dB, Error: within $\pm 0.2 \text{ dB}$ |
| d. Temperature in use of set: | Temperature = 0—40°C, Humidity = 90% or less |



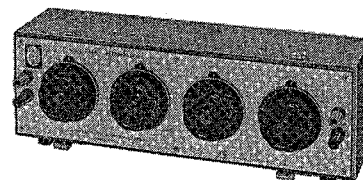
(2) Automatic-spot distortion meter (with vacuum tube voltmeter)

- A. Distortion factor measurement
- a. Frequency (fundamental wave): 400 Hz, 1 kHz $\pm 10\%$
 - b. Measurement: 0.1—100% (6 ranges)
 - c. Input: 50 mV—50 V
 - d. Fundamental wave attenuation: 60 dB or more
- B. Level measurement
- a. Measurement: 1 mV (–60 dB)—30 V
(30 dB) (9 ranges)
 - b. Frequency response (1 kHz basis): 20 Hz—100 kHz ± 0.3 dB
 - c. Input impedance: 1 M Ω $\pm 10\%$, less than 50 pF
 - d. Error in indicated value: Within $\pm 3\%$ at 1 kHz
- C. Output
- a. Frequency response: 10 Hz—100 kHz ± 1 dB
100 kHz—1 MHz ± 3 dB
 - b. Output voltage: 1 Vrms $\pm 10\%$ (1 kHz sine wave)



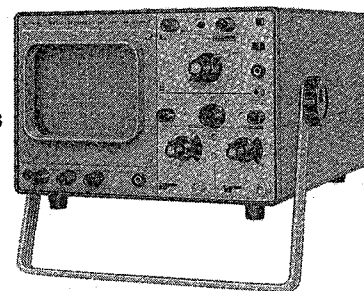
(3) Attenuator

- a. Input impedance: 600 Ω unbalanced
- b. Maximum attenuation: 121 dB
- c. Minimum attenuation: 0.1 dB



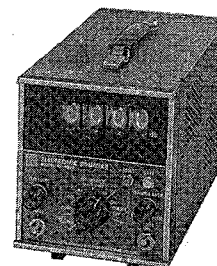
(4) Dual trace oscilloscope

- a. Cathode ray tube: 8 $\times$ 10 DIV (1 DIV $\div$ 9.5 mm)
- b. Vertical axis
 - * Input sensitivity: 10 mV/DIV—5 V/DIV in 9 steps
 - * Frequency range: DC—7 MHz
 - * Transient time: 50 ns.
 - * Input impedance: 1 M Ω , 35 pF.
- c. Horizontal axis
 - * Sweep speeds: 0.5 S/DIV—0.5 S/DIV in 19 steps



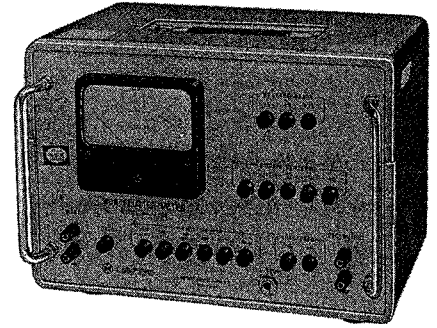
(5) Digital electronic counter

- a. Number of figure: 4 (decimal system)
- b. Input sensitivity: 100 mVrms
- c. Input impedance: 1 M Ω , 40 pF
- d. Frequency measurement range: 10 Hz—100 kHz
- e. Counting time: 0.1, 1, 10 s



(6) Wow meter

- | | |
|-------------------------------------|--|
| a. Measured center frequency range: | 3 kHz $\pm$ 4% |
| b. Input level range: | 30 mV—3 V |
| c. Input impedance: | About 50 K Ω unbalanced |
| d. Measurement: | 0.01—3% (5 ranges) |
| e. Indicator error: | Maximum error in indicated value $\pm$ 5% in each range. |
| f. Frequency response: | Conforming to weighting curve characteristics (WRMS), JIS C5551.
Flat characteristics (RMS) 0.5—200 Hz, within -3 dB (4 Hz basis) |
| g. Meter indication system: | Effective value indication, conforming to JIS C5551. |
| h. Meter response characteristic: | About 5—7 sec. |
| i. Oscillation frequency: | 3 frequencies (3 kHz, 3 kHz $\pm$ 3%) |
| j. Temperature range: | 0—40°C |



II. MEASUREMENT CONDITIONS

1. Standard measurement conditions

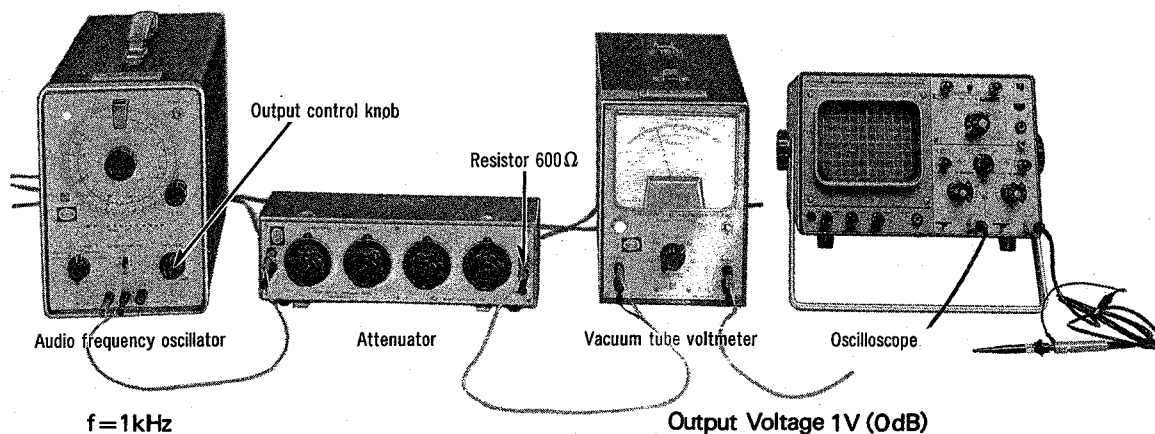
- * Ambient temperature: 10—30°C (50—86°F)
- * Ambient humidity: 30—90% RH
- * Power voltage accuracy: $\pm$ 3%

2. Position of tape recorder

- * When measuring, place the unit under test in a horizontal position.

3. Oscillator output voltage adjustment

- * Connect the equipments as shown in the following and adjust the oscillator output control for 1 V ($f = 1$ kHz) through the attenuator while keeping the attenuator at 0 dB.
- * When supplying a signal to the tape recorder amplifier, adjust the input level using the attenuator.



III. TEST TAPE

Test tape life

The more frequently the test tape is used, the more the tape characteristics will deteriorate (e.g. lowering of recorded level, worsening of frequency response particularly in high-frequency range, and an increase in wow due to tape elongation) until measured values become unreliable. Even in such a case when a tape is not used, but stored, for a long period of time, tape shows deterioration in performance because of self damagenetization due to storage conditions, etc.

Please refer to the tape life specification and take care not to use a tape longer than its rated life when servicing.

Frequency of use: Not more than 20 times for each tape length.

Storage period: Not more than 60 months.

* Test tape

PARTS NO.	PARTS NAME	SPECIFICATIONS	REMARKS
QZZOF380EX	Standard recording level, azimuth and frequency response tape	0dB -10dB F (Hz) 400 16K 400 16K 10K 4K 1K 250 63 31.5 SEC 30° 60° 15°	• Tape speed: 38cm/s • Full track: • 400Hz 0dB, • 20kHz—31.5 Hz • -10dB
QZZOF190EX	Standard recording level, azimuth and frequency response tape	0dB -10dB F (Hz) 400 16K 400 12.5K 8K 4K 2K 500 125 31.5 SEC 30° 60° 15°	• Tape speed: 19cm/s • Full track: • 400Hz, 0dB • 16kHz—31.5 Hz • -10dB
QZZOW380EX	Wow and tape-speed tape	0dB 3kHz	• Tape speed: 38cm/s • Full track: 8 (min) • 3kHz 0dB
QZZOW190EX	Wow and tape-speed tape	0dB 3kHz	• Tape speed: 19cm/s • Full track: 8 (min) • 3kHz 0dB
QZZORA218	Reference blank tape	Blank	• Unrecorded tape (550m)

1. MECHANISM

[1] Pressure Roller

Make the following checks/adjustments if the left and right pressures are different, or if any other replacement related to pressure rollers is made.

- [A] Pressure Roller Position Adjustment
- [B] Cue Lever Adjustment
- [C] Pressure Roller/Plunger Position Adjustment
- [D] Stopper Position Adjustment
- [E] Adjustment of Tape Travel to Pressure Roller Center
- [F] Pressure Roller Pressure Measurement/Adjustment

For adjustment of parts related to pressure rollers:

- Remove top cover, and rear cover.
- Remove power-supply transformer section.

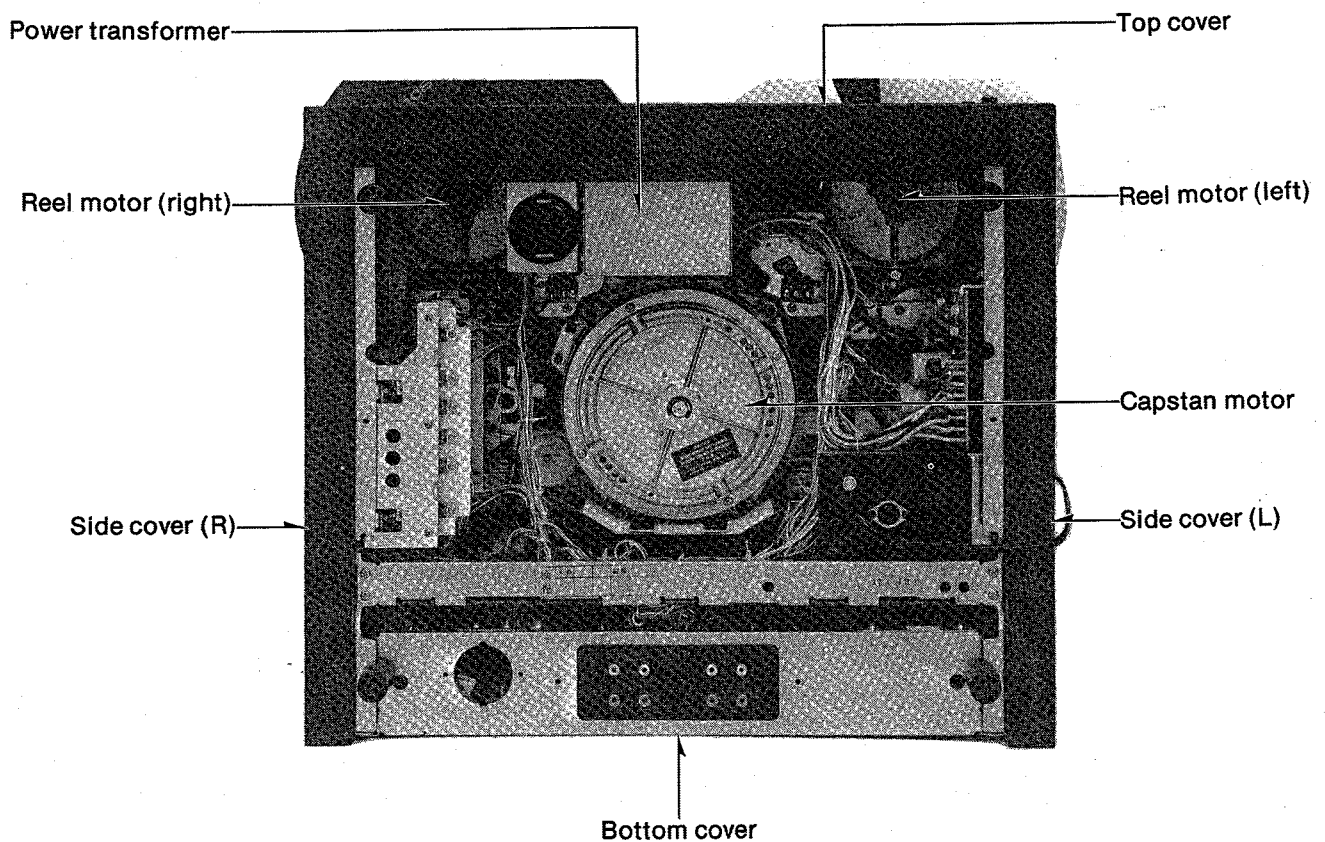


Fig. 1

[A] Pressure Roller Position Adjustment

The pressure rollers must be symmetrical left and right with relation to the capstan.

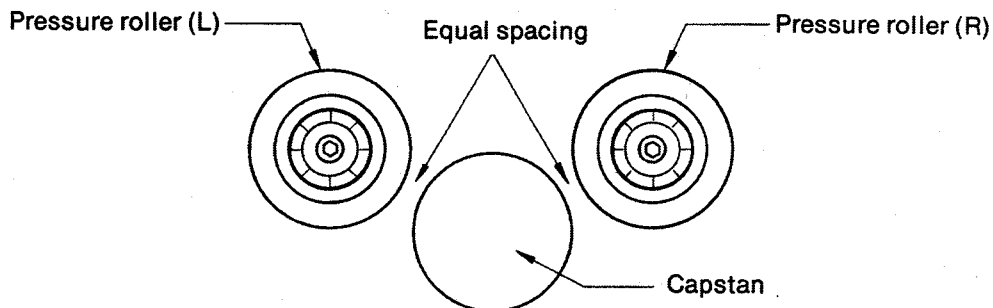


Fig. 2

Checking method (See fig's. 2, and 3)

- (1) Pull control plate upward by hand, and confirm that both pressure rollers contact capstan simultaneously.
- (2) If contact is not simultaneous, make re-adjustment.

Adjustment method (See fig. 3)

- (1) Loosen adjustment screws (A) and (B), move control plate to left or right so that pressure rollers are symmetrical to capstan.
- (2) Re-tighten screws (A) and (B).

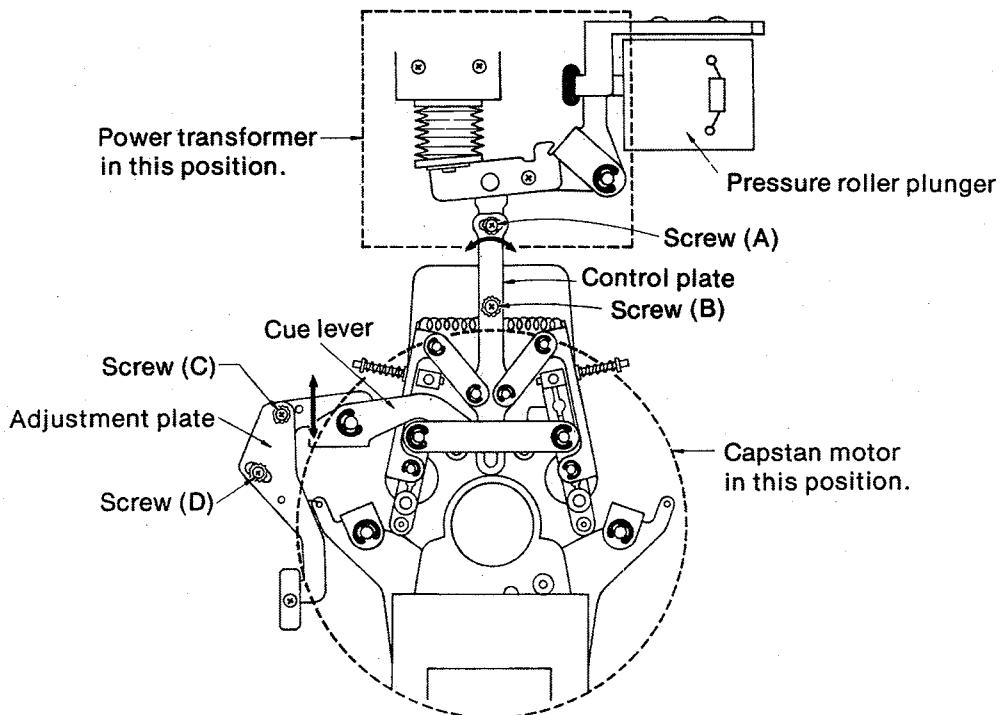


Fig. 3

[B] Cue Lever Adjustment

The purpose of the cue lever adjustment is to adjust the space between the capstan and both pressure rollers.

Checking method (See fig. 4)

- (1) Set cue button (on front of unit) to ON position and confirm that approx. 1 mm of space is left between capstan and pressure rollers.
- (2) If it is not, make re-adjust.

Adjustment method (See fig's. 3 and 4)

- (1) Loosen screws (C) and (D).
- (2) Set cue button (on front of unit) to "ON" position.
- (3) Adjust setting position of adjustment plate on cue lever so that l_1 and l_2 are about 1 mm, and tighten screws (C) and (D).

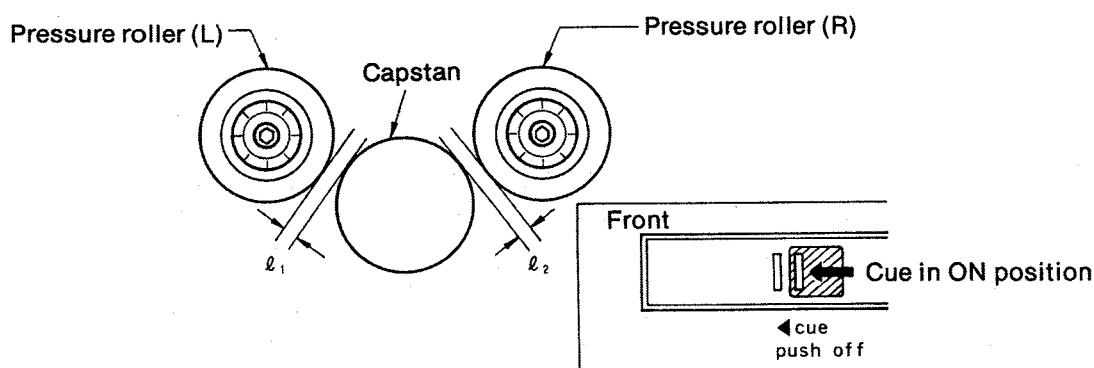


Fig. 4

[C] Pressure Roller Pressure Measurement/ Adjustment

Pressure roller pressure: 900 ± 100 gr.

Checking method

- (1) Place unit in playback mode.
- (2) As shown in figure 5, pull with spring gauge.
- (3) Measure tension at moment when pressure rollers move away from capstan.
- (4) If tension is not within standard value, make readjustment as described in item [D].

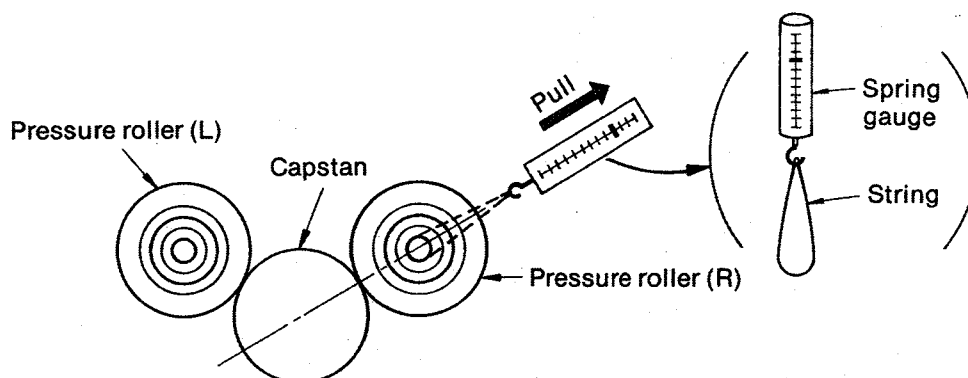


Fig. 5

[D] Pressure Roller/Plunger Position Adjustment (See figure 6.)

This plunger position is adjusted to obtain the specified pressure of pressure roller.

- (1) Remove screws (E) and (F), and remove stopper.
- (2) Loosen screws (G) and (H).

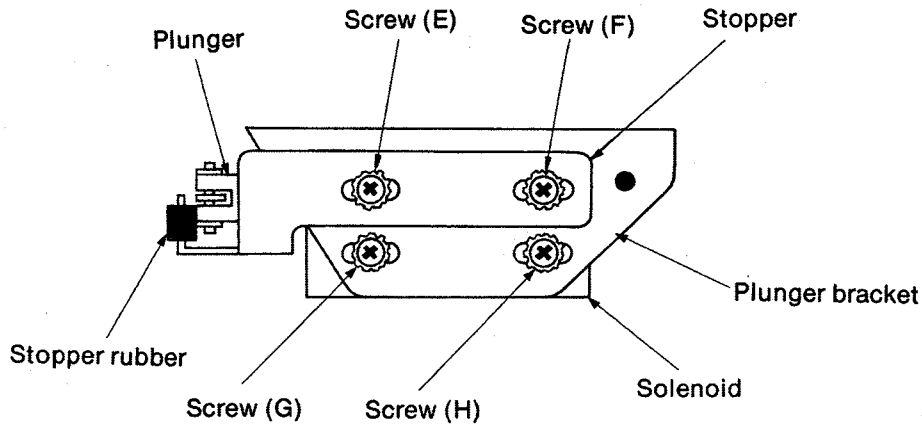


Fig. 6

- (3) With the plunger pushed all the way into the solenoid, move the plunger in the direction shown by the arrow in figure 7.
- (4) When it is moved, the pressure rollers will move closer to the capstan.
- (5) Move the plunger in the direction of the arrow to a point about 1 mm beyond where the pressure rollers contact the capstan, and then secure the solenoid.

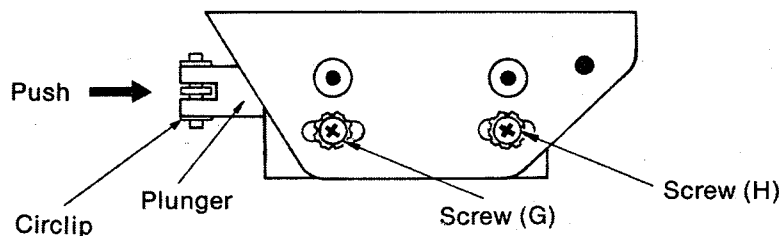


Fig. 7

[E] Stopper Position Adjustment

The stopper is used to match the timing of other mechanisms with the start of tape movement.

- (1) With the stopper rubber piece and plunger pushed (in direction of arrow) 1—1.5mm beyond where they come into contact, tighten screws (E) and (F).

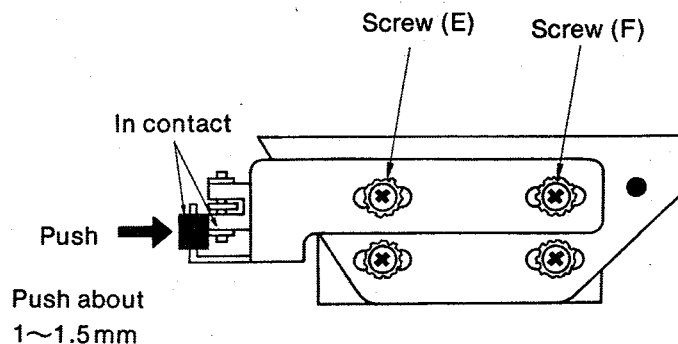


Fig. 8

[F] Pressure Roller Height Adjustment

To make tape movement come to the center of the pressure rollers.

- (1) Thread tape; place unit in playback mode.
- (2) Check whether or not tape movement is at center of pressure rollers.
- (3) If tape movement is too high or too low, adjust the number of washers shown in figure 9.

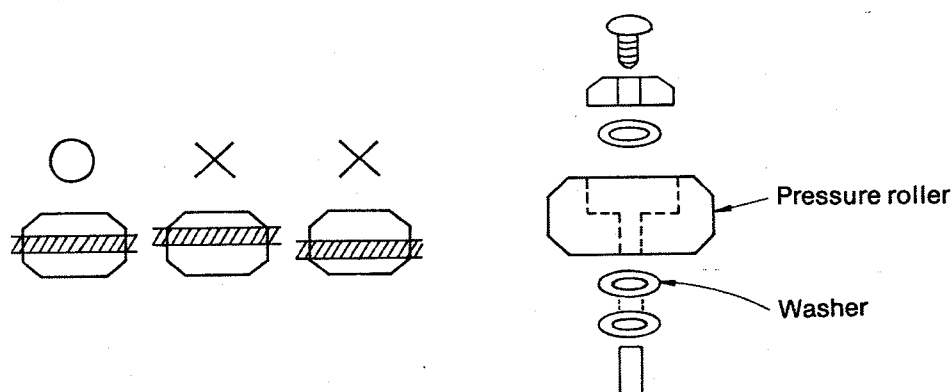


Fig. 9

[2] Brakes

Make the following checks/adjustment if any braking effect is poor, or if any replacement related to the brakes is made.

Note that the rotor section of the reel motors should be cleaned with alcohol before making adjustment.

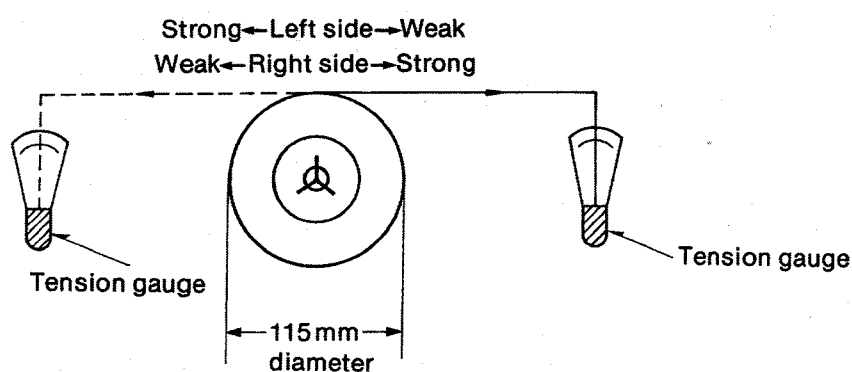


Fig. 11

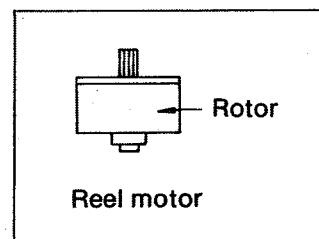


Fig. 10

Braking force differs depending upon direction. For both the take-up side and the supply side:

Strong direction: 450 ± 70 gr

Weak direction: 140 ± 25 gr

Measurement

- (1) Attach the tension gauge to the end of tape wound with 115 mm diameter on a reel.
- (2) With the unit in stop mode, measure the tension while pulling in the direction of the arrow.

Adjustment

If measured value is not within standard value, or if plunger, brake, etc. are replaced, adjust as described below.

- (1) Loosen the plunger bracket screws (I) and (J).
- (2) As shown in figure 12 (for right side) and figure 13 (for left side), secure the bracket so that the space between the pin and bracket is 1—1.5 mm.

Right Side

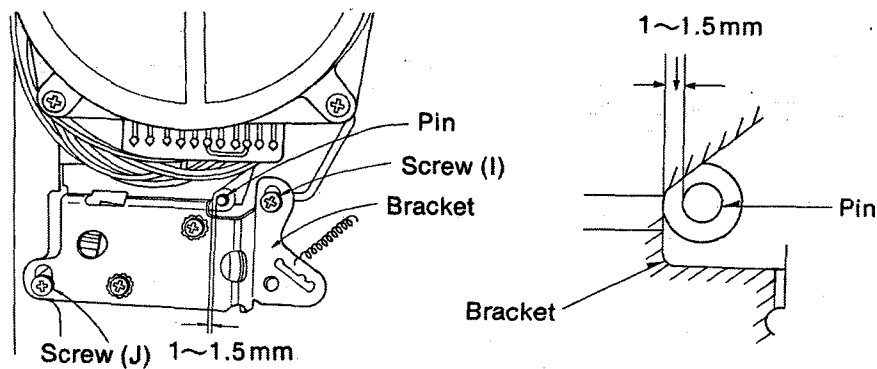


Fig. 12

Left Side

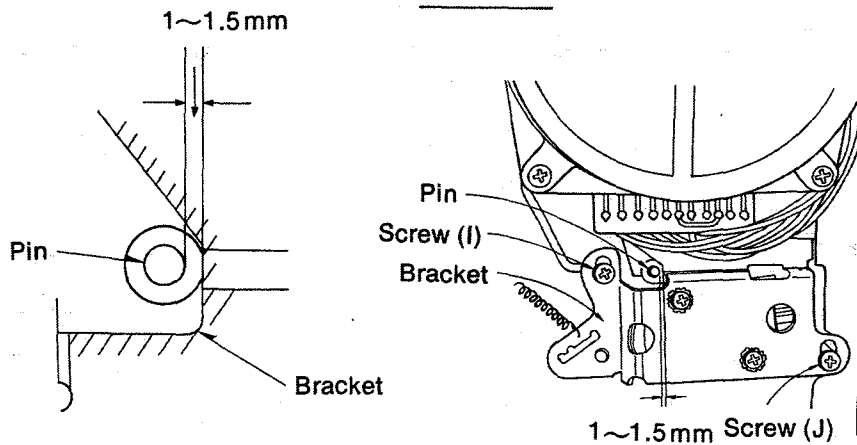


Fig. 13

- * For replacement of plungers, it will be necessary to remove either the reel-drive circuit board (for the right plunger) or the power-supply circuit board (for the left plunger) after remove the side covers.

[3] Tape Tension Adjustment

Tape tension during playback mode:

Takeup torque: 65 ± 5 gr

Back tension: 75 ± 5 gr

Simple Method

- (1) Install a full wound tape (10" or 7").
- (2) Set tape-speed selector to 19 cm/s.
- (3) Connect a VTVM to terminal IT (for take-up torque) or IS (for back tension) on reel-drive circuit board as shown in fig. 14.
- (4) Playback the tape about its middle.
- (5) At this time, voltage at each terminal;

	IT	IS
with 10" reel tape	0.31 V	0.21 V
with 7" reel tape	0.21 V	0.14 V

- (6) If there is a large deviation, adjust;
 IT terminal voltage: with VR802
 TS terminal voltage: with VR801

Reel Drive Circuit Board

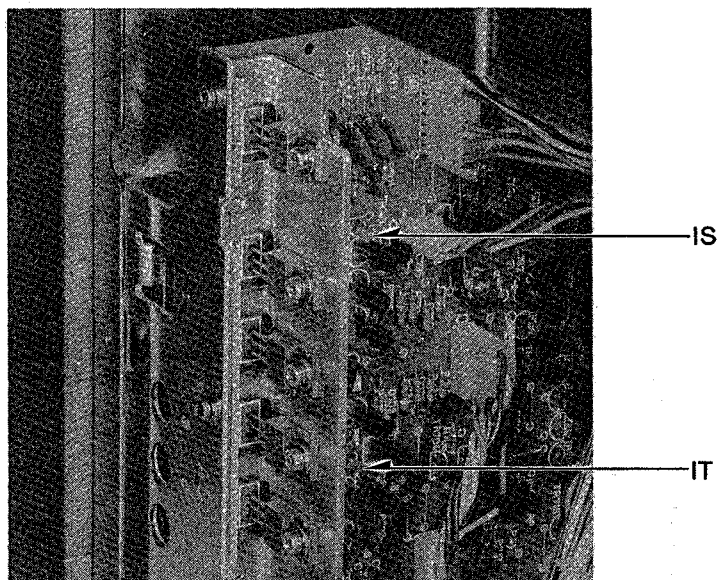


Fig. 14

Ordinary Method

Use a tension analyzer, as shown in figure 15.

- (1) Thread a 10" reel of tape, and begin playback.
- (2) Check whether standards described above are satisfied.
- (3) If standards are not satisfied, adjust:
 Take-up side with VR802
 Supply side with VR801
- (4) Confirm the tension for each tape speed.

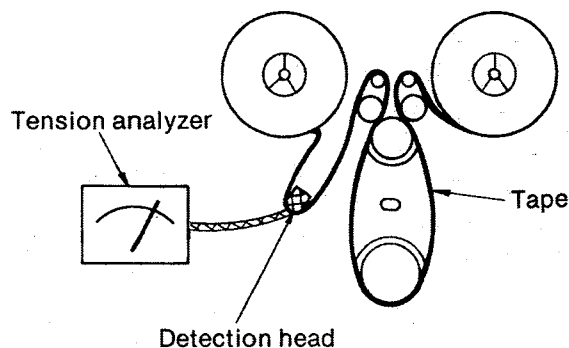


Fig. 15

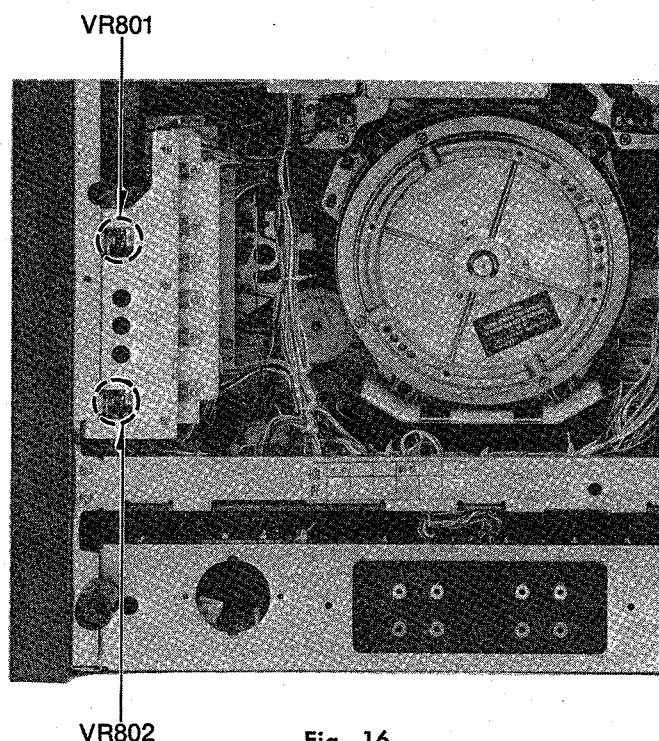


Fig. 16

[4] Tape Transport

For adjustment of the tape transport section, it is necessary to adjust the following parts.
Be sure that the moving tape does not curl at the tape guides, etc., and that the tape moves at their center.

- (A) Tension Rollers
- (B) Reel Tables
- (C) Guides

[A] Tension Roller Height Adjustment

To make the tape move at the center of the tension roller.

- If the tape moves up and down as it passes over the tension roller, adjust the number of washers shown in figure 17.

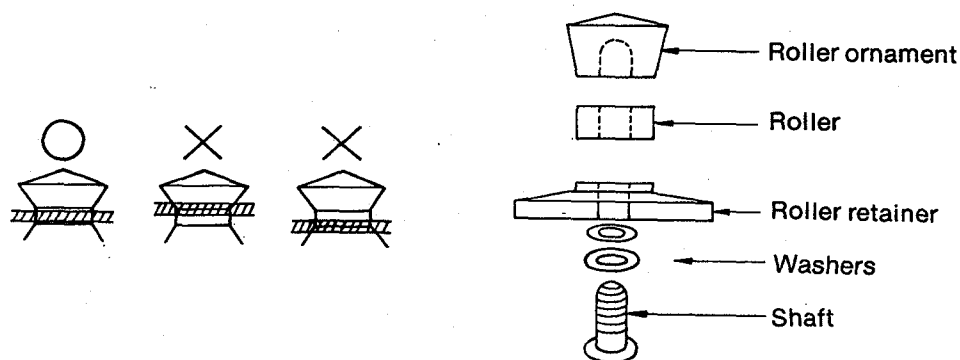


Fig. 17

[B] Reel Table Height Adjustment

- (1) Loosen a nut.
- (2) Adjust screw so that the tape moves at center of a reel and is wound on the center of the reel.

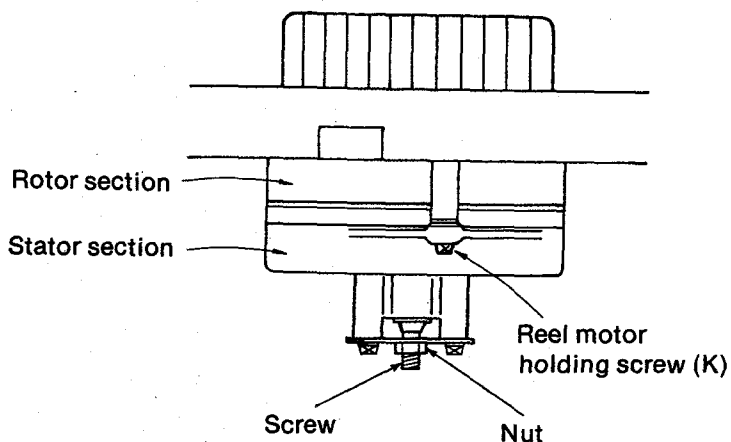


Fig. 18

[C] Tape Guide Adjustment

Six tape guides are used. As shown in figure 19, they are divided into 3 groups (A, B and C). Of these, tape guides (B) are fixed, and thus become the standard for tape movement.

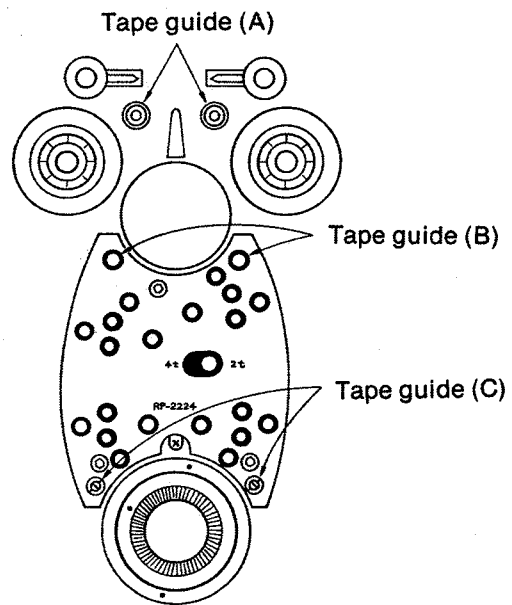


Fig. 19

Adjustment of Tape Guides (A) (Refer to figure 20.)

- (1) Loosen the guide set screw.
- (2) Begin tape movement, and turn tape guides so that tape is at center of guide (B).
- (3) After adjustment, tighten the guide screw.

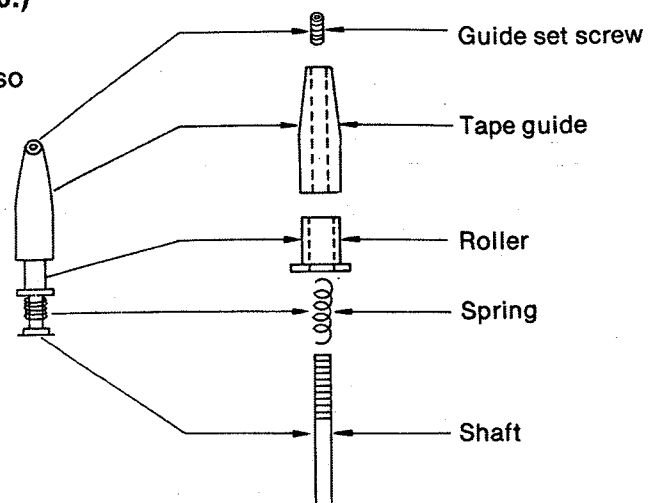


Fig. 20

Adjustment of Tape Guides (C)

- (1) Loosen the guide nut.
- (2) Adjust the guide so that tape is at center of guide.

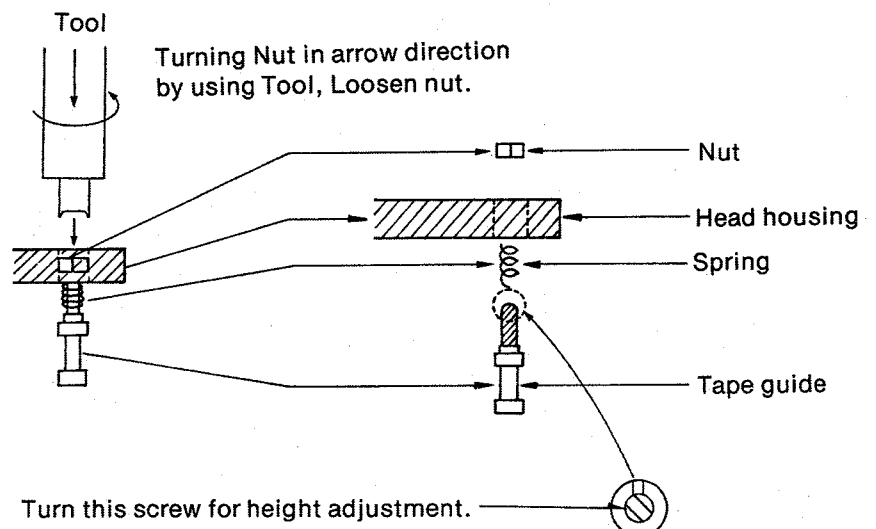


Fig. 21

[5] Measurement of Tape Speed, Wow and Flutter

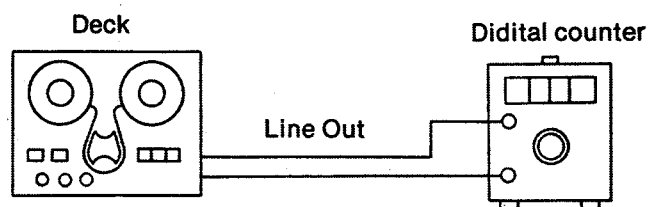


Fig. 22

Tape Speed (cm/s)	Speed Deviation $\frac{f-3000}{3000} \times 100\%$	Speed Fluctuation $\frac{f_1-f_2}{3000} \times 100\%$	Wow & Flutter		Pitch Control (%)
			JIS WRMS (%)	DIN W/P-P (%)	
38	± 0.10	0.10	0.018	± 0.035	± 6
19	± 0.15	0.15	0.03	± 0.080	

[A] Tape Speed Measurement

- (1) Connect a digital counter to line output jack.
- (2) Set tape speed selector to 38 cm/s.
- (3) Set pitch control to OFF position.
- (4) Thread test tape QZZOW380EX, and begin playback.
- (5) Read the playback output frequency (f) with digital counter.
- (6) Tape speed deviation is expressed by the following formula.

$$\text{Speed Deviation} = \frac{f-3000}{3000} \times 100(\%)$$

Note: Use test tape QZZOW190EX for 19cm/s tape speed, measurement method is by the procedure described above.

[B] Pitch Control Adjustment

- (1) Connect a digital counter to line output jack.
- (2) Set tape speed selector to 38 cm/s.
- (3) Set pitch control to ON position.
- (4) Set pitch control knob to center position.
- (5) Playback test tape QZZOW380EX.
- (6) Read the output frequency, and confirm that output frequency is 3000 Hz.
- (7) If it is not 3000 Hz, adjust VR904 so that it becomes 3000 Hz.
- (8) After adjustment described above, turning pitch control to maximum and minimum position, confirm that more than 3180 Hz is obtained at its maximum position and less than 2820 Hz at its minimum position.

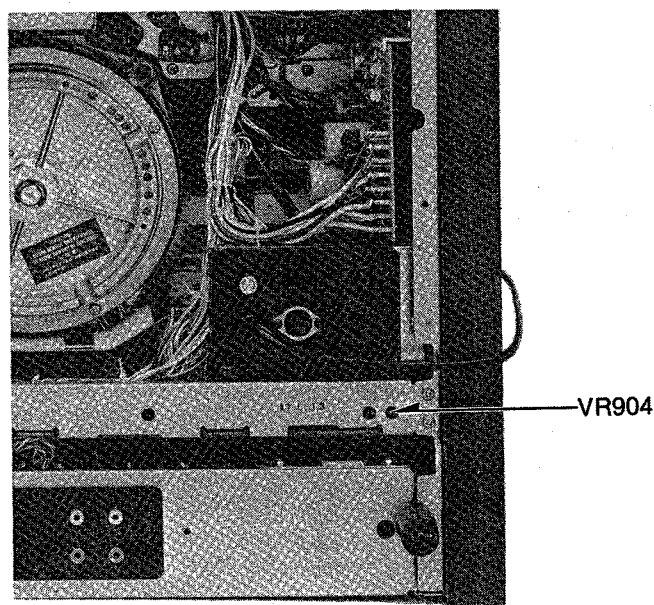


Fig. 23

[C] Tape Speed Fluctuation Measurement

- (1) Connect a digital counter to line output jack.
- (2) Set tape speed selector to 38 cm/s.
- (3) Set pitch control to OFF position.
- (4) Playback test tape QZZOW380EX.
- (5) Read output frequency at beginning and at end of tape.
- (6) Tape speed fluctuation is expressed by the following formula.

$$\text{Tape speed fluctuation} = \frac{f_1 - f_2}{3000} \times 100\%$$

f_1 : frequency at beginning of tape.

f_2 : frequency at end of tape.

Note: Use test tape QZZOW190EX for 19 cm/s tape speed, measurement method is by the procedure described above.

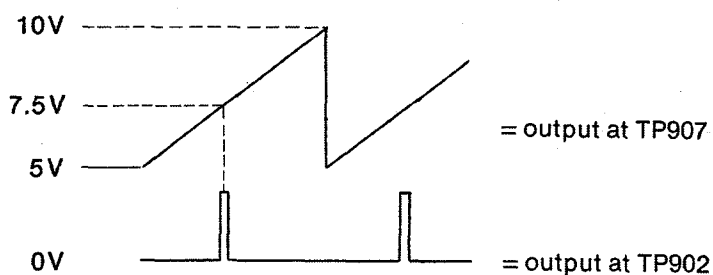
[D] Wow and Flutter Measurement

- (1) Connect a wow-flutter meter to a line output jack.
- (2) Set tape speed selector to 38 cm/s.
- (3) Set pitch control to OFF position.
- (4) Playback test tape QZZOW380EX and read wow & flutter.

Note: Use test tape QZZOW190EX for 19 cm/s tape speed.

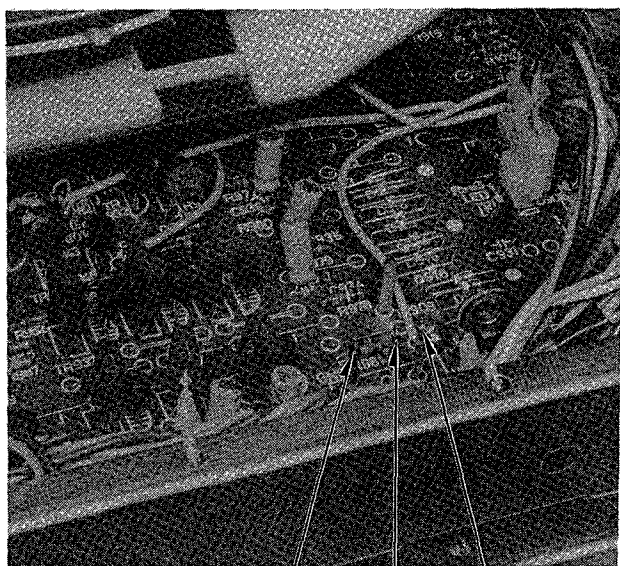
[E] Adjustment of Capstan-Motor-Control Circuitry

- (1) Connect a dual-trace oscilloscope to test points TP902 and TP907, shown in fig. 25.
- (2) Set AC/DC selector of oscilloscope to DC position.
- (3) Thread 10" or 7" reel tape and set tape speed selector to 9.5 cm/s.
- (4) Playback the tape at its middle.
- (5) Adjust VR905 so that the peak value of the sawtooth wave which appears at TP907 is 10V.
- (6) Next, adjust VR901 so that the phase relationship between the sawtooth wave in (4) and the pulse signal which appears at TP902 is as shown in fig. 24.



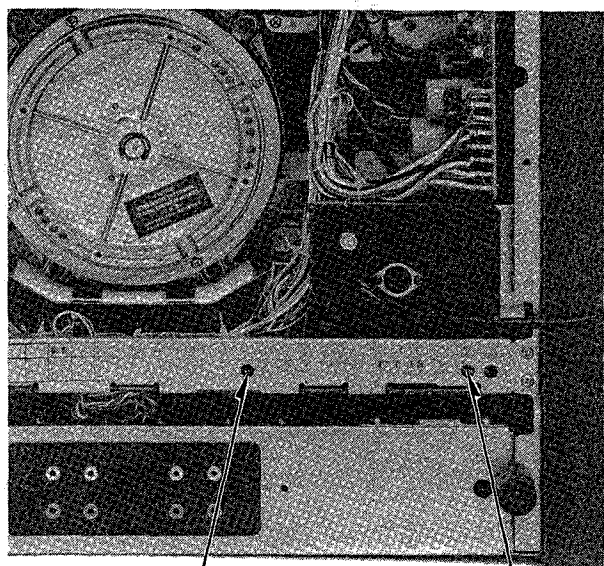
Adjust so that the pulse signal at 50% of the amplitude of the sawtooth wave.

Fig. 24



E TP907 TP902

Fig. 25



VR905

VR901

Fig. 26

2. PLAYBACK HEADS

As shown in figure 27, the following items are involved in head adjustment:

- [A] Head Height
- [B] Azimuth
- [C] Tilt
- [D] Contact and Tangency
- [E] Other Adjustments

When replacing a head, therefore, it is necessary to make readjustment for each of these items.

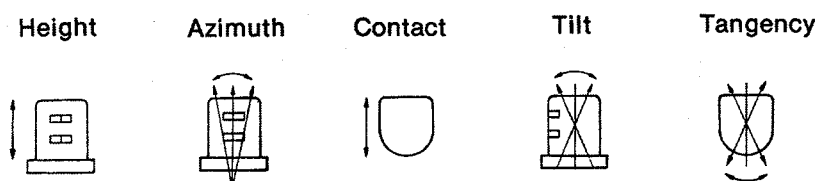


Fig. 27

* 2tr Playback Head (4tr Playback Head in RS-1506US)

The screws used to make each adjustment of the 2-track playback head are in the places shown in figure 28.

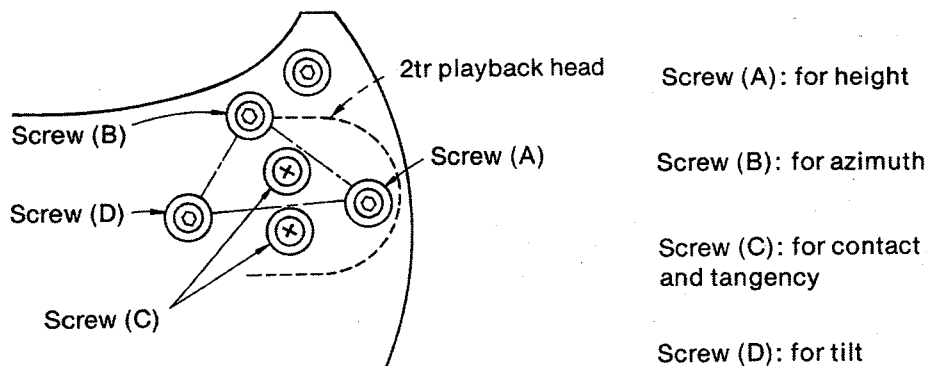


Fig. 28

- (1) Set the head selector to the 2-track position.
- (2) As shown in figure 29, connect a VTVM's to the line-output jacks.
- (3) Set to the 19cm/s tape speed.
- (4) Use 16 kHz position (for azimuth adjustment) in test tape QZZOF190EX.

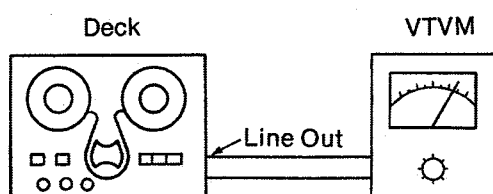


Fig. 29

[A] Head Height Adjustment

First use the height-adjustment screw (A) to adjust so that the tape-to-head relationship are, as visually estimated, approximately as shown in figure 30.

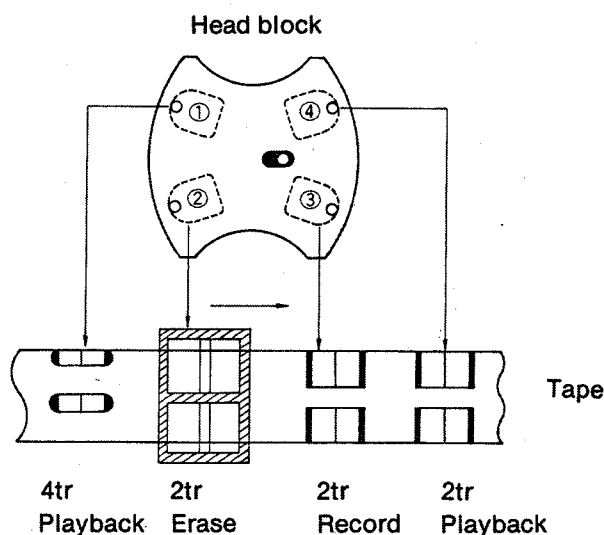


Fig. 30

- (1) Playback test tape QZZOF190EX, and adjust the screw (A) so that both left and right outputs are maximum.

[B] Azimuth Adjustment

- (1) In the condition shown in figure 29, playback test tape QZZOF190EX.
- (2) Adjust the azimuth-adjustment screw (B) (figure 28) so that playback output (VTVM readout) becomes maximum.

[C] Tilt Adjustment

- (1) In the condition shown in figure 29, playback test tape QZZOF190EX, and adjust the tilt-adjustment screw (D) so that output becomes maximum.
- Because the adjustments described in [A]—[C] above mutually influence each other, adjustments should be repeated about 3 times.

[D] Contact and Tangency Adjustments

- (1) Set the tape selector to the 19cm/s position, and playback the 16kHz section (for azimuth adjustment) of test tape QZZOF190EX.
- (2) Lightly touch the supply reel in order to increase back tension.
- (3) If playback output increases, Loosen screws (C) and adjust the head contact and tangency.
- (4) Tighten screws (C) at the position where playback output does not increase even when back tension is increased.

[E] Other Adjustments

* Playback Head Phase Adjustment

After completing the adjustments in items [A]—[D], check the phase between both channels.

- (1) Playback test tape QZZOF190EX, and visually inspect the left and right channel Lissajous' waveform by oscilloscope.
- (2) When the phase difference is not within 60° , turn the azimuth-adjustment screw (B) slightly so that it will be within 60° .

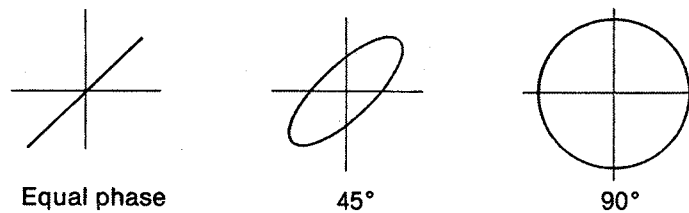


Fig. 31

* 4 Track Playback Head (2tr Playback Head in RS-1506US)

The screws used for adjustment of the 4-track playback head are as shown in figure 32.

The adjustments should be made in the same way as for the 2-track playback head.

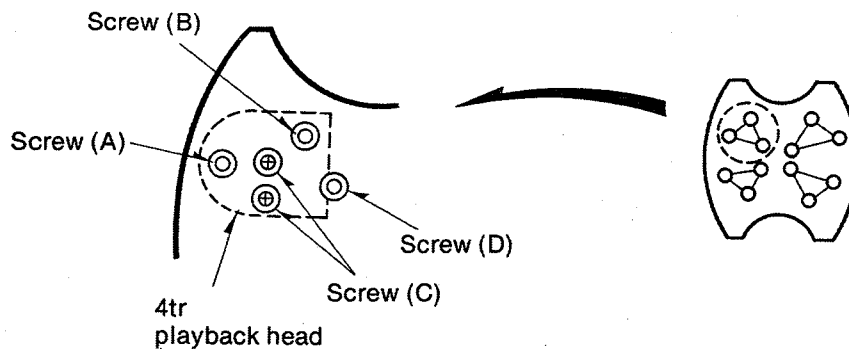


Fig. 32

3. PLAYBACK AMPLIFIER

Equipment:

- * VTVM
- * Oscilloscope
- * Test tape
QZZOF380EX: 38 cm/s
QZZOF190EX: 19 cm/s

UNIT CONDITIONS

- * 2t/4t head-selector: 2t (4t in RS-1506US)
- * Pitch-control switch: OFF
- * Timer-start switch: OFF
- * Meter scale selector: +3dB
- * Mic. att. selector: 0dB
- * Mic. level VR: Minimum
- * Line-in level VR: Minimum
- * Output level VR: "8" position on front panel
- * Monitor selector: Tape (both channels)
- * Equalizer selector: 2
- * Bias selector: 2
- * Recording mode selector: OFF (both channels)

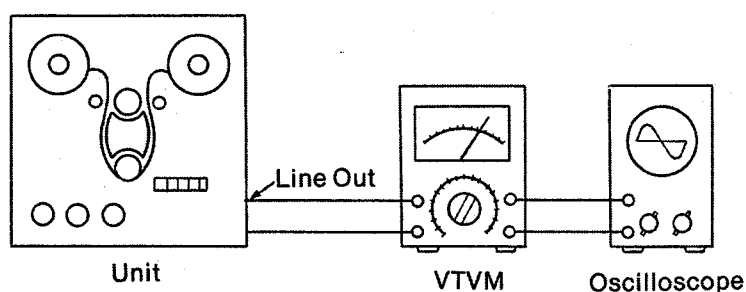
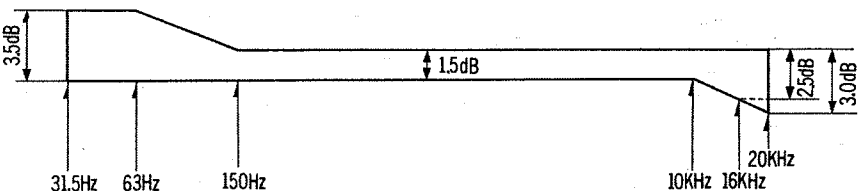
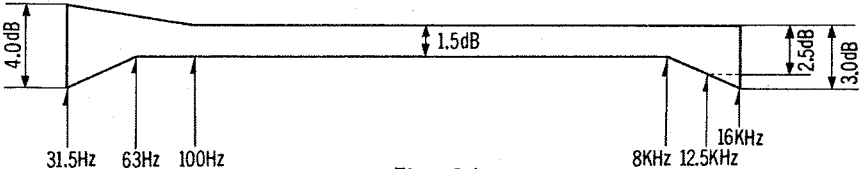


Fig. 33

ITEM	MEASUREMENTS & ADJUSTMENTS
Playback frequency response	1. Test equipment connections are shown in fig. 33. 2. Place unit into playback mode. 3. Play frequency response test tape (QZZOF380EX or QZZOF190EX). 4. Measure output level at 20kHz (38cm/s), 16kHz, 12.5kHz, 10kHz, 8kHz, 4kHz, 2kHz, 1kHz, 500Hz, 250Hz, 125Hz, 63Hz, and 31.5Hz and compare output level with standard frequency 400Hz at LINE-OUT. 5. Make measurement for both channels. 6. Make sure that the measured value is within the range specified in the frequency response chart below. Playback frequency response charts. [Tape speed: 38 cm/s]  [Tape speed: 19 cm/s]  Fig. 34 [Adjustment] 1. If the measured value is not within standard, adjust the playback equalizer VR, VR105 (L-CH) and VR205 (R-CH) shown in fig. 35.
Playback gain	1. Test equipment connections are shown in fig. 33. 2. Play standard recording level portion on test tape, and, using VTVM, measure the output level at LINE-OUT jacks. 3. Make measurement for both channels. Standard value: 0.55 V (- 5.2dB) [Adjustment] 1. If measured value is not standard, adjust the playback level adjustment VR, VR106 (L-CH) and VR206 (R-CH) (See fig. 35.) 2. After adjustment, check "Playback frequency response" again.

ITEM	MEASUREMENTS & ADJUSTMENTS
	[Confirmation] 1. Change 2t/4t head selector. 2. Confirm that deviation of output between 4tr and 2tr is within $\pm 2.5\text{dB}$.
	Fig. 35
Playback S/N ratio	1. Test equipment is shown in fig. 33. 2. Play standard recording level portion on test tape, and read output level on VTVM. 3. Refer to "Playback gain adjustment." 4. Play again without tape. 5. Measure noise level at this time, using VTVM, and determine ratio of this level to test tape output signal voltage (400Hz = 0.55V, -5.2dB). Standard value: Greater than 50dB for 38 cm/s (unweighted) Greater than 48dB for 19 cm/s

4. RECORD AMPLIFIER

Equipment:

- * AF Oscillator
- * Attenuator
- * VTVM
- * Oscilloscope
- * Blank test tape QZZORA218EX

UNIT CONDITIONS

- * 2t/4t head selector: 2t (4tr in RS-1506US).
- * Pitch-control switch: OFF
- * Timer-start switch: OFF
- * Meter scale selector: +3dB
- * Mic. att. selector: 0dB
- * Mic. level VR: Minimum
- * Line-in level VR: Maximum
- * Output level VR: "8" position on front panel
- * Monitor selector: Source (both channels)
- * Equalizer selector: 2
- * Bias selector: 2
- * Recording mode selector: OFF (both channels)

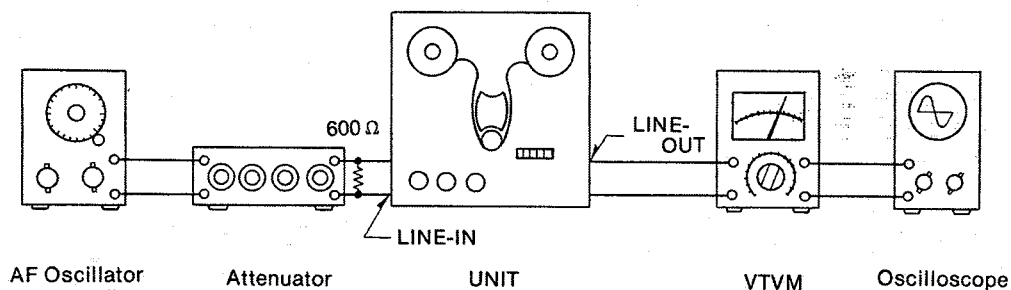


Fig. 36

ITEM	MEASUREMENTS & ADJUSTMENTS
Standard recording level	1. Test equipment connections are shown in fig. 36. 2. Supply 1 kHz signal ($-24\text{dB} \pm 3\text{dB}$) from AF oscillator, through ATT, to LINE-IN jacks. 3. Set the output control to "8" position on front panel and confirm that the output level at LINE-OUT jacks on VTVM becomes 0.55V. [Adjustment] 1. If the measured value is not within standard value, adjust the Line-in level adjustment VR, VR101 (L-CH) and VR201 (R-CH), (See fig. 37.) Standard recording levels: Line-in: $-24\text{dB} \pm 3\text{dB}$ Mic-in: $-72\text{dB} \pm 2\text{dB}$

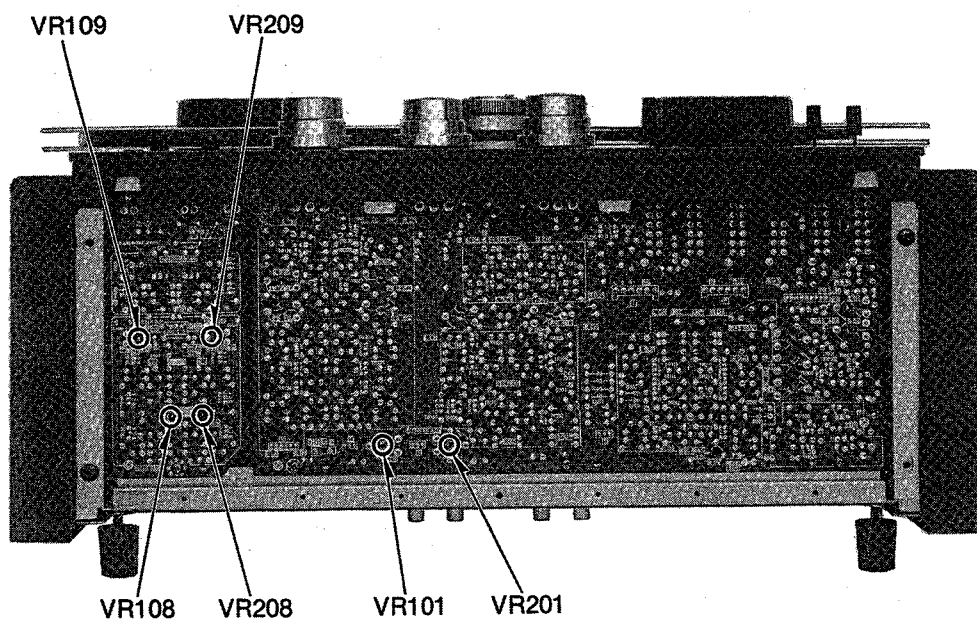
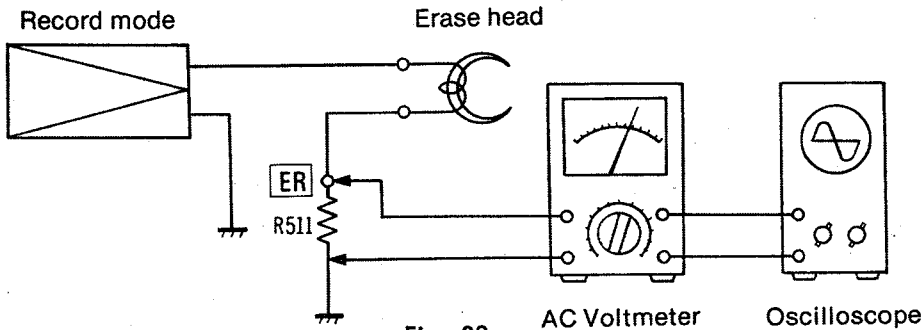
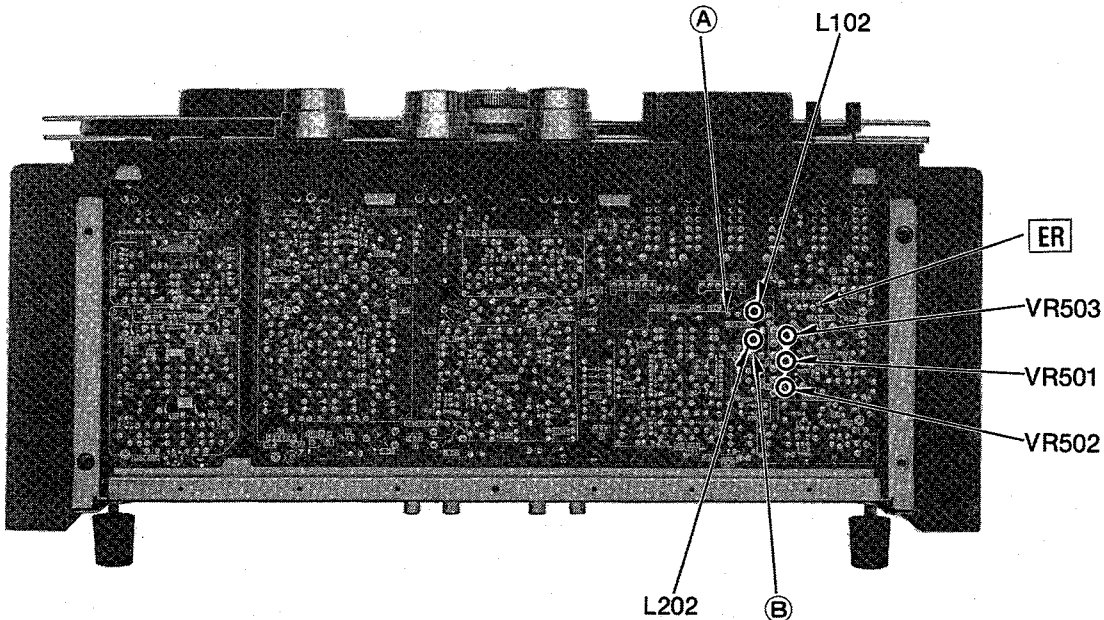
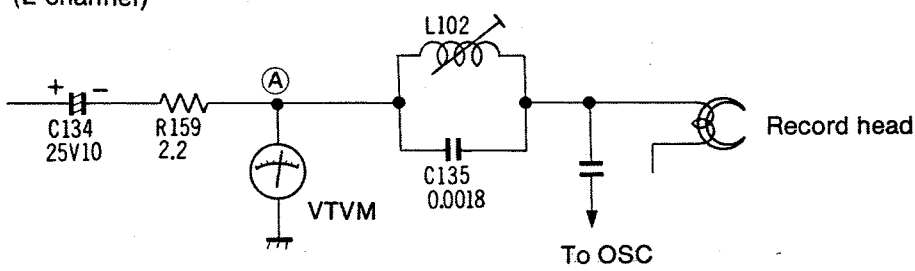


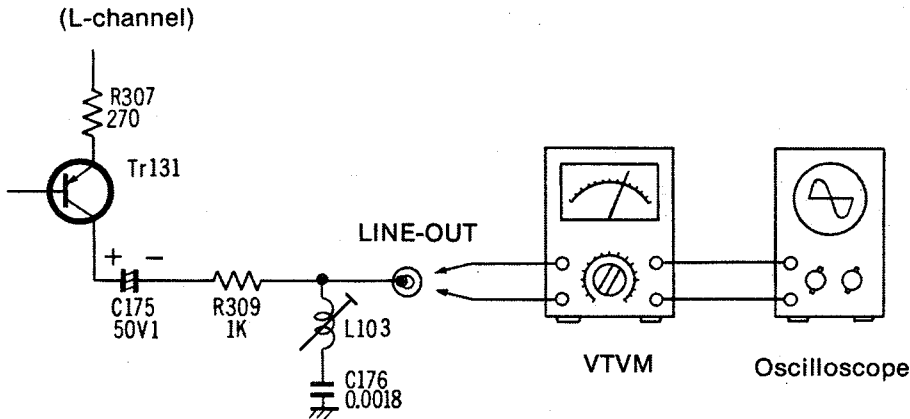
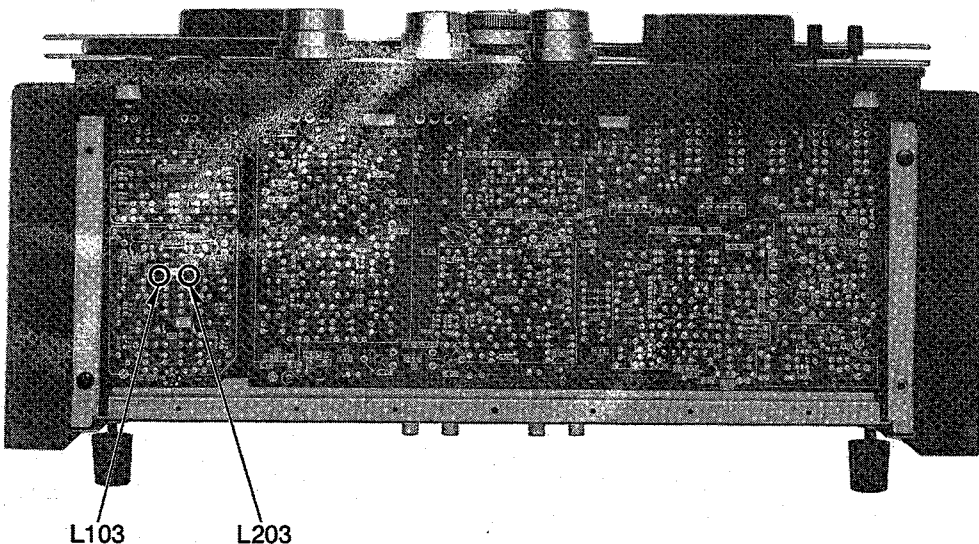
Fig. 37

ITEM	MEASUREMENTS & ADJUSTMENTS
Level meter for source monitor	1. Test equipment connections are shown in fig. 36. 2. Set the monitor selector to "SOURCE" position. 3. Set the output control to "8" position on front panel. 4. Supply 1 kHz signal ($-24\text{ dB} \pm 3\text{ dB}$) from AF oscillator, through ATT, to LINE-IN jacks. 5. Adjust ATT so that the output level at LINE-OUT jacks on VTVM becomes 0.55 V. 6. Then confirm that the level meter indicates 0 VU position. [Adjustment] 1. If the level meter does not indicate 0 VU position in the above condition, adjust the level meter adjustment VR, VR108 (L-CH) and VR208 (R-CH). (See fig. 37.) [Confirmation] 1. Place unit into the above measurement condition. 2. Set the meter scale selector to "+6 dB" position. 3. Confirm that the level meter indicates within $-3 \pm 1\text{ VU}$ on "+3 dB" scale.
Level meter for tape monitor	1. Test equipment connections are shown in fig. 36. 2. Place unit in the same condition as for "Standard recording level adjustment." 3. Thread "open" blank test tape (QZZORA218EX). 4. Set the meter scale selector to "+3 dB" position. 5. Set the monitor selector to "tape" position (both channels). 6. Set the recording mode selector to "ON" position (both channels). 7. Place unit into recording mode. 8. Then confirm that the level meter indicates 0 VU. [Adjustment] 1. If the level meter does not indicate 0 VU in the above condition, adjust the level meter adjustment VR, VR109 (L-CH) and VR209 (R-CH). (See fig. 37.)

ITEM	MEASUREMENTS & ADJUSTMENTS
Erase current	1. Test equipment connections are shown in fig. 38. 2. Set the Line-in level control to minimum position. 3. Set the bias selector to "1" position. 4. Set the tape speed selector to "38" position. 5. Set the recording mode selector to "ON" (L-CH) and "OFF" (R-CH). 6. Place unit into recording mode. 7. Measure voltage at point (A) and then calculate erase current by formula below. $\text{Erase current} = \frac{\text{Value read on VTVM (V)}}{1 (\Omega)}$ Standard value: Bias selector "1" position: around 65 mA 8. Then set the recording mode selectors to "OFF" (L-CH) and (R-CH), and confirm that the above standard value can be obtained. [Adjustment] If the measured value is not satisfied, adjust the erase current adjustment VR, VR501. (See fig. 39.) 9. Next, set the bias selector to the "2" position, and confirm that the standard value shown below can be obtained. Standard value: Bias selector "2" position: around 71 mA [Adjustment] If the measured value is not satisfied, adjust the erase current adjustment VR, VR502. (See fig. 39.)

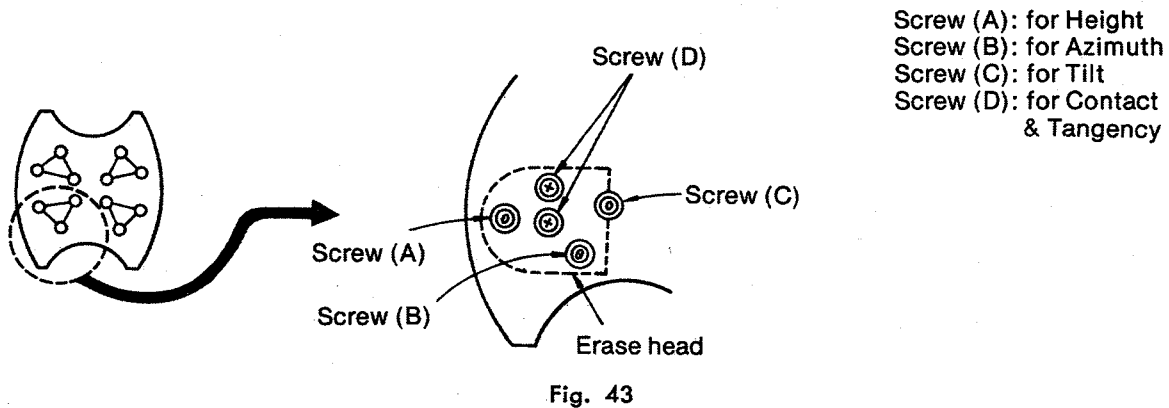
ITEM	MEASUREMENTS & ADJUSTMENTS
	10. Next, set the bias selector to "3" position and confirm that the standard value shown below can be obtained. Standard value: Bias selector "3" position: around 78 mA [Adjustment] If the measured value is not satisfied, adjust the erase current adjustment VR, VR503. (See fig. 39.) Note: When there is difference between values of L-CH "ON" and R-CH "ON", adjustment should be made so that the lower side becomes within each standard value.  Fig. 38  Fig. 39

ITEM	MEASUREMENTS & ADJUSTMENTS
Bias current leakage-1	To prevent bias current leakage to REC-AMP. (L-channel)  Fig. 40 1. Test equipment connections are shown in fig. 40. 2. Thread "open" blank test tape (QZZORA218EX). 3. Place unit into recording and playback modes. 4. Set the recording mode selectors to "ON" (L-CH) and "OFF" (R-CH). 5. Measure and adjust bias trap coil L102 (L-CH) to obtain minimum voltage (less than 3V) at point (A). 6. Change the recording mode selectors to "OFF" (L-CH) and "ON" (R-CH). 7. Measure and adjust the bias trap coil L202 (R-CH) to obtain minimum voltage (less than 3V) at point (B). Adjustment parts and test points (A) and (B) are shown in figure 39.

ITEM	MEASUREMENTS & ADJUSTMENTS
Bias current leakage-2	To prevent bias current leakage to LINE-OUT.  Fig. 41 1. Test equipment connections are shown in fig. 41. 2. Thread "open" blank test tape (QZZORA218EX). 3. Place unit into recording and pause modes. 4. Set the both of REC mode selectors to "ON" position. 5. Measure and adjust the bias trap coils L103 (L-CH) and L203 (R-CH) to obtain minimum voltage (less than 3mV) at LINE OUT jacks.
	 Fig. 42

5. ERASE HEAD

The adjustment screws for adjustment of the erase head are located as shown in figure 43.

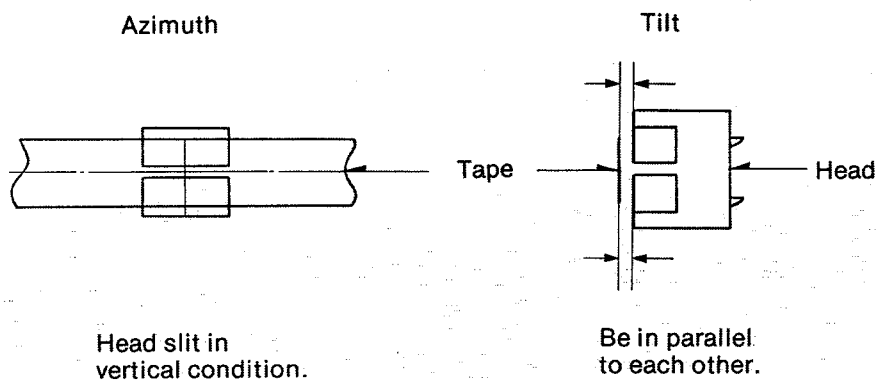


[A] Height Adjustment

Use the height-adjustment screw (A) to adjust so that the head-to-tape relationship is as shown in figure 30.

[B] Azimuth and Tilt Adjustments

Use screws (B) and (C) respectively to adjust so that the condition will be as shown in figure 44, estimating azimuth and tilt visually.



[C] Contact and Tangency Adjustments

Push outward to the extent that there is no head-to-tape contact during fast forward, rewind and stop modes.

6. RECORD HEAD

The adjustment of the record head should be made only after the playback heads are completely adjusted.

- * The items for adjustment of the record head are the same as those for the playback heads.
- * The screws for each adjustment are in the positions shown in figure 45.

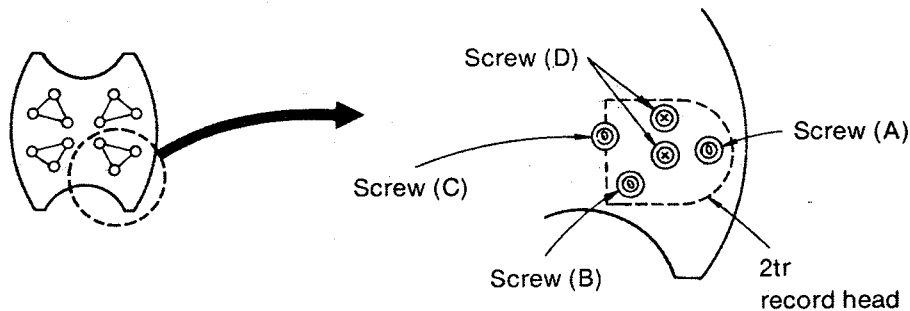


Fig. 45

- * Measurement instrument connections are as shown in figure 36.

*** Prepare the tape deck as follows:**

- Set the monitor switches to the "tape" position.
- Set the record mode switches to the "on" position.
- Set the line level control to its maximum position.
- Set the output level control to "8."
- Thread a blank test tape QZZORA218EX.

[A] Height Adjustment

Use the height-adjustment screw (A) to adjust to the tape-to-head relationship shown in figure 30.

[B] Azimuth Adjustment

- (1) Set the tape speed to 38 cm/s.
- (2) Supply a 26 kHz, -44 dB signal from an audio oscillator to the line-input terminals, and record the signal.
- (3) Use azimuth-adjustment screw (B) to adjust so that the output from the line-output jacks (both left and right) is maximum.

[C] Tilt Adjustment

With the unit in the condition described in [B], use the head-holding screws so that left/right balance is good and maximized.

Adjustments [A] through [C] have mutual effect upon each other, and therefore should be repeated about 3 times.

[D] Contact and Tangency Adjustments

In the same way as for the playback heads.

[E] Phase Adjustment

- (1) Connect the left and right line-output jacks to the horizontal input and vertical input jacks of the oscilloscope.
- (2) Set the tape speed selector to 38 cm/s.
- (3) Supply a -44 dB signal from the audio oscillator, and record the signal while varying the frequency from 1 kHz to 5 kHz.
- (4) View this playback output on the oscilloscope, and confirm that the phase difference is within 60° .
- (5) When phase difference is not within 60° , turn the azimuth-adjustment screw (B) slightly so that it will become within 60° .

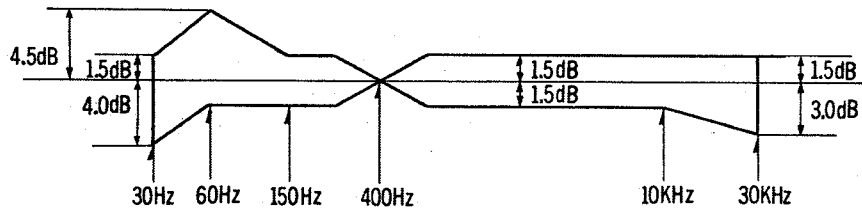
* Refer to figure 31 concerning the Lissajou's figure on the oscilloscope.

7. OVERALL SPECIFICATION

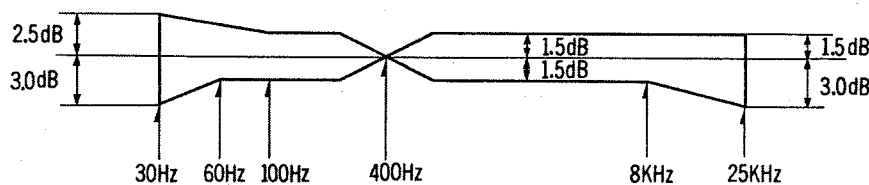
ITEM	MEASUREMENTS & ADJUSTMENTS
Overall frequency response	1. Test equipment connections are shown in fig. 36. 2. Thread blank test tape QZZORA218EX. 3. Supply 400 Hz signal (-24 dB ± 3 dB) from AF oscillator, through ATT, to LINE-IN jacks and adjust ATT so that the output level at LINE-OUT jacks on VTVM becomes 0.55 V. 4. Next, adjust ATT so that the input level is -20 dB below standard recording level. (Standard recording level = 400 Hz, -24 dB) 5. Place unit into recording mode. 6. Set the monitor selector to "Tape" position (both channels). 7. Record each frequency (400 Hz, 30 Hz, 60 Hz, 150 Hz, 1 kHz, 10 kHz, 20 kHz and 30 kHz) at the same level. 8. Playback (or tape monitor) and express in dB the difference between playback (or tape monitor) output level of each frequency based on playback (or tape monitor) output level of 400 Hz. 9. Make sure that the measured value is within the range specified in the overall frequency response chart, as shown in fig. 46. 10. If the measured value is not within the range specified, adjust following points.

Overall frequency response chart

[Tape speed: 38 cm/s]



[Tape speed: 19 cm/s]



[Tape speed: 9.5 cm/s]

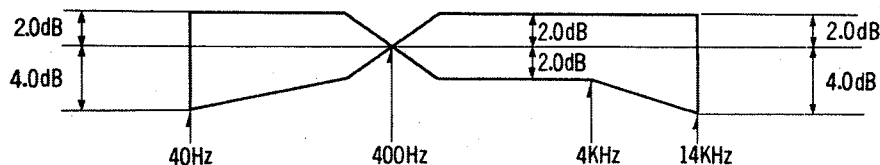


Fig. 46

[Adjustments]

Characteristics at 19 cm/s and 38 cm/s

1. Set tape speed to 19 cm/s, apply an input of 400 Hz, -44 dB, and set the unit for recording.
2. Adjust VR505 (for L-CH) and VR504 (for R-CH) so that playback output becomes maximum. Then read the playback output.
3. Next, change the frequency of the input signal to 24 kHz.
4. Confirm whether or not the 24 kHz playback output is, with relation to the 400 Hz output, within 0—-1 dB.
5. If it is not within 0—-1 dB, adjust VR505 (for L-CH) and VR504 (for R-CH) so that it is within this range.
6. Next vary the input signal frequency between 24 kHz and 5 kHz, and confirm that the frequency response is within the range shown in fig. 46.
7. Next change tape speed to 38 cm/s, apply an input of 26 kHz, -44 dB, and set the unit for recording.
8. Confirm whether or not the playback output is, with relation to the 400 Hz output in step 2 above, within 0—-1 dB.

ITEM	MEASUREMENTS & ADJUSTMENTS
	9. If it is not within 0— – 1 dB, adjust VR505 and VR504 for within this range. 10. Once again change the tape speed to 19cm/s, and input signal frequency to 24kHz, and confirm that playback output is as described in step 4 above. 11. If it is not, adjust peaking coils L101 (for L-CH) and L201 (for R-CH) shown in figure 47. After the above measurements and adjustments, measure the overall frequency response at 19cm/s and 38cm/s tape speeds, and confirm that it is within the range shown in fig. 46. Characteristics at 9.5 cm/s tape speed After adjustments described above are complete for 38cm/s and 19cm/s, confirm frequency response at 9.5 cm/s. 1. Record an input signal of 14kHz, – 44 dB at 9.5 cm/s tape speed, and measure the playback output. 2. If the measured value is not within the range shown in fig. 46, adjust VR506 so that it is within this range.

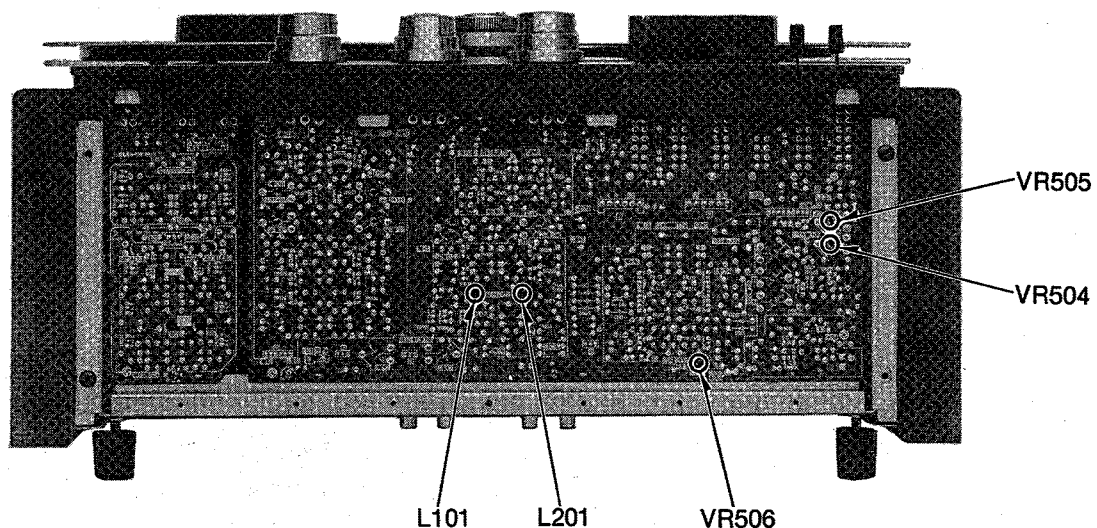
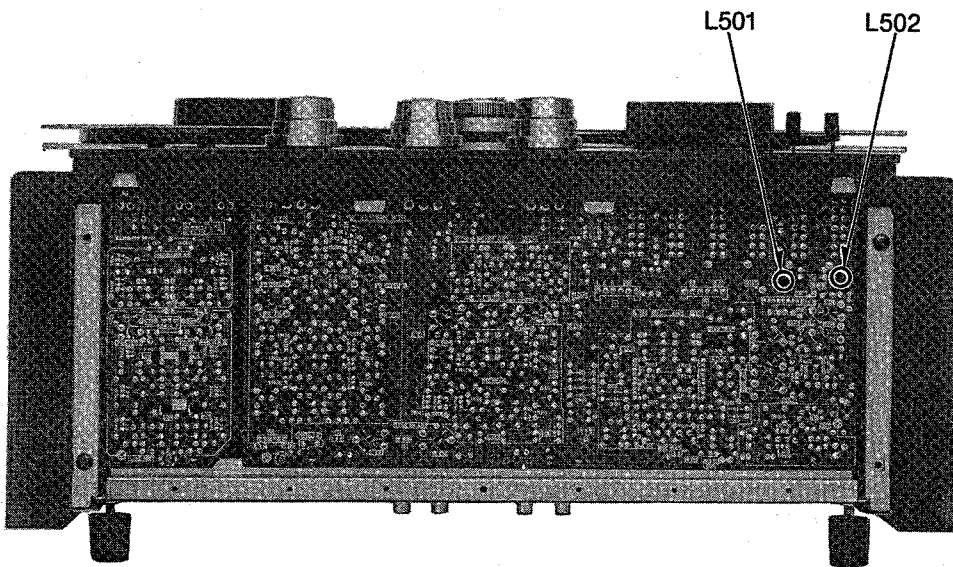
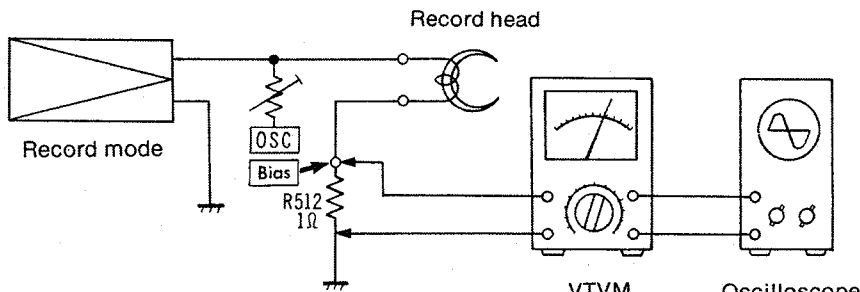


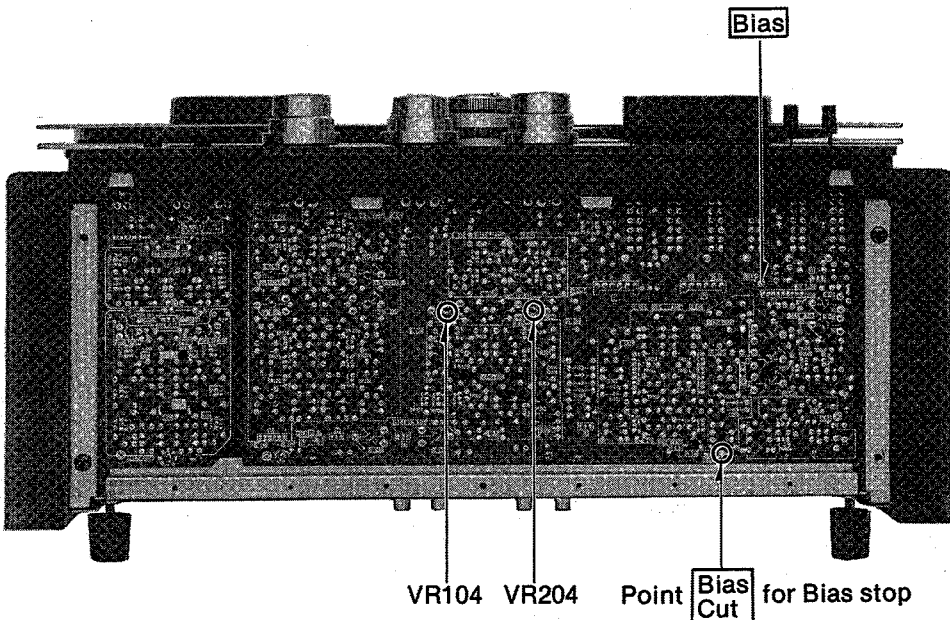
Fig. 47

ITEM	MEASUREMENTS & ADJUSTMENTS
Dummy coil	The purpose of Dummy coils adjustment is to obtain overall frequency response specified with mono-channel recording. Specification: Within $\pm 2\text{dB}$ at 16kHz with relation to overall frequency response specified with stereo mode. 1. Test equipment connections are shown in fig. 36. 2. Set tape speed selector to 19cm/s. 3. Set bias selector to "2" position. 4. Set equalizer selector to "2" position. 5. Thread blank test tape QZZORA218EX. 6. Set recording mode selectors to "ON" position. 7. Apply an input signal of 16kHz, -44dB and set the unit for recording. 8. Measure the playback outputs of both channels. 9. Next change recording mode selector L-CH only to "OFF" position. 10. Confirm whether or not R-CH playback output is, with relation to the output in step 8 above, within $\pm 2\text{dB}$. 11. If it is not, adjust dummy coil L501 so that it is within this range. 12. Next set the L-CH recording mode selector to "ON" position, and R-CH to "OFF" position. 13. Make the same measurements and adjustments described in steps 10 to 11 above. (Note, however, that peaking coil L502 is to be adjusted.)
 Fig. 48	

ITEM	MEASUREMENTS & ADJUSTMENTS
Bias current	1. Test equipment connections are shown in fig. 49. 2. Set the bias selector to "2" position. 3. Set the tape speed to 38 cm/s. 4. Set the unit to the recording mode. 5. Set the recording mode selectors: L-CH to ON and R-CH to OFF. 6. Measure voltage across R512 (1Ω) (at point Bias) shown in fig. 50. 7. Next set the record mode selectors: R-CH to ON and L-CH to OFF. 8. Measure voltage at point Bias. 9. Bias current is calculated by formula below. $\text{Bias Current} = \frac{\text{Voltage read on VTVM}}{1\Omega} \text{ (V)}$ Standard value at 38 cm/s tape speed and at "2" position of Bias Selector: around 3 mV 10. Next set bias selector to "1" position, and measure the bias current in the same way as described in steps 3 to 9 above. 11. Confirm that the bias current is 10% less than at the "2" position of the bias selector. 12. Next set bias selector to "2" position and confirm that bias current is 10% greater than at the "2" position of the bias selector. In the same way, measure bias current at 9.5 cm/s tape speed. (Standard value at "2" position of bias selector is around 2.6 mV.)
Recording current	1. Test equipment connections are shown in fig. 49. 2. Stop the bias oscillation by unsoldering the connection point Bias Cut for bias current ON/OFF shown in figure 50. 3. Thread blank test tape QZZORA218EX. 4. Set the tape selector to "38" position. 5. Set the equalizer selector to "2" position. 6. Supply 1 kHz signal (–24 dB ± 3 dB) from AF oscillator, through ATT, to LINE-IN jacks, and adjust ATT until source monitor level at LINE-OUT jacks on VTVM becomes 0.55 V. 7. Set the recording mode selectors to "ON" (L-CH) and "OFF" (R-CH). 8. Place unit into recording modes.

ITEM	MEASUREMENTS & ADJUSTMENTS												
	9. Measure voltage across R512 (1 Ω), and then calculate recording current by formula below. Recording current = $\frac{\text{Value read on VTVM (V)}}{1 (\Omega)}$ Standard value: around 0.16 mV 10. Then set the recording mode selectors to "OFF" (L-CH) and "ON" (R-CH), and confirm that the above standard value can be obtained.  Fig. 49												
Recording equalization	- Test equipment connections are shown in fig. 49. - Place unit in the same condition as for "Recording current measurement" on page 41. (Step 1—Step 10). - Change the supplied signal (1 kHz) to 31.5Hz, 100Hz, 400Hz, 6.3kHz and 20kHz, and compare output level with standard recording current vlaue across R512 (1 Ω) = Bias point. Standard level difference: (tape speed: 38 cm/s, equalizer: 2 position) <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th>Input frequency (Hz)</th> <td>31.5</td> <td>100</td> <td>400</td> <td>6.3 K</td> <td>20 K</td> </tr> <tr> <th>Level difference (dB) across R512</th> <td>5 $\pm$ 2</td> <td>0 $\pm$ 2</td> <td>0</td> <td>- 2 $\pm$ 2</td> <td>2 $\pm$ 3</td> </tr> </table>	Input frequency (Hz)	31.5	100	400	6.3 K	20 K	Level difference (dB) across R512	5 $\pm$ 2	0 $\pm$ 2	0	- 2 $\pm$ 2	2 $\pm$ 3
Input frequency (Hz)	31.5	100	400	6.3 K	20 K								
Level difference (dB) across R512	5 $\pm$ 2	0 $\pm$ 2	0	- 2 $\pm$ 2	2 $\pm$ 3								

ITEM	MEASUREMENTS & ADJUSTMENTS																		
	Reference of standard level difference: (tape speed: 19cm/s, 9.5cm/s, equalizer: 2 position) <table><tr><td>Input frequency (Hz)</td><td>100</td><td>400</td><td>6.3K</td><td>12.5K</td><td>16K</td></tr><tr><td>Level difference (dB) for 19cm/s</td><td>0 ± 2</td><td>0</td><td>3 ± 3</td><td>—</td><td>12 ± 4</td></tr><tr><td>for 9.5cm/s</td><td>0 ± 2</td><td>0</td><td>4 ± 3</td><td>15 ± 4</td><td>—</td></tr></table> 4. Next, set the equalizer selector to “3” or “1” position in the above condition. The following standard level difference should be obtained. A) Standard level difference (dB): (tape speed: 38 cm/s, Input frequency: 20 kHz). “1” position: + 3dB ± 1 dB higher than “2” position. “3” position: – 3dB ± 1 dB lower than “2” position. B) Standard level (dB): (tape speed: 19 cm/s, Input frequency: 16 kHz) “1” position + 3dB ± 2dB higher than “2” position. “3” position: – 3dB ± 2dB lower than “2” position. C) Standard level difference (dB): (tape speed: 9.5cm/s, Input frequency: 12.5kHz) “1” position: + 4dB ± 3dB higher than “2” position. “3” position: – 4dB ± 3dB lower than “2” position.	Input frequency (Hz)	100	400	6.3K	12.5K	16K	Level difference (dB) for 19cm/s	0 ± 2	0	3 ± 3	—	12 ± 4	for 9.5cm/s	0 ± 2	0	4 ± 3	15 ± 4	—
Input frequency (Hz)	100	400	6.3K	12.5K	16K														
Level difference (dB) for 19cm/s	0 ± 2	0	3 ± 3	—	12 ± 4														
for 9.5cm/s	0 ± 2	0	4 ± 3	15 ± 4	—														



VR104 VR204 Point Bias Cut for Bias stop

Fig. 50

ITEM	MEASUREMENTS & ADJUSTMENTS															
Overall gain	1. Test equipment connections are shown in fig. 36. 2. Thread blank test tape QZZORA218EX. 3. Supply 400Hz signal (-24 ± 3dB) from AF oscillator, through ATT, to LINE-IN jacks. 4. Adjust ATT so that the output level at LINE-OUT jacks on VTVM becomes 0.55V. 5. Place unit into recording mode. 6. Set the monitor selector to "Tape" position (both channels). 7. Then, measure the output level at LINE-OUT jacks when VTVM indicates 0.55V. [Adjustment] 1. If the measured value is not satisfied, adjust the overall gain adjustment VR, VR104 (L-CH) and VR204 (R-CH) shown in figure 50.															
Overall S/N ratio	1. Test equipment connections are shown in fig. 36. 2. Thread blank test tape QQZORA218EX. 3. Set monitor selector to "Source" position. 4. Supply 1 kHz signal with $-24\text{dB} \pm 3\text{dB}$ from AF oscillator, through ATT, to LINE IN jacks and adjust ATT so that the output level at LINE OUT jacks indicates 0.55V. 5. Record the above signal. 6. Nex, make another recording without supplying signal (Disconnect inputs to LINE IN jacks.) 7. Then, rewind the tape and playback it with monitor selector at "Tape" position. 8. Measure the output level of 1 kHz signal and no-signal (noise), and determine the ratio in decibels (dB). 9. The value is different between "playback S/N" and "Overall S/N". For decibel calculation, however, refer to "Playback S/N". Standard values <table><tr><th>Tape speed</th><th>RS-1500US</th><th>RS-1506US</th></tr><tr><td>38cm/s</td><td>Greater than 49 dB</td><td>Greater than 46 dB</td></tr><tr><td>19cm/s</td><td>Greater than 49 dB</td><td>Greater than 46 dB</td></tr><tr><td>9.5cm/s</td><td>Greater than 47 dB</td><td>Greater than 44 dB</td></tr><tr><td colspan="3">Bias and EQ: position 2 and without NANB filter.</td></tr></table>	Tape speed	RS-1500US	RS-1506US	38cm/s	Greater than 49 dB	Greater than 46 dB	19cm/s	Greater than 49 dB	Greater than 46 dB	9.5cm/s	Greater than 47 dB	Greater than 44 dB	Bias and EQ: position 2 and without NANB filter.		
Tape speed	RS-1500US	RS-1506US														
38cm/s	Greater than 49 dB	Greater than 46 dB														
19cm/s	Greater than 49 dB	Greater than 46 dB														
9.5cm/s	Greater than 47 dB	Greater than 44 dB														
Bias and EQ: position 2 and without NANB filter.																

ITEM	MEASUREMENTS & ADJUSTMENTS			
Erase ratio	1. Test equipment connections are shown in fig. 36. 2. Thread blank test tape QZZORA218EX. 3. Supply 1 kHz signal ($-24\text{ dB} \pm 3\text{ dB}$) from AF oscillator, through ATT, to LINE-IN jacks, and adjust ATT so that the output level at LINE-OUT jacks indicates 0.55V. 4. Next, adjust ATT so that the input level is $+10\text{ dB}$ higher than standard recording level. (Standard recording level = 1 kHz, -24 dB). 5. Record above signal with 38 cm/s tape speed. 6. Set the monitor selector to "Tape" position (both channels). 7. Next, rewind to recorded part, disconnect inputs to LINE-IN jacks, and erase the above recorded part. 8. Measure the output level of the part which is erased, and determine the ratio in decibels (dB) between the playback output signal level and the erased level. Standard values (using band-pass filter) <table><tr><td>1 KHz: Greater than 70 dB</td></tr><tr><td>100 Hz: Greater than 60 dB</td></tr><tr><td>With position 1 of Bias and position 2 of EQ.</td></tr></table>	1 KHz: Greater than 70 dB	100 Hz: Greater than 60 dB	With position 1 of Bias and position 2 of EQ.
1 KHz: Greater than 70 dB				
100 Hz: Greater than 60 dB				
With position 1 of Bias and position 2 of EQ.				
Overall distortion	1. Test equipment connections are shown in fig. 51. 2. Thread blank test tape QZZORA218EX. 3. Supply 1 kHz signal ($-24\text{ dB} \pm 3\text{ dB}$) from AF oscillator, through ATT, to LINE-IN jacks and adjust ATT so that the output level at LINE-OUT indicates 0.55V. 4. Place unit into recording mode. 5. Set the monitor selector to "Tape" position (both channels). 6. Measure the distortion factor of output level. [Adjustment] 1. If the distortion factor does not satisfy the standard, check the bias current. If the bias current is lower than standard, distortion will increase. Care should be exercised in the adjustment because the bias current also has an influence on the overall frequency response. Refer to "Overall frequency response."			

ITEM	MEASUREMENTS & ADJUSTMENTS
	Standard value: Tape speed: 38 cm/s, Bias and EQ selectors: 2 Less than 0.8% The diagram illustrates two measurement setups for a tape recorder. The top setup is for recording: an AF oscillator is connected to the ATT (Attenuator) section, which is then connected to the Record mode section via a 600 Ω resistor. The Record mode section is connected to the Record head, which is in contact with a Test tape. The bottom setup is for playback: a Test tape is connected to the Playback head, which is connected to the Playback mode section. The Playback mode section is connected to the Distortion meter, which is then connected to an Oscilloscope. The LINE OUT terminal is also shown on the Playback mode section.

Fig. 51

SPECIFICATIONS

RS-1500US, RS-1506US

A) The specifications are prescribed provided that the tape deck conditions should be as follows, unless otherwise specified:

<u>Selector</u>	<u>Position</u>
1. Tape speed selector:	38 cm/s
2. 2T/4T head selector:	2T
3. Equalizer selector:	2
4. Bias selector:	2
5. Pitch-control:	OFF
6. Timer-start switch:	OFF
7. Meter scale selector	+3dB
8. Microphone attenuator switch:	0dB
9. Output level control:	8 position
10. Mic in control:	Maximum
11. Line in control:	Maximum

B) Test tape used: QZZOF380EX
QZZOF190EX
QZZOW380EX
QZZOW190EX
QZZORA218EX

C) Standard output level: 0.55V

Item	Specification	Adjustment Part	Remarks
Playback System			
Playback frequency response		VR105 (L-CH) VR205 (R-CH)	_____
[Tape speed: 38 cm/s] [Tape speed: 19 cm/s]			
Standard playback output	0.55 V	VR106 (L-CH) VR206 (R-CH)	See page 26
Maximum playback output	0.775 V	_____	Output level control: maximum
Playback S/N ratio (unweighted)	50 dB or more (38 cm/s) 48 dB or more (19 cm/s, 9.5 cm/s)	_____	
Playback level meter	0 VU	VR109 (L-CH) VR209 (R-CH)	See page 30
Recording System			
Standard recording level	Line in: -24 ± 3 dB Mic in: -72 ± 2 dB	VR101 (L-CH) VR201 (R-CH)	
Recording level meter	0 VU	VR108 (L-CH) VR208 (R-CH)	See page 30
Erase current	65 mA (at Bias position 1) 71 mA (at Bias position 2) 78 mA (at Bias position 3)	VR501 VR502 VR503	
Bias current leakage-1	Minimum (less than 3 V)	L102 (L-CH) L202 (R-CH)	
Bias current leakage-2	Minimum (less than 3 mV)	L103 (L-CH) L203 (R-CH)	

Item	Specification	Adjustment Part	Remarks
Bias current	When 38cm/s, 19cm/s Around 2.7mA (at Bias position 1) Around 3mA (at Bias position 2) Around 3.3mA (at Bias position 3) When 9.5cm/s Around 2.6mA (at Bias position 2)	(VR501) (VR502) (VR503) (VR506)	Note the bias current has heavily influence upon overall frequency response
Recording current	Around 160 μ A	(VR104: L-CH) (VR204: R-CH)	
Recording equalization		_____	See page 42

Compensation values depending upon frequencies.

Tape speed: 38cm/s, Eq position: 2

Frequency (Hz)	31.5	100	400	6.3K	20K
Value (dB)	5 $\pm$ 2	0 $\pm$ 2	0	-2 $\pm$ 3	2 $\pm$ 3

Tape speed: 19cm/s, EQ position: 2

Frequency (Hz)	100	400	6.3K	16K
Value (dB)	0 $\pm$ 2	0	3 $\pm$ 3	12 $\pm$ 4

Tape speed: 9.5cm, EQ position: 2

Frequency (Hz)	100	400	6.3K	12.5K
Value (dB)	0 $\pm$ 2	0	4 $\pm$ 3	15 $\pm$ 4

Compensation values depending upon EQ position.

Tape speed: 38cm/s, Frequency 20kHz

EQ position	1	2	3
Value (dB)	+3 $\pm$ 1	0	-3 $\pm$ 1

Tape speed: 19cm/s, Frequency: 16kHz

EQ position	1	2	3
Value (dB)	+3 $\pm$ 2	0	-3 $\pm$ 2

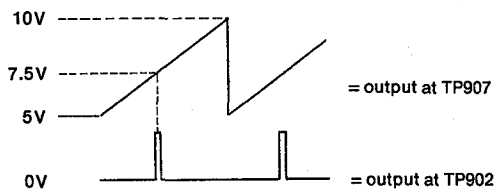
Tape speed: 9.5cm/s, Frequency: 12.5kHz

EQ position	1	2	3
Value (dB)	+4 $\pm$ 3	0	-4 $\pm$ 3

Item	Specification	Adjustment Part	Remarks												
Overall System															
Overall frequency response (stereo mode)	VR505 (L-CH) VR504 (R-CH) L101 (L-CH) L201 (R-CH) (for 38 cm/s, 19 cm/s) VR506 (for 9.5 cm)														
[Tape speed: 38 cm/s] [Tape speed: 19 cm/s] [Tape speed: 9.5 cm/s]															
Overall frequency response (monaural mode)	Within ± 2 dB	L502 (L-CH) L501 (R-CH)	With relation to that of stereo mode. See page 40												
Overall gain	$0.55\text{ V} \pm 0.5\text{ dB}$	VR104 (L-CH) VR204 (R-CH)													
Overall S/N ratio															
<table><tr><th>Tape speed</th><th>RS-1500US</th><th>RS-1506US</th></tr><tr><td>38 cm/s</td><td>49 dB or more</td><td>46 dB or more</td></tr><tr><td>19 cm/s</td><td>49 dB or more</td><td>46 dB or more</td></tr><tr><td>9.5 cm/s</td><td>47 dB or more</td><td>44 dB or more</td></tr></table> Bias & EQ positions: 2, and without NAB filter.				Tape speed	RS-1500US	RS-1506US	38 cm/s	49 dB or more	46 dB or more	19 cm/s	49 dB or more	46 dB or more	9.5 cm/s	47 dB or more	44 dB or more
Tape speed	RS-1500US	RS-1506US													
38 cm/s	49 dB or more	46 dB or more													
19 cm/s	49 dB or more	46 dB or more													
9.5 cm/s	47 dB or more	44 dB or more													
Erase ratio															
<table><tr><th>Frequency</th><th>Standard value</th></tr><tr><td>1 kHz</td><td>70 dB or more</td></tr><tr><td>100 Hz</td><td>60 dB or more</td></tr></table> Bias and EQ position: 2, Tape speed: 38 cm/s				Frequency	Standard value	1 kHz	70 dB or more	100 Hz	60 dB or more						
Frequency	Standard value														
1 kHz	70 dB or more														
100 Hz	60 dB or more														
Overall distortion	0.8% or less														

Item	Specification	Adjustment Part	Remarks
Mechanism System			
Pressure roller position	Symmetrical with relation to capstan Approx. 1 mm space left between capstan and pressure rollers	Control plate Adjustment plate	See page 11 See page 12
Pressure of pressure roller	900 ± 100 gr	Pressure roller plunger	See page 13
Pressure roller height	See page 14	Number of washer	See page 14
Brakes	450 ± 70 gr: Strong direction 140 ± 25 gr: Weak direction	Brake plunger	See page 14
Tape tension	65 ± 5 gr: Take up torque 75 ± 5 gr: Back tension	VR802 VR801	IT: 0.31 V IS: 0.21 using 10" reel
Tension roller height	See page 17	Number of washer	See page 17
Reel table height	See page 17	Height adjustment screw	See page 17
Tape guides position	See page 18	Each guide	See page 18
Tape speed			

Tape Speed (cm/s)	Speed Deviation (%)	Speed Fluctuation (%)	Wow & Flutter	
			JIS, WRMS (%)	DIN, W/P-P (%)
38	± 0.10	0.10	0.018	± 0.035
19	± 0.15	0.15	0.03	± 0.080
9.5	± 0.15	0.20	0.06	± 0.16

Item	Specification	Adjustment Part	Remarks
Pitch control	$\pm 6\%$	VR904	See page 19
Capstan motor control circuit		VR905, VR901	See page 21
 Adjust so that the pulse signal at 50% of the amplitude of the sawtooth wave.			
Playback heads	See page 22	Head set screws	See page 22
Playback head phase	Within 60°	Azimuth adjustment screw	See page 24
Erase head	See page 35	Head set screws	See page 35
Record head	See page 36	Head set screws	See page 36
Record head phase	See page 37	Azimuth adjustment screw	See page 37

RS-1500US
RS-1506US

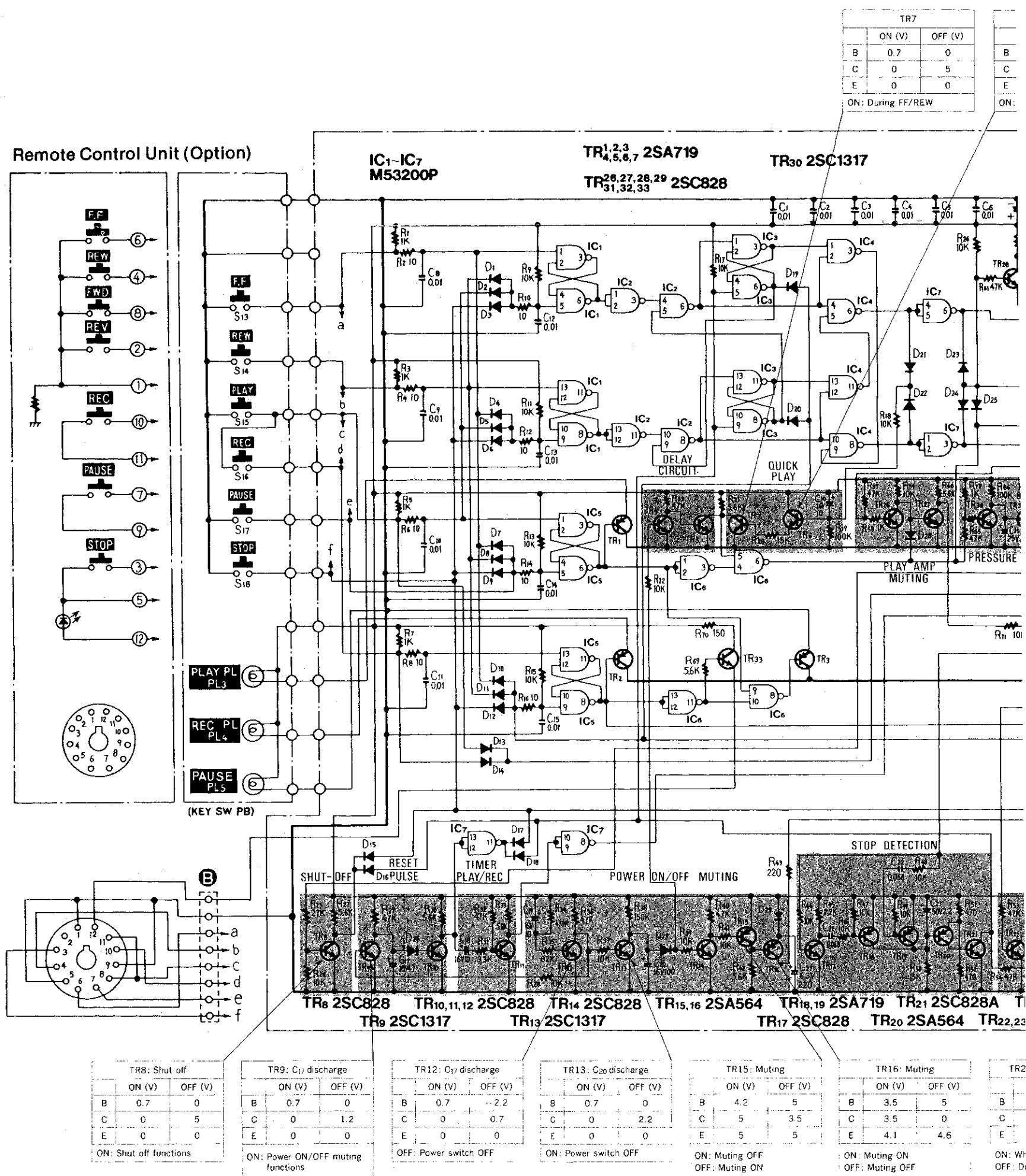
SCHEMATIC DIAGRAMS

S
S

GRAMS

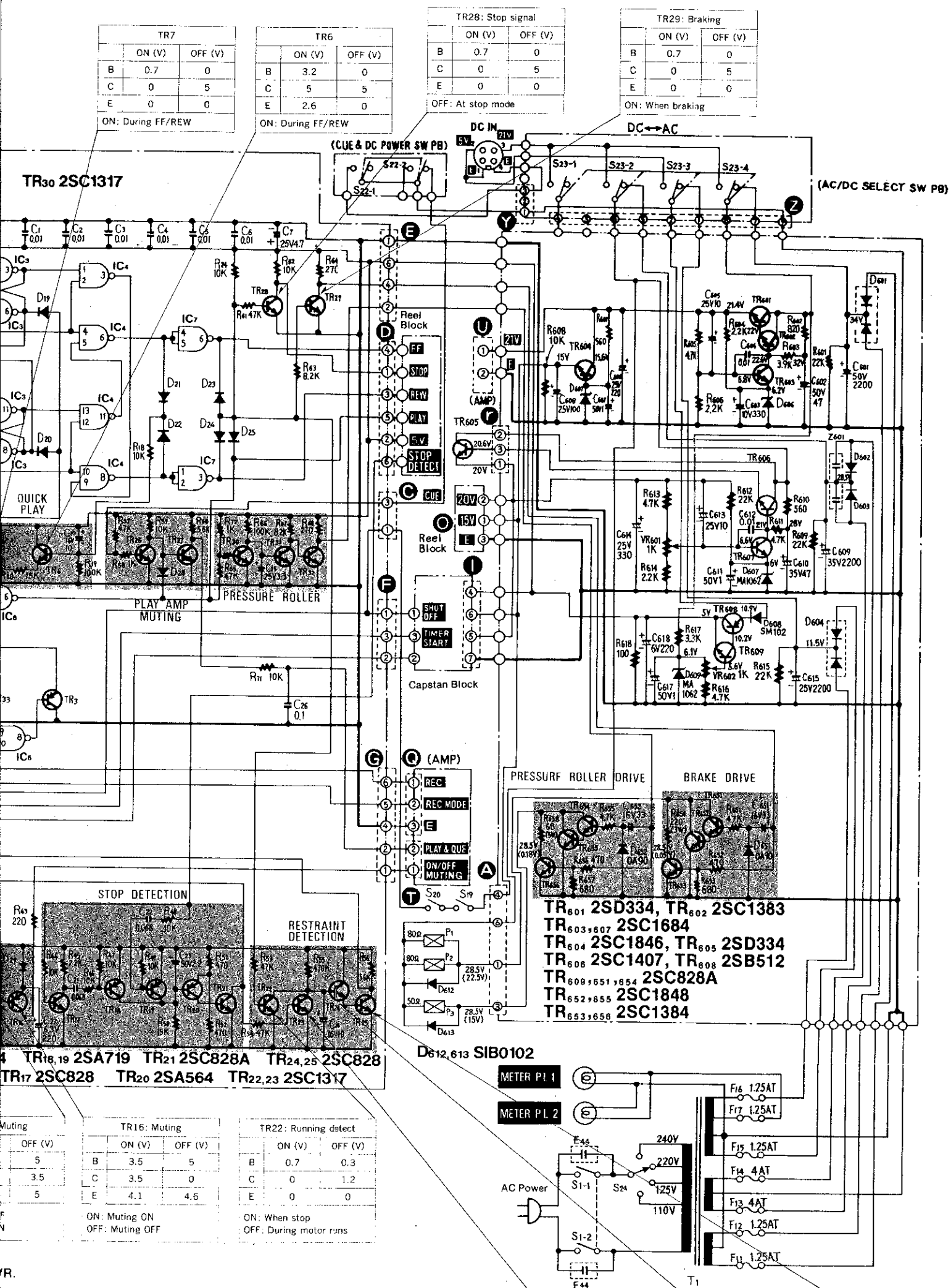
SCHEMATIC DIAGRAM MODEL RS-1500US

Power Supply Section and Main Control Circuit



- NOTE:**
- S₁ Power ON/OFF switch.
 - S₁₃ FF switch.
 - S₁₄ Rew switch.
 - S₁₅ Play switch.
 - S₁₆ Rec switch.
 - S₁₇ Pause switch.
 - S₁₈ Stop switch.
 - S₁₉, S₂₀ Shut-off switch.
 - S₂₂₋₁—S₂₂₋₂ Cue ON/OFF & DC power ON/OFF switch, (shown in cue off position).
 - S₂₃₋₁—S₂₃₋₄ AC/DC select switch (shown in AC position).
 - S₂₄ Voltage selector switch.
 - VR₆₀₁ Voltage (5V) adjustment VR.
 - P₁, P₂ Brake plunger.
 - P₃ Pressure roller plunger.
 - Resistor values are in ohms (Ω), 1/4W watt unless specified other wise.
K = 1000.
 - Capacitor values are in microfarads (μF) unless specified otherwise.
P = Pico-farads.
 - Voltages shown in () are voltages when plunger is in "ON" condition.

Specifications are subject to change without notice.



unless specified otherwise.

unless specified otherwise.

when plunger is in "ON" condition.

without notice.

TR23: Stop detect		
ON (V)	OFF (V)	
B	0.7	0
C	0	1.2
E	0	0
ON: During motor runs		
OFF: When stop detection		

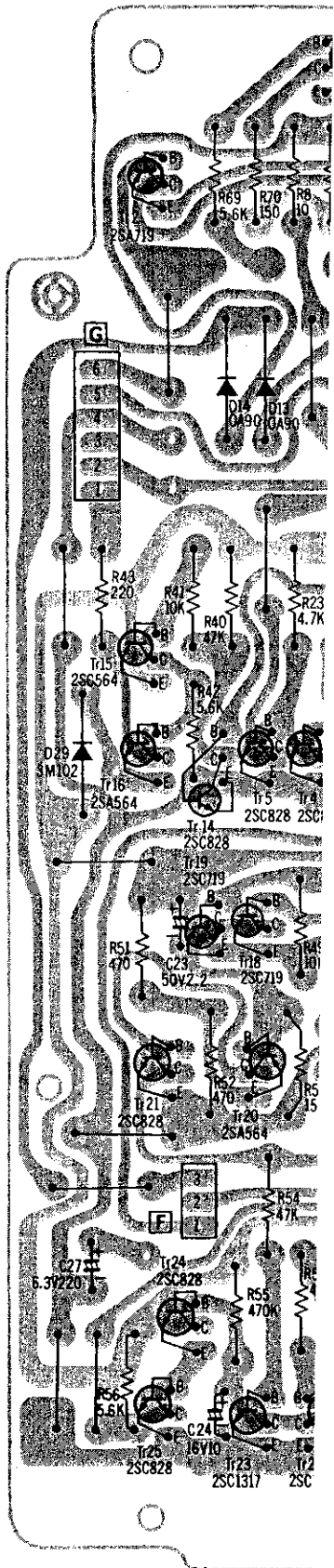
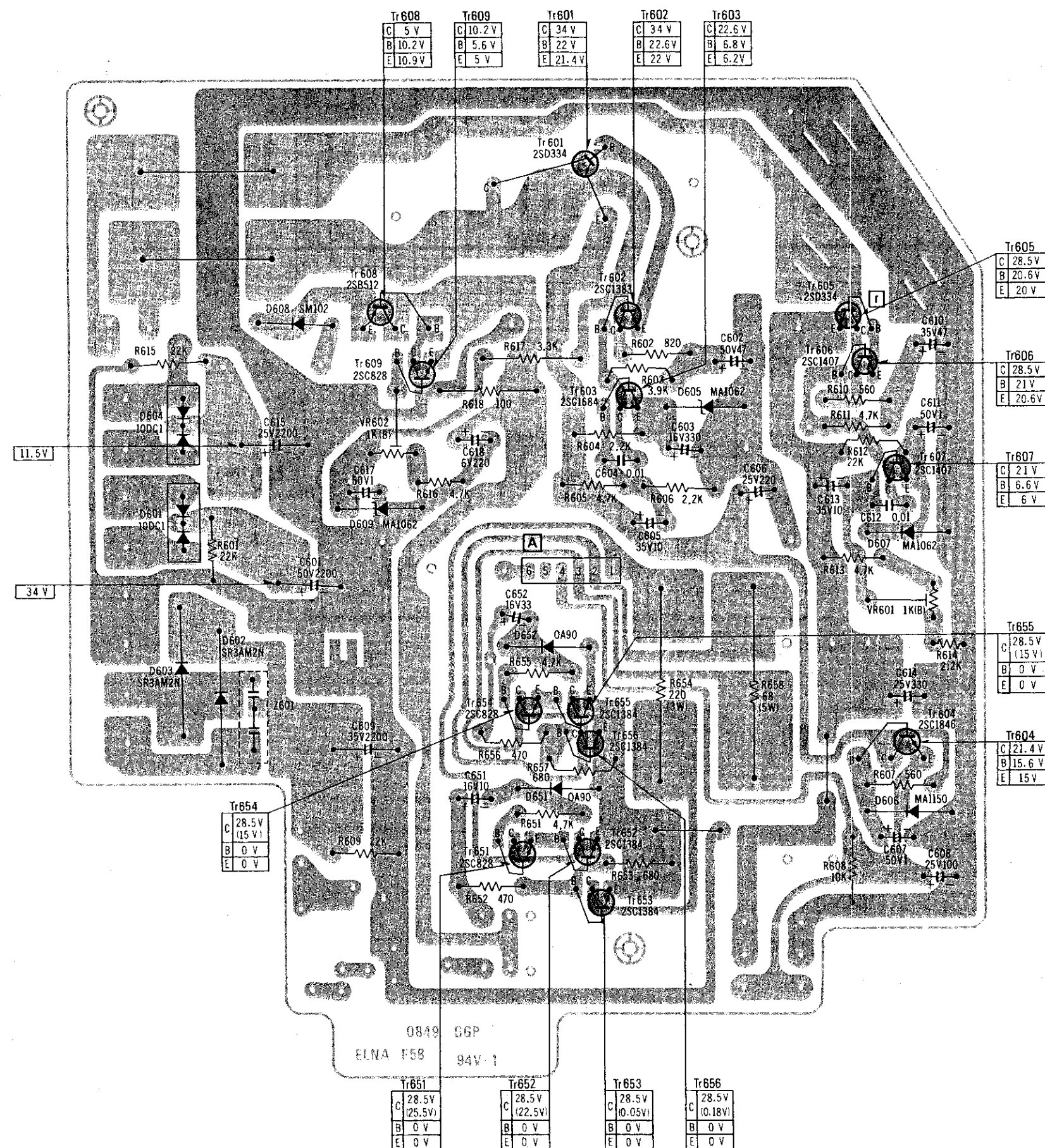
TR24: Restraint detect		
ON (V)	OFF (V)	
B	0.7	0
C	5	5
E	0.7	5
ON: When being restrained		
OFF: At normal running		

TR25: Restraint detect		
ON (V)	OFF (V)	
B	0.7	0
C	0	5
E	0	5
ON: When being restrained		
OFF: At normal running		

CIRCUIT BOARD

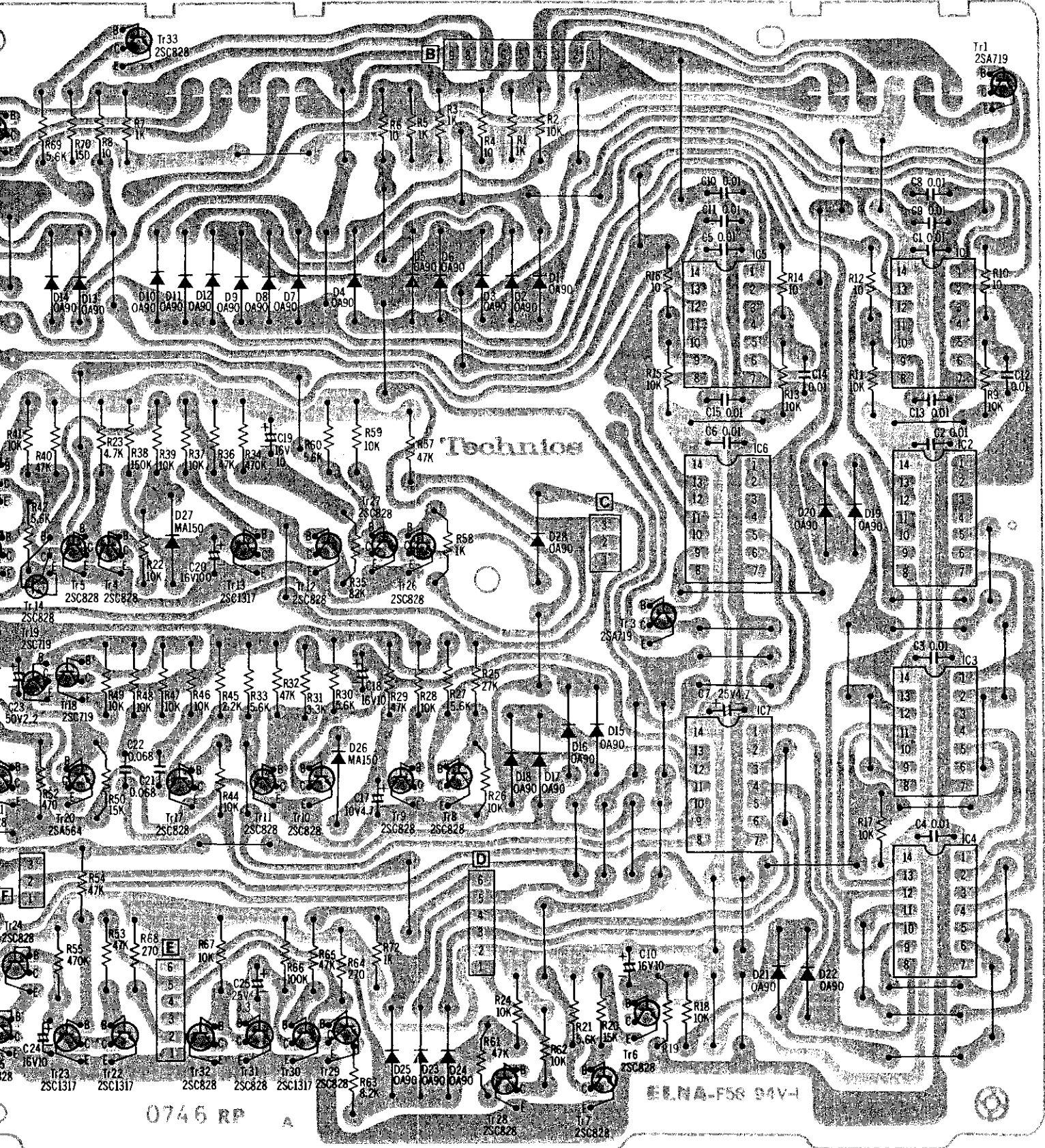
Power Supply Circuit Board

Main Control Circuit Board



NOTE:
The circuit shows
Values indicated
chassis and ele

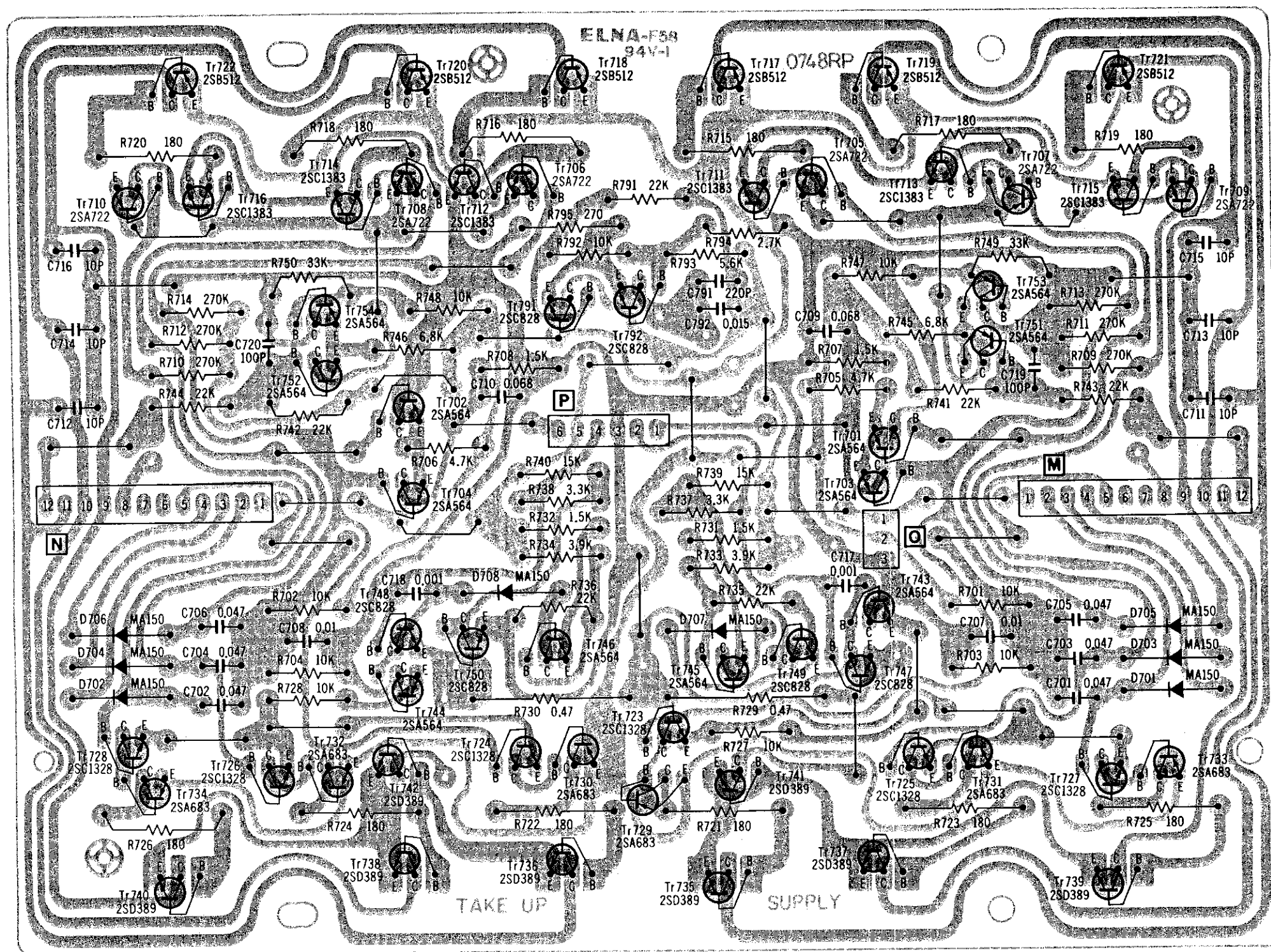
Control Circuit Board



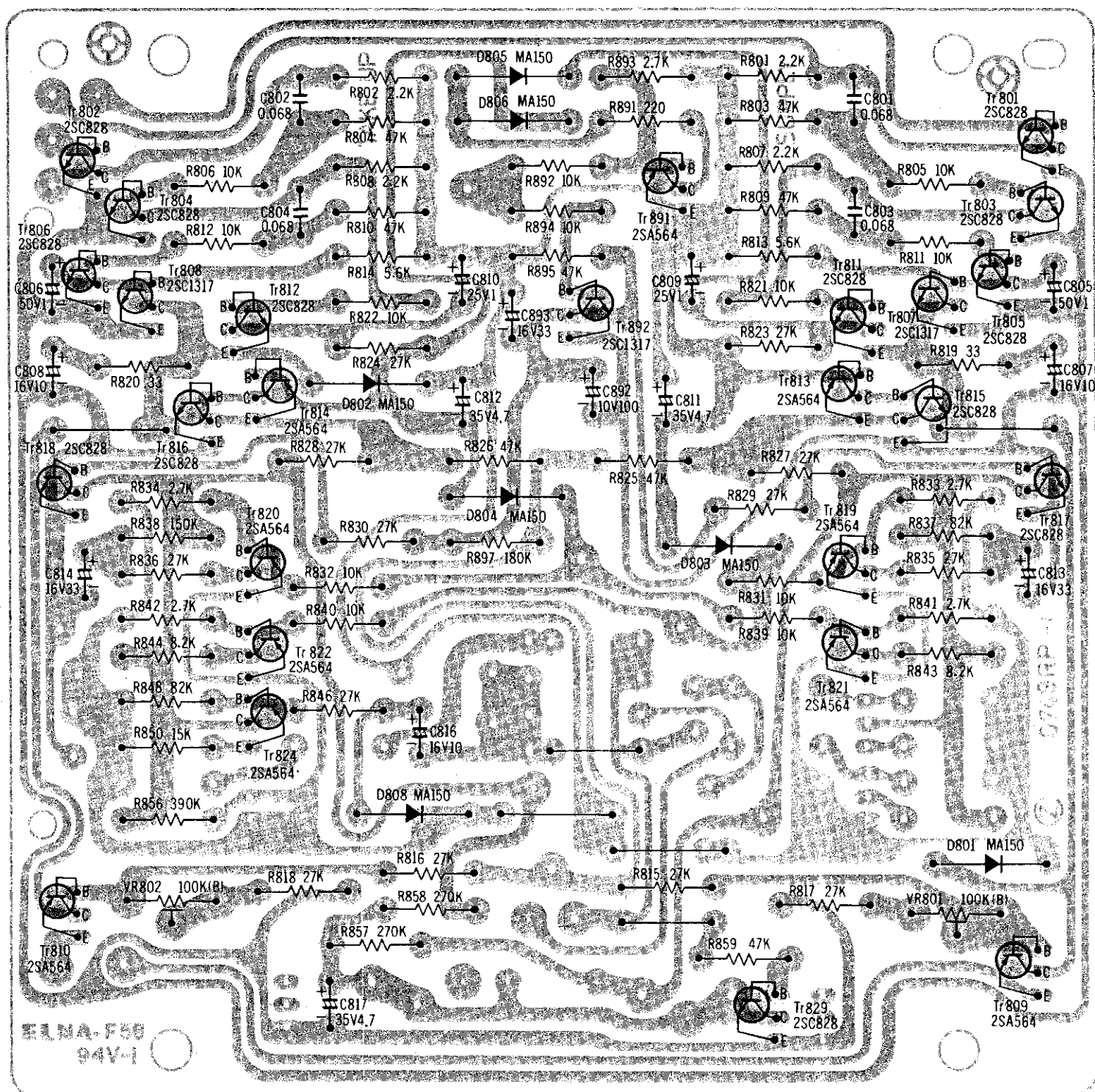
NOTE:
The circuit shown in red on the conductor is B circuit.
Values indicated in are DC voltage between the
chassis and electrical parts.

Voltages shown in () are voltages when plunger is
in "ON" condition.

Reel Motor Driving Circuit Board



Reel Motor Tension Control Circuit Board

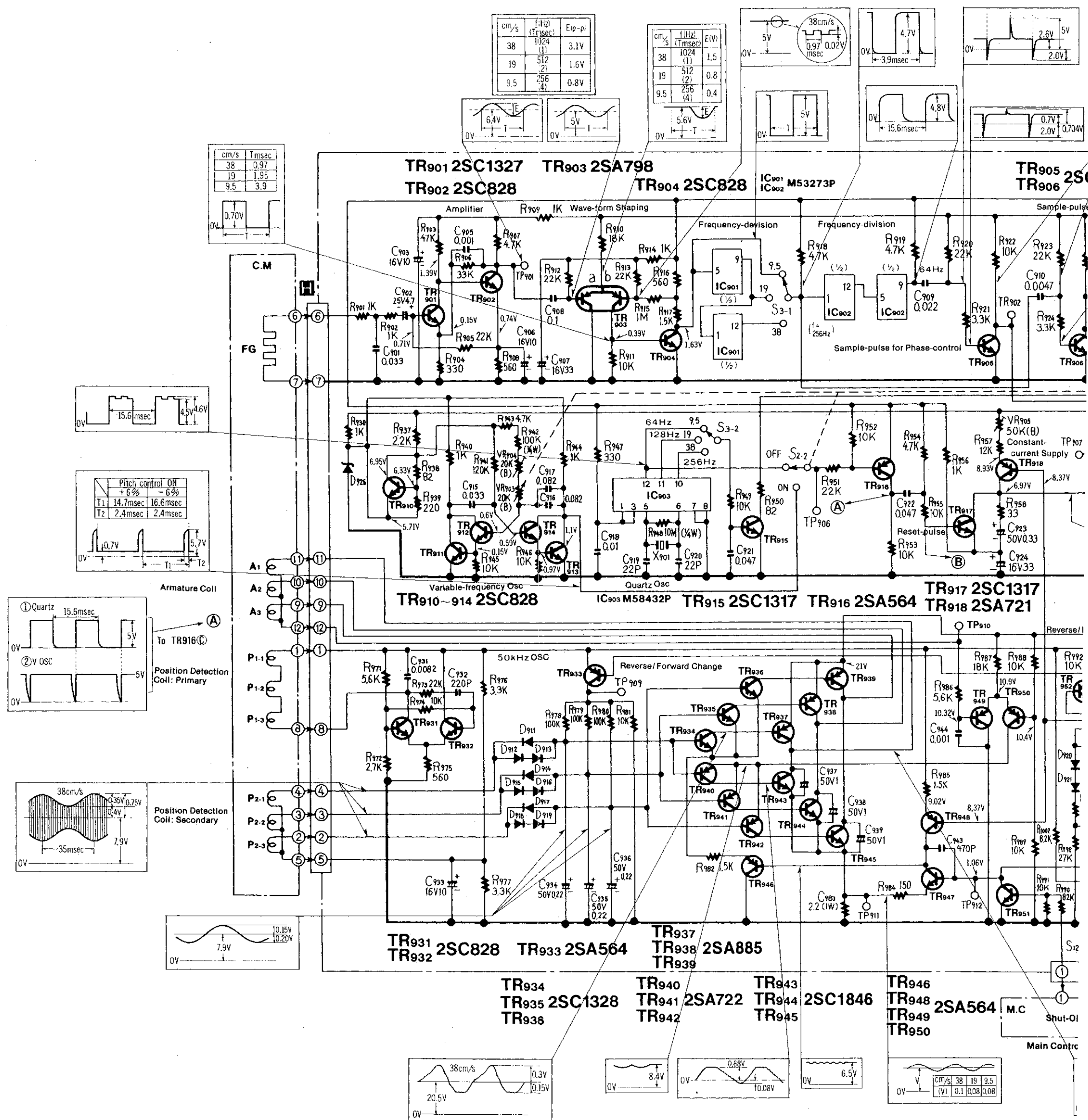


NOTE:

The circuit shown in red on the conductor is B circuit.
Values indicated in are DC voltage between the chassis and electrical parts.

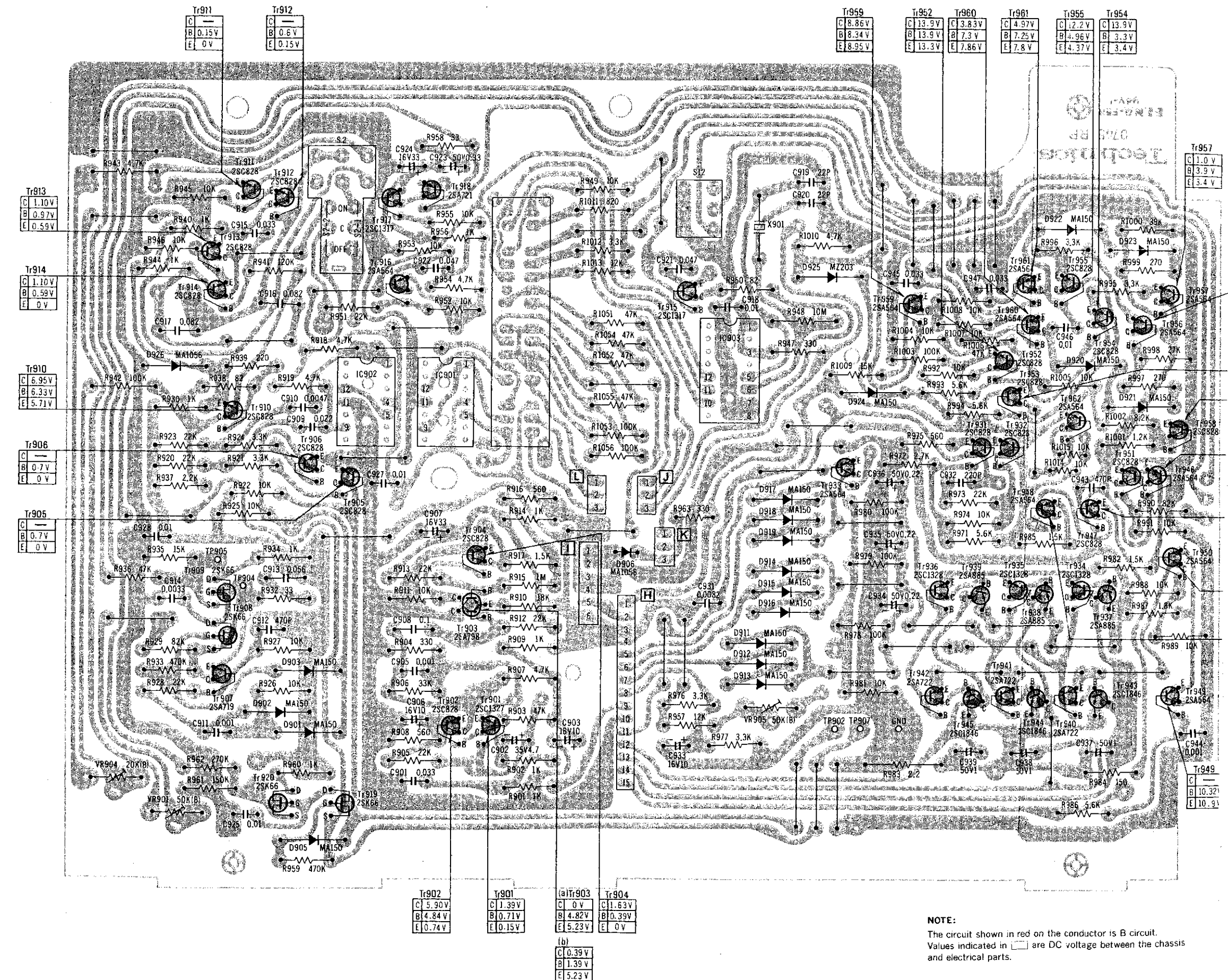
SCHEMATIC DIAGRAM MODEL RS-1500US

Capstan Motor Section



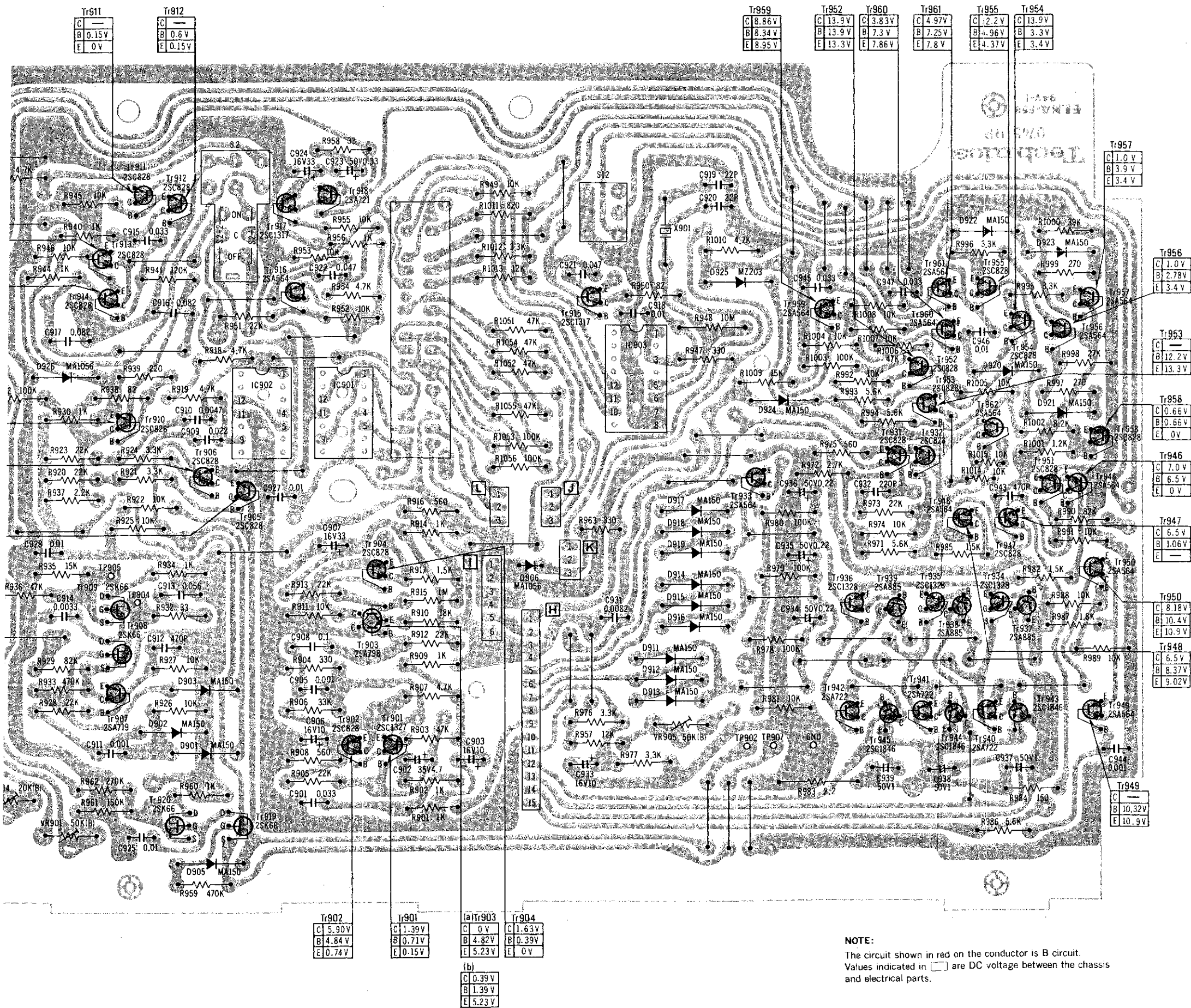
CIRCUIT BOARD

Capstan Motor Control Circuit Board



T BOARD

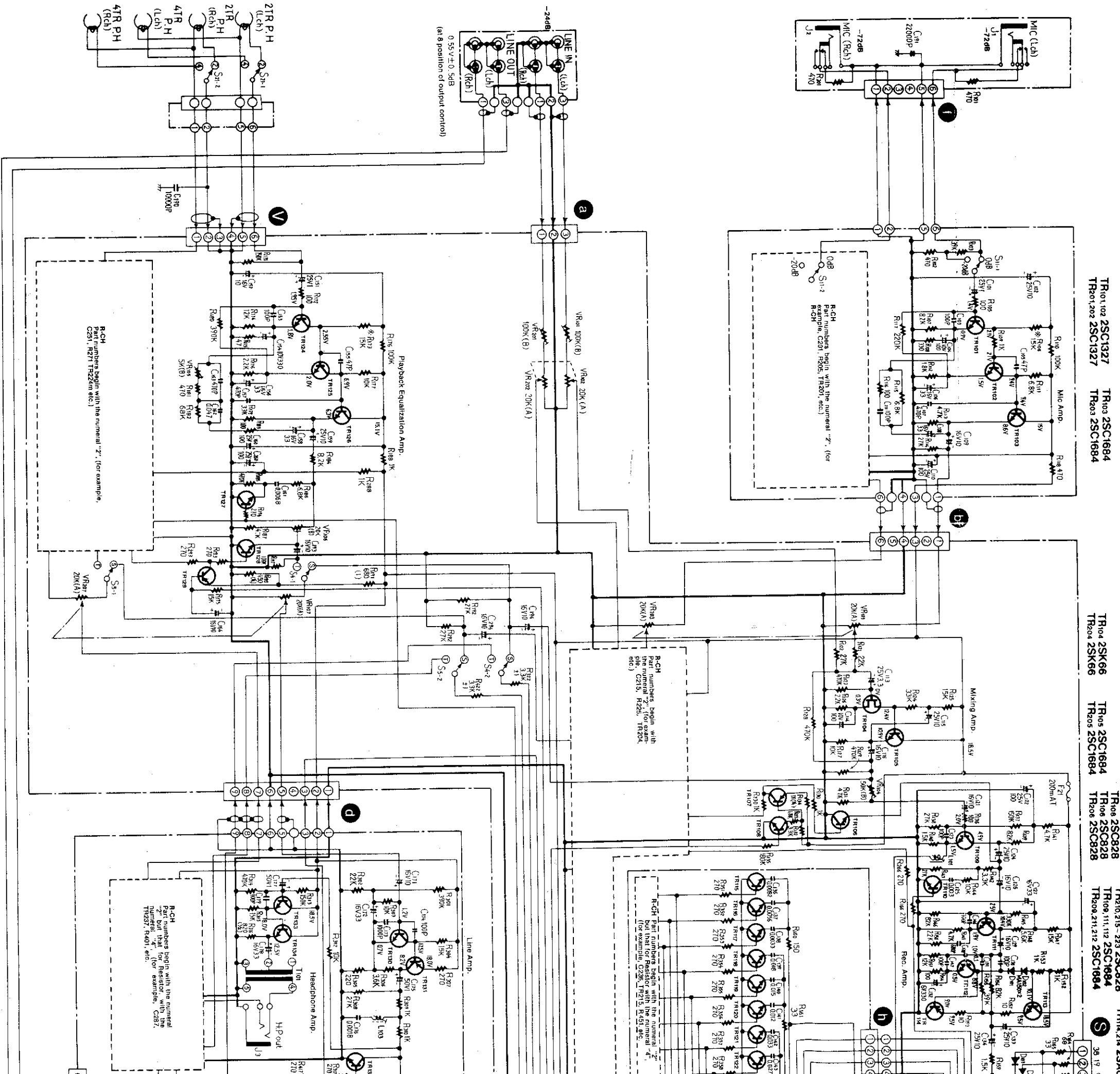
Motor Control Circuit Board



NOTE:
The circuit shown in red on the conductor is B circuit.
Values indicated in [] are DC voltage between the chassis
and electrical parts.

SCHEMATIC DIAGRAM MODEL RS-1500US

Main Amp. Section



TR101,102 2SC1327 TR103 2SC1684
TR101,202 2SC1327 TR103 2SC1684

TR104 2SK66 TR105 2SC1684
TR104 2SK66 TR105 2SC1684

TR107 2SA564 TR108 2SC828
TR109 2SC828 TR110 2SC828
TR109,111,112 2SC1684 TR110,111,112 2SC1684
TR109,211,212 2SC1684 TR110,211,212 2SC1684

TR113 2SC1 TR114 2SA6
36 19 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

TR124,125 2SC1327 TR126 2SC1684
TR124,125 2SC1327 TR126 2SC1684

TR127,128 2SC828 TR129 2SA564
TR127,128 2SC828 TR129 2SA564

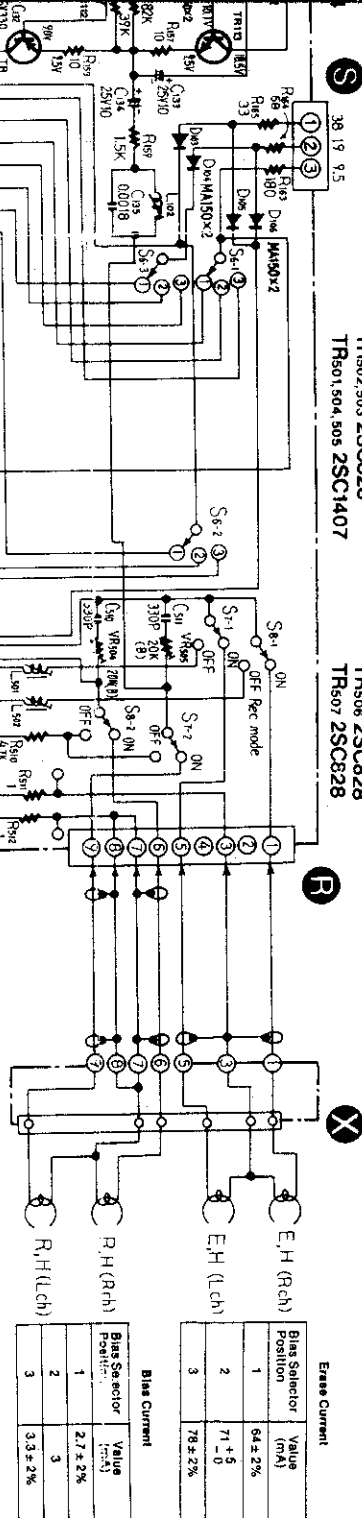
TR130 2SC1684 TR131 2SA564
TR130 2SC1684 TR131 2SA564

TR133 2SC1 TR134 2SA6
TR133 2SC1 TR134 2SA6

TR13.213 2SC1383
TR14.214 2SA683

TR502.503 2SC828
TR501.504.505 2SC1407

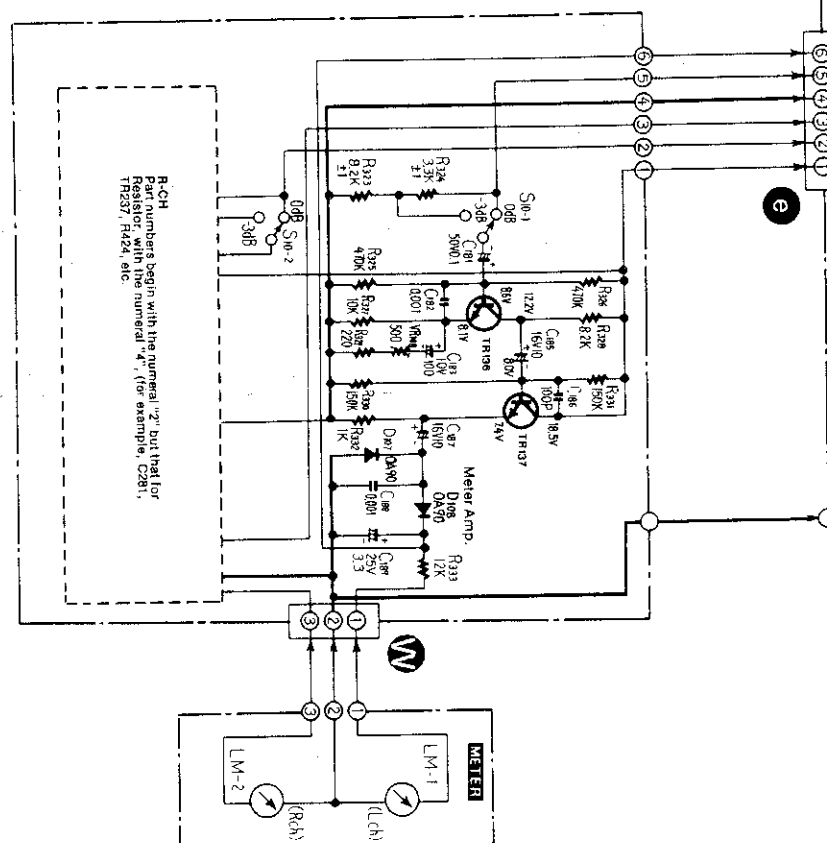
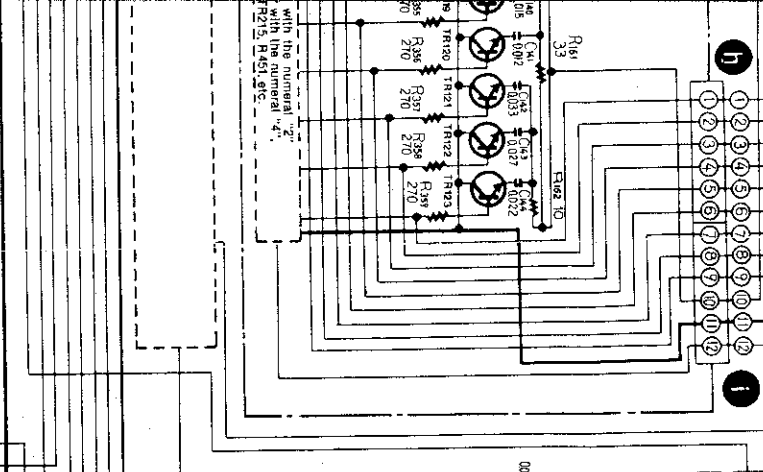
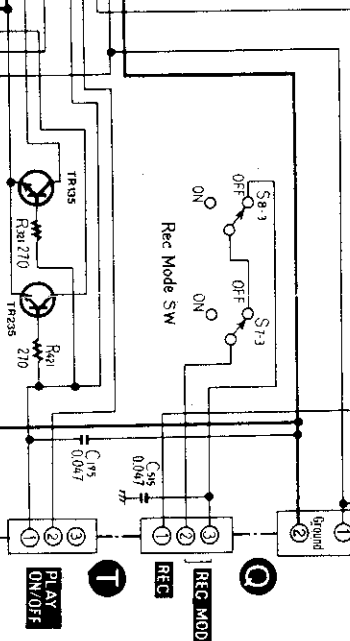
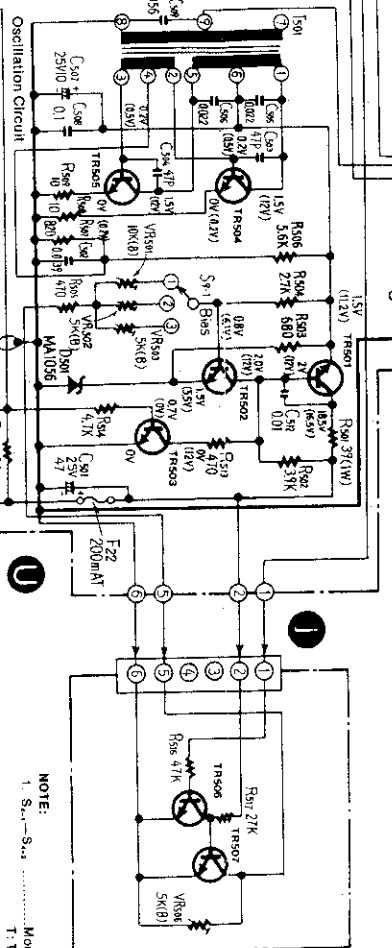
TR506 2SC828
TR507 2SC828



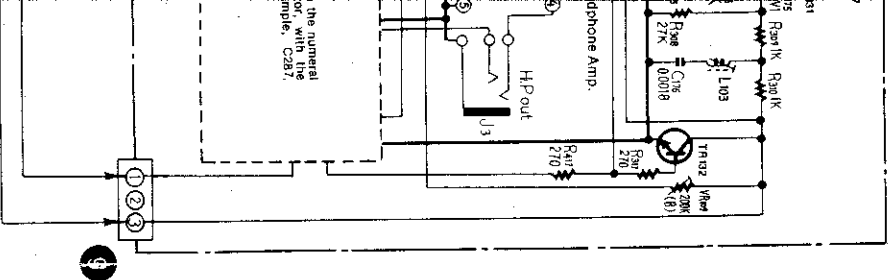
Erase Current	
Bias Selector Position	Value (mA)
1	64 ± 2%
2	71 ± 5
3	78 ± 2%

Bias Current	
Bias Selector Position	Value (mA)
1	2.7 ± 2%
2	3
3	3.3 ± 2%

NOTE:
1. S₁—S₁₂ Monitor switch (L-CH, S: Source, T: Tape).
2. S₁₃—S₁₄ Monitor switch (R-CH, S: Source, T: Tape).
3. S₁₅—S₁₆ Equalization select switch.
4. S₁₇—S₁₈ Rec. mode ON/OFF switch, (L-CH) (green) ON/OFF position.
5. S₁₉—S₂₀ Rec. mode ON/OFF switch, (R-CH) (green) ON/OFF position.
6. S₂₁—S₂₂ Bias current select switch.
7. S₂₃—S₂₄ Meter range select switch.
8. S₂₅—S₂₆ Microphone estimator switch (0dB/—20dB).
9. S₂₇—S₂₈ Playback head select switch (217/417).
10. V_{R1}—V_{R12} Line-in level adjustment VR.
11. V_{R13}—V_{R14} Line-in level control.
12. V_{R15}—V_{R16} Mic-in level control.
13. V_{R17}—V_{R18} Recording level adjustment VR.
14. V_{R19}—V_{R20} Playback equalization adjustment VR.
15. V_{R21}—V_{R22} Playback level adjustment VR.
16. V_{R23}—V_{R24} Output level control.
17. V_{R25}—V_{R26} Meter indication balance adjustment VR (tape to source).
18. V_{R27}—V_{R28} VR (tape to source).
19. V_{R29}—V_{R30} VR (tape to source).
20. V_{R31}—V_{R32} Bias current adjustment VR (for each Rec. head of L-CH and R-CH).
21. V_{R33} Bias current adjustment VR (when S₂₁ is of tape speed).
22. L₁—L₁₂ Record equalization adjustment coil.
23. L₁₃—L₁₄ Bias trap coil (in Rec. amp.).
24. L₁₅—L₁₆ Bias trap coil (in Line amp.).
25. L₁₇—L₁₈ Erase dummy load.
26. T₁—T₁₂ Headphone output transformer.
27. T₁₃ Headphone output transformer.
28. Resistor values are in ohms (), 1/4 watt unless specified otherwise.
29. Capacitor values are in microfarads (μF) unless specified otherwise.
P = Pico-farads.



TR136.137 2SC828
TR236.237 2SC828

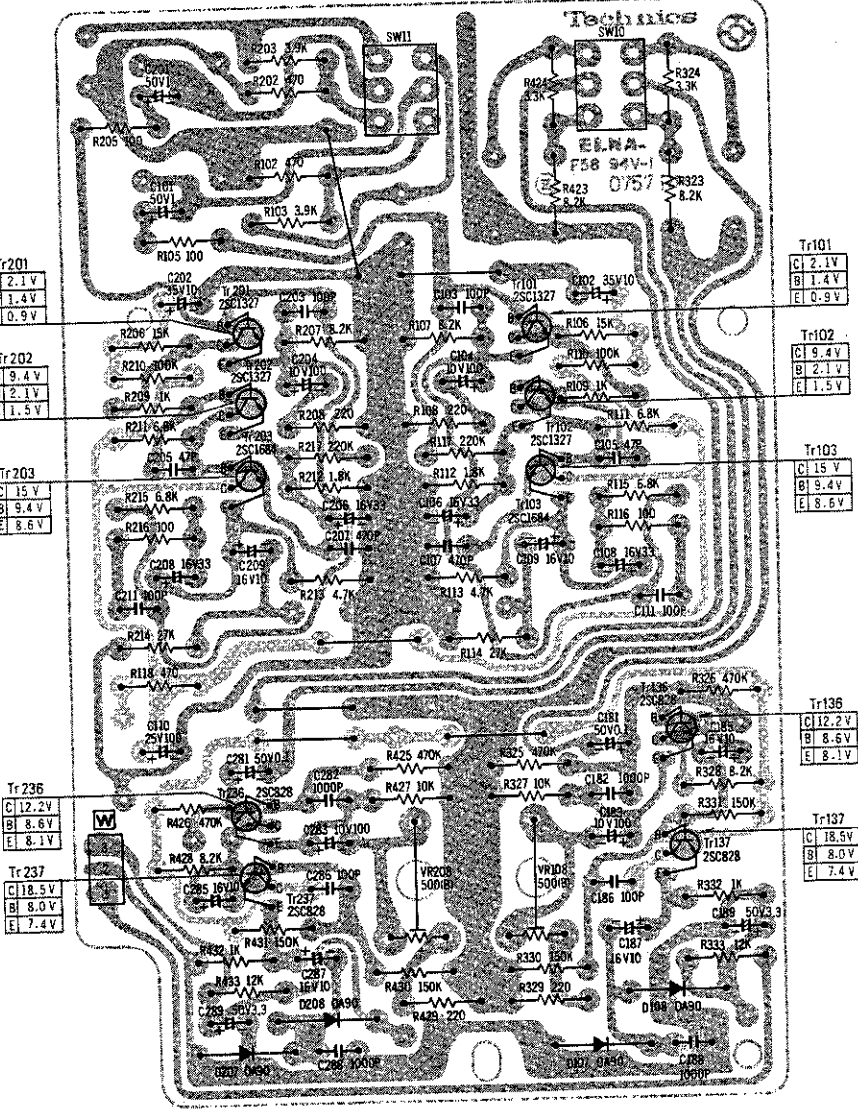


TR133-135 2SC828 TR112.232 2SC1317
TR233 235 2SC828

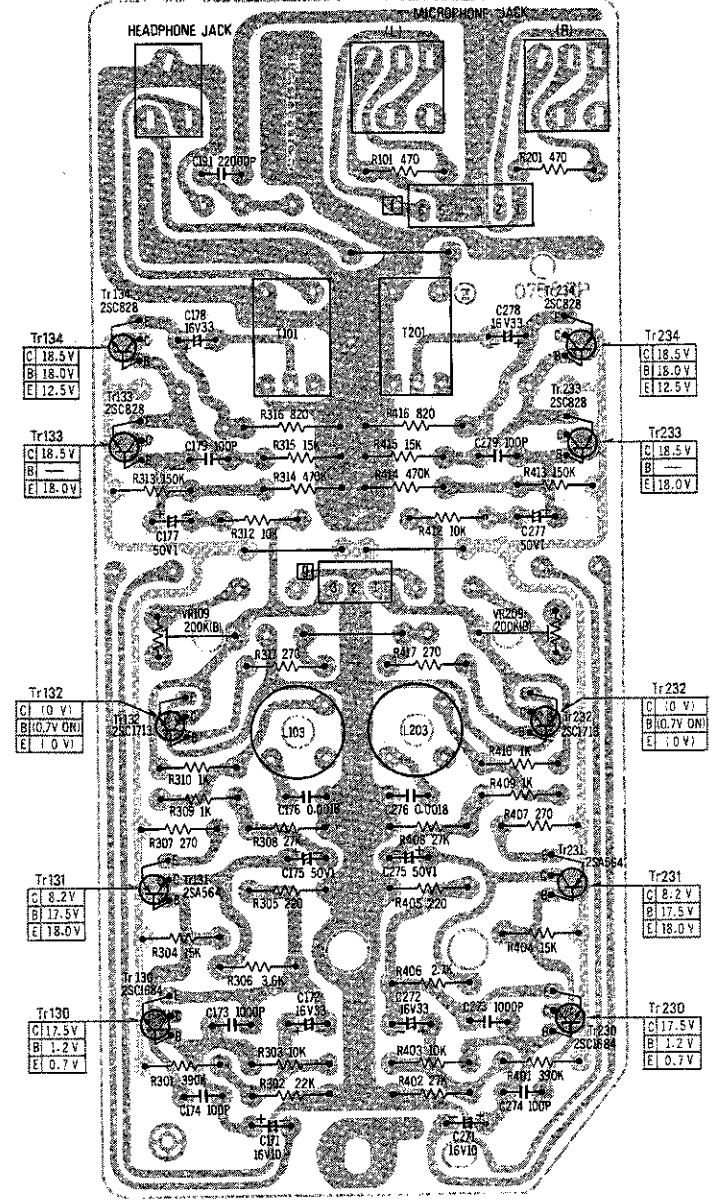
Specifications are subject to change without notice.

CIRCUIT BOARD

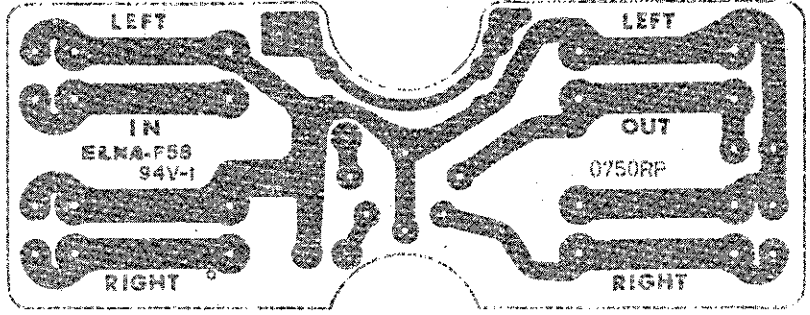
Mic and Meter Amp. Circuit Board



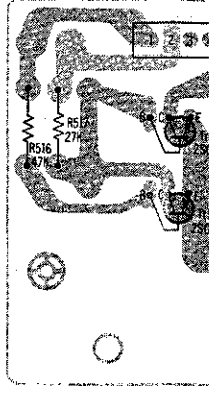
Line-out Headphone Amp. Circuit



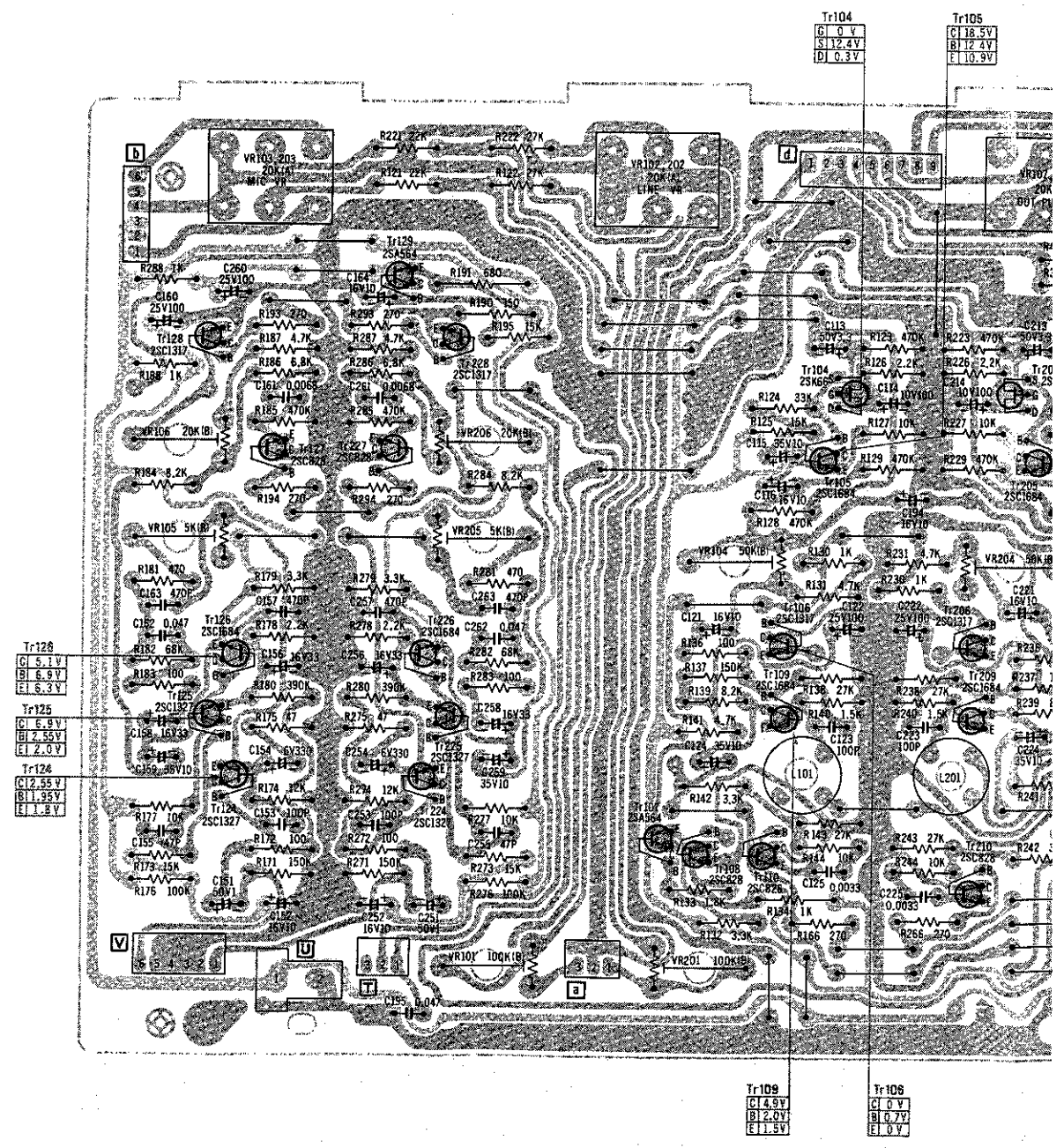
Jack Circuit Board



Tr507 Cir

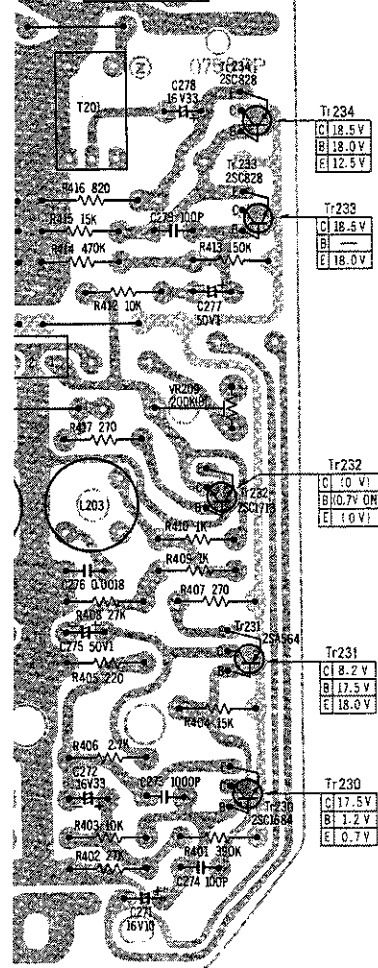


Main Amp. Circuit Board



NOTE:
The circuit shown in red on the conductor is B circuit.
Values indicated in are DC voltage between the chassis and electrical parts.
Voltages shown in () are voltages when UNIT is in "recording" condition.
Voltages for R-channel are same voltages as L-channel.

Figure 1 consists of two circuit diagrams, (A) and (B), showing the connection of a microphone to a jack. Diagram (A) shows a microphone connected to a 20K resistor, which is then connected to a 470 ohm resistor. Diagram (B) shows a microphone connected to a 20K resistor, which is then connected to a 470 ohm resistor. Both diagrams include a 100 ohm resistor connected to ground.



LEFT

IN
ELNA-F58
94V-1

RIGHT

LEFT

OUT
0750RP

RIGHT

Technics
ELTA-P66 94V-I

Tr104
C 0.0V
B 12.4V
D 0.3V

Tr105
C 18.5V
B 12.4V
E 10.9V

Tr126
C 5.1V
B 6.9V
E 6.3V

Tr125
C 5.9V
B 2.55V
E 2.0V

Tr124
C 2.55V
B 1.95V
E 1.9V

Tr109
C 4.3V
B 0.7V
E 1.5V

Tr108
C 0.7V
B 0.7V
E 0.7V

Tr113
C 18.5V
B 10.9V
E 9.5V

Tr114
C 0.7V
B 0.7V
E 9.5V

Tr111
C 10.4V
B 2.5V
E 1.5V

Tr112
C 8.3V
B 1.0V
E 6.5V

Tr505
C 1.5V
B 12.0V
E 0.2V

Tr504
C 1.5V
B 12.0V
E 0.2V

Tr503
C 0.0V
B 10.0V
E 0.0V

Tr501
C 18.5V
B 16.5V
E 1.5V

Tr502
C 2.0V
B 0.8V
E 1.5V