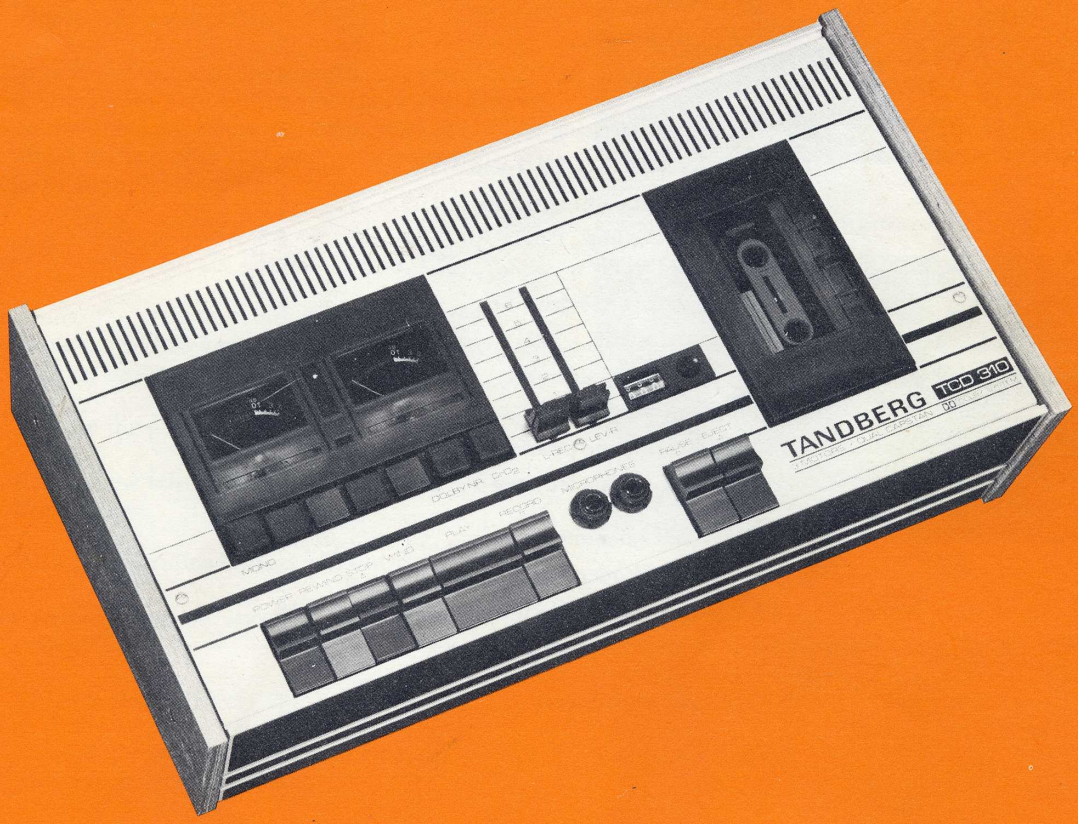
# Service Manual

# Cassette Deck TCD 310




TANDBERG

## CONTENTS

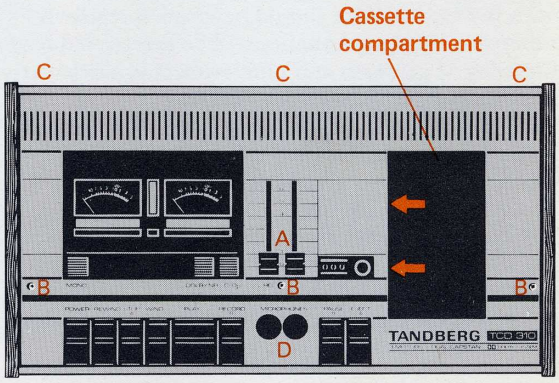
# 1. DISMANTLING

## 1.1 REMOVAL OF TOP PLATE

1. Remove the plastic lid from the **cassette compartment**, and push the compartment down to closed position.

2. Remove the RECORD LEVEL buttons (A). Remove the 3 screws on the top plate (B) and the 3 screws at the top of the rear plate (C). **US-version only**: Remove the nuts from the microphone sockets (D).

3. Grip the left edge of the cassette compartment aperture with your fingers (indicated with arrows on the drawing). Remove the top plate by lifting the rear edge first, and pulling the plate away from the recorder.




## 1.2 REMOVAL OF INNER TOP PLATE

The inner top plate with indicators and volume controls can be lifted to the vertical position to give access to the electrical parts.

1. Remove the **plastic cover** of the indicators.

2. Remove the **left side wall** by unscrewing the two black screws.

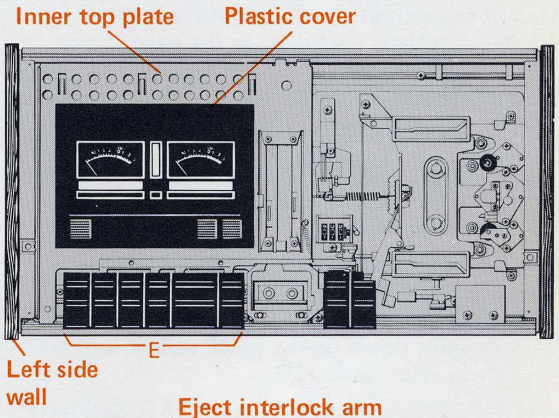
3. Push the operating buttons (E) out to the left.

4. Remove the plastic arm (F) from the PAUSE switch.

5. Unscrew the 6 screws (G).

6. Unhook the **eject interlock arm** from the moving plate on the **switch bracket**.

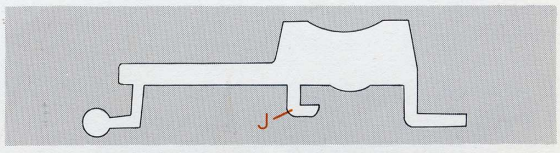
7. Grip the right edge of the inner top plate and lift it carefully to vertical position.




## 1.3 A NOTE ON REASSEMBLING

When reassembling make sure that the hooks (J) on the operating buttons are hooked onto the plastic arms on the switches.

Also make sure that the eject interlock arm is hooked onto the moving plate on the eject switch bracket.




*Profile of operating button.*

# 2. REGULAR MAINTENANCE

## 2.1 CLEANING

The parts of the cassette deck that are in contact with the tape surface should be cleaned regularly, otherwise the sound quality will be greatly reduced. **Cleaning of capstans and pinch rollers is particularly important to avoid wow and flutter.**

If the cassette deck is used every day, cleaning should be performed **at least once a month.**

The cleaning can be done with cotton wool or a piece of flannel wrapped around a small stick and moistened with pure alcohol or methylated spirit. A kit intended for this purpose, "Tandberg Professional Tape Head Cleaner", is available.

**NOTE!**
Do not use solvents, such as acetone or trichlorethylene, as these may damage the heads.

**How to clean**

1. Press the EJECT button, and remove the plastic lid from the cassette compartment.
2. Push the cassette compartment down to closed position.
3. Clean the record/playback head (A), erase head (B), tape guide (C), capstans (D) and pinch rollers (E). Do not use too much cleaning liquid on the pinch rollers, and dry them afterwards.

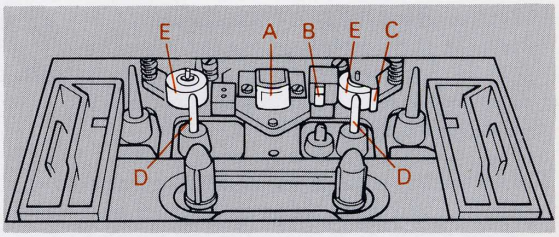
   DO NOT USE ANY SHARP OBJECTS WHEN CLEANING. DO NOT TOUCH THE ADJUSTMENT SCREWS.
4. Check the surrounding area for dust and deposits from the tape. Clean if required.

Cleaning should be performed both before and after adjustments.

## 2.2 DEGAUSSING

A marked increase in background noise from the tape may indicate that the heads or other parts in the tape path should have the residual magnetism removed (degaussing).

If required, degaussing should be carried out as follows. Switch off the deck. **Remove the cassette from the deck.** Remove the plastic cassette compartment lid and move the degausser slowly past each one of the metal parts normally in contact with the tape. Take great care not to let the degausser **touch** the heads or metal parts in the tape path. Do not switch off the degausser until it is at least **3 ft** from the deck.



*Parts to be cleaned*

Degaussing should be performed both before and after adjustments.

## 2.3 LUBRICATION

The capstan motor and the reel motors may require lubrication from time to time. The interval between each lubrication should be at least 3000 hours of operation.

Use the following types of oil:

**Capstan motor:** ANDEROL 465 from Tenneco Chemicals, U.S.A., or oil supplied by Tandberg.

**Reel motors:** NUTO H36 (also called SPINESSO 34) from Esso.

**NOTE!**
Use only one drop of oil for each motor.

# 3. MECHANICAL SERVICING

## 3.1 MICROSWITCHES MS 1 AND MS 2

**Pinch rollers released:**

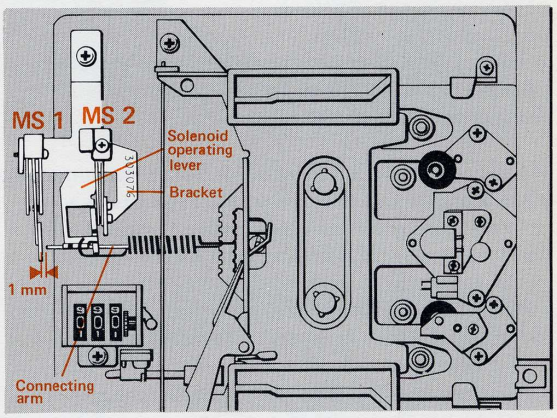
MS 1: Check that there is a gap of about 1 mm between the **connecting arm** and the middle leaf of the switch (see figure).

MS 2: Check that the two leaves of the switch are pressed together between the **solenoid operating lever** and the **bracket.** Adjust by bending the bracket.

**Pinch rollers operated:**

MS 1: Check that the left and the middle leaf are pressed together.

MS 2: Check that the switch is open.




*Pinch rollers released*

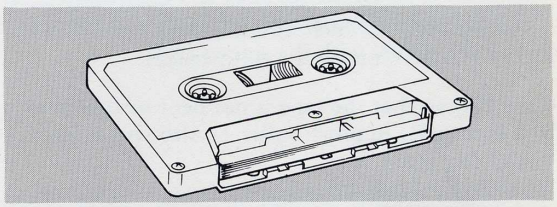
## 3.2 TAPE PATH ADJUSTMENTS

The following equipment is needed:

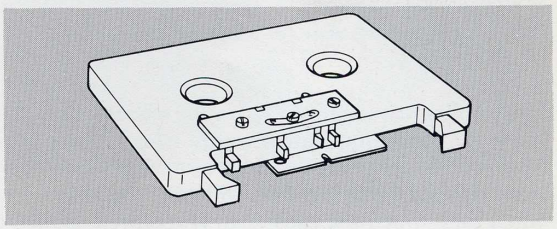
– An ordinary high quality cassette which has been cut open so that the tape is visible (see figure).

– Tandberg test tape No. 23 (azimuth test).

For really extensive adjustments – for example if several parts in the tape path are replaced – a Tandberg Adjustment Plate may be needed. Such adjustments should be carried out by a Tandberg representative.



*Open cassette to be used for adjustment*



*Tandberg Adjustment Plate*

### 3.2.1 Outline of the adjustment procedure

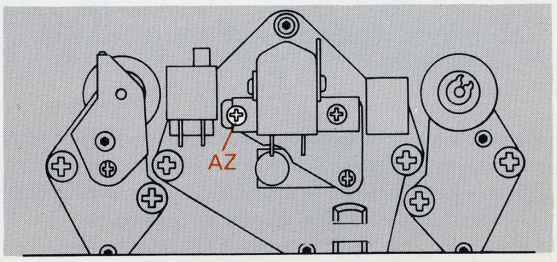
Insert an open cassette and set the deck to PLAY.

Check that the tape does not "climb" on the capstans and is not bent or folded at the tape guides. Also check that the tape does not "bulge" at the heads ("bulging" indicates wrong azimuth adjustment of the heads). **When viewed from above the tape should be seen as an almost invisible line.**

Also check that the top of the erase head is flush with the top edge of the tape. **The erase head should not be visible above the tape.**

If erratic tape motion is observed, try to eliminate it by turning the adjustment screws for heads or pinch rollers.

Insert a Tandberg test tape No. 23 and adjust with the screw (AZ) on the record/playback head to maximum output signals on both OUTPUT sockets. The difference between the tracks should be less than 4 dB. (Details: see next page.)



### 3.2.2 Details of adjustment procedure

#### ■ Pinch rollers.

**Parallelity.** Move the mounting plate inwards so that the pinch rollers almost touch the capstans. Adjust with the screws (P) so that both rollers are parallel with the capstans.

A white piece of paper can be inserted behind the pinch roller and capstan to make it easier to see the gap between them.

**Height.** Insert the open cassette. Move the mounting plate inwards and check that the tape fits exactly into the tape guide on pinch roller 1. Adjust with the two screws (H) if necessary (turn both screws equal amounts). Also turn the azimuth screw (AZ) correspondingly in the opposite direction to keep the roller roughly in correct azimuth position.

Adjust pinch roller 2 to corresponding height. This adjustment is not critical.

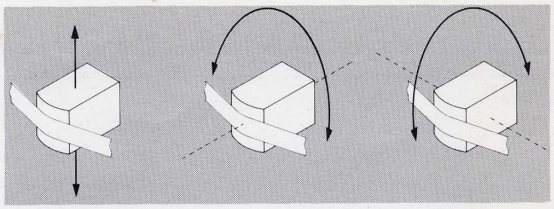
**Azimuth.** Set the cassette deck to PLAY and check that the tape does not "climb" on the capstans. If necessary, adjust with the screws (AZ).

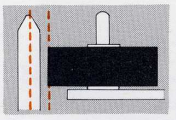
Check again that the tape is not bent or folded at the tape guide of pinch roller 1. Also check the parallelity again.

Height and azimuth can also be adjusted by means of a Tandberg Adjustment Plate. The pinch rollers are then checked against the tabs marked A and B in the figure.

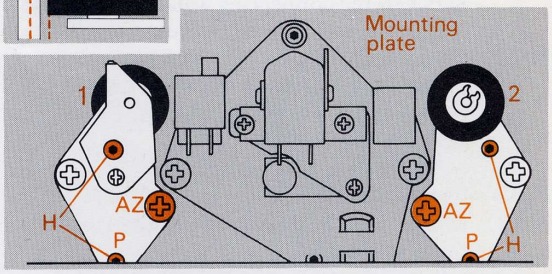
(A special adjustment plate for the pinch roller shafts can also be used).

**Pinch roller operation.** Remove the cassette and move the mounting plate inwards. Check that both pinch rollers meet the capstans at exactly the same time (the pinch rollers will start rotating when they touch the capstans). If required, adjust with the eccentric screw as shown.

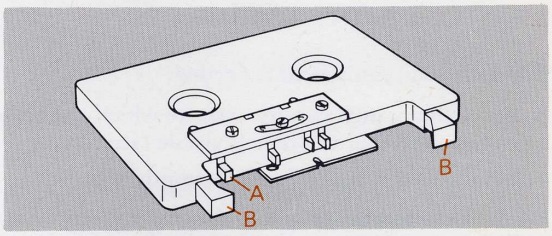


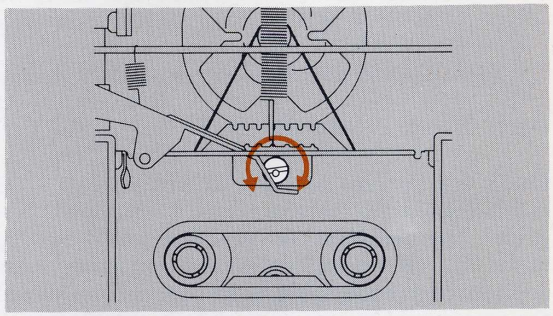
*Parallelity of pinch roller.*




*Adjustment screws for pinch rollers*




*Tandberg Adjustment Plate*

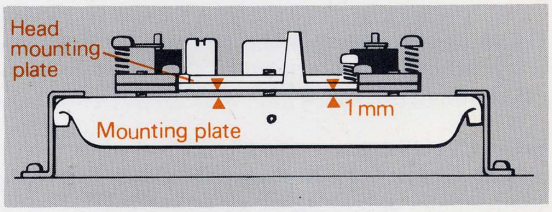


*Adjustment screw for pinch roller operation*

#### ■ Erase head

The position of the erase head is adjusted by turning the screws on the head mounting plate **(see top figure next page ).**

**Preadjustment of head mounting plate.** Adjust with the screws (H) and (AZ) so that the head mounting plate is parallel with the underlying mounting plate. The gap between them should be approx. 1 mm. To check this, the right chassis plate must be removed.




*Preadjustment of head mounting plate*

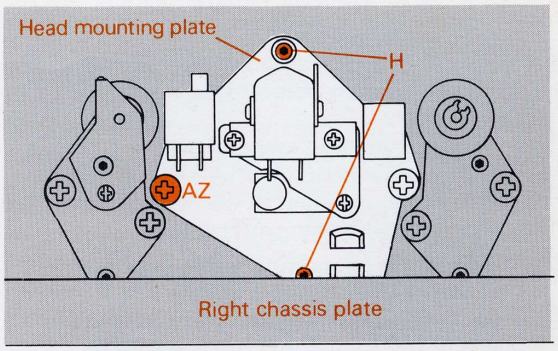
**Adjustment of erase head.** Insert the open cassette and move the mounting plate inwards. Adjust with the screws (H) and (AZ) so that the top of the erase head is flush with the top edge of the tape. The front of the erase head should be parallel with the tape.

Set the deck to PLAY. Check that the erase head is not visible above the tape, and that the tape does not "bulge" at the head.

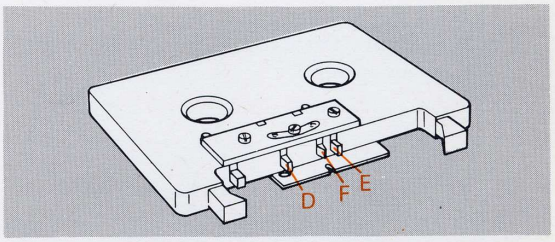
Keep the head mounting plate parallel with the underlying mounting plate.

The screws (H) must not be unscrewed too far, as the spring under the head mounting plate will then prevent the mounting plate from moving freely.

An Adjustment Plate can also be used. In this case the top of the erase head should be flush with tab D. The front of the erase head should be parallel with the tab.




*Adjustment screws for erase head*




*Tandberg Adjustment Plate*

## ■ Record/playback head

The position of the record/playback head is adjusted by turning the screws on the head bracket. **Do not touch the adjustment screws for the head mounting plate.** It is assumed that the head mounting plate has already been correctly adjusted

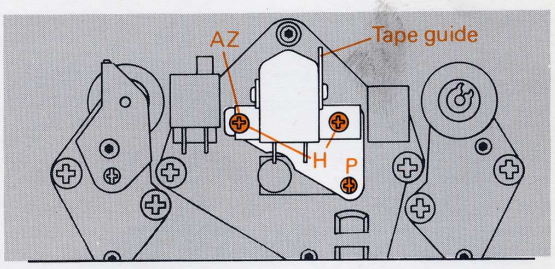
**Height and parallelity.** Insert the open cassette and move the mounting plate inwards. Adjust with the screws (H) and (P) so that the tape fits exactly into the tape guide of the head. The front of the head should be parallel with the tape.

Set the deck to PLAY. Check again that the tape is not bent or folded at the tape guide, and does not "bulge" at the head.

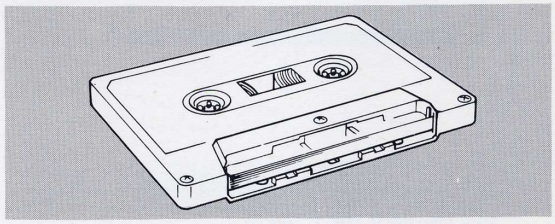
**Azimuth.** Insert a Tandberg test Tape No. 23 (6,300 Hz azimuth test). Connect a voltmeter to each OUTPUT socket and set the deck to PLAY. Adjust with the screw (AZ) to **maximum output signals** with no more than 4 dB difference between the tracks (adjust to best compromise).

Check the height and parallelity again, and re-adjust if necessary. If readjustments are made, the azimuth must be checked again.

If an Adjustment Plate is used, the parallelity must be checked against tab F, and the height against tab E. **Do not turn the screws while the tape guide of the head touches tab E as this may cause bending of the tape guide.**




*Adjustment screws for record/playback head*



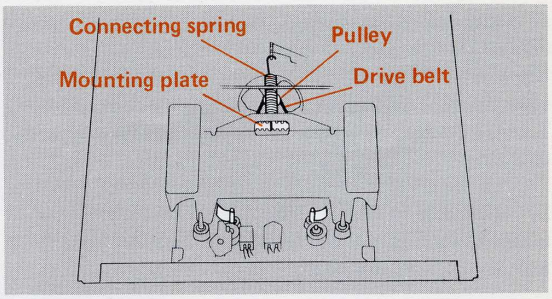
*Open cassette*

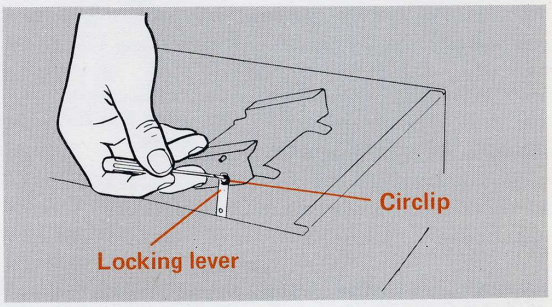
**Tracking control.** Insert an ordinary cassette and record a signal on both tracks. Then turn the cassette around and set the deck to PLAY. Listen for crosstalk on the recorded piece of tape.

## 3.3 REPLACING THE DRIVE BELT

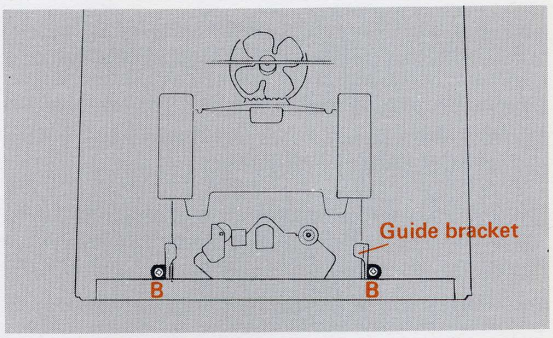
Before starting this operation remove the top plate and the cassette compartment lid.

1. Wind a piece of sellotape a few times around each capstan (see fig.). This is done to ensure that the capstans and flywheels will stay in place during the dismantling.
2. Unhook the **connecting spring** from the **mounting plate**. Be sure to note which notch the spring is fastened to, so that you will be able to replace it correctly.
3. Unhook the **drive belt** from the **pulley**.
4. Remove the circlip on the front side of the cassette compartment (see fig.).
5. Unhook the **locking lever** from the cassette compartment. The cassette compartment can now swing upwards.

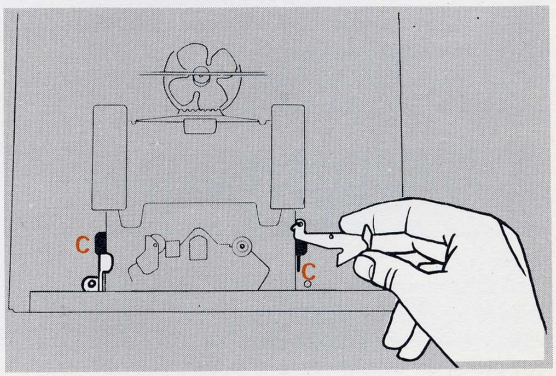


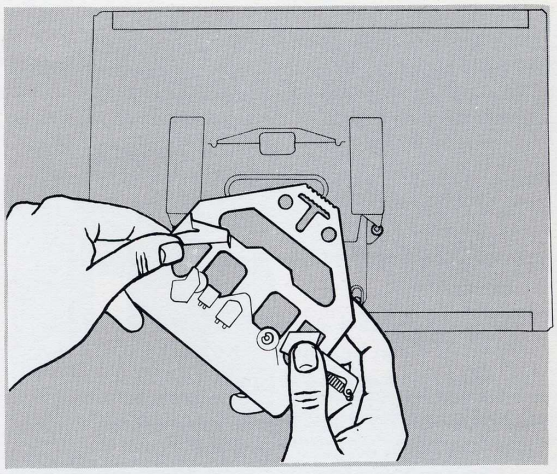

6. Unscrew the two screws (B) holding the **guide brackets** for the mounting plate.



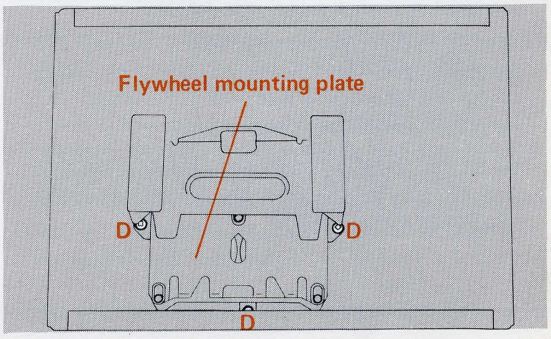

7. Unhook the two guide brackets and pull them out through the holes (C).



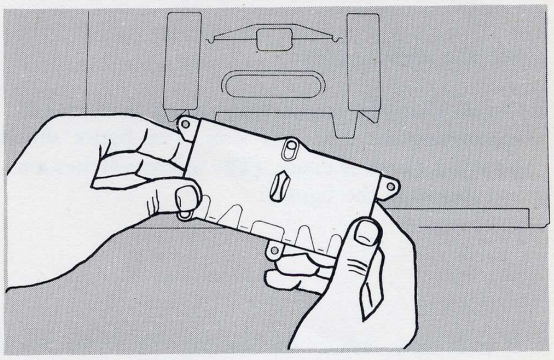
8. Remove the mounting plate carefully.



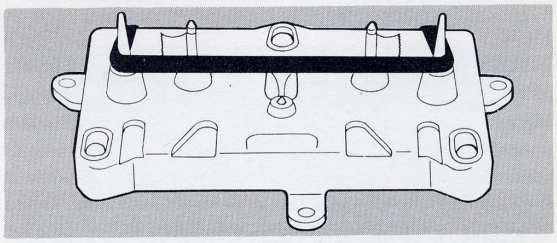
9. Unscrew the three screws (D) holding the **flywheel mounting plate** and –




– lift out the flywheel mounting plate with capstans and flywheels.



10. Remove the old drive belt.
11. Place the new drive belt around the flywheels and hook it around the cassette guides (see fig.) TAKE CARE NOT TO GET OIL OR GREASE ON THE DRIVE BELT.



12. Replace the flywheel mounting plate and hook the drive belt around the pulley. NOTE! The drive belt should pass under the counter drive belt.
13. Replace the mounting plate and check that it runs freely back and forth. Add a little grease on the ball bearings if required.

Use Mobilplex grease No. 47 or equivalent.

14. Replace all other parts. Remove the sellotape from the capstans and **CLEAN THE CAPSTANS THOROUGHLY.** Insert a cassette and check that the tape does not stick to the capstans.

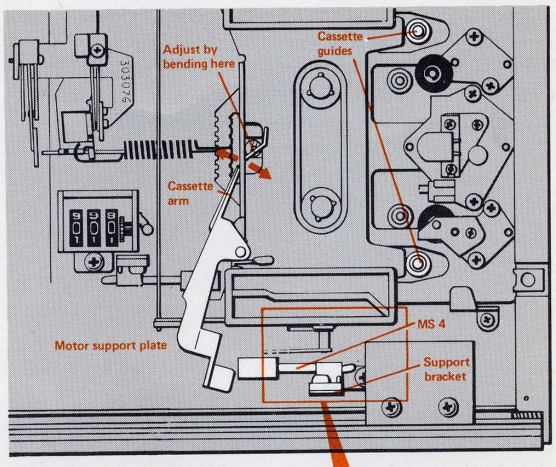
## 3.4 CASSETTE ARM

The **cassette arm** can be adjusted by bending the end which normally rests against the cassette (see figure).

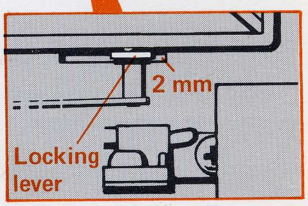
Insert a cassette, close the cassette compartment and check the following:

- The cassette should rest against the **cassette guides.**
- Microswitch **MS** 4 should be closed. (If necessary, MS 4 can be adjusted by bending the **support bracket** for the microswitch).
- The **locking lever** extending from the cassette compartment and down through a slot in the **motor support plate** should be about 2 mm from the right end of this slot (see figure).

  NOTE! If the cassette arm is bent too much to the right, the locking lever will be moved so far to the left that it will not lock the cassette compartment in the lower position.
- When the cassette compartment is released, the cassette arm should push the cassette half-way out of the compartment.




*Adjustment of cassette arm*

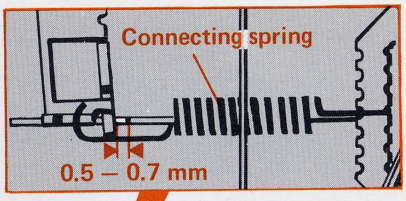



*Position of locking lever (cassette in compartment)*

## 3.5 PINCH ROLLER SOLENOID

1. Set the deck to play.

2. Check that the connecting spring is stretched approximately 0.5 - 0.7 mm. The figure shows how this check is made. (The microswitches are not shown in the figure).

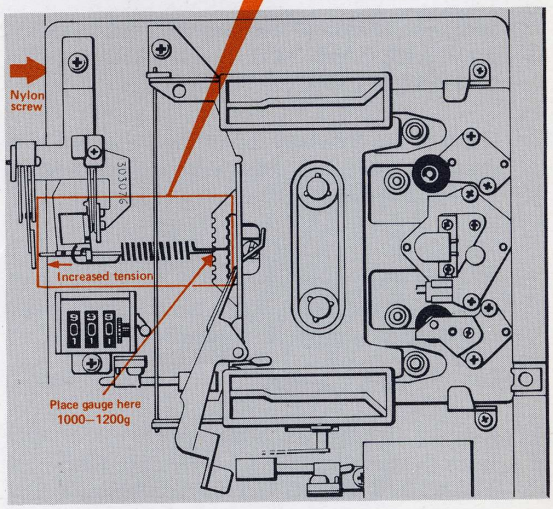



*Spring tension (cassette deck in PLAY)*

3. If necessary, adjust by turning the **nylon screw** in the armature of the solenoid. To reach this screw: **Switch off the power,** lift the inner top plate (with the indicators) to vertical position. Adjust by angling the screwdriver towards the armature from the left.

4. Check with a gauge that the force needed to lift the pinch rollers away from the capstans is **1000 - 1200** grams.

5. If necessary, this force can be adjusted by moving the connecting spring to another notch. If the spring is moved, the spring tension must be checked again as explained in 2.




*Pinch roller pressure*

## 3.6 PAUSE CONTROL

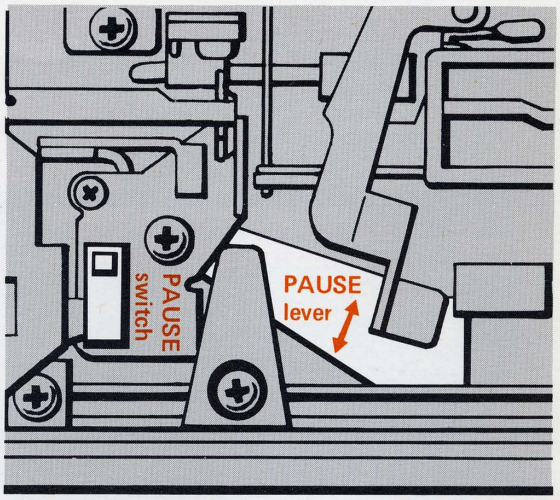
When the PAUSE button is depressed, the gap between pinch rollers and capstans can be adjusted with a screw marked "PAUSE ADJUST", which can be reached by removing the right side wall.

Insert a cassette and set the deck to PLAY. Depress the PAUSE button a few times, and check the following:

– The **PAUSE lever** should move freely, without touching the motor support plate or the bracket of the PAUSE switch. (If required, this bracket can be bent a little with a screwdriver.)

– When the PAUSE button is depressed, the tape should stop, and the pinch rollers should be lifted away from the capstans. The gap must be wide enough that neither of the pinch rollers touch the capstans under any circumstance. If required, adjust with the PAUSE ADJUST screw.

– At the same time, the gap must be so narrow that the pinch roller solenoid will pull the pinch rollers in again when the PAUSE button is released, both during PLAY and RECORD.




**IMPORTANT!** With the deck in PLAY, release the PAUSE button and check that the PAUSE lever can be moved a little up and down (as indicated with an arrow in the figure). If the lever cannot be moved, the reason is probably that the PAUSE ADJUST screw butts against the lever, and the force of the pinch roller solenoid is transferred to the lever. The pressure of the pinch rollers is then correspondingly reduced.

## 3.7 ADJUSTING THE POSITION OF A REEL MOTOR

Insert a high quality cassette and close the cassette compartment. Check that the tape spindle on the motor is exactly in the center of the corresponding hub on the cassette.
Try the recorder in play, wind and rewind. Check that the hub runs easily and does not wobble.

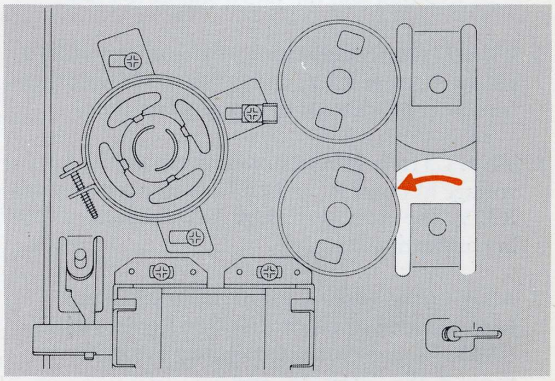
If necessary, adjust by loosening the two screws holding the reel motor. This will be easier if you remove the circlip on the left side of the cassette compartment and swing the cassette compartment upwards (see page 8, step 4).

The reel motor can now be moved slightly.

## 3.8 SALVAGING TANGLED TAPE

Occasionally the tape will wind itself around the last of the two capstans.

To salvage the tape proceed as follows:
1. Remove the bottom plate of the deck.
2. Turn the flywheel of the entangled capstan slowly **against** its normal rotation. Use your finger to turn the flywheel.
3. When the tape has been untangled from the capstan, wind it manually onto the hubs of the cassette.



*Turning the flywheel in order to salvage tangled tape*

# 4. MOTOR AND SOLENOID CIRCUITS

## 4.1 A SHORT EXPLANATION OF THE SOLENOID OPERATING CIRCUIT (Q305, Q306)

Operation of the pinch roller (start) solenoid should be slightly delayed, to give the reel motors time to remove any slack in the tape, before the pinch rollers are pulled in.

When both PLAY and RECORD buttons are released, C316 has no voltage and Q307 (PNP) is cut-off. Q306 (NPN) has a base voltage of 0 V and is also cut-off.

When the PLAY or RECORD button is depressed the following sequence is started:

1. 13.5 V is connected to the +side of C316. The voltage drop over R326 gives Q307 an emitter voltage of about 11 V. The transistor requires a base voltage which is 0.7 V more negative than the emitter to start conducting. The transistor will therefore still be in cut-off state.

2. C316 is charged through R328/R333. The positive voltage at point A is connected via C315 to the base of Q307. This voltage is gradually reduced as C316 is charged.

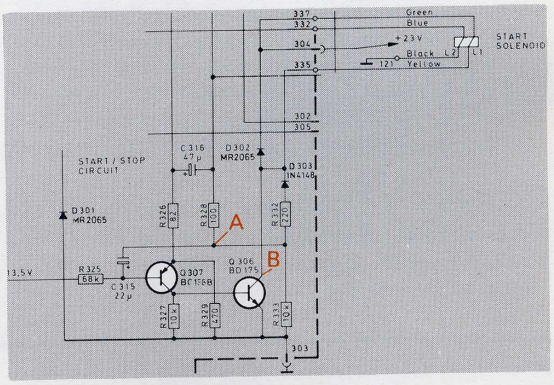
3. After a little while, the voltage at point A has been reduced so much that the base of Q307 drops lower than 10.3 V, and the transistor starts conducting.

4. When Q307 starts conducting, the collector voltage increases, driving Q306 into conducting state. Point B is connected to ground, current passes through the "activate" coil ($L_1$) of the start solenoid and the pinch rollers operate.

5. When Q306 is conducting, the current to C316 passes through R332 and Q306. C316 will therefore be fully charged in a very short time.

6. When C316 is fully charged, there will be no voltage at point A, and C315 is charged through R325. The current through R325 will keep Q307 in conducting state.

7. After a little while the current to C315 has been reduced so much that Q307 goes cut-off. Q306 also goes cut-off, stopping the current through the "activate" coil.




*Solenoid operating circuit*

## 4.2 A SHORT EXPLANATION OF THE MOTOR CONTROL CIRCUITS

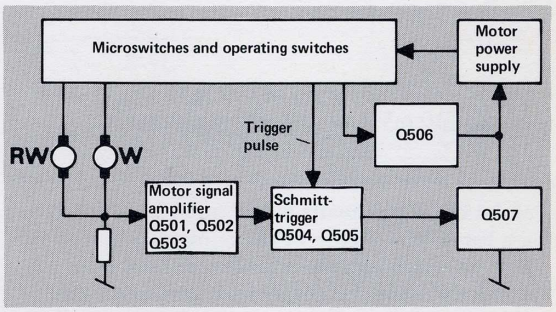
When the reel motors revolve, they generate pulses. These pulses are used to control the motor power supply.

**When both motors are stationary**, no pulses are fed to the motor signal amplifier. Q504 of the Schmitt-trigger is cut-off, and Q505 is conducting. Q507 is also conducting, and the motor power supply is connected to ground. Therefore, no voltage is fed to the motors.

**When the REWIND, WIND, PLAY or RECORD button is depressed,** one of the capacitors C317, C320 or C321 will give a trigger pulse to the Schmitt-trigger. Q504 starts conducting and Q505 goes cut-off. Q507 also goes cut-off, and the motor power supply feeds a voltage to the motors (via microswitches and operating switches). The motors start revolving, feeding pulses to the motor signal amplifier. The output from this amplifier will keep Q504 in conducting state.

During wind or rewind the supply motor works as a generator, feeding a negative voltage to transistor Q506, which regulates the motor power supply. The voltage from the power supply is therefore dependent on the speed of the supply reel.

**When the tape stops** (for instance at the end of the tape) the input to the motor signal amplifier drops to zero, and the Schmitt-trigger reverts to unoperated state after a short delay (determined by C508/R512). Q507 starts conducting and the voltage from the motor power supply drops to zero.




*Block diagram of motor control circuits*

## 4.3 CONTROL OF MOTOR VOLTAGES

Remove the bottom plate, insert a cassette in the deck and check that the voltages across the motors are as specified below:

| | WIND motor | REWIND motor |
|---|---|---|
| Depress PLAY | 2.5 V – 3 V | 0 V |
| Depress STOP | 0.7 V – 0.8 V Drops to 0 after a short while | 0.7 V – 0.8 V Drops to 0 after a short while |
| Depress WIND and run tape to end stop | 10 V – 3.5 V Drops to 0 a little while after the end stop is reached | |
| Depress REWIND and run tape to end stop | | 10 V – 3.5 V Drops to 0 a little while after the end stop is reached |

# 5. ELECTRICAL ADJUSTMENTS

## GENERAL

– "0 dB" level is defined as 775 mV. Thus –5 dB equals 450 mV and –35 dB equals 14 mV.

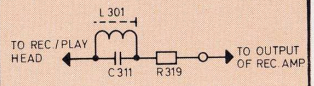
– Make the adjustments in the order in which they are listed here. Many of the adjustments require that previous adjustments have already been correctly made. It is especially important that adjustment for $CrO_2$ tape be made **before** adjustment for HL tape.

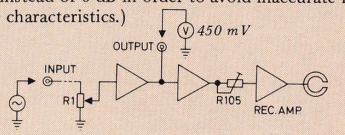
– Clean and degauss the tape path before and after the adjustments. It is assumed that the tape path has already been correctly adjusted as described on pages 5, 6 and 7.

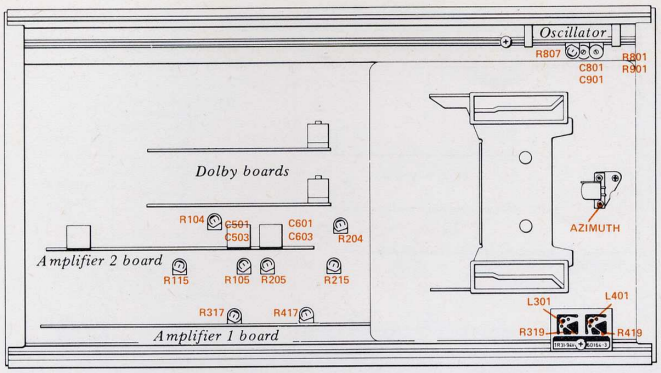
## NECESSARY EQUIPMENT

– 2 high impedance voltmeters (do NOT use universal meters).
– Frequency counter.
– Audio generator.
– Distortion meter.
– Wow meter (required for wow test only).
– Hum/noise meter (required for signal/noise test).
– Tandberg test tapes No. 21 (1,000 Hz speed test), No. 22 (3,150 Hz wow test), No. 23 (6,300 Hz azimuth test) and No. 24 (1,000 Hz playback level).
– TDK C60 CHROM or equivalent chromium dioxide cassette.
– Maxell C60 UD or equivalent HL cassette.

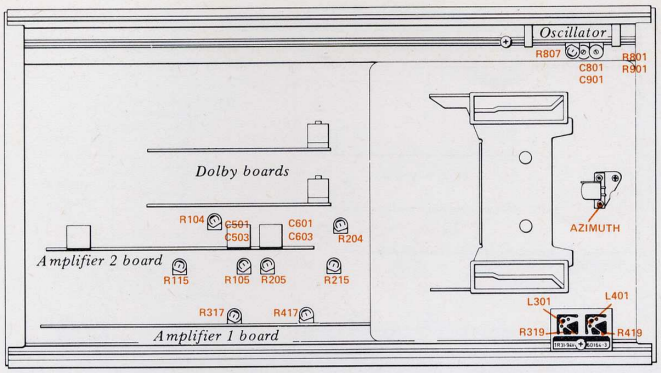
**Location of test points and adjustable components: see page 17**

| No. | Adjustment or check | Tape | Set the cassette deck to | Measuring instrument | Measure at | Correct reading | Adjust | Comments |
|---|---|---|---|---|---|---|---|---|
| 1 | Record/playback head azimuth | No. 23 | Playback | Voltmeters | OUTPUT sockets | Maximum output signal. Difference between the tracks: < 4 dB | Azimuth screw on head | Adjust to best compromise |
| 2 | Playback level | No. 24 | Playback | Voltmeters | OUTPUT sockets | 775 mV | R317 (left ch.) R417 (right ch.) | – |
| 3 | Tape speed | No. 21 | Playback | Frequency counter | OUTPUT socket | ± 1% (990 – 1010) | – | – |
| 4 | Wow | No. 22 | Playback | Wow meter (according to DIN 45.507) | OUTPUT socket | ≤ 0.2% (DIN 45,507 peak weighted) | – | Measure at end of tape. Measure both in vertical and horizontal position |
| 5 | Oscillator frequency | $CrO_2$ | $CrO_2$ Recording | Frequency counter | Connect inductively to erase head (see comments) | 80 - 100 kHz | – | Connection is made with a coil or a few turns of ordinary wire. Instead of a frequency counter a long-wave receiver ( tuned to 3rd harmonic) can be used |
| 6 | Oscillator erase voltage | $CrO_2$ | $CrO_2$ Recording | Voltmeter | Across erase head | 28 – 32 V | – | – |
| 7 | Oscillator voltage on output | $CrO_2$ | $CrO_2$ Recording | Voltmeters | OUTPUT sockets | ≤ 2 mV | – | INPUT sockets open |
| 8 | Oscillator voltage stop filter | $CrO_2$ | $CrO_2$ Recording | Voltmeters | R319 (left) R419 (right) to ground | Minimum reading (2–4 V) | L301 (left ch.) L401 (right ch.)   | The filters prevent the record amplifiers from short-circuiting the bias voltage to ground |

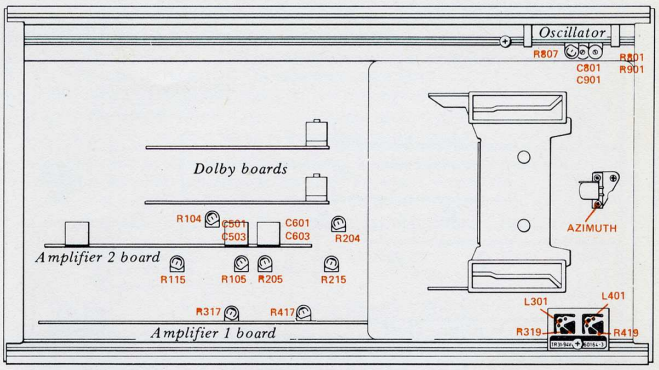
| No. | Adjustment or check | Tape | Measuring instrument | Measure at | Procedure |
|---|---|---|---|---|---|
| 9 | ADJUSTMENT FOR $CrO_2$ TAPE | | | | |
| 9.1 | Bias (preadjustment) | $CrO_2$ | Voltmeters | R801 (left ch.) R901 (right ch.) see "location" drawing | Set the cassette deck to **$CrO_2$ recording** and adjust **C801** (left ch.) and **C901** (right ch.) to readings of approximately **6–8 mV.** (Measure between ground and the side of the resistor which is connected to the head.) |
| 9.2 | Recording level | $CrO_2$ | Voltmeters | OUTPUT sockets | Set the cassette deck to **$CrO_2$ recording.** R1 and R2 to mid-position. Connect an audio generator to the INPUT sockets. Adjust the generator to 400 Hz, –5 dB (= 450 mV on the voltmeters). (–5 dB is used instead of 0 dB in order to avoid inaccurate results caused by varying tape characteristics.)   Rewind and play back. The voltmeters should now read **–5 dB (=450 mV) ± 0.5 dB.** If outside the tolerance, make a new recording while adjusting **R105** (left ch.) and **R205** (right ch.) as required. Then play back and check once more. |
| 9.3 | Overall frequency response (adjustment) | $CrO_2$ | Voltmeters | OUTPUT sockets | Set the cassette deck to **$CrO_2$ recording.** Adjust the generator to –35 dB (= 14 mV on the voltmeters) and record a 400 Hz and a 10,000 Hz signal at this level.<br>Rewind and play back. Use the 400 Hz signal as a reference and check on both channels that the 10,000 Hz signal is within the following tolerance: **–0 dB to +5 dB.**<br>If outside the tolerance adjust **C801 and C901** (bias). Then make a new recording, play back and check once more. |
| 9.4 | Distortion | $CrO_2$ | Distortion meter | OUTPUT sockets | Set the cassette deck to **$CrO_2$ recording.** Generator to 1000 Hz, 0 dB (=775 mV on the voltmeters).<br>Rewind and play back. Check that the distortion is $\leqq$ **5%** (3rd. harmonic distortion according to DIN 45,405).<br>If outside the tolerance adjust **C801 and C901** (bias). Make a new recording, play back and check once more. Then repeat step 9.3. |
| 9.5 | Overall frequency response (check with DOLBY) | $CrO_2$ | Voltmeters | OUTPUT sockets | Set the cassette deck to **$CrO_2$ DOLBY (!) recording.** Adjust the generator to –35 dB and record the following frequencies: 400 Hz, 55 Hz, 1000 Hz, 4000 Hz, 10,000 Hz, 12,500 Hz.<br>Rewind and play back. Use the 400 Hz signal as a referance, and check that the other signals are within the following tolerances:<br>**55 Hz: –3 dB to +2 dB** **10,000 Hz: 0 dB to + 5 dB**<br>**1000 Hz: –2 dB to +2 dB** **12,500 Hz: –2 dB to + 5 dB**<br>**4000 Hz: –2 dB to +4 dB**<br>If outside the tolerances try changing the values of **C501/C502** (left ch.) and **C601/C602** (right ch.). Increased values give higher treble response. |
| 10 | Indicators | $CrO_2$ | Indicators | | Record a 400 Hz, 0 dB signal and adjust **R115** (left ch.) and **R215** (right ch.) to 0 dB deflection on both indicators. |
| 11 | ADJUSTMENT FOR HL TAPE | | | | |
| 11.1 | Recording level | HL | Voltmeters | OUTPUT sockets | Same as in step 9.2, except that the $CrO_2$ button is released.<br>If outside the tolerance adjust **R104** (left ch.) and **R204** (right ch.). DO NOT TOUCH R105 OR R205.<br>NOTE! Adjustment of R104 and R204 will not affect the readings on the indicators of the cassette deck. |
| 11.2 | Overall frequency response (adjustment) | HL | Voltmeters | OUTPUT sockets | Same as in step 9.3, except that the $CrO_2$ button is released.<br>If outside the tolerance adjust **R807**. DO NOT TOUCH C801 OR C901. |
| 11.3 | Distortion | HL | Distortion meter | OUTPUT sockets | Same as in step 9.4, except that the $CrO_2$ button is released.<br>If outside the tolerance adjust **R807**. Then repeat 11.2. DO NOT TOUCH C801 OR C901. |
| 11.4 | Overall frequency response (check with DOLBY) | HL | Voltmeters | OUTPUT sockets | Same as in step 9.5, except that the $CrO_2$ button is released. Tolerances:<br>**55 Hz: –3 dB to +2 dB** **10,000 Hz: –2 dB to +5 dB**<br>**1000 Hz: –2 dB to +2 dB** **12,500 Hz: –3 dB to +4 dB**<br>**4000 Hz: –2 dB to +4 dB**<br>If outside the tolerances try changing the values of **C503/C510** (left ch.) and **C603/C604** (right ch.). Increased values give higher treble response. |
| 12 | Erasure | $CrO_2$ | Voltmeters | OUTPUT sockets | Record a 400 Hz, 0 dB signal. Rewind and erase. Then rewind once more and play back the erased piece. The voltmeters should read **< – 62 dB.** |
| 13 | Signal/noise | $CrO_2$ and HL | Hum/noise meter (according to DIN 45.405) | OUTPUT sockets | The signal/noise ratios at 5 % distortion should be at least as good as specified in the table below:<br>**NORMAL DOLBY**<br>**Signal/tape noise: HL $CrO_2$ HL $CrO_2$**<br>**DIN 45.511 (Geräuschspannung) 46 dB 49 dB 55 dB 58 dB**<br>**DIN 45.511 (Fremdspannung) 46 dB 48 dB 50 dB 50 dB** |



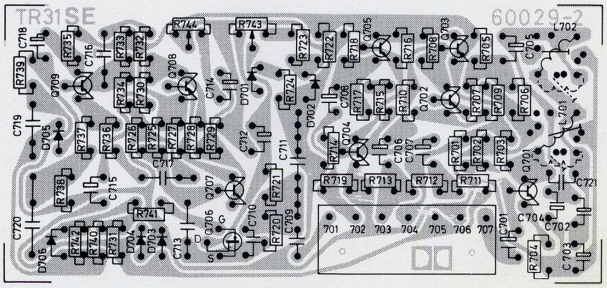

*Location of test points and adjustable components*



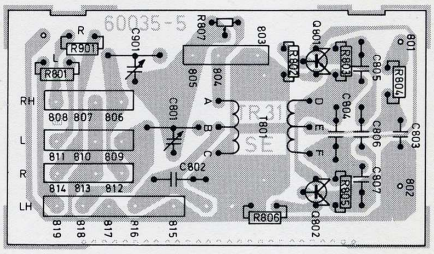

*Location of test points and adjustable components*



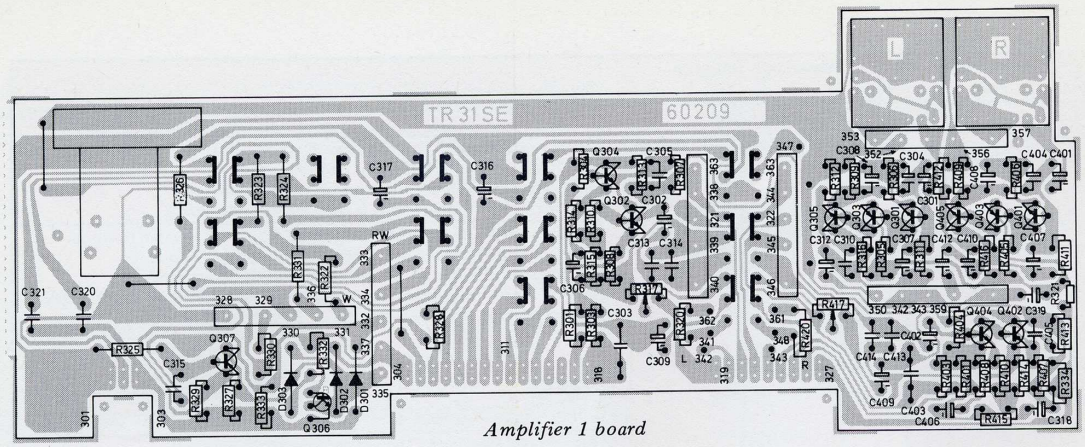

*Location of test points and adjustable components*



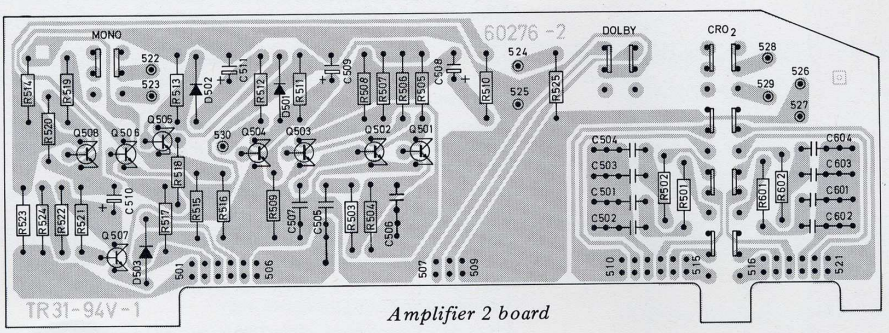

*Dolby board*



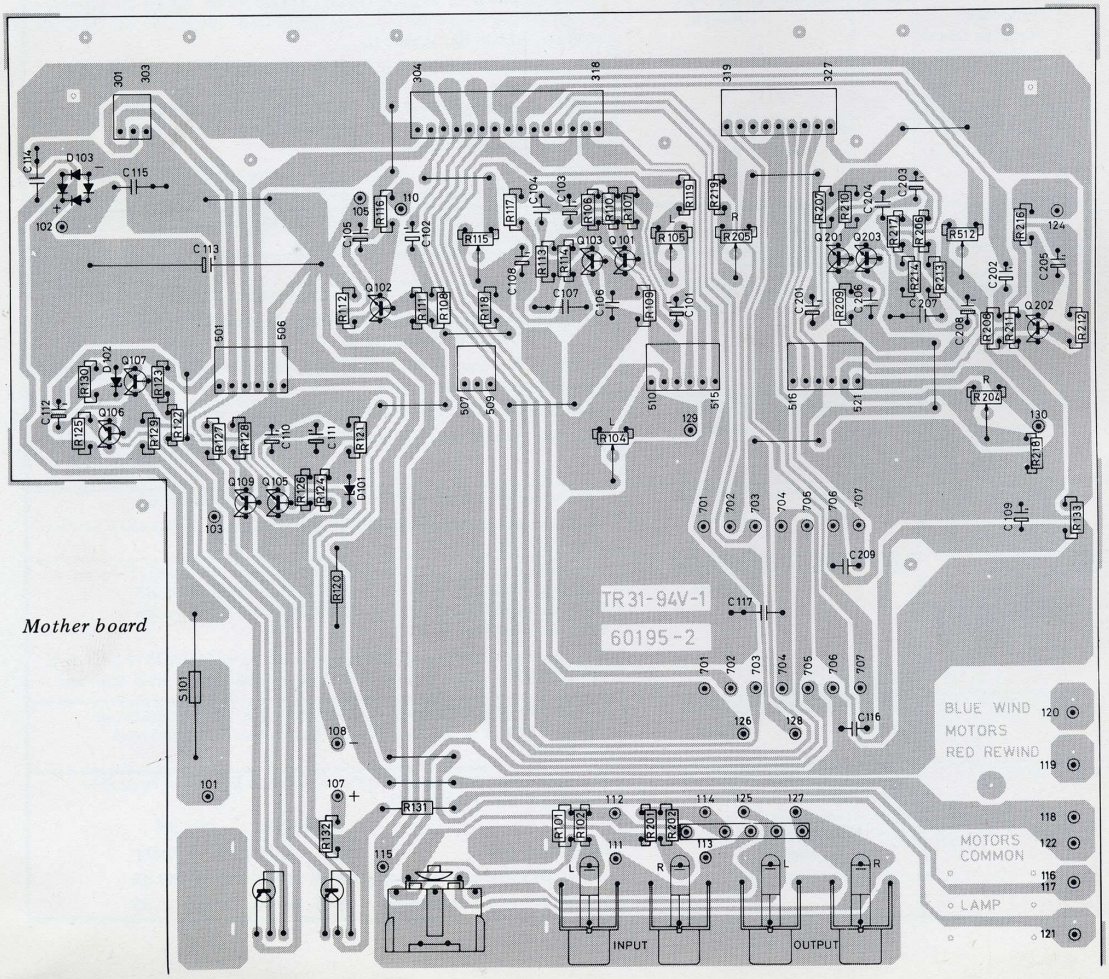

*Oscillator board*



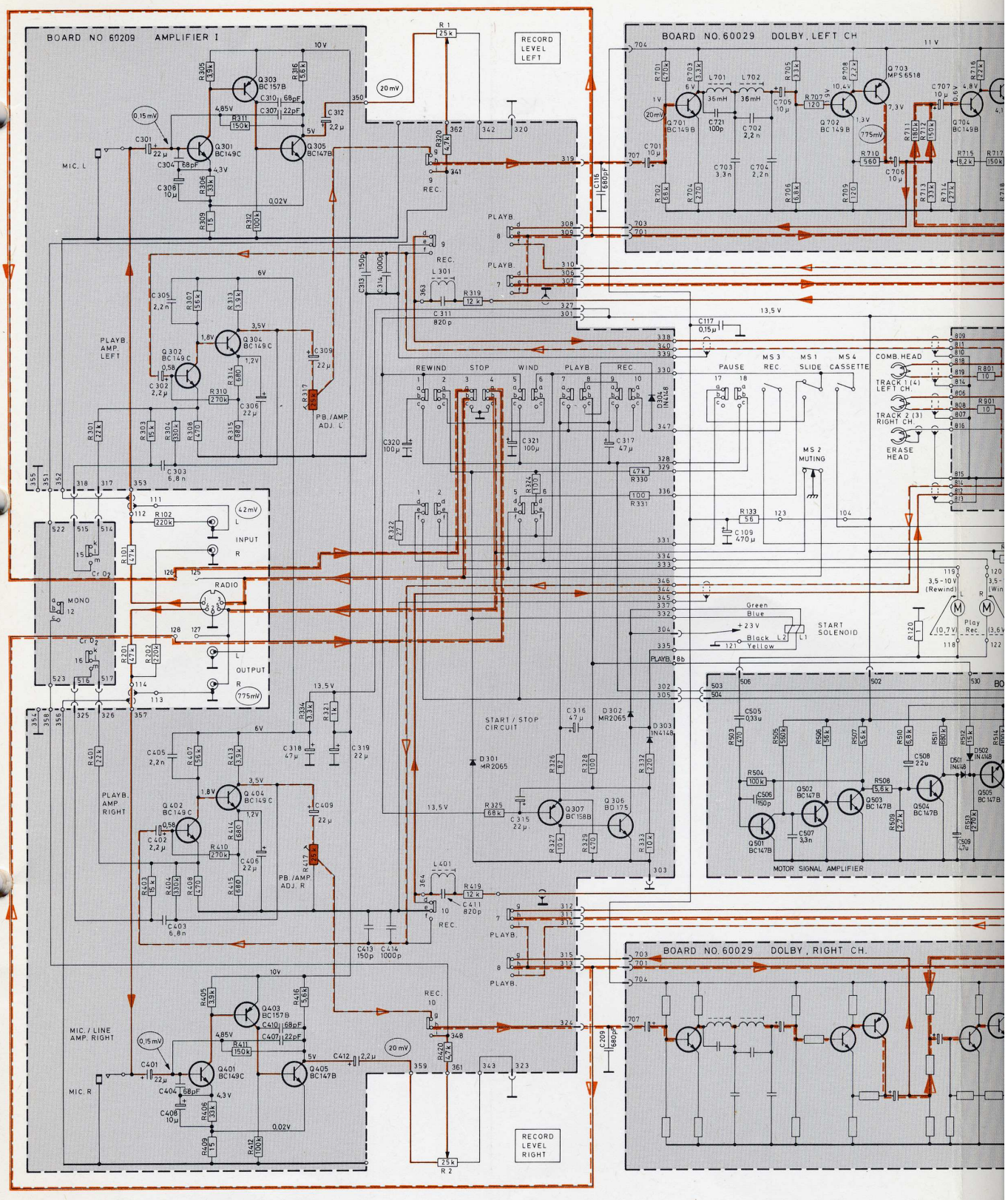

*Amplifier 1 board*




*Amplifier 2 board*




*Mother board*




All voltages are measured with V.T.V.M. with input impedance min. 10 M ohms.
All DC voltages measured without signal

(1mV) Denotes signal voltages (1000 Hz)
1mV Denotes DC voltages
(10V) Denotes voltages in operated mode

L = Left channel (Track 1 or 4)
R = Right channel (Track 2 or 3)
→) = Connector
○ 101 = Connection terminal

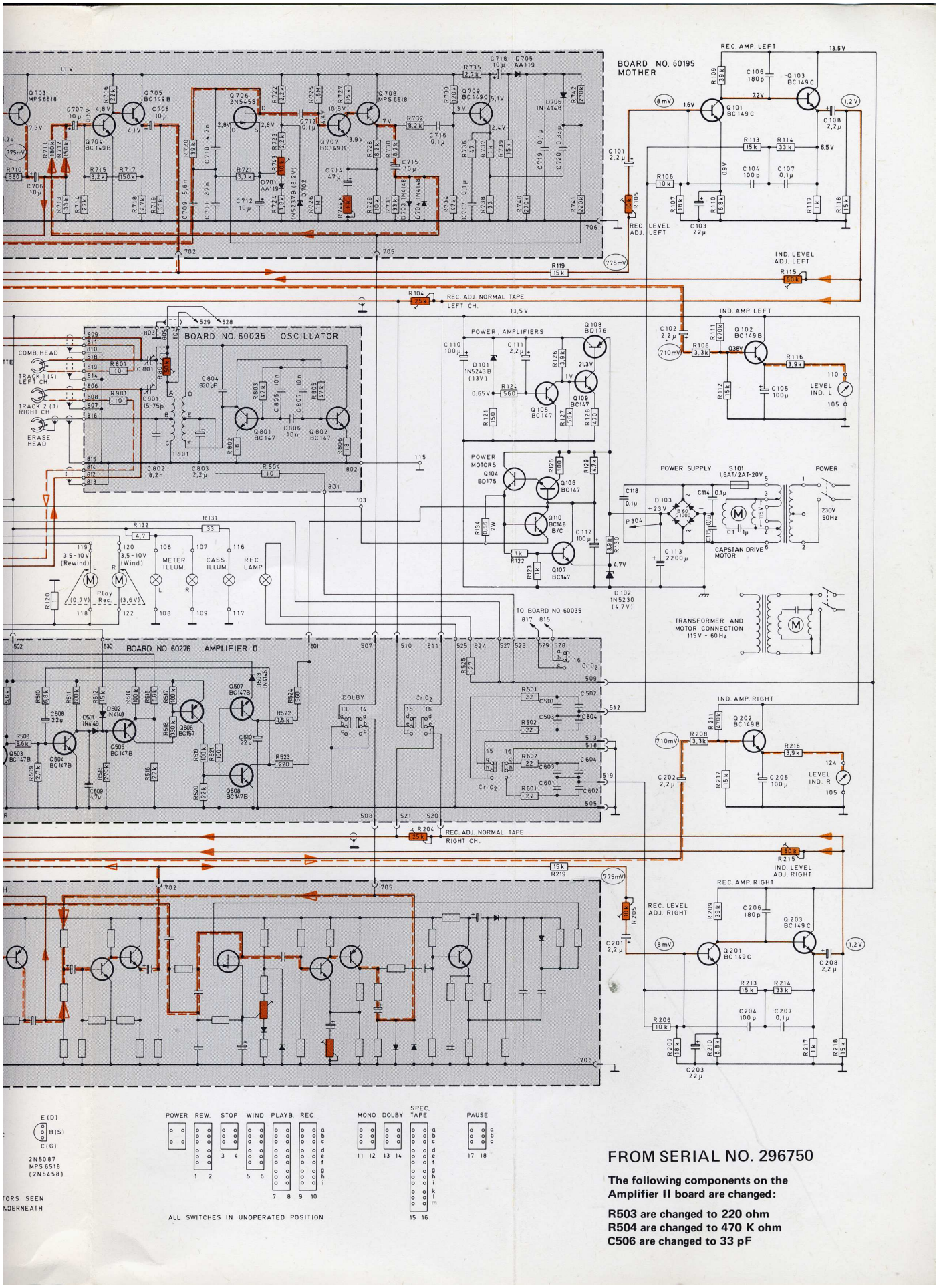
**Signal path – RECORDING**
**Signal path – PLAYBACK**

BD 175
BD 176

BC 147
BC 149 B
BC 149 C

2N5087
MPS 6518
(2N5458)

TRANSISTORS SEEN FROM UNDERNEATH




## FROM SERIAL NO. 296750

**The following components on the Amplifier II board are changed:**

**R503 are changed to 220 ohm**
**R504 are changed to 470 K ohm**
**C506 are changed to 33 pF**

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