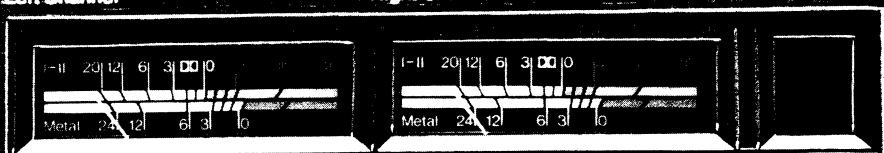


Left Channel

Right Channel



Release



Record



Rewind



Stop



Wind



Play



Set



Rec. Preset

Off  
On

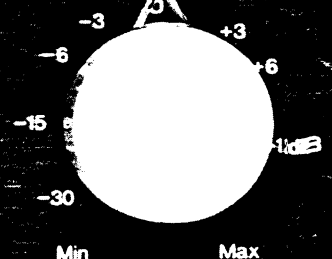
Memory

Stop  
Off  
Repeat

Timer

Play  
Off  
Record

Master Control



Monitor/Test

Source  
Tape  
Off  
15kHz  
315Hz



Output



Dolby NR

Off  
B  
C



Balance

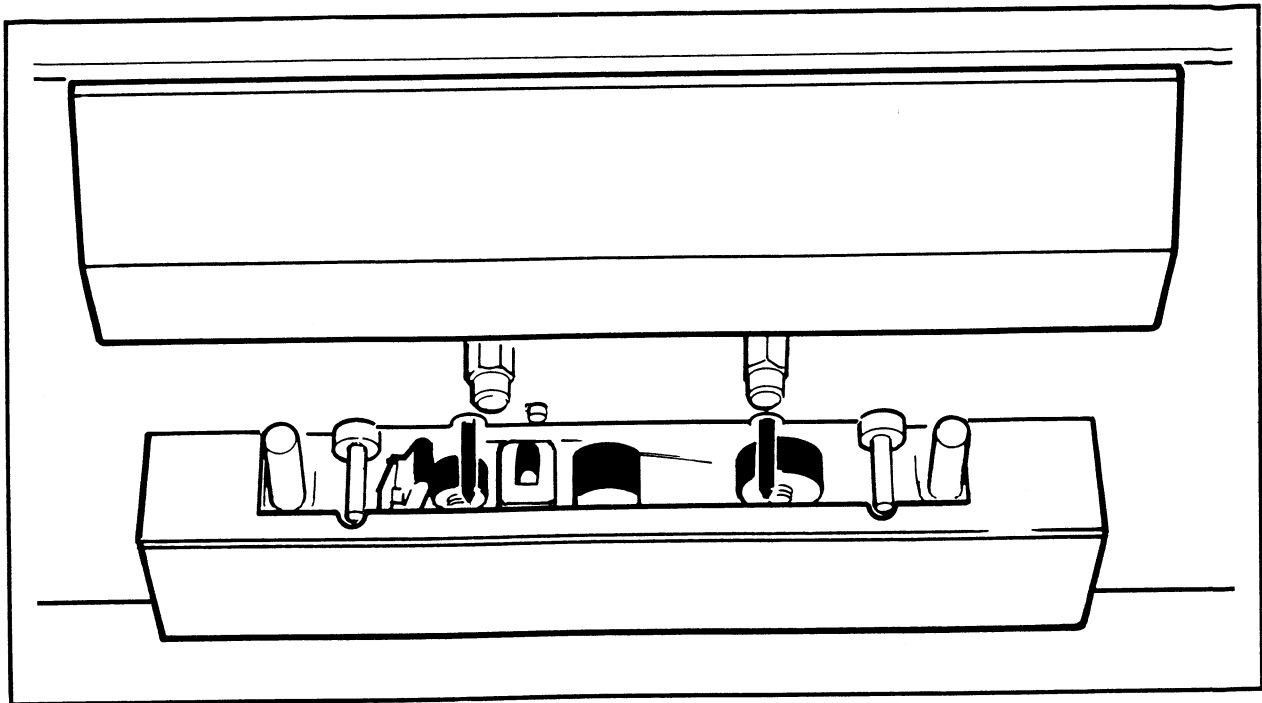


Min

Max

## Contents

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*Clean the places marked with colour*

#### **Cleaning the tape path**

- Press the Release button and remove the cassette.
- Press the Stop button. This raises the tape path and makes it more accessible for cleaning.
- Clean those places marked in colour in the figure. The pinch rollers must be well dried after cleaning.
- Take care that the cleaning fluid does not run along the capstans into the bearings or into the pinch roller bearings.

#### **De-magnetizing**

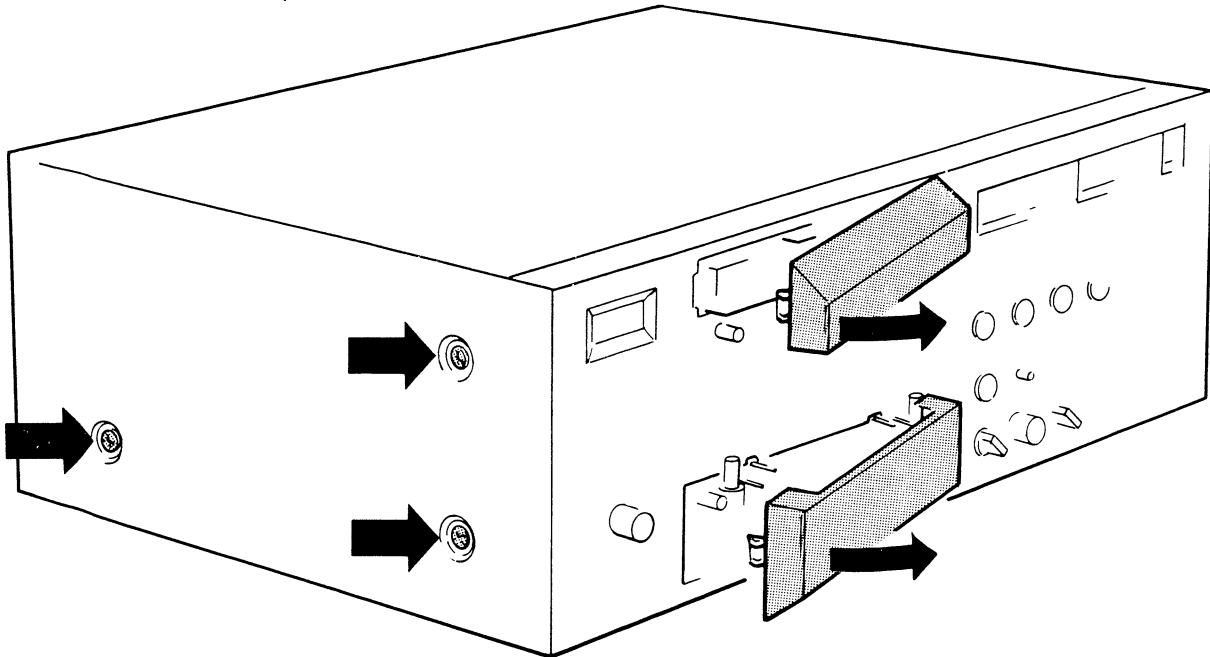
An audible increase in background noise from the tape can be a sign that the heads and other parts of the tape path need to be de-magnetized. This can be done with a de-magnetizing rod and the procedure is as follows:

Switch off the cassette deck. Remove the lower head cover. Switch on the de-magnetizer and move it slowly past the metal parts which are normally in contact with the tape. Make sure that the rod does not touch the metal parts. Do not switch off the rod before it is at least *1 meter* from the deck.

## Mechanical service

### Removing the top/side cover

Remove the three screws (see figure) on both sides and lift off the top/side cover.

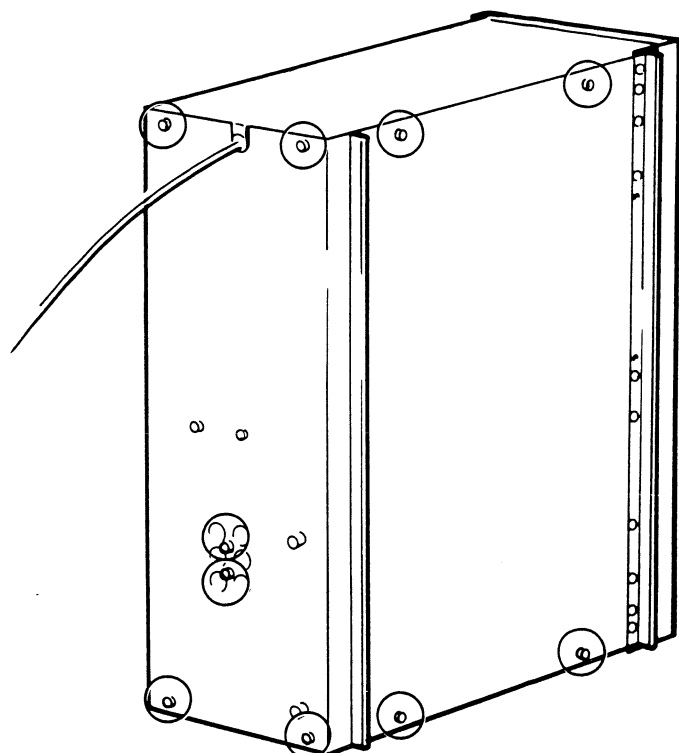


Pull off the head covers, see figure.

**NOTE!** Do not pull off the function knobs as Release, Record, Rewind etc. or the other push buttons.

### Removing the back/bottom cover

Unscrew the ten screws (see figure), unsnap the input board and remove the back/bottom cover.



**Cassette drive mechanism**

Loosen\* the screws B in the figure with maximum two turns.

**\*NOTE!** If you unscrew the two screws B, the nuts behind the screws will fall down.

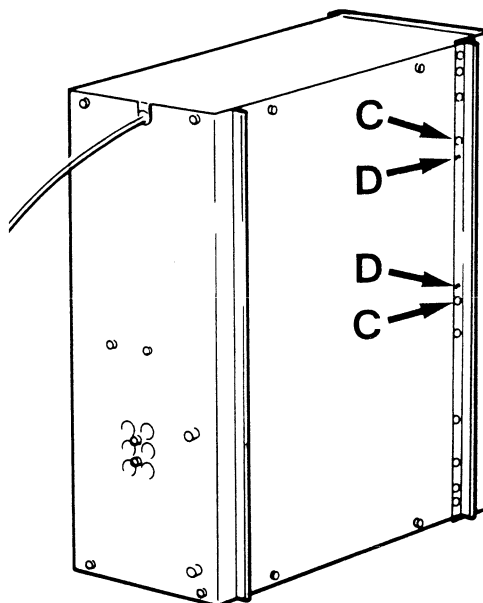
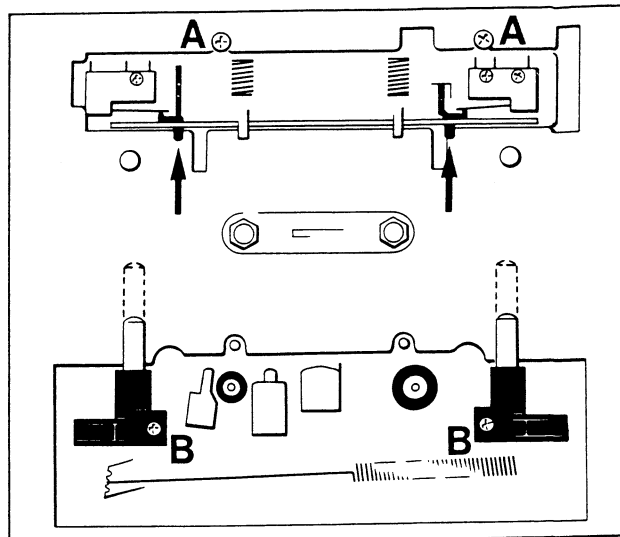
Push or pull the cassette guides out from the black plastic moldings, see figure.

Remove the two wire clamps behind the mechanism and the connector from the Tape Counter display board.

Pull out the Azimuth button.

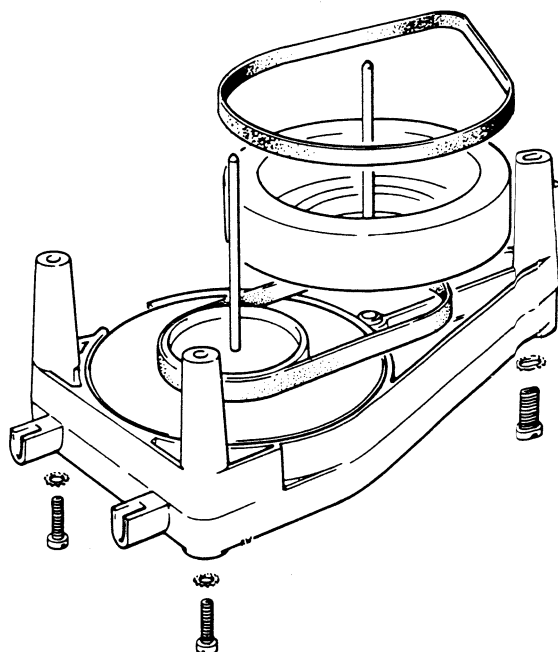
Remove the screws C and A and press the guide lugs D out of the holes, see figure.

Press in the record protection switch and the playback EQ switch and lift the mechanism out.



**Replacing the drive belts**

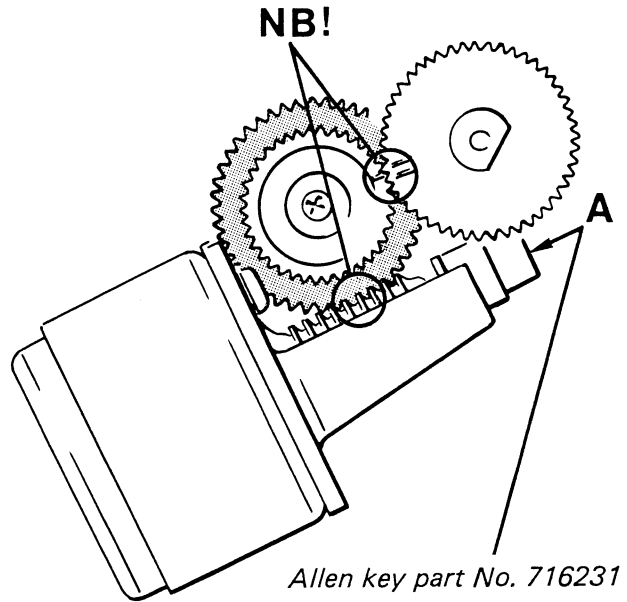
Remove the three screws (see figure) to loosen the mounting plate. Replace the drive belts and fasten the mounting plate. Check that the capstans have a very small play. If not, adjust the bottom bearings and seal the bearings with some laquer.



## Cam motor

When changing the motor adjust the end play (screw A) by means of an Allen key to minimum or no end play. If no end play check that the motor is running free.

When assembling the gear wheels make sure they are in correct position as shown in the figure and that the spaces between the gear wheels are as small as possible. If the end play in the motor or the spaces between the gear wheels are too big the mechanism will make noise when the headbridge is moving, see figure.



### Dismantling the drive mechanism

When dismantling the mechanism start with parts marked in colour in figure 1, continue to figure 2, and so on.

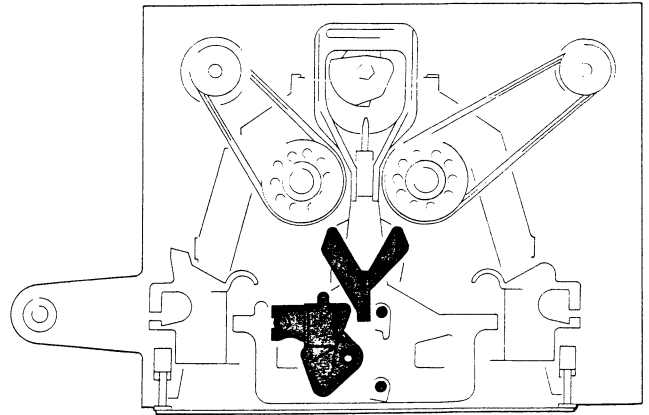


Figure 3

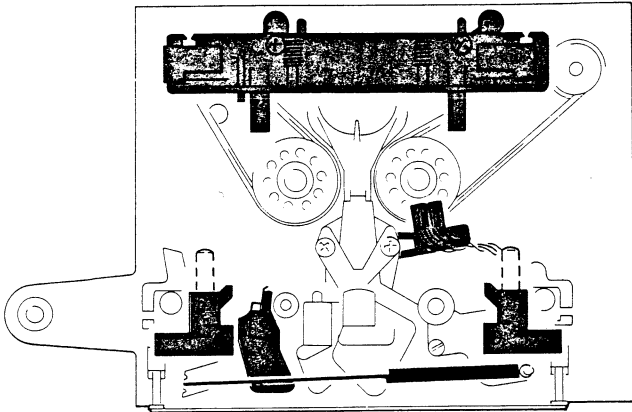


Figure 1

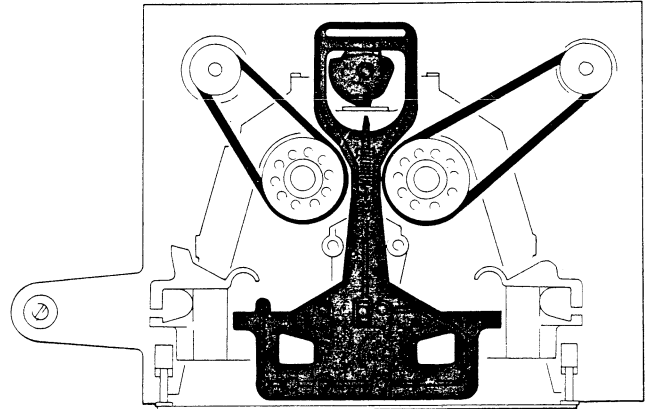


Figure 4

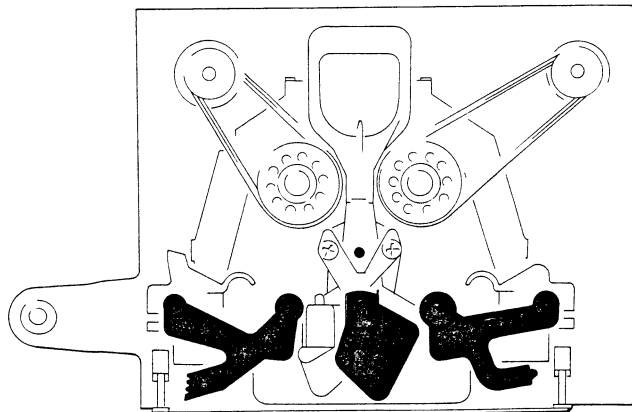


Figure 2

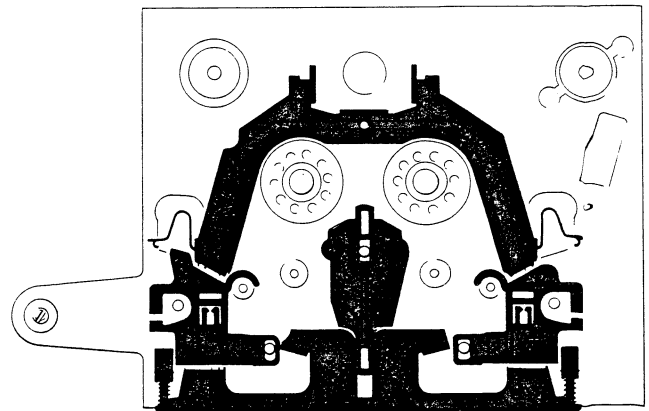


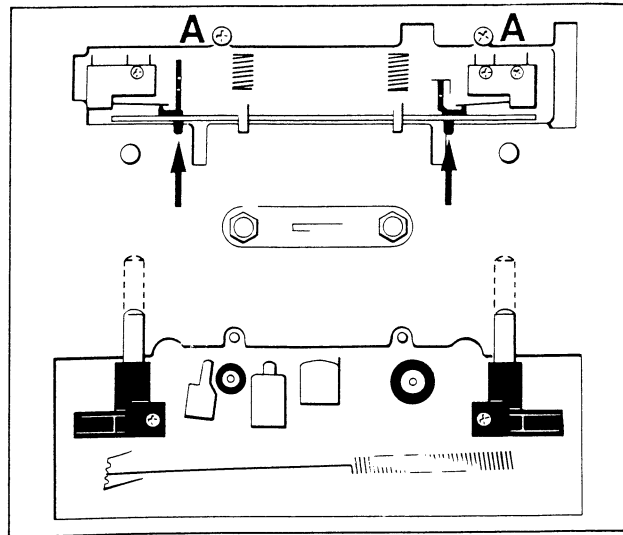
Figure 5

## Replacing the mechanism

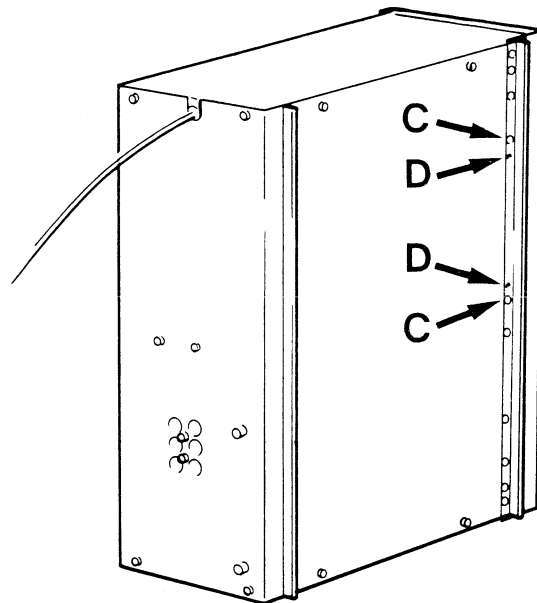
Check that the screened head wires are in correct position and press in the cassette switches when the mechanism is mounted. Press the guide lugs D in position, tighten the screws C and then the screws A.

Check that the headbridge is running free and that no wires are pinched between the bracket and the chassis or any other places.

**NOTE!** Make sure all the connectors are fastened.

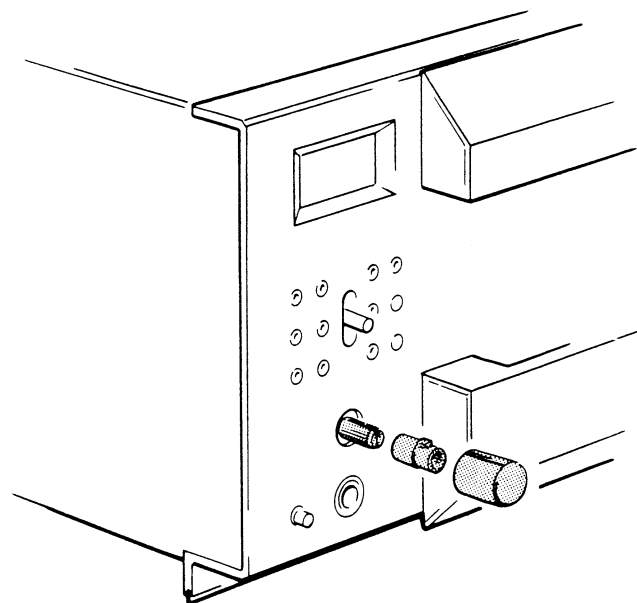


If a new mechanism is installed the two screws holding the bracket must not be tightened until the screws A and C are tightened. The screws are located from the bottom of the deck and are placed in the two lowest corners of the mechanism.



## Adjusting the Azimuth button's end positions

- Insert a cassette which gives a difference at 15 kHz from side to side as little as possible.
- Adjust the Azimuth for the record head to maximum output.
- Remove the Azimuth button and the spindle stop sleeve. Place the spindle stop sleeve with the stop piece pointing upwards and then mount the Azimuth button to mid-position, see figure.

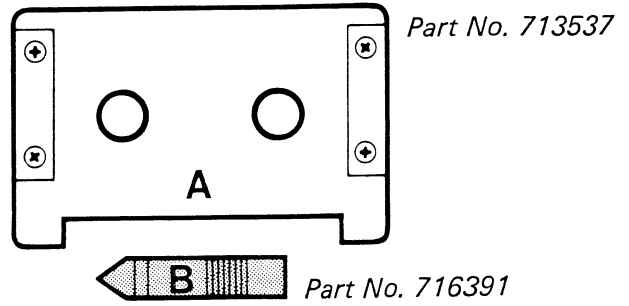




**Tape path adjustments**

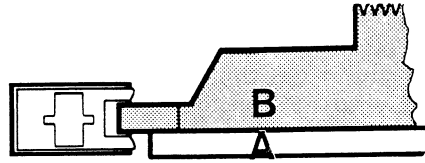
**NOTE!** When using a tape path gauge, move part B on the gauge slowly and carefully when it is near the heads.

The tape path adjustments must be carried out in the order described since they affect each other.



**Erase head**

The erase head has only a height adjustment. Adjust the height with the tape path gauge when the head bridge is in Play position. Part B of the gauge must fit into the tape guides without rubbing, see figure.

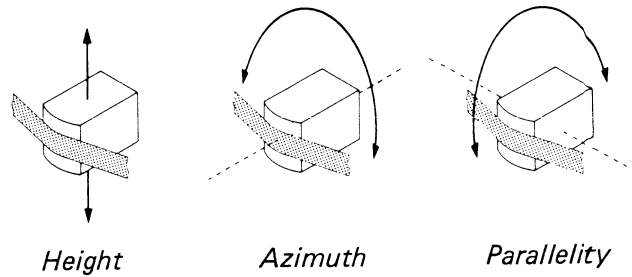


*Tape path gauge*

**Playback head**

Adjust the height of the playback head so that part B of the gauge fit into the tape guides without rubbing. The head bridge shall be in Play position.

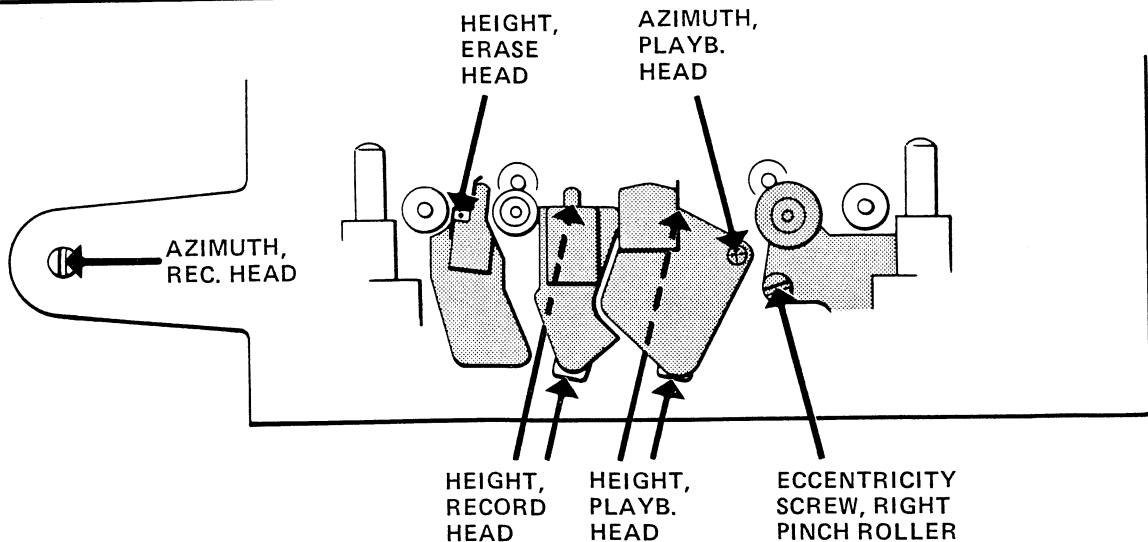
- Adjust the height adjustment screws by equal amounts so that the parallelism does not change.



**NOTE!** The pointed end of part B must be parallel with the head face.

Insert a Tandberg test tape No. 23 or a standard azimuth cassette. Adjust the azimuth screw on the playback head to obtain max. output measured on the Play sockets.

*Allen key set (3 pieces)  
for head adjustments  
Part No. 997013*



## Record head

### Adjusting the parallelism

Use a tape path gauge. Adjust the parallelism so that the pointed end of part B is parallel with the head face. The adjustment is made easier when using a small lamp in the background of the pointed end of part B. Adjust by means of the screws as shown in the figure on page 9.

### Adjusting the height

Insert a new quality cassette. Set the deck to Record. Record 1000 Hz from an audio generator at normal recording level. Set the Monitor/Test switch to Tape and adjust the height of the record head by means of the screws shown in the figure on page 9 to obtain max. output on the Play sockets. When you obtain max. output on the sockets, the tracks across the heads will be at the same height.

Adjust the height adjustment screws by equal amounts so that the parallelism does not change.

**NOTE!** Check the parallelism after height adjustment.

## Pinch roller arms

### Adjusting the eccentricity screw

After one or both pinch rollers have been changed you must check that the eccentricity screw is correctly adjusted.

Set the deck to Play.

Press the head bridge assembly away from the capstans. Then check that both pinch rollers meet the capstans at the same time or that the larger pinch roller meet the capstan a bit earlier before the smallest one. If necessary, Adjust the eccentricity screw shown in the figure on page 9.

**NOTE!** Seal the eccentricity screw after the adjustment.

## Unstable playback

Check the parallelism on the record head and playback head in Play position with the tape guide and adjust if necessary. When adjusting the parallelism check the height and adjust if necessary.

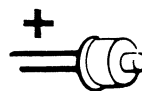
If playback is still unstable the pinch rollers can be turned upside down or changed.

## Control board

If necessary the Control board can be fastened with screws and plastic washers. Be careful not to shortcircuit the wires on the board.

## Light emitting diodes

When replacing LED's the long leg must be connected to the + mark on the board.



## Electrical adjustments

### General

Before adjusting fold out page 15. The electrical adjustments require that the tape path is cleaned and demagnetized as well as correctly adjusted.

Before adjusting, set the knobs to the following positions:

- Tape selector to I.
- Monitor/Test selector to Tape.
- Output Control to maximum.
- Dolby\* NR selector to Off.
- Balance Control to the middle.
- Master Control to maximum.
- Record Preset selector to On.
- Memory selector to Off.
- Timer selector to Off.
- MPX Filter button to Off (back of the deck).
- Playback Eq. button to Off (back of the deck).

**Note!** When removing/inserting the Dolby NR boards, the deck must be switched off.

When inserting, the Dolby NR boards must be put back in the same place, otherwise the deck may have to be readjusted.

### Equipment required:

- 2 millivoltmeters
- Audio signal generator
- Frequency counter
- Distortion meter
- Wow and flutter meter
- Tandberg test cassettes:
  - No. 21 (speed check 1000 Hz)
  - No. 22 (wow and flutter check 3150 Hz)
  - No. 23 (azimuth adj. playback head 10 kHz)
  - No. 24 (playback level adj. 1000 Hz)
- Measuring cassettes:
  - Group I: Maxell XL I S
  - Group II: Maxell XL II S
  - Metal: Maxell MX Metaxial
- Playback alignment tape (18 kHz) IEC, New Standard available from BASF or TEAC.

\* "Dolby" and the double-D-symbol are trademarks of Dolby Laboratories Licensing Corporation.  
Noise reduction system manufactured under license from Dolby Laboratories Licensing Corporation.

### Dc. offset adjustments (from serial No. 02500 only)

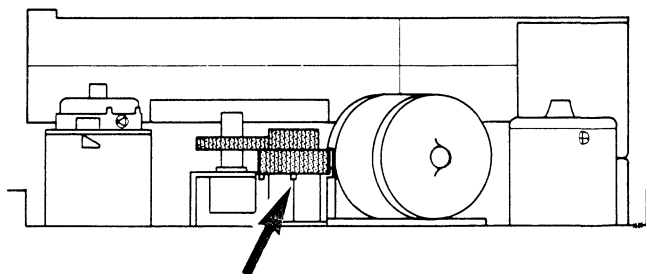
Connect a dc. voltmeter to P506 pin 1 and P506 pin 3 and adjust with R504 and R604 to 0 V dc.  $\pm 10$  mV.

Connect a dc. voltmeter to the center of R132/R133 on the left and R232/R233 on the right and adjust with R100 and R200 to 0 V dc.  $\pm 100$  mV.

### Headbridge position

Alternately press Release and Play for adjusting.  
– Adjust Release with R1236 and Play with R1235.

The two marks on the worm gear and the bearing sleeve should be in conformity, see figure.



### Bias oscillator

The bias oscillator frequency is between 80 and 85 kHz. The voltage measured on the erase head should be approx. 7 V for all the Tape selector positions.

### Bias traps

#### Encoder

- Set the audio signal generator to read oscillator frequency and connect the signal to the Record sockets.
- Set Monitor/Test selector to Tape position and turn down the Master Control.
- Adjust to minimum signal in TP2 on both Dolby NR boards with L581/L681.

#### Decoder

- Set the Monitor/Test selector to Tape position and turn down the Master Control.
- Set the deck to Record.
- Adjust C356/C456 to minimum bias on the Play sockets.

## Sensitivity adjustment

- Set Monitor/Test selector to Source.
- Apply 400 Hz to the Record sockets.
- Adjust Master Control and Balance to 700 mV on the Play 700 mV sockets.
- Adjust the Program meters to 0 dB with R532/R632 (top scale).
- Adjust R702 to 700 mV in TP2 (both Dolby NR boards).
- Press the Stop button.
- Hold the Record prevention switch in and adjust the Program meters to 0 dB with R531/R631.

## DYNEQ® adjustment

- Apply 20 kHz to the Record sockets (350 mV on the Play 700 mV sockets).
- Set Monitor/Test selector to Source.
  - Adjust R177/R277 to + 1 dB on the Program meters.
  - Set Rec. Preset to On.
  - Press the Stop button.
  - Hold the Record prevention switch and set the Tape selector from pos. I to pos. II and then to Metal. Read the deflection on the Program meters.  
Group I: + 1 dB  
Group II: + 3 dB  
Metal: + 5 dB

## Antisaturation network

The antisaturation network is adjusted from the factory and should normally not be readjusted.

## Encoder

- Set Monitor/Test selector to Source and the Dolby NR selector to C position.
- Apply 19.9 kHz to the Record sockets (use a frequency counter) and adjust L711 to minimum in TP2 on both Dolby NR boards.

## Decoder

- Set the deck to Play and the Dolby NR selector to C position.
- Set the Monitor/Test selector to Play.
- Apply 19.9 kHz 10 mV (use a frequency counter) to the free leg on C751 and adjust to maximum in TP4 on both Dolby NR boards.

## MPX Filter adjustment

- Apply 19 kHz to the Record sockets.
- Set Monitor/Test selector to Source.
  - Press in the button marked MPX Filter.
  - Adjust L582/L682 to minimum reading on the millivoltmeters in TP2 (both Dolby NR boards).
  - Set the MPX Filter button to Off.

## Playback level adjustment

**Note!** The Playback Eq. must be set to Automatic.

- Insert Tandberg test cassette\* No. 24 (Playback level adj. 1000 Hz).
- Adjust R378/R478 to 750 mV measured on the Play 700 mV sockets.

\* If you use a Dolby NR level cassette, adjust to 580 mV measured on TP4 on both Dolby NR boards.

## Playback Equalizer

The Playback Eq. adjustment is to be carried out only when the playback head is replaced.

- Insert a Playback alignment cassette and adjust azimuth at 18 kHz to maximum out on the Play 700 mV sockets.
- Adjust L350/L450 at 18 kHz 1.5 dB higher than the 315 Hz level.  
Tolerance at 31.5 Hz — 18 kHz: ± 2 dB.

## Azimuth adjustment

- Insert Tandberg test cassette No. 23 (Azimuth adj. Playback head 10 kHz) or a standard azimuth cassette.
- Adjust the Playback azimuth screw to maximum output or best compromise on the Play 700 mV sockets.

## Adjustments for metal tape

- Set the Tape selector to Metal position.
- Apply 400 Hz to the Record sockets and adjust Master Control to 50 mV out in Source position.
- Set the Monitor/Test selector to Tape position and adjust the Record Current (Metal) to 50 mV on the Play 700 mV sockets.
- Set the audio generator to 12 kHz and adjust Azimuth for the Record head to maximum out.
- Adjust the Bias Current (Metal) to 50 mV out and if necessary readjust the Record Current.

## Record Equalizer

This adjustment affect the HF EQ for all groups of tape.

- Apply 20 kHz to the Record sockets and adjust the Master Control to 50 mV out in Source position.
- Set the Monitor/Test selector to Tape position and adjust R169/R269 to 50 mV on the Play 700 mV sockets.

## Calibration oscillator

The test and the azimuth oscillator frequencies are 315 Hz and 15 kHz.

- Set Monitor/Test selector to 315 Hz and adjust R138 to 0 dB on the Program meters.
- Set Monitor/Test selector to 15 kHz, adjust the Azimuth control to obtain the highest and most stable deflection on the Program meters. Then adjust R140 to 0 dB on the Program meters.

## Adjustments for group II tape

The HF EQ (R169/R269) must not be altered.

- Set the Tape selector to II position.
- Use the same procedure as for Metal tape.

## Adjustments for group I tape

The HF EQ (R169/R269) must not be altered.

- Set the Tape selector to I position.
- Use the same procedure as for Metal tape.

## Frequency range

Metal IV (– 20 dB) With Dolby C NR	18 Hz – 23 kHz ± 1.5 dB ± 3.0 dB
Tape II (– 20 dB)	18 Hz – 20 kHz ± 1.5 dB
Tape I (– 20 dB)	18 Hz – 20 kHz ± 1.5 dB

## Distortion

Record 1000 Hz at 0 dB deflection on the Program meters. (For this adjustment the top scale also applies to metal tape).

Harmonic Distortion – 250 nW/m, Dolby B NR:	
Metal IV	< 1%
Tape II	< 2%
Tape I	< 1.5%

## Speed check

Play back Tandberg cassette No. 21 (speed check 1000 Hz) and measure with a frequency counter on the Play 700 mV sockets:  
± 0.5% (995 Hz to 1005 Hz).

If necessary, adjust R60 on the motor control board to correct speed.

## Wow and flutter check

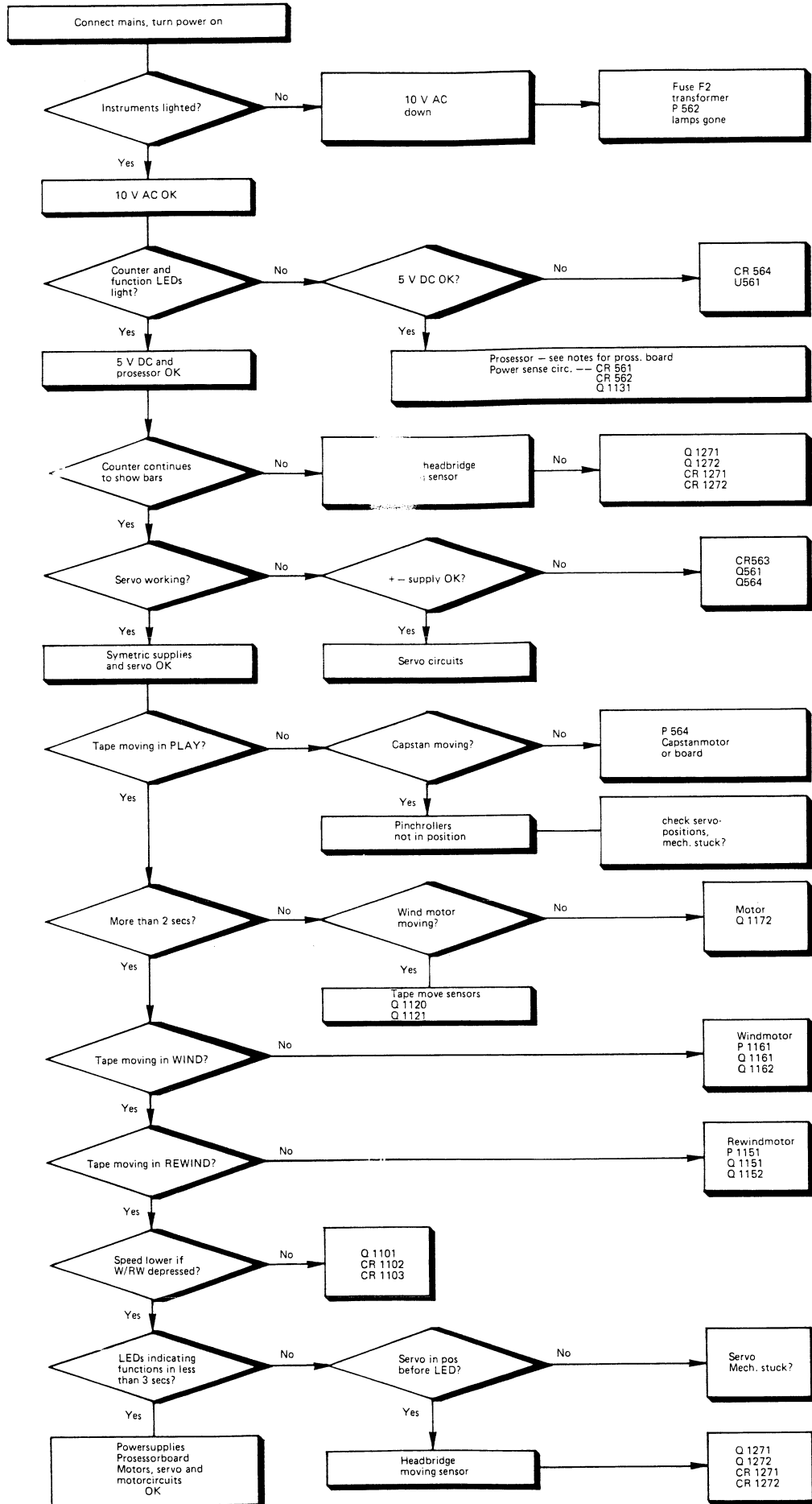
### Playback

Play back Tandberg test cassette No. 22 (3150 Hz) and measure with a wow and flutter meter on the Play 700 mV sockets.  
Playback (Weighted RMS): < 0.06%

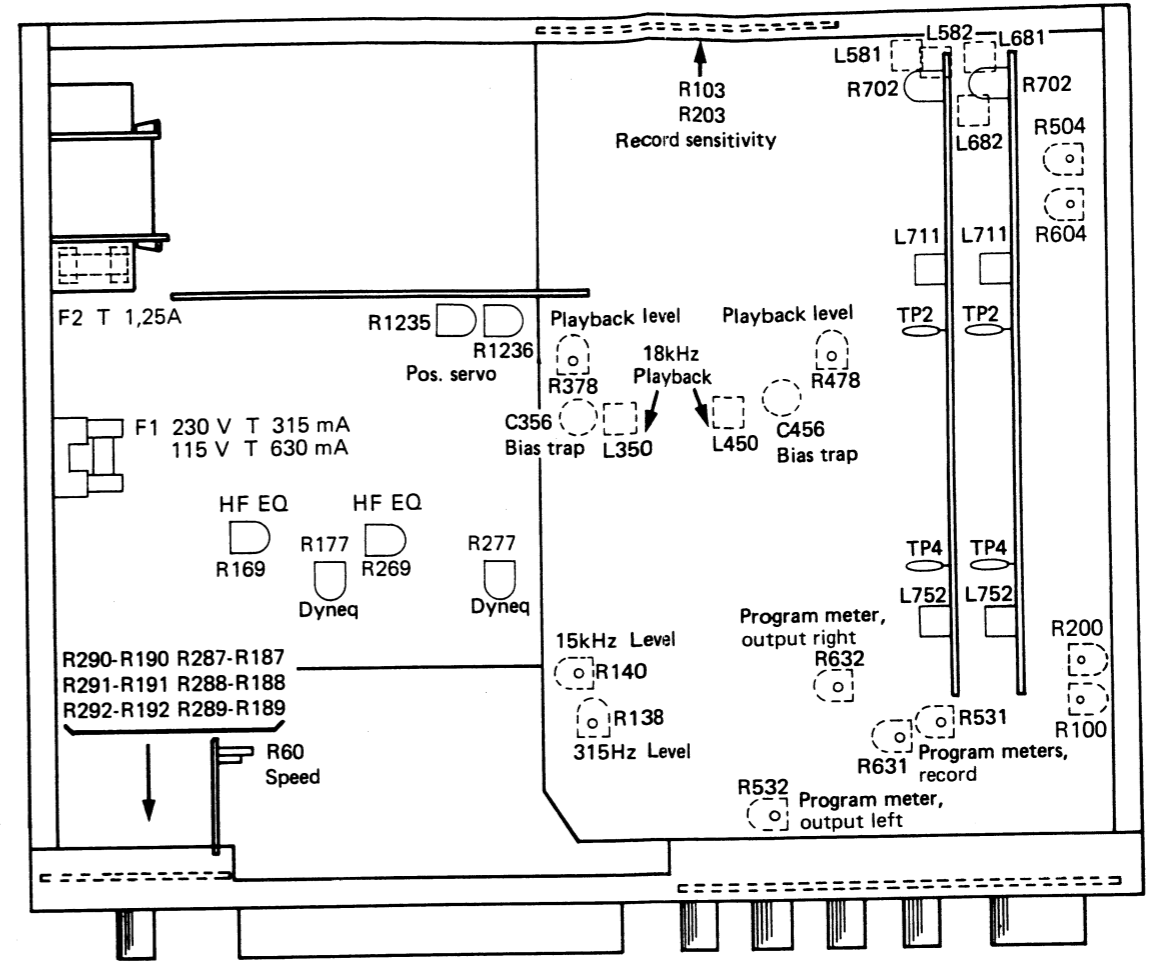
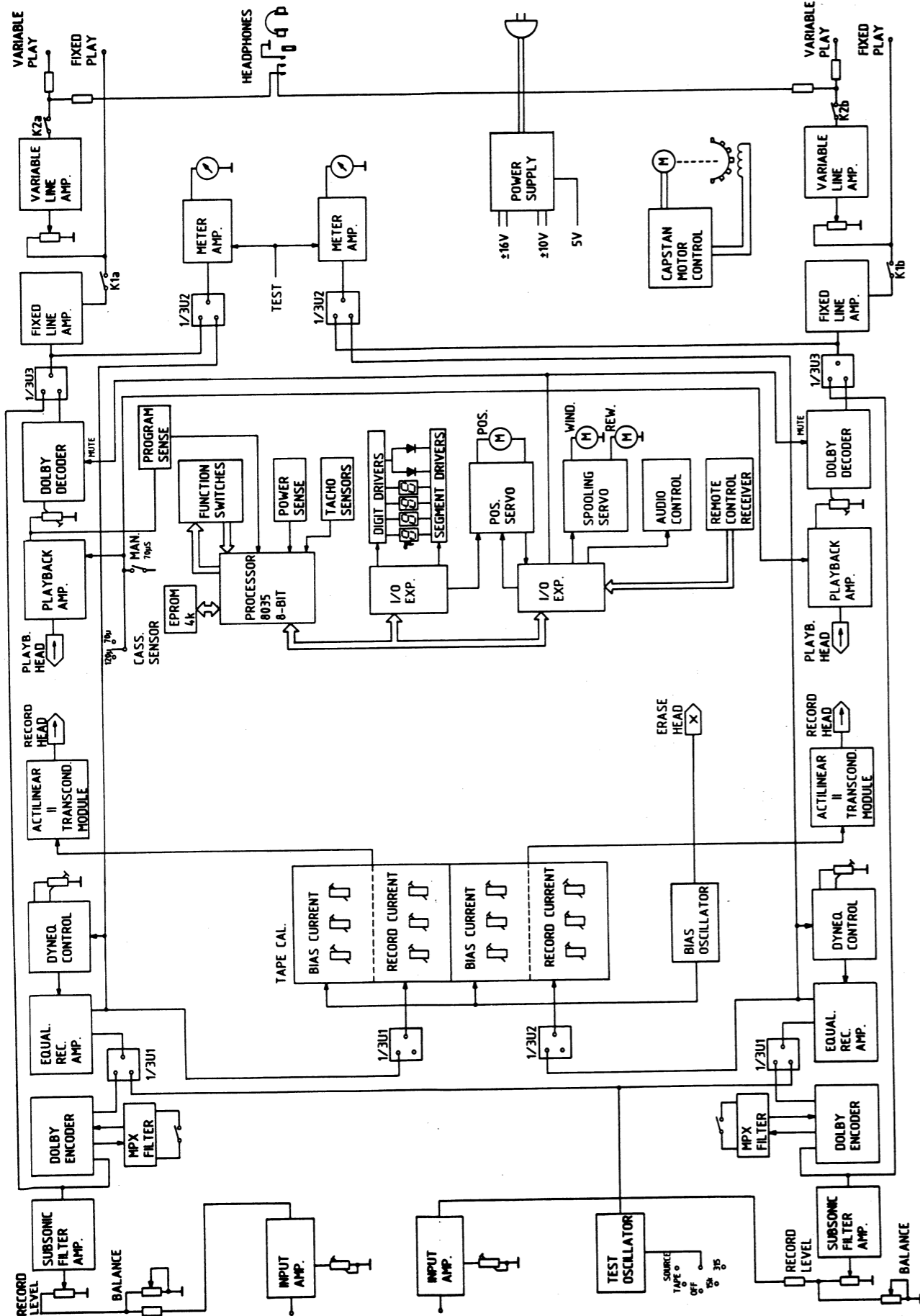
### Record/playback

Use a Maxell C-90 XL I S cassette. Connect the wow and flutter meter to the Record/Play 700 mV sockets. Set the deck to Record and record for about a minute. Wind back the cassette and set the TCD 3014 to Play.  
Record/playback (DIN - IEC): < 0.12%  
Record/playback (Weighted RMS): < 0.09%

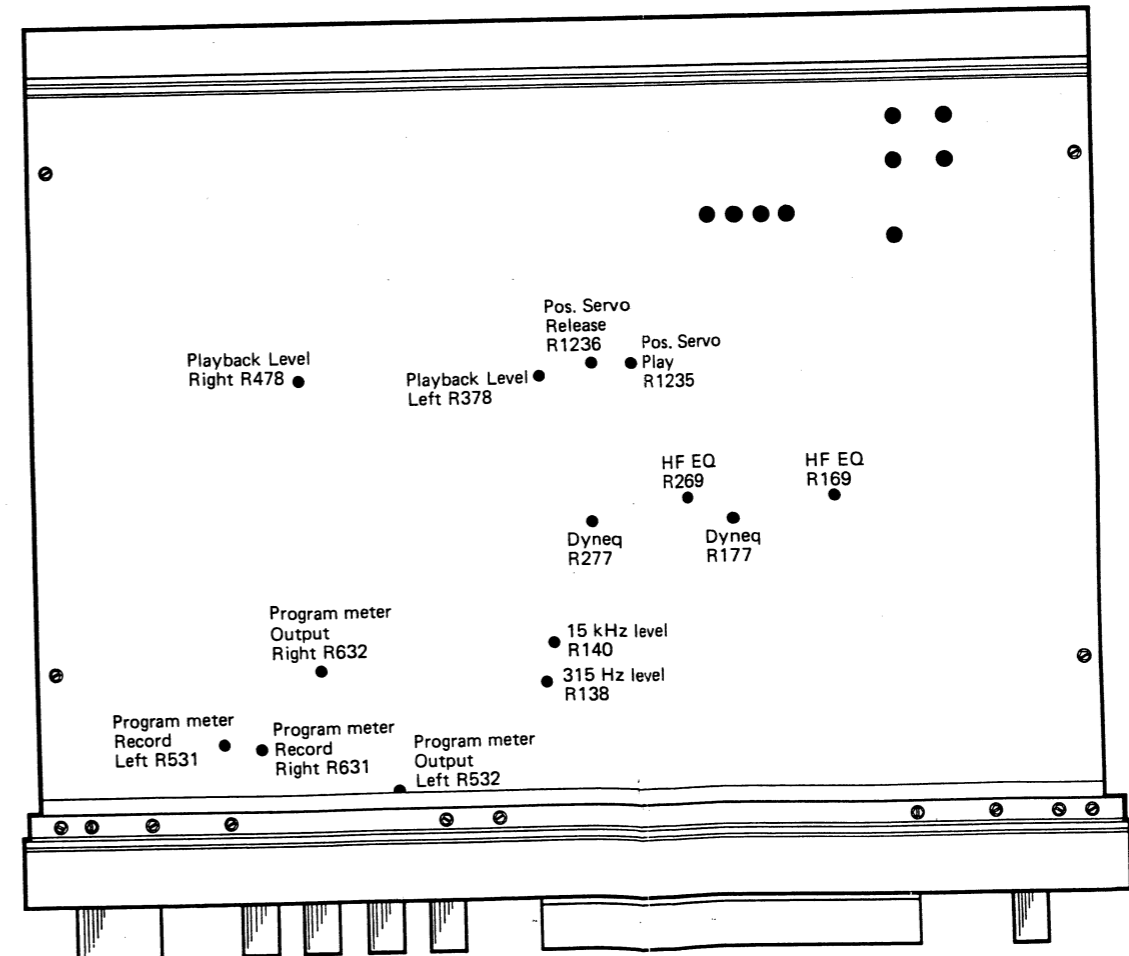
# Flowchart for logic-check



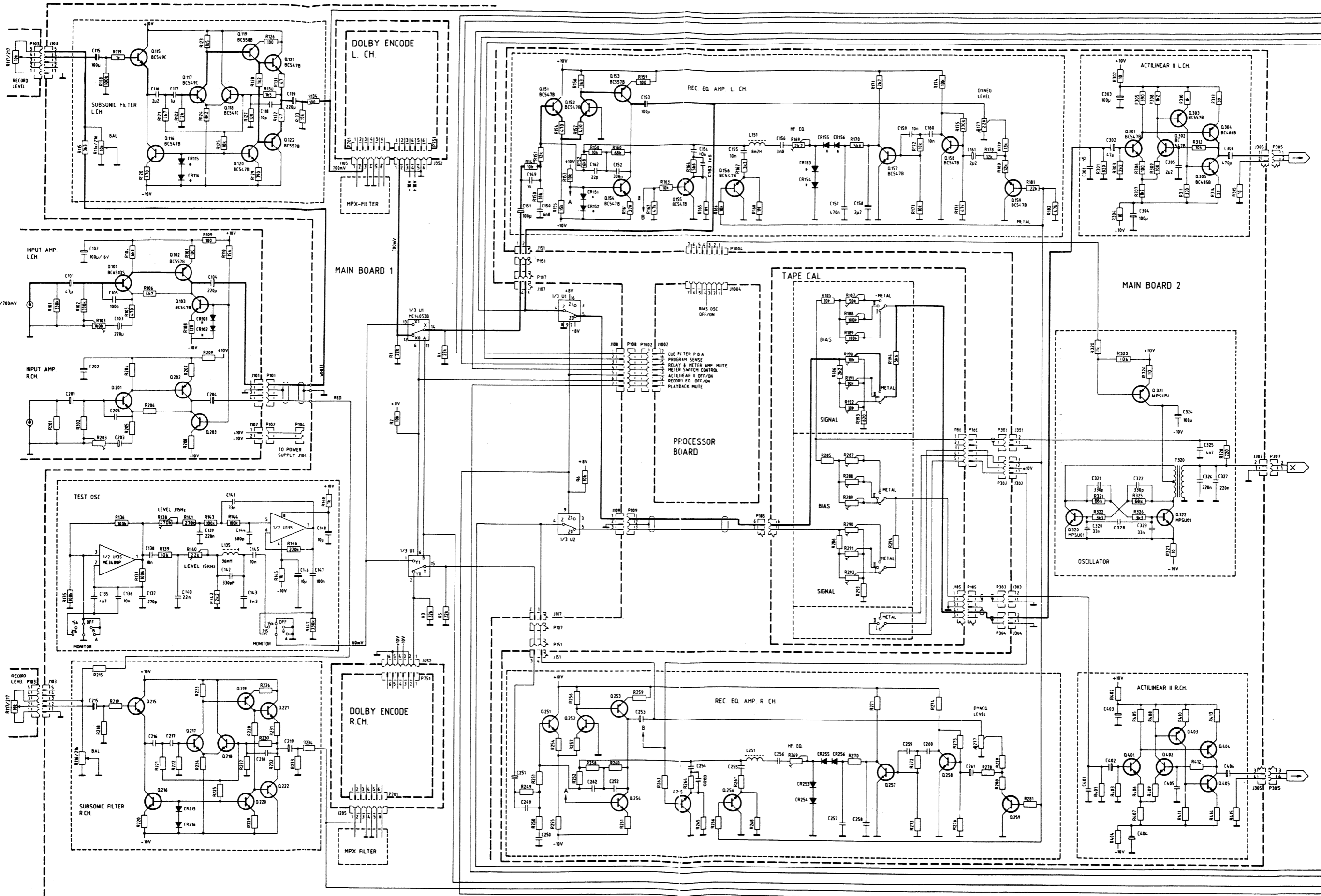
Block diagram



Adjustments seen from the top

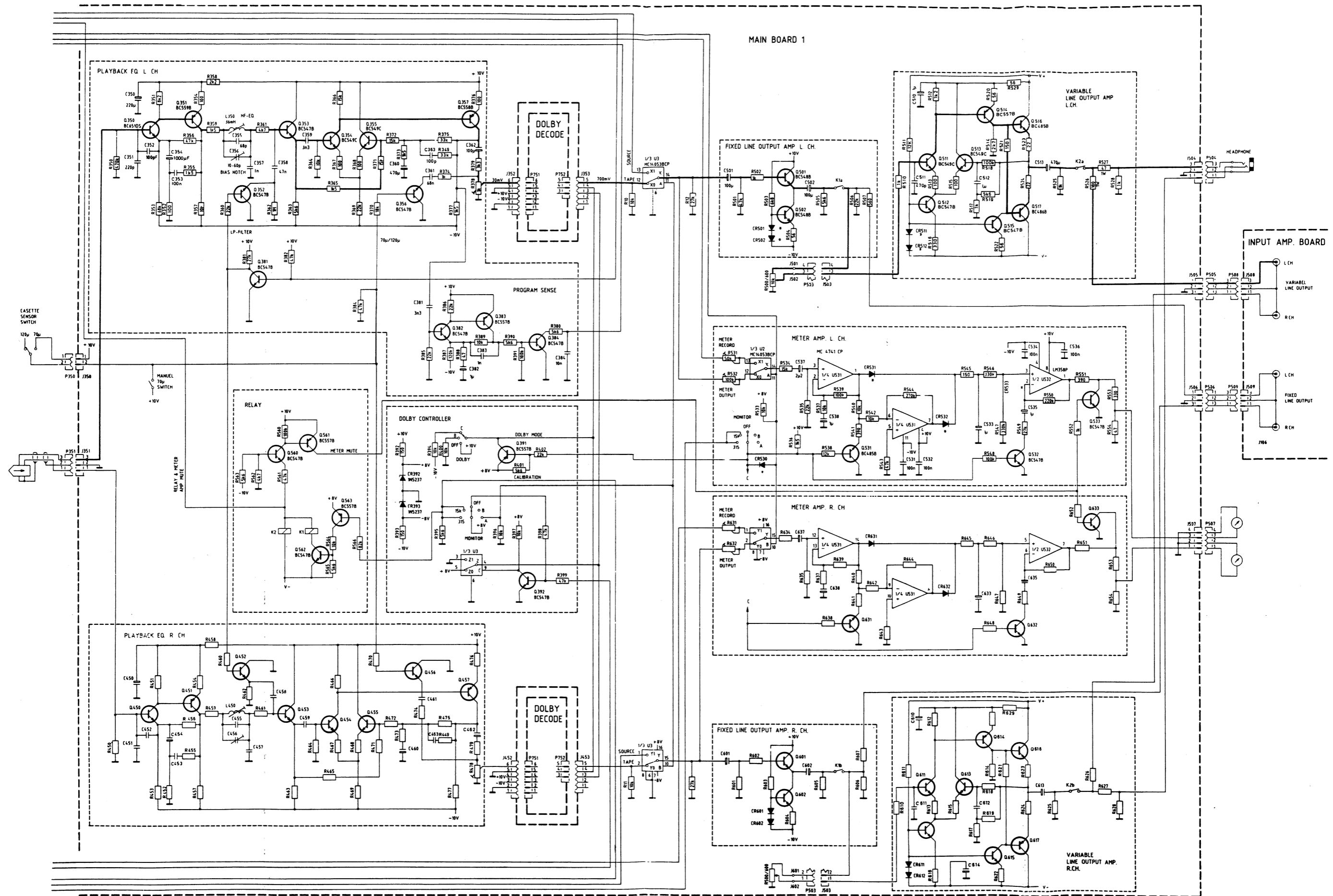


Adjustments seen from the bottom  
Available through holes in the bottom plate

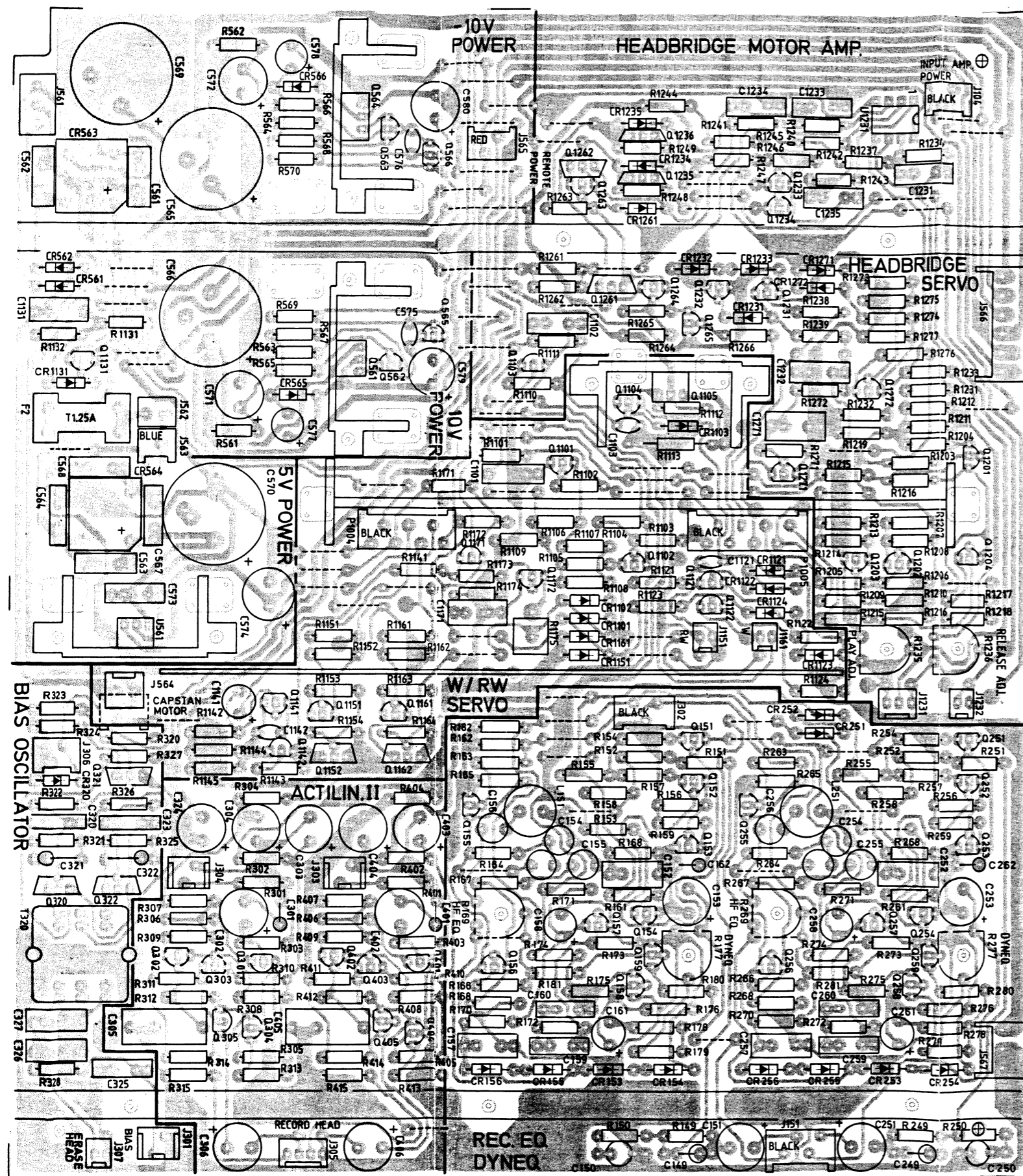


Record Amplifier  
To serial No. 01578





Playback Amplifier  
To serial No. 02499



Main board 2, component side  
To serial No. 01578

### Input amplifier

The input amplifier has high input impedance allowing the use of DIN standard as well as other low level sources.

The stage has low output impedance thus maintaining low noise level feeding the Balance and Record level controls.

Using high level, low impedance sources, the sensitivity control in the input amplifier should be set to low, having unity gain. The feedback capacitors C103/C203 are inoperative.

With low level sources the sensitivity control should be set to High, the gain is increased 20 dB by grounding C103/C203 through R103/R203. C105/C205 maintain RF immunity. Q103 works as constant current sink.

### Subsonic filter

To be able to record at high levels from live sources and warped records which have a lot of subsonic components, it is necessary to reduce the ability for these components to drive the tape into saturation without providing sound information.

Together with the ACTILINEAR® II module the subsonic filter forms a fourth order subsonic high pass filter.

Q115/Q215 with the current sink Q116/Q216 are feeding the filter input C116/C216 with low impedance which gives low impedance and noise level in the filter. The 16 times gain feeds the Dolby NR circuits and analogue switches with the internal signal level of 700 mV. The components at the base of Q117/Q217 are forming the second order subsonic filter. This prevents Dolby NR- and record circuits from disturbing infrasonic signals. The thereby reduced voltage modulation of capacitors secures the ability to store the finest details in the music.

### Record amplifier

The record amplifier shall provide correct frequency response by means of the following components and circuits.

The bass equalization is given by R160/260 and C152/252.

Treble equalization is given by L151/251 and C156/256 and the amount is statically controlled by R169/269, dynamically by the diodes CR153-156/253-256 and the current given by the DYNEQ-controller.

Special midrange equalization for group II and IV-tapes is provided by components connected to Q155/255 and Q156/256.

The Dynamic Equalizer control is made from Q158/258 and Q157/257. The treble detector-filter is located at the base of Q157/257.

The components at the emitter of Q159/259 are forming a switchable attenuator to take care of the 4 dB higher treble saturation level for Metal tapes.

The difference between the old and the new playback standards is given by R149/249, R150/250, R151/251, C149/249 and C150/250.

After the signal has passed the Record Equalization Amplifier it is ready for recording and represented by a voltage. The analogue switch is blocking the signal unless the tape deck is in Record mode.

At the Tape Calibration board the several levels of Bias, Audio-recording current and dc signals to the Equalization networks are provided for all tapes.

Bias and audio are passively summed and the resulting voltage is fed to the ACTILINEAR II circuit. Here the voltage is converted to current and fed to the recording head directly.

### Program meter amplifier

The program meters show peak reading regardless of phase, linear in source and playback, equalized in record mode.

The program meter circuits have increased sensitivity and slower reaction in tape testing, than they have reading program information.

Input switching is provided by the analogue switches in U2. R532/R632 is adjusted to give right level in source (700 mV = 0 dB) and R531/R631 during recording (at 1 kHz group I tape).

The first stage provides gain for the negative half period which is then rectified by CR 531.

The positive half period is first fed through a switchable attenuator controlled by Q531/Q631. The attenuator is normally on and is only switched off during tape testing.

The attenuated signal is amplified in the next stage to give unity gain thus securing correct peak reading for both negative and positive peaks.

In tape testing, the necessary additional gain is provided by the attenuator being switched off.

The peaks are stored at C533/C633, R545/R645 in series with R547/R647 determines the decay time of the program meter.

U532 drives the program meters. The components in series with Q532/Q632 are forming a derivation network thus cancelling the needle mass and speeds up its mechanical response. Q532/Q632 is turned off during testing.

Q533/Q633 is muting the meters during power on and off.

### Playback amplifier

The playback head is directly coupled to the base of Q350/Q450 where C351/C451 gives some treble boost and cuts H.F. together with C352/C452. The first stage have the gain controlled by R356/R456 in the bass together with C353/C453.

C353/C453 defines the New IEC playback time constant for Type I tapes together with R352/R452 and R355/R455 ("120  $\mu$ s").

L350/L450 forms a treble adjustment together with C357/C457. By adjusting the inductor it is possible to match the playback head to the standard playback tape (New IEC-standard). The 18 kHz should be played back at +2 dB compared to the 315 Hz.

L350/L450 is also forming a bias notch together with C355/C455 and the adjustable C356/C456. If the inductor is ever adjusted, C356/C456 has to be readjusted to give minimum bias at TP4 on the Dolby NR boards during recording of Metal tape.

To reduce too high output levels from the playback head during cueing R361/R461 and C358/C458 forms a switchable L.P.-filter controlled by Q352/Q452. The filter is switched off in playback and record modes only.

Q353/Q453 is a buffer for the following all-pass phase correcting stage. C359/C459 and R364/R464 defines the 90° phase shifted frequency at the positive input of the next stage Q354/Q454.

The components in front of the base of Q355/Q455 are forming the negative input. This amplifier configuration corrects treble phase 180° without sacrificing headroom. R349/R449 and C363/C463 gives a 10  $\mu$ s treble roll off complying with the New IEC standards.

Q356/Q456 is switching the additional 70  $\mu$ s equalization for chrome- and metal tapes.

R378 and R478 are the playback level adjustments and are adjusted to give 700 mV at TP4 on the Dolby NR boards or fixed outputs with IEC-DIN level tape.

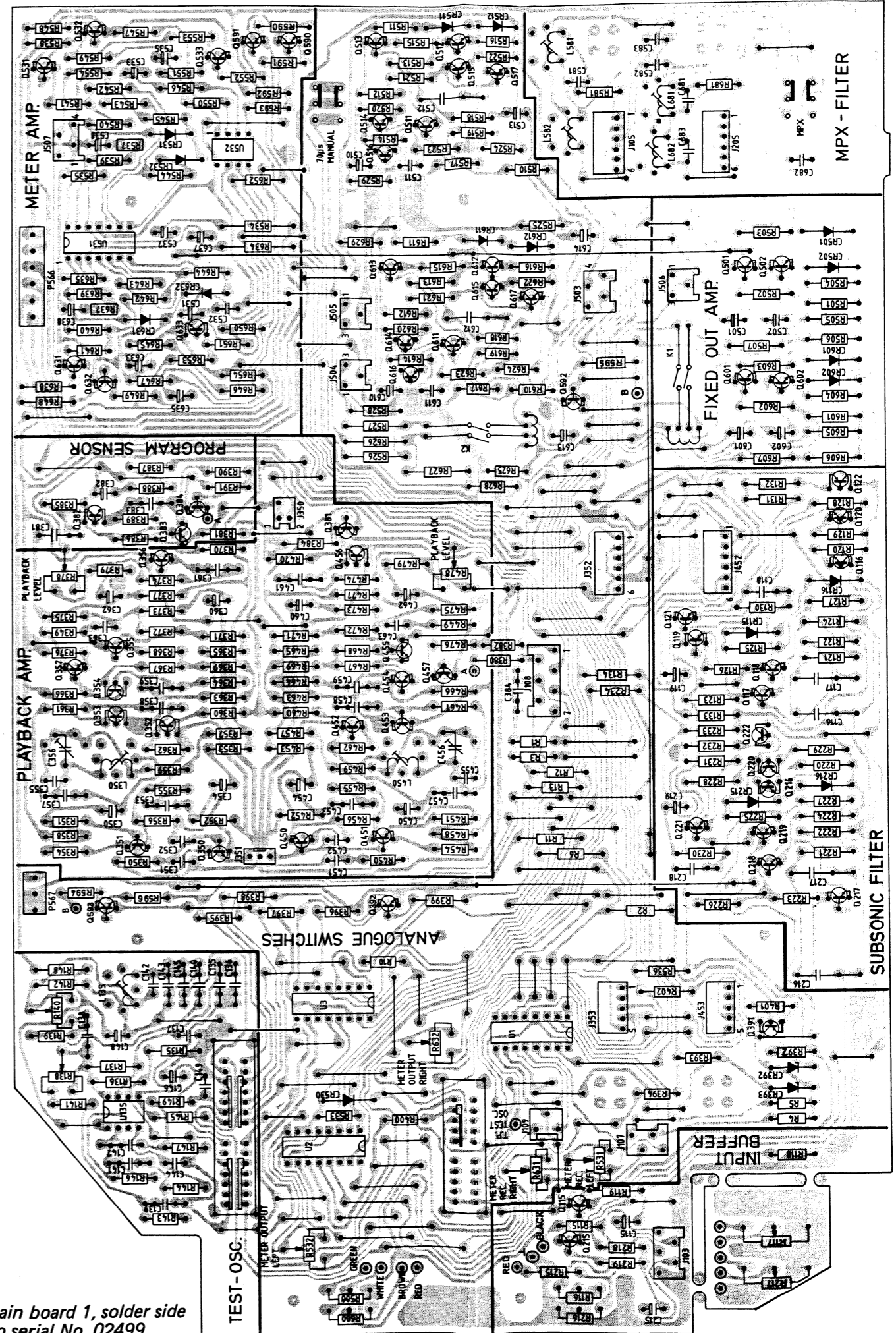
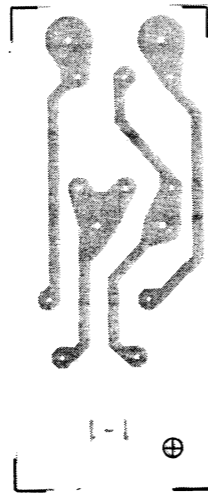
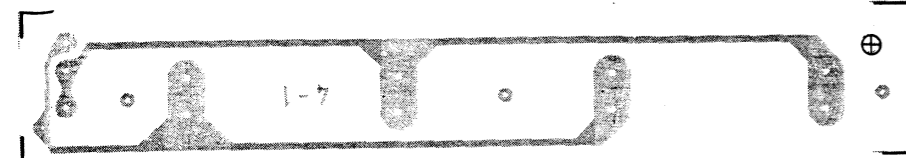
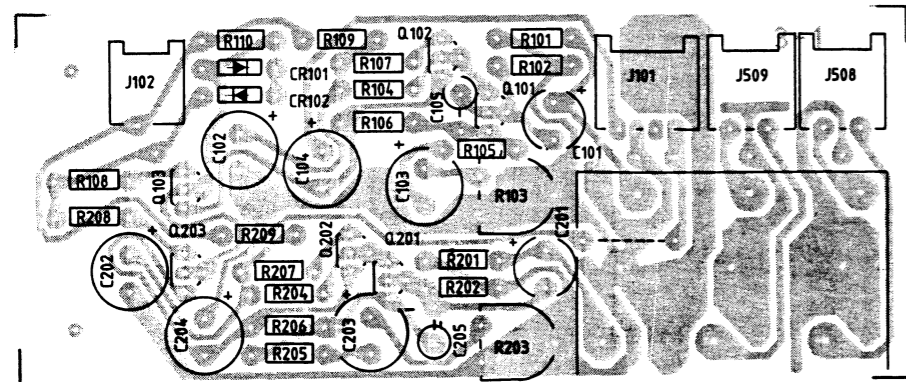
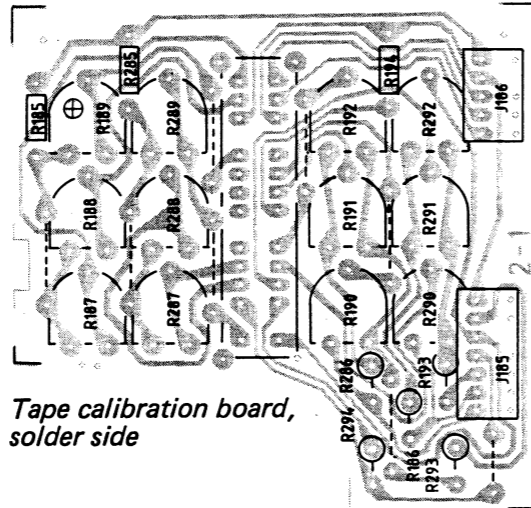
### Program sensor

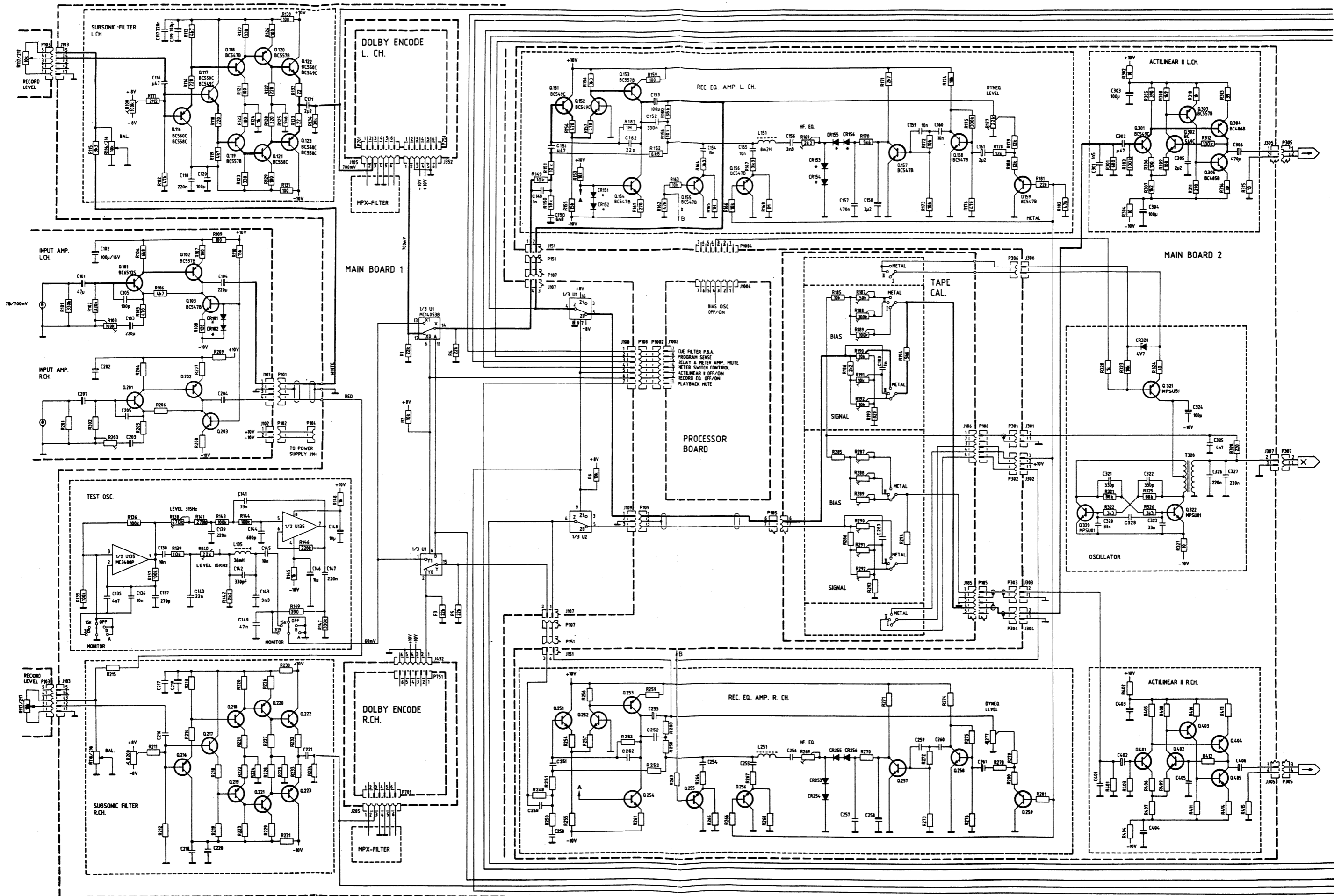
The program sensor is checking whether the level from the tape is more than a certain limit defining "a program". When the program is present, the collector of Q384 is pulled low and this is read by the microprocessor.

C381 and R385 are acting as a high pass filter and C383 is giving the high frequency limit.

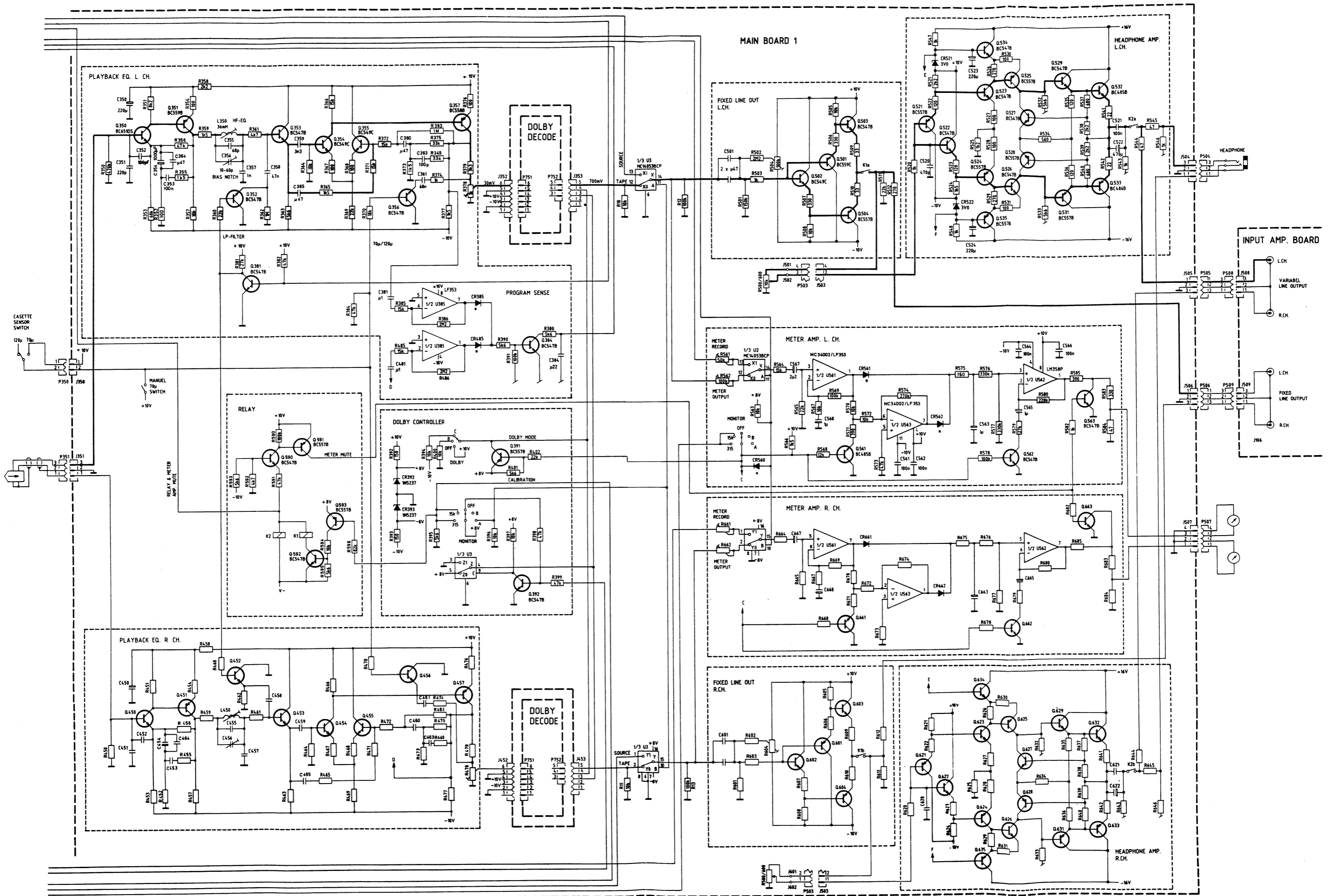
Q382 and Q383 are connected as an amplifier and the base/emitter voltage of Q384 is used as program threshold.

R380 is limiting the speed on the line to the processor together with C384.

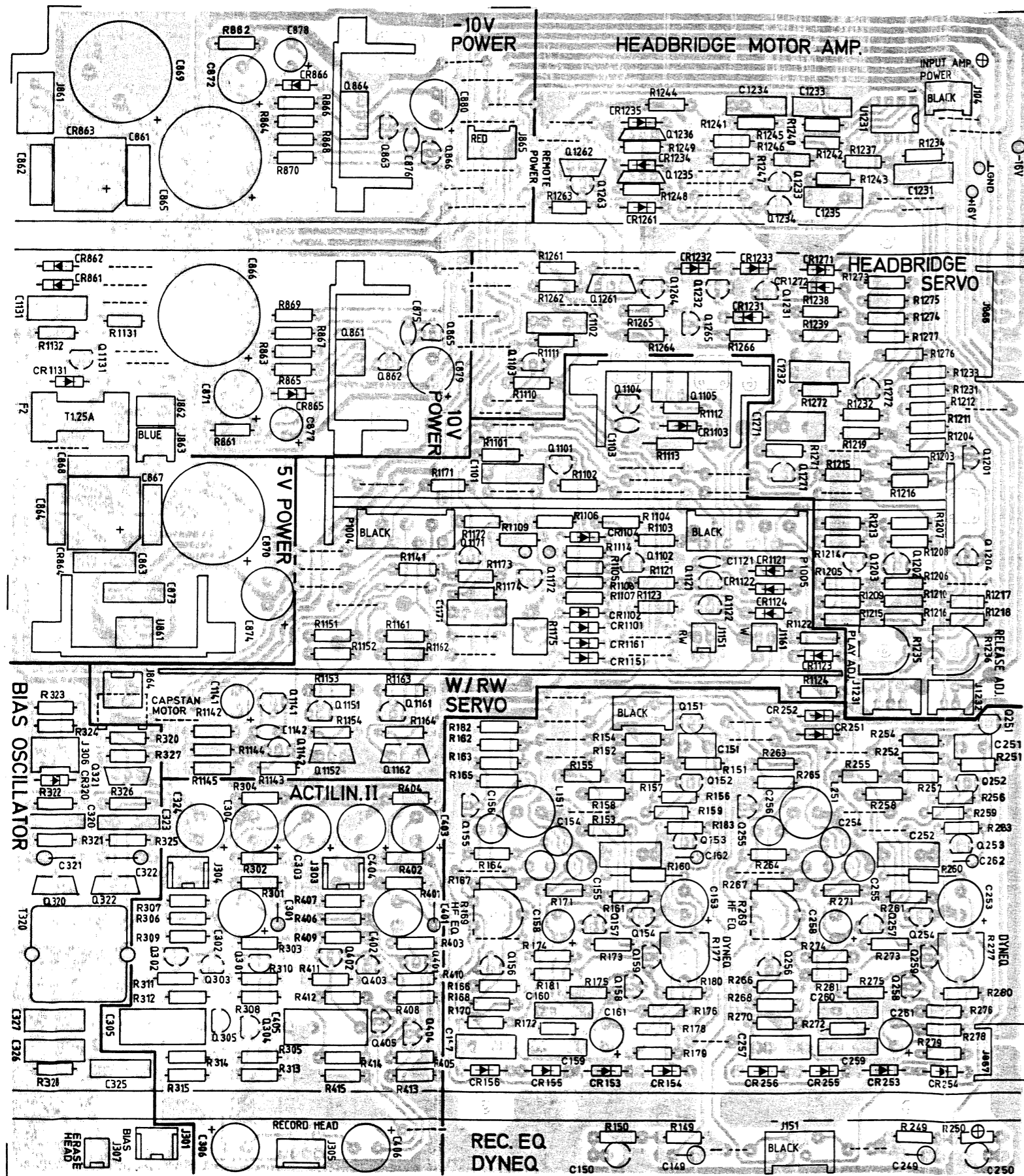




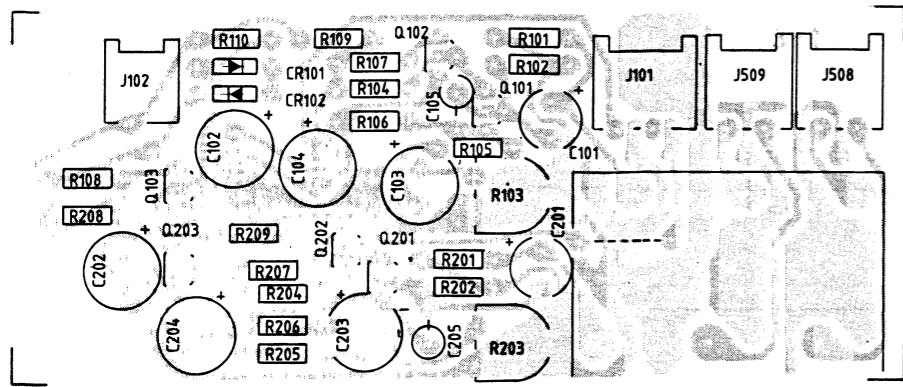
Record Amplifier  
From serial No. 01579



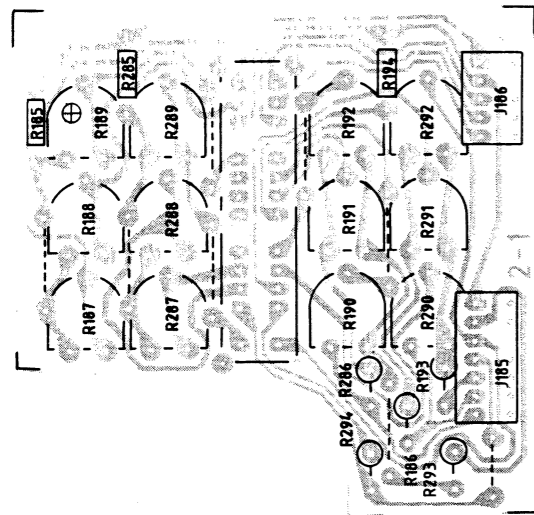
Playback Amplifier  
From serial No. 02500



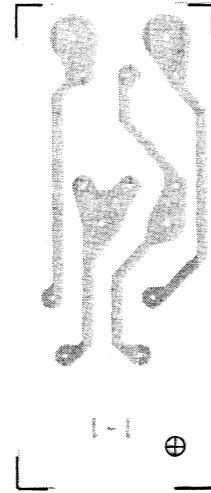
Main board 2, component side  
From serial No. 01579



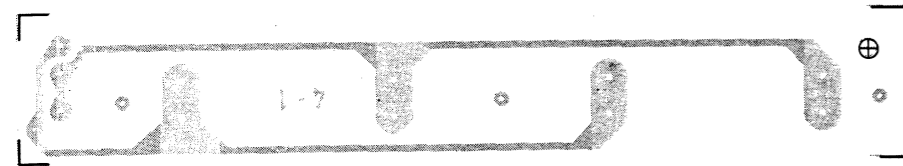
Input board, solder side



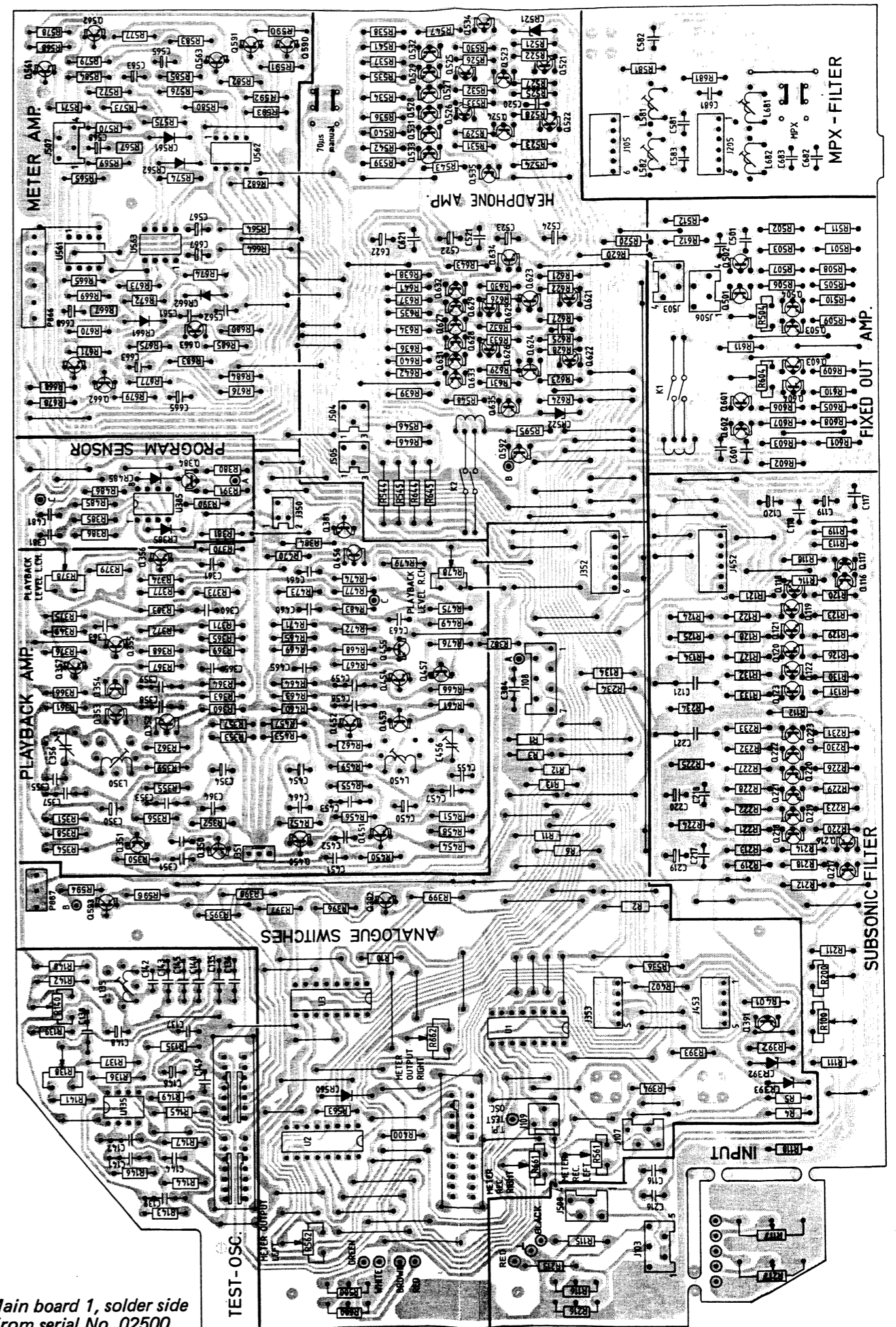
Tape calibration board, solder side



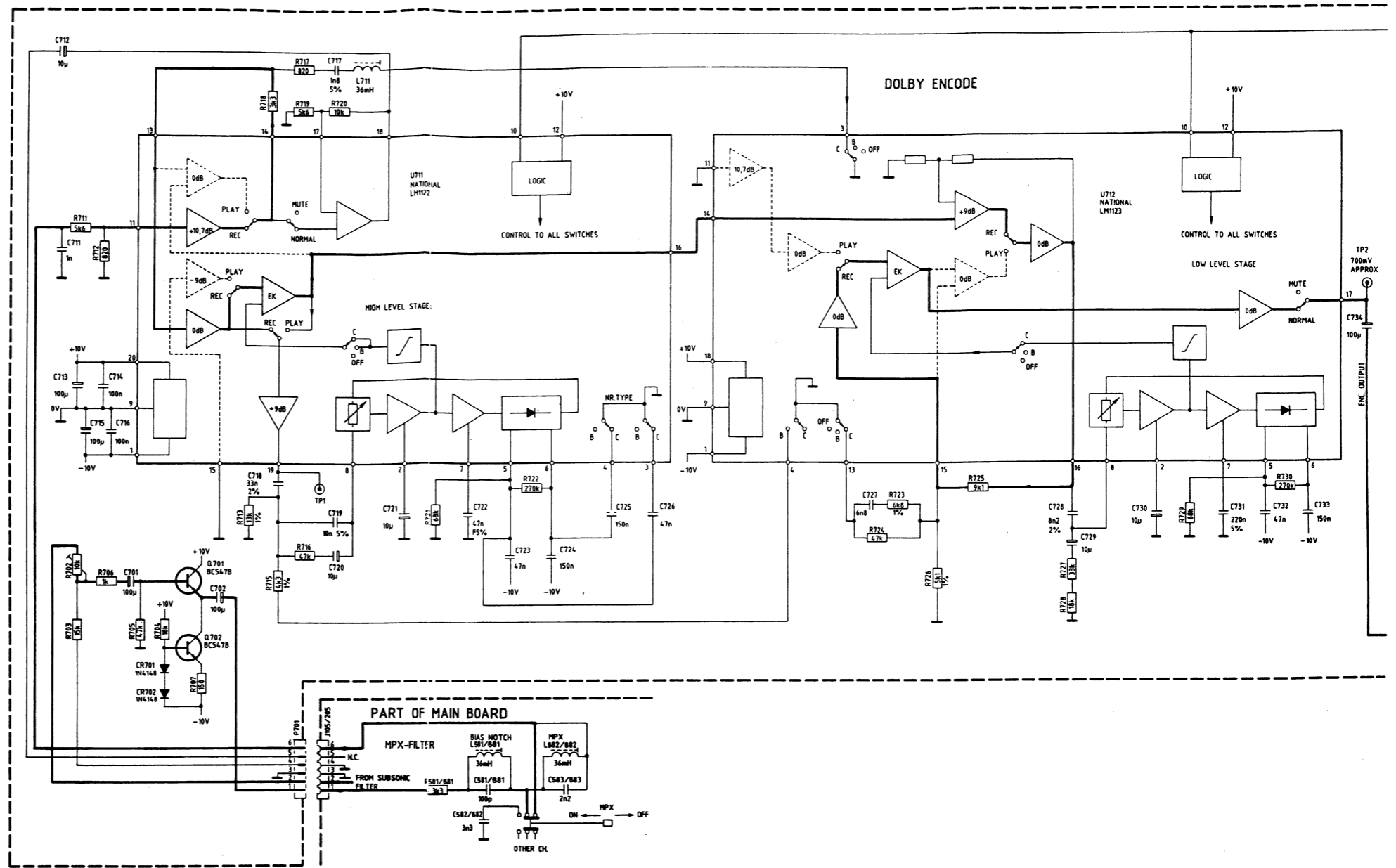
Power switch board, solder side



Lamp board, solder side

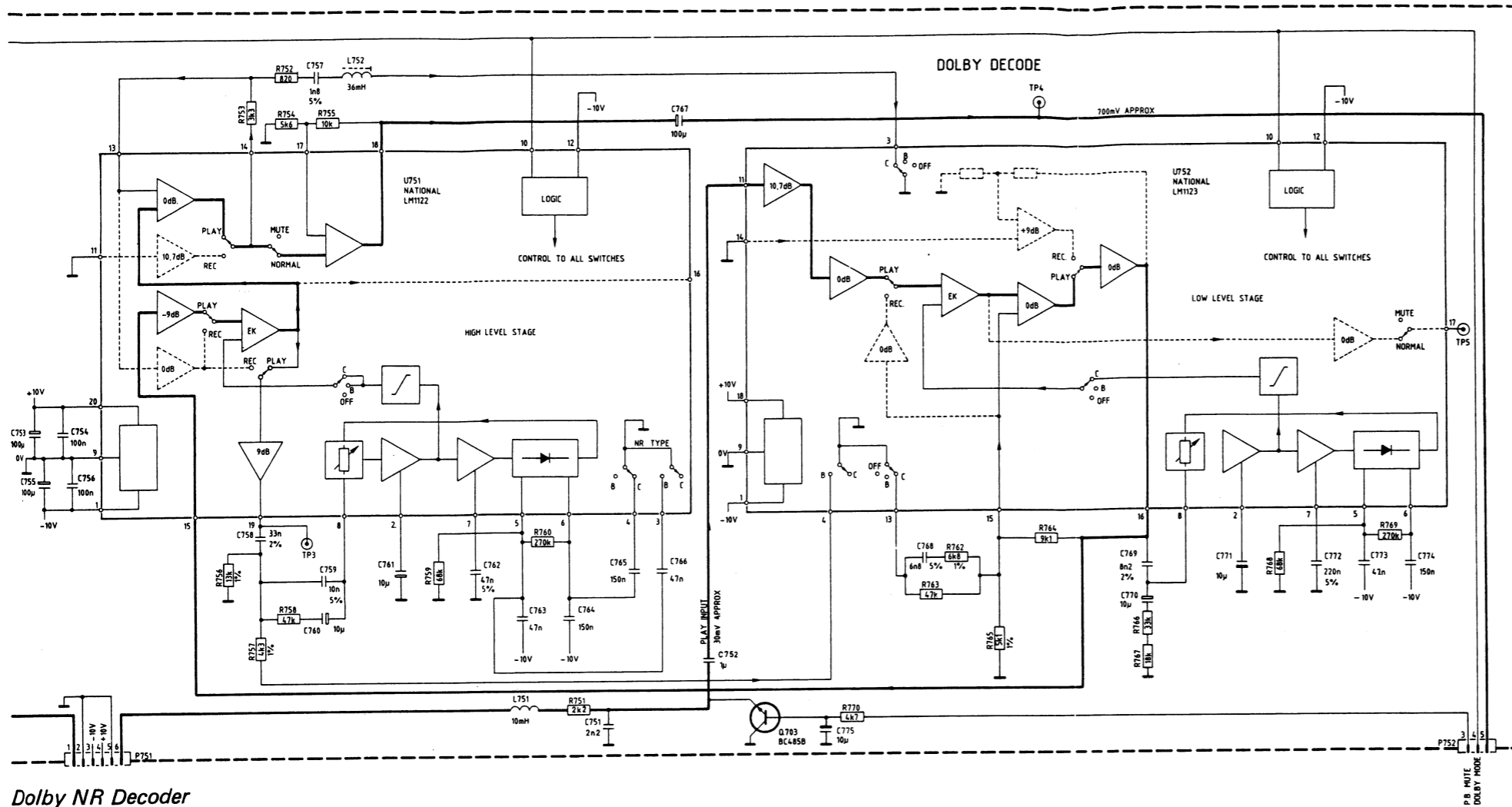


Main board 1, solder side  
From serial No. 02500

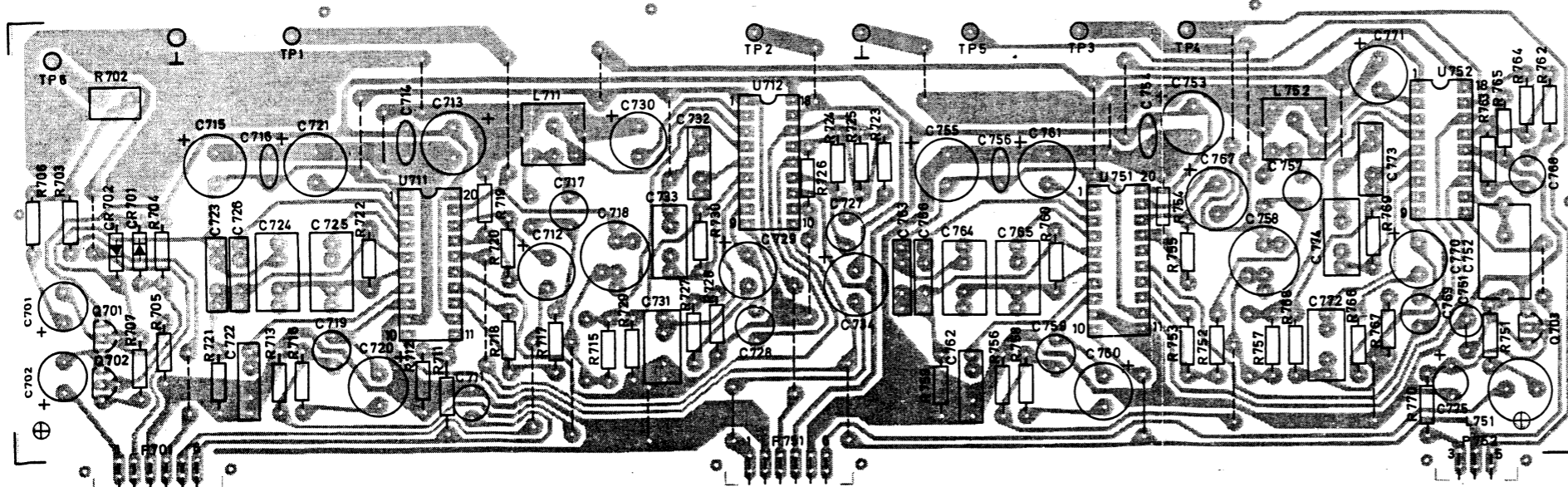


Dolby NR Encoder  
To serial No. 02499





Dolby NR Decoder  
To serial No. 02499



Dolby NR board, component side  
To serial No. 02499

## Dolby NR circuits

The Dolby NR circuits used in TCD 3014 are selected for sonic quality, very high signal headroom and low distortion levels.

To ensure optimal tracking the IC's have to be selected to form an ideal complete Dolby C NR channel. The slightest level difference will cause changes in the frequency response from lower midrange to the highest treble.

Therefore the bias and record current adjustments will be more critical when Dolby C NR is used. If one IC is damaged in a set, the set has to be matched again, and therefore the whole circuit board should be changed. Do not adjust the coils L711 and L752. They are forming the antisaturation network in Dolby C NR mode and are also matched at the factory.

One complete channel in a recorder will have unity gain from TP6 to TP4.

Usually faults are located outside the above mentioned components, and this is the reason why a brief circuit description is given.

R702 is adjusted to give unity gain from the input (TP6) to the output (TP2) of the encoder in Dolby NR Off mode. The MPS filter is adjusted to maximum attenuation at 19 kHz with L582/L682 and L581/L681 adjusted to notch the bias frequency.

All the integrated circuits have a main path and a side chain with a variable resistor element.

The signals from the side chain are added in encoder and subtracted in decoder.

If Dolby NR is set to Off, none of the side chains are used. In Dolby B NR mode the side chains of U711 and U751 are used only.

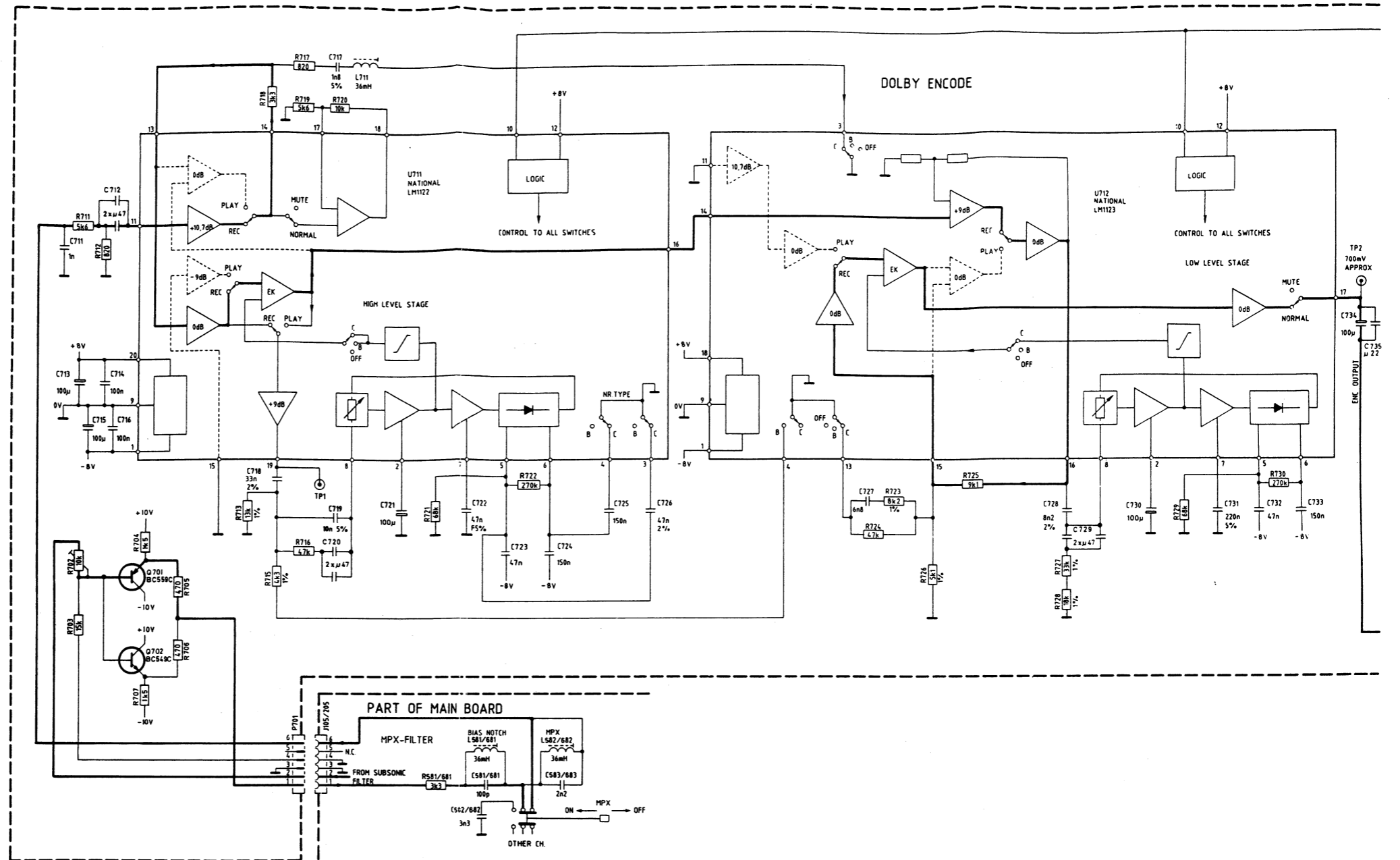
In Dolby C NR mode both side chains and the antisaturation networks are switched in (L711 and L752).

Dolby NR mode is given by the voltage at pin 10 on all IC's. Dolby NR Off when the voltage is positive, Dolby B NR when the voltage is zero and Dolby C NR when the voltage is negative.

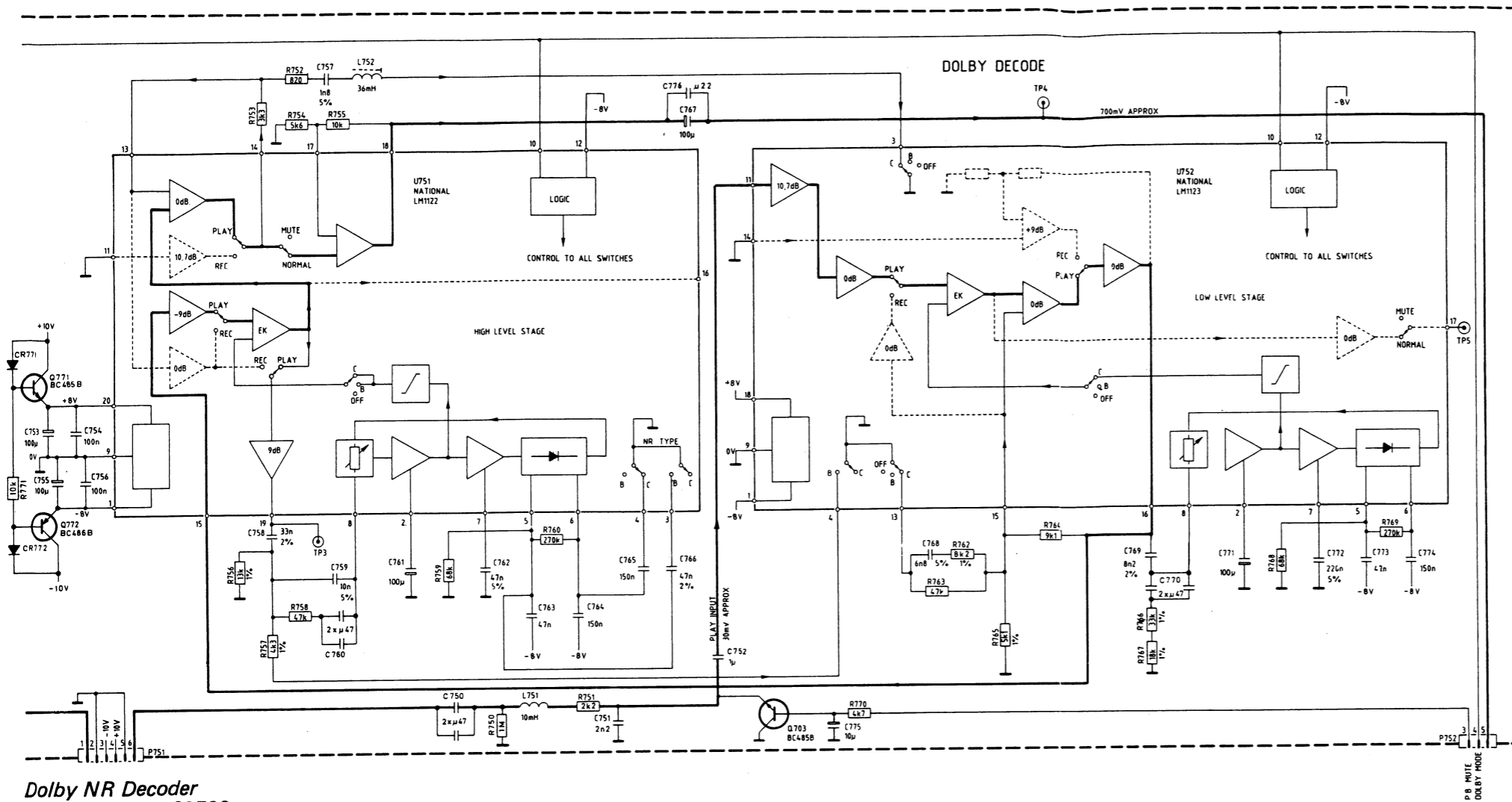
The muting of the decoder is done by switching Q703 into saturation.

When changing components, use the same tolerances as specified.

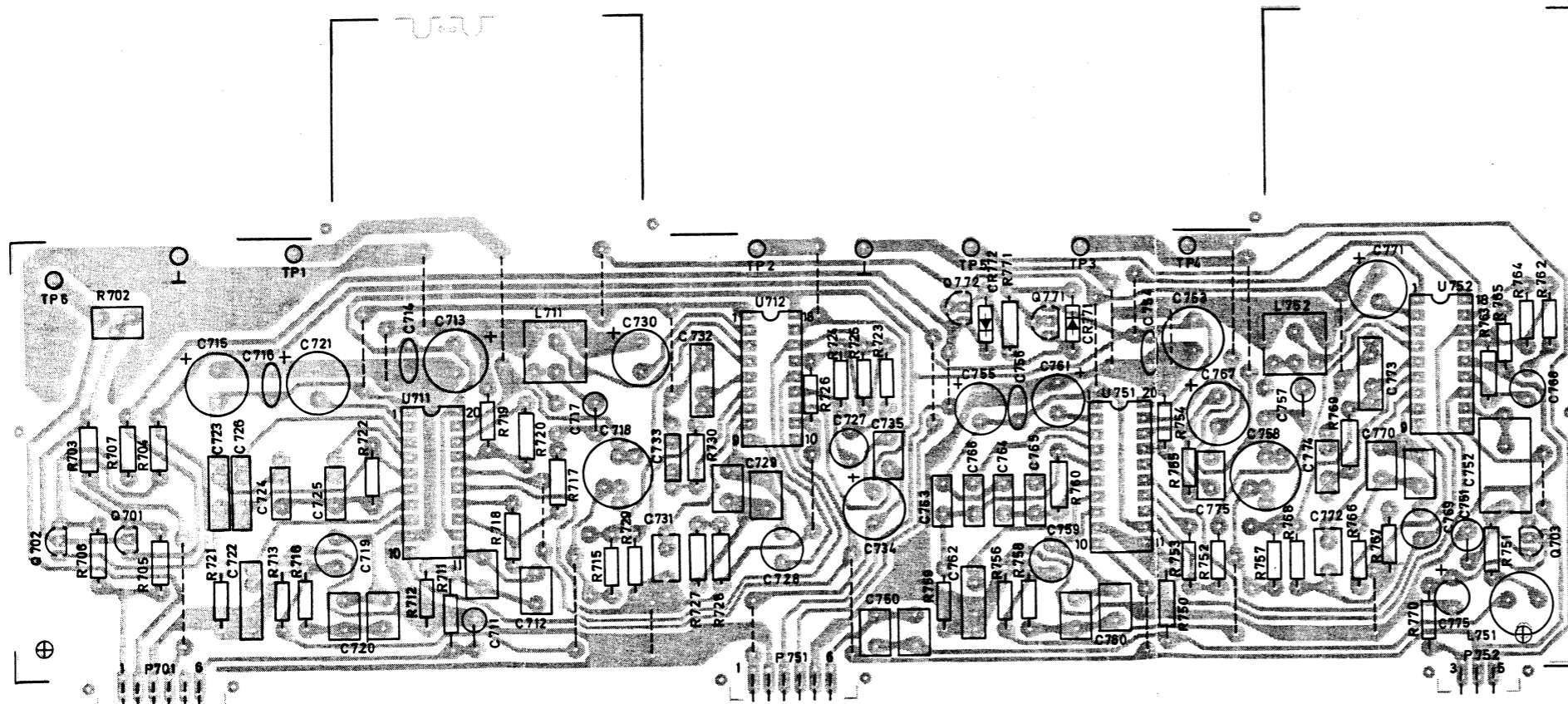
**NOTE!** If any of the integrated circuits need to be replaced the whole board has to be changed.



Dolby NR Encoder  
From serial No. 02500

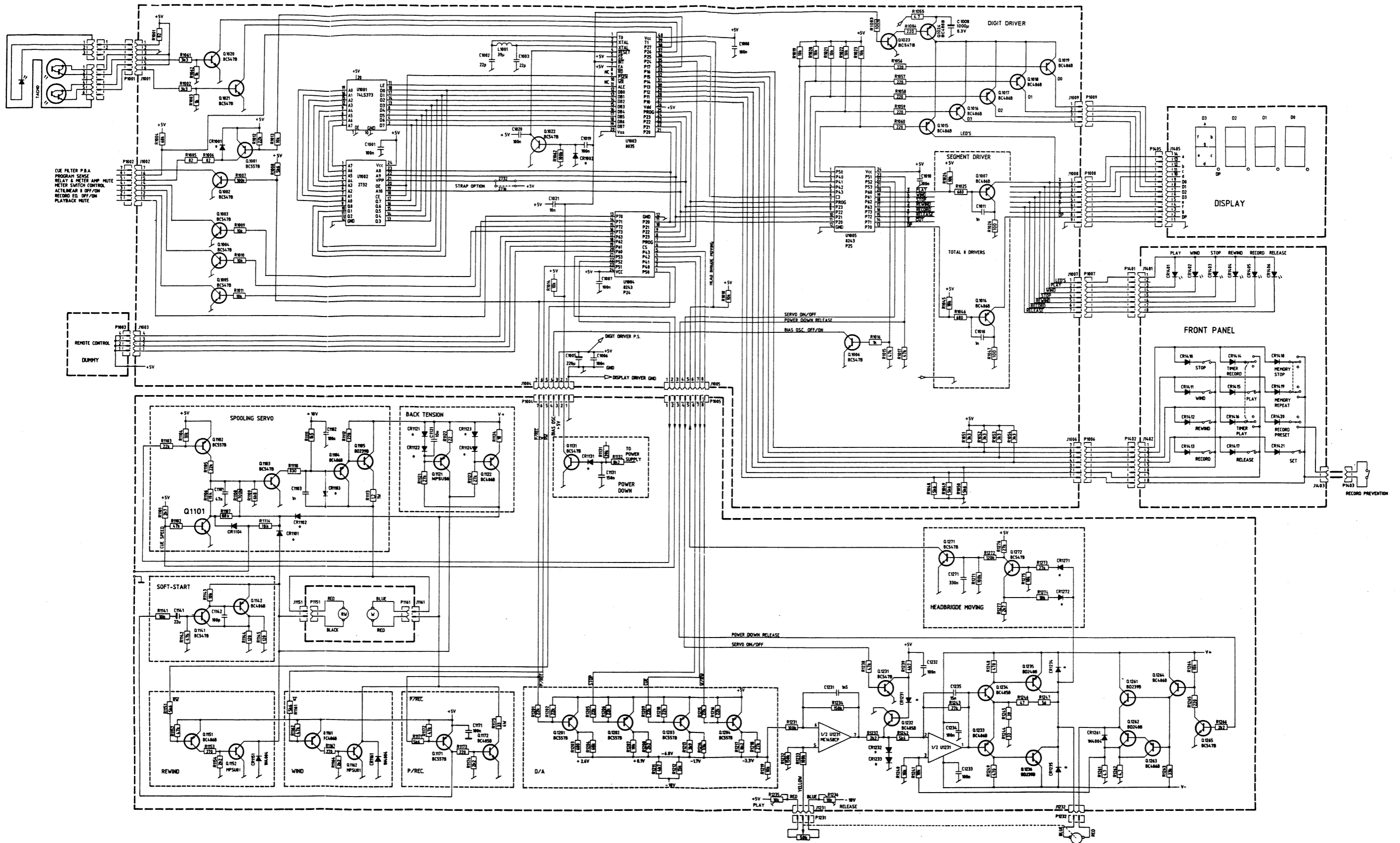


Dolby NR Decoder  
From serial No. 02500



Dolby NR board, component side  
From serial No. 02500

NOTE! If any of the integrated circuits need to be replaced the whole board has to be changed.



Processor and Motor Control

## Processor and motor control

All the logic functions in the TCD 3014 are carried out by the microprocessor U1003.

The execution speed is determined by L1001, C1002 and C1003.

The program instructions are collected in U1002 (EPROM), from where the processor is reading them.

The databus (DB0 - DB7) is bidirectional and while the PROM is read, the address latch will hold the lower 8 address lines locked.

The upper 4 address lines are given by the processor itself by port 2 (P20 - P23).

The address latch is controlled by pin 11 ALE and this pin will confirm that the processor is executing instructions by almost 400,000 read cycles per second.

Port 2 is also used for I/O expansion with U1004 and U1005. The expanders are selected at pin 6 (Chip Select) and the PROG-line.

P10 - P16 are used for scanning of knobs and switches in a 3 x 4 matrix.

When power is switched on, Q1022 provides a complete reset of the processor at pin 4. In case of power down the Q1131 will tie pin 6 low, disabling the LED's (Q1023, Q1024). The processor will execute a "power down" program which activates the "power down release" line if necessary to move the headbridge away from the tape.

If pin 6 is not let high, or the line from Q1271 confirms the servo is operating after power on, the counter will stay dark.

The signals from the infrared sensors are used to determine the counter values and also give information about tape movement. To provide exact information the relative phase between the sensor signals are checked during every level transition, so that the direction can be determined.

Therefore the mechanical position of the detector transistors with respect to one another and to the IR-emitting diode is critical to maintain accurate function in all modes. Consequently if not absolutely necessary, the detectors should not be touched.

When they are moved or replaced, they must be realigned so that transitions (both positive and negative) from both sensors are separated as much as possible in all modes in both directions. For this alignment, connect a two-channel oscilloscope through probes at the collectors of Q1020 and Q1021.

The headbridge positions are determined by the output voltage from the D/A converter Q1201 to Q1204.

The approx. voltages in the different modes are shown in the diagram.

All transistors off is release position.

All headbridge positions, determined by the D/A voltage are controlled through a voltage comparator U1231 comparing the output of the D/A converter to the output of the position servo potentiometer.

Play and release positions are aligned by adjusting R1235 and R1236 respectively so that the adjustment mark on the wormgear bearing sleeve is in line with one of the adjustment marks on the wormgear itself, dependent on which position is being aligned.

Voltage differences are amplified, and limited by Q1232, CR1231, CR1232 and CR1233 to give constant motor speed between positions. When a position is reached, Q1271 and Q1272 confirms this to the processor, which then turns off the servo by turning on Q1232.

The last half of U1231 together with accompanying parts forms the servo's power stage with current feedback for load compensation.

Q1262 and Q1263 are switched on during normal operation. During POWER DOWN RELEASE Q1261 is switched on instead.

## Wind/Rewind motor control

Q1152, Q1162 and Q1172 are acting as switches, and all are switched off in release. Q1172 gives current control of the wind motor during play and record modes.

Q1104 and Q1105 are forming a voltage follower with current limiting and the controlling voltage is applied at the base of Q1104.

In stop mode both Q1152 and Q1162 are switched on together with Q1102 and Q1103 thus feeding both motors with a low voltage. This gives stop tension and this is also applied when headbridge-servo is working and also performs automatic slack take up.

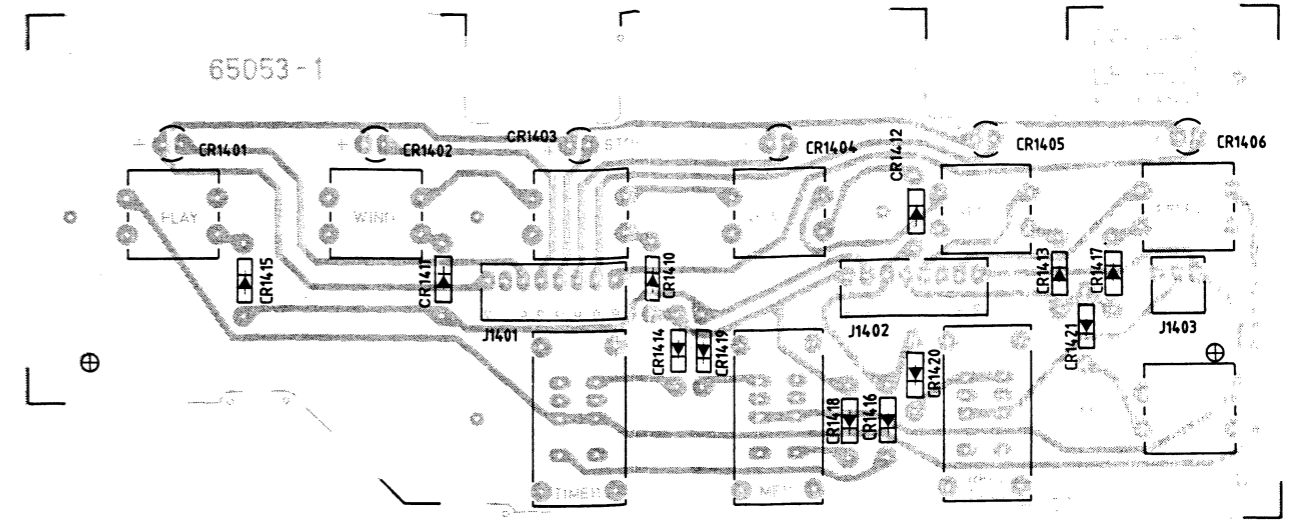
During Wind/Rewind and Play CR1101 and CR1102 are supplying voltage to the resistor network leading to the base of Q1103.

In Wind and Rewind the voltage will be the sum of the induced voltages in the motors, thereby giving almost constant linear tape speed.

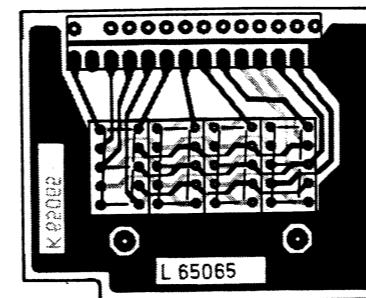
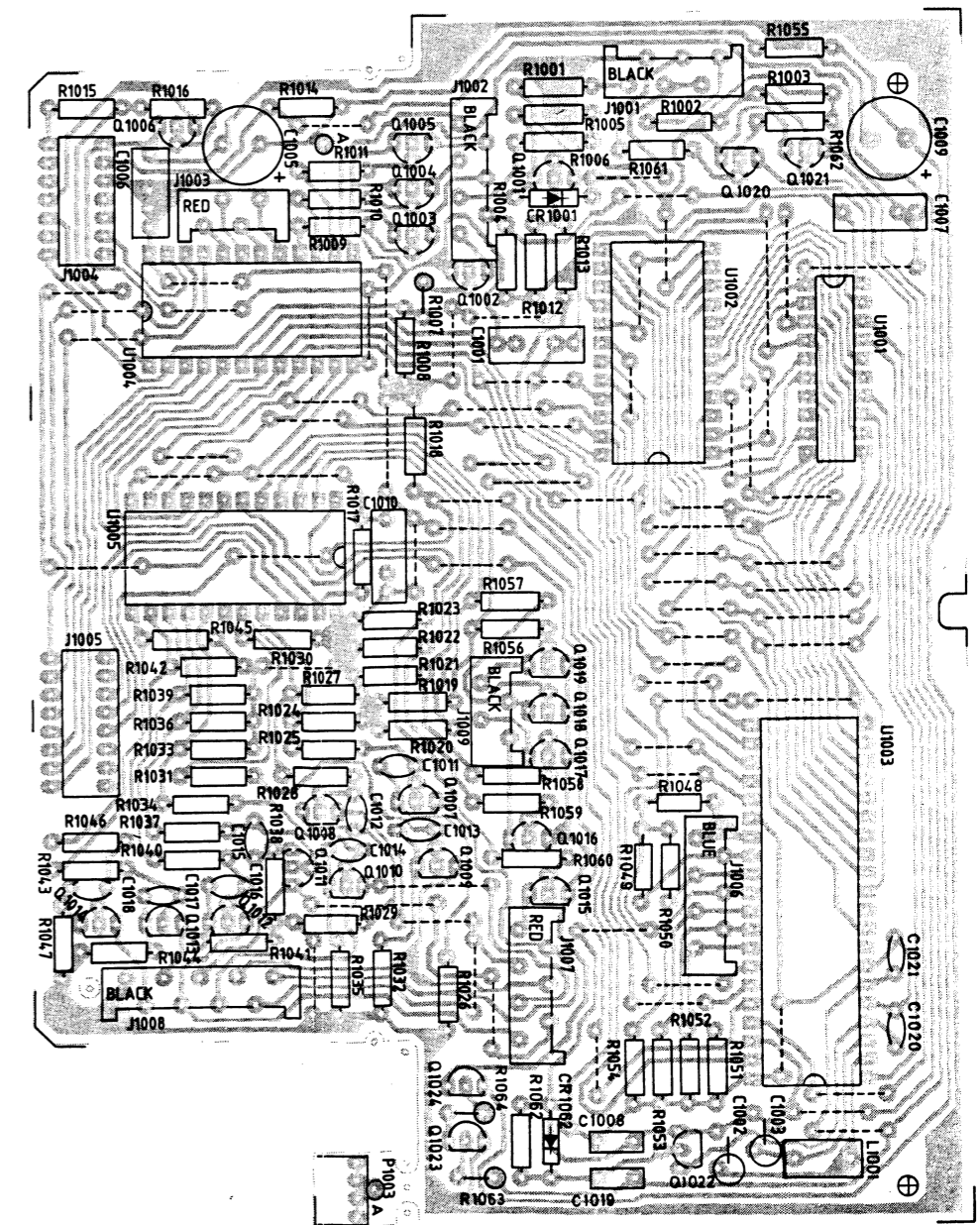
Full speed is determined by turning Q1102 off and Q1101 on.

Slow wind, rewind, cue, and search speed is given by switching off Q1101.

The remote control is read by the 4-bit bus connected at J1003. If not used this contact must be terminated to + 5 V and all lines high means "No command". Commands on the bus will override the decks keyboard, but if it is necessary to bypass the remote control, the STOP button can be kept depressed during the Power On period, thus preventing reading of the remote bus.

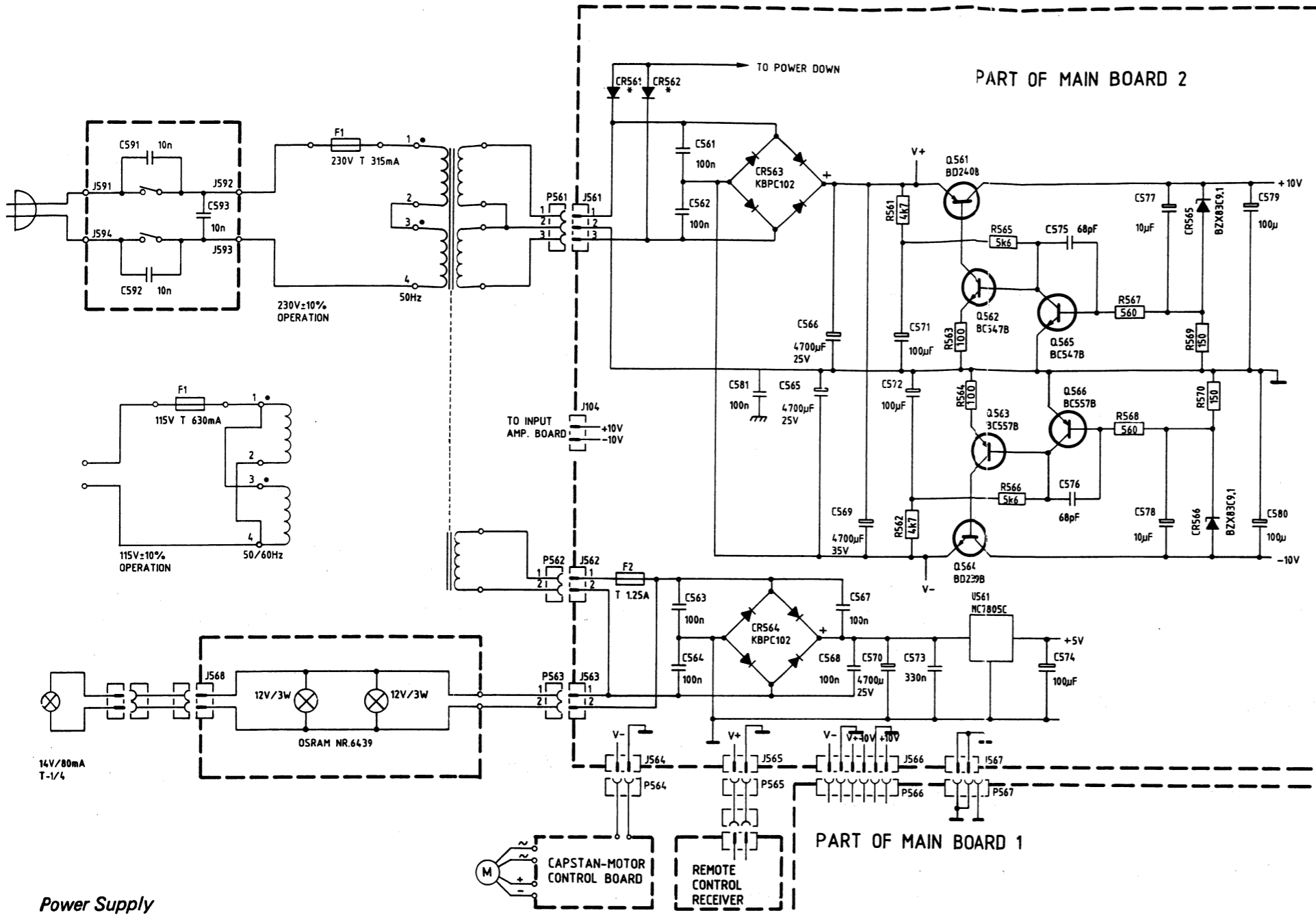


Control board, solder side

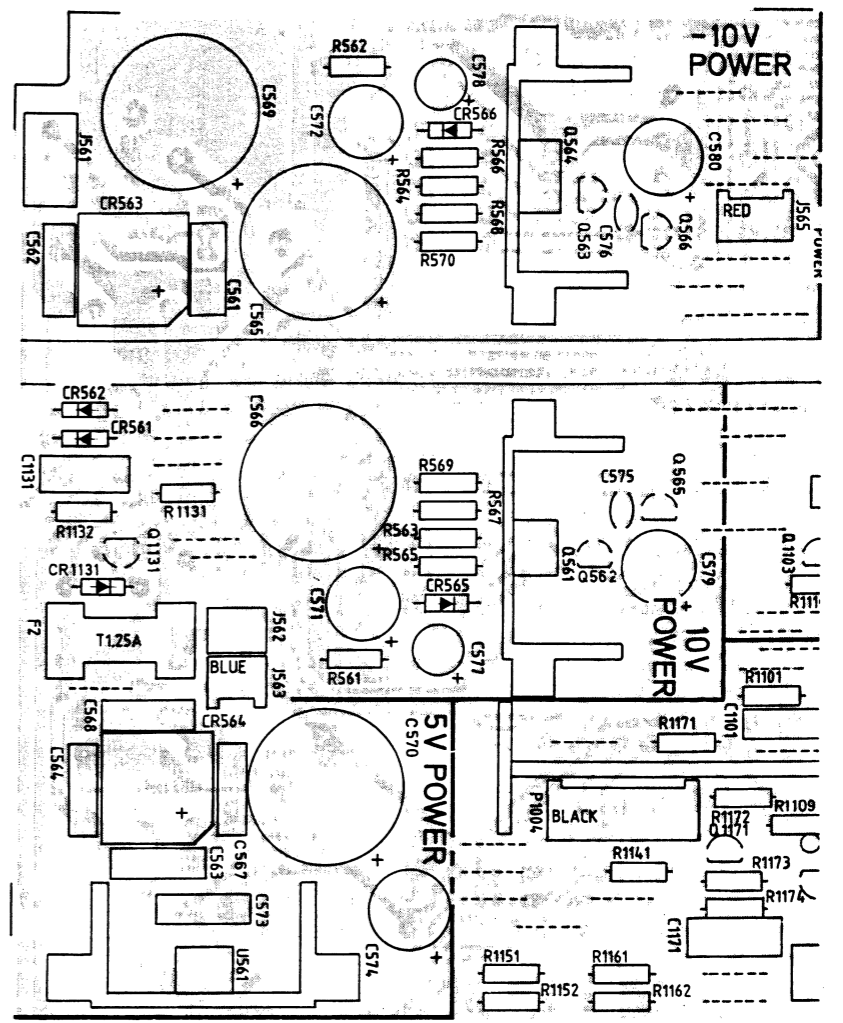


Display board, solder side

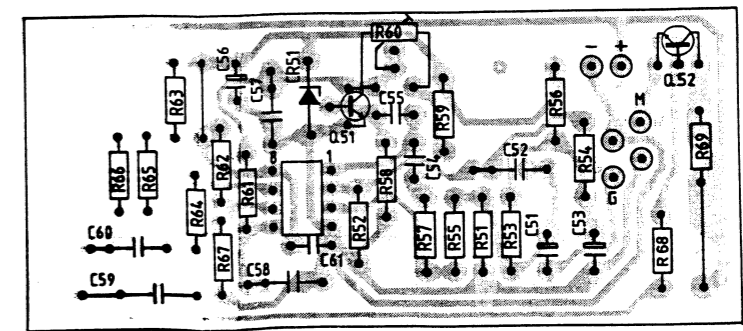
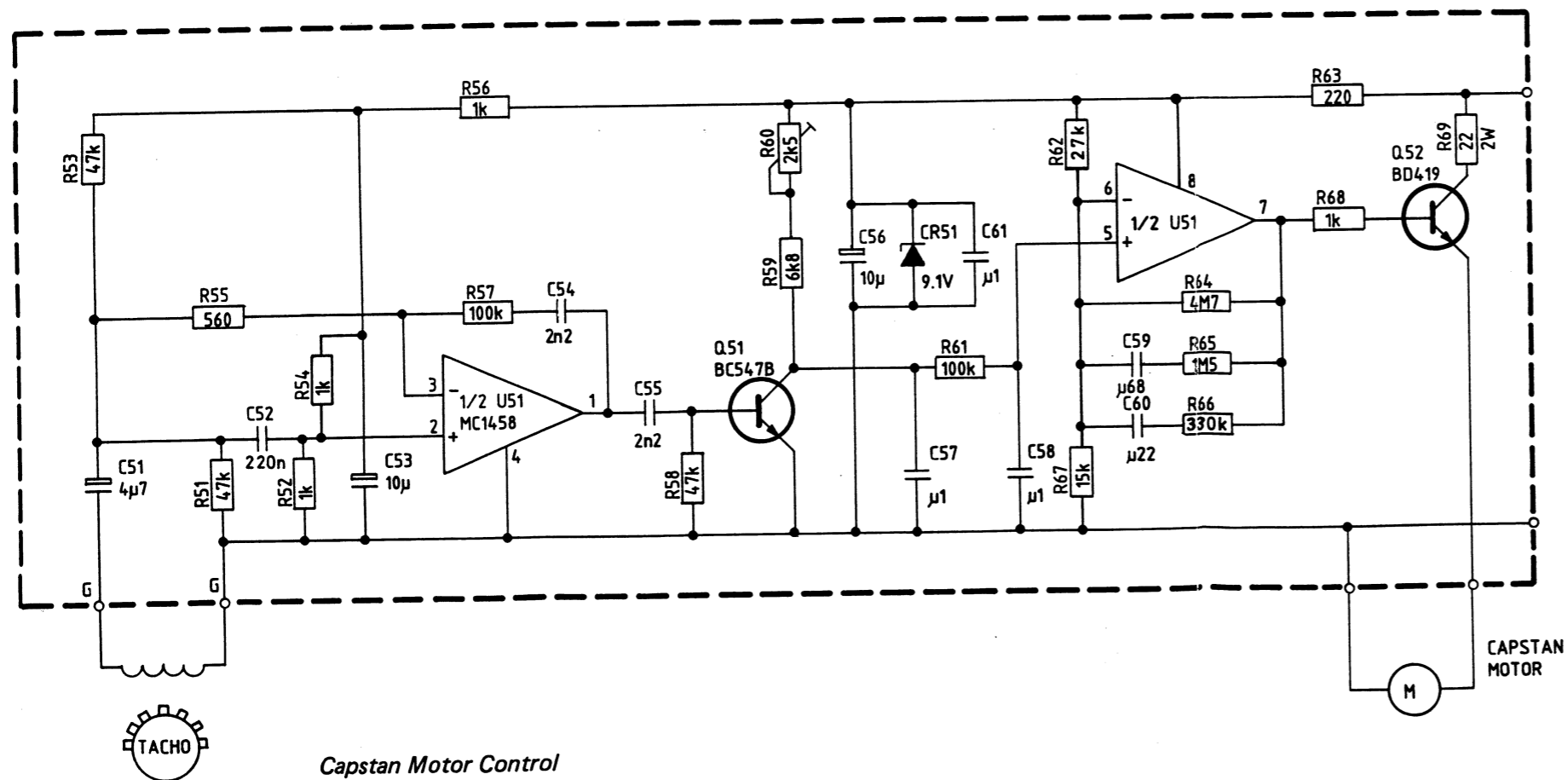
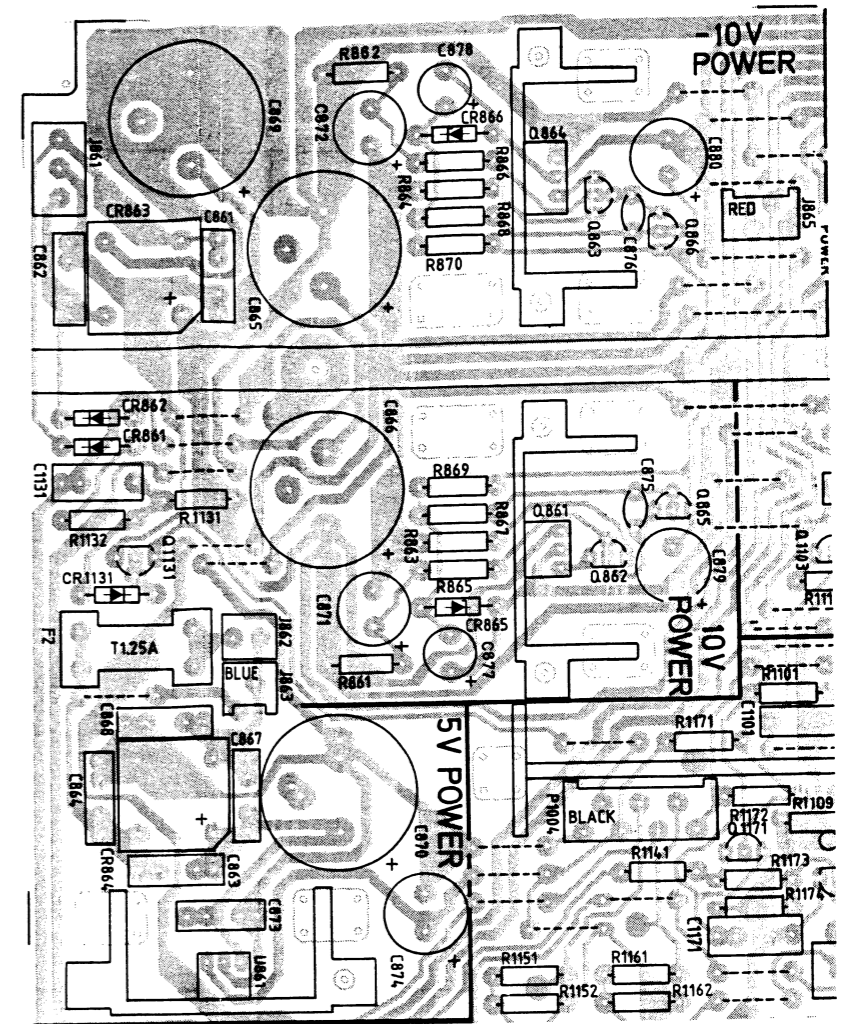
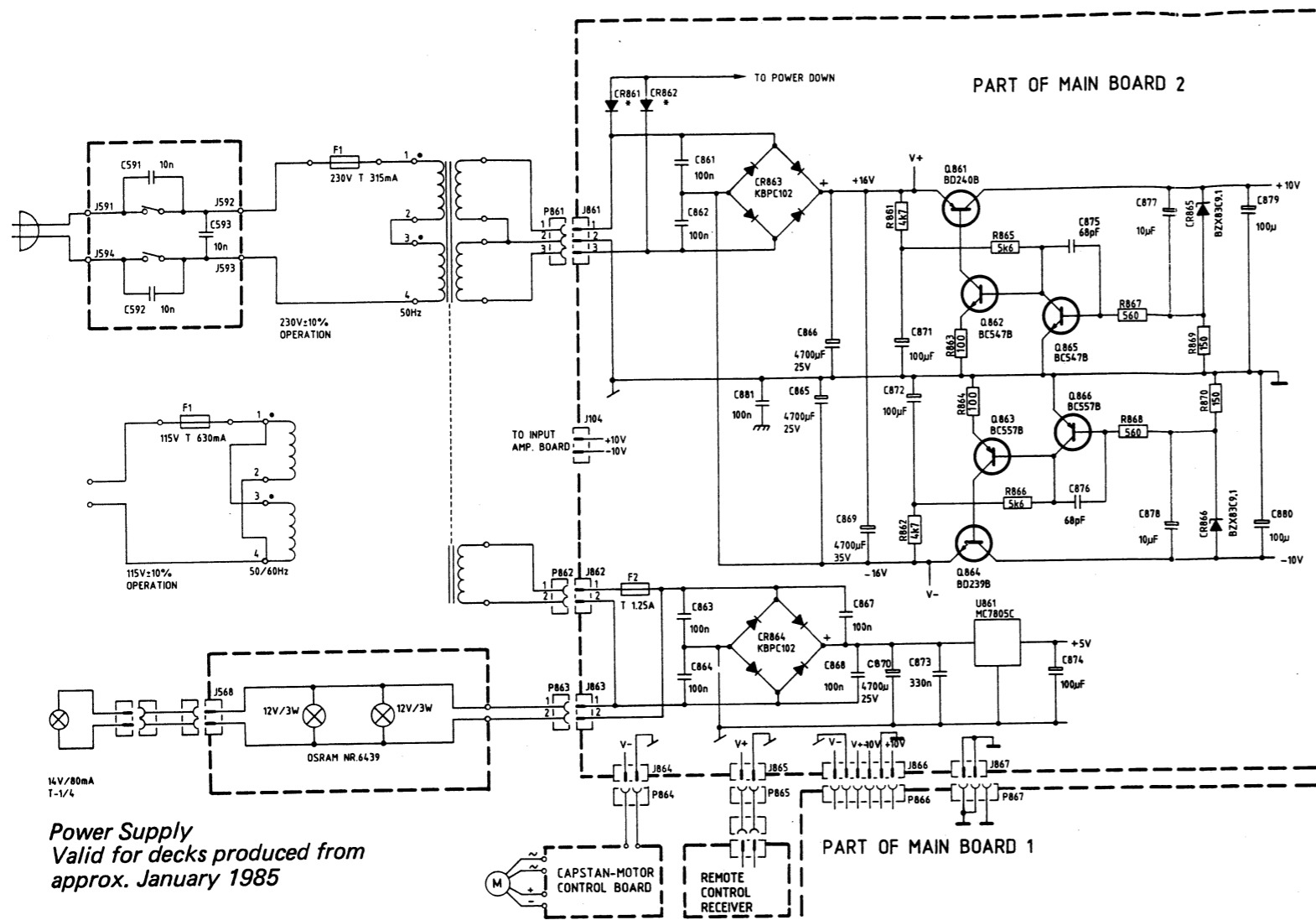
Motor Control board, component side

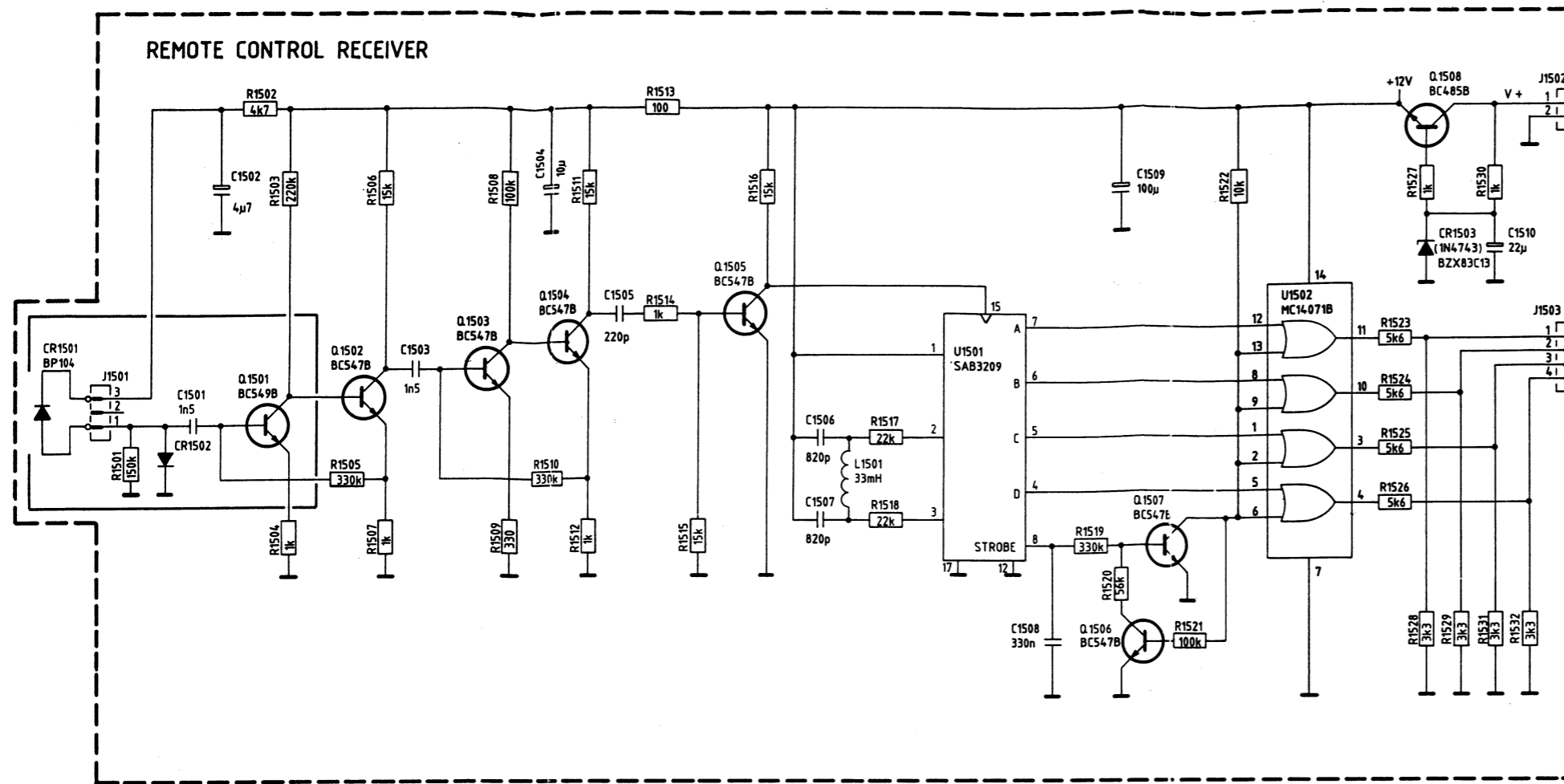


Power Supply

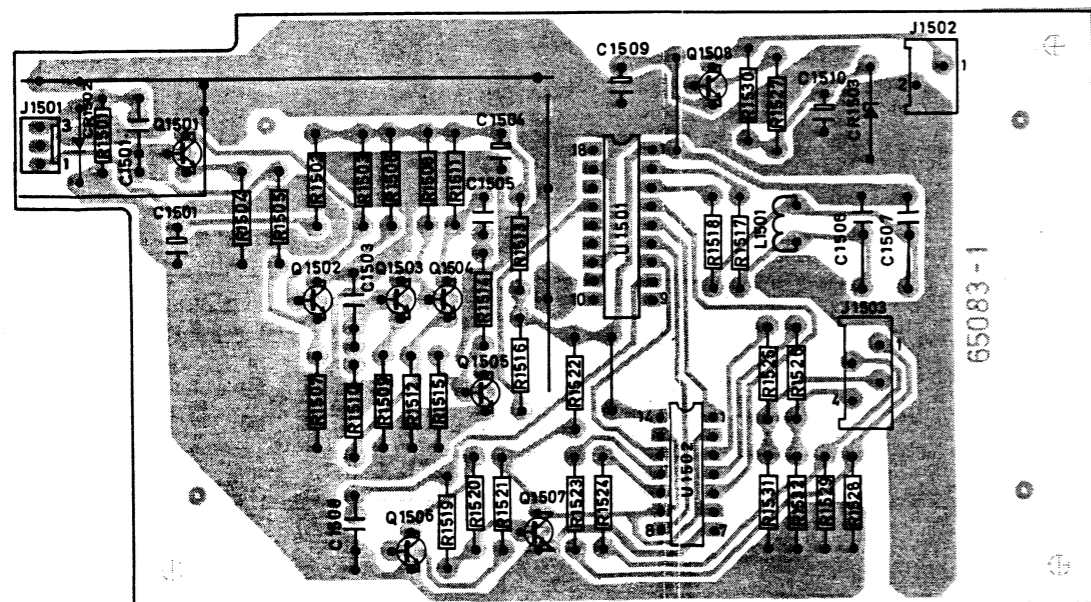


Power Supply board, component side  
(Part of main board 2)





Remote Control Receiver



Remote Control Receiver board, solder side



## Technical specifications

<b>Supply Voltage:</b>	230 V $\pm$ 10%, 50 Hz 115 V $\pm$ 10%, 60 Hz	<b>Signal-to-Noise Ratio, A-curve weighted (Dolby C NR):</b> Metal IV	> 74 dB
<b>Power Consumption:</b>	50 watts	<b>Erasure (1 kHz):</b> Metal IV	> 80 dB
<b>Tape Speed:</b>	1 7/8 ips.	<b>Crosstalk:</b> Side A – B (1 kHz) Track 1 – 2 (1 kHz)	< 60 dB < 40 dB
<b>Speed Tolerance*:</b>	$\pm$ 0.5%	<b>Inputs:</b> Input impedance	150 kohms
<b>Wow and Flutter:</b> WRMS (Play) WRMS (Rec – Play) DIN – IEC	0.06% 0.09% 0.12%	Sensitivity: Low High	100 mV 10 mV
<b>Frequency Range:</b> Metal IV (– 20 dB) With Dolby C NR	18 Hz – 23 kHz $\pm$ 1.5 dB $\pm$ 3.0 dB	<b>Outputs:</b> Minimum load impedance/max. voltage at unloaded input: Play 700 mV (Fixed line output) Play Variable (Variable line output) Headphones:	100 ohms/700 mV 100 ohms/0 – 4 V 8 ohms/3.5 V
Tape II (– 20 dB)	18 Hz – 20 kHz $\pm$ 1.5 dB	<b>Dimensions:</b> Width Height Depth Weight	43.5 cm (17 1/8") 16.6 cm (6 9/16") 35.0 cm (13 3/4") 9.8 kg (21.6 lbs)
Tape I (– 20 dB)	18 Hz – 20 kHz $\pm$ 1.5 dB		
<b>Harmonic Distortion – 250 nW/m, Dolby B NR:</b> Metal IV Tape II Tape I	< 1.0% < 2.0% < 1.5%		

\* At nominal mains voltage and normal operating temperature.

Specifications are subject to change for further improvement without notice.