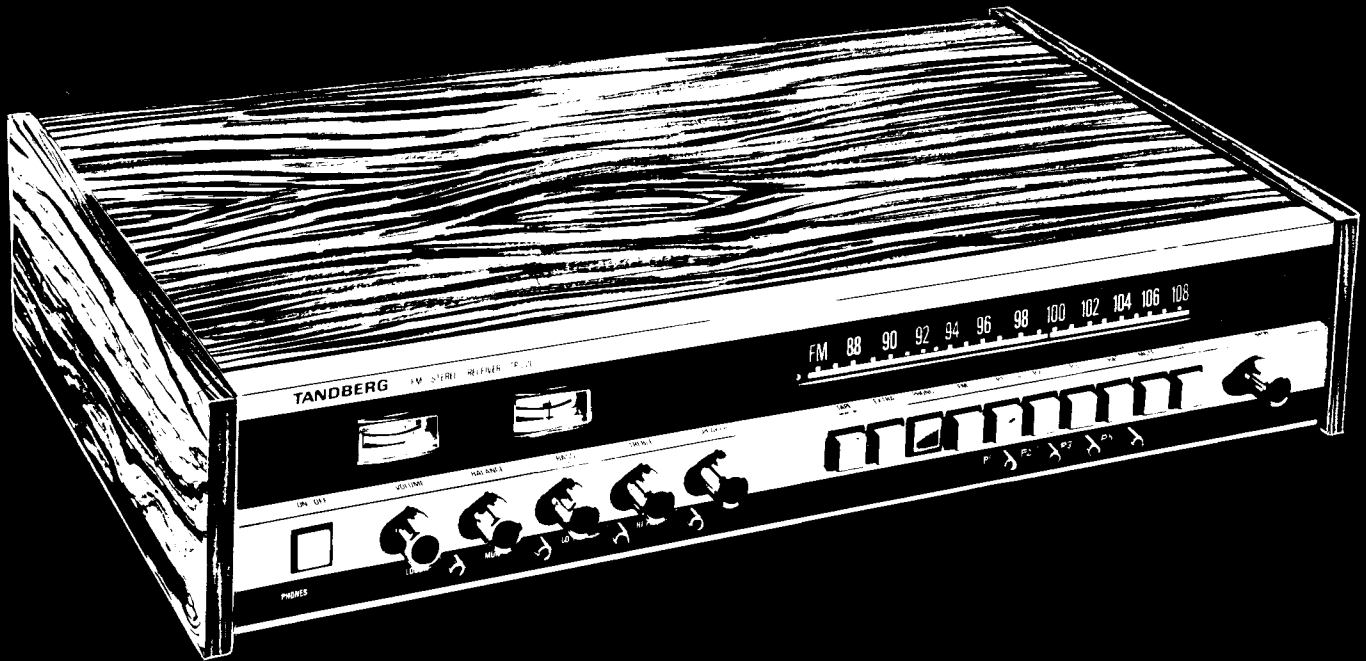


TANDBERG

TR 220

Service Manual



CONTENTS

	Page
Changing and cleaning switches	2
Dismantling	3
Alignment procedure for the stereo decoder	4
FM alignment procedure, table	4
All boards, seen from the component side	5
All boards, seen from the solder side	6
Circuit diagrams	7
Guide to operating controls, plugs, and sockets	8

CHANGING AND CLEANING SWITCHES

To ensure a satisfactory switching action, clean and lubricate the switch contacts with a good cleaning agent applied on a fine brush. We recommend "Tandberg Klüberfett" or "Wählerfett" which can be supplied from our service department.

DISMANTLING

Petrick switch - interlocked

Switch arm

Pull the locking plate slightly forward and move it across in the direction of the arrow (see diagram) so that it clears the locking tag. When the locking is moved in the direction of the arrow, all the switch arms, interlocked and independent, will spring out at the same time. *Therefore hold your hand in front to catch these parts.*

When you are re-assembling, *hold all the switch arms in at the same time* (with a plate) as the locking tag is pushed into its locking position.

NOTE! It pays to set one end of the locking plate up on the edge of the locking tag *before* you hold the switch arms in.

Switch housing

Unsolder the switch housing from the solder side of the board and any leads on the side of the switch. Clamp tabs A together. The switch housing will now be free.

Interlock return spring

To gain access to the interlock return spring you must first free the switch housing as described above. Interlock return spring are not *always* fitted to switch houses of the interlocking type.

Petrick switch - independent

Switch arm

Dismantle in the same way as described above in the paragraph "Switch arm".

Switch housing

To remove the locking plate, return spring, and locking pin, clamp tabs A together. Further dismantling can be achieved by following the description given above in the paragraph "Switch housing".

NOTE! Take care with the return spring when dismantling and re-assembling so that it does not lose its tension.

Free-standing Petrick switch - push button switch with independent release

Switch arm

Pull the front locking plate forward at one end (the left end seen from the front) so that it lies on the edge of the switch carrier.

Push the back locking plate in the direction of the arrow (see drawing) and at the same time make sure that the switch arm does not spring out.

Switch housing

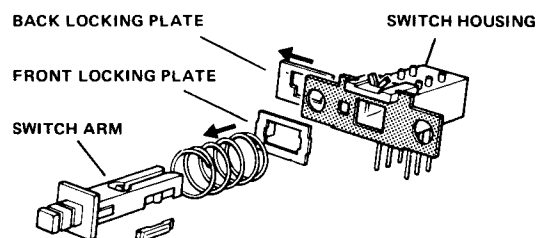
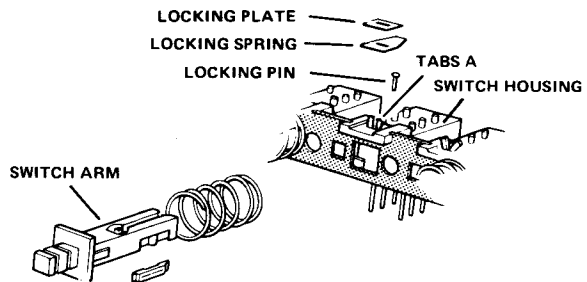
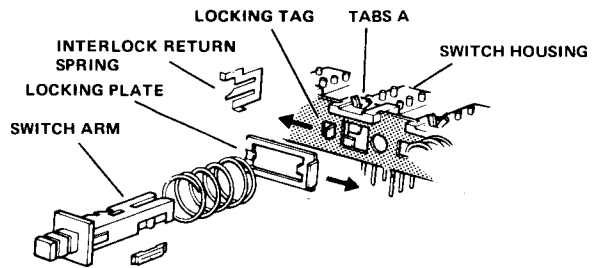
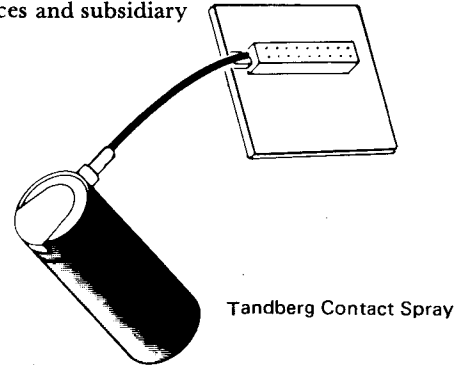
Dismantle as described in the "Switch housing" paragraph for the independent and interlocked switches.

We also recommend pure alcohol or methylated spirit for cleaning followed by a light application of vaseline for lubrication.

NOTE! Do not touch the contacts with your fingers because this can lead to corrosion.

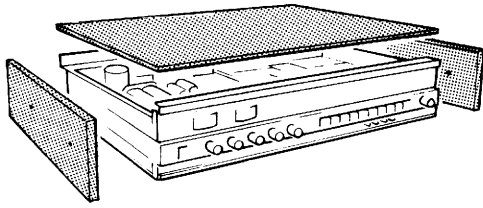
Avoid using cleaning agents that could attack the metal surfaces.

NOTE! We have developed our own cleaning/lubricating agent, "Tandberg Contact Spray" in aerosols, and we can recommend it for all types of contacts. The aerosols can be supplied through our district offices and subsidiary companies.



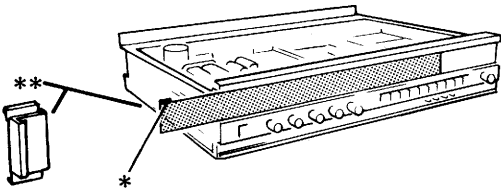
DISMANTLING

CABINET



Remove the 2 screws holding each side panel using an Allen (Unbrako) key. Lift up the top panel at the back edge and pull it out backwards.

SCALE GLASS

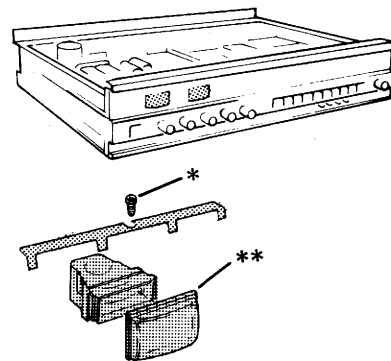


Pull the scale glass out sideways.

*There are 3 loose pieces of plastic tubing on the top edge of the glass, one at each end and one in the middle. When re-assembling, replace the 2 end pieces of tubing after the scale glass has been put back.

**On later models the outer plastic tubing pieces have been replaced with special end pieces. On these models the scale glass is slightly shorter. The plastic piece of tubing in the middle has been retained.

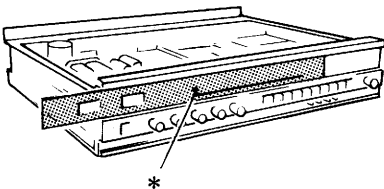
THE METERS



*Remove the bracket retaining screw. Pull the meter out backwards.

** The lenses in front of the meters are fitted loose against the scale plate.

THE SCALE



*First pull out the STEREO lamp which is located in a hole in the scale (at the back). Pull the scale out sideways.

CHANGING AND CLEANING SWITCHES

See previous page.

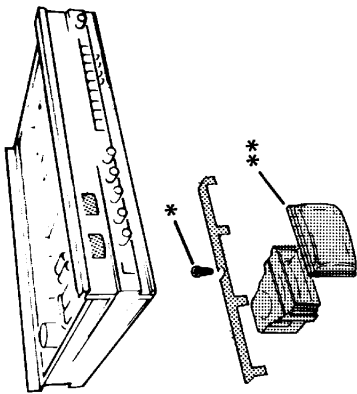
*Release the drive cord pulley unit (2 screws). Remove the old cord.

Turn the pulley to its end position, anti-clockwise seen from the front. Fix the loop on the cord to the lug inside the pulley as shown in the figure. Take the cord end A, with the spring, and thread it through the hole at the top edge of the pulley and lay the cord half a turn anti-clockwise in the back channel and fix it with tape.

Lay the cord end B as shown in the figure one and a half turns clockwise in the front channel and fix it with tape. Screw the pulley unit back into place. Lay the rest of the cord as shown in the figure.

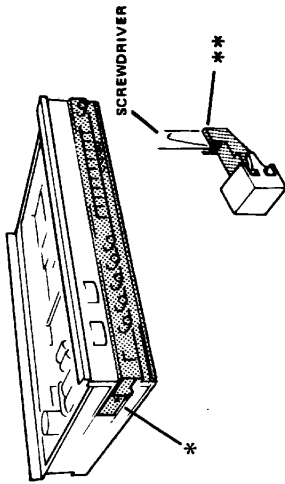
** The end position of the scale cursor can be obtained when the pulley is in its extreme anti-clockwise position. See Fig

THE METERS



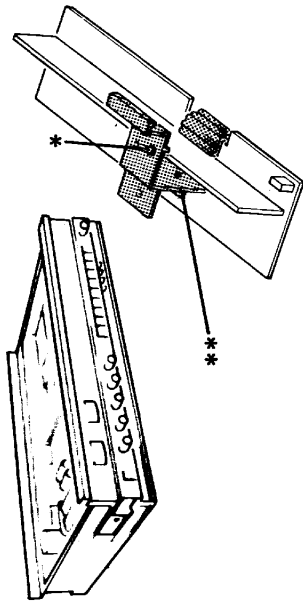
- * Remove the bracket retaining screw. Pull the meter out backwards.
- ** The lenses in front of the meters are fitted loose against the scale plate.

THE FRONT PLATE (Die-casting)



- Pull off the VOLUME, BALANCE, BASS, TREBLE, SPEAKERS and TUNING knobs.
- * Release the screws holding the bracket (one on each side). Pull the front plate off forwards.
 - ** Before re-assembling the front plate, you will find it easier if all the push buttons are removed. Finally, push the buttons back on.

SCALE ILLUMINATION BOARD

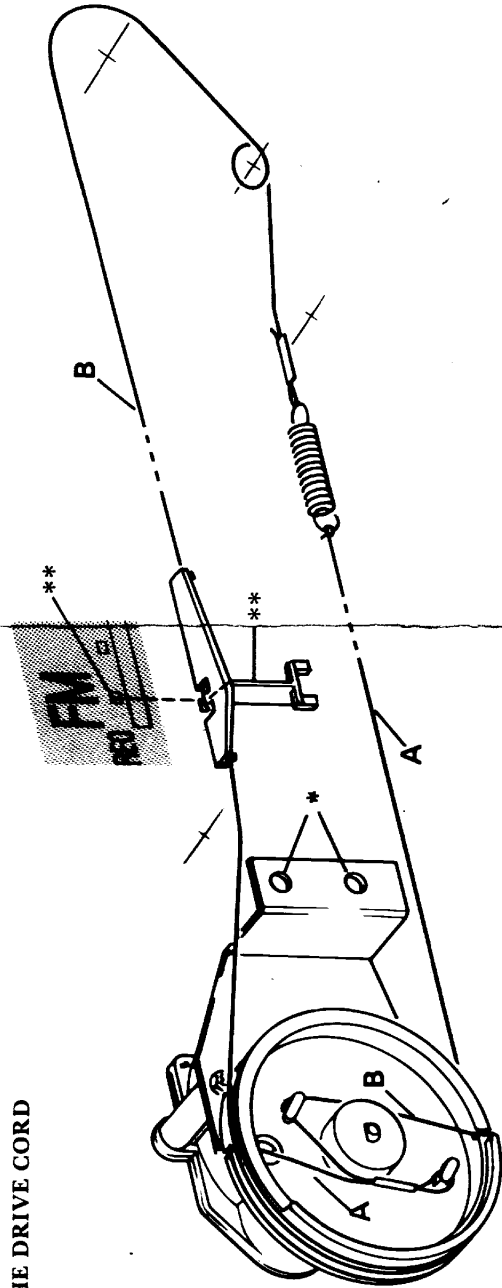


- * Remove the retaining screw for the scale illumination glass and remove the glass.
- ** Remove the scale illumination board retaining screw.

CHANGING AND CLEANING SWITCHES

See previous page.

THE DRIVE CORD



- * Release the drive cord pulley unit (2 screws). Remove the old cord.

Turn the pulley to its end position, anti-clockwise seen from the front. Fix the loop on the cord to the lug inside the pulley as shown in the figure. Take the cord end A, with the spring, and thread it through the hole at the top edge of the pulley and lay the cord half a turn anti-clockwise in the back channel and fix it with tape.

Lay the cord end B as shown in the figure one and a half turns clockwise in the front channel and fix it with tape. Screw the pulley unit back into place. Lay the rest of the cord as shown in the figure.

- ** The end position of the scale cursor can be obtained when the pulley is in its extreme anti-clockwise position. See Figure.

ALIGNMENT PROCEDURE FOR THE STEREO-DECODER

Equipment required:

- FM stereo sig. generator.
- Oscilloscope (sensitivity 5 mV/cm)
- Frequency counter
- Valvevoltmeter, 20 kHz LP filter or a selective valvevoltmeter.

Complete alignment:

- Decoder oscillator: 19 kHz (see section 1).
- Channel separation (see section 2).
- Signal level for mono/stereo switch-over (see section 3).
- Definition: Pilot signal 19 kHz \pm 2Hz

1. Decoder Oscillator: 19 kHz

Apply 1 mV to the aerial input from the FM sig. generator, unmodulated. No 19 kHz.

Adjust R305 until you read 19 kHz on the frequency counter connected to M310 (board A2).

Alternative without a frequency counter:

Apply 1 mV to the aerial input from the FM stereo sig. generator, modulation: 10% pilot signal. Turn R305 slowly from its end position to a position slightly past the point where the stereo lamp comes on. Finely adjust R305 to a position where the pot. must be turned equal amounts in both directions for the stereo lamp to go out.

2. Channel separation:

Apply 1 mV from the FM stereo sig. generator to the aerial input, modulation: 10% pilot signal. Modulate the right channel 90% with 1 kHz. Connect the oscilloscope to the TAPE OUT socket for the left channel.

Adjust R335 for minimum picture height on the oscilloscope. Modulate the left channel 90% with 1 kHz and connect the oscilloscope to the TAPE OUT socket for the right channel. Again adjust R335 for minimum picture height. The amplitude of the curve must be the same for both channels.

Alternative without a stereo sig. generator:

Adjust R335 for minimum signal from the right (or left) loudspeaker when the receiver is tuned in to a test transmission from an FM transmitter which is modulated only with a pilot signal and a signal in the left (or right) channel.

3. 19 kHz filter:

Apply 1 mV to the aerial input from the FM stereo sig. generator 10% modulated with a pilot signal. Adjust R327 (R328) alternately to obtain min. 19 kHz signal from the TAPE OUT socket for the left (right) channel, measured selectively. (Or with a 20 kHz LP filter to remove the residual 38 kHz voltage).

4. Signal level for mono/stereo switch-over:

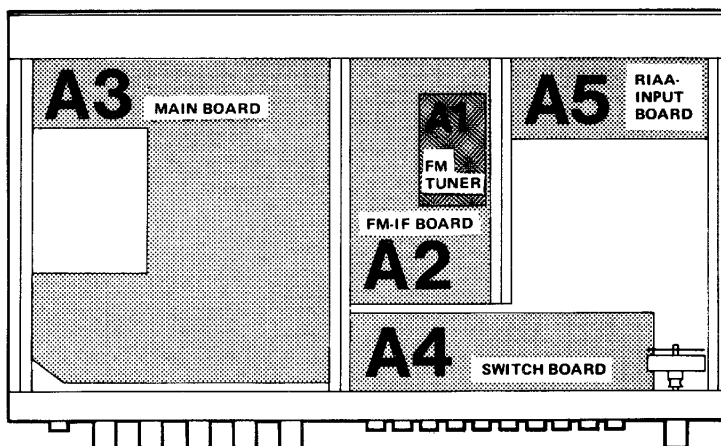
Apply 10 μ V to the 75 ohm aerial input from the FM stereo sig. generator 10% modulated with a pilot signal.

Turn R223 to its end position (anti-clockwise seen from the component side) and then turn it slowly clockwise until the stereo lamp comes on.

Alternative without a stereo sig. generator:

Use an ordinary FM sig. generator and apply 10 μ V modulated with 19 kHz, deviation 7.5 kHz (10%) to the 75 ohm aerial input. Check the 19 kHz with a frequency counter.

Otherwise follow the same alignment procedure explained in the previous paragraph.

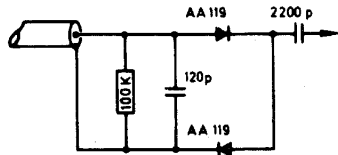


Seen from the component side

FM ALIGNMENT PROCEDURE

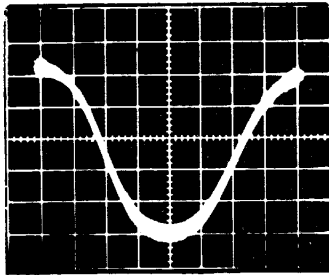
Step	Alignment sequence	Receiver			Signal Generator	
		Frequency	Frequency	Deviation	Frequency	Deviation
1	25 V for Varicap					
2	FM IF	90 MHz	90 MHz		\pm 200 kHz	
3 A	FM-osc. (FM)	90 MHz 105 MHz	90 MHz 105 MHz		\pm 200 kHz	
3 B	FM-Preset (P1)				\pm 200 kHz	
3 C	FM-Preset (P2)	88 MHz	88 MHz			
4	Aerial circuit	90 MHz 105 MHz	90 MHz 105 MHz		\pm 200 kHz	
5	Discriminator	90 MHz	90 MHz		\pm 75 kHz	
6	Centre tuning meter	90 MHz	90 MHz		\pm 75 kHz	
7	AFC	90 MHz	90 MHz		\pm 75 kHz	
8	Signal meter	90 MHz	90 MHz		Un-modulated	

Figure 1 Diode probe



SIGNAL: $V_{inn} = 150 \mu V / 75 \text{ ohms}$, $f = 90 \text{ MHz}$,
dev. = $\pm 200 \text{ kHz}$ applied to M1 via aerial socket.

OSCILLOSCOPE: Vert.: 5 mV/div., Hor.: 50 kHz/div.
applied to M201 via the diode probe (Figure 1).



* **3** **B**
The FM-preset (P1).

The FM preset knob has no mechanical end stop. When the knob is turned to either end of the adjustment range a mechanical click will be heard.

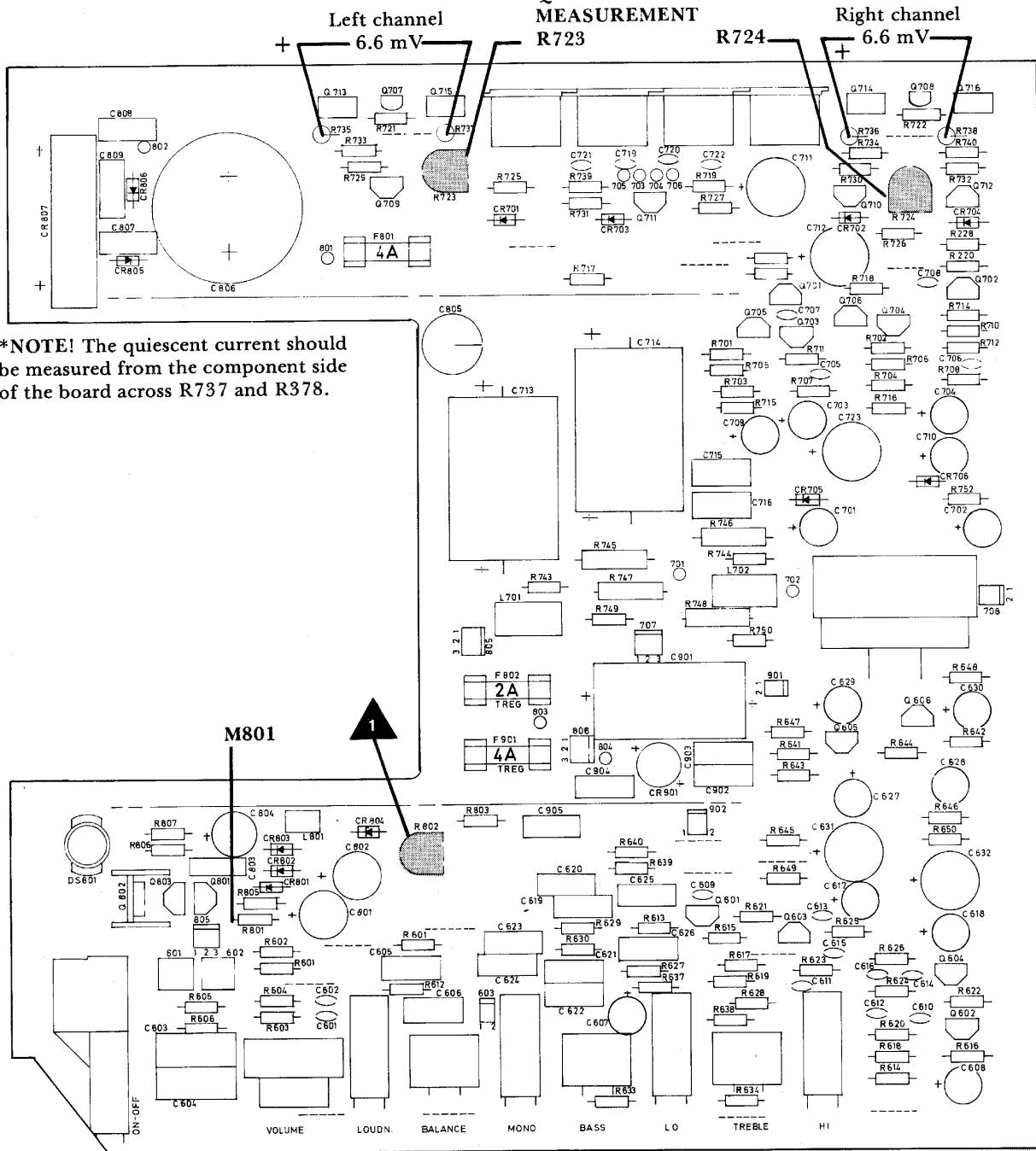
Alternative: Discriminator

Connect a valve voltmeter to the TAPE OUT socket (pin 1). Tune in to get a symmetrical IF curve. Adjust L202 for max. output voltage. **NOTE!** Be precise with this adjustment.

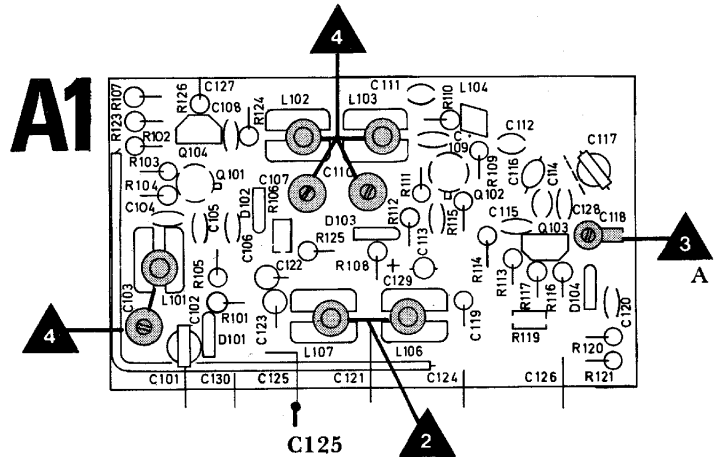
Signal Generator		Oscilloscope	Circuits		Notes
Deviation	Applied (M)	Connected (M)	Adjust	Board No.	
			R802	A3	DC meter applied to M801 (board A3). Adjust to 25 V (± 0.1 V).
$\pm 200 \text{ kHz}$	M1*	M201*	L106, L107	A1	Press the AFC button in. The centre frequency is determined by a ceramic filter. Adjust for max curve height and symmetry (see Fig. 2). FM IF 10.6 to 10.8 MHz.
$\pm 200 \text{ kHz}$	M1*	M201*	R412	A4	Check the position of the scale cursor. The cursor should sit over the first gradation on the scale under "FM". Check 95 MHz and 100 MHz.
			C118	A1	
$\pm 200 \text{ kHz}$	M1*	M201*	R411	A4	*Turn pot. P1 to its extreme clockwise position. Adjust R411 until the cursor sits over the beginning of the "8" in "108".
			R418		Adjust R418 until the curve on the 'scope sits in the middle.
$\pm 200 \text{ kHz}$	M1*	M201*	L101, L102, L103 C103, C107, C110	A1	Adjust for max. curve height (see Fig. 2). Check 95 MHz and 100 MHz.
$\pm 75 \text{ kHz}$	M1* 1 mV/75 ohms	M201*	L202	A2	For the best results the distortion from the sig. generator itself should be less than 0.1%. If not, use the alternative method described above this table. Tune in for a symmetrical IF curve. Dist./voltmeter applied to the TAPE OUT socket (pin 1). Adjust L202 for max. output voltage and min. distortion.
$\pm 75 \text{ kHz}$	M1* 1 mV/75 ohms	M201*	R230	A2	With a signal applied, adjust to get the pointer in the centre of the meter. Short circuit C125 (A1) to earth and check that the pointer stays in the centre.
$\pm 75 \text{ kHz}$	M1*	M201*	R235	A2	Release the AFC button. Adjust R235 for a symmetrical curve on the 'scope. Check that the curve does not change when the AFC button is pushed in and then released.
Un-modulated	50 mV/75 ohms		R222	A2	Adjust to 90% of max. deflection.

A3

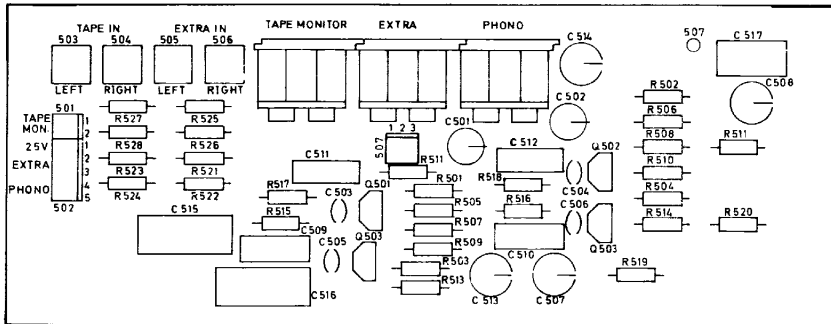
* QUIESCENT CURRENT MEASUREMENT



Seen from the component side

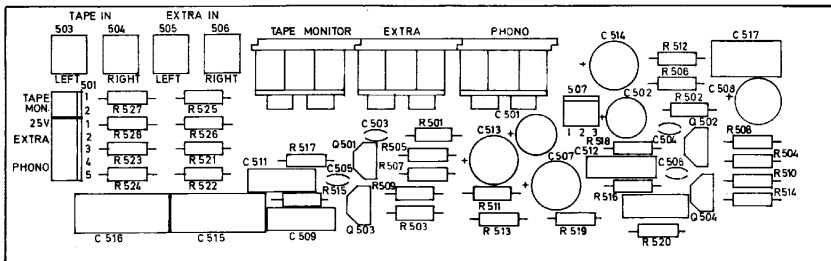


TO APPROX. SERIAL No. 1711000



Seen from the component side

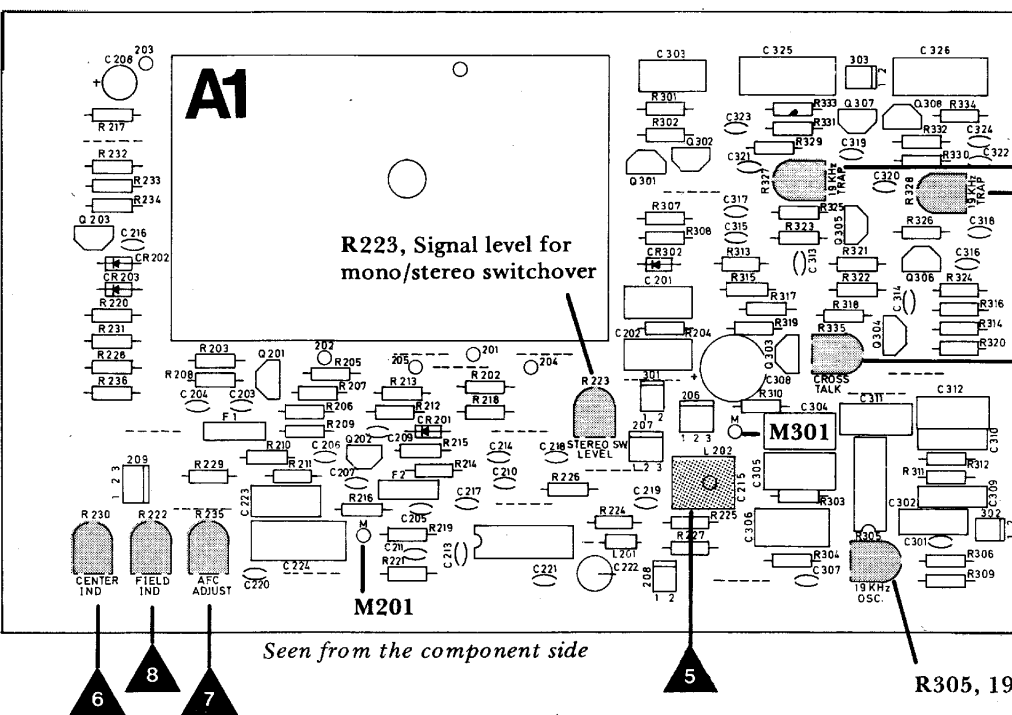
FROM APPROX. SERIAL No. 1711001



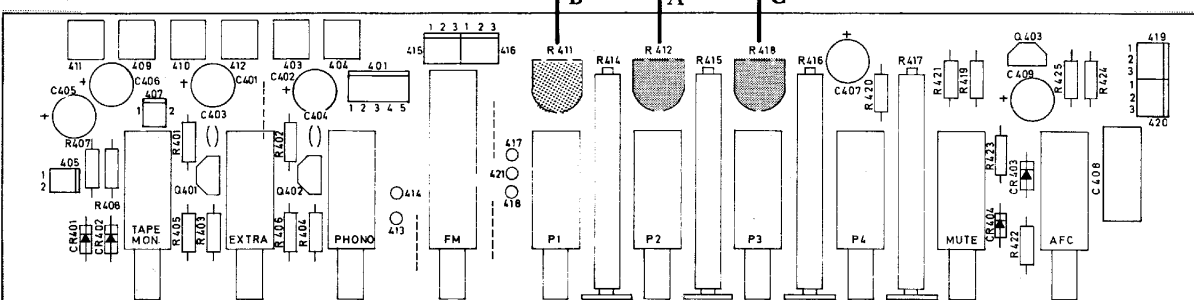
Seen from the component side

Input boards A5 and A5* are electrically identical.

NOTE! When receivers with serial No. 1711001 (approx.) come on the market, the service parts store will only supply board A5* as a service part.



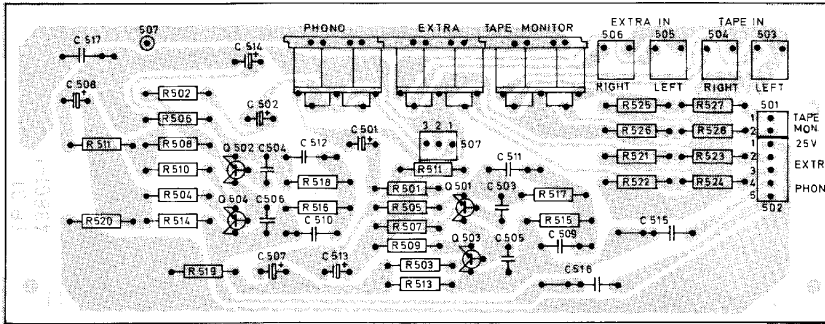
Seen from the component side



Seen from the component side

To approx. serial No. 1711000

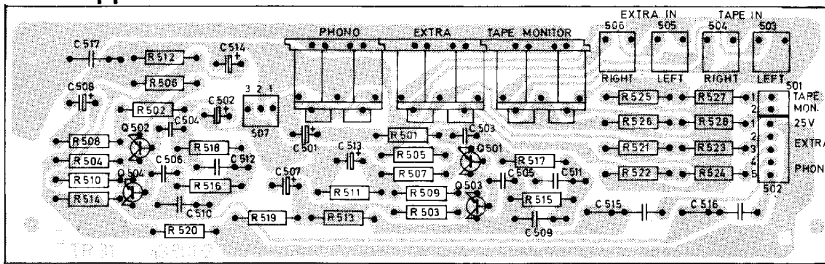
A5



Seen from solder side.

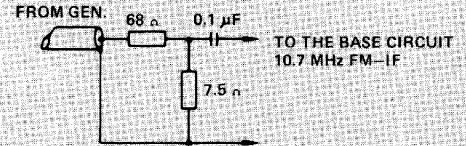
From approx. serial No. 171101

A5*



Seen from solder side.

NOTE: The sensitivity measurements mentioned in the circuit diagram were made with a voltage divider in series with the sig. generator for M2, M3, and M4 (see figure below).



$$10 \text{ V (GENERATOR)} = \text{V (BASE)}$$

AC Voltage divider

NOTE: The leads of the components in the voltage divider must be as short as possible.

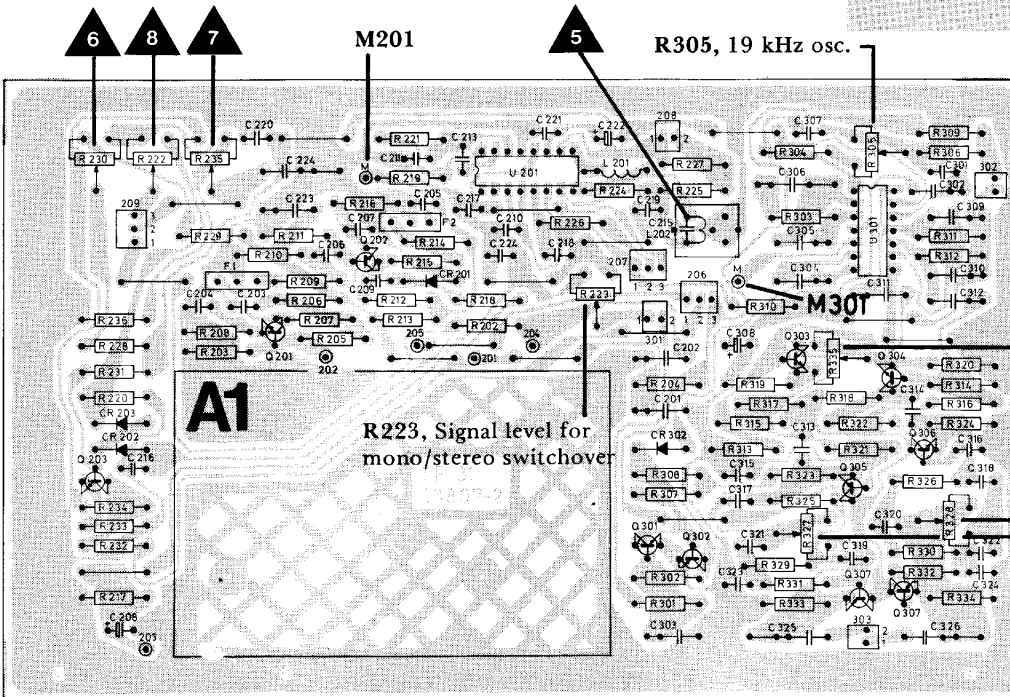
THE MEASUREMENTS ARE MADE AS FOLLOWS:

- *M5: Out max. AF voltage, reduced by 3 dB.
- M1: In 0.5 μV from sig. generator.
- M5: Out max. AF voltage, reduced by 3 dB
- M2: In 90 μV from sig. generator.
- M5: Out max. AF voltage, reduced by 3 dB.
- M3: In 250 μV from sig. generator.
- M5: Out max. AF voltage, reduced by 3 dB.
- M4: In 650 μV from sig. generator.

NOTE: There can be a slight spread on the sensitivity measurement figures between different receivers.

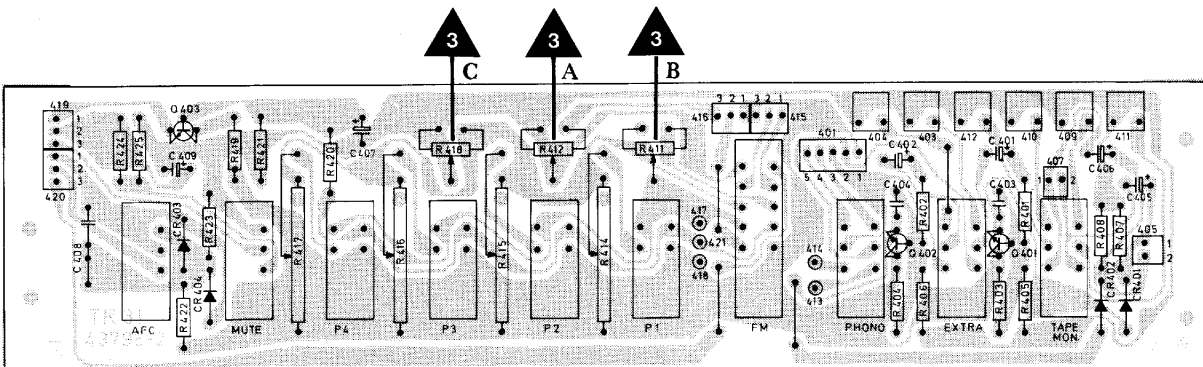
*NOTE! When measuring only the sensitivity between M1 and M5 you can use the TAPE OUT (pin 1 or 4) socket as M5 to avoid dismantling the cabinet.

A2



Seen from solder side.

A4

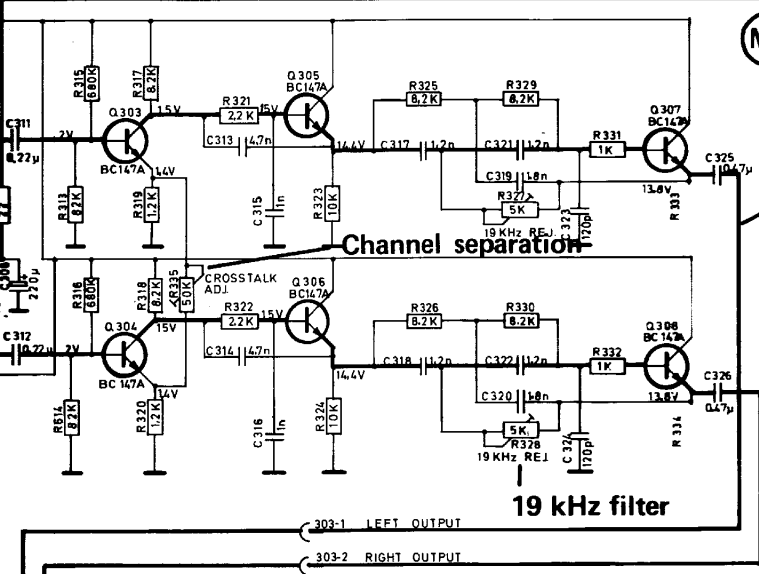
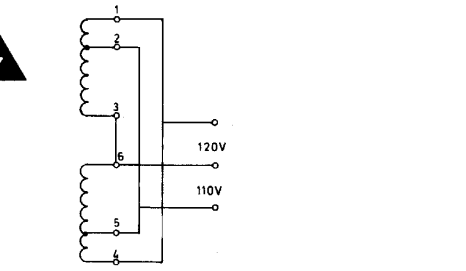
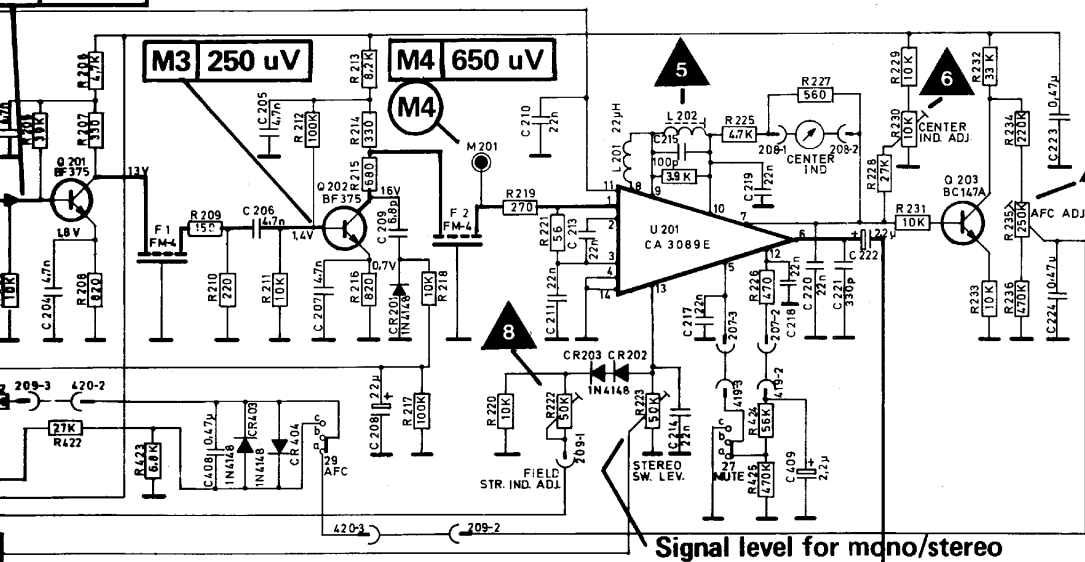


Seen from solder side.

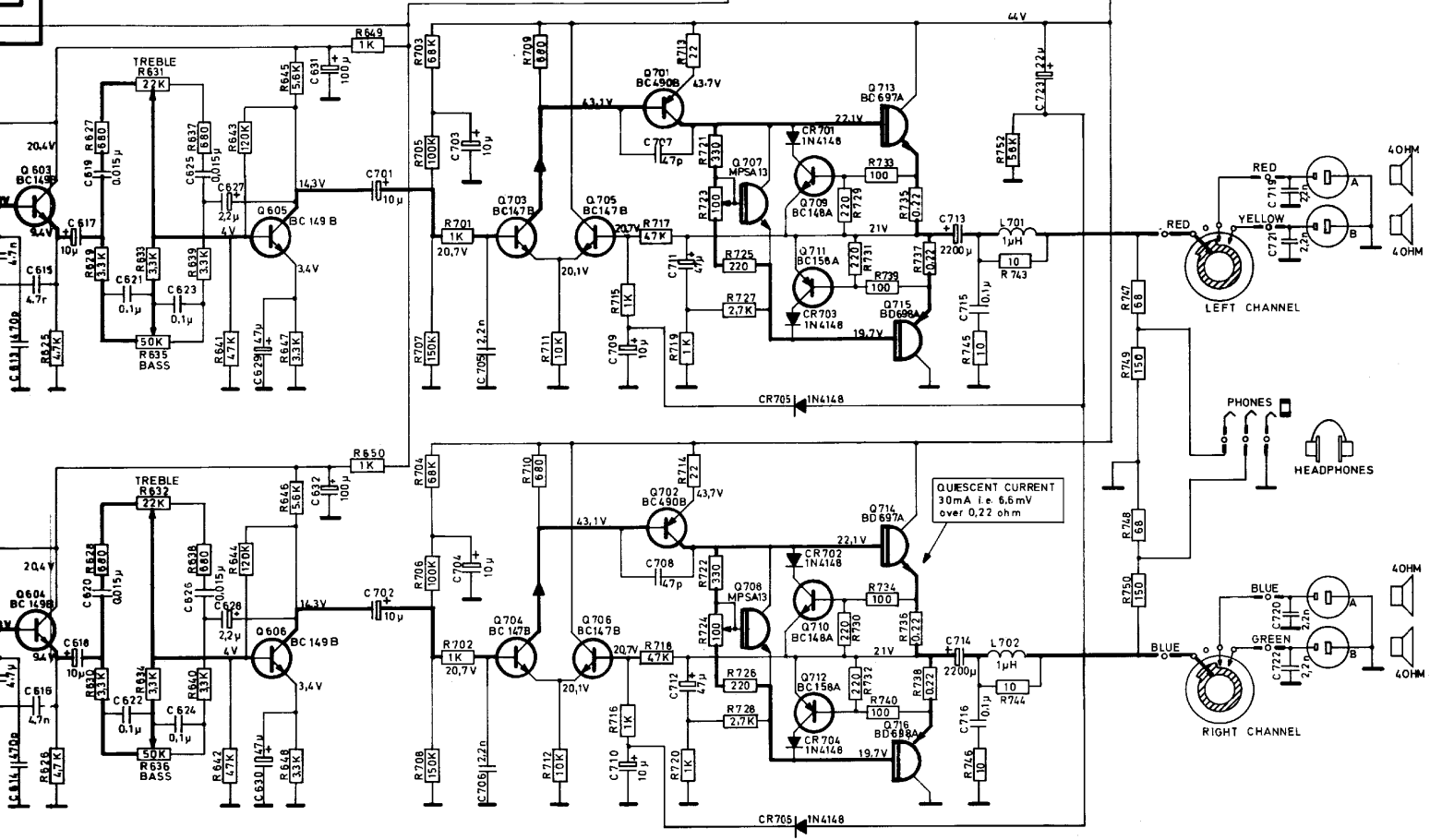
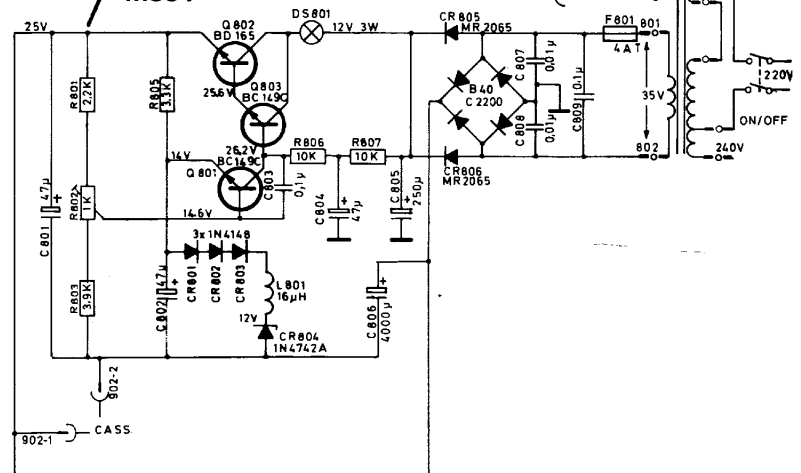
M2 90 uV

M3 250 uV

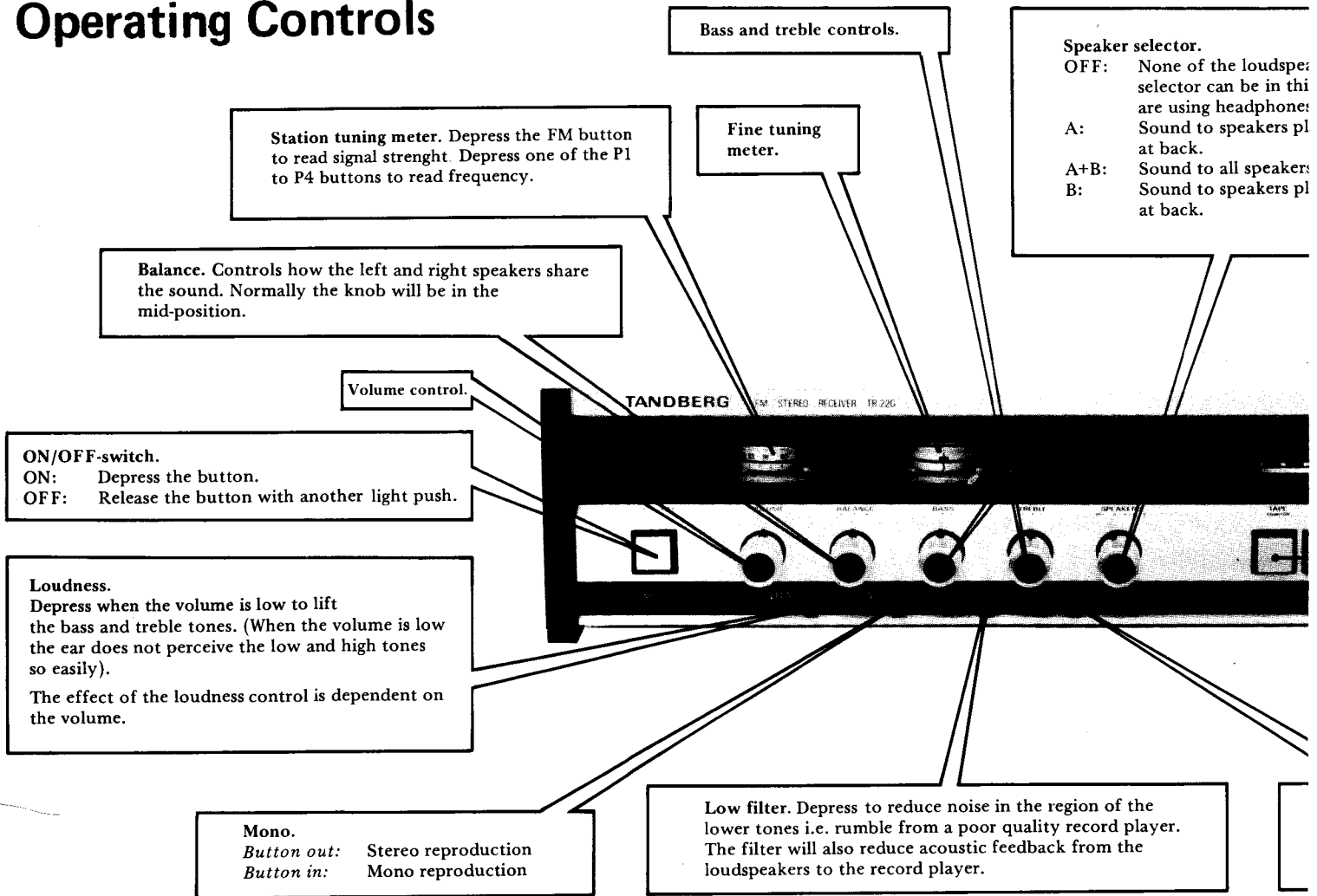
M4 650 uV



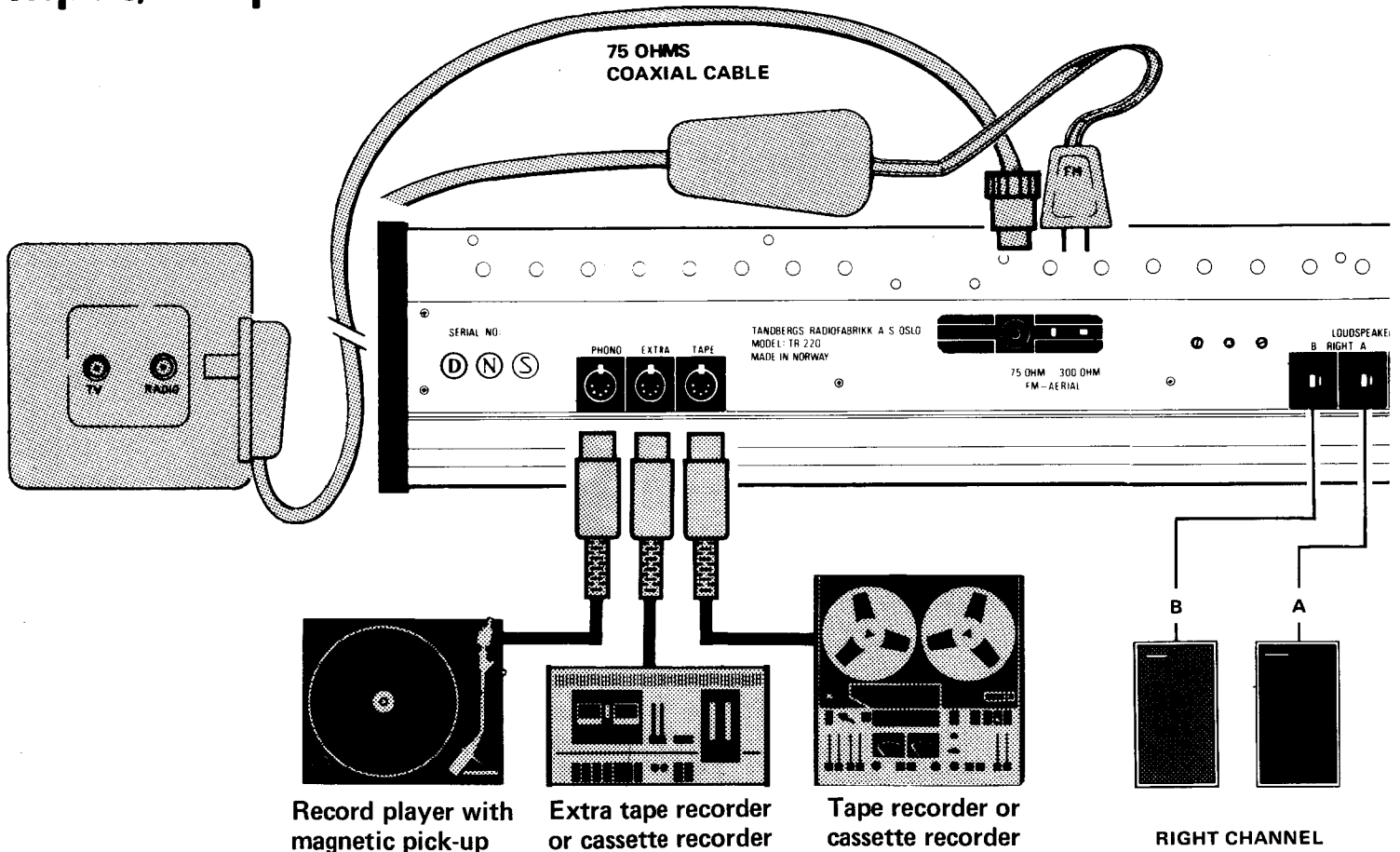
M5 Max.: AF O/P Voltage -3 dB.



Operating Controls



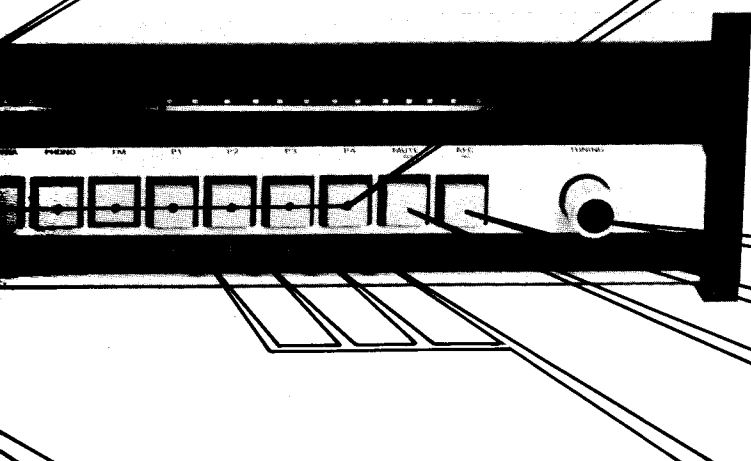
Input/Output Sockets



ers connected (the position when you plugged in to A sockets plugged in to B sockets

FM stereo light
The light will come on when you are receiving a stereo program of sufficient strength.

Program buttons.
TAPE: Depress when playing back a tape on a tape recorder (cassette or reel-to-reel) connected to the TAPE socket at the back of the radio. You can also use this button to check the quality of a program when you are recording
IMPORTANT! The TAPE button must be released by a push when one of the other program buttons is in use. If you forget to do this the radio will be silent.
EXTRA: Depress when playing back a tape on a tape recorder (cassette or reel-to-reel) connected to the EXTRA socket at the back of the radio.
PHONO: Depress when using a record player connected to the PHONO socket at the back of the radio.
FM, P1, P2, P3, P4: Pre-select buttons for FM programs.



Tuning knob for FM.
Automatic frequency control for FM (AFC).
Muting (noise cancellation) for FM.

High filter. Depress to reduce noise in the high tone regions i.e. scratch noise from old records or hiss from a bad tape.

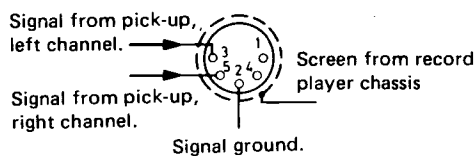
Tuning knobs for pre-tuning stations.

Connecting plugs/Technical data

The plugs must be wired as shown below.

The plugs are seen from this side.

RECORD PLAYER DIN PLUG (PLUGS INTO SOCKET MARKED PHONO)

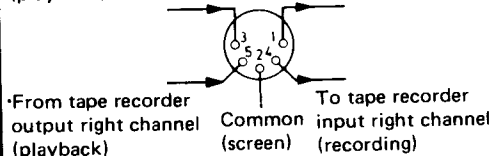


The signal ground and screen must not be wired together.

Contact 1 and 5 are joined together on the socket.

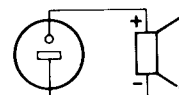
TAPE RECORDER DIN PLUG (PLUGS INTO SOCKET MARKED TAPE OR EXTRA)

From tape recorder output left channel (playback) To tape recorder input left channel (recording)

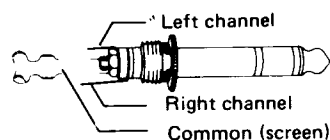


LOUDSPEAKER DIN PLUG

The flat pin on the plug is "earth".



HEADPHONES JACK PLUG (PLUGS INTO SOCKET MARKED PHONES)



INPUTS

	Sensitivity for nominal output power in 4 ohms at 1 kHz	Input impedance
TAPE	130 mV	12-25 k ohms
EXTRA	130 mV	47 k ohms
PHONO	2.5 mV	47 k ohms

TANDBERGS RADIOFABRIKK A/S
Postboks 9, Korsvoll, Oslo 8
Norway