Service Manual

Thorn Studio 500 and 600 series
Models 501 502 503 504 600 601 602 603 604

TECHNICAL SPECIFICATIONS

Power Output
(Measured with 1 kHz sinewave, both channels driven).
501 and 502: 15 or 20 watts per channel.
503, 504, 600, 601, 602, 603, 604: 20 watts per channel.

Frequency Response
30 Hz – 20 kHz ± 1 dB using tape input.

Power Bandwidth
30Hz – 20 kHz unclipped at – 2 dB points

Distortion
Less than 0.1% up to 1 dB below maximum power output.

Sensitivity
(Measured at 1 kHz for 15w output).

Magnetic pickup	4 mV
Tape input	200 mV
Auxiliary input	85 mV

Power Consumption
75 watts from nominal 230V (215-245V) AC 50 Hz. Supply.

Semi-conductor Complement
26 Transistors
10 Diodes

Tone Controls
(Reference 0 dB at 1 kHz)
Bass ± 12 dB at 40 Hz
Treble ± 12 dB at 10 kHz

Contour
(at 30 dB below full volume setting).
+ 9 dB at 40 Hz
+ 7 dB at 10 kHz

Low Filter
– 20 dB at 20 Hz

High Filter
– 10 dB at 10 kHz

Crosstalk
Better than 40 dB at 1 kHz for any input.

Tape Output
100 mV with 4 mV into gram at 1 kHz. Source impedance 100 k

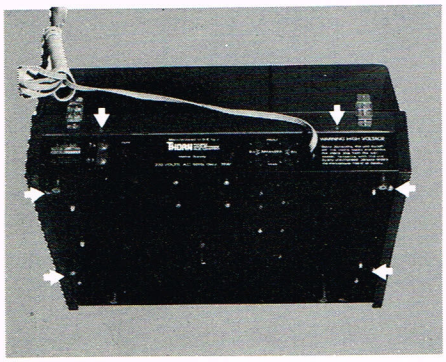
Auxiliary Output
100 mV with 4 mV into gram at 1 kHz. Source impedance 100 k

THORN RADIO INDUSTRIES N.Z. LIMITED A MEMBER OF THE THORN GROUP OF COMPANIES IN 18 NATIONS

SERVICING 500 AND 600 SERIES AMBIOPHONIC UNITS

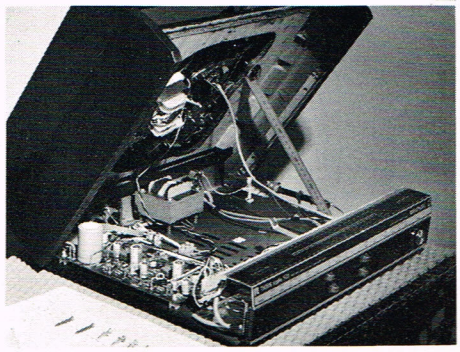
The mechanical dismantling procedures to be followed prior to servicing are as follows. To dismantle the 501, 503, 601 and 603, remove the 6 screws indicated. Do not remove any other screws.
Carefully release the front extrusion whilst sliding the wooden cabinet backwards. Lift the cabinet directly upwards ensuring that the metal chassis does not damage the inside faces of the cabinet – particularly at the front.
Most servicing can be done with the record deck directly supported by a wooden stay and still connected to the amplifier. To remove the deck completely, disconnect the two mains conductors secured in the terminal block on the chassis and the three push on cartridge leads (at the chassis end). The record deck can then be removed. There are slight changes in this procedure for the 502, 504, 602 and 604. The 4 screws (2 in the front rail and two at the back of the unit) are first removed. Slide the chassis forward about ½". Lower the rear of the chassis to clear the turntable mechanism. Draw the chassis almost out of the cabinet. On some units it may also be necessary to lift the rear edge of the turntable during this operation. Disconnect the two mains conductors and three cartridge leads (at the chassis end). Withdraw the chassis completely ensuring that the inside faces of the cabinet are not damaged by the edges of the metal chassis.

Remove the six screws arrowed



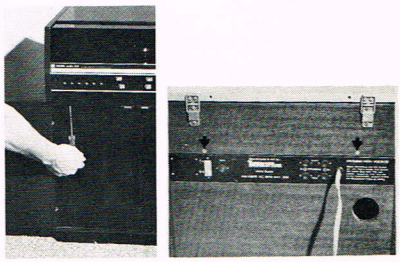
Carefully release the front extrusion (above) whilst sliding the wooden cabinet backwards (below)

Most servicing can be done with the record deck supported by a wooden stay (below). To remove the deck completely disconnect the two mains conductors secured in the terminal block on the chassis and the three push on cartridge leads at the chassis end.



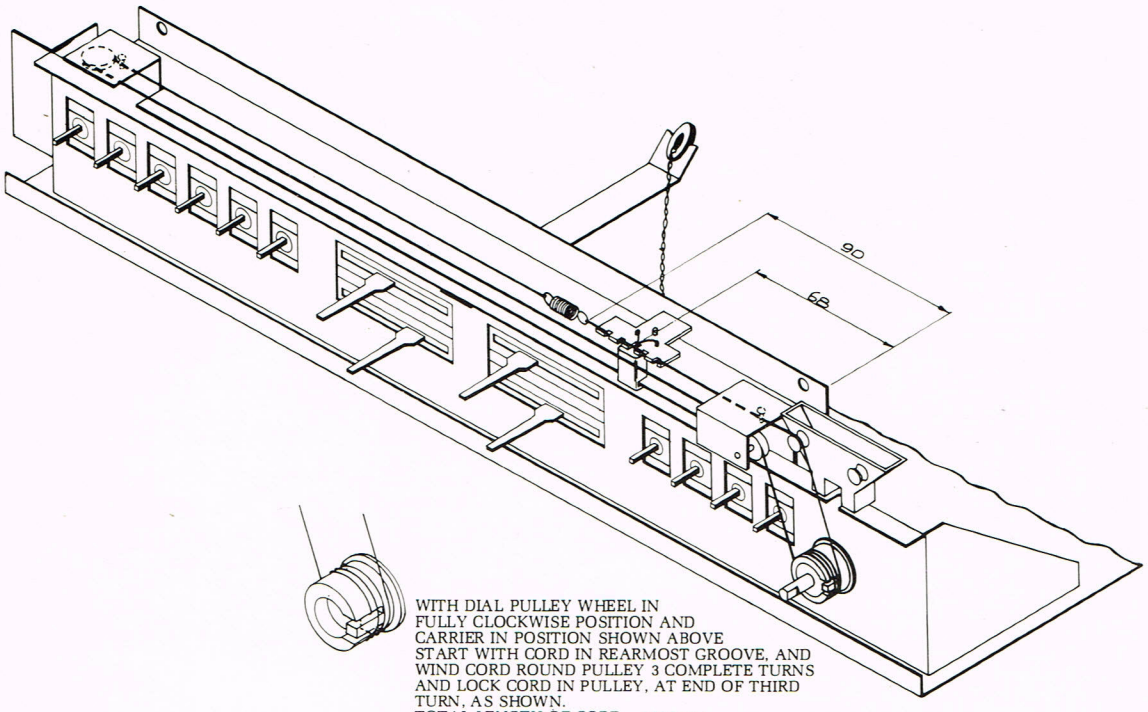
The chassis is then almost withdrawn from the cabinet. The two mains conductors and the three cartridge leads can now be disconnected prior to complete removal of the chassis. Take care that the inside faces of the cabinet are not damaged by the edges of the metal chassis.

502 and 504.
602 and 604. Remove the four screws (arrowed.)



*Slide the chassis forward about ½", and lower the rear of chassis to clear turntable mechanism.**

Model 600 Tuner Amplifier.
To remove the cabinet from this model remove the four screws from the bottom outer edges of the chassis and the two screws from the top back edge of the chassis. Slide the cabinet carefully back so that the dial escutcheon clears the slot in the front of the cabinet and then lift clear.



WITH DIAL PULLEY WHEEL IN FULLY CLOCKWISE POSITION AND CARRIER IN POSITION SHOWN ABOVE START WITH CORD IN REARMOST GROOVE, AND WIND CORD ROUND PULLEY 3 COMPLETE TURNS AND LOCK CORD IN PULLEY, AT END OF THIRD TURN, AS SHOWN.
TOTAL LENGTH OF CORD – 1020 mm

DIAL CORD STRINGING

ADJUSTING QUIESCENT CURRENT

To set the quiescent current remove fuses F401 and F501 and connect a 100 mA meter across the fuse holder.
Link pins A and B on power amplifier printed circuit board to increase the current or Link pins B and C to decrease the current.
The quiescent current should read between 20 and 60 mA under no signal conditions. After adjusting both channels replace the fuses F401 and F501. If the quiescent current cannot be adjusted using the above procedure the amplifier should be checked for a fault. See Service Hints.

TUNER ALIGNMENT

1. **IF Stage**
   Set dial pointer to the datum mark at the right hand end of the scale with the tuning gang fully open (that is fully clockwise).
   See that the aerial coupling coil L1 is in the centre of the rod and seal with wax.
   Connect an AC millivoltmeter between the junction of R114 and R112 and ground.
   Connect an AM, RF signal generator to the aerial terminal and inject a 455 kHz signal. Adjust T101, T102 and T103 for maximum reading on the millivoltmeter.
   Ensure that the output from the signal generator is kept at a level just sufficient to operate the meter. Do not inject too strong a signal and over-load the receiver as a false reading may be obtained.

2. Calibration and sensitivity RF Alignment

Set the signal generator to 600 kHz and tune the receiver to this frequency on the dial.

(a) Adjust T100 (oscillator coil) and L2 (aerial coil) for maximum meter reading at this frequency.

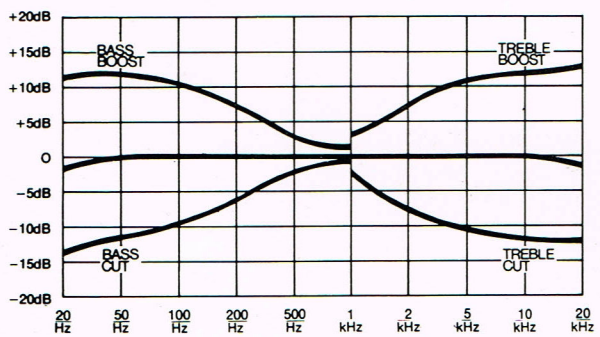
(b) Tune the signal generator and receiver to 1400 kHz and adjust C106 (oscillator trimmer) and C102 (aerial trimmer) for maximum meter reading.
Repeat A and B until no further improvement can be obtained.
Seal aerial coil L2 to rod with wax.

SERVICE HINTS

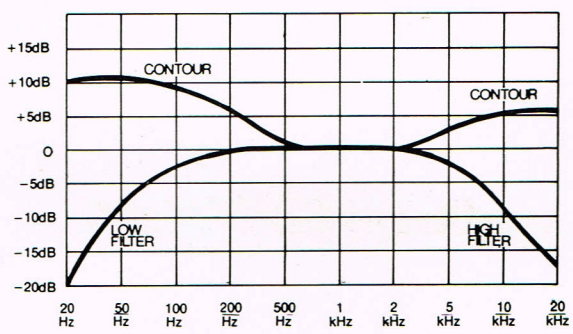
Power Amplifier board

1. By removing fuses F401 and F501 from the two power amplifiers the power supply can be checked off load.
If the fuse of one of the power amplifiers has blown it may be removed and replaced with a 100 Ω 10 watt resistor soldered across the blown fuse. By using this resistor the current to the amplifier is limited. The quiescent current can be ascertained by measuring the voltage drop across the 100 resistor and using the conversion factor IV=10mA.

If the current drawn by the amplifier under no signal conditions is excessive then the fault is probably leakage in the output pair or driver transistors. The symmetry of the two amplifiers allows easy checking for leakage with minimum removal of devices. Also check for the correct operation of the biasing transistors Q403 and Q503.
To break the DC feedback loop:-
Disconnect speaker 4/2 for RH channel and unsolder the base lead of Q402. If the amplifier is now switched on, the centre rail should be between 42V and 44V. If it is not then Q402 is probably leaking.
If Q402 is not leaking connect a 4k7 resistor between the collector and emitter and under this condition the centre rail should be approximately 22V. The quiescent current should also be correct. This then allows Q402, Q404, Q405, Q406, and Q407 to be checked for correct operation.
When the centre rail is at the correct voltage (22V) the operation of Q401 can be checked by connecting a voltmeter across R408 and adjusting the preset pot R402. When fully clockwise the voltage across R408 is zero and when fully anti-clockwise approximately 2v.



Tone Control Range



Filter & Contour Responses

Description of complementary power output stage.

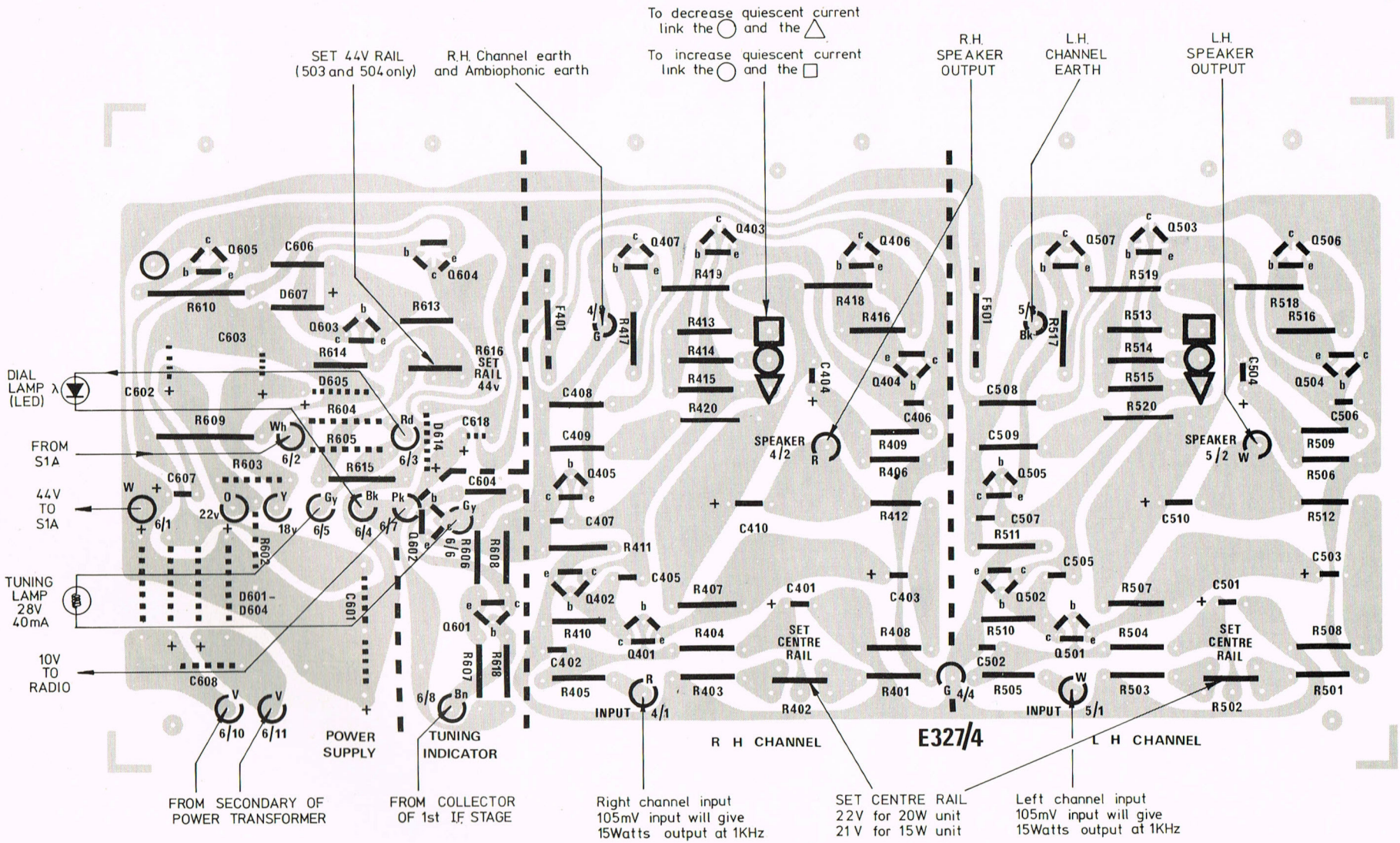
The collector of transistor Q402 is directly coupled to the bases of a pair of complementary transistors Q404 and Q405 acting as drivers for the push-pull class B output pair, Q406 and Q407. Direct coupling is used between the drivers and their corresponding output transistors. The driver Q404 is effectively in the common collector mode and the Q405 also in the common collector mode. Since the drive transistors Q404 and Q405 comprise an NPN and a PNP, they conduct on alternate half-cycles of signal, thereby driving the output transistors likewise. There is no voltage gain, but power gain occurs due to impedance changes, being the emitter-follower action of Q404/Q406 and Q405/Q407 alternately. In the absence of signals, a steady current flows through Q404/Q406 and Q405/Q407 and their emitter load resistors. A steady current also flows in the driver base resistors R406/R409 making Q406 base potential slightly positive with respect to its emitter. Current through Q402 causes Q405 to be slightly negative with respect to the centre rail. Thus Q404 and Q405 have a small forward bias which aids in the removal of cross-over distortion in the output.

Transistor Q403 provides bias stabilisation for the driver stage output. This is achieved by having the Ic of Q402 flow through Q403 and making biasing of Q406 and Q407 less dependent on the Ic of Q402. Effective thermal tracking is achieved by placing Q403 on the same heat sink as the output devices (Q406 and Q407). Q403 acts as a low impedance path for both signal and changes in d.c.

D.C. coupling is used in one feed-back loop to set up the d.c. working point of the output transistors. This feed-back loop also keeps the distortion level low. In this regard, the potential at the junction of R418/R419 is critical. If it is upset, severe clipping will result in one half-cycle only at high signal levels. The junction of R418/R419 is returned via R407 to the emitter of Q401. In addition to acting as an amplifier, Q401 compares the voltage at the junction of R418/R419 with that at its emitter. For example, if the mid-point starts to rise, Q401 emitter is driven more positive. Q401 collector voltage rises causing a corresponding rise at Q402 base. Q402 collector falls, lowering the base voltages on Q404 and Q405. As Q404 is an NPN transistor it will conduct less, with the PNP transistor Q405 conducting more. This causes the centre rail voltage to fall counter-acting the original drift upwards. Pre-set control R402 in a voltage divider chain between the +44V rail and earth, sets the centre-rail (working point).
R420 and C409 in parallel across the ouput provide the necessary high frequency load to the ouput transistors required due to the rising impedance of the loud speaker at high frequencies. They also prevent destruction of Q406 and Q407 if speakers are disconnected.

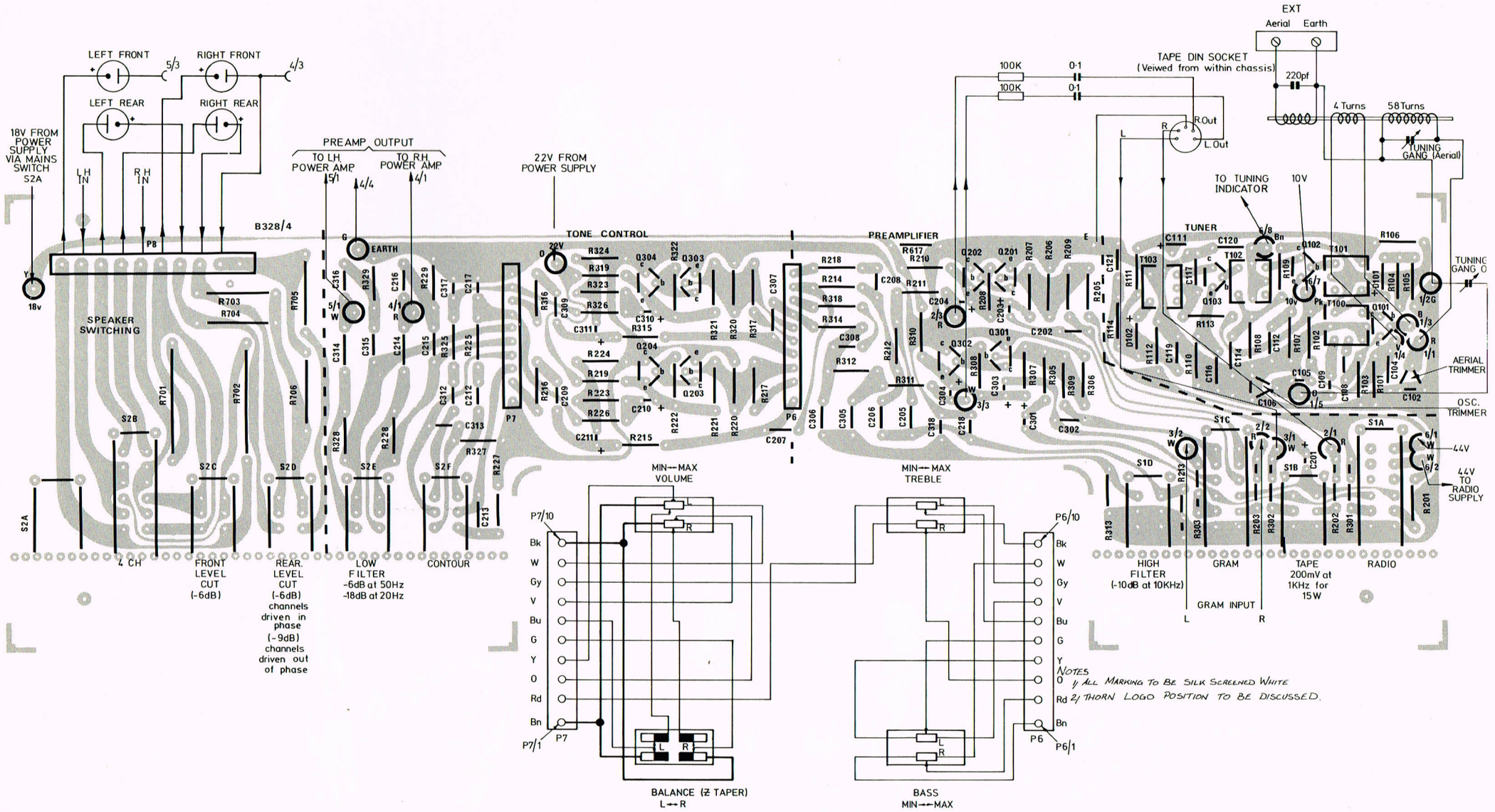
R412 and R408 form an A.C. feed-back loop.
C402 acts as an RF bypass, as RF can present a substantial signal level at this point.
C405 is the high frequency roll-off capacitor, ensuring high frequency stability.
C406 and C407 determine the maximum slewing rate possible at the output and hence the upper frequency of the power band width.
R411 prevents high loop currents flowing in the ground line to which A class stages Q401 and Q402 are connected.
C404 acts as a bootstrapping capacitor and also filter for line hum.

POWER AMPLIFIER BOARD (Veiwed from component side)



If ordering spares please quote:
(a) Parts reference number from above diagram
(b) Model number, e.g. Thorn 504
(c) Serial number of unit.

PRE-AMPLIFIER BOARD (Viewed from component side)



NOTE: R205 and R305 is 6.8 k Ω to suit magnetic cartridges with an inductance of 400 to 1100 mH (670 mH nominal). If a cartridge with lower inductance i.e. 180 to 400 mH (280 mH nominal) is used the value of R205 and R305 should be changed to 1k

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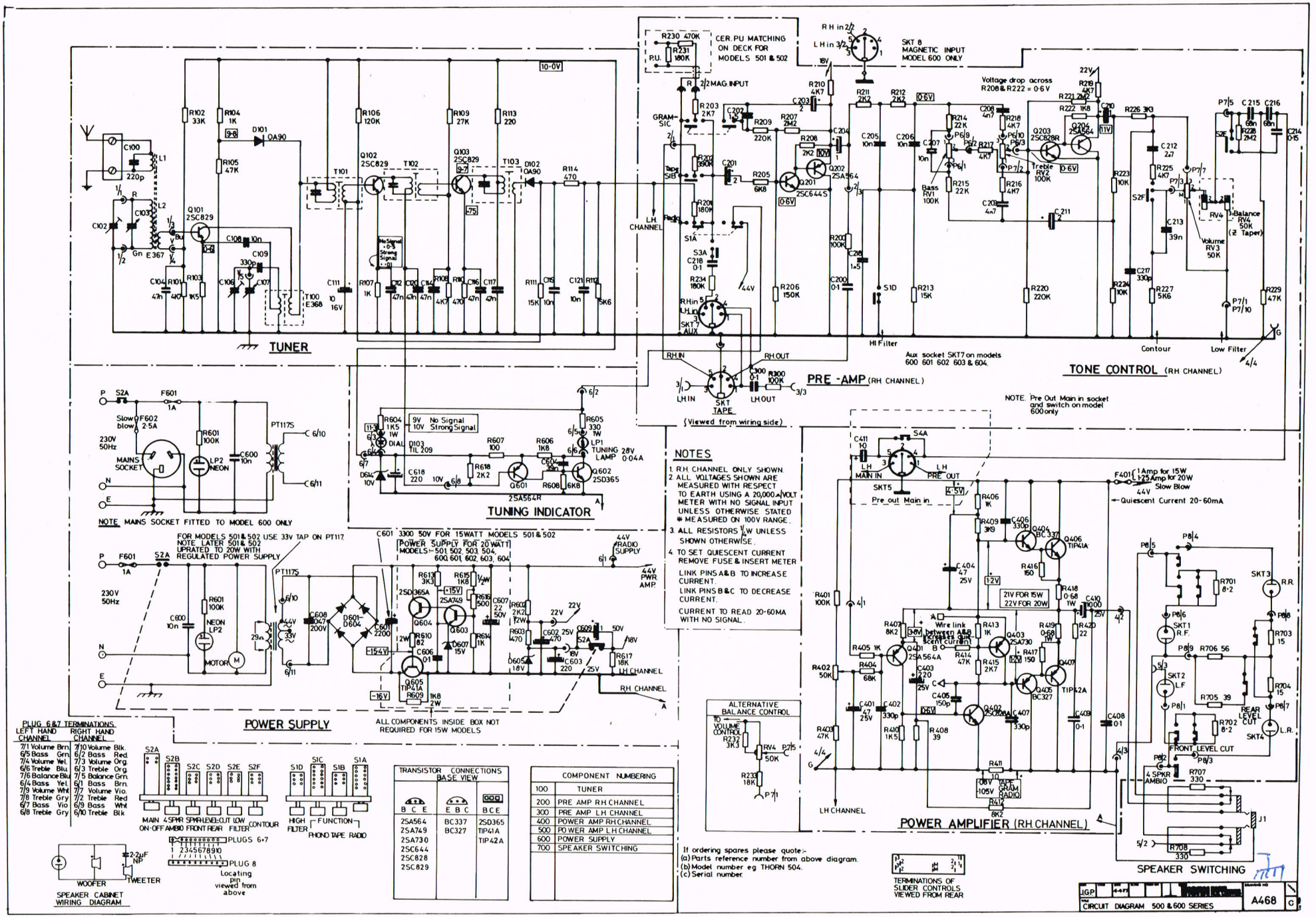
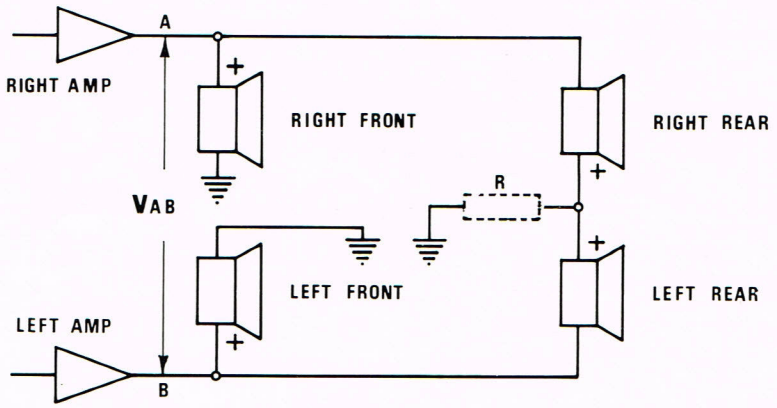
(a) Parts reference number from above diagram
(b) Model number, e.g. Thorn 504
(c) Serial number of unit.


TUNER
PRE-AMP (RH CHANNEL)
TONE CONTROL (RH CHANNEL)
TUNING INDICATOR
POWER SUPPLY
POWER AMPLIFIER (RH CHANNEL)
SPEAKER SWITCHING
NOTES
1. R.H. CHANNEL ONLY SHOWN.
2. ALL VOLTAGES SHOWN ARE MEASURED WITH RESPECT TO EARTH USING A 20,000Ω/VOLT METER WITH NO SIGNAL INPUT UNLESS OTHERWISE STATED * MEASURED ON 100V RANGE.
3. ALL RESISTORS ½W UNLESS SHOWN OTHERWISE.
4. TO SET QUIESCENT CURRENT REMOVE FUSE & INSERT METER
LINK PINS A&B TO INCREASE CURRENT.
LINK PINS B&C TO DECREASE CURRENT.
CURRENT TO READ 20-60MA WITH NO SIGNAL.
NOTE MAINS SOCKET FITTED TO MODEL 600 ONLY
ALL COMPONENTS INSIDE BOX NOT REQUIRED FOR 15W MODELS
PLUG 6&7 TERMINATIONS
LEFT HAND CHANNEL
RIGHT HAND CHANNEL
7/1 Volume Brn. 7/10 Volume Blk.
6/5 Bass Grn. 6/2 Bass Red.
7/4 Volume Yel. 7/3 Volume Org.
6/6 Treble Blu. 6/3 Treble Org.
7/6 Balance Blu. 7/5 Balance Grn.
6/4 Bass Yel. 6/1 Bass Brn.
7/9 Volume Wht 7/7 Volume Vio.
7/8 Treble Gry 7/2 Treble Red
6/7 Bass Vio 6/9 Bass Wht
6/8 Treble Gry 6/10 Treble Blk
SPEAKER CABINET WIRING DIAGRAM
WOOFER
TWEETER
TRANSISTOR CONNECTIONS BASE VIEW
2SA564 2SA749 2SA730 2SC644 2SC828 2SC829
BC337 BC327
2SD365 TIP41A TIP42A
COMPONENT NUMBERING
100 TUNER
200 PRE AMP R.H CHANNEL
300 PRE AMP L.H CHANNEL
400 POWER AMP R.H CHANNEL
500 POWER AMP L.H CHANNEL
600 POWER SUPPLY
700 SPEAKER SWITCHING
If ordering spares please quote:-
(a) Parts reference number from above diagram.
(b) Model number eg THORN 504.
(c) Serial number.
TERMINATIONS OF SLIDER CONTROLS VIEWED FROM REAR
ALTERNATIVE BALANCE CONTROL
CIRCUIT DIAGRAM 500 & 600 SERIES
A468

AMBIOPHONIC DESCRIPTION



BASIC AMBIOPHONIC CIRCUIT
FIG. 1

It will be seen in Fig. 1 that the rear speakers are connected in a bridge configuration across the outputs of the right and left amplifiers. If the right and left amplifiers are driven in phase then the voltage at "A" will always equal the voltage at "B" i.e. VAB =O and no output will appear in the rear speakers. Fig. 2.

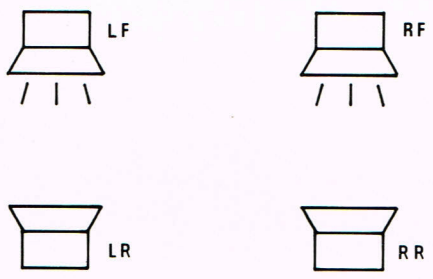
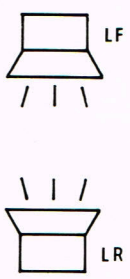
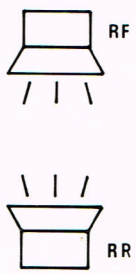


FIG 2 MONO OR STEREO



(Left – Right)



(Left – Right)
AMBIOPHONIC

FIG 3

If there is a difference between the left and right channels this appears in the rear speakers (Fig. 3) and gives an ambiance to the music. All music is a combination of these two situations. The resistor R (Fig. 1) is added to obtain separation between the rear speakers and to give some output to the rear channels when a mono signal source is used.

Manufactured in New Zealand by
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Specifications may be subject to change without notice.

PN 935

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