## Linear Amplifier Unit Type A200

INTRODUCTION

This is a self contained linear amplifier designed to be used with an existing AM or FM radiotelephone as an 'add-on' unit. Operating from r.f. inputs in the range 2% to 15W it delivers 8 to 50W according to input. Frequency bands currently available are 148–174MHz, 132–156MHz, 105–108MHz and 68–88MHz.

Automatic (r.f.) switching, a temperature cut-out and comprehensive polarity protection are incorporated in the circuitry. Due to the wideband characteristic of the amplifier, re-tuning entails only a few simple operations.

A separate 13,6V d.c. circuit, fused at 12A in the live lead is required to power the amplifier. The third core of the 3-core power cable together with the optional lead assembly is used only when the amplifier power supply has to be switched. If the radiotelephone to be used with the amplifier is one of the Pye Olympic VHF series, then the amplifier can be switched by the radiotelephone OFF/ON switch.

## SUMMARY OF DATA

<table>
<thead>
<tr>
<th>Switching</th>
<th>2% of mean frequency of associated radiotelephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>AM or FM</td>
</tr>
<tr>
<td>Frequency</td>
<td>148–174 MHz, 132–156 kHz, 105–108 MHz, 68–88 MHz</td>
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<tr>
<td>Bands</td>
<td>A Band, B Band, M Band, E Band</td>
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<tr>
<td>Power Supply</td>
<td>13,6V d.c. Polarity Protection</td>
</tr>
<tr>
<td>Current Consumption</td>
<td>5/S/By</td>
</tr>
<tr>
<td></td>
<td>Transmit</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2. With switching</td>
<td>Radiotelephone lead</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td>ON (S/By)</td>
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<tr>
<td></td>
<td>Transmit</td>
</tr>
<tr>
<td></td>
<td>Fusing</td>
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<tr>
<td></td>
<td>Output Power</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Option</td>
</tr>
<tr>
<td>Dimensions</td>
<td>207 mm wide x 52 mm high x (over major projections.) (8,15 in. x 2,05 in. x 5,25 in.)</td>
</tr>
<tr>
<td>Weight</td>
<td>1,60 kg. (3 lbs. 9 oz.)</td>
</tr>
<tr>
<td>Casing</td>
<td>Die-cast, finned, weatherproof</td>
</tr>
</tbody>
</table>

## Construction

The unit consists of a motherboard and a heavy duty, die-cast shell with cooling fins.

All the circuitry is accommodated on the motherboard, logically grouped in the three main functions of Switching, Amplifier, and Antenna Filter. Printed wire board matching sections are used in the Amplifier.

## INSTALLATION

### General

The amplifier is connected in the radiotelephone antenna feeder and the 12V power supply is taken from the vehicle battery by independent wiring fused at 12A. Power switching is required only if used in hazardous environments.

### Notes

1. Instructions for installing the radiotelephone are shown in the appropriate Service Manual.
2. This unit is contained in a weatherproof diecasting. If possible, it should be mounted in a clean, dry location.
3. Fixing screw dispositions and sizes are shown in the Set of Bagged Items (AT85737).
4. Permanent vehicle wiring consists of two 2,5 mm conductors, normally red and black. The lengths of these conductors (not supplied) depend upon the installation. All other lead lengths are shown on the installation diagrams.
5. Before finalising an installation, it is recommended that its feasibility proved by running the cables. If drilling is necessary, the holes should be grommeted.

### Equipment Required — See ‘Set of Bagged Items’ in Parts List.

Note In this procedure the starred operations are necessary only when optional power switching is required.

### Procedure

*(a)* Remove top cover of radiotelephone (see Removal of Transceiver Cover). Replace blind grommet with open grommet attached to Lead Assy. (AT12739). Feed Berg sockets end of 3-core lead through the grommet and connect to the Mother Board as shown:—

- Yellow Green to pin 18 AM pin 27 FM
- Brown to pin 19 AM pin 4 FM
- Blue to pin 20 AM pin 5 FM

Replace top cover. Refit radiotelephone to cradle.

*(b)* Fit Radiotelephone Installation (12V) as detailed in the appropriate instructions.

*(c)* Locate 3-way Terminal Block A within 500 mm of cable outlet mentioned at *(a)* and connect 3-core cable to it.

*(d)* Site the amplifier on the route of the antenna feeder. Fix mounting plate and secure amplifier to it, SKB (N type socket) nearest to the antenna.

*(e)* Cut the antenna feeder to suit the amplifier location. Terminate the free end of the co-axial cable still attached to the antenna with the N type plug and terminate the free end of that attached to the radiotelephone with a TNC type plug. Connect plugs to the appropriate amplifier sockets.

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PYE TELECOMMUNICATIONS LTD., CAMBRIDGE ENGLAND.
Installation Diagram

(f) Fix 3-way Terminal Block B within 500 mm run of amplifier and connect the amplifier 3-core cable to it.

(g) Fix Fuseholder 2 close to the battery. Connect vehicle permanent wiring from battery to Terminal Block B routing only the live lead through Fuseholder 2.

(h) Link the yellow green cores of Terminal Blocks A and B with a single wire to complete the switching circuit.

(i) Insert 12A fuses in Fuseholder 2. (One in circuit, one spare.)

(k) Carry out Change of Frequency Procedure. (See Alignment and Test Procedure.)

Removal of Transceiver Cover

(a) Set OFF/ON switch to ON (upward) position.

(b) Remove the front panel cover by releasing the retaining pin through the access hole on the right hand edge of the cover. Swing front panel cover to the left and remove.

(c) At each end of the frame top edge, release 2 x M4 screws. Lift top cover to the rear to disengage the interlocking rear edges and remove.

PARTS LIST

R.F. Linear Amplifier Type A200
consisting of:—
Amplifier Assy. AT04697
Amplifier Case AT27647/—
Cover BT15621
Socket (input) SKA FS43952
Socket (output) SKB FS43701
Pillar BT04110
Gland BT17678
Gland Nut BT19206
Gland Washer (2 off) BT29217
Washer Gasket BT29218
Sealing Washer BT29219
'O' Ring FS15107
Unit Label BT18466
Instruction Label BT18937
3-core 2.5mm Cable (1m.) FC07326

Screws:—
S.T. No.4 x 3/16 in. 2/Label QJ08239/A
Pozi Pan M4 x 20mm 4/Cover QJ11921/A
Pan Taptitre M3 x 10mm 9/F.W.B. QJ11552/A
Washer M4 4/Cover to case OA15007/A

Set of Bagged Items AT85737

consisting of:—
Mounting Plate AT12641
Terminal Block (A) 3-way FT16450

*Lead Assy.
(Includes Terminal Block (B) and Grommet)
Fuseholder FH02837
Fuse 12A (2 off) FF00826

Screws:—
Pozi Pan M5 x 30mm 2/Mtg. Plate A200 QJ11937/A
Slot Pan ST No. 6 x ½ in. 2/Fuseholder QW41212/A
Slot Pan ST No. 10 x ½ in. 4/Mtg. Plate QO41208/A
Washer M5 2/Mtg. Plate QA15009/A
Plug (PLA) FP13741
Plug (PLB) FP13715

*Optional accessory required only for switching

AMPLIFIER ASSY. (AT27647/—)

CAPACITORS

| C1 | 1p | ±0p1 |
| C2 | 220n | ±10% |
| C3 | 4n7 | ±10% |
| C4 | 4n7 | ±10% |
| C5 | 4n7 | ±10% |
| C6 | 10u | 25V |
| C7 | 2–18p Variable | 132–174 250V |
| C8 | 10–80p Variable | 132–174 |
| C9 | 4n7 | ±10% |
| C10 | 1n | ±20% |

PN00023
PN99508
PN99604
PN99604
PN99604
PN99604
PS00513
PV07670
PV07664
PV07664
PV07654
PV05408
PV08359
PV08359
PN99604
PV13051
WORKSHOP CHECKS

1. 'Off' Current Test

**NOTE.** The following tests require the arrangement shown in Fig. 4 which includes a single pole single throw switch for Off/On switching.

(a) Set OFF/ON switch to OFF.
(b) Set multimeter to 100 mA range and connect it in the A200 positive supply lead.
(c) Check that the reading is between 2 mA and 12 mA.

2. Voltage Tests

(a) Set the multimeter to 25V range and connect the negative to the Mother Board at pin 8.
(b) Connect the positive lead to the following points and check that the readings are as shown:—
   - Mother Board pin 6 (Input Voltage) 13.6V
   - TR5 collector 12.6V to 13.2V
   - C27 positive 6.0V to 13.2V
   - D5 positive (cathode) 9.4V to 10.6V
(c) Set the OFF/ON switch to ON.
(d) Connect the positive lead to the following points and check that the readings are as shown:—
   - Mother Board pin 6 13.6V
   - C27 positive 13.6V

3. Quiescent Current Check

(a) Connect as in Fig. 4, OFF/ON switch set to OFF.
(b) Connect Mother Board pin 6 (13V) to TR1 base via a 10k ohm resistor to operate the switching chain.
(c) With the multimeter set to 10V range, measure the voltage across R12. Check reading is approx. 0.9V at 25°C.
(d) Set multimeter to 1A range and connect it in the A200 positive supply lead. Check reading is between 200 mA and 800 mA.

4. Temperature Cut-out Check

(a) Tape thermometer so that the bulb is close to TH1.
(b) Using the hot air blower, gradually heat TH1 and check that relay RLB switches off at between 80°C and 100°C. Note switch-off temperature.
(c) Allow TH1 to cool and note that RLB switches on again at about 5°C below switch-off temperature.

CHANGE OF FREQUENCY PROCEDURE — AM and FM

**WARNING**

If this procedure is carried out in a vehicle, the engine should be run at fast idling speed.

(a) Remove A200 cover.
(b) Connect power meter between antenna and A200 output socket SKB.
(c) Adjust power supply for 13.6V.
(d) A, B & M band — Tune C8 & C17 for maximum output
   E Band — Tune C8 & C17 & C34 for maximum output
(e) AM only — Set C7 for 25W output.
   FM only — Check output is 50W.
(f) Disconnect power meter. Replace A200 cover.

**NOTE** If it is required to check the driver output with the A200 connected to it, disconnect the A200 power supply and carry out the above procedure. The power output should be:

AM 5.5 W  
FM 13 W
ALIGNMENT AND TEST PROCEDURE

Test Equipment Required.

Power Supply  P.S.U. 13.8V at 20A
Radiotelephone  AM — Olympic M201
                  FM — Olympic M202
Audio Oscillator  1 kHz  Marconi TF2102 and TF2162
Modulation Meter  Up to 90% 68 to 174 MHz  Marconi TF2303
Oscilloscope  General Purpose  Telequipment S43
R.F. Power Meter  50 ohms 100W  Bird Termaline 6154
T-attenuator  -40 db  Marconi Signal
              (-50 db at 25 MHz  Sniffer
              -24 db at 500 MHz)
Multimeter  20,000 ohms/volt  Pye TM1 or Avo Model 8.

Trimming Tools
Hot Air Blower (or other means of heating)
Thermometer  25°C — 100°C
10k ohm Resistor

Notes
1. Ensure that the amplifier frequency coverage is compatible with that of the Radiotelephone.
2. The Radiotelephone should be keyed only for the time necessary to make an adjustment and observe the reading.
3. If the amplifier under test is to be used in an installation providing for OFF/ON switching, then the links between pins 2 and 3 and 4 and 5 of the P.W.B. must be removed and a switch wired between pins 7 and 8.

Preliminary Operations
1. Remove the A200 cover and check that the resistance between the negative power lead and the chassis is greater than 1 megohm.
2. Check that the Radiotelephone output is correct according to its specification. Typically 5 to 6 watts for AM and 12 to 15W for FM.
3. Select the Radiotelephone channel tuned to the highest frequency.

Alignment
NOTE The power outputs quoted in this Alignment Procedure are typical for Radiotelephones delivering 6W (AM) and 15W (FM). The Amplifier will function on smaller inputs (minimum 2%W AM or FM) but its output will be proportionately less.

1. Connect Radiotelephone and Amplifier as in Fig. 1. Set PSU to 13.6V.
2. Set C7 to minimum capacitance. (Maximum Gain).
3. Key the Radiotelephone and adjust C17, C8 (and C34 for E Band equipments) in sequence for maximum output
   AM  25W minimum
   FM  50W minimum
4. If the maximum output exceeds 25W on AM, adjust C7 to reduce it to 25W. On FM, C7 remains at minimum capacitance.
5. Check that the d.c. input current does not exceed 8A (AM) or 13A (FM) and that it falls to less than 20mA (AM and FM) when the Radiotelephone Key is lifted.
6. Reduce the output voltage of the PSU to 11V. Connect output meter directly to the Radiotelephone antenna socket and check its output. Increase PSU voltage output, if necessary to obtain meter reading of 2%W.
7. Key the Radiotelephone and check that the Amplifier relay RLB operates and that the minimum power output is 8W.
CIRCUIT DESCRIPTION

General
Essentially, this unit consists of an r.f. wideband amplifier, TR8 and TR9 controlled by a switching chain, TR1 to TR5, and provided with a temperature sensing circuit TR6 and TR7. Operation of the switching chain is initiated by the r.f. input; the sensing circuit will inhibit the switching chain if the ambient temperature rises to between 80°C and 100°C.

The unit is connected to the 13.6V d.c. supply at all times and in the 'off' condition, a small standing current maintains C27 in a state of charge. This is necessary to avoid the overloading of the start relay (RLA) contacts which would occur if C27 was charged from 0V when that relay is energised as a result of the r.f. input.

OFF/ON Switching.
If it is required to use the amplifier where stringent safety precautions are required, the start relay RLA should be operated by the associated radiotelephone OFF/ON switch via the interconnecting lead provided. If this optional switching arrangement is to be used then the links connecting pins 2 and 3 and pins 4 and 5 of the printed wire board must be removed. For normal applications, these links must be in place.

Switching Circuit, TR1 to TR5.
(a) Without OFF/ON switching.
When an r.f. signal of suitable level is applied to the input at C1, a d.c. potential, derived from D2 C2 R2, is applied to the base of TR1 to switch on the chain TR1 to TR5. The start relay RLA/1 is energised by the fall at TR4 collector and contact pair A1 close to short out R25. Relay RLB/2 is energised by the rise at TR5 emitter and this potential is used to apply bias to the bases of TR8 and TR9. Contact pair B1 connects the applied r.f. from the associated radiotelephone and contact pair B3 connects the amplified and filtered output to the antenna. The d.c. feed back from TR3 collector ensures that the power level at which the amplifier switches off is lower than that required to switch on thus preventing relay chatter.

(b) With OFF/ON switching (in the ON position.)
As in (a) but start relay RLA will be energised so long as the associated radiotelephone OFF/ON switch is set to ON.

Temperature Sensing Circuit TR6 and TR7
At normal ambient temperatures, the base potential of TR6, as defined by the voltage divider network R14 R12 and TH1, holds off TR6 (p.n.p.). If the ambient temperature rises to between 80°C and 100°C, its effect on TH1 causes TR6 base potential to fall to cut-on point and TR7 collector to fall to ground. The base of TR1 is therefore grounded and the amplifier switching inhibited.

Amplifier Stages
The amplifier consists of two paralleled Class AB amplifier stages, TR8 and TR9. Standing bias to their bases is derived from TR5 emitter and limited by the diodes D11 and D12. R.F. from the associated radiotelephone transmitter is fed via SKA and relay contact B1 to the impedance matching filter C8, L2, C12, L3, C14, C13.

The amplified outputs appearing at the collectors of TR8 and TR9 are parallel fed to the impedance matching filter L7, C15, L8, C17. The final output is filtered by the elliptic function low pass filter C18 to C24, L10, L11, L12 and passed via the relay contact B2 and the output socket SK2 to the antenna.

The gain of the amplifier is controlled by C7 in conjunction with R20.
<table>
<thead>
<tr>
<th>PARTS LIST (cont.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMPLIFIER ASSY. (AT27647/-) (Cont.)</td>
</tr>
<tr>
<td>CAPACITORS (cont.)</td>
</tr>
<tr>
<td>C11 1n ±20% 123–174 350V PP13051</td>
</tr>
<tr>
<td>C12 200p ±20% 123–174 350V PP10024</td>
</tr>
<tr>
<td>C13 200p ±20% 105–108 350V PP10016</td>
</tr>
<tr>
<td>C14 200p ±20% 148–174 350V PP10024</td>
</tr>
<tr>
<td>C15 200p ±20% 105–108 350V PP10016</td>
</tr>
<tr>
<td>C16 1n ±20% 105–108 350V PP13051</td>
</tr>
<tr>
<td>C18 6p8 ±5% 123–156 70p PP9537</td>
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<tr>
<td>C19 25p ±4 105–108 750p RV09359</td>
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<td>C20 22p ±5% 105–108 750p PP9537</td>
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<tr>
<td>C21 3p9 ±5% 123–174 750p PP9537</td>
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<td>C22 25p ±5% 123–174 750p PP9537</td>
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<tr>
<td>C24 15p ±5% 105–108 750p PP9537</td>
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<td>C25 1n ±20% 350V PP13051</td>
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<td>C26 220n ±10% 100p PP9508</td>
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<td>C27 1500u ±10% 100p PP9508</td>
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<td>C28 4n7 ±10% 100p PP9508</td>
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<td>C30 2n ±20% 123–174 70p PP9537</td>
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<td>C34 8p ±20% 123–174 70p PP9537</td>
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<td>C35 150p ±20% 148–174 63V PP9582</td>
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<td>C36 4n7 ±10% 123–174 100p PP9508</td>
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<td>R25 680 ±5% PP10016</td>
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<td>R26 12 ±5% 148–174 PP10016</td>
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<tr>
<td>R27 D10 Diode 1N914 PP09359</td>
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<td>R28 D1 Diode G.P. (S) PP9537</td>
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<td>R3 0.1 ±5% 123–174 68p PP9537</td>
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<td>Matching Section P.W.B. No 2 105–108 ET18831</td>
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<tr>
<td>RELAYS</td>
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<tr>
<td>RLA Relay (Board Mounted) FR03972</td>
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<tr>
<td>RLB Relay (Bracket Mounted) FR03993</td>
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</table>

**MECHANICAL ITEMS**

Printed Wire Board Assy Sub Printed Wire Board (68–88 MHz only) AT27647
Heatsink BT36649
Relay Bracket BT11130
Screen BT26541
Screws, Pozi Pan Head— M2 x 6 mm 2/Relay Bkt. Q11945/A
M4 x 16 mm 3/Mother Board to Case Q11920/A
Eyelet 3/Mother Board QA1604/A
Full Nut M2.5 2/Relay Bkt. QA1604/A
Washer, large M2.5 2/Relay Bkt. QA1604/A
Insulating Bead 2/TH1 FJ00007
Medallion 200309/09

**Complete Assy. Part No.**

148–174 MHz AT27647/01
132–156 MHz AT27647/04
105–108 MHz AT27647/02
68–88 MHz AT27647/03