OUTPUT CONNECTIONS

The output of the amplifier is connected to Zobel Network R12A/C8A. This network presents a defined load impedance to the output stage at high frequencies to ensure stability. Either of R12A or C8A being faulty will result in the amplifier oscillating at high frequency, which may also be evidenced by mains "hum" and/or distortion at the output. This signal is fed via output choke L1A which isolates any load capacitance from the amplifier feedback to ensure stability.

The output is then fed through output relay RLY1A and on to the rear panel output connectors.

PROTECTION SYSTEM

The protection system is based around IC1, a TL074 quad op-amp.

The temperature of the heatsink is monitored by TH1, an LM35DZ temperature sensor integrated circuit producing 10mV / ^{0}C. The temperature signal is then multiplied by 10 by one op-amp (pins 8,9,10) & R16,R17. The output (pin 8) is fed directly to pins 6 & 13 serving as a temperature dependent (0.1V / ^{0}C) reference for two comparator circuits: one (pins 5, 6, 7) controls the relays and the other (pins 12, 13, 14) controls the fan speed.

The Fan can run at two speeds, the changeover happening at about 55^{0}C. R9 and ZD2 produce a reference voltage of 9.1V at the cathode of ZD2. This is divided by R18 & R19 to give about 5.5V at pin 12, the noninverting input, which is compared with the temperature signal at pin13, the inverting input.

1) Temperature signal is less than 5.5V: the output of the op-amp will be high (+24V), turning Q1 off and therefore Q2 off. The fan speed is controlled by R21 which forces approximately half speed.
2) Temperature signal is more than 5.5V: the output of the op-amp will be low (-5.6V), turning Q1 on and therefore Q2 on. R21 is now effectively shorted out by Q2 and the fan runs at full speed.

At turn-on, C16 will charge through R9 and R10 towards the 9.1V reference (ZD2). The voltage is fed to the non-inverting input (pin 5) of op-amp at pins 5,6,7 configured as a comparator with hysterisis (D9 and R11). The reference for the comparator is set by the temperature reference which is about 2.5V at room temperature (25^{0}C), When the voltage across C16 exceeds the temperature reference, the op-amp output will swing high (+24V) and turn Q3 on via current limiting resistor R13. When Q3 is on, it pulls current through the coils of RLY1 (softstart) and RLY1A, RLY1B on the output board. This also means that the collector of Q3 will swing low (close to 0V) effectively shorting out R15 and LED2 to turn LED2 (Protect, Yellow) off.

The output of each channel is fed via resistors R2 (Channel A) and R3 (Channel B) into C9. The combination of C9 with R2 and R3 forms a low-pass filter, and so at signal frequencies C9 will have no voltage across it. In the event of a DC offset appearing at the output; however, C9 will charge to a DC voltage. This voltage is limited to 3 diode drops (about 2V) by D3-D7 which also define a window comparator with R5, R6 and op-amp at pins 1,2,3. Nothing happens while the voltage across C9 is between about +1 and -1. If the voltage across C9 exceeds this then the output (Pin 1) of the comparator will swing low (-5.6V). This will discharge C16 (see previous paragraph) through D8 and thus open the RLY1, RLY1A, RLY1B and turn LED2 (Protect) on.

The network consisting of D1, D11, D12, R1, R4, C10 and C11 provides the rapid turn-off feature of the

protection system. R1 is connected via D11, D12 to the +/- 18V AC secondaries of the mains transformer. The union of D11 and D12 will have a negative going full-wave rectified version of the secondary voltage. This is averaged by C11 to a negative DC voltage, reverse biasing D2 and, therefore, has no effect on the protection system. Should the power be turned off, C11 will be rapidly charged towards the +24 rail via R4 (and D1, C10 which hold up the voltage while the supply discharges), forward biasing D2, resulting in the same action as for a DC fault in the amplifier.

POWER SUPPLY

The amplifier operates from nominal (off-load) +/- 65V (XLS 202), +/- 80V (XLS 402) or +/- 93V (XLS 602) supplies, with an auxiliary +/- 24V supply for the protection circuitry and the optional AMPSAP card. To generate the supplies, the mains transformer has one secondary with a center tap, two 18Vac taps and the usual end taps. The end tap outputs are rectified by BR1 and smoothed by C1,C3,C5,C7 to get +HT and C2,C4,C6,C8 to get -HT (note: not all of C1-C8 are installed on XLS 402 and XLS 202). The +/- 18Vac taps are rectified by D13-D16 and smoothed by C17 to get +24Vdc and C18 to get -24Vdc.

SOFT START SYSTEM

AC mains enters the board on fastons (Red, Black, Blue) and leaves for the transformer by way of connectors Main1 (220/240) and Main2 (110/120). The soft-start components include R22, PTC1, PTC2 and the contacts of RLY1. At switch-on, R22 limits surge current and PTC1, PTC2 protect R22 from overheating. After a few seconds, the protection circuit energizes RLY1 coil, closing RLY1 contacts which short out R22, PTC1, PTC2, allowing full power operation.

FAULT-FINDING HINTS

When powering-up a unit after repair, undetected faults may result in further damage when the unit is retested. To minimize the risk of damage, please follow this procedure:

1) If the unit is set to 220V/110V, lift the 'RED' faston and connect a 100W mains lamp between the RED wire and the 'RED' board mounted faston. If the unit is set to 240V/120V, lift the 'BLACK' faston and connect a 100W mains lamp between the black wire and the 'BLACK' board mounted faston.
2) Power up in the normal way. The lamp will initially glow brightly, and then dim down as the internal capacitances become charged. The unit may then be functionally tested with no load connected. Once the unit is operating correctly, the mains supply may be applied to the unit as normal, and the unit may be load tested.

In the event that the lamp does not dim down, this indicates that a major fault still exists, which must be remedied before full mains may be applied.

LOCATING MAJOR FAULTS

Major faults resulting in high current draw (as indicated by the series lamp refusing to dim) can be isolated as follows:

1) The secondaries of the transformer can be unplugged from the board. Should the fault persist, this indicates the fault to be with the mains transformer. However, this may not be the only fault.
2) It is now necessary to unplug and remove the board.
3) A faulty channel may be isolated to only a few possibilities

- A faulty power supply capacitor
- A faulty output device

- Over-bias of the output stage: If the lightbulb is glowing brightly then a reading of more than + 2V across the Vbe multiplier (Q8A, R22A, R21A) indicates excessive current draw in the output stage.

XLS PROCEDURE TEST SPEC

Load switch set to 4 W position unless stated otherwise.
Test carried out on all versions unless stated otherwise.

1. Protected power-up.

2. Short circuit test. OUTSC.TST LOAD SWITCH S/C.
I/P -10dBu @ 10kHz, 1kHz and 100Hz.
O/P between 0dBu and -40dBu -- unit survives.

3. Sensitivity test. GAIN1.TST.
I/P 0dBu @ 10kHz, 1kHz and 100Hz.
O/P 0dBr +/- 0.5dB ref. 31.5dBu.
XLS 602TX O/P 0dBr +/- 0.5dB ref. 33.4dBu.

4. THD test. THDA.TST.

XLS 602 I/P +4dBu @ 20kHz, 10kHz, 1kHz and 100Hz.
O/P 0dBr +/- 0.5dB ref. 35.5dBu and
< 0.1, 0.06, 0.02, 0.02 % THD respectively.

XLS 602TX I/P +2.25dBu @ 20kHz, 10kHz, 1kHz and 100Hz.
O/P 0dBr +/- 0.5dB ref. 35.5dBu and
< 0.1, 0.06, 0.02, 0.02 % THD respectively.

XLS 402 &TX +3dBu @ 20kHz, 10kHz, 1kHz and 100Hz.
O/P 0dBr +/- 0.5dB ref. 34.5dBu and
< 0.1, 0.06, 0.02, 0.02 % THD respectively.

XLS 202 I/P +0dBu @ 20kHz, 10kHz, 1kHz and 100Hz.
O/P 0dBr +/- 0.5dB ref. 31.5dBu and
< 0.1, 0.06, 0.02, 0.02% THD respectively.

5. THD + capacitor load test. THDAC.TST LOAD SWITCH 4uF.

XLS 602 I/P +4dBu @ 10kHz, 3kHz and 1kHz.
O/P <0.2, 0.07, 0.07 % THD respectively.

XLS 602TX I/P +2.25dBu @ 10kHz, 3kHz and 1kHz.
O/P <0.2, 0.07, 0.07 % THD respectively.

XLS 402&TX I/P +3dBu @ 10kHz, 3kHz and 1kHz.
O/P <0.2, 0.07, 0.07 % THD respectively.

XLS 202	I/P +0dBu @ 10kHz, 3kHz and 1kHz. O/P <0.2, 0.07, 0.07 % THD respectively.
6. Noise test.	NOISEA.TST. O/P <-90dBr ref. 31.5dBu.
XLS 602TX	O/P @ 50Hz and 100Hz <-68dBu.
XLS 402TX	O/P @ 50Hz and 100Hz <-68dBu.
7. Volume Control.	LIMA.TST.
XLS 602	I/P +6dBu O/P ref. 37.5dBu.
XLS 602TX	I/P +3dBu O/P ref. 34.5dBu
XLS 402&TX	I/P +5dBu O/P ref. 36.5dBu.
XLS 202	I/P +2dBu O/P ref. 33.5dBu. CW 0dBr +/- 0.5dB. CCW -90dBu.
8. Limiter test.	LIMIT.TST (JMLIMIT.TST on XLS 202). I/P increase from 0dBu to +10dBu O/P ref. 31.5dBu.
XLS 602	O/P limit to +5dBr +/- 1dB.
XLS 402	O/P limit to +3dBr +/- 1dB.
XLS 202	O/P limit to 0dBr +/- 1dB.
9. 15Hz filter test.	FILT15.TST I/P -10dBu sweep 10Hz to 100Hz O/P ref. 21.5dBu. O/P Smooth curve with -3dBr @ 15Hz +/- 1dB.
10. 30Hz filter test.	FILT30.TST I/P -10dBu sweep 10Hz to 100Hz O/P ref. 21.5dBu. O/P Smooth curve with -3dBr @ 30Hz +/- 1dB.
11. CMRR.	CMRR.TST I/P 0dBu @ 10kHz, 3kHz, 1kHz. O/P <-30dBr @ 10kHz ref. 31.5dBu. O/P <-40dBr @ 3kHz & 1kHz ref. 31.5dBu.

Please note:
For the XLS 402TX version, the test limits are the same as that for the standard XLS 402 except for the noise test where an extra parameter is included as per the XLS 602TX.