

The Model 20 OTL Amplifier

(Discontinued)



Instructions for the Model 20 OTL (Output Transformer-Less) Stereo Amplifier

SPECIFICATIONS

Frequency Response: 10 Hz. to 50 Khz.

Power Output: 75 Watts per channel with a 4 Ohm load, both channels driven.

100 Watts per channel with a 8 Ohm load, both channels driven.

Input Sensitivity: 1.75 VAC input = full power output. (both channels)

Input impedance: 500K Ohms (each channel)

Polarity: Does not invert polarity.

Power Requirements: 110-125 VAC, 60 Hz.

Power Consumption with a 120 VAC line: With no signal: 525 Watts.

At full power with both channels driven: 1400

Watts

Configuration: Dual Mono except for the driver stage B+ power transformer and rectifier which are common to both channels. (Filtering is separate for each channel)

CIRCUIT DESCRIPTION

The basic circuitry is based on a modified version of an Output Transformer-Less (OTL) amplifier which was first described by D.P. Dickie, Jr. and A. Macovski in an article for the June 1954 issue of Audio magazine. Performance is enhanced by the use of modern components and a dual Mono configuration for this Stereo amplifier. Each of the two channels has its own 625 VA power transformer, bias transformer and filtering circuits. The 275 volt B+ transformer and bridge rectifier circuit for the driver stages is common to both channels; however, each has its own filter circuit.

Unlike the original circuit that used 3ea. 6082 vacuum tubes in parallel for the output stage this design uses 10ea. 6AS7 / 6080 vacuum tubes in parallel for each channel. (In 1954, it was a single Mono amplifier. The 6082 is the same as the 6080 / 6AS7 except for filament voltage) This allows for the use of less overall feedback and the elimination of an additional 12AT7 driver stage. It also results in a considerable increase in power and the ability to drive a 4 Ohm load. The 6.3 VAC filaments (heaters) of the 20 ea. 6AS7 / 6080 output tubes are connected in series directly across the 120 VAC line to save the weight and cost of another large transformer. The driver tube filaments are powered by DC from a small switching supply mounted on the power supply circuit board. High quality, conservatively rated components are used throughout for long life. Output stage balance is easily adjusted with a single potentiometer for each channel, bias tracks the line voltage so

is optimum for any voltage within the normal range. Three LED's are provided to make the balance adjustment easy and obviate the need for a test meter. Provision is made for taking the feedback directly at the speaker, thus including the speaker wire within the feedback loop. This is optional and configuring it either way is easily done. The high, 500K, input impedance allows this amplifier to be used with most any vacuum tube or solid-state preamplifier.

Speaker and amplifier protection is provided by 10 fuses. If any one of the 10 fuses should blow, the amplifier is instantly shut down and the blown fuse is indicated by one of 10 red LED's. An 11th. LED will also light indicating a shutdown condition.

The amplifier is housed in a powder-coated, aluminum case. The powder coating provides a highly durable, chip resistant finish.

The amplifier is relay controlled and may be switched on and off from a preamp accessory outlet for convenience. A non-polarized plug-in cord is provided for this purpose. A standard IEC plug-in cord is provided for the amplifiers main power source. A standard, single, grounded outlet fused for a maximum of 3 Amps. (350 Watts) is provided at the rear of the amplifier. This may be used for the control cord if preamp on/off switching is not used. It may also power a small accessory such as a CD player.

OPERATION

1. Because of the power demands from the line when operating at high power, it is suggested that a dedicated 15 or 20 Amp AC outlet be used to power this amplifier. If this is not practical, the outlet used should have little or no other load connected to it.
2. The input, DC balance controls and speaker outputs are left and right as you face the front of the amplifier. The feedback input is the terminal strip between the left and right speaker terminals.
3. Speaker wiring should be of at least 16 AWG for runs up to about 20 Ft. and 14 AWG for longer runs. For ease of connection, the use of spade-type solderless lugs is suggested.
4. Feedback jumpers must be in place as shown in the pictorial diagram. If it is desired to include the speaker wiring within the feedback loop, a third wire must be run from the left and right feedback terminals to the left and right speaker + terminals as shown in the pictorial diagram. In this configuration the feedback jumper wires are not used. This third (feedback) wire need not be of heavy gauge.
5. Refer to the pictorial diagram. Connect the main IEC power cord to the AC source. The amplifier may be switched on and off from a switched preamplifier outlet by using the non-polarized control cord supplied. When this configuration is used, the OTL 20 power switch is left in the "ON / AUTO" position. If this is not desired, connect the control cord to the OTL 20 aux. outlet or other AC source. In this configuration, the OTL 20 is turned on and off with the "OFF-ON / AUTO" switch.

5. Output DC balance adjustment. This should be checked occasionally and after any replacement of the 6AS7 / 6080's. Refer to the pictorial diagram, there are three LED indicators and a three-position switch provided to aid in this adjustment. When the switch is in it's center position, the green LED will be on as a pilot lamp.

Procedure: A. Disconnect both inputs or insure that there is no signal input and connect a 4 or 8 Ohm resistor or speaker load to each channel.

B. Turn on the amplifier and allow a 10-20 minute warm up time.
(Or check after amplifier has been in operation)

C. Move the three position switch to the left or right position, if the DC balance is correct, the green LED will remain lighted.

D. If the right, red LED is on, turn the corresponding right or left balance control slowly to the left (ccw) until the green LED lights.
If the left, red LED is on, turn the right or left corresponding balance control slowly to the right (cw) until the green LED lights.

NOTE: The balance controls have a limited but sufficient range of adjustment, inability to achieve a balance may indicate a defective output tube in that channel. (See troubleshooting)

E. A DMM (Digital Multi-Meter) may also be used for this adjustment. Set the DMM to the 20 Volt DC scale and connect it to the left or right channel outputs. Adjust as in D. (above) for 0 VDC.

NOTE: There may be some +/- drift and a small offset is not significant.

F. The three position selector switch may remain in it's left or right position without harm but the flickering LED's in normal operation may prove to be annoying.

SAFETY and TROUBLESHOOTING

1. Fuses: There are 10, 3AG style, 1/4", 250 Volt, glass fuses that protect the amplifier and the connected speakers. If any one of the fuses should blow, there is associated circuitry that will quickly shut down the amplifier. There are 10 red LED's that will indicate the fuse that has blown; an 11th. red LED indicates the shutdown condition. Referring to the pictorial diagram, the eleven LED's are visible through the top of the power supply cover. Six of the fuses are mounted, along with the LED's, on the protection (Fuse) circuit board and are identified as follows:

XF1, Left Channel + Rail (3 Amp fast acting, Littlefuse type 312)

XF2, Right Channel + Rail (3 Amp fast acting, Littlefuse type 312)

XF3, Left Channel - Rail (3 Amp fast acting, Littlefuse type 312)

XF4, Right Channel - Rail (3 Amp fast acting, Little fuse type 312)

XF5, Left Speaker Fuse (2 Amp fast acting, Littlefuse type 312 for 8 Ohm speakers)
(4 Amp fast acting, Littlefuse type 312 for 4 Ohm speakers)
(1 Amp fast acting, Littlefuse type 312 for 16 Ohm speakers)

XF6, Right Speaker Fuse (Same as for XF5)

(XF7-XF9 are mounted on the chassis bottom, XF10 is on the power supply circuit board-See pictorial)

XF7, Left Channel Power Transformer (6.25 Amp slo-blo, Littlefuse type 313)

XF8, Right Channel Power Transformer (6.25 Amp slo-blo, Littlefuse Type 313)

XF9, Aux. AC Outlet (3 Amp fast acting, Littlefuse type 312)

XF10, Output Tube Heater Circuit (3 Amp slo-blo, Littlefuse type 313)

LED's, DS1-DS10 indicate for their associated fuse (XF1-XF10) DS11 LED indicates a shutdown condition because of a blown fuse.

NOTE: Speaker fuses are suggested values only. For best speaker protection the lowest value should be used that does not cause nuisance blowing.

2. If any of the four power supply rail fuses are blown, the cause may be a defective 6AS7 / 6080 output tube. This may also be caused by operating the amplifier continuously at or near full power output.

3. Before removing the power supply cover to service fuses, note indicated fuse that has blown.

4. Remove all power to amplifier by unplugging both the IEC power cord and the control power cord.

5. Use an insulated fuse puller (supplied with amplifier) to remove and insert fuses. This is because the power supply filter capacitors may still retain a hazardous charge.

6. For qualified service personnel only: If any other work is to be done inside the amplifier, the filter capacitors should first be discharged by using a 100 Ohm, 10 Watt resistor attached to a insulated test lead. Ground one end of the test lead to either the left or right - (Ground) speaker terminal. Then touch the resistor to the terminals of J4-J6 on the protection (Fuse) circuit board and J4-J6 on the power supply circuit board. Verify discharge with a DMM set on the highest DC scale.

NOTE: Because of the high voltages and currents used in the OTL 20, only those persons familiar with the servicing of vacuum tube equipment should attempt to service this amplifier, other than fuse replacement.

7. The most likely cause of failure in the OTL 20 will be do to a defective vacuum tube. Inability to achieve DC balance in one channel is most likely do to a defective 6AS7 / 6080 output tube in that channel. Check tubes by sustitution or (more easily) with a suitable tube tester. The 10 output tubes in each channel need not be precisely balanced but should be fairly close for best load-sharing.

8. If all 20 output tubes are not lighted, check that the XF10, 3 Amp fuse is good. If it is, the problem may be a open filament (heater) in one of the 6AS7 / 6080 tubes. Check by substitution or with a tube tester. You may also check for continuity accross pins 7 and 8 with a DMM (tube pins are counted clockwise looking at the bottom of the tube or it's socket)

9. The 12AT7 and 12SN7 driver circuit tubes are connected in parallel to a 12.6 VDC switching supply mounted on the power supply circuit board. If none of the four tubes are lighted, check the switching supply. The 12.6 VDC switching supply has a green LED mounted on it's circuit board and is lighted when the power supply is working. The switching supply has a potentiometer to allow adjustment to 12.6 VDC measured at the driver tube sockets.

10. Do to availability, some may wish to use two 6SN7's in place of the supplied 12SN7 vacuum tubes. The filament circuit may be easily reconfigured for the 6SN7 as shown in the pictorial diagram. Please note that either two 12SN7's or two 6SN7's must be used, not one of each.

11. The OTL 20 should be installed in an area that is not accessable to small children or pets

VENTILATION

The OTL 20 produces a considerable amount of heat and should not be placed in any confined area. It is best placed on a table in the open air. If placed on a floor that has deep-pile carpet, provision should be made to raise the feet such as to maintain 1/2" clearance under the amplifier.

Craig D. Merz, P.O. Box 1871 Silver City NM 88062-1871 U.S.A. Tel: 505-534-9106,
e-mail: ax78@gilnet.com