# OWNER'S MANUAL
# XL-600 POWER AMPLIFIER


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# SPECIFICATIONS

**POWER RATING:** Less **than 0.08%** THD at any power level up to **305** watts per channel into 8 ohms at any frequency from **20** - 20 kHz with both channels driven.

**CONTINUOUS POWER OUTPUT:** 450 watts per channel into 4 ohms at less than 0.1% THD, 20 - 20 kHz. 900 watts in mono into 8 ohms at less than 0.1% THD, 20 - 20 kHz.

**CONTINUOUS POWER AT CLIPPING: ***
Into 8 ohms, per channel: 360 watts
Into 4 ohms, per channel: 500 watts
Into 2 ohms, per channel: 750 watts
Into 1 ohms, per channel: 900 watts
Into 8 ohms, per channel: 1000 watts
Into 4 ohms, per channel: 1500 watts

**IM DISTORTION (SMPTE):** Less than 0.04% from 1 watt to 305 watts into 8 ohms.

**FREQUENCY RESPONSE @ 1 WATT INTO 8 OHMS:**
+/- 0.1 dB, 10 Hz to 50 kHz
+/- **3** dB, 0.1 Hz to 500 kHz

**POWER BANDWIDTH:** Greater than 100 kHz

**PHASE SHIFT FROM** 20 - 20 **kHz:** Less than 1/4 of one degree

**SLEW RATE:** 10 kHz, 130 volts peak-to-peak square wave: 100 V/us

**SIGNAL TO NOISE RATIO, UNWEIGHTED:** More than 100 dB @ 305 watts into 8 ohms

**INPUT:** 47,000 ohms; 1.8 volts for 305 watts into 8 ohms

**DAMPING FACTOR INTO 8 OHMS:** > **200** to 1 kHz; 150 @ 10 kHz

**PHYSICAL:** 7" high, 19" wide, and 13" deep, plus 1/2" for feet, plus 2" for handles. Net weight 51 lbs.; Shipping weight 55 lbs.

*Continuous duty cycle across the audio band. Depending on impedance, time may be thermally limited to several minutes.

Congratulations on your purchase of this EXCELINEAR POWER AMPLIFIER. We are confident that this amplifier is capable of driving any known loudspeaker load, with sufficient power reserves to suit any home listening situation. Furthermore, its refined circuitry will deliver that power with an accuracy that is sure to satisfy the most demanding of audiophiles.

# INSTALLATION

The gloss black insert on the faceplate of your new Hafler Equipment has been packaged with a **removable** protective coating. Please peel off this coating following installation.

When cleaning the faceplate, we advise a soft cotton cloth with a non-abrasive cleaner that is safe for Lexan and painted surfaces. **DO NOT** use paper towels or any coarse materials to clean the faceplate as these materials may scratch the insert.

## Ventilation

Adequate air flow is important to the continuing reliability of any power amplifier. The XL-600 uses a quiet, continuously variable speed fan to cool the entire chassis Cool air must circulate freely into the side vents and out the rear vent. Allow at least one inch on each side, and at least three inches to the rear for unimpeded flow.

## AC Line Connections and Switching

**NOTE: BE SURE YOUR AMPLIFIER IS WIRED FOR YOUR LOCAL LINE (MAINS) VOLTAGE BEFORE CONNECTING AC POWER!**

The XL-600 is normally wired for use on 120 Volt 60 Hz power lines. If your line (mains) voltage is different, you will require the optional export multi-voltage transformer, which accommodates voltages from 100 to 240 VAC, at 50-60 Hz.

The XL-6003 power switch may be left ON, and the amplifier switched remotely via a preamplifier or other control center, provided that device has a switched AC outlet capable of supplying 20 amperes for the amplifier, in addition to the requirements of other units being switched. Alternately, you may connectthe amplifier directly to a wall outlet, and use the front panel power switch provided on the amplifier.

As a general rule, power amplifiers should be turned ON LAST, and turned OFF FIRST, before other equipment, to avoid switching transients that may be generated by prior stages Hafler *OH-100, OH-110, IRIS and SE-100* preamplifiers employ protective muting circuitry which obviate this concern.

## Input Connections

Conventional shielded RCA type cables should be used to connect the amplifier's gold input jacks to the preamplifier's output, Gold connectors provide added assurance against signal degradation due to contact corrosion. Regardless of cable or connector material, verify that the contacts are clean, and that the plug's outer shield is tight on the jack, to avoid hum.

If you wish to install the XL-600 at some distance from the preamp, the preamp's output impedance and cable capacitance determine the maximum cable length to avoid high frequency losses. If, as with Hafler preamps, the output impedance is 600 ohms or less, and the cable capacitance is 50 picofarads (pF) or less per foot, then up to 50 feet of cable may be used. On long runs, keep the left and right cables close together, and avoid running them parallel to AC power wiring to minimize hum pick up.

## Output Connections

To preserve the high damping factor of the XL-600, and to minimize power loss, the use of at least 16 gauge speaker wire is recommended, especially for speakers of less than 8 ohms impedance, or for wire runs of 15 feet or more. Your dealer can advise you on the wide variety of premium cables available from specialty manufacturers. The gold plated output binding posts on the XL-600 are of the "5-way" type, and will accept single or dual banana plugs, spade plugs, pin plugs, or bare wire through the hole in the center post. If using bare wire connections, tinning the end of the wire with solder is recommended, to avoid any frayed ends of the wire shorting to adjacent terminals or the chassis.

Be sure to follow proper phasing relationships when connecting the speakers, **FOR STEREO OPERATION,** the amplifier "+",or RED terminal, must be connected to **the** speaker's "+", or RED terminal, and the amplifier's "--", or BLACK terminal must be connected to the speakers "--" or BLACK terminal. Speaker cables identify one conductor from the other by the wire color, or by marking or coloring the insulation, FOR MONO OPERATION, see the following section.

## Monophonic Operation

To drive a single speaker with increased power capability, the XL-600 can be operated in a "bridged" mono configuration, to deliver over 900 watts into 8 ohms. To use this mode, set the stereo/mono switch to **MONO,** connect the input signal to the LEFT INPUT ONLY, and connect the speaker load to the two RED BINDING POSTS ONLY. These output terminals are "floating", with the right red terminal the "-" connection, and the left red terminal the "+" connection. In this mode, THERE ARE NO CONNEC-**TIONS TO EITHER BLACK BINDING POST OR RIGHT INPUT JACK.** Make all changes with the power off. It is recommended to place a piece of tape over the unused connections to avoid later confusion.

## Grounding

The XL-600 employs a common ground between the two channels, which, for the input, is connected directly to chassis, and for the output, is connected to chassis through a 5 ohm thermistor to avoid ground loops. This common ground allows the use of external devices which also have common grounds, such as headphone or speaker switching boxes. Make sure that the "-", or black terminal of the amplifier is connected to the corresponding terminal of the accessory device.

# OPERATION

## Power Switch and Pilot Lamp

The red bar above the power switch will glow when the power is switched on unless excessive, long term, heat sink temperature has opened a thermal breaker, or the AC line fuse has blown. If the unit has tripped off thermally, reduce the input signal to avoid high turn-on level. The red pilot bar will light a few seconds before operation is automatically restored if the XL-600 has cooled down and the power switch is left on. If a second shutdown occurs, check for inadequate ventilation, continued excessive input signal, or a severely reduced load impedance.

## Belayed Turn On and Protective Relay

To avoid the turn-on transients generated by some preamplifiers, the XL-600 provides a 3 second delay before a relay connects the output terminals, If your preamp requires a longer delay period, consult the factory on extending the delay. The relay will also disconnect the load if significant DC is present at the output, or if the short term heat sink temperature becomes excessive, while allowing the fan to continue cooling the amplifier.

## Initial System Check Out

After initial set-up, leave the XL-600 switched off (rocker switch to the left) and turn on the rest of the system. Wait 30 seconds, and switch on the amplifier. If you hear a loud sharp “thump” from the speakers, or no sound is heard after the relay engages and signal is applied, consult the section "In Case of Difficulty” at the end of this manual.

## Mono / Stereo Switch

This switch should be left in the **STEREO** position, unless bridged operation is desired, as outlined in the section “Monophonic Operation”.

## Speaker Fuses

The fuse holders on the back panel provide a measure of protection against excessive power output to the speakers. They are not intended to protect the amplifier. The XL-600 is supplied with 5 ampere fast blow fuses installed. This value will afford minimal protection for most speakers. A spare pair of 10 ampere fast blow fuses has been included, for testing purposes, or high power applications. This fuse value will offer no speaker protection. **IF THE MANUFACTURER OF YOUR LOUDSPEAKER RECOMMENDS A SPECIFIC FUSE VALUE, OBTAIN TYPE 3AG OR AGC FUSES AND INSTALL THEM IN THE BACK PANEL FUSE HOLDERS.**

# THE EXCELINEAR CONCEIT

The purpose of the Excelinear technology is to detect and then minimize all possible non-linearities, or distortions. This is done by subtracting the output of the amplifier from its input, A perfect amplifier would have no residual signal. The less difference signal that remains, the better the amplifier. The test described below enables you to hear only the difference signal- the sum total of all audible

amplifier distortion, It will already be exceedingly low on the XL-600 as you receive it because each amplifier channel has been factory adjusted using a typical loudspeaker load. But when the XL-600 is connected to your own speakers, careful readjustment by a technician may yield some slight improvement. The test is as sensitive as one's hearing, and much more precise than available measurement technology because it is able to reveal the audible effect of **all** distortions - even those which have not yet been identified or quantified!

This is a very useful amplifier comparative technique which supplements conventional distortion measurements. With the XL-600, the **total** of all residual distortion products will be on the order of 60 dB or more down across the audio band - a substantial improvement over other amplifiers, where 40 dB figures are among the best. Only a few amplifiers cannot be subjected to this test: those which are phase inverting, and those which have floating (not grounded) outputs, or those which cannot tie together the output grounds.

The XL-600 provides a unique internal adjustment for "fine tuning" each channel when it is connected to **your** speakers. This "tweaking" may fairly be described as significant only to those persons with "golden ears". The rest of us who simply wish to indulge ourselves with fine sound need not be concerned with this consummate pursuit of perfection.

The range of adjustment provided is within the defined operating specifications of the amplifier. Misadjustment will not damage or impair the performance of either amplifier or speaker. The region of change is several octaves above the range of human hearing. Yet we have found that minute differences in absolute linearity can be heard, and this "tweaking" can minimize them. Do not change the factory's setting until you have at hand the appropriate gain control circuit described below. You will need the special tool provided, patience, quiet, and good hearing, but no test instruments to complete the task. Because the amplifier must be operated with the cover off, and high voltages are exposed, **this should only be undertaken by a qualified technician.**

A pair of headphones which have a high degree of isolation from outside sounds may simplify your test listening, but are not essential. If a very sensitive meter is available, it can replace the listening requirement, but your ears are better than conventional meters. Using a loudspeaker, what you hear is what (distortion) you get.

## PERFORMING THE ADJUSTMENTS

One channel of the amplifier may be used as a driving source to provide a signal at a conventional listening level; the other is the tested amplifier. These are then interchanged to enable adjustment of both channels. Any type of signal may be used - music, white or pink noise, etc. The accuracy of the driving amplifier is not a factor - if it has distortion, that distortion is simply a part of the test signal, and does not detract from the test accuracy.

The circuit diagram shows the appropriate connections, and the values which provide a precise attenuator to adjust the gain so that the output level will exactly match the input level. The monitor loudspeaker is connected differentrally across the outputs of the two amplrfiers. If the signals are identical, there will be no sound from the monitor loudspeaker. Any differences between the input to and output from the test amplifier represent some form of distortion, and this will be audible in the monitor speaker, either as program related content, or as noise.

The monitor speaker is not a part of the load, and it may be replaced by headphones, or by an AC voltmeter which can read down to 0.001 volt. It is preferable to use a similar speaker for monitoring, because you hear the distortion products at realistic levels and content. It makes comparative evaluation of amplifiers more representative. A good amplifier will have low distortion, so you will have to listen very carefully, close to the speaker, to achieve the best null. Since the load speaker's very audible output would interfere with listening to the much weaker signal from the monitor speaker, it must be moved to another room. However, headphones which have earcups which are effective seals may enable you to make the adjustment without having to move the speaker. Because headphones are

much more sensitive than speakers, however, the relative loudness of the residual distortion may be misleading.

**WARNING: DANGEROUS VOLTAGES ARE EXPOSED DURING THIS PROCEDURE. REFER TO QUALIFIED TECHNICIAN.**

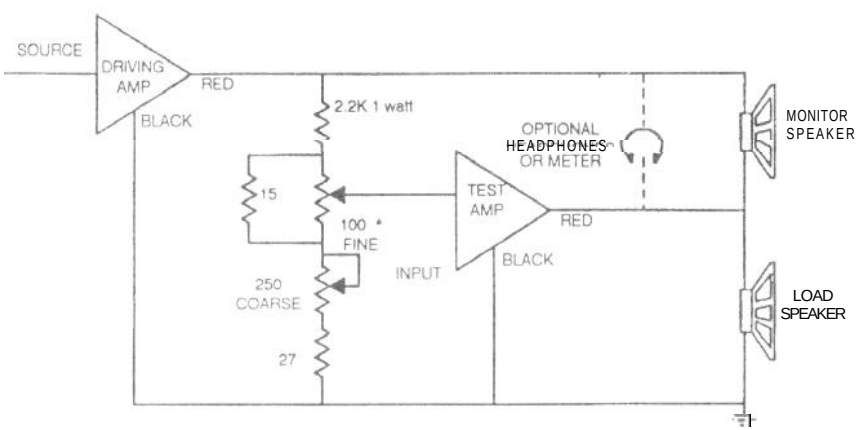
**The test procedure is as follows:**

1. First use the right channel of the XL-600 as the driving amplifier and the left channel as the test amplifier. Turn off the amplifier each time before making any change in connections, and before removing the cover.

2. Connect a speaker to the right channel speaker terminals to first obtain a normal listening level by adjusting the preamp's volume control. A convenient signal is the interstation noise from an FM tuner with its muting deactivated. This is similar to white, or uniform broad band noise.

3. Now reconnect this "Monitor" speaker (here you may instead use headphones or a meter) between the left and right red binding posts.

SCHEMATIC DIAGRAM FOR AMPLIFIER STRAIGHT WIRE DIFFERENTIAL TEST




* wirewound potentiometer not suitable

(all resistor values in Ohms)

4. Connect the attenuator circuit to the right channel output, and connect the left channel input to the attenuator. Be sure the attenuator is also connected to the right channel ground.

5. Connect the “Load” speaker to the left output

8. Center the “Fine” potentiometer, and adjust the “Coarse” potentiometer for minimum signal from the monitor speaker. Readjust the “Fine” control for minimum signal -the best null.

7. With the cover removed from the amplifier, the variable capacitors on each circuit board are accessed from the center rear. Using only the plastic tool provided, adjust the capacitor which is 1-1 /4” in on the left channel board, above the stereo/mono switch. DO NOT USE ANY METALLIC TOOL. Alternate between the “Fine” potentiometer and this “tweaking” adjustment to achieve the best null,

8. Turn off the amplifier, change both input and output connections to the opposite channel, and repeat steps 6 and 7 to adjust the right channel.

## IN CASE OF DIFFICULTY

If a loud “thump” is heard from the speaker when the amplifier is switched on, it could indicate a spurious DC voltage present at the output. Minor turn-on thumps or clicks are normal and should be ignored. Since the XL-600 is direct coupled, any DC present at the input to the amplifier will be passed onto the output. Any more than 100 millivolts (1/10th volt) of DC is excessive, and voltages of a volt or more will cause speaker distortion. Check by breaking and making the speaker connections while the amplifier IS on. If a noise is heard, then DC is present. Turn off the amplifier, wait 30 seconds, turn the unit back on, and repeat the disconnecting/reconnecting procedure. If the noise disappears, the amplifier is functioning properly. Whatever component introduces the noise when it is connected will probably require service.

If the pilot lamp does not glow when the amplifier is turned on, and it is not due to an excessive temperature condition, then either the internal 15 ampere line fuse is blown, or the circuit breaker or fuse supplying the AC power has interrupted power.

If no sound is heard once the relay engages and an input signal is applied, check all input and output connections, as well as the back panel speaker protection fuses.

In addition to the internal 15 ampere line fuse, there are four 10 amp rail fuses, None of these internal fuses are intended to be user replaceable, and a blown condition usually indicates a need for professional service.

## FACTORY SERVICE & LIMITED WARRANTY

If you encounter any difficulty or have any questions concerning your XL-600 amplifier, **please call our Customer Service Department weekdays, 8 am to 3:30 pm Mountain Standard time, at 602-967-3565.**

Before returning any unit to the factory for service, please call us. All units being returned (regardless of warranty status) must receive a Return Authorization (RA) Number. In addition, we can offer trouble-shooting assistance that may often simplify or even eliminate the need for factory service.

The Hafler XL-600 is warranted for 3 years from date of purchase, including parts, labor, and return shipping costs from the factory to the owner within the Continental USA.

It is the owner's responsibility to pay shipping (preferably UPS) to the factory: collect shipments will not be accepted. Units under warranty should be accompanied by a copy of a dated Bill Of Sale. Use the original carton and all packing material, and be sure to include a return address, and a brief description of the difficulty, including whether is intermittent.

This warranty gives you specific legal rights. You may also have other rights which vary from state to state.