
Fender[®]
2235

Professional Power Amplifier

OWNER'S MANUAL

Fender[®] 2235

Professional Power Amplifier

Your new Fender 2235 Power Amplifier has been designed to provide high performance specifications in a cost-effective package. This amplifier utilizes a unique protection system which allows maximum output levels into reactive (speaker) loads yet provides protection from continuous short circuits. A unique feature of the protection circuit is automatic crosscoupling in the Bridged Mode. This provides an equal level of protection when operating in the Bridged Mode.

The 2235 is also equipped with a high efficiency forced air cooling system which includes a temperature controlled two-speed fan and a removable front panel air filter.

Fender Musical Instruments
1130 Columbia St., Brea, CA 92621

DESCRIPTION OF FEATURES

FRONT PANEL

OPERATE LED INDICATOR

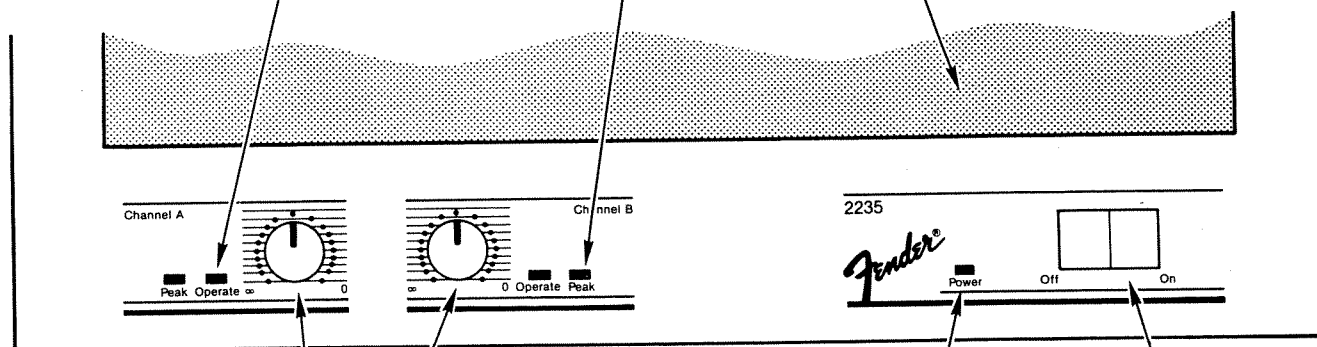
This LED indicator is illuminated when the channel is in operating condition. The indicator will turn off whenever any of the protection circuit is activated. The protection can be activated by either a short circuit on the output or excessive heatsink temperature. The circuit will automatically reset when the short circuit is removed or the heatsink temperature is reduced. Separate indicators are provided for both channels. Operation of the protection circuits are independent except when the amplifier is in the Bridged Mode in which case both channels will protect simultaneously.

PEAK LED INDICATOR

This LED indicator is illuminated when the voltage output of the amplifier reaches clipping (maximum peak output voltage). The threshold for this indicator is automatically adjusted to compensate for load impedance and supply voltage variations.

AIR FILTER

This decorative foam filter is removable for easy cleaning. To remove for cleaning grasp along the top and bottom edges and pull away from the chassis. Clean with water and let dry completely before reinstalling in the chassis.



POWER LED INDICATOR

This LED is illuminated when the amplifier is turned on and main voltage is present. If this indicator does not light when the power switch is turned on (and does not trip) then check the supply of AC power.

INPUT LEVEL CONTROLS

Two (2) 41-position attenuators that control the amplifier input sensitivity. The control settings can vary between zero attenuation or loss (sensitivity is +4dB/1.23VRMS) and infinite loss (at least -85dB from maximum sensitivity). The controls are detented (click-stepped), making them accurately resettable. A separate control is provided for each channel. When operating in the Bridged Mode only the Channel A control is active (the Channel B control has no function). Refer to the Amplifier Operation section (page 6) for additional information on proper adjustment of the input level controls.

POWER SWITCH

This switch is actually a magnetic circuit breaker that will automatically "trip" (turn off) if a major fault occurs inside the amplifier. If the switch trips repeatedly (for instance, immediately at turn on), the amplifier needs service. It should be returned to an authorized FENDER service center. Using a circuit breaker switch instead of a more conventional power switch and fuse eliminates the need to carry spare fuses and provides an instant visual indication when the circuit breaker has been tripped.

REAR PANEL

OUTPUT CONNECTORS

Each channel has a pair of five-way binding posts which will accommodate single or dual banana plugs, spade lugs, or bare wire. The Channel A and Channel B outputs are spaced so that one dual banana plug can be used for bridged operation.

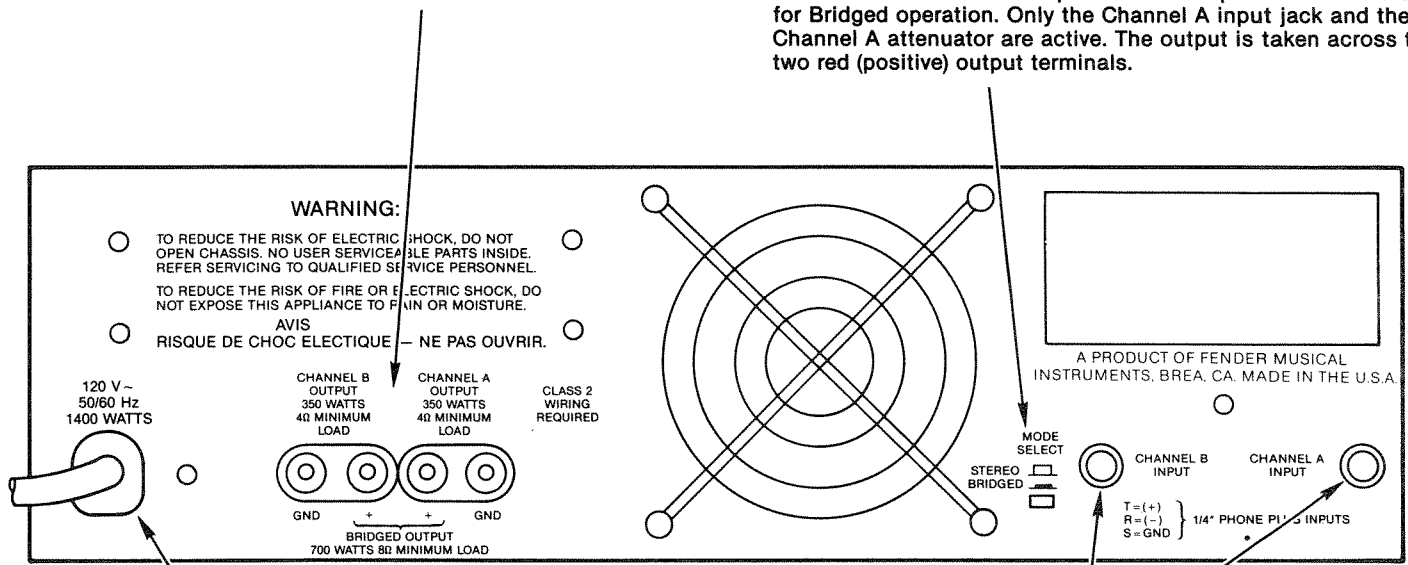
CAUTION: Do *not* operate the amplifier in the two channel (stereo) mode with a load impedance of less than 4 ohms connected to either channel.

Do *not* operate the amplifier in the Bridged Mode with a load impedance of less than 8 ohms.

MODE SWITCH

This two-position switch selects either the normal stereo (or two-channel mono) or the Bridged (single-channel mono) mode. With the button in the "out" position the input circuit is connected for normal stereo operation. If a separate input is supplied to both Channel A and Channel B input jacks each channel operates independently. If an input is supplied only to the Channel A input jack it is fed to both Channel A and Channel B. Both input attenuators are operative and will control their respective channels.

With the button in the "in" position the amplifier is connected for Bridged operation. Only the Channel A input jack and the Channel A attenuator are active. The output is taken across the two red (positive) output terminals.



AC POWER CORD

This must be connected to a source of 120V, 50 to 60Hz AC power with a current capability of at least 20 amps. Normal electrical code in the U.S. specifies a 20-amp limit on normal wall outlets. Therefore, each 2235 should be connected to an independent circuit if continuous full power operation is required.

As a general guideline it is acceptable to connect two (2) 2235 amplifiers to one (1) 20-ampere circuit provided the load is limited to 4-ohm loudspeakers on each channel and the signal source is full range music or speech. If you are going to heat up resistors with a sine wave you will need a separate 20-ampere circuit for each amplifier.

INPUT CONNECTORS

Each channel is provided with a 1/4-inch tip-ring-sleeve (stereo) phone jack. Each input is electronically balanced and will accept signals from balanced line sources (either active or transformer) or from unbalanced circuits. If only the Channel A input connector is used both channels are connected in parallel (two-channel mono). If the Channel B input connector is used the two channels operate independently.

The chassis has been punched to allow installation of XLR connectors (one female and one male per channel). These connectors, along with all necessary mounting hardware and connecting cables are available from FENDER as a kit. If XLR connectors are installed and normal stereo operation is desired the normal internal commoning of Channel A and Channel B input must be disconnected by plugging an open circuit stereo (tip-ring-sleeve) phone jack into the Channel B input.

BASIC CONNECTIONS AND WIRING

Power and audio signal cables are the most common sources of sound system failure. Well-made and carefully maintained cabling is essential to the reliability of the whole system. If long speaker cables are required, make sure the wire is of sufficient size to transfer all the available amplifier power to the speakers rather than absorbing power itself. As a rule of thumb, the larger the wire, the better (larger wire has smaller "gauge number").

We have listed the smallest wires (the highest numbered gauges) recommended for best results. To make it simple, we'll assume you're operating under worst case conditions, with 4 ohm loads; 8 ohm operation will improve results with the same wire, and 2 ohm operation requires still heavier wire because the cable resistance is a higher percentage of the total load on the amplifier.

LENGTH* UP TO	25 FEET	25 TO 50 FEET	50 TO 100 FEET
MINIMUM WIRE SIZE**	#16 AWG	#14 AWG	#12 AWG
<p><i>*Length of dual conductor cable (i.e., the 100-foot run specified here from amplifier to speaker represents a 200-foot round trip).</i></p> <p><i>**Small diameter wire = high gauge #, large wire = low gauge #, AWG is an abbreviation for American Wire Gauge.</i></p>			

TABLE 1. RECOMMENDED MINIMUM SPEAKER WIRE SIZES. Every three increments in wire gauge either doubles or halves the wire's resistance.

Large diameter (small gauge number) wire is expensive, and long cables made from it are heavy. Rather than running long speaker cables, it is better to locate power amplifiers near speakers and run a line-level signal cable over the long distance to the amplifier. This approach eliminates most of the signal loss due to speaker cable's resistance so the speakers will be fed all the amplifier's power without the need for heavy cables. It can actually save money in many instances.

Always use stranded wire for three reasons:

- (1) It is more flexible and less prone to metal-fatigue breakage.
- (2) If an end is nicked while insulation is being stripped for connection, only one or two strands will break, not the entire wire, and . . .
- (3) There is some evidence, though disputed, that higher frequency audio signals flow along the outside of each conductor (skin effect); if this is so, the more strands, the lower the effective cable resistance to high frequencies.

In cases where speakers and power amplifiers are located far away from the signal source (be it a mixer or a preamp), "balanced line" signal cables are a wise choice.

CAUTION: NEVER USE COILED CORDS FOR SPEAKER HOOKUP, even in an emergency. Coiled guitar-type cords usually have higher internal resistance than the speakers themselves. This is due to the light-gauge wire used to keep the coil cords flexible. These cords will prevent most of the power from reaching the speakers. In high power operation, a coil cord can melt, cause a fire hazard, and possibly damage the amplifier. As a general rule, guitar-type connecting cords, both straight and coiled, make poor speaker cables.

The 2235 can produce enough power output to damage electronic equipment connected to its output. Besides being capable of destroying speakers, under certain circumstances shock and/or fire hazards are possible. High power amplifiers should always be properly maintained and used with care in clean and dry environments.

If you've mounted all your sound equipment in a rack or portable case, you can ensure that everything stays calibrated by marking the settings of the necessary controls. Small pointers made from masking tape are visible in dim light, and can be removed with alcohol or rubber cement thinner without damage to the paint on most front panels, including those of the Fender amplifiers. However, be sure to check the finish in an inconspicuous place to determine the suitability of any cleanser.

Assuming you're NOT turning all the equipment on at once with a switched power receptacle "strip," be sure to turn on the power amplifier last. This will prevent turn-on "thumps" from the mixer or other pieces of gear from possibly damaging speakers. The reverse logic should be used—turn OFF the amplifier FIRST—when shutting the system down.

The 2235 is timed to turn on the speaker outputs after the amplifier's power supply is fully charged up, thus preventing any turn-on noise. Timing of the amplifier's turn-on circuit is usually sufficient to accommodate all the turn-on anomalies from other pieces of gear in a system, making it acceptable to use a single switched power string in a permanent or semi-permanent system.

CAUTION: The 2235 can draw a lot of AC power. Be sure the AC power source for your AC distribution system has adequate current capability to bear the entire load with an extra margin of safety. If you use a power strip with a built-in circuit breaker, make sure the breaker is rated for sufficient current to handle its load as well.

In multiple amplifier installations, we recommend sequential turn-on (either manually or via timed relays) to avoid a sudden, major drain on the AC line.

You should keep in mind that severe reduction of power line voltage affects the amount of power you can get FROM the amplifier. If you need to run long AC extension cords, make sure their conductors are as large as practical (small gauge number). Just as smaller diameter wire causes speaker line loss, smaller power lines cause loss. However, the effect of small AC lines is one of intermittent clipping under severe conditions.

AMPLIFIER OPERATION

This procedure applies to stereo, mono, or bridged operation into a full-range loudspeaker system which uses a passive high-level crossover (or none at all). If you are using the 2235 in a multi-amplified system with an electronic or low-level passive crossover, the INPUT LEVEL controls on the amplifier are generally set to maximum (zero loss), and all level controlling is done at the crossover (skip step 10):

1. Turn all equipment OFF.
2. Plug the amplifier into a source of 120 volt, 50–60Hz AC power. Follow the precaution mentioned earlier in this manual about the current capability of the power circuit.
3. Connect the wiring from the signal source(s) to the amplifier's input jack(s).
4. Select the appropriate settings for the MODE switches.
5. Connect the speaker(s) to the output terminals, as appropriate for the setting of the MODE switch.
6. Adjust the INPUT LEVEL controls to their minimum (infinity) setting.
7. Turn everything else ON except the amplifier.
8. Adjust the controls on the signal source for "normal" indications on the source's meter or level indicator. If there is no metering, then set the master control at zero (minimum).
9. Turn the amplifier ON. After a short delay, the OPERATE indicator should illuminate.
10. Adjust the INPUT LEVEL control(s) to maximum. Carefully advance the master control on your signal source until the sound level from the speaker system is just past the "correct" level; i.e., just a little bit too loud. Remove the input signal from the source, leaving the master control (and any input controls on the source) set as they were. If the system is noisy (hissy), reduce the setting of the 2235 INPUT LEVEL control(s) by one "click" and repeat this step. You must "juggle" the settings of the source's controls and the amplifier's controls until you find a combination that gives you the desired amplifier output, freedom from clipping caused by excessive output demands placed on the signal source, and poor signal-to-noise performance caused by excessive amplifier gain.

SPECIFICATIONS

Output Power

Continuous sine wave output power,
both channels driven, 20Hz to 20kHz
at less than 0.1% THD:

8 ohms _____ 200 Watts
4 ohms _____ 350 Watts

Single channel driven, 1kHz, 1% THD
(power at clip):

8 ohms _____ 300 Watts, Typical
4 ohms _____ 550 Watts, Typical

Frequency Response _____ +0, -1dB; 20Hz to 20kHz

Power Bandwidth _____ Better than 10Hz to 50kHz
(3dB down points from rated power)

IMD (SMPTE) _____ Less than 0.1% at 350 Watts into 4 ohms

Hum & Noise _____ More than 100dB below rated output

Damping Factor _____ Greater than 200 at 1kHz, 8 ohms

Rise Time _____ Less than 10 μ Sec

Slew Rate _____ $\pm 20V/\mu$ Sec

Channel Separation _____ Greater than 80dB at 1kHz

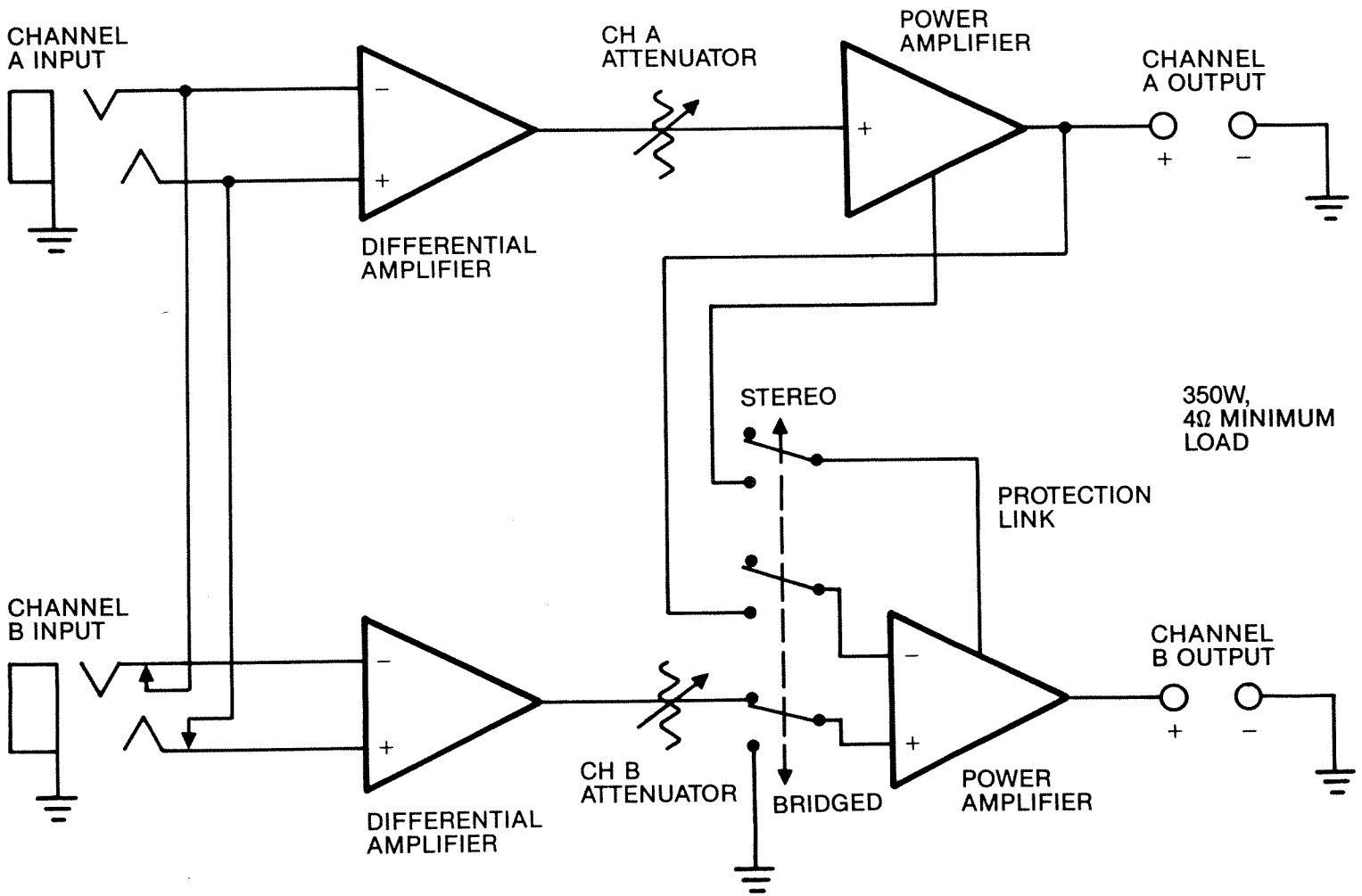
Input Impedance _____ Greater than 20k Ω differential

Sensitivity _____ +4dB (1.23V_{RMS}) for rated power

Power Requirements _____ 120V, 50 to 60Hz, 15 amps

Weight _____ 40 lbs.

Dimensions _____ 19" Wide, 5-1/4" High, 15" Deep
(12.5" behind the front panel not including
connectors)



FENDER 2235 POWER AMPLIFIER BLOCK DIAGRAM

FENDER MUSICAL INSTRUMENTS BREA, CALIFORNIA MADE IN USA
