Fosgate Audionics

HOME THEATER AUDIO

MODULAR MULTI-CHANNEL AMPLIFIER

Introduction

Thank you and congratulations on your purchase of the Fosgate Audionics Amplifier 1000.5. The 1000.5 power amplifier is designed for use with high quality speakers.

This manual contains information on using the 1000.5 amplifier. It is organized into two sections. “Installation” covers the location and connection of the amplifier in the system. Like many precision components, careful attention to the initial setup can yield dividends in higher performance and trouble-free use. “Operation” covers the controls and features of the amplifier, and how to use them to get the best effect. We strongly urge reading over the Installation and Operation portions of this manual before putting the amplifier into service.

The 1000.5 is a five-channel home theater power amplifier. Passive cooling through large heatsinks have eliminated the need for cooling fans. Our **trans•*ana***® circuit topology and MOSFET output stage ensure trouble free, long term operation and is backed by our three-year warranty.

The circuitry used in the Fosgate power amplifiers is our **trans•*ana*** (**TRANS**conductance **A**ctive **N**odal **A**mplifier) topology. The **trans•*ana*** technology operates the output stage with its full voltage gain, which allows the input stage to operate from a low voltage regulated supply. The input signal is shifted up in level to the high voltage section by the driver stage, which forms an active node at ultrasonic frequencies. This results in very stable, highly linear operation. It has proven to offer sound quality satisfying to the most analytic audiophile or the most demanding professional. The natural sound and realistic reproduction have made **trans•*ana*** amplifiers preferred in many installations. Since our pioneering use of MOSFETs in the Hafler DH-200 amplifier, MOSFET output stages have consistently demonstrated their fault tolerance, even in abusive situations. This robustness enables the amplifier to drive reactive speaker loads without the performance and sound penalties imposed by overzealous protection schemes.

Specialized circuits prevent damage to the amplifiers and speakers without affecting the audio signal. A soft start circuit prevents sending potentially destructive turn-on and turn-off transients to the speakers. A thermal sensing network monitors the heatsink temperature and shuts down the amplifier to protect from excessive operating heat. The need for internal fuses has been eliminated; the amplifier automatically monitors the output and shuts down operation when it detects a short in the output load.

The circuit board contains all the operational components. The circuit board assembly makes extensive use of surface mount components in the low power portion of the audio circuitry. Automated equipment is used to place and solder the components which yield greater uniformity and reliability.

The 1000.5 combines a premium finish with the technical features that provide the home theater enthusiast with loud levels, excellent sonic quality, wide dynamic range, superb power delivery, and a stylish look.

Fosgate Audionics .... a talented staff of experienced industry professionals.

Jim Fosgate, Senior Executive Consultant, one of the most renown surround processing circuit designers in the world, holds more than 25 patents in the audio industry. His latest efforts include Dolby® Pro Logic II—acclaimed as a milestone in matrix surround technology—and the FAVP1 tube surround processor/preamp. Jim continues to refine his designs in his home audio laboratories in Utah and Arizona.

Jim Strickland, Vice President of Engineering, has designed some extraordinary products including the famous and highly regarded Acoustat electrostatic loudspeakers, the **trans•*nova***® power amplifier series and now the Fosgate Audionics **trans•*ana*** 1000.5 amplifier design. He has been a published AES member since 1970 and holds nine audio patents.

Charles Wood, Executive Consultant, originally founded Audionics of Oregon in 1969. In 1986 Audionics merged with Fosgate Research to form Fosgate Audionics. Charles Wood and Jim Fosgate have been responsible for many industry "firsts" in multi-channel sound that have been widely adopted throughout the home theater industry.

Gary Church, Chief Acoustic Engineer, has been designing and developing loudspeakers for more than 25 years. His extensive experience and attention to detail has enabled him to lead a talented engineering team at our Rockford Acoustic Design (RAD) facility in Michigan.

The Best of All Worlds

Fosgate Audionics, part of Rockford Corporation, is one of the few companies with the resources to design and manufacture electronic components and loudspeakers to exacting world-class standards.

Fosgate Audionics customer support is second to none—a result of years of experience in designing, building and marketing sophisticated multi-channel audio products. We know home theater and multi-channel sound inside and out.

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Safety

NOTICE - IMPORTANT SAFETY INFORMATION

The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure, that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

READ ALL INSTRUCTIONS

All the safety and operating instructions of your Fosgate Audionics equipment should be read before power is applied to the equipment.

RETAIN OWNER'S MANUAL

These safety and operating instructions should be retained for future reference.

HEED WARNINGS

All warnings on the equipment and in the operating instructions are important and should be followed.

FOLLOW INSTRUCTIONS

All operating and use instructions are important and should be followed.

HEAT

The equipment should be kept away from areas of high temperature, i.e., heater vents, radiators, stoves/ovens, fireplaces, etc.

VENTILATION

The equipment should be used in an area suitable for proper ventilation. Care should be taken not to impede airflow in and around the cabinet.

WATER AND MOISTURE

The equipment should not be used in or around water, such as a bathtub, sink, or swimming area. Also, the equipment should not be used in areas prone to flooding, such as a basement.

POWER SOURCES

The equipment should be connected only to a power source of the same voltage and frequency as that listed on the rear panel above the power cord entry point.

POWER CORD GROUNDING

The power supply cord is of a three wire grounded type, designed to reduce the risk of electric shock sustained from a live cabinet. It is assumed to be of suitable length for most uses of the equipment. The use of extension cords and power strips is discouraged unless they are of suitable rating to deliver the required total current for safe operation of all connected equipment. Furthermore, extension cords or power strips must provide the same three wire grounded connection. It is important that the blades of the equipment plug be able to fully insert into the mating receptacle. Never remove the round grounding pin on the plug in an attempt to mate to a two wire ungrounded receptacle: use a grounding adapter with the grounding tab or wire suitably connected to earth ground.

POWER CORD PROTECTION

Power cords should be arranged so they do not interfere with the movement of objects in the room: people, fan blades, utility carts, etc. Also, care should be taken that the cord is not pinched or cut, and placed so it is not in danger of being pinched or cut, as in under a rug, around a tight corner, etc.

NON-USE PERIODS

During periods of extended non-use, the power cord should be unplugged from the power source.

CLEANING

The equipment should be cleaned only as detailed in the operating instructions.

OBJECT AND LIQUID ENTRY

Care should be taken so that objects and/or liquids, such as cleaning fluids or beverages, are not spilled into the enclosure of the equipment.

DAMAGE REQUIRING SERVICE

Fosgate Audionics equipment should be serviced by qualified service personnel when:

A. The power supply cord or plug has been damaged, or
B. Objects have fallen onto, or liquid has been spilled into the equipment, or
C. The equipment has been exposed to rain, or
D. The equipment does not appear to operate normally or exhibits a marked change in performance, or
E. The equipment has been dropped, or the enclosure has been damaged.

SERVICING

The user should not attempt to service the equipment beyond that which is described in the operating instructions. All other service should be referred to qualified service personnel.

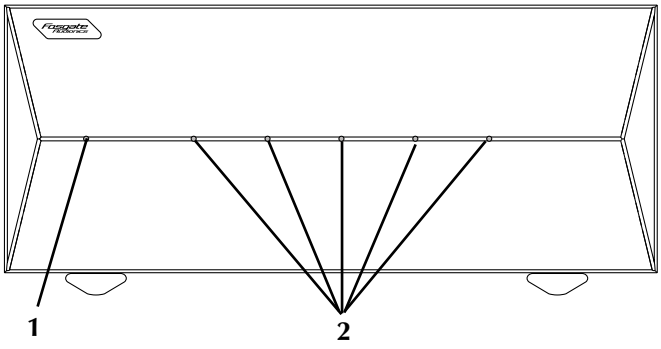
CARTS AND STANDS

The equipment should be used with carts or stands only of sufficient strength and stability for the use intended.

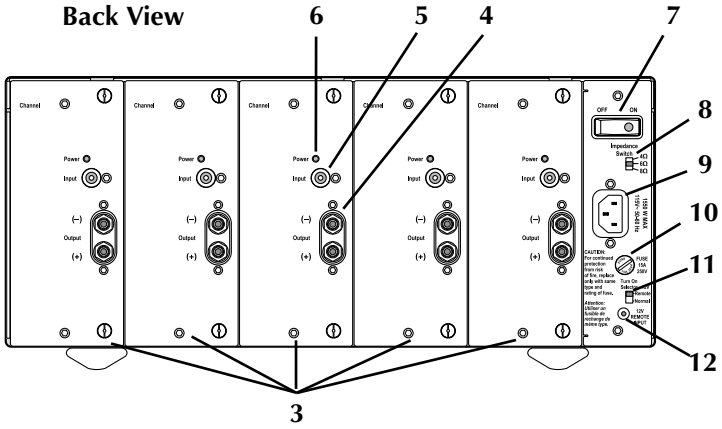
An equipment and cart combination should be moved with care. Quick stops and starts, excessive force, and uneven surfaces may cause the equipment and cart combination to topple.

Features

Front View



Back View



1. **Power LED Indicator**
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3. **Modular Channel Panels**
4. **5-way Binding Post Outputs**
5. **RCA Inputs**
6. **LED Indicator**
7. **Power Switch and Indicator Light**
8. **Impedance Selector Switch**
9. **Main Power**
10. **Fuse**
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Installation Considerations

LOCATION

The amplifier can produce considerable heat in normal operation, so the primary consideration when determining a location for the amplifier is to allow for adequate ventilation. The large heatsinks provide unrestricted airflow, but care must be taken to keep the ventilation holes in the bottom panel and top cover clear. If the amplifier is mounted in an equipment rack, make sure adjacent equipment does not impede cool air flow.

Inadequate ventilation can shorten component life, especially when other equipment raises the ambient air temperature, so circulating fans should be considered in tight quarters.

The substantial electrical and magnetic signals generated inside the amplifier can induce noise in other low-level audio components such as preamps, tuners, phonographs or tape decks. Caution should be exercised when placing any sensitive equipment near the FAA1000.5 chassis, power cord or speaker cables.

AC LINE

The amplifier operates from a 120 volt, 60Hz AC power line. Connection is made by a 16 gauge, IEC Type 320, grounded line cord. For safety considerations only a properly grounded (earthed) receptacle should be used. If a grounded circuit is not available, do not break off the ground pin; use the proper adapter plug for a two wire receptacle. The line fuse is accessible from the rear panel. If this fuse blows, replace it only with the same type and rating fuse. The correct replacement fuse value is printed on the rear panel of the amplifier. If the new fuse blows, this is an indication of a fault with the amplifier. Servicing should be performed only by a qualified technician.

INPUT CONNECTIONS

The input jacks located on the back of the amplifier are RCA style connectors.

OUTPUT CONNECTIONS

The speaker output connectors are dual binding posts. These binding posts will directly accept 12 AWG wire or banana plugs, and are spaced on 3/4" centers to accept dual banana plugs.

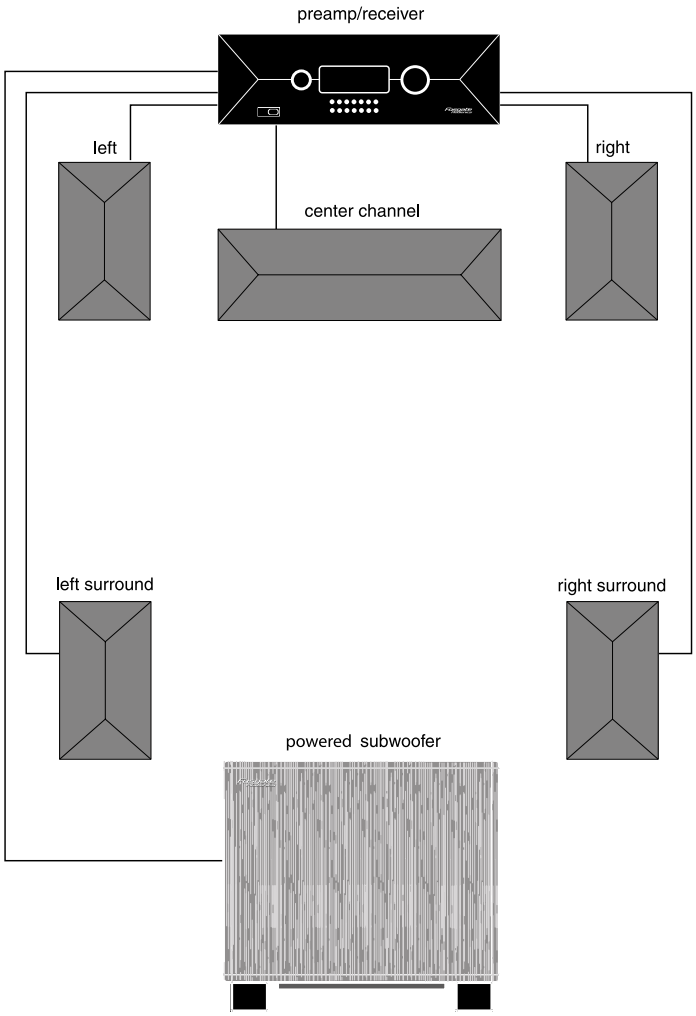
12V REMOTE TURN-ON

If you intend to use the 12V remote turn-on input of the FAA1000.5, plan ahead to be sure the cable is of sufficient length to reach from the Preamp/Processor. As an alternative to standard methods of remote turn-on, a 12VDC "wall wart" supply with a 3.5mm male connector can be used in conjunction with any remote-controlled switched outlet (such as X-10, or accessory outlets on a preamp). An approved 12VDC supply can be purchased from Digikey (part number T508-P1P-ND at 1-800-344-4539 or www.digikey.com). Contact Rockford/Fosgate Audionics for additional technical support.

LAYOUTS

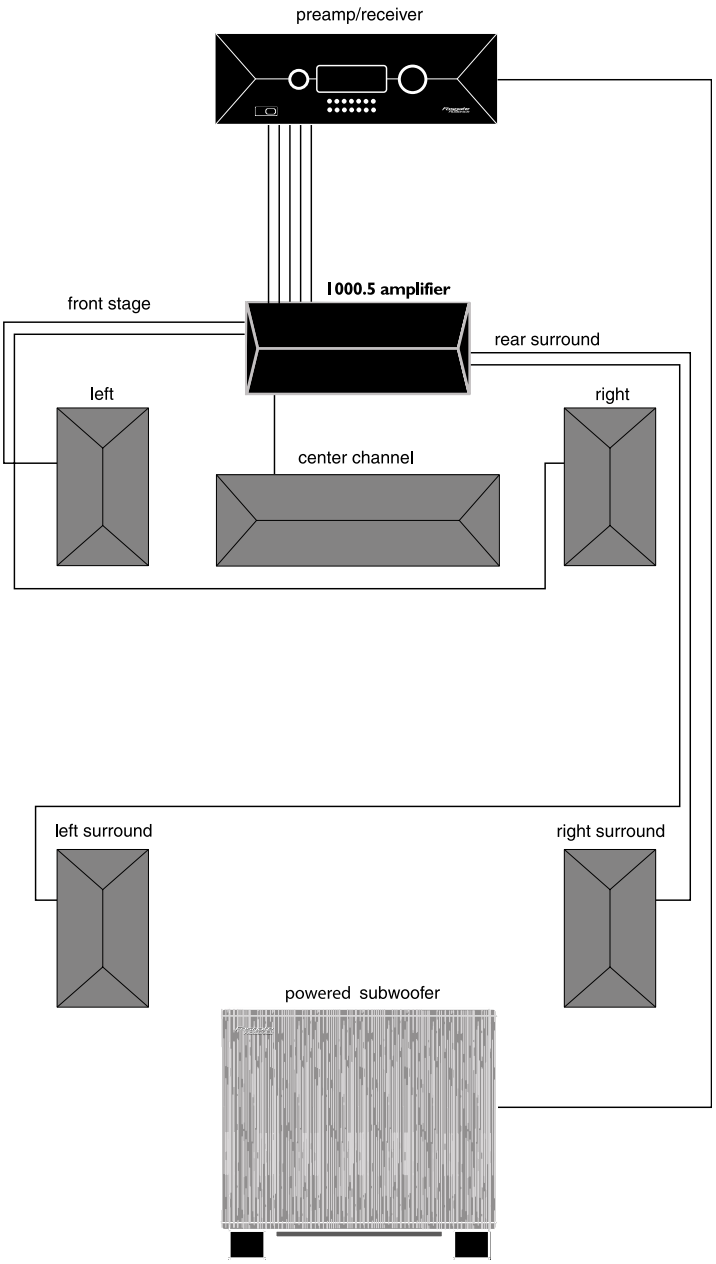
Typical Home Theater System

This system uses a receiver that has built-in amplification



High Performance Home Theater System

This system uses a receiver with dedicated amplification



Location

The size of the room used for your Home Theater can have a significant effect on the bass response of your system. Since many movies exaggerate explosions, earthquakes, and other low frequency effects, a high demand on the subwoofer system is required. Your Fosgate Audionics subwoofer is specially designed for these high levels of excursion and linearity. In order to get the most out of your subwoofer, Fosgate Audionics has documented the Home Theater installation.

Typical Studio Installations

In studio installations, damping material is commonly used on the walls and ceilings make the room “acoustically dead." In this type of anechoic environment, the subwoofer will tend to experience minimal “Boundary Loading” effects. Firing the subwoofer downward or directly facing forward, (Fig. 1), and keeping the cabinet at least 5” (12.7 cm) away from any wall will provide best results.

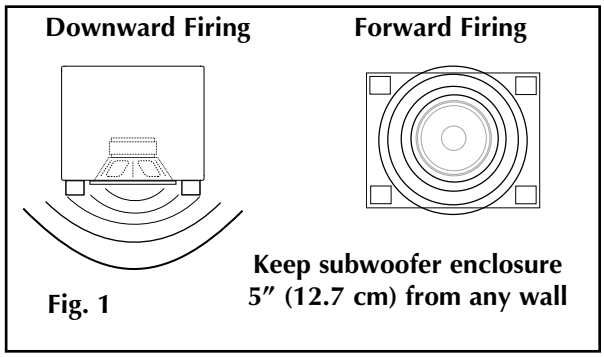
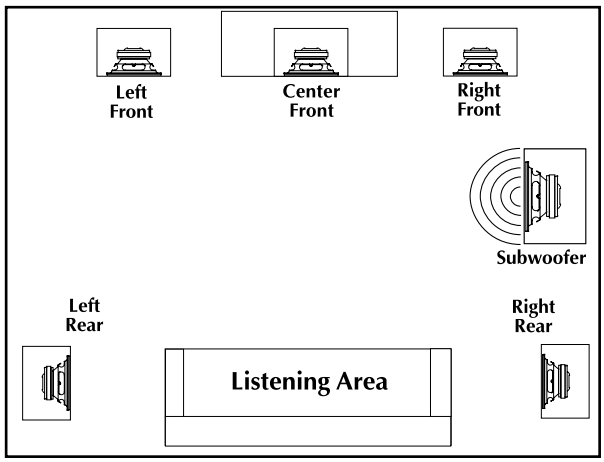


Fig. 1

Home Theater Installations

Home Theater installations are typically medium sized living rooms or game rooms that have large, flat walls. Acoustics in this type of installation can have a big effect on the SPL (**S**ound **P**ressure **L**evel) and f3 (low frequency cut-off) of the subwoofer because the walls are very reflective. The only elements in these installations that acoustically “absorb” sounds are furniture and carpet. Dramatic “Boundary Loading” can be achieved by locating the subwoofer under a table, next to a wall or in a corner, thus increasing SPL and lowering the f3 of the subwoofer system. Locating the subwoofer in the middle of the room or in a large open area where there are few reflective surfaces will cause a decrease in SPL and an increase in f3 and standing waves. Experiment with different locations in the room to determine which type of bass response works best in your home theater.

Another technique is to place the subwoofer in the listening area, then listen to the subwoofer while standing in different locations in the room. A location where you hear the most accurate and smoothest bass response would be a good location to place the subwoofer.



A Note On Cable Lengths

The length of signal and speaker cabling used in your home theater system can have an audible effect on your system performance capabilities. Whenever possible, locate the amplifier such as to minimize the cable lengths between the amplifier output terminals and speakers themselves. By minimizing these cable lengths one can avoid possible interaction with other high voltage cabling, and signal loss and/or degradation of signal quality can be avoided. Extreme cable lengths can diminish the damping factor of the amplifier and negatively alter the amplifiers ability to control the speaker it is driving.

Selecting Surround Speakers

An ideal 5.1 surround system will employ 5 identical speakers in the front left, front right, center, back left and back right locations. Often a D'Appolito center speaker can be utilized; these speakers typically use a pair of mid range/mid bass speakers and a single tweeter. In some applications this yields better aesthetic qualities. Care should be taken to ensure that the overall timbre of the center-channel speaker is near identical to the front and rear surround speakers. Your Fosgate Audionics amplifier is capable of generating large amounts of usable output power; therefore, you should pay close attention to the rated power of the speakers selected for use.

Operation

POWER SWITCH

The POWER switch is located on the rear panel of the amplifier. An internal lamp indicates when it is turned on.

Standard practice is to turn the amplifier on last and off first when powering your sound system up or down, to prevent sending damaging transients to the speakers.

It is possible to leave the power switch in the on position and switch the amplifier remotely through a power strip or preamp switched outlet. When doing so, make sure the powerstrip or switched outlet is rated for the power required by the amplifier.

IMPEDANCE SWITCH

Located on the rear panel. This allows the amplifier power supply to be matched to the speaker load for more efficient, cooler running operation. Set the Impedance Switch according to the lowest nominal impedance among all your speakers. Use the following guide when selecting the Impedance Switch setting:

Nominal Speaker Impedance	*Impedance Switch setting*
6-8Ω or higher	8Ω
4-6Ω	6Ω
4Ω or lower	4Ω

If you're are uncertain of the nominal impedance of your speakers, start with an Impedance Switch setting of 8Ω. Listen to a clean recording of human voice or acoustic instruments at high volume levels. Excessive popping noises (other than the clipping distortion or speaker cone popping expected from excessive power levels) indicates the protection circuits have activated. In this case, select the next lower value Impedance Switch setting until the popping noise is eliminated. The lower value Impedance Switch settings will prevent overloading the amplifier when driving low impedance speakers.

AMPLIFIER POWER PROTECTION

The amplifier output MOSFETs are protected from excessive power dissipation by complex protection circuitry. This power protection circuitry limits the power when it measures signal voltage and current conditions that will exceed the pre-determined power limit of the MOSFETs. An instantaneous power calculation is performed within each of the five channels, causing the affected amplifier to automatically limit power when needed. A speaker load with an excessively low impedance will activate the protection when sufficient audio is present, but continue operating normally otherwise.

SHORT PROTECTION

The amplifier protection circuit also protects against shorts, and will instantly limit the output power if speaker wires are shorted together. Normal operation will continue immediately after the short is removed.

POWER SUPPLY CURRENT LIMITING PROTECTION

The switching power supply will protect itself from excessive power dissipation by continuously monitoring currents in the switching MOSFETs. The Current Limiting circuit measures the currents in the switching MOSFETs and will instantaneously limit them to a safe level.

12V REMOTE TURN-ON/NORMAL

The FAA1000.5 can be turned on remotely with a 12V DC signal. In order to operate correctly, the Power Switch must be on, the Turn-On Selector switch must be in the "12V Remote" position, and a 12V DC signal must be connected to the 3.5mm input jack and activated from a Preamp/Processor unit. If no 12V remote signal is available, place the Turn-On Selector switch in the "Normal" position, and the amplifier will operate normally whenever the Power Switch is turned on.

RED/AMBER/BLUE INDICATORS

The different color LEDs correspond to particular circuits within the amplifier, and can be useful in analyzing problems. All of these indicators must be on before signal will be delivered to the speakers.

Red indicates that AC Line power is connected to the amplifier, and the Line fuse is not blown.

Amber indicates that the Switch Mode Power Supply is operating and delivering power to the amplifier modules.

Blue indicates that each of the corresponding five amplifier modules has a "12V Remote" or "Normal" turn-on signal, and will deliver power to a speaker when an input signal is applied.

TURN-OFF TRANSIENT PROTECTION

Speaker loads are protected from turn-off transients by a circuit that monitors the power supply and controls the amplifier when power turn-off events are detected. At turn-off, this circuit acts quickly to mute the amplifier (before power supply capacitors discharge and voltages collapse into the output signal), preventing speaker 'pops'.

SOFT TURN-ON

Each channel contains a Soft Turn-On circuit that eliminates turn-on 'pops'. This is an 'active-on' circuit that will not power up the amplifier channel until all power supplies (commonly referred to as 'rails') have fully charged up and settled. Only then will the Soft Turn-On process slowly begin to ramp up the bias currents of the amplifier, and gradually start to deliver energy to the speaker load. Within 10 seconds, full bias currents are established and the amplifier is capable of delivering rated power to your speaker load. This way, turn-on transients from rapidly rising rail voltages are isolated from your speakers.

WARM UP

To achieve the best sonic performance from the amplifier, we recommend letting it warm up for one (1) hour before beginning any critical listening. The amplifier may not deliver its full potential sound quality before this time has passed.

CLEANING AND MAINTENANCE

There is no requirement for regular maintenance on the electronic components of the amplifier. If the case becomes soiled it can be cleaned using a soft cloth and a mild detergent, such as spray window or glass cleaner. To avoid liquid entering the amplifier, spray cleaner on a cloth instead of directly on the amplifier. If the amplifier is located in a particularly dusty environment cleaning the inside with compressed air or vacuuming every 18 to 24 months is sufficient.

MODULAR PANEL REMOVAL AND INSTALLATION

The modular panels are easily removed and installed for cleaning and future upgrades.

⚠ **CAUTION:** To prevent injury and/or damage to the unit, always ensure the amplifier is turned off and unplugged from the power source before removal or installation of channel modules.

Removal

Disconnect input and output cables from the modular panel to be removed.

Unscrew the thumb screws at the top and bottom of the panel.

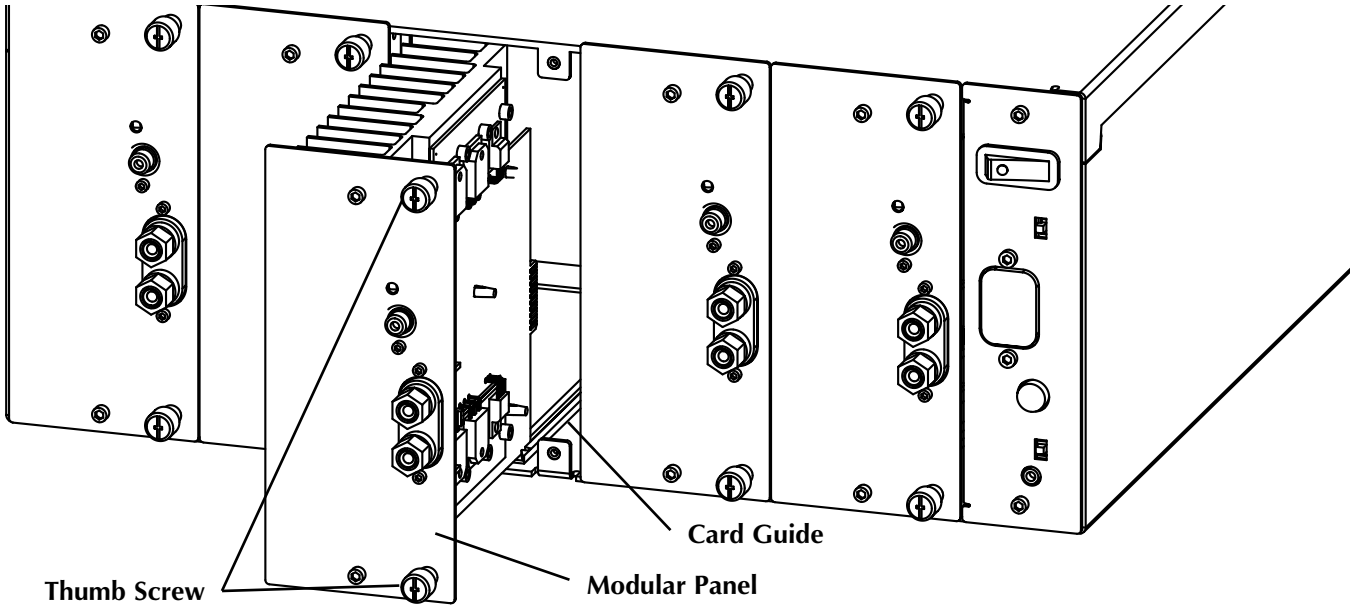
Slide the modular panel straight out from the amplifier.

Installing

Ensure the modular panel is inserted into the card guide at the bottom of the amplifier. See illustration below.

Slide the panel straight into the amplifier. Slight pressure may be required to set the connection of modular board.

Slowly hand tighten the thumb screws until the modular panel is flush against the amplifier. DO NOT overtighten the screws.



trans•*ana*►

The acronym **trans•*ana*** was assigned to this amplifier topology by Rockford's resident amplifier genius, Jim Strickland. The **trans•*ana*** (**TRANS**conductance **A**ctive **N**odal **A**mplifier) is characterized by the power gain in the output stage, a characteristic it shares with the recording studio standard Hafler **trans•*nova*** amplifiers, also designed by Jim Strickland.

The **trans•*ana*** topology is particularly well suited to multi-channel amplification because of its simplicity and efficiency. The vertical MOSFETs used in the 1000.5 have much lower 'on' resistance than the lateral MOSFETs used in the early years of MOSFET amplification, which results in less operating heat with lower resistance speakers. This produces less power dissipation on the amplifier heatsinks, and creates the tremendous power capability of the 1000.5 amplifier.

The input and driver stages of the **trans•*ana*** topology operate at low voltage, allowing the use of low-power preamp-type circuitry for all the amplifier stages ahead of the output stage.

The transition from the low voltage input to the high voltage output circuit is handled by a pair of complementary bipolar driver transistors. The drivers form an *active node* at ultrasonic frequencies and couple very accurately to the gates of the MOSFETs. This results in highly stable and highly linear performance.

The output stage uses Vertical MOSFETs configured in a "source-on-rail" connection to deliver their full voltage gain. Using source-on-rail configured MOSFETs to provide voltage gain inherently increases the power gain (for the same bandwidth) of the output stage by typically 10 times over a conventional "voltage-follower" connection. Despite whether the voltage-follower amplifier uses MOSFETs, or Bipolar transistors, and despite the number of devices used, or the beta (current gain) or transconductance specs of these parts, no voltage-follower topology can possibly match the **trans•*ana*** for power gain in the output stage.

This concentration of power gain in the output circuit of the amplifier is the crucial characteristic of **trans•*ana*** that allows the use of the finest preamp circuitry available up until the very last stage. Additionally, the **trans•*ana*** requires a total of only four (4) serial stages from input to output, compared to the five (5) or six (6) required by more conventional amplifier designs. The 'less is more' philosophy historically embraced by audiophiles is audibly demonstrated in the clarity and presence of the Fosgate Audionics 1000.5 **trans•*ana*** amplifier.

SHORT HISTORY OF MOSFETs

Jim Strickland has been designing amplifiers with MOSFETs from the beginning of his audio career, as the founder/inventor/owner of Acoustat loudspeakers. Why? Because he thinks they sound better. The earliest MOSFETs were rare and expensive. Still, audiophiles demanded the best sound available, and companies such as Hafler and Acoustat provided the MOSFET amplifiers they wanted. Years later, Rockford Corporation bought Hafler and Acoustat, and appointed Jim VP of Engineering to oversee all technical issues. Naturally, when designing the Fosgate Audionics amplifier, he continued the tradition of many notable MOSFET amplifiers of the past. These days, besides the continually growing opinion among professional recording engineers and audiophiles that MOSFETs are the device of choice for sonic excellence in power amplifiers, there are sound economic benefits to MOSFETs that make them a considerable value to the audio enthusiast.

The "Made in the USA" audio manufacturing industry in total is a very small and insignificant economic force in the eyes of the world semiconductor manufacturing industry. Pleas for quality audio components go unheard among the din of colossal prospects such as the automotive, telecom and computer industries clamoring for attention. Fortunately, for the last 20 years MOSFETs have steadily grown to become the power device of choice for ALL industries, eclipsing Bipolars, IGBTs and others by leaps and bounds. The future of power devices is in MOSFETs. The high current switching needs demanded by automotive, and high speeds demanded by switching power supplies for computers and telecom are all being met today by MOSFETs, not Bipolars. Competition among semiconductor manufacturers to produce the fastest switching, highest current MOSFET is fierce because the rewards are high. At this point in history, long-suffering MOSFET-loving audiophiles are reaping benefits from the battling titans of industry.

JFETs

The most critical element of any amplifier circuit is the differential amplifier. This is the "front-end" part of the circuit that compares the input signal to the output signal, and makes tiny adjustments to the amplifier to correct any errors. To accomplish this task, the differential amplifier must be extremely fast, extremely accurate, and extremely quiet. Most commonly, this circuit is made out of two matched bipolar transistors. In the Fosgate Audionics amplifiers, we have chosen to use JFETs (**J**unction **F**ield-**E**ffect **T**ransistors) for the differential amplifier circuit. JFETs are most commonly seen only in low-power audio equipment such as preamps or phono stages.

JFETs are small-signal amplifying devices that operate in a manner similar to the power MOSFET devices used in the output stage of the Fosgate Audionics amplifiers. Both devices are 'transconductance' devices, and work more like a triode tube than a Bipolar. Besides many technical advantages JFETs can have over Bipolar transistors, there may be sonic advantages to a discrete circuit comprised of 'FET-like' devices in both the input and output stages.

ALL DISCRETE CIRCUITRY

The better amplifiers and preamps in the world do not use operational amplifiers (opamps) in the signal path. Instead, they use discrete components (transistors, resistors, capacitors, JFETS etc.) to build up each stage of the amplifier. In this way, the amplifier designer has control over all operating parameters of the circuit.

An opamp is a cheap and easy way to buffer a signal, and can be used to add gain controls, tone controls, and other user-controlled functions that cause variable impedances in the signal path. Each opamp is composed of a discrete circuit sealed in an 'IC chip' package, such that only a few selected points in the circuit can be accessed. In other words, an opamp cannot be tweaked or modified. In the mind of the amplifier designer, using an opamp surrenders a small part of the sonic signature of the amplifier to the manufacturer of the opamp. This situation makes opamps and gain controls less desirable for high-end amplifiers. The Fosgate Audionics amplifiers are all-discrete amplifiers, with no gain controls.

ELIMINATE GAIN CONTROLS

A gain control feature in an amplifier will add the need for at least one more stage in the signal path of the amplifier. Even worse is the front-panel mounted gain control, which adds long signal runs from the back panel inputs to the front. These wires are vulnerable to noise signals that exist inside the amplifier.

Eliminating this gain feature improves the amplifier in two (2) ways: First, there is one less stage in the signal path to add noise and distortion. Second, it is more likely to produce a clean-sounding, noise-free system installation.

The worst hum and hiss problems are caused by the natural tendency to turn the amplifier gain controls all the way up. A properly designed system will have the amplifier gain controls turned DOWN as far as possible, and have a hotter input signal on the RCA cables. This arrangement minimizes the amplification of any hum picked up on the RCA cable. By eliminating the gain controls in the Fosgate Audionics amplifiers, it forces this issue back on the input signal, and ***requires*** a hot input signal to drive the amplifier to full output.

CHANNEL GROUNDING

The first lesson in grounding is this: eliminate ground loops.

On paper, any system with multi-channel unbalanced RCA connectors has built-in ground loops. For instance, an unbalanced RCA stereo connection between a preamp and an amplifier has this ground loop: Starting at the left channel preamp RCA ground, through the cable to the amplifier left RCA ground, through the amplifier ground to the right RCA ground, back through the cable to the right preamp RCA ground, through the preamp ground back to the left RCA ground. This is a ground loop that can pick up hum. The longer the RCA cables are, and the further they are physically apart from each other, the worse the hum gets.

Now look at a typical 5.1 home theater system and imagine how bad the situation can get. Fortunately, the Fosgate Audionics amplifier addresses this issue by establishing a separate ground for each channel of the amplifier. Each RCA ground is treated as a "ground signal", and each channel amplifies only the difference between the 'hot' signal and the 'ground' signal of each RCA. This way any hum signal caused by RCA ground loops between channels will not result in hum at any amplifier output, since each channel will establish its own ground reference at its RCA input.

Technical References

REGULATING SWITCHING POWER SUPPLY

The most common topic heard when discussing amplifier power supplies is CAPACITANCE. Everyone wants to know how many 'farads' of capacitance a particular amplifier has.

If the power supply is a conventional 60Hz design, there is reason behind that concern. The purpose of power supply capacitance is to provide energy storage. The exact amount of energy a capacitor holds can be specified by the number of energy units, called 'Joules', it contains when fully charged. A 60 Hz supply will fully charge the "rail" capacitors 120 times every second (the "rail" is the main high-voltage DC power supply that powers the output stage). This charging event occurs almost instantaneously at the peaks of the AC voltage signal. During the time between charging events, the amplifier is **discharging** the capacitors, causing voltage sag on the power supply rails. This 'discharging time' is approximately 1/120th of a second, or about eight (8) milliseconds. In other words, during this eight (8) ms discharging time, the amplifier is draining energy from the rail capacitors and using it to drive the speaker load. Exactly ZERO Joules of this energy is coming from the wall socket during this time. As a result, 60 Hz supplies need extremely large amounts of capacitance to "hold up" the rails between charging events, and prevent excessive voltage sag and clipping distortion.

Is there any other improvement that could be made other than adding more capacitance? What if you could DOUBLE the number of times the rail capacitors get charged every second? Then the discharge time would be cut in HALF, and the rail capacitors would be fully recharged TWICE as often. Unfortunately, this is just not possible with a 60 Hz power source.

With Switch-Mode-Power-Supply (SMPS) technology, you can provide not just twice as many, but well over 1,000 charging events for every one event in a 60 Hz supply. In fact, the SMPS used in the Fosgate Audionics amplifiers fully charges the rail capacitors 100,000 times every second.

Besides the quantum leaps in charging events per second, the Fosgate Audionics power supply employs a dedicated feed-back-controlled amplifier – completely separate from the audio amplifier – to further eliminate voltage-sag distortion in the DC rails of the power supply. The Fosgate Audionics power supply is a Regulating Switch-Mode-Power-Supply. It has its own power supply amplifier with an extremely precise DC reference voltage as an input signal, and a high-voltage DC rail for the output. Feedback from the DC rail to the regulating 'power supply amplifier' senses any 'distortion' caused by changing load conditions, and adjusts each charging time in an attempt to produce a 'non-distorted' (i.e. pure DC) amplified version of its' input reference voltage. It operates the same way an audio amplifier does, monitoring the output with feedback, and correcting internal operating parameters to produce a non-distorted amplified version of its audio input.

The 'power supply amplifier' accomplishes this by precision control of the charging event. Unlike a 60 Hz supply, where charging of the capacitors is an uncontrolled, instantaneous event, the Fosgate Audionics power supply monitors the demands of the audio amplifier, and adjusts the charging time of the power supply for minimal voltage droop on the rail capacitors. In the case of maximum power load, the charging event can take a long time. In fact, it may require a nearly continuous transfer of energy from one event to the next. At idle, the charge event happens very quickly, as there is very little demand for energy when the amplifier is at idle (i.e. no signal). Since the feedback-controlled "power supply amplifier" is an analog process, there is a nearly infinite amount of resolution available to adjust these charging times. This is most fortunate, since the variety of energy demands in an audio amplifier are also infinite in nature.

In these two ways, increasing to 100,000 charging events every second, and precisely **regulating** each of these charging events for minimum voltage droop, the Fosgate Audionics power supply achieves the ultimate goal of any power supply design: 'stiff rails' that are impervious to the radical load fluctuations at the output of every audio amplifier.

LINE REGULATION/ACTIVE POWER CONDITIONING

Another benefit of a regulating switch-mode-power-supply is the uncanny ability to react to aberrations in the 60 Hz power line. The Fosgate Audionics amplifiers are rated to deliver full power over the voltage range of 100-140 VAC, 50-60 Hz. What is not readily apparent from this specification is the fact that over this entire line voltage range, the power supply rails do not change. So not only does this supply maintain a constant output voltage to the amplifier rails when the speaker load changes, it also endures aberrations in the 60 Hz power line. This supply effectively provides its own active power conditioning and is impervious to 'brown-out' conditions and line transients. What is active line conditioning, except the ability to **regulate** the line voltage and protect the circuitry from these line fluctuations? The Fosgate Audionics Regulating Switch-Mode-Power-Supply produces these same results as a side benefit of the regulating power supply process itself.

By comparison, a conventional 60 Hz power supply will pass these aberrations directly through to the amplifier power supply rails. For example, a low line of 100 VAC would cause low rails and result in a lower output power rating. A high line of 140 VAC would cause a rail that is higher – in direct proportion to the increase in line voltage – and may overpower the amplifier or exceed the voltage rating of some circuit components. For this reason, the 60 Hz supply-based amplifier will usually be designed with more costly higher-voltage components in order to guard against this dangerous condition.

SHORT PROTECTION

All FOSGATE AUDIONICS amplifiers are protected from damage due to shorted speaker leads, or failed speakers. This short protection circuit shuts off the amplifier the instant a short is detected, and automatically recovers when the short is removed. The amplifier operates normally after recovery.

This electronic short protection has many advantages over fuse protection. First, there is no need to replace fuses after a short occurs. The short protection circuit will activate, then recover automatically, with no parts to replace or breakers to reset.

Second, by electronically measuring the amplitude and duration of the short, the short protection circuit can be tailored to each individual amplifier. There is more accuracy available than with fuses. Fuses come in two types: Slo-Blo and Fast-Blo. They also come in a handful of values. At some point the amplifier designer has to choose one. Invariably this fuse is a little too big, or a little too small. Either way, someone will not be happy.

Third, the short protection circuit cannot be replaced with a paper clip, a cigarette filter rolled in tin foil, or any other homemade "No-Blo" fuse.

NOTE: The line fuse listed on the specifications page will blow in the event of a major component failure. Typically it will not interfere with normal operation.

MULTIPLYING POWER PROTECTION

The simplest protection circuit commonly used in power amplifiers is known as 'current-limiting' protection. This type of circuit simply measures the output current of the amplifier and, when it reaches a certain value, clamps off the output devices. This can function well under controlled circumstances, but it has two serious problems. A current-limiting circuit does not measure the actual power dissipation in the output devices, and it does not necessarily allow the high-current transients that are so prevalent in many speaker loads.

What could be more important than measuring power dissipation, if your goal is to protect the output devices (MOSFETs) from failing? In order to measure the power dissipation of a device, you need to know both the current through it, and the voltage across it. Then, to calculate the power, multiply the current by the voltage to solve the power equation P = VI. Current-limiting protection circuits only measure the current, and ASSUME a worst-case voltage. This assumption can place severe limitations on the amplifier ability to protect a wide variety of speaker loads. The Fosgate Audionics amplifiers employ a multiplier circuit to calculate the actual power dissipation in the output devices. This circuit is more costly and complicated than a current-limiting circuit, but is absolutely essential if 'real-power' protection is desired. This real-power information is the heart of the Fosgate Audionics protection system, and allows the circuit to activate based only on the actual power dissipation of the output devices, not on the assumed dissipation.

OVER/UNDERPROTECTION

In designing an effective protection circuit, overprotection can be as undesirable as underprotection. Underprotection might allow amplifier failures. Overprotection can limit the dynamic performance of the amplifier. The conservative amplifier designer will not allow an amplifier to exceed its power rating for even a moment. The fact is, although there are hard limits on the voltage and current capabilities of output devices, every system has some capability of absorbing peak power events. This ability to endure short periods of excessive power dissipation is due to the thermal capacitance of the system a real and measurable quantity directly related to the physical mass of the output devices, heatsink, and other mechanical or thermal components in the vicinity of the device at risk. The thermal capacitance of any system indicates the speed at which the components heat up. Knowing this, as well as being able to measure the actual power dissipation in the output devices, allows the Fosgate Audionics amplifier to delay activation of protection circuits during peak power events and avoid limiting the dynamic performance of the amplifier whenever possible.

Specifications

Frequency Response:	20Hz to 20kHz, ±0.1dB at rated output
Total Harmonic Distortion:	0.1% from 20-20kHz @ 4Ω
Input Impedance:	Nominal 18k ohms
Input Sensitivity Range:	1.4V for Full Rated Output @ 8Ω 1.0V for Full Rated Output @ 4Ω
Gain:	Voltage gain of 29dB
Power Rating:	200 watts RMS continuous per channel, all channels driven from 20Hz to 20kHz @ 4, 6, or 8 Ω (Ohms)
Damping Factor:	>2500 from 10Hz to 400Hz, >700 up to 20KHz, 8Ω reference
Crosstalk:	>115db (1KHz)
Remote Turn-On:	+12V DC Nominal, +6V DC Minimum, +16V DC Maximum
Mains Power Voltage:	100-140V AC, 60-410Hz
Line Fuse:	15A, 3AG, Slo-Blo, 1ea.
Power Requirements:	1500 Watts Maximum
Dimensions:	7.5"H x 17"W x 15.75"D (19.1cm x 43.2cm x 40.0cm)
Net Weight:	62 lbs. (24.8kg)

Rockford Corporation (Fosgate Audionics Division) offers a limited warranty on Fosgate Audionics products on the following terms:

•Length of Warranty

Five (5) years

•What is Covered

This warranty applies only to products sold to the original owner and is non-transferable. This warranty only applies to units sold in the continental United States. A copy of the receipt is required stating the customer's name, dealer name, product purchased and date of purchase.

•Products Found to be Defective During the Warranty Period

Defective products will be repaired or replaced (with product deemed to be equivalent) at Fosgate Audionics' discretion.

•What is NOT Covered

1. Damage caused by accident, abuse, improper operations, water, theft
2. Service performed by anyone other than Fosgate Audionics or an Authorized Fosgate Audionics service center
3. Any product purchased outside the United States (please contact your local dealer)
4. Shipping charges to get the unit to Fosgate Audionics
5. Any product which has had the serial number defaced, altered, or removed

•Limit on Implied Warranties

Any implied warranties including warranties of fitness for use and merchantability are limited in duration to the period of the express warranty set forth above. Some states do not allow limitations on the length of an implied warranty, so this limitation may not apply. No person is authorized to assume for Fosgate Audionics any other liability in connection with the sale of the product.

•How to Obtain Service or Technical Support

Please call 1-866-777-7282 for Rockford/Fosgate Audionics support. You must obtain an RA # (return authorization number) to return any products to Fosgate Audionics. You are responsible for shipment of product to Fosgate Audionics.

Technical Repair

Rockford Corporation
Fosgate Audionics Division
2055 E. 5th Street
Tempe, Arizona 85281

Jim Fosgate

Jim Fosgate began his career in multi-channel audio with the "Tate" surround technology, a quadraphonic circuit. He worked with Peter Schreiber, the inventor of matrix surround decoding. Jim and Peter created the Space Matrix 3600 decoder that was a 5 channel circuit. Jim holds 25 patents in the audio industry. He created the acclaimed "6-Axis" surround decoding technology. He is also the creator of the acclaimed Dolby Pro-Logic II decoding technology, which incorporates feedback steering logic. Jim's love is tube components and he is considered among the finest tube component designers in the world.

Fosgate Audionics

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11/02 BM
MAN-3598-B

Printed in U.S.A.