
CARVIN

FET 400, 900, & 2000

POWER AMPLIFIER MANUAL

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INTRODUCTION

This manual is designed to give an overview of the features and performance of Carvin's professional MOSFET amplifier line. Each of the "FET" series amplifiers (FET-400, FET-900, and FET-2000) incorporate the same front and rear panel features. They differ from each other in performance specifications and power output. This manual will attempt to describe the features common to each amplifier, acknowledging the specifications and power output differences.

This manual will deal with unpacking, features, set-up, connections (input & output), special uses and full service (technical) information about the FET series amps. There are several user oriented diagrams and illustrations that should prove helpful in better understanding the capabilities and various functions of the amps.

The information presented in this manual will help you become acquainted with the various capabilities and features of the Carvin FET series amps, which should ensure the best possible performance and enjoyment. If you have any questions regarding the operation of your new amplifier not covered in this manual, please call our toll-free number (800)854-2235, and our sales and engineering staff will be happy to assist you.

FEATURES

- * Third Generation MOSFET Technology
- * Superior Sonic Performance
- * 2 ohms Load Capacity on Most Models
- * Heavy-Duty Linear Power Supply Exceeding FTC Ratings
- * Variable Speed Electronic Fan Controller for Quiet Operation
- * Professional Accessory Group:
 - * Limiters with Four Adj. Levels
 - * Hi Pass and Lo Pass Filters
 - * Balanced and Unbalanced Inputs
 - * 41 Step (1/2dB) Input Level Attenuators
 - * Mono Bridging Capability
- * LED Status Indicators for Signal and Clip Levels
- * Advance Protect System with "Speaker Guard"
- * Sound Reinforcement, Keyboards, and Hi-Fi/Recording Applications
- * Modular Construction
- * Professional Reliability
- * Carvin's Commitment to Excellence

CAUTION:

**DO NOT BLOCK THE REAR FAN VENTS.
KEEP A 3" MIN. CLEARANCE!!**

NOTE: THE ADVANCED ELECTRONIC SPEED CONTROLLER
WILL NOT START THE FAN UNTIL THE AMP IS WARM.
IT IS NORMAL TO HEAR A LOW LEVEL FAN HUM JUST BEFORE
AND AFTER THE FAN STARTS.

SECTION I

UNPACKING & INSPECTION

UNPACKING

Carefully remove your new Carvin power amplifier from its carton by turning the unit upside down (referenced by the lettering on the outside of the box). Pull the staples, remove any tape securing the box flaps and hold the flaps out. Gently turn the product right side up and lift the box off of the amp.

INSPECTION

TRUCK FREIGHT SHIPMENTS:

NOTE: INSPECT YOUR AMPLIFIER AND THE SHIPPING CARTON FOR ANY DAMAGE that may have occurred in shipping. If damage is found, notify the shipping company and Carvin immediately and obtain a DAMAGE INSPECTION REPORT from the shipping company. (BE SURE TO SAVE ALL PACKING MATERIALS FOR PROOF OF DAMAGE). Send a copy of the damage inspection report to Carvin and return the goods to Carvin. This will allow us to process any damage claim with the shipping company and provide you with the fastest return of new goods. All goods must first be received back at Carvin prior to exchanging or shipping a new item to you. This is both for yours and our protection.

Also, please note: if you file a "Damage Claim" you will have to settle directly with the shipping company. Upon receiving your settlement you will then have to re-order a new replacement.

UPS SHIPMENTS:

If damage is found, and the unit was shipped by UPS, first make note of the damage to the unit and SAVE ALL PACKING MATERIALS. Then, call Carvin and notify UPS of the damage. Have UPS inspect the damage and issue a damage report number. Then have your unit picked up and returned to us. Carvin will handle the damage claim with UPS, and upon receipt of your damaged unit, a new amplifier will be shipped to you immediately.

NOTE: Have UPS issue the damage report because if you file a claim with UPS, you will have to wait until you receive your settlement before re-ordering from Carvin. This could delay you receipt of properly operating amplifier 2 to 3 weeks. If you are at all in doubt, call Carvin and we'll be happy to assist you.

Also, be sure to insure the returned goods for the full amount. This will assure proper protection against further damage that could result in the return shipment.

Save the carton and all packing materials. In the event you have to re-ship your amplifier "ALWAYS" use the original carton and packing materials. This will provide the best possible protection for your unit during shipment. Both Carvin and the shipping company will not accept liability for damage caused by improper packing. (Replacement cartons are available from Carvin at \$10.00 + \$2.00 shipping)

Save your invoice. It will be required for warranty servicing of your unit in the event such servicing is necessary. Always check your invoice against the items you have received. If you find some items missing it may be that they were simply split up during shipment. Please allow several days for the rest of your order to arrive before inquiring. If you determine (after allowing an appropriate amount of time) that you have not received all your items, please call Carvin in order that we may take the necessary steps to assure that you receive all the items in your order.

CAUTION--TO PREVENT ELECTRIC SHOCK, DO NOT DEFEAT THE SAFETY GROUND CORD.

WARNING-- TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE UNIT TO RAIN, MOISTURE, EXPLOSIVE ATMOSPHERE, OR INSTALL AN IMPROPER FUSE.

Questions? Call our toll-free number (800) 854-2235.

SECTION II

ABOUT THE FET SERIES AMPLIFIERS

The primary considerations in the design of our new FET series amplifier is performance and reliability. The FET series amplifiers is designed using the latest generation MOSFET's (Metal Oxide Silicon Field Effect Semi-Conductors). These devices have a wide degree of thermal protection and inherent stability. They offer significant advantages in performance and reliability compared to conventional bipolar transistor technology. These devices coupled with Carvin's advanced computer aided design and test systems have allowed us to incorporate unique new circuits that exploit the MOSFET advantages. The combination of intelligent engineering and manufacturing have allowed the FET series amplifiers to achieve a competitive edge in performance when compared to other amplifiers. The following information will help you become more familiar with the advantages of MOSFET technology and your new FET series Carvin amplifier.

Why MOSFETS?

Carvin's MOSFET's are a third generation solid-state device quite different from transistors. They are high impedance in nature featuring a broader frequency range. The net result is a more transparent sound generated from their faster speed (higher frequency response). This is also translated into a higher "slew rate" performance. In many ways they resemble high impedance tubes but without all the inefficiencies of tubes. You will definately hear the sonic improvements the FET Series will make for your system!

MOSFET'S exhibits properties of "self protection" from thermal stress. They offer high current capacity for increased reliability and quick response to high level transients. They are inherently more reliable than bipolar transistors for several reason.

- 1) MOSFET's have a negative temperature coefficient relative to current flow. This means that as a device heats up, its internal impedance increases and the device becomes more resistive to current flow. This effectively distributes the current demand among the remaining devices and allows the troubled device to cool. The result is a more even temperature distribution and elimination of thermal runaway.
- 2) Conventional bipolar transistor amplifiers have a positive temperation coefficient. This means that as the devices temperature increases, its internal impedance decreases. Since the device's internal impedance lowers, the device tends to conduct more current..which heats the device more...etc. Eventually the device can fail resulting in an amp failure. When bipolar devices fail they will usually fail shorted. This means that the device can connect the D.C. rail voltage of the amplifier directly to the speaker outputs damaging your speakers.

3) Speaker protection by the virtue of the MOSFET's negative temperature coefficient becomes a built in safety feature. However, Carvin has taken the FET Series one step further by incorporating an exclusive "Speaker Guard" protection circuit that removes any potential damaging DC voltages to the speaker. Special "Traic" circuitry is far faster than mechanical relays assuring immediate shut down of the output section.

This speaker protection represents the best possible protection against speaker damage, Carvin offers a \$100 cash refund towards the purchase of new speakers should DC voltage by the FET Series (greater than two volts at the output terminals) damage speakers. There is no better guarantee in the industry.

NOTEABLE ADVANTAGES OF THE FET AMP:

MOSFET devices offer many significant advantages over conventional amplifiers as we have discussed. In addition to these advantages, Carvin has addressed engineering innovations that further distinguish the FET series amplifiers as truly innovative. The following engineering features are incorporated into each of the FET series amplifiers. They further ensure that you will receive absolutely non-compromised performance from your new Carvin amplifier.

1) Each FET amp is designed to perform well beyond the requirements of FTC power ratings. The FTC ratings specify very harsh operating conditions for Hi-Fi amplifiers, but in our opinion are not tough enough to guarantee long term reliability for pro-sound applications. So we established more stringent test conditions for specifying output over ratings. We push the amps harder, and insists that they maintain adequate safety margins under extreme temperatures. We also insists that the amplifiers operate continuously under heavy loads without degrading performance.

2) The FET series amplifiers feature heavy-duty linear power supplies with high current transformers and filters. The combination of these heavy duty power supplies with an extremely high current output amplifier allows these amps to drive continuous 2 ohm loads without thermal stress. Carvin elected to used massive iron core transformers instead of "lighter" switching power supplies because of their simplicity and better reliability. The FET-2000 features two power transformers with 60,000 mfd of filtering. This provides massive power bursts on low frequency transients. The outputs current capability of the FET amps is astounding. Normally the FET-900 amplifiers will deliver a continuous current of 60 amps when driven into a 2 ohm loads. The output current capacity of MOSFET devices in the FET-900 will delivery 360 amps per channel safely. The FET-2000 amplifier delivers 720 amps!

3) The FET series amplifiers are also short circuit protected. Shorted speaker cables (or intermittent shorts in cables) can kill some amplifiers. The FET series amplifiers will disconnect themselves from the load. Removing the output short will allow the amplifiers to reset and resume normal operation.

4) All FET amplifiers feature "turn on muting." This circuit mutes the input of the amplifier for approximately three seconds after the power is applied to the unit. It allows the amplifiers to properly stabilize and suppress any high current spikes that could damage your speakers.

5) All FET amplifiers feature a thermally controlled fan. This circuit is especially unique in that it offers continuously variable fan settings according to the heat dissipation requirements of the unit. This means that, as the MOSFET devices require additional cooling, the fan will smoothly adjust to an appropriate speed to afford the specific air flow for the load conditions. This eliminated thermal shock (common to fans that "switch on") and maintains the lowest possible fan setting at all times lowering overall fan noise. **CAUTION: DO NOT BLOCK VENTS--KEEP A 3" CLEARANCE!** Note: The advanced electronic fan speed control will not start the fan until the unit is warm. It is normal to hear a low level fan hum before the fan starts.

6) Carvin utilizes only premium grade components in the construction of the FET amplifiers. All components used are graded and evaluated both during the quality control stages of assembly, in bench, and final testing.

7) Carvin uses a special computer test system (ATE) to perform over 100 diagnostic tests on every amp before it leaves production. This includes output power, protection systems, THD, slew rate, and a host of other performance tests. In addition to this computerized testing, each unit is stress tested and undergoes a 8 hour burn-in period. Carvin's goal is to ensure you of quality without compromise.

8) Although the FET series amplifiers are designed to handle loads and endure conditions as that normal high fidelity amplifiers are not designed for, the FET amplifiers specs are typically much better than even the best hi-fi amps. They are an excellent choice for critical listening (as control room amplifiers) for digital playback systems or high quality stereo systems.

9) The extremely rugged construction of the FET amplifiers provides excellent results in demanding road use. The chassis is constructed from heavy 16 gauge steel sub panels with a standard 19" x 5 1/4" front rack panel milled from .187" thick aluminum. It is finished in a durable brushed black anodize process. All P.C. cards are the highest quality epoxy fiberglass with moisture-proof epoxy overplating. Only the highest quality (factory inspected) electronic components are used. Its rugged...and it's built to last!

As you read through the front and rear panel features (discussed in later sections of this manual) you will find even more examples of Carvin's noncompromised approach to designing the FET series amplifiers. The superior sonic quality and reliability of the Carvin FET series amplifiers coupled with FACTORY DIRECT sales enables Carvin to offer the FET series amplifiers at a competitive price....while providing superior performance.

FRONT PANEL FEATURES

#1 **POWER SWITCH** - Pushing the power switch "Up" will apply power to your unit. The red "LED" power "PWR" indicator light will illuminate to indicate the power amplifier is operational. The turn on "mute" circuitry will engage immediately upon applying power to your unit. This will delay applying amplified audio to the speaker outputs for approximately three seconds. This delay is normal and is designed to allow the amp to stabilize and protect your speakers from any high level transients that may be induced from a "turn on" spike.

#2 **PROTECT LIGHT** - The protect light will only illuminate when the FET's internal protection circuitry is engaged. This will happen in the presence of major low frequency transients or harmful D.C. voltages. The protect circuit utilizes high speed triac devices to sense any harmful signals that could possibly damage speakers and it will immediately engage the protect circuit to disconnect the speaker load from the amplifier. If this light illuminates, shut the amplifier down. Unplug the speakers determine if they are shorted.

NOTE: Under some conditions the Protect Light will briefly illuminate as the unit is turned on. This is normal and will not affect amps the performance.

#3 **CH#1 AND CH#2 LEVEL CONTROLS** - These controls are precision 41 step calibrated in 1/2 dB steps input level attenuators. They allow the operator to adjust the sensitivity of the power amp to match the mixer or pre-amp output levels. These controls do not limit the amps output power, and maximum output levels can be achieved at settings less than "full on." To properly adjust the gain controls:

- A. For full output, set the FET amplifier levels controls to #6.
- B. Adjust the mixers/pre-amp gain controls to the desired levels.
- C. The maximum input capacity on all FET models:
 - 1. Balanced.....+10 dBm
 - 2. Unbalanced.....+15 dBm
- D. If distortion occurs before the red peak indicators light, reduce the gain of the mixer/pre-amp and increase the level of the FET amplifier

#4 **LED STATUS INDICATORS** - To the left of the Input Level Attenuator for each channel are a pair of LED's that indicate the signal status of the channel. The "GREEN LED" indicates when a -30 dB signal is present at the putput (post level). The "RED LED" indicates precisely when clipping (distortion) starts to occur. These indicators monitor the output circuits of the amplifier offering an accurate indication of the presence of signal and any overloading. If the red clip indicators are lighting, you should turn down either the mixer/pre-amp, gain or the level at the amplifier until the light just stops flashing (occasional flashing is OK). These indicators feature a special stretch and hold circuit that will provide a very bright indication of both signal presense and clipping. Proper monitoring of the clip indicators from time to time will ensure that the cleanest possible signal is being delivered by the amplifier. **NOTE:** Continual flashing of the red clip indicators will not damage the amp but will be harmful to the speakers because of the square wave contents of the signal.

#5 **RACK MOUNT AND HANDLES** - The FET series amplifiers will fit in a standard three space 5 1/4" rack mount configuration. When rack mounting the amplifier be sure to allow for adequate ventilation. Each FET amplifier features contoured handles for carrying and positioning your amplifier. Use of the handles is recommended for ease and safety when carrying or positioning your amplifier. The rack handles are used to mount the front panel of the amplifier to the sub-chassis. It is not recommended to remove the handles.

REAR PANEL FEATURES

#1 **A.C.LINE CORD** - The FET series amplifiers are supplied with three conductor line cords. This arrangement (3 pin grounding type plugs) greatly reduce the possibility of electrical shock when used with three conductor outlets. (NEVER DEFEAT THE THIRD PIN GROUND OF THE A.C. CORD).

#2 **THE A.C. PRIMARY MAIN FUSE** - The FET series amplifiers utilize standard fuses according to the following configurations:

FET-400	5 Amp --Type 3 AGC
FET-900	10 Amp --Type 3 AGC

These are standard fuses and may be purchased from a local vendor. Never bypass or defeat the fuse. If you are consistently blowing A.C. main fuses you should consult the warranty service section.

#3 **SPEAKER OUTPUTS** - CH#1 AND CH#2 speaker outputs feature two 1/4" phone plugs (wired in parallel). This allows for direct connection of two speakers to each side of the FET series amplifiers. In addition to the two 1/4" phone jack outputs, each channel also features dual gold-plated 25 amp binding posts Banana jacks. The red denotes positive output and and Black denotes negative output. (See "Bridging the Amp" for additional uses of the Banana jacks.") NOTE: Only the use of the binding posts are recommended with the FET 2000 amps due to their high current output.

#4 **OUTPUT FUSES**- The output fuses are offered for added speaker protection. However, the AGC 10 amp fuse provided with your unit is too large to protect any speaker. This value is supplied because some speaker systems (like Carvin's) have their own protection. If your speaker system does not have protection, you may remove the AGC 10 amp fuse and replace it with the following suggested fuse values.

- A. 3/4 amp standard fuse for horn drivers up to 50 watts (bi-amped).
- B. AGC 1.5 amp standard fuse for horn driver up to 50 watts using a passive crossover.
- C. AGC 2.5 amp fuse for woofer rated between 100 to 150 watts.
- D. AGC 3 amp standard fuse for 300 to 400 watt speaker.
- E. AGC 2.5 amp standard fuse for 2 or 3 way speaker system rated at 100 watts.

These approximate fuse values are moderately conservative, but should offer exceptional volume levels with an adequate safety margin.

NOTE: The speaker fuse values assumes an 8 ohm loading. A lower impedance value "multiple speaker system" (or paralleled speakers) may require a larger fuse value. If you are at all unsure of a correct fuse value for your system, please feel free to call Carvin. Our sales and engineering staff will be eager to help you determine a proper value fuse for your system.

PROCEED WITH CAUTION!- WE ASSUME NO RESPONSIBILITY FOR ANY DAMAGE DONE TO SPEAKERS REGARDLESS OF CIRCUMSTANCES.

#5 **INPUTS-** Your amplifier will accept either a balanced line through the D3F "balanced" connector or an unbalanced line through the phone jack. The D3F connector pin wiring is:

Pin #1 - Ground
Pin #2 - Positive Bal.
Pin #3 - Negative Bal.

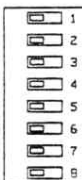
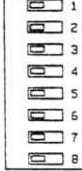
The balanced circuit features a transformerless differential amplifier designed to accept balanced lines down to 150 ohms. Input impedances as high as 50,000 ohms can also be used, but with some loss of high frequencies. This input "transformerless" design offers superior THD and frequency response over conventional inputs. The balanced inputs offer better than 90 dB rejection of common mode noise. So, your balanced lines will remain as quiet as possible.

The 1/4" phone plug input located to the side of the D3F balanced connector is a "stereo 1/4" phone jack." This allows for a balanced 1 1/4" phone plug input. Wiring of this connection is as follows:

Shield - Ground
Ring - Pin #2 Positive Bal.
Tip - Pin #3 Negative Bal.

Utilizing the 1/4" paralleled balanced inputs together with the standard D3F (XLR) inputs provides an excellent way of connecting CH#1 and CH#2 together. You may use a cord (such as the one depicted below) to connect the two inputs of the FET series amplifiers together for standard monaural operation. If you wish to utilize this connection, you may purchase a pre-built cord for Carvin (XLPH-6) cord to easily achieve the connection. The XLPH-6 cord costs \$12.00 plus \$2.00 shipping.

**Carvin FET Series Amplifiers
Accessory Switch Settings**

Switch	Action	Switch Position	
		Left	Right
 S1	S1-1	CH 1 Low Cut Filter	<-- <-->
	S1-2	CH 1 High Cut Filter	On Off
	S1-3	CH 1 Compressor, 10% Power (-10dB)	Off On
	S1-4	with S1-3 on, 15% Power (-8dB)	Off 15%
	S1-5	with S1-3 on, 20% Power (-7dB)	Off 20%
	S1-6	with S1-3 on, 25% Power (-6dB)	Off 25%
	S1-7	with S1-3 on, 50% Power (-6dB)	Off 50%
	S1-8	Stereo/Mono Bridge (see note below)	Stereo Mono
 S2	S2-1	CH 2 Low Cut Filter	On Off
	S2-2	CH 2 High Cut Filter	Off On
	S2-3	CH 2 Compressor, 10% Power (-10dB)	Off On
	S2-4	with S2-3 on, 15% Power (-8dB)	Off 15%
	S2-5	with S2-3 on, 20% Power (-7dB)	Off 20%
	S2-6	with S2-3 on, 25% Power (-6dB)	Off 25%
	S2-7	with S2-3 on, 50% Power (-6dB)	Off 50%
	S2-8	Stereo/Mono Bridge (see note below)	Mono Stereo

Note: For **Normal Stereo Operation** set S1-8 Left, and set S2-8 Right.
For **Mono Bridged Operation** set S1-8 Right, and set S2-8 Left.

For a complete description of switch settings see the operators manual. Unplug the amp from the power line, remove switch cover and use a small screw driver or the tip of a pencil to change switch settings. Replace switch cover.

#6 **PROFESSIONAL ACCESSORY GROUP (Remove the plastic cover plate with a screwdriver)**-These are gold conductor mini switches that are used to select the various accessory functions of the FET series amplifier. The switches are grouped according to the channel that they control. The "S1" grouped switches (switches #1 through #7) select the functions for channel #1 and the "S2" groups (switches #1 through #7) select the functions for channel #2. Switch #8 in both the "S1" and "S2" switch groups must be simultaneously selected together. They select either the "Stereo" or "Mono bridged" mode of the amplifier. The following chart and switch settings should help clarify the use of these switch groups.

NOTE: The following describes the use of the switches in normal stereo mode. Only the "S1" groups of switches is depicted for A Channel. These settings are the same for the B Channel "S2" switch group and you may transfer these settings to achieve the same function on channel #2.

The normal switch setting (as shipped from the factory) is S1-#1 (ON), S2-#1 (ON), S2-#8 (ON). all other switches are OFF.

<u>SWITCH #</u>	<u>SWITCH POSITION</u>	<u>FUNCTION</u>
S1-#1	LEFT	Turns on the low cut filter for the channel. This switch effectively cuts off all sub bass below 10hz. It is mainly used to eliminate sub bass that is unwanted during live performance use. It helps conserve the amplifiers power by eliminating power consuming sub-bass frequencies. This switch will nearly always be selected "ON" for concert/live performances. For studio monitor application, you will probably not use the low cut filter in order to advantage of the wide bandwidth response of the FET series amplifier.

concert/live performances. For studio monitor application, you will probably not use the low cut filter in order to advantage of the wide bandwidth response of the FET series amplifier.

S1-#2	RIGHT	Turns on the high cut filter for the channel. The high cut filter eliminates high frequency material above 30kHz. Because of the wide bandwidth of the FET series amplifiers (8Hz to 100kHz), it may be prudent to eliminate ultra-sonic frequencies above 30 kHz. This helps protect horn drivers and is a feature usually used for live performance situations. In the studio (as a control room monitor amplifier) you may wish to utilize the full bandwidth of the amplifier for the most accurate possible response. In this case you would leave both the "low cut" and "high cut" filters in the OFF position.
S1-#3	RIGHT	This switch does two things. First, it activates the compressor circuit for the channel. Second, it selects 10% of "over easy, soft knee" compression. Operation is virtually undetectible under normal operation. It helps eliminate transient peaks and effectively offers increased headroom. This ultimately allows for increased volume levels from your amplifier without distortion. The compressor ratio is 2:1. This means that above the preset threshold level a signal with a 10dB intensity would be reduced to 5dB for subsequent amplification. This switch set to the "ON" position represents the least compression and will offer a real perceived power increase of approximately 10%.
S1-#3,S1-#4	BOTH RIGHT	Switch S1-#3 turns the compressor on and switch S1-#4 selects an additional 8dB of compression for a total 18dB of compression. With these two switches in the "ON" position you will perceive a 15% increase in effective power.
S1-#3,S1-#5	BOTH RIGHT	Both of these switches are selected to "ON". ALL OTHER COMPRESSION SWITCHES ARE OFF. These two selected will provide a total 25dB of compression for an effective headroom power increase of approximately 20%.
S1-#3,S1-#6	BOTH RIGHT	ALL OTHER COMPRESSION SWITCHES OFF. This will provide a total 31dB of compression for an increased headroom power increase of 25% more power.

- S1-#3,S1-#7 BOTH RIGHT These two switches in the "ON" position will offer the greatest amount of compression. With both switches on (ALL OTHER COMPRESSION SWITCHES OFF) will offer a total 37dB of compression and an effecton power headroom increase of 50%.
- S1-#8,S1-#8 S1-#8 LEFT
S2-#8 RIGHT This switch configuration offers normal "stereo"operation from the FET amplifier.
- S1-#8,S2-#8 S1-#8 LEFT
S2-#8 RIGHT This switch configuration will place the amplifier in "mono bridged" mode.

The following chart may prove useful in an additional explanation regarding the use of the accessory switches on the FET series amplifier.

	Switch	Action	Switch Position	
			Left	Right
S1	1	CH 1 Low Cut Filter	On	Off
	2	CH 1 High Cut Filter	Off	On
	3	CH 1 Compressor, 10% Power (-10dB)	Off	On
	4	with S1-3 on, 15% Power (-8dB)	Off	15%
	5	with S1-3 on, 20% Power (-7dB)	Off	20%
	6	with S1-3 on, 25% Power (-6dB)	Off	25%
	7	with S1-3 on, 50% Power (-6dB)	Off	50%
	8	Stereo/Mono Bridge (see note below)	Stereo	Mono
S2	1	CH 2 Low Cut Filter	On	Off
	2	CH 2 High Cut Filter	Off	On
	3	CH 2 Compressor, 10% Power (-10dB)	Off	On
	4	with S2-3 on, 15% Power (-8dB)	Off	15%
	5	with S2-3 on, 20% Power (-7dB)	Off	20%
	6	with S2-3 on, 25% Power (-6dB)	Off	25%
	7	with S2-3 on, 50% Power (-6dB)	Off	50%
	8	Stereo/Mono Bridge (see note below)	Mono	Stereo

Note: For Normal Stereo Operation set S1-8 Left, and set S2-8 Right.
For Mono Bridged Operation set S1-8 Right, and set S2-8 Left.

For a complete description of switch settings see the operators manual. Unplug the amp from the power line, remove switch cover and use a small screw driver or the tip of a pencil to change switch settings. Replace switch cover.

#7 THERMOSTATICALLY CONTROLLED FAN-The FET series amplifiers use a continuously variable fan. The fan will speed up or slow down in response to the loads imposed on the amplifier and the required heat dissipation. The fan has been carefully tested to provide optimum cooling under any condition. CAUTION: DO NOT BLOCK THE VENTS. KEEP A 3" MIN CLEARANCE! NOTE: The advanced electronic fan speed control will not start the fan until the unit is warm. It is normal to hear a low level fan hum before the fan starts.

#8 THERMAL SHUT-DOWN - The FET series amplifiers incorporates a thermal shut-down switch mounted directly on the MOSFET heat sink. In the event the air supply is cut off to the amp or the amp is subjected to unusual loads or conditions, the AC primary circuit is turned off. Once this switch has been activated, all indicators will turn off. The fan will remain on to cool the amp down. By waiting approximately five minutes, the thermal switch will re-engage

Before using the amp, again please check the following:

1. The incoming air to the amp has not been pre-heated by other equipment.
2. Air supply around the amp has not been reduced or partially blocked.
3. The "Hot Air Outlet" has not been blocked, or feeding back directly into the air intake because of partial enclosure of the amp.
4. The amp load is highly reactive or the total speaker impedance is lower than 2 ohms per channel.

#9 120V/220V SWITCHING for the FET 400/900-This switch is located directly beside the A.C. fuse. A protective label will be placed over this switch marked with the setting it is set to. **BE SURE THIS SWITCH IS PROPERLY SELECTED TO THE APPROPRIATE LINE VOLTAGE PRIOR TO APPLYING POWER TO THE AMPLIFIER.** This switch will indicate the voltage that it is set to. So, simply looking at the switch and reading the voltage listed will indicate its voltage setting.

SECTION III

CONNECTIONS TO THE AMPLIFIER

INPUT CONNECTIONS

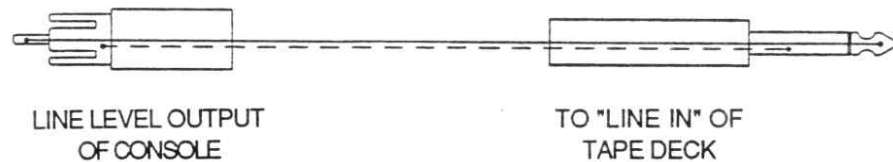
#1 **A.C. INPUT for the FET 400/FET 900-** The A.C. main voltage should be 120V or 220 V (as selected) at 50Hz/60Hz. The 3 pin grounded type AC plug is standard and is accommodated by all standard 3 pin American sockets. The color code of the cord is as follows:

HI (Switched Leg).....	Black
LO (Neutral).....	White
EARTH (Chassis Ground).....	Green w/Yellow Tracer

#2 **"XLR TYPE BALANCED INPUT"** - The 3 pin XLR input is provided on the rear panel of the FET series amplifiers. This is a balanced bi-polar differential input capable of accepting impedances from 150 to 50,000 ohms. If you will be using input cables that are longer than 10 feet it is recommended that you utilize the balanced inputs on your amp. Low impedance characteristically allows for best input performance from long cable runs, while electronic balancing helps to reduce stray field "hum".

#3 **RCA to 1/4" PHONE PLUG-**If you need to connect a single ended (RCA phono, or 1/4" phono) connection to the XLR or 1/4" phone plug input, you may utilize the following diagram for achieving this connection.

RCA TO 1/4" PHONE DIAGRAM
RCA TO XLR DIAGRAM



- #4 **1/4" PHONE PLUG INPUTS** - These inputs are "stereo phone plug" balanced inputs. They may be used as either a balanced or single ended input. If you wish to use them as a 1/4" balanced input you should use a stereo 1/4" phone plug wired according to the diagram presented in this manual.

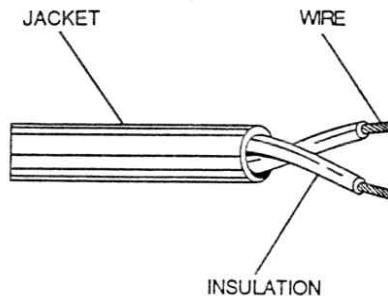
You may also insert a standard 1/4" phone plug (guitar type shielded cord connection) into this input. Using this single ended type input connection will short Pin #3 & #1 together to ground. This will leave Pin #2 as the positive input signal connection. This is a standard connection and will in no way harm the amplifier. However, if you are using a single ended 1/4" phone connection you cannot simultaneously use the balanced input. To do so will yield unsatisfactory performance from the balanced input.

NOTE: When making any connections, be sure you grasp only the plug and not the cord. This will prolong the life of the cords and greatly preserve reliable performance from your cords.

OUTPUT CONNECTIONS

- #1 **1/4"PHONE PLUG SPEAKER CONNECTIONS-** There are two 1/4" phone type speaker output connections per channel. These two jacks are wired in parallel. All speaker cords connected at these jacks should be non-shielded. See the following diagram for an illustration of the difference between shielded and unshielded cords.
NOTE: Use only the binding post on the FET 2000 for high current output applications

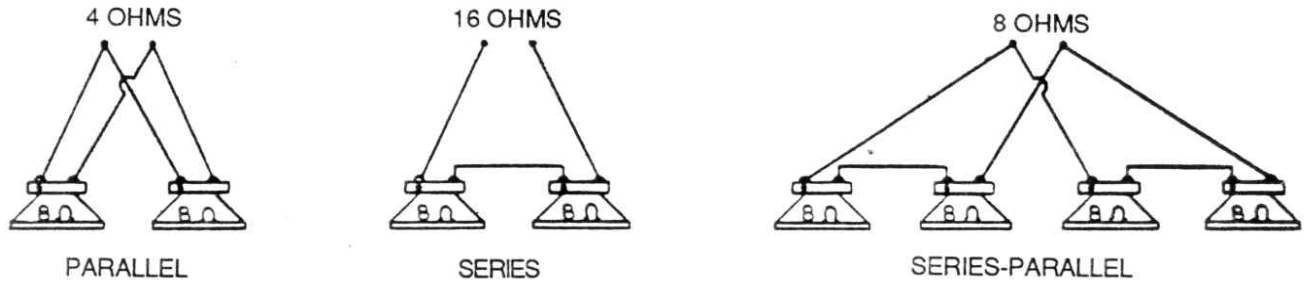
NON-SHIELD CABLE



To determine the appropriate gauge of unshielded speaker wire to use for the cable distance use the following chart:

<u>WIRE GAUGE</u>	<u>LENGTH</u>
18 Gauge	50'-100'
16 Gauge	100'-150'
14 Gauge	150'-200'
12 Gauge	200'-300'

Do not load any side of the amplifier below its rated minimum impedance (2 ohms). To achieve this you may have to utilize parallel, or series speaker connections. Please see the following diagram for the difference between series and parallel connections.



The actual formula for calculating parallel impedances is $Z_{\text{parallel}} = \frac{1}{\frac{1}{Z_1} + \frac{1}{Z_2} + \frac{1}{Z_3} + \dots + \frac{1}{Z_n}}$

The formula for series impedance is $Z_{\text{series}} = Z_1 + Z_2 + Z_3 + \dots + Z_n$

Usually when you are simple plugging two or more speakers into your amplifier you will be paralleling them to the output of your amp. In Series connections you will simply add the rated impedance of the speakers together to find the loading:

EXAMPLE: 2 ohms + 2 ohms = 4 ohms.

When you are paralleling speakers you should utilize the following formula to determine your amplifier loading:

FORMULA FOR PARALLEL IMPEDANCE

Take the rated impedance of each of your speakers, whether it is 8, 4, 3, 16 ohms or whatever. Invert these numbers (i.e. make a fraction out of them), For instance, 8 ohms would become 1/8, 4 ohms would become 1/4, etc. Add each of these fraction together and divide the numerator by the denominator. The result will be your load impedance produced by your speaker system. For instance, two 8 ohm speakers connected in parallel would provide the following calculation:

$$\frac{1}{8} + \frac{1}{8} = \frac{2}{8}$$

Inverted = 8/2 = 4 ohms **TOTAL LOAD IMPEDANCE**

If you have any questions regarding how many speakers you can run off your amplifier, please call Carvin. We will help you determine if you are operating your amplifier properly

BRIDGING THE AMP

Amplifier bridging is only recommended for high voltage "monaural" applications. Bridging a stereo amplifier essentially utilizes one side (heatsink) circuit assembly to amplify the positive waveform while using the remaining side to amplify the negative swing. Utilizing the additional power output devices in this configuration affords increased wattage (output power) at the same impedance value. Bridging is normally used in distributed speaker systems such as ceiling speaker arrays. The main benefit of bridging is the 70V output of the amplifier. This allows the amp to efficiently drive a speaker transformer required in multiple speaker arrays.

To bridge your amp, follow these directions:

- #1 Use Channel #1 input only. Channel #2 will not function when the amplifier is in the bridged mode. Remember, the amplifier will be operating in a monaural mode, so only (1) input will be required. You will use Channel #1 (Balanced) input only.
- #2 Locate the "Accessory Switches" on the rear panel of your unit. Remove the plastic cover plate with a screw driver. On the top group of switches "S1" group select "S1" group select switch #8 to the right. On the lower group of switches "S2" group, select switch #8 to the left. This will place your unit into the bridged mode.
- #3 Connect your speaker load across both of the "red" banana jack terminal posts. Channel #1 (red terminal) will carry the positive amplified signal, and Channel #2 (red terminal) will carry the negative signal. The black terminals are NOT used.
- #4 Connect the input signal to the amplifier. You must use the balanced input of Channel #1 only.
- #5 Switch on the amplifier and raise Channel #1 gain control to achieve the desired volume.

NOTE: Channel #2 volume control will have no effect on the input signal when the amp is in the bridged mode.

SECTION IV

BI-AMPING AND TRI-AMPING

We will discuss how to set up a conventional sound system where a full range audio signal passes through one amplifier and feeds a passive crossover within the speaker. This crossover divides the "lows" from the "highs". Outputs of the respective signals are fed to the low and high frequency drivers. In "bi-amping", the system utilizes an "active" electronic crossover, receiving the output signal from the pre-amp outputs of your mixing console. Internally, the active crossover divides the signal into its high and low frequency parts. The low frequency output of the crossover are then fed to the amplifier that directly drives the low frequency drivers (woofers). The high frequency output of the active crossover similarly feeds the amplifier dedicated to high frequency amplification, which drives the high frequency drivers (horns).

Bi-amplification requires the use of a power amplifier dedicated to high frequencies as well as another power amplifier for the low frequency drivers. It will deliver a cleaner sound with minimal distortion and will more efficiently drive the loudspeakers. Bi-amping offers better control over the crossover points as well as the relative volume levels of the high and low frequency components.

Tri-amping is the same as bi-amping except it utilizes a midrange output within a three-way system. In tri-amping, the output of the mixing console (full range audio signal) is fed to an active crossover that splits the audio into three frequency ranges. The outputs are fed to their respective amplifiers subsequently driving the high, mid, and low frequency drivers. Tri-amping offers exceptional control over the relative levels of each element's volume while offering selectivity for each of the two crossover points. Tri-amping is often used in high-quality high-level sound reinforcement applications. Please the block diagram for conventional versus Bi/Tri-Amped sound systems.

BENEFITS OF BIAMPING AND TRI-AMPING

Bi/Tri-Amping provides a great degree of efficiency that is typically lost by a conventional "Passive" crossover. Conventional crossovers utilize inductors, resistors, and capacitors in their design. The components of a passive crossover are used "In Line" with the outputs of the power amplifier and they affect the way in which the amplifier responds. These electronic devices can affect the output response of the power amplifier or waste much of its available output power. Since Bi-Amping or Tri-Amping circumvents these problems a more efficient delivery of power from the amps to the speakers is achieved. This results in greater efficiency from the sound system.

Bi-Amping and Tri-Amping also provides real power output "Headroom" advantages. Higher frequencies tend to "Ride" on top of the higher energy low frequencies being amplified. As the output of the amplifier begins reaching its total output power capacity these high frequencies may begin to reach the "Peak Output" of the amplifier before the low frequency material. This

effectively clips the high frequency material. Since the human ear is a very sensitive to high frequency distortion, this type of "High Frequency" clipping is very noticeable. By dividing the high and low frequency material prior to amplification by the systems power amplifiers this headroom problem is minimized. Bi-Amping allows for more low frequency headroom and greater high frequency headroom when compared to passive systems.

WHEN TO UTILIZE A BI/TRI AMP SYSTEM

Bi-Amped or Tri-Amped sound systems are best targeted toward high level sound reinforcement. The increased efficiency and headroom of these types of systems allow for higher volume levels, greater speaker protection and less overall cost in multiple speaker/amplifier systems. Because of the greater efficiency and protection of these types of systems, a Bi-Amped or Tri-Amped system will provide a higher degree of reliability for demand "high volume" sound reinforcement. Bi-Amping or Tri-Amping is the choice among professionals and sound companies where continuous high level sound reinforcement is required. It provides greater simplicity in set-up and affords more control over the response of the sound system.

If high level sound reinforcement is not needed, the best choice would be a passive crossover network system. In small to medium sized rooms, clubs or auditoriums you may not require the output of a Bi-Amped or Tri-Amped sound system. Passive sound systems are overall less expensive and sound excellent for these types of applications.

HOW TO USE AN ACTIVE CROSSOVER IN BI/TRI-AMPED SYSTEMS

Understand the optimum operating frequency ranges and power handling capacities of the loudspeaker drivers is essential to properly setting up the active crossover in a sound system. This information will allow the system operator to select the right crossover points in order to maximize the response of the system utilizing those driver. For example, a high frequency driver may indicate its optimum response range is from 1500 Hz to 20Khz. Its power handling capacity within that range may be 60 watts. The best choice for a crossover frequency would then be 1500Hz and above. To choose a lower crossover frequency could cause excessive coil excursion and subsequent damage to the driver. NOTE: For every octave a drivers frequency range is lowered its power handling capacity is divided by four. So dropping the crossover frequency to 750Hz would allow the above driver only approx. 15 watts of power handling capacity. However, a higher crossover point could allow for increased power handling capacity and less distortion. If a higher crossover frequency was then desired (for example, 2K or 2.5KHz) you would want to choose a woofer (or mid-range) speaker to compliment this crossover frequency. So, you would look for a low or mid-frequency driver that maintained a response out to the desired crossover frequency.

Good quality drivers are very important in achieving a "Flat" system. Any "dips" or inconsistencies in the response of drivers will reduce the accuracy of the sound systems reproduction of sound. Select drivers that have a smooth response throughout the range where they will be used. This will assure the best possible driver response from the sound system.

The Carvin XC-1000 electronic crossover is an excellent representation of a quality crossover. It features 18dB/octave Butterworth filters that "phase" sum accurately. It offers sweepable parametric selection of crossover frequencies. Its high efficiency roll-off offers maximum protection to high frequency drivers. As with any professional audio product, its inputs and outputs are balanced (and will accept high impedance sources). It will interface with any professional audio system, and addresses correct input and output impedance for maximum signal quality and performance. Carvin highly recommends the use of this crossover with any of our professional Bi-amp or Tri-amp systems.

Some of the recommended settings for Bi-Amping and Tri-Amping Carvin's speakers are as follows:

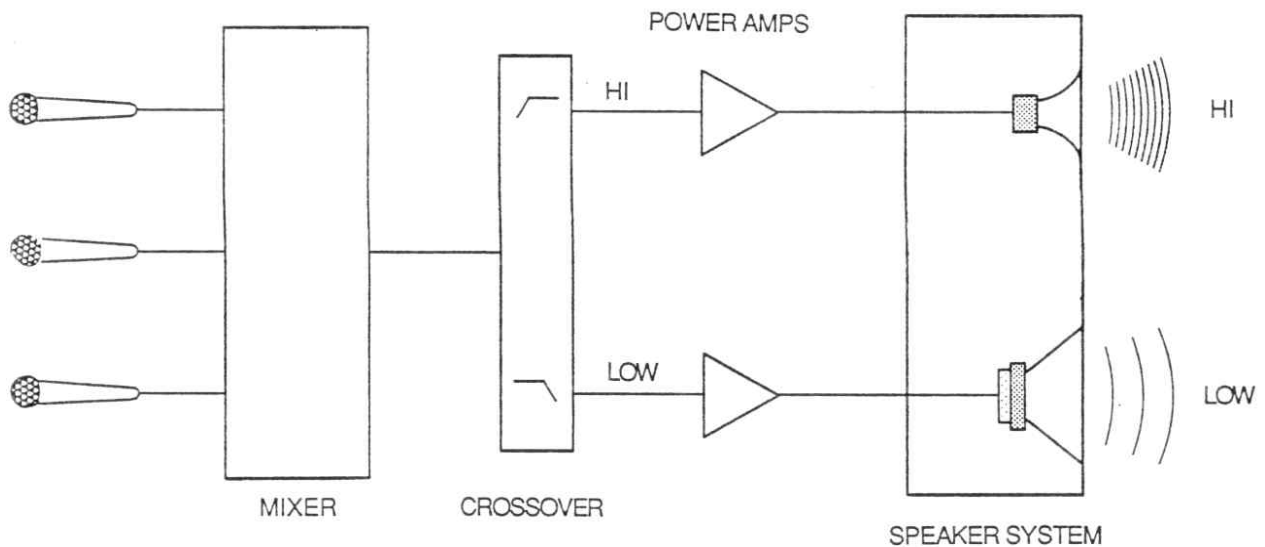
WOOFER/HORN SYSTEMS

RECOMMENDED CROSSOVER FREQUENCY

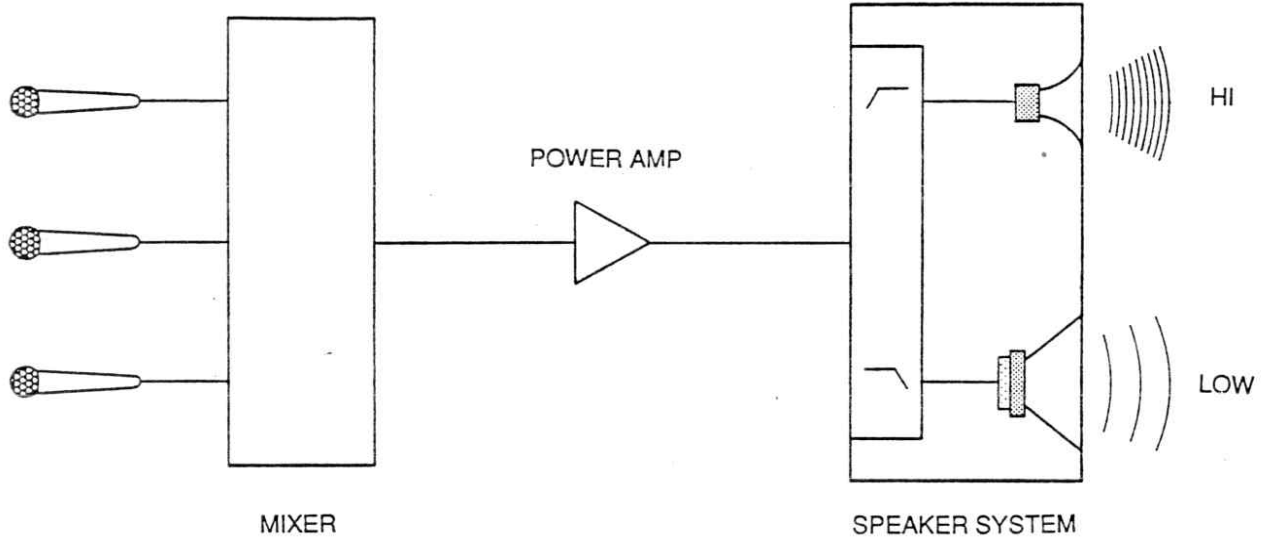
3000 E&H
 1200 E&H
 1330 E&H
 R-550 H&E (Horn)
 980 E&H
 960 E&H
 850 E&H

500Hz or Lower
 2kHz or Lower
 1500Hz or Lower
 1.2k or Higher
 1.6k
 1.6k
 1.6k

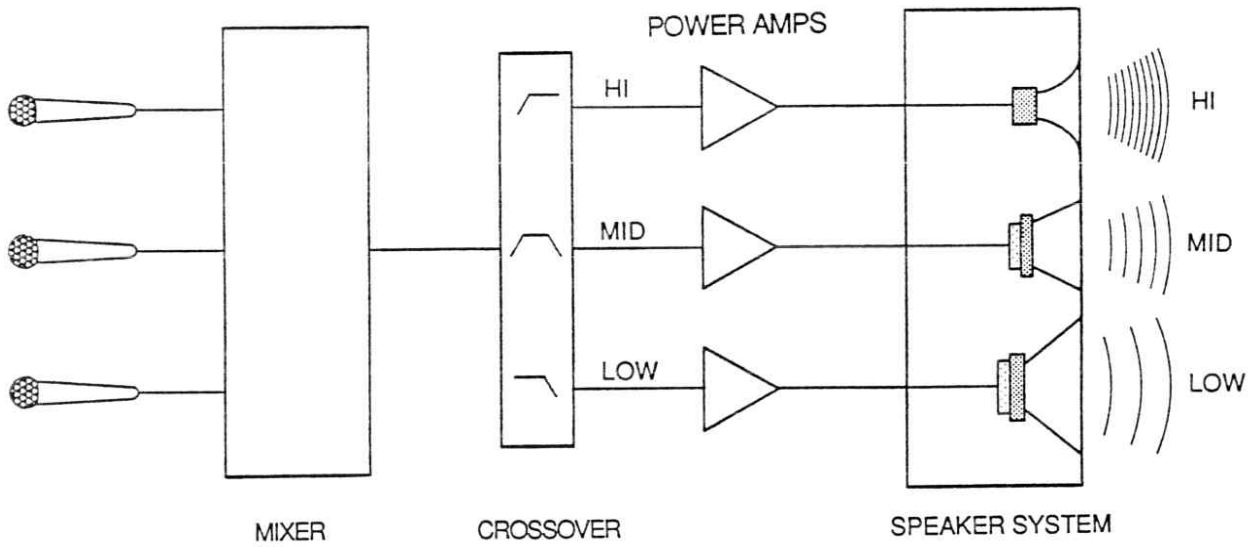
BI-AMPLIFIED SYSTEM WITH ACTIVE CROSSOVER (2 WAY)



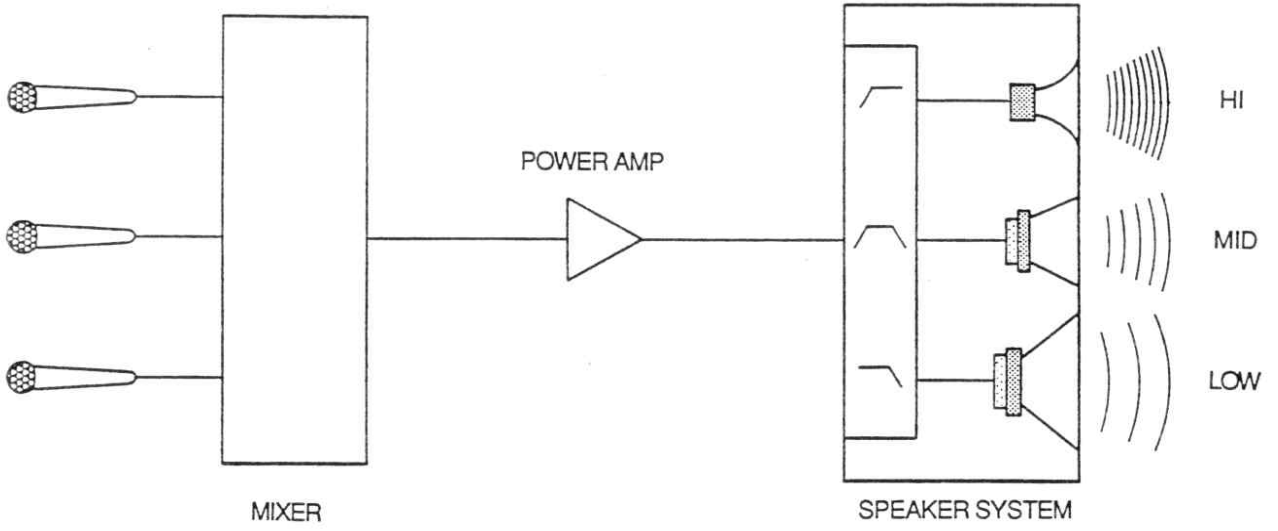
**CONVENTIONAL 2-WAY LOUDSPEAKER SYSTEM
WITH PASSIVE CROSSOVER SYSTEM**



**TRI-AMPLIFIED SYSTEM
WITH ACTIVE CROSSOVER (3 WAY)**



CONVENTIONAL 3-WAY LOUDSPEAKER SYSTEM
WITH PASSIVE CROSSOVER SYSTEM



SECTION V

SERVICE /WARRANTY

SERVICING IN YOUR AREA

You may select your own service center or have your own qualified technician work on the unit at your own expense. This will not void the warranty for future repairs unless damage was done because of improper servicing or component replacement. If damage was done, a normal fee for parts and servicing will be charged.

Under the ONE YEAR WARRANTY, Carvin will ship parts pre-paid to you or your technician providing that the defective part(s) are first returned for our inspection.

If you do not have a qualified service person, we ask that you do not involve yourself in servicing the unit. By sending the unit back to us, you may save time, money, and frustration. Also, you will know that your unit was serviced according to factory specifications.

If it is necessary to have your unit serviced locally, we strongly recommend that you have your technician call us before servicing your unit. We find that those who do this are able to make necessary repairs faster, and for less money. We are glad to help in this manner.

REMINDER: CARVIN DOES NOT PAY FOR SERVICING OR PARTS OTHER THAN OUR OWN - NO EXCEPTIONS. IF YOU ELECT TO HAVE YOUR OWN SERVICING DONE, THESE BILLS MUST BE PAID BY THE CUSTOMER.

CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT DEFEAT THE SAFETY GROUND ON THE POWER CORD. DO NOT REMOVE COVER. NO USER-SERVICEABLE PARTS INSIDE.

WARNING: TO PREVENT FIRE OR SHOCK HAZARD DO NOT EXPOSE TO RAIN, MOISTURE, EXPLOSIVE ATMOSPHERE OR INSTALL AN IMPROPER FUSE!

FACTORY SERVICING PROCEDURES

We highly recommend utilizing our specialized servicing staff to bring your unit up to factory specifications. Regardless of your warranty status, please follow these guidelines when returning units for service:

1. Enclose a full description of the malfunction. Please use the "Service Authorization Form" included with this manual.
2. Include a copy of the original invoice to verify your warranty.

3. Return the product in its original carton with the original packing material. NEITHER CARVIN NOR THE SHIPPING COMPANY WILL ASSUME LIABILITY FOR IMPROPERLY PACKED UNITS. Ship the unit by UPS if possible. You must pre-pay the shipping cost.
4. Please allow five working days for servicing plus shipping time to and from destination. All repairs in by MONDAY will be ready by the following MONDAY.
5. Carvin will pre-pay the shipping back to you providing the unit is covered under warranty. If you wish to have it sent back by AIR, you will be required to pay the difference COD.
6. If your unit is out of warranty, you will be charged a modest fee (generally lower than typical repair shops). You must pay shipping charges both ways. These charges will be collected COD.
7. If in doubt about the malfunction, please call a Carvin salesman toll-free at 800-854-2235. Occasionally we receive merchandise that works fine, but because of an oversight, the unit was returned needlessly.

LIMITED WARRANTY

Your Carvin Professional Series Product is protected against failure for ONE YEAR. Carvin will service the unit, supply all parts, and pay the RETURN shipping charges at no charge to the customer providing the unit is under warranty. CARVIN WILL NOT PAY FOR PARTS OR SERVICING OTHER THAN OUR OWN.

This warranty is extended to the original purchaser only and is not transferable. THIS WARRANTY DOES NOT INCLUDE FAILURES CAUSED BY INCORRECT USE, INADEQUATE CARE OF THE UNIT, OR NATURAL DISASTERS. A COPY OF THE ORIGINAL INVOICE IS REQUIRED TO VERIFY YOUR WARRANTY.

Carvin takes no responsibility for any horn driver speaker damaged by this unit.

This warranty is in lieu of all other warranties, expressed or implied. No representative or person is authorized to represent or assume for Carvin any liability in connection with the sale or servicing of Carvin products. No liability is assumed for damage due to accident, abuse lack of reasonable care, loss of parts, or failure to follow Carvin's directions. CARVIN SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

In the interest of creating new products and improving existing ones, Carvin is continually researching the latest state-of-the-art audio design methods, and modern packaging and production techniques. Thus, Carvin reserves the right to make changes in its products and specifications without notice or obligation.

SECTION VI

MUST READ BEFORE USING YOUR AMPLIFIER

FACTS ABOUT USE

Your new FET series amplifier is designed to offer many years of trouble free performance. Understanding the following concepts about the use of your new amplifier will help greatly in maintaining the best performance and reliability from your unit.

- #1 The wires used for your speakers should be #16 AWG or heavier in order to retain the highest possible damping factor from the amp. All speaker wires must be NON-SHIELDED. Shielded speaker wires will cause high frequency oscillations resulting in excessive heat build-up and eventual amplifier shut down or failure. For additional information see the data on type and gauge of speakers wires to use in this manual.
- #2 The high power output capability of the FET series amplifiers is capable of damaging loudspeakers. Each speaker should be fuse protected. This will ensure the best possible protection for you speaker system. If your speakers are not fuse protected, you may insert a fuse "In Line" (In series with the hot line) of your speaker cord. Usually the fuse will be in series with the lead going to the "red" terminal of the speaker (or tip of the 1/4" phone speaker terminal of the speaker (or tip of the 1/4" phone speaker jack). Please remember that fuses are not 100% fail safe. There are instances where fuses blew and damage was still done to the speaker. However, fuses do offer protection not otherwise achieved and they have received a good reputation (overall) for adequate speaker protection.
- #3 Periodic cleaning of your amplifier is strongly recommended. One of the major contributors to reduced reliability is dust and dirt. Keeping your amplifier dusted and free from excessive build-up of dirt will help provide extended reliability from your amplifier.
- #4 The FET amplifier features an automatic thermostatically controlled fan. When the amp is operated into heavier loads the fan will increase in speed to properly cool it down. When the load is reduced, the fan will reduce its speed automatically.
- #5 The FET series amplifiers feature a special "Protect" circuit that will shut the amplifier down if any D.C. appears at its outputs or if there is an improper input signal or shorted speaker wire. If this light is on you should unplug the amp entirely (both inputs and output). Then apply power to the unit. The protect light should go out. If it does not you should contact Carvin or return the unit to Carvin. DO NOT INSERT A LARGER FUSE OR CONTINUE TO APPLY POWER TO THE AMPLIFIER IF THE PROTECT LIGHT IS CONTINUALLY COMING ON.

- #6 You will note that the FET series amplifiers do not have a ground reversal switch. It has been eliminated to prevent shock hazard. All grounding is done through the ground lug of the three conductor A.C. plug. This is the safe and proper way to ground all electrical appliances. If for any reason you require an A.C. lone phase reversal, you may do so by utilizing a 3 to 2 prong adaptor and flipping the plug. NEVER DEFEAT THE USE OF THE 3RD PIN GROUND PLUG ON THE AC RECEPTACLE. WHEN USING A 3 TO 2 PRONG ADAPTOR, BE SURE THE GROUND LINE IS PROPERLY CONNECTED TO A "GOOD" GROUND. THIS IS TO PROVIDE THE BEST MARGIN OF SAFETY AND PERFORMANCE FROM YOUR AMP.
- #7 Always be sure you are plugging the amp into the proper A.C. voltage. Be sure the voltage is properly regulated and will not fluctuate more than 10% above or below the 120V/220V requirement of the amp. If the amplifier is going to be powered from a generator, be sure the generator has proper "electronic" voltage regulation and that the A.C. lines are free from voltage surges.
- NOTE:** It is recommended that you use a A.C. surge supsressor/broad band noise filter, when operating the amp powered by a generator. This will provide further protection against voltage surges and spikes.
- #8 Whenever turning ON or OFF your amp you should follow this rule: "LAST ON-FIRST OFF." This means that you will turn on all associated pre-amp (mixers) and associated equipment prior to turning on the amp. When you are finished with a performance, the amplifier will be the first item shut down. Following this procedure will help eliminate pops and power surges (created by preceding equipment) that are annoying to audiences and potentially harmful to speakers.
- #9 Do not remove the amplifiers cover at any time while the amp is plugged in or powered up. THERE ARE POTENTIALLY LETHAL VOLTAGES INSIDE THE AMP.

PRECAUTIONS

Observing the following precautions concerning the use of your amplifier will help provide for the most dependable operation.

- #1 All connections to the amplifier should be made with the power to the amp off.
- #2 Never parallel two amplifier outputs together.
- #3 Do not connect an input ground lead to an output ground lead. This could potentially cause a ground loop or oscillation.
- #4 Do not use shielded or "Coax" type cables for speakers. All speaker cords must be "NON-SHIELDED".

- #5 Never connect the output of the amplifier to the input of another amplifier. Never connect the output of the amplifier to any other power source such as a battery, output of another amp, power main, etc.
- #6 DO NOT expose the amplifier to corrosive chemicals such as soft drinks, corrosive cleaning chemicals, salt water, etc. Never immerse the amplifier in any liquid.
- #7 NEVER operate the amplifier near combustionable items.

AMP SET UP (PROCEDURES BEFORE TURNING ON AMP)!!

The FET series amplifiers are designed for "table top" or "rack mounting." The four rubber feet may be removed if amps are to be rack mounted .

When "rack mounting" the amp, be sure to allow for sufficient air flow. The rack must have an open back to allow for the normal flow of air into and away from the rack.

Make all connections to the amplifier (input and output) prior to turning on the unit. Be sure all cords are well maintained and of the proper type for the input and output connections to the amp. (All input connections should be non-shielded cable, and all output connections should be non-shielded 16AWG gauge wire or greater.

SPECIFICATIONS

Model	FET 400	FET 900	FET 2000
Power (Continuous Watts)			
Mono Bridged Mode			
8Ω, Bridged (1 kHz, <.1% THD)	400	600	1200
4Ω, Bridged (1 kHz, <.1% THD)	—	900	2000
Both Channels Driven			
8Ω (1 kHz, <.1% THD)	100/100	200/200	400/400
4Ω (1 kHz, <.1% THD)	200/200	300/300	600/600
2Ω (1 kHz, <.1% THD)	—	450/450	1000/1000
Distortion (THD)			
20 to 20kHz, any power level up to clipping:	<.05%	<.05%	<.05%
8Ω, 1 kHz, 50% rated power (typical):	.006%	.005%	.005%
4Ω, 1 kHz, 50% rated power (typical):	.007%	.006%	.006%
2Ω, 1 kHz, 50% rated power (typical):	—	.007%	.007%
Signal to Noise Ratio:	100 dB	103 dB	106 dB
Damping Factor (1 kHz, 8Ω:	>250	>250	>250
Sensitivity for Full Power (4Ω, Vms):	1.0	1.0	1.0
Slew Rate (Volts per microsecond)	30	40	55
Frequency Response (All models):	±0.5 dB, 20 Hz to 20 kHz (-3 dB at 5 Hz and 100 kHz)		
Input Impedance (All models):	>10K Ω, balanced, unbalanced		
Protection Circuits:			
<ul style="list-style-type: none"> • Speaker Guard Speaker Protection (Protects Speakers from DC Voltage) • Short Circuit Current Limiting • Speaker Fuses • Thermal Shut-Off Switch (Heatsink Temp. above 85°C) 			
Controls and Indicators:			
Front: Power switch			
41 detent attenuators			
Indicators: Signal Present LED, Clip LED, Protect LED, Power LED			
Rear: Professional Accessory Group:			
Power Limiter Selection Switches (four per channel plus on/off)			
Subsonic Filter Switch (one per channel) -3 dB at 30 Hz			
Ultrasonic Filter Switch (one per channel) -3 dB at 25 kHz			
Mono Bridge Mode Switch (one per channel)			
Dimensions: 5¼" High x 19" Wide x Depth:	10"	10"	14"
Maximum Power Requirements:	120 VAC:	4.5 Amps	9 Amps
(120/240 VAC, 50/60 Hz)	240 VAC:	2.25 Amps	4.5 Amps
			20 Amps
			10 Amps
Shipping Weight:	28 lbs.	35 lbs.	55 lbs.

