POWER 650 MOSFET

POWER AMPLIFIER

OWNER'S MANUAL

Rockford Fosgate

INDEX

INTRODUCTION

The Power 650 MOSFET is a high-performance four-channel power amplifier for cars, vans, or wherever a 12-volt battery is available. It is designed to be used with a Rockford-Fosgate equalizer/pre-amplifier and/or any high-quality radio, tape player, compact disc player, or other music source.

Power amplifiers with rugged, fast MOSFET design and forced-air cooling system combined produce effortless performance at over 650 Watts total output power. Switch-controlled crossovers and easily-bridgeable, load-tolerant amplifiers make biamplified systems, bridged systems, four-channel systems, and combinations easy to design.

Protection circuitry in the amplifier prevents damage due to load shorts, system power problems, and internal failures. The amplifier incorporates internal battery line filtering and extensive noise prevention circuitry.

The Power 650 MOSFET is designed to be **professionally installed.** The length and nature of your warranty are dramatically affected if you attempt to install it yourself (see Warranty). Skill and experience are required to achieve high-end sound, reliability, and appearance in a high-powered autosound system. If you want to install your own unit, read this booklet completely, research speaker systems and source units extensively — and good luck!

POWER 650 MOSFET FEATURES

The Power 650 MOSFET amplifier combines a number of capabilities that make it the highest-performance amplifier on the road.

- 650 Watts total power (stereo mode, 4-Ohm loads)
- 4-, 3-, or 2-channel operation, biamplified or stereo
- Rugged and fast MOSFET design
- 30-Ampere peak current capacity each channel
- Thermostatically controlled fan for cooling
- Built-in selectable electronic crossovers
- Built-in bridging capability
- 2-Ohm load rated, each channel
- Selectable independant stereo operation
- Extensive noise-rejection circuitry
- Full internal protection
- Single-chassis, easy-installation design

MOSFET POWER AMPLIFIERS

Conflicting demands on the power output transistors of high power amplifiers often force compromises in performance. Designing for the raw power and current required to force a recalcitrant woofer into position calls for large, rugged power transistors, which may be too sluggish to reproduce transients and high frequency material cleanly.

The new MOSFET (Metal Oxide Silicon Field Effect Transistor) power devices combine the compactness and efficiency of bipolar transistors with many of the advantages of tubes. Compared to an equivalent bipolar transistor, the MOSFET is much faster, more rugged, more linear, and requires less drive power. The Power 650 MOSFET output stages take advantage of MOSFET performance to improve virtually every performance characteristic. Speed, distortion, current capacity, and ruggedness are exceptional.

The result is an amplifier with superb smoothness and transient response, combined with the raw power and current required to drive complex low impedance loads effortlessly. In essence, the amplifier will cleanly drive any load which does not blow its internal fuses.

SYSTEM FLEXIBILITY

A combination of switched crossovers and four bridgeable channels in the Power 650 MOSFET provides unmatched system flexibility with simple wiring changes. Some of the possibilities are:

Biamplified Stereo — A pair of channels drives mid and high frequency speakers; another pair drives woofers. The crossovers are set to separate the input frequencies into high and low frequencies for each speaker system.

Biamplified Stereo with Bridged Mono Woofer — Otherwise similar to the Biamplified stereo system above, this arrangement bridges the two low channels into a single woofer.

Bridged Stereo — Each pair of channels on Left and Right sides is bridged into a full-range speaker system. The crossovers are set at Flat position.

Bridged Mono Biamplified — Both Left and Right channels combine into one mono channel. The high-frequency channel pair is bridged into midtweeter speaker system and the low-frequency pair is bridged into a woofer. The crossovers are set to separate woofer and midrange frequencies.

Dual Stereo — With the crossovers set at "Flat" position, the power amp will act as two separate stereo amplifiers, one channel pair for rear full range speakers, one pair for front full-range speakers. If only one set of speakers can handle bass frequencies, the "High" crossover can be set to cut off the front speakers' low frequency drive.

All of these system configurations are obtained with simple wiring variations; there are no special "black boxes" to buy and the system may be modified at any time.

AMPLIFIER BRIDGING

Operating an amplifier in the "bridged" or "strapped mono" mode means driving one speaker or speaker system with two amplifier channels. Each channel will put out full power into its half of the speaker load, so the system can drive the speaker with double the power that a single amplifier channel would be capable of.

When amplifiers are bridged into a single speaker, each amplifier "sees" half of the total speaker impedance.

New Rockford-Fosgate amplifiers are designed so that connecting the amplifier for bridged mode is a simple matter of using the correct speaker leads as shown in the appropriate system diagram. In these amplifiers, one channel of each pair is inverted in the amplifier. In normal stereo use, the inverted channel output is connected to the negative lead of its speaker load, thus preserving the system's polarity. In bridged mode, the inverted channel is connected to the negative lead of the speaker to be bridged, and the positive lead of the speaker is connected to the non-inverted channel. This provides the out-of-phase drives required for bridged operation.

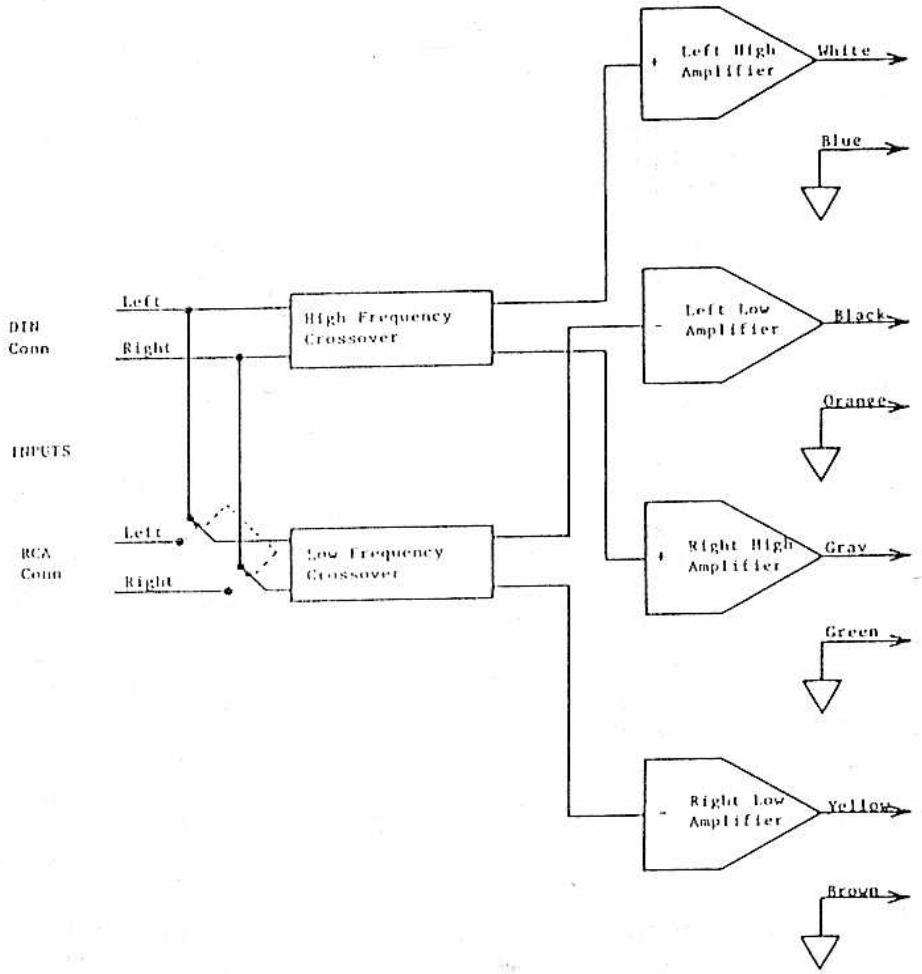
The Power 650 MOSFET is designed so that the four amplifier sections can be bridged in several ways. Right High and Left High-Frequency channels can be bridged, the Right Low and Left Low-Frequency channels can be bridged, the Right High and Right Low channels can be bridged together, and the Left High and Left Low channels can be bridged. These combinations allow an unmatched flexibility in designing stereo, biamplified, and hybrid bridged systems.

The Amplifier Block Diagram shows a simplified diagram of the crossover and amplifier system. In the amplifier blocks, the input shows a "+" for the non-inverted channels and a "–" for the inverted channels. Each "+" channel can be mated to a "–" channel into a bridged speaker load.

SPEAKER IMPEDANCE

The Power 650 MOSFET is designed to drive 2-Ohm minimum speaker loads on each of its four channels, or 4-Ohm minimum loads when used in Bridged mode (two amplifier sections driving the same speaker). A 2-Ohm load is formed by paralleling two 4-Ohm speakers or four 8-Ohm speakers. Of course, higher-impedance loads than the minimum are entirely acceptable to the amplifier.

Speakers which are isolated from the amplifier by series capacitors or high-pass crossovers (for instance, tweeters) do not usually have a large effect on the amplifier load and should not be considered in calculating load impedance. The 650



POWER 650 MOSFET

AMPLIFIER BLOCK DIAGRAM

MOSFET is also very tolerant of reactive loads, so complex multiple-element passive crossover systems should pose no problems if well-designed.

WHY BIAMPLIFY?

For the **performance.** Biamplified systems can play cleanly at higher output levels than stereo systems of the same total power.

For the **convenience.** Building a satisfactory crossover system for woofer-to-midrange crossover frequencies requires large, expensive inductors and capacitors, as well as design time and mounting problems. With a biamplified system it's all done for you in the active crossover.

Biamplified systems consist of an active (electronic) crossover system and two stereo amplifiers. The crossover separates the input signal into low and high-frequency groups and sends each group of frequencies to a separate amplifier pair. In most installations, the low-frequency amplifiers drive a pair of woofers and the high-frequency amplifiers drive a midrange-tweeter pair.

In ordinary stereo systems, as the output level increases, the low-frequency, high-power notes of the music start to drive the amplifier into clipping. When the bass (drums, rhythm, etc.) start to overload the amplifier, all higher frequencies are naturally clipped as well, so midrange distortion is immediately audible. The harshness and "gargling" effects of clipping are obnoxious to listen to and may destroy tweeters.

In a well-designed biamplified system, when the low frequencies start to clip only the low-frequency amplifiers overload. The high-frequency amplifiers are still reproducing the music cleanly. Harshness and other overload effects are not heard in the middle and high frequencies until the high-frequency amplifiers clip, at a much higher level. The worst effects of the bass amplifiers' clipping will usually not be audible, since the woofers won't reproduce the high-frequency harmonics of the clipped drive, and the clean middle and high frequencies cover the low-frequency blurring and muddiness of the bass.

We have found that, for crossover frequencies up to about 600 Hertz, it is best to use approximately equal power for the low and high frequency amplifiers of biamplified systems. If the high-frequency amplifiers are significantly lower in power, the highs will clip before bass distortion is audible, and much of the bass power capability will be wasted.

Triamplifying; that is, using another active crossover and stereo amplifier to run the tweeters only, is technically interesting but less cost-effective. For one thing, there is little or no masking effect from the very high frequencies for midrange distortion, so the biggest performance advantage of multiple-amp systems isn't available. Crossover components for passive midrange-to-tweeter crossovers are reasonably small and inexpensive. Running a separate tweeter amp system will prevent tweeter burnout due to heavy midrange clipping, and this is the most substantial advantage of triamplified systems.

SPEAKER POWER RATINGS

The Power 650 MOSFET is a very high-powered amplifier, and special care must be taken to be sure that the speakers can handle the power level. Speaker manufacturers' recommendations for power levels and crossover frequencies should be observed. The power capacity required for speakers corresponds to the rated output of the amplifier and the mode of operation. Minimum output into various loads is shown below:

MODE	4-Ohm Speaker	8-Ohm Speaker
Stereo	125 Watts	75 Watts
Bridged	325 Watts	250 Watts

Woofers with high power ratings sometimes "pop", "clang", "snap", or otherwise show signs of bottoming. These speakers are designed to use the "air spring" of an enclosed box to prevent bottoming at high power inputs. This applies to most woofers originally designed for home or professional use. One solution is to use speakers designed for "infinite baffle" use, which have very stiff suspensions. The best solution is to build boxes for the woofers.

As with woofers, midrange drivers' power capabilities are determined by voice coil and suspension design. The most common power-handling problems for mid-ranges arise when they are crossed over at too low a frequency or with too shallow a crossover slope. For every doubling of the crossover

frequency, a given midrange driver will handle 20-50% more system power. The same improvement would result from going from a 6dB/Octave to a 12dB/Octave crossover.

Tweeters will react the same as midranges to changes in the frequency and slope of their crossovers: the higher the frequency and the greater the slope, the more power the tweeter will handle. In view of the high power capacity of the 650 MOSFET, it is likely that all but the most rugged tweeters will require more than a simple single-capacitor crossover. Twelve-dB-per-Octave or even 18-dB-per Octave passive crossovers will help typical tweeters to survive. (See "Passive Crossovers" section of this booklet.)

SPEAKER FUSING

The Power 650 MOSFET is provided with in-line fuses for speaker protection. These fuses should always be fast blow types and should be selected on the basis of the speaker's power handling capacity. Three Ampere type AGC (3AG) fast-blow fuses are provided as standard.

The speaker fuses are **not** required to protect the 650 MOSFET power amplifier and may be eliminated if desired. However, speaker fuses of 6 Amperes or less will avoid the inconvenience of replacing internal fuses in case of a speaker or wiring short.

IT SHOULD BE NOTED THAT WHEN USING ONLY THE INTERNAL FUSES, THE 650 MOSFET IS CAPABLE OF DESTROYING VIRTUALLY ANY UNPROTECTED SPEAKER, DUE TO THE POWER AVAILABLE.

INTERNAL FUSING

The ruggedness of triple paralleled MOSFET devices allows the elimination of both short-protection shutdown (shortstop) and Safe Operating Area current limiters, allowing the amp to drive extremely reactive loads without distortion or shutdown. Amplifiers are protected by two 7.5 Ampere type AGA (1AG) fuses per channel. The internal fuses are accessible through a flush mounted hatch on the mounting side of the amplifier.

Replace internal fuses **only** with 7.5 Ampere type AGA (1AG) fast blow fuses. Always disconnect the main power wire (White 8 Gauge) from the battery before removing the fuse access hatch.

CROSSOVER SYSTEM

The Power 650 MOSFET incorporates separate high- and low-frequency crossovers, which are controlled by screwdriver-slot switches on one end of the power amplifier. The crossover frequency is set to one of five frequencies or to flat response, depending on speaker and system characteristics.

The crossover is a two-pole (12 dB/Octave) constant-power design with a Butterworth transfer characteristic. Outputs are designed for an accurate phase match between low- and high-frequency outputs (within 5 degrees) to reduce cancellation and lobing errors.

High-Frequency Crossover		Low Frequency Crossover	
Position	**Frequency**	**Position**	**Frequency**
1	Flat	1	Flat
2	140 Hz	2	70 Hz
3	200 Hz	3	100 Hz
4	280 Hz	4	140 Hz
5	400 Hz	5	200 Hz
6	560 Hz	6	280 Hz

USING THE CROSSOVERS

The crossover system in the 650 MOSFET is designed to combine the option of flat system response with flexible biamplified system crossover points.

The Flat position of the crossover should be used when a channel pair is driving a high-power full-range speaker load. Light-duty "full-range" speakers will probably not handle full bass power and should be connected to the high-channel amplifiers. Then the high-frequency crossover can be set to reduce the low-frequency drive. (It is doubtful that any 4-inch speaker can handle the power of a 650 MOSFET at a lower cutoff than 280 Hertz, for example.)

The Flat position of both the high and low-frequency crossovers must be used when the speakers are connected in the Bridged Stereo mode. In Bridged Stereo, the Left High and Left Low channels (for instance) are both connected to a single speaker system, so both Left channels need the same full-range drive.

In biamplified systems, the low-frequency crossovers remove midrange and high frequencies from the woofer amplifiers, and the high crossovers remove bass energy from the midrange/tweeter amplifiers. The exact settings depend on system design. The low frequency crossover should be set low enough to reduce resonance present in small enclosed spaces like vehicle interiors. Typical settings range from 70 to 140 Hertz. The high-frequency crossover should be set to the highest frequency which does not produce a frequency response "hole" in the lower-midrange response: this will keep midrange power requirements as low as possible. Typical settings range from 200 to 560 Hertz. A properly set-up system will avoid both tubbiness (most audible on male announcers' voices) and thinness (most audible as a lack of body in singers' voices).

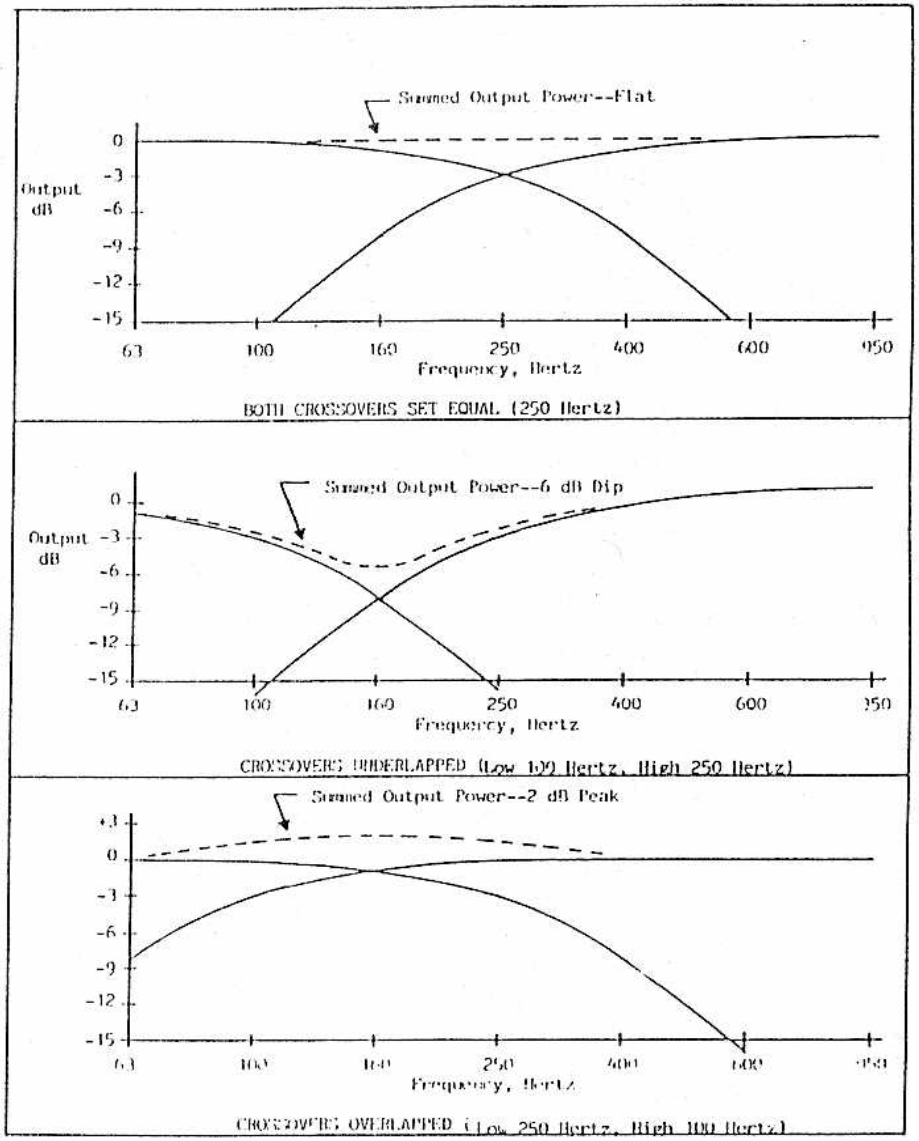
TYPICAL CROSSOVER SETTINGS

Crossover Setting (LOW/HIGH)	Typical Application
FLAT/FLAT	Bridged Stereo systems; Dual Stereo systems where both speaker pairs can run full-range, full-power.
FLAT/140 to FLAT/560	Dual Stereo systems with lower-power front speakers. The higher the HIGH crossover setting, the less bass power the front speakers must handle.
70 to 140/200 to 560	Typical Biamplified system settings.

SPEAKER PHASING

In any stereo system, the left and right speakers must agree in phase (polarity); that is, the positive terminals of both Left and Right speakers must be connected to the positive terminals of the Left and Right amplifier outputs, respectively. For bi-amplified systems, the phasing between the woofers on the bass channels and the midrange/tweeters on the high channels must also be considered.

When stereo pairs of speakers are connected out of phase, the symptoms are severe loss of bass, loss of directional information, and added coloration at middle and high frequencies. A



CROSSOVER RESPONSE CURVES

convenient way to check for out-of-phase speaker pairs uses the Left/Right fader in the source unit. Swing the fader all the way Left (or Right) and listen to the sound. Then center the fader for stereo. If the bass decreases in the centered position, the woofers are out of phase. Out-of-phase midranges will not have good stereo localization and the tone will change.

If the woofers and midrange speakers of a biamplified system are improperly phased, a "hole" in the system frequency response will occur near the crossover frequency. This usually produces reduced impact in the bass or thin reproduction of vocals. The proper phasing for 650 installations of several types is shown in the system diagrams in the back of this booklet. Note, however, that the time delay of sound traveling through air, speaker mounting variations, and crossover setting variations can produce unexpected phase cancellations. It is always best to try out both woofer phases on the bass channel to find which performs best. (Change all woofer polarities at once, of course, since they all must be in the same phase to work as stereo pairs.)

AMPLIFIER POWER WIRING

The Power 650 MOSFET battery power connections are made with heavy oil- and gas-resistant 8-Gauge wire. A self-resetting 50-Ampere circuit breaker and connectors are provided with the unit. For best performance wire the amplifier exactly as described. Any resistive connections or voltage drops in the power wiring will result in significant power losses and/or noise problems.

White Power Wire — This wire goes directly to the circuit breaker mounted near the battery. It is best to use as short a wire run as possible: spare crimp connectors are provided with the unit. The White Power Wire is a high-current, high-noise conductor. **DON'T** run it next to the amplifier input cabling, radio antenna wire, radio power wire, or noise-sensitive harnesses, since it is likely to induce noise.

Circuit Breaker and Battery Power Wire — The circuit breaker should be mounted in the car engine compartment near the battery. Connect the "BAT." terminal of the breaker to the Positive (+) terminal of the battery using the 1-foot length of heavy wire pro' 'ed. Connect the other terminal to the white power wire leading to the power amplifier.

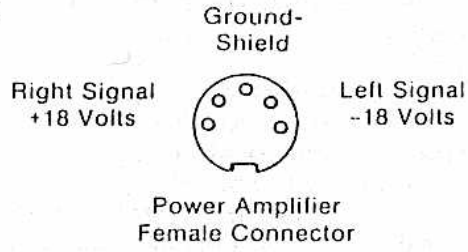
Black Ground Wire — Connect this wire directly to a good chassis ground point. Clean off paint and corrosion around the ground point to ensure a good connection and bolt the wire securely to the metal. Be sure that the ground point you have selected is a piece of chassis metal that is welded to the main body of the car. (Bare metal should be protected with a layer of grease or paint to prevent rusting.) DO NOT extend the ground lead over one foot longer than supplied, since any voltages developed in the ground lead can appear as hard-to-suppress system noise problems.

Remember that the Power 650 MOSFET can have peak current demands well over 100 Amperes. Make any splices secure, never use less than 8-Gauge wire, and never use longer wire runs than necessary.

DIN INTERCONNECT CABLE

The 5-pin DIN cable provided connects the Amp to its equalizer/preamplifier. Run this cable away from the main power wire (white 10-Gauge) to prevent noise from being coupled into the cable. Cable color code and pin configuration are given below:

Shield — Ground
Red — +18 Volts
Black — -18 Volts
White — Right Channel Signal
Green — Left Channel Signal
(or yellow)



INPUT MODE SWITCH

The input of the Power 650 MOSFET normally comes from the DIN input connector and is split by the crossovers into high and low channel drives. However, there are some cases where it is desirable to be able to drive the low channels independently. For

instance, if one wanted to drive the system as two completely independent stereo amplifiers, one would need to drive the high channel pair with one stereo signal pair, and the low channel with another as in using an active fader.

The input mode switch (located near the crossover controls on the units front panel) switches the low channel inputs to the RCA female connectors. The low-frequency crossover remains in the circuit and can be used as usual.

BATTERY AND CHARGING SYSTEM

The Power 650 MOSFET amplifier draws enough current to put a substantial additional demand on automotive electrical systems. When played very loudly, the 650 MOSFET may draw 20 to 40 Amperes on the average, with peak demands up to 120 Amperes!

A typical stock battery and alternator in good condition will handle moderate to low average levels, with occasional brief episodes of hard use. However, alternator and battery life will be shortened. We strongly recommend that a premium deep-cycle battery and heavy-duty alternator be used with 650 MOSFET systems.

If the sound system will be used when the car is not running, the battery will obviously be discharged — perhaps enough to prevent restarting. The discharge/recharge cycle will reduce battery life, and alternator life will be shorter because of the high-current recharge requirements.

If problems arise:

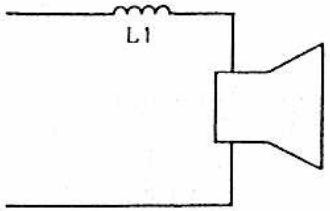
a) Use a premium battery or deep-discharge marine battery.
b) Use a heavy duty alternator.
c) Use a trickle-charger or battery charger.
d) Install a second battery for the amp, with a switching system for recharge.

Passive Crossovers

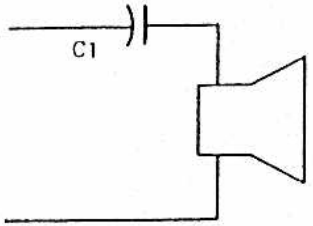
Passive crossover systems for the 650 MOSFET amplifier should always use high-current chokes (inductors) and 50-Volt minimum non-polarized capacitors.

Single-element 6-dB-per-Octave crossovers reduce the undesired speaker drive voltage by one half for each doubling (or halving) of drive frequency. In view of the high power capacity of the Power 650 MOSFET, this may be inadequate to prevent damage to sensitive speakers (especially tweeters). Double-element 12-dB-per-Octave crossovers allow less than half the undesired drive frequencies into the speaker compared to single-element crossovers. They are therefore a good choice for tweeter crossovers, or where there is some doubt as to a midrange speaker's power capacity.

The following tables give approximate values for crossover components for various speaker impedances. Choke (inductor) values are given in millihenries (mH) or microhenries (uH); capacitor values are given in microfarads (uF). Component values within 20% of those given are close enough, since speaker characteristics vary so much that tight tolerances are wasted unless components are selected according to the measured output and impedance characteristics of the individual driver type.



6 dB/Octave Low Pass

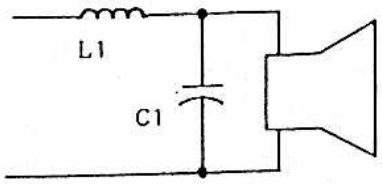


6 dB/Octave High Pass

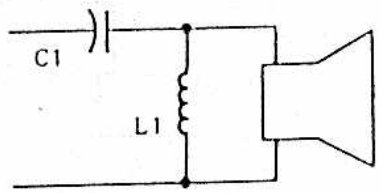
Frequency Hertz	Speaker Impedance					
	2 Ohms		4 Ohms		8 Ohms	
	L1	C1	L1	C1	L1	C1
80	4.1 mH	1000 uF	8.2 mH	500 uF	16 mH	250 uF
100	3.1 mH	800 uF	6.2 mH	400 uF	12 mH	200 uF
130	2.4 mH	600 uF	4.7 mH	300 uF	10 mH	150 uF
200	1.6 mH	400 uF	3.3 mH	200 uF	6.8 mH	100 uF
260	1.2 mH	300 uF	2.4 mH	150 uF	4.7 mH	75 uF
400	.8 mH	200 uF	1.6 mH	100 uF	3.3 mH	50 uF
600	.5 mH	136 uF	1.0 mH	68 uF	2.0 mH	33 uF
800	.41 mH	100 uF	.82 mH	50 uF	1.6 mH	25 uF
1000	.31 mH	78 uF	.62 mH	39 uF	1.2 mH	20 uF
1200	.25 mH	66 uF	.51 mH	33 uF	1.0 mH	16 uF
1800	.16 mH	44 uF	.33 mH	22 uF	.68 mH	10 uF
4000	.08 mH	20 uF	.16 mH	10 uF	.33 mH	5 uF
6000	51 uH	14 uF	.10 mH	6.8 uF	.20 mH	3.3 uF
9000	34 uH	9.4 uF	68 uH	4.7 uF	.15 mH	2.2 uF
12000	25 uH	6.6 uF	51 uH	3.3 uF	100 uH	1.6 uF

6 db/Octave High and Low Pass Filters

Table of Component Values



12 dB/Octave Low Pass

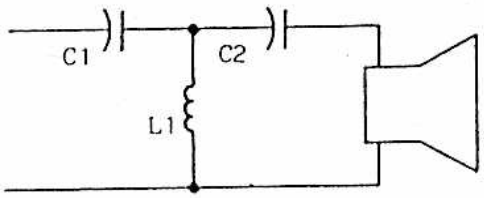


12 dB/Octave High Pass

Frequency Hertz	Speaker Impedance					
	2 Ohms		4 Ohms		8 Ohms	
	L1	C1	L1	C1	L1	C1
80	5.5 mH	680 uF	11 mH	330 uF	22 mH	180 uF
100	4.7 mH	560 uF	9.1 mH	270 uF	18 mH	150 uF
130	3.3 mH	400 uF	6.8 mH	200 uF	15 mH	100 uF
200	2.2 mH	300 uF	4.7 mH	150 uF	9.1 mH	75 uF
260	1.8 mH	200 uF	3.6 mH	100 uF	6.8 mH	50 uF
400	1.1 mH	150 uF	2.2 mH	68 uF	4.7 mH	33 uF
600	.75 mH	100 uF	1.5 mH	47 uF	3.0 mH	27 uF
800	.50 mH	68 uF	1.0 mH	33 uF	2.0 mH	15 uF
1000	.47 mH	50 uF	.91 mH	27 uF	1.8 mH	13 uF
1200	.33 mH	44 uF	.75 mH	22 uF	1.5 mH	11 uF
1800	.27 mH	30 uF	.50 mH	15 uF	1.0 mH	6.8 uF
4000	.10 mH	15 uF	.22 mH	6.8 uF	.47 mH	3.3 uF
6000	75 uH	10 uF	.15 mH	4.7 uF	.33 mH	2.2 uF
9000	50 uH	6.8 uF	.10 mH	3.3 uF	.20 mH	1.5 uF
12000	39 uH	4.7 uF	75 uH	2.2 uF	.15 mH	1.0 uF

12 dB/Octave High and Low Pass Filters

Table of Component Values



18 dB/Octave High Pass

Frequency Hertz	Speaker Impedance					
	4 Ohms			8 Ohms		
	C1	L1	C2	C1	L1	C2
80	330 uF	6.0 mH	1000 uF	160 uF	12 mH	500 uF
100	270 uF	4.7 mH	800 uF	150 uF	10 mH	400 uF
130	200 uF	3.9 mH	600 uF	100 uF	7.5 mH	300 uF
200	130 uF	2.4 mH	400 uF	68 uF	5.4 mH	200 uF
260	100 uF	1.8 mH	300 uF	50 uF	3.3 mH	150 uF
400	68 uF	1.2 mH	200 uF	33 uF	2.4 mH	100 uF
600	47 uF	.80 mH	130 uF	91 uF	1.6 mH	68 uF
800	33 uF	.60 mH	100 uF	16 uF	1.2 mH	50 uF
1000	27 uF	.47 mH	75 uF	13 uF	.90 mH	39 uF
1200	22 uF	.39 mH	68 uF	11 uF	.80 mH	33 uF
1800	15 uF	.27 mH	47 uF	7.5 uF	.50 mH	22 uF
2000	13 uF	.24 mH	40 uF	6.8 uF	.47 mH	20 uF
3000	8.8 uF	.16 mH	27 uF	4.7 uF	.33 mH	14 uF
4000	6.8 uF	.12 mH	20 uF	3.3 uF	.24 mH	10 uF
6000	4.7 uF	82 uH	13 uF	2.2 uF	.27 mH	6.8 uF
8000	3.3 uF	60 uH	10 uF	1.5 uF	.12 mH	5.0 uF
10000	2.7 uF	47 uH	8.2 uF	1.3 uF	.10 mH	3.9 uF
12000	2.2 uF	39 uH	6.8 uF	1.1 uF	82 uH	3.3 uF

18 dB/Octave High Pass Filter

Table of Component Values

TURN-ON CONNECTION
(Red Wire from 9-Pin Connector)

The Power Amplifier is turned on by applying Positive 12 Volts to the red wire. Usually, the red wire is connected to source unit's "Access."

Although the majority of high-quality automotive source units have an Accessory or Auto-Antenna output, there are many variations which may require different turn-on methods. If the source has no Auto-Antenna lead (or if Auto-Antenna goes down during tape operation):

a. Find the internal switched power voltage inside the source unit and solder a lead to it. Run the lead out through the back of the unit (being sure to use a grommet for insulation from the case) and connect to the amplifier's red turn-on wire.

b. Or: Install a switch in the car with one terminal connected to +12 Volts and the other to the amplifier's red lead.

c. Or: Connect the amplifier's red lead to the Accessory point at the car's fuse block. In this case the amplifier will be on whenever the car is on. This method will allow the amplifier to amplify any noise and turn-on and turn-off transients, and may therefore be unsatisfactory.

MOUNTING THE POWER 650 MOSFET

Since the Power 650 MOSFET has forced-air cooling rather than relying on convection, it can be mounted anywhere and in any position it will fit. The only requirement is that the fan intake and exhaust are not blocked from fresh air.

POWER 650 MOSFET SPECIFICATIONS

Power Ratings: 4 Channel

4 Ohms: 125 watts per channel continuous power into 4 Ohms, 4 channels driven, from 20 to 20,000Hz, with less than 0.05% THD + N (Total Harmonic Distortion & Noise).

2 Ohms: 160 watts per channel continuous power into 2 Ohms, 4 channels driven, from 20 to 20,000Hz, with less than 0.1% THD + N.

Power Ratings: 2 Channel (bridged)

4 Ohms: 325 watts per channel continuous power into 4 Ohms, 2 channels driven, from 20 to 20,000Hz, with less than 0.05% THD + N.

Frequency Response: 20 to 20,000Hz, ± .5dB.
Bandwidth: 15 to 20,000Hz, ± 3dB.
Damping Factor: greater than 200 at 50Hz.
Slew Factor: greater than 2.5.
Slew Rate: greater than 10 volts per microsecond.

Protection

The Punch also employs thermal switches which protect the amplifier from overheating damage.

Fuses are provided for speakers which are directly connected with no crossover components.

See page for further details on internal fusing.

Dimensions

18 3/10" long × 8 1/10" wide × 2½" high, exclusive of knobs and wiring.

19 3/10" long × 8 1/10" wide × 2½" high, minimum mounting requirements.

Note: Achieving ultimate performance from Rockford Fosgate products is our main concern. Therefore research and development of a new product doesn't end when it finally reaches production. For this reason Rockford's specifications are subject to change without notice.

Noise:
Less than -80dB both power amp and preamp.

Crossover:
12dB/Octave, switch controlled.

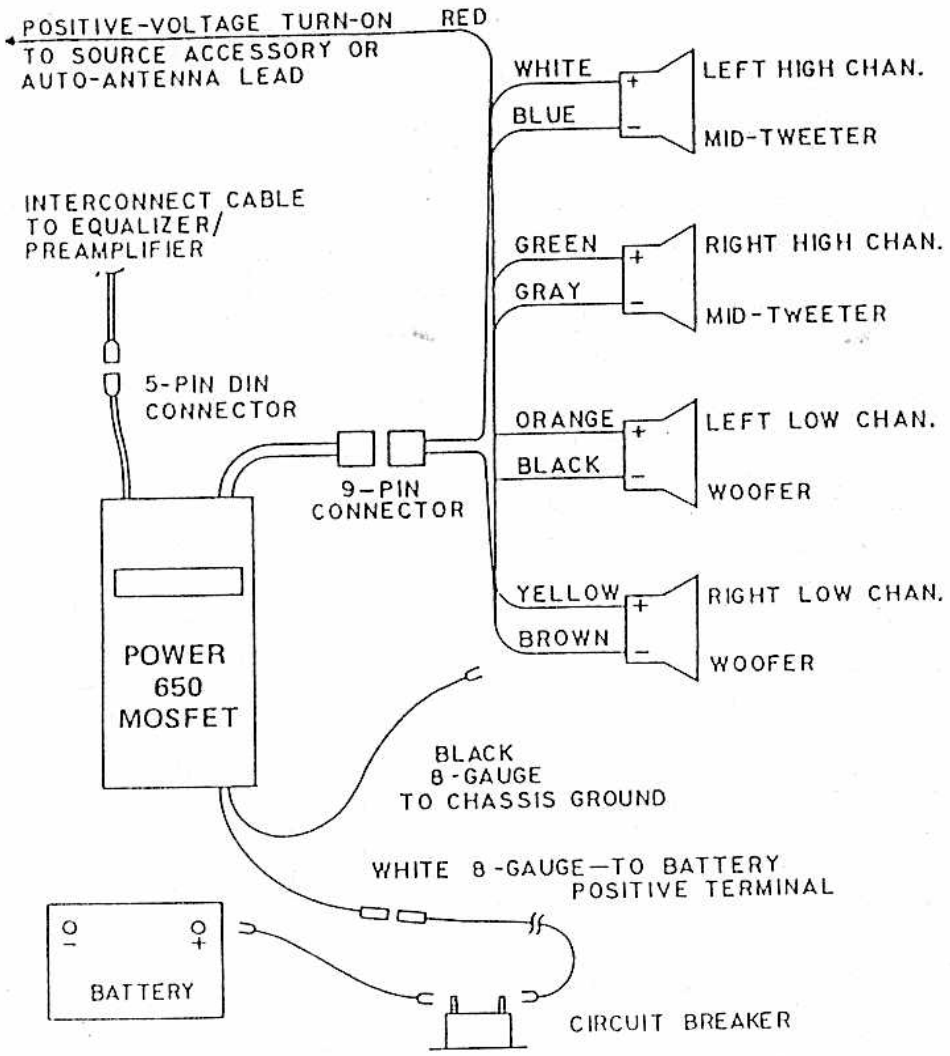
Crossover Frequencies:

Low Channel	**High Channel**
Flat	Flat
70 Hz	140 Hz
100 Hz	200 Hz
140 Hz	280 Hz
200 Hz	400 Hz
280 Hz	560 Hz

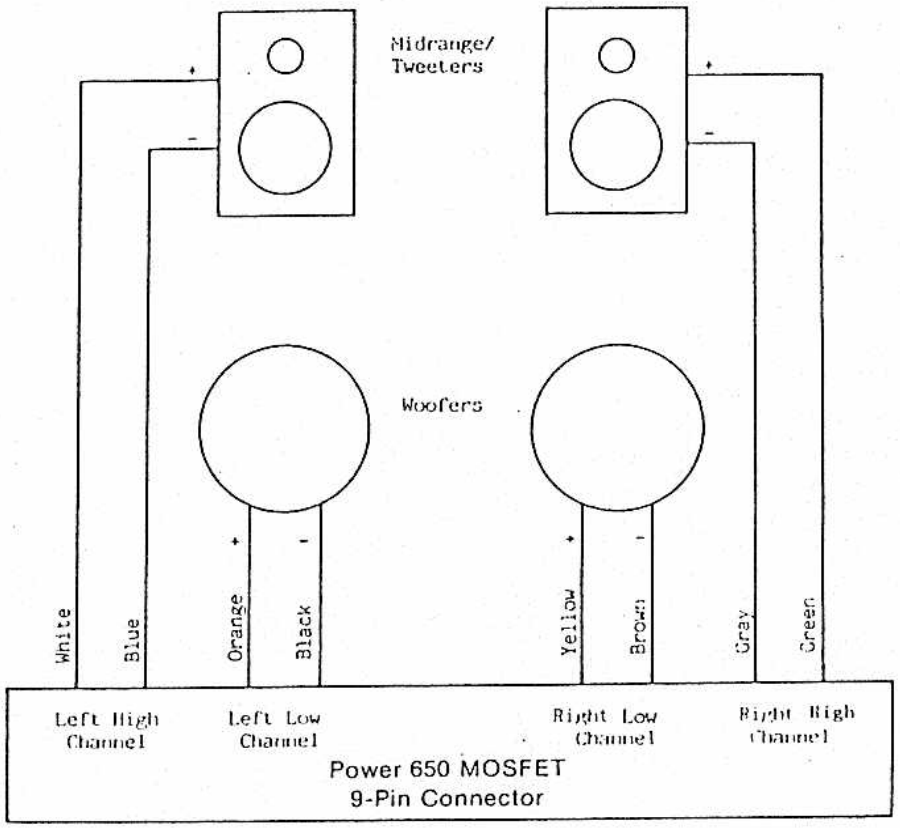
Preamp Sensitivity:
50Mv to 2.5V adjustable.

Preamp Frequency Response:
20-Hz-20KHz ± .dB.

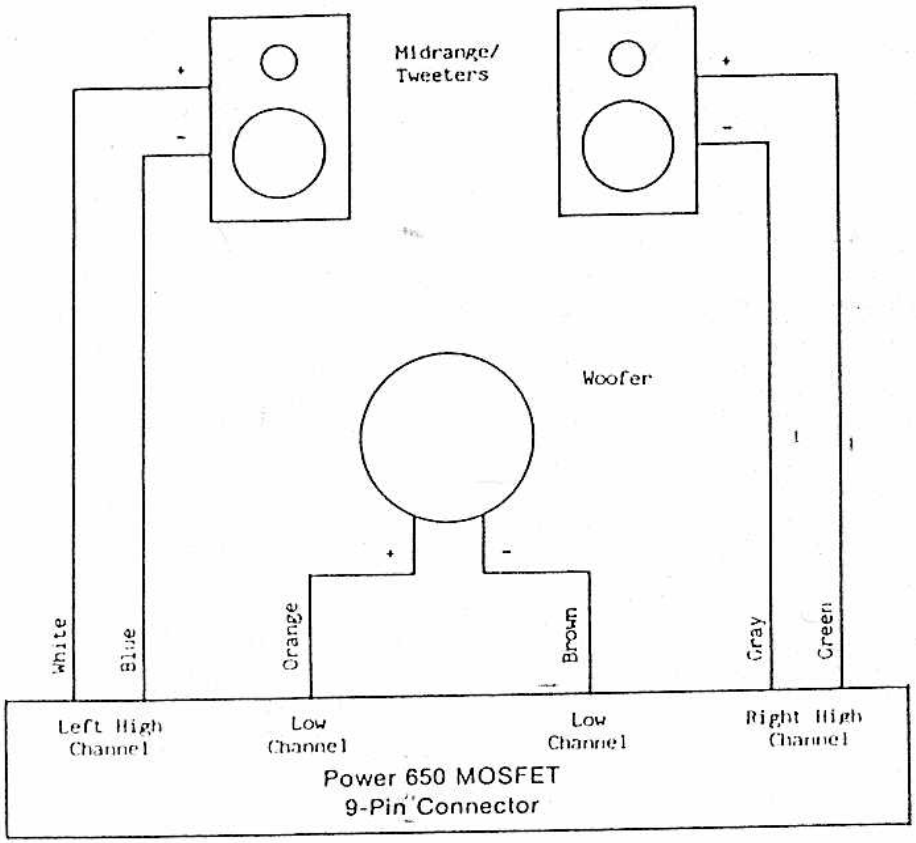
Input Gain:
250 MV to 2.5V adjustable.



POWER 650 MOSFET
STEREO BIAMPLIFIED MODE
HIGH AND LOW CROSSOVERS ACCORDINGLY

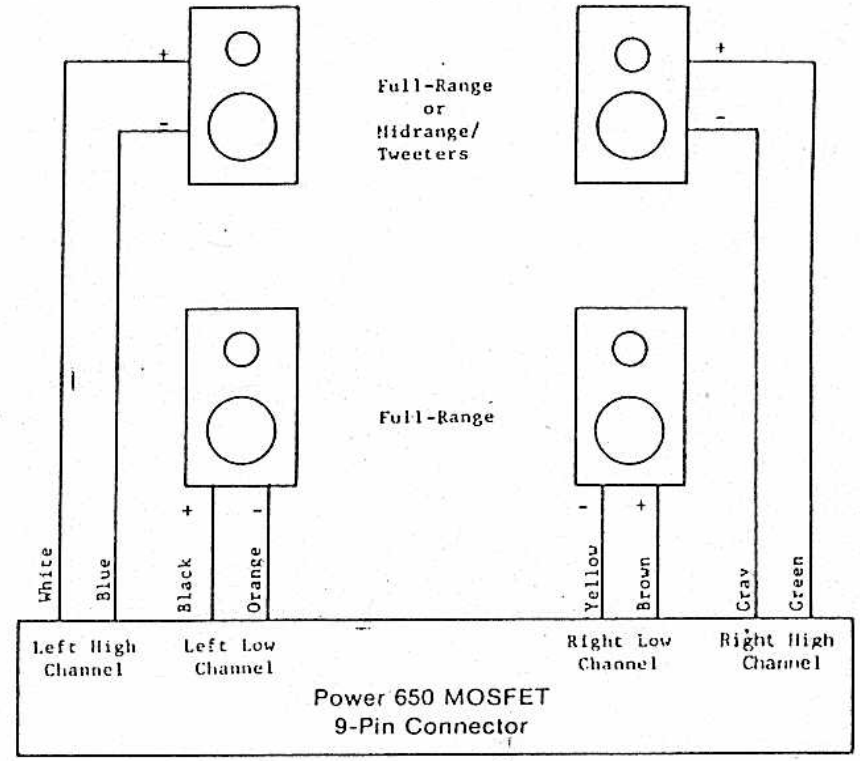


NOTES: Low crossovers set to 70, 100 or 140 Hertz
High crossovers set to 140, 200, 280 Hertz.



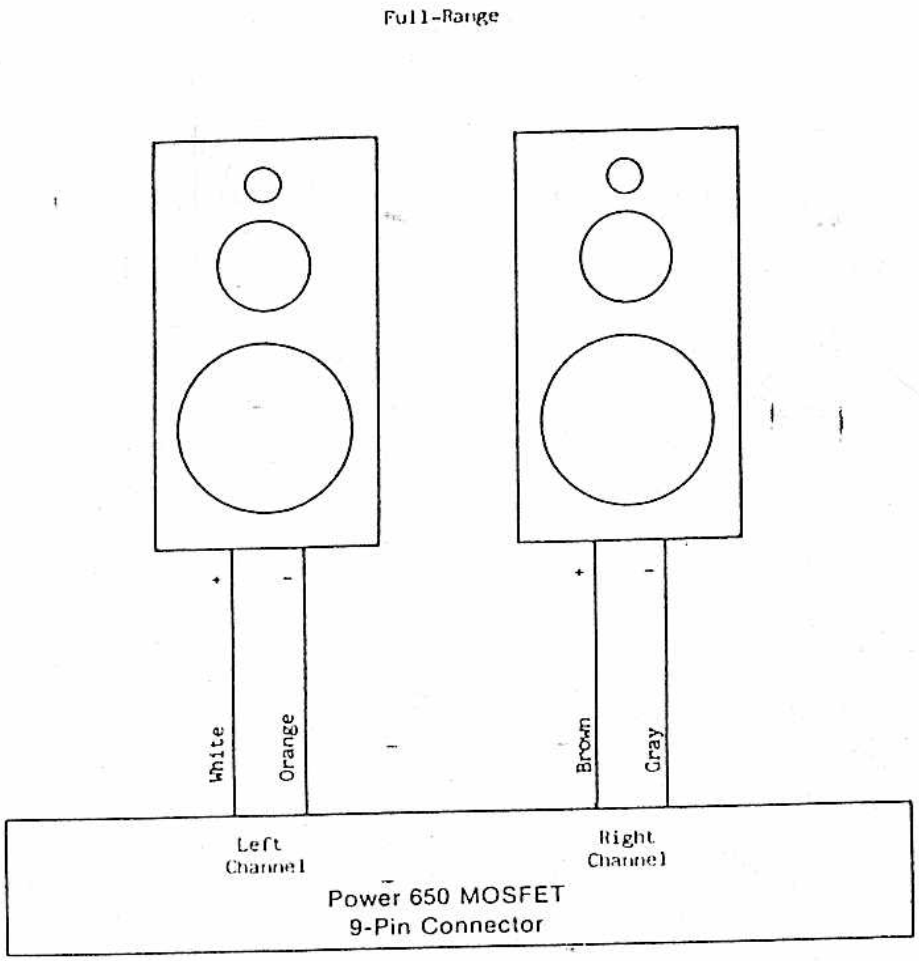
NOTES: Low crossovers set to 70, 100 or 140 Hertz.
High crossovers set to 140, 200 or 280 Hertz.

BIAMPLIFIED STEREO
BRIDGED MONO WOOFER



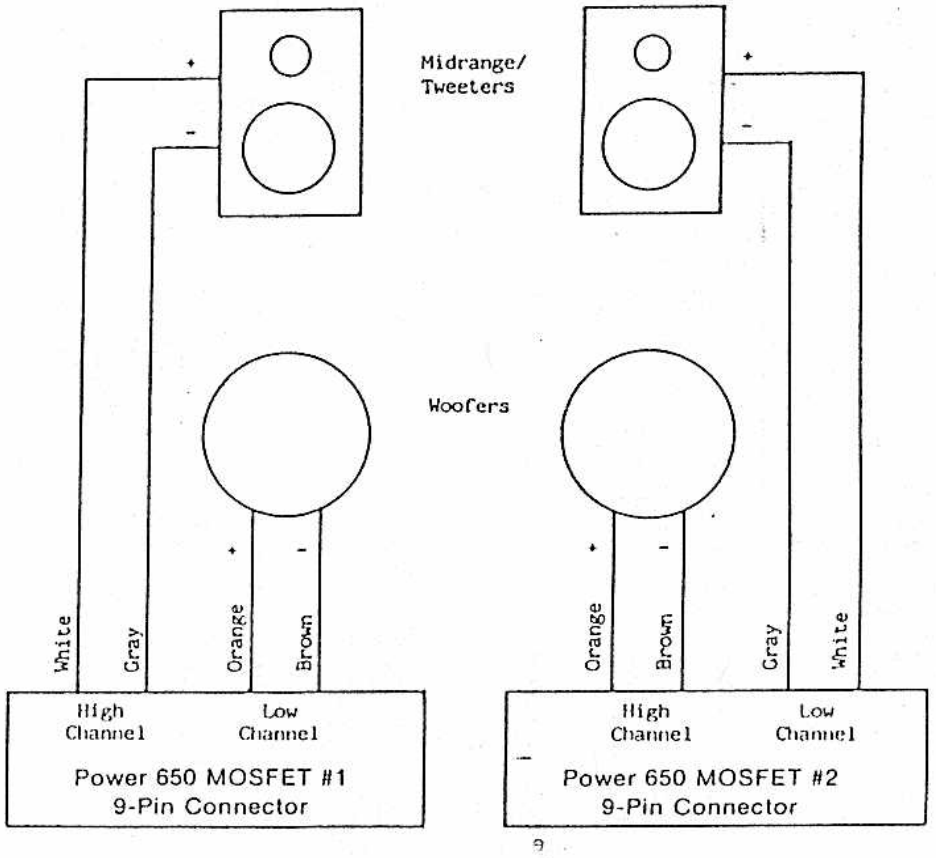
NOTES: Low crossover set to "Flat".
High crossover set to "Flat" for full-range front speaker system, 280 or 400 Hertz for Midrange/Tweeter front system.

Note that low channel color codes are reversed from those of biamplified systems.



Notes: Both High and Low Crossovers set to "Flat" position.

BRIDGED STEREO



NOTES: Low crossovers set to 70, 100 or 140 Hertz.
High crossovers set to 140, 200 or 280 Hertz.

Bridging "Y" Adapter, P/N FA-G683, is used to split out Left and Right channels to separate amplifiers.

BRIDGED MONO BIAMPLIFIED

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