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# M50

Triple Darlington  
High Definition Amplifier

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## BEFORE YOU BEGIN YOUR INSTALLATION

Thank you for choosing a Phoenix Gold product. In doing so you've demonstrated a desire to own the finest in audio reproduction. We strive to provide you, the customer, with the finest products possible.

Properly installed, your Phoenix Gold amplifier will provide years of high quality sonic reproduction. Before installing the M50 in your vehicle, please read the entire manual carefully. It is required reading for the protection of your vehicle and for the maximum performance of your car audio system.

The M50 uses the fastest output devices in the industry. Where most manufacturers use 3 to 5MHz output devices, Phoenix Gold uses 25MHz high temperature devices. These devices are not only faster, but more costly—and much more reliable. We don't just use run-of-the-mill capacitors in our circuitry, but rather low ESL/ESR type capacitors, and we use them extensively in our amplifier. This helps reduce one of the major failure modes of all car audio amplifiers—heat. The M50 amplifier has been extensively tested and “burned in” for maximum reliability.

### Phoenix Gold Warranty

If you, the consumer, install this amplifier we provide a limited warranty for 30 days. If your authorized Phoenix Gold dealer professionally installs the amplifier you receive full warranty coverage for 18 months from the date of purchase. See your warranty card for more details on the extended warranty of this power amplifier.

Remember, at Phoenix Gold, we don't just manufacture mobile electronics, we also manufacture cables, “PowerFlow” distribution systems, alternators and accessories for the professional.



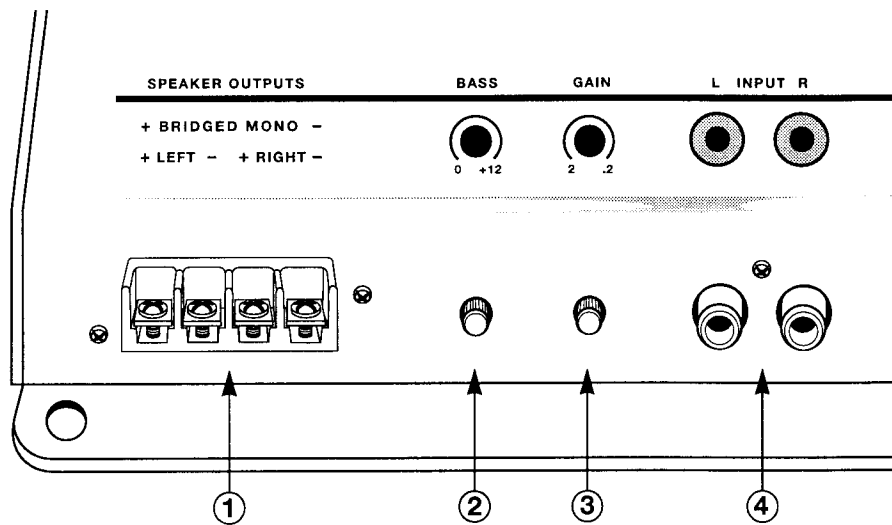
## M50 POWER AMPLIFIER FEATURES

- ❑ 2 x 50 Watts per channel
- ❑ Bridgeable Outputs
- ❑ Tri-Linear™ output capability, simultaneous stereo & bridged mono
- ❑ Adjustable Bass EQ (0 to +12dB) @ 45Hz
- ❑ Pulse Width Modulated MOSFET Switching Power Supply
- ❑ Stable into 1 Ohm loads
- ❑ High-Current Triple-Darlington Output Design
- ❑ 2 layer, 2 ounce Gold Plated Copper G-10 Glass-Epoxy Printed Circuit Board
- ❑ Variable input sensitivity (200mV to 2V)
- ❑ Thermal Overload Protection
- ❑ Superior muting circuitry assures no turn on/turn off noise
- ❑ Optically isolated power supply
- ❑ VI limiting circuitry with overcurrent LED
- ❑ Extensive burn-in and QC testing for the ultimate in reliability
- ❑ Made in the good ol' U.S.A.

## M50 POWER AMPLIFIER SPECIFICATIONS

- ❑ Output Power per Channel: Both Channels Driven
  - Into 4Ω @ 12V DC .....50 WRMS
  - Into 2Ω @ 12V DC ..... 100 WRMS
  - Bridged Power into 4Ω .....200 WRMS
- ❑ THD at rated power 4Ω .....0.02%
- ❑ SMPTE at rated power 4Ω .....0.05%
- ❑ DIM at rated power 4Ω .....0.01%
- ❑ Frequency response .....10Hz to 30KHz ±1dB
- ❑ Signal to Noise Ratio ..... > 100dB (20 to 20KHz)
- ❑ Input Sensitivity .....200mV to 2V
- ❑ Input Impedance .....10KΩ
- ❑ Damping Factor (50Hz @ 4Ω) .....250 to 1
- ❑ Idle Current .....1.5A
- ❑ Current Consumption
  - @ 4Ω stereo ..... 15A
  - @ 2Ω stereo .....30A
  - @ 2Ω stereo, 4Ω mono .....35A
- ❑ Efficiency ..... > 80% (Power Supply)
- ❑ Min to Max Voltage requirements ..... 10.2 to 15.5V DC
- ❑ Dimensions .....10.625inL x 8.25inW x 2.0inH

## AMPLIFIER CONTROLS AND FUNCTIONS



### 1. SPEAKER OUTPUT

This 24kt Gold barrier connector hooks up to any gauge speaker wire. We recommend a Phoenix Gold PRO80/81 Gold spade terminal.

### 2. BASS ADJUSTMENT

This bass equalizer circuit allows for matching of the subwoofer enclosure to any vehicle.

### 3. GAIN ADJUSTMENT

The Gain Adjustment allows for correct matching of any signal source (CD player, AM/FM cassette deck, etc.) from its pre-amp output to the M50. Adjustments range from 0.2 Volts to 2 Volts AC/Audio.

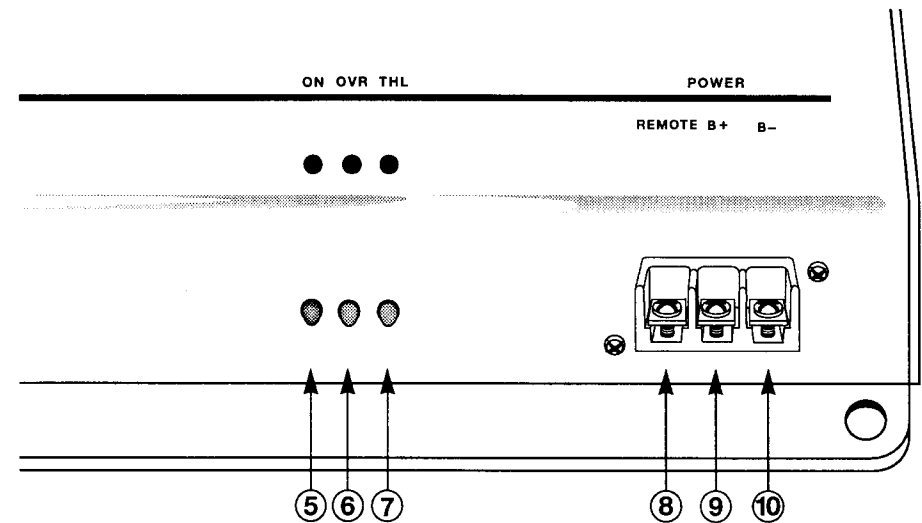
### 4. RCA INPUTS

The M50 is set for pre-amp inputs. Typically all CD players and AM/FM cassette decks with RCA outputs should operate.

### 5. POWER ON: GREEN LED INDICATOR

This LED lights when the amplifier is on, with 12V at B+ and remote wires.

## AMPLIFIER CONTROLS AND FUNCTIONS



### 6. OVERLOAD: RED LED INDICATOR

This LED lights up when the amplifier has:

- A. Passed more than 16 Amps of current in the output stage, or
- B. Passed more than 440 total Watts total—more power than the amplifier is built for.

### 7. THL: AMBER LED INDICATOR

The Thermal Protection LED lights when the amplifier has "Thermaled," or shut off temporarily to protect itself, as the temperature of the heatsink has reached 90°C or 200°F.

### 8. REMOTE TURN-ON

This Remote Turn-on Terminal can be connected to the automatic antenna lead or "remote" switched 12V DC lead of your CD player. This allows the M50 to be turned on and off through the controls on the CD player.

### 9. POWER INPUT (B+ POSITIVE 12 VOLTS DC)

This 24kt Gold three position barrier type connector is designed to accommodate up to 7 gauge power cable. We recommend using Pro Ruby Red 9 gauge Phoenix Gold power cable, and that you "PowerFlow" and properly fuse (40A maximum) your M50. See page 8.

### 10. POWER GROUND (B- CHASSIS GROUND)

We recommend using our Pro Onyx 9 gauge Phoenix Gold ground cable to ground the M50.

## AMPLIFIER LOCATION/MOUNTING

### Amplifier Location

The M50 has been designed to dissipate heat more efficiently than any other amplifier manufactured today. However, prolonged operation at high volumes or extremely low impedances without the aid of a fan shroud can cause the unit to overheat and protect itself. Regardless of where you decide to mount the M50 make sure that there is at least a 2-inch clearance above and around the amplifier.

The amplifier may be mounted either upright (Figure 1) or horizontally (Figure 2), but **never upside down** (Figure 3)—a position which allows the rising heat to “feed-back” into the amplifier causing a premature system shut down.

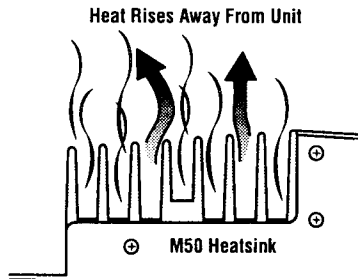


Figure 1: Upright Mount

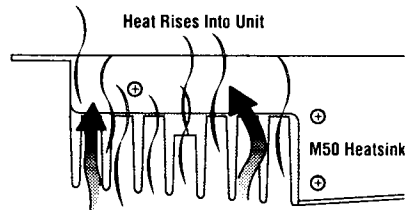


Figure 3: Inverted Mount

Heat Rises Through Heatsink Causing Each Fin To Heat More Rapidly.

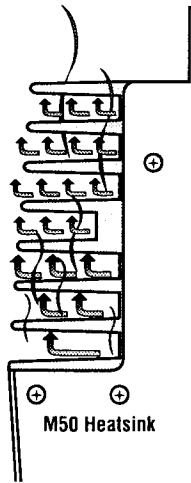


Figure 2: Horizontal Mount

The M50 should be protected from exposure to moisture and it is best to mount the amplifier on:

1. The back wall or floor of the trunk.
2. The side of the subwoofer enclosure.
3. Under the seat.

Place amplifier in the position that you wish to use and check for clearances around the amplifier.

## AMPLIFIER LOCATION/MOUNTING

### Amplifier Mounting

Mounting considerations: Is there enough space for the signal input plugs? Will the speaker cables be able to enter the terminal connectors straight? Will your mounting position allow easy viewing of indicator LEDs and amplifier controls?

1. Use the M50 as the template. Mark the mounting surface with a felt pen or pencil. Placing masking tape on the surface first will make these marks more visible.
2. Drill  $\frac{1}{8}$  inch pilot holes.

**Warning:** Do not drill any holes while using the amplifier as a template. It is very easy to damage the amplifier's powder coated surface in this manner.

3. Mount the amplifier with four (4) #10 by  $\frac{3}{4}$  inch panhead phillips screws.

The optimum mounting configuration is shown below in Figure 4. This mount allows the heatsink fins to act as a chimney thus keeping the amplifier cool over longer periods of time.

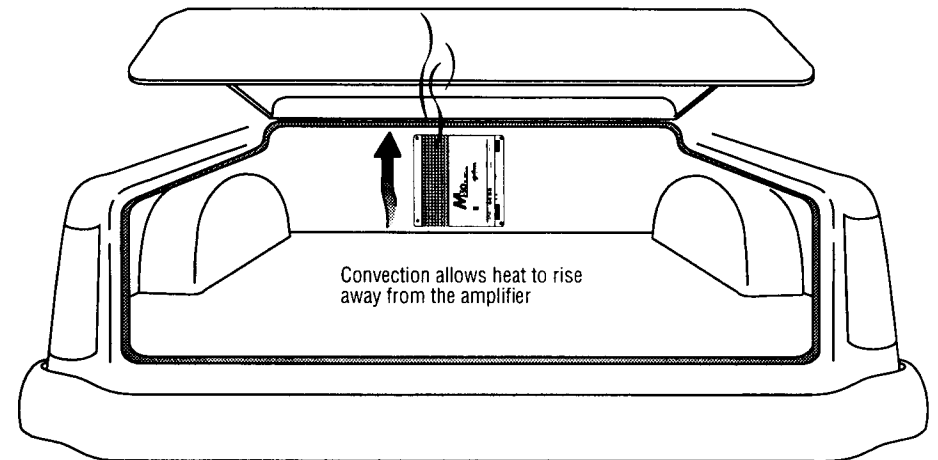
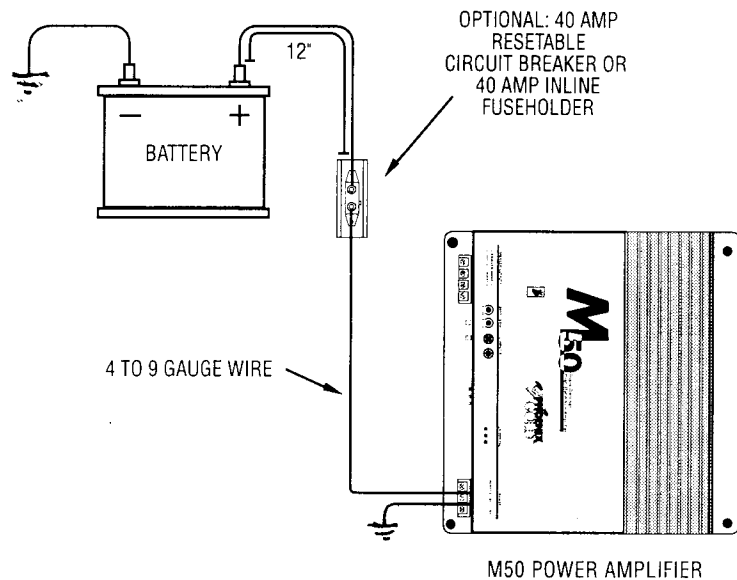


Figure 4: Trunk Mount

## ELECTRICAL INSTALLATION

**Warning:** Always disconnect the battery ground cable before working on a vehicle's electrical system.

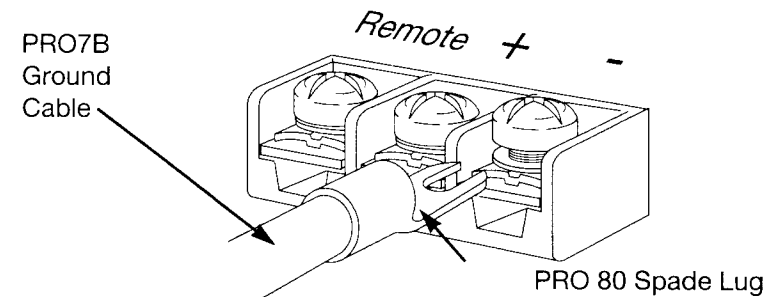
1. Always use the largest gauge power/ground cable available. We recommend using Phoenix Gold Pro7 R and Pro7 B wire for Power and Ground.
2. Always place a fuse or circuit breaker no more than a foot from the battery. This protection is only for the vehicle, not the stereo and should be no greater than 15-20A per amplifier. (See Figure 5)



**Figure 5: PowerFlow System**

## ELECTRICAL INSTALLATION

3. For audio connections, we recommend using high-quality audio interconnects like the Phoenix Gold A540 Trans-Balanced or our compact CSI cables. Our cables are the ultimate in sound quality and reducing or eliminating unwanted "radiated noise" from your system. Make sure that you run your audio cables **away** from your power wires. This will help reduce any noise caused by the power wire "radiating" into the audio cables.
4. Based on the current draw of your system, always use the largest gauge power and ground wire possible. The M50 barrier strip style power terminal can handle up to 7 gauge wire when using a Phoenix Gold's Pro 80/81 spade lug. (See Figure 6). Using the largest gauge power and ground wire will give you the highest "damping factor" thereby the tightest and most accurate bass.



**Figure 6: Remote/Power/Ground Terminal connections**

- If the Green LED is lit, the amplifier is on.
- If the Amber LED is lit, the amplifier has thermalized: the heatsink has reached 200°F and the amplifier has protected itself by turning off.
- If the Red LED is lit, the amp has reached full power at 0.75Ω or less.
- If the Green LED flashes on for a second, then the Red LED flashes, then the Green LED flashes again and so on, one or more of the speakers are shorted out. Having a shorted speaker will not damage your Phoenix Gold M50 but it will cause the protection circuitry to engage, as indicated by the flashing lights.

## AUDIO SYSTEM DESIGN

With the extreme flexibility of the M50, extra care must be taken while designing the entire system **before** its installation. The following system diagrams should be used as ideas towards designing a truly awesome car audio system.

Remember that this amplifier likes to be driven hard. Whenever possible always choose the Tri-Linear™ mode (i.e., stereo & bridged mono simultaneously). You must use passive crossover networks to protect drivers.

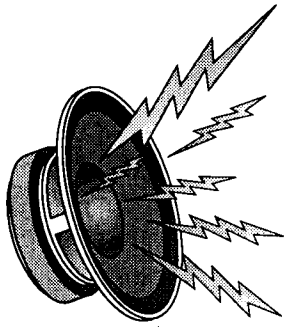
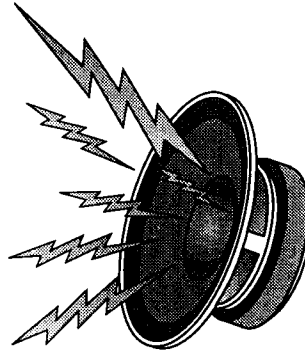
The following Crossover Slope charts are for your reference. When passive components (capacitors and inductors) are used in multi-speaker systems, the crossover's impedance **and** the speaker system combinations **must** be considered especially when determining the amplifier loading. These system diagrams do

not consider crossover component values for the system you have chosen; those values will be determined by the frequency you select for your crossover point and the impedance of the speakers at the crossover point selected for your system.

12dB per octave crossovers are good, but tend to create sonic problems if not utilized correctly. A 12dB per octave crossover (an inductor and capacitor for each speaker) forms a series resonant circuit to ground whose impedance at that resonance

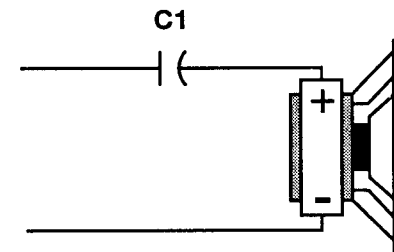
frequency is determined by the speakers **dynamic** impedance. If the speaker, for whatever reason, becomes "open" or disconnected the crossover input impedance is theoretically zero (0): a direct **short**.

Fortunately, Phoenix Gold amplifiers are designed to withstand this type of treatment. Most amplifiers **do not** like to see this condition. We recommend 6dB or 18dB per octave type crossovers, especially in automobiles. These crossover slopes are "In Phase" and tend to sound better.

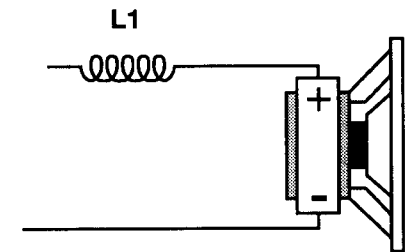


## CROSSOVER SLOPES/COMPONENT VALUES

FREQUENCY HERTZ	SPEAKER IMPEDANCE					
	2 Ohm		4 Ohm		8 Ohm	
	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	38 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	80 uH	20 uF	.16 mH	10 uF	.33 mH	5 uF
6000	51 uH	14 uF	.10 mH	6.8 uF	.29 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	.1 mH	1.6 uF



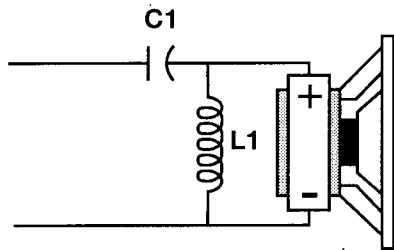
6dB Per Octave High-Pass Filter



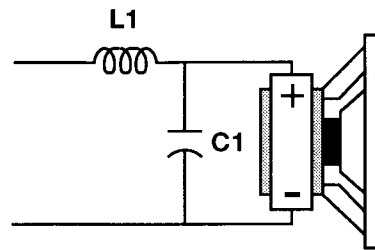
6dB Per Octave Low-Pass Filter

# CROSSOVER SLOPES/COMPONENT VALUES

FREQUENCY HERTZ	SPEAKER IMPEDANCE					
	2 Ohm		4 Ohm		8 Ohm	
	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	.23 mH	1.5 uF
12000	39 uH	4.7 uF	75 uH	2.2 uF	.15 mH	1.0 uF



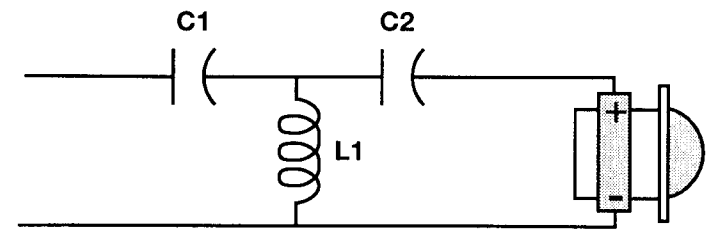
12dB Per Octave High-Pass Filter



12dB Per Octave Low-Pass Filter

# CROSSOVER SLOPES/COMPONENT VALUES

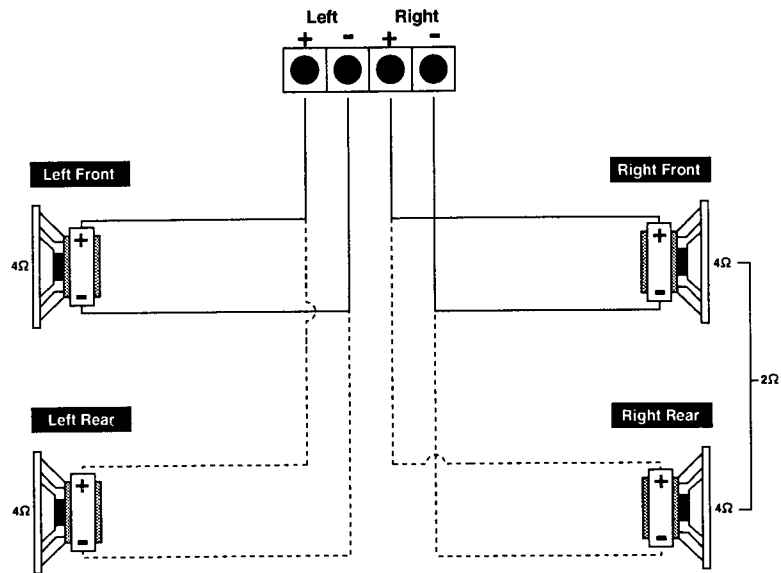
FREQUENCY HERTZ	SPEAKER IMPEDANCE					
	4 Ohm			8 Ohm		
	C1	L1	C2	C1	L1	C2
80	330 uF	6.0 mH	1000 uF	160 uF	12 mH	500 uF
100	270 uF	4.7 mH	800 uF	150 uF	10 mH	400 uF
130	200 uF	3.3 mH	600 uF	100 uF	7.5 mH	300 uF
200	150 uF	2.2 mH	400 uF	68 uF	5.4 mH	200 uF
260	100 uF	1.8 mH	300 uF	50 uF	3.3 mH	150 uF
400	68 uF	1.1 mH	200 uF	33 uF	2.4 mH	100 uF
600	47 uF	.80 mH	130 uF	21 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	.21 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	38 uH	6.8 uF	1.1 uF	82 uH	3.3 uF



18dB Per Octave High-Pass Filter

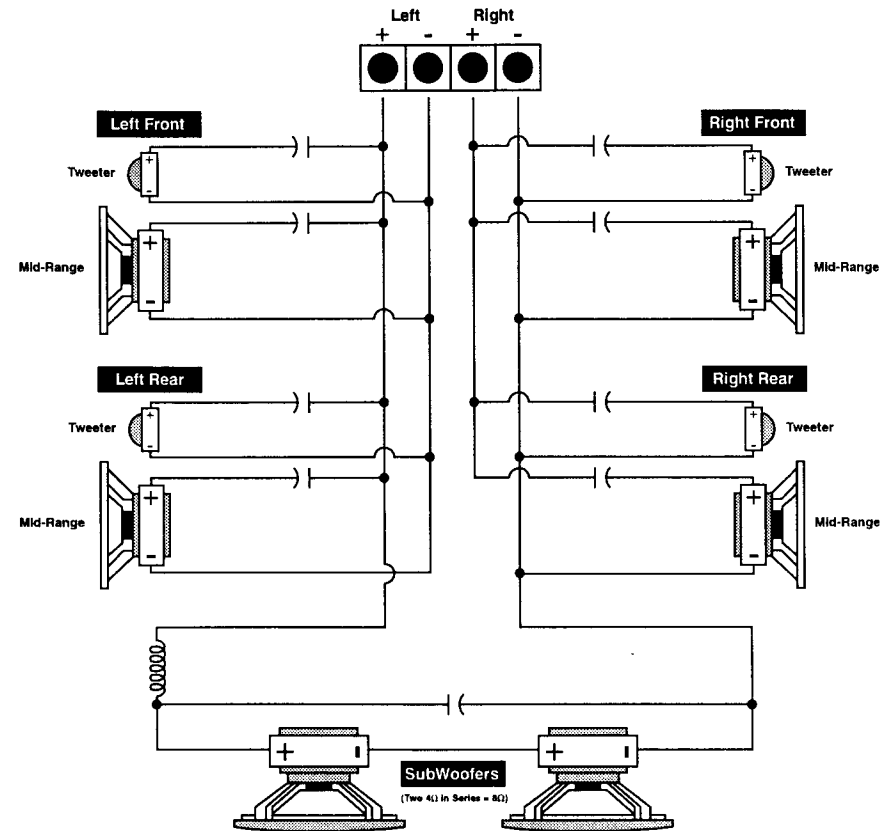


# PHOENIX GOLD SYSTEM 1



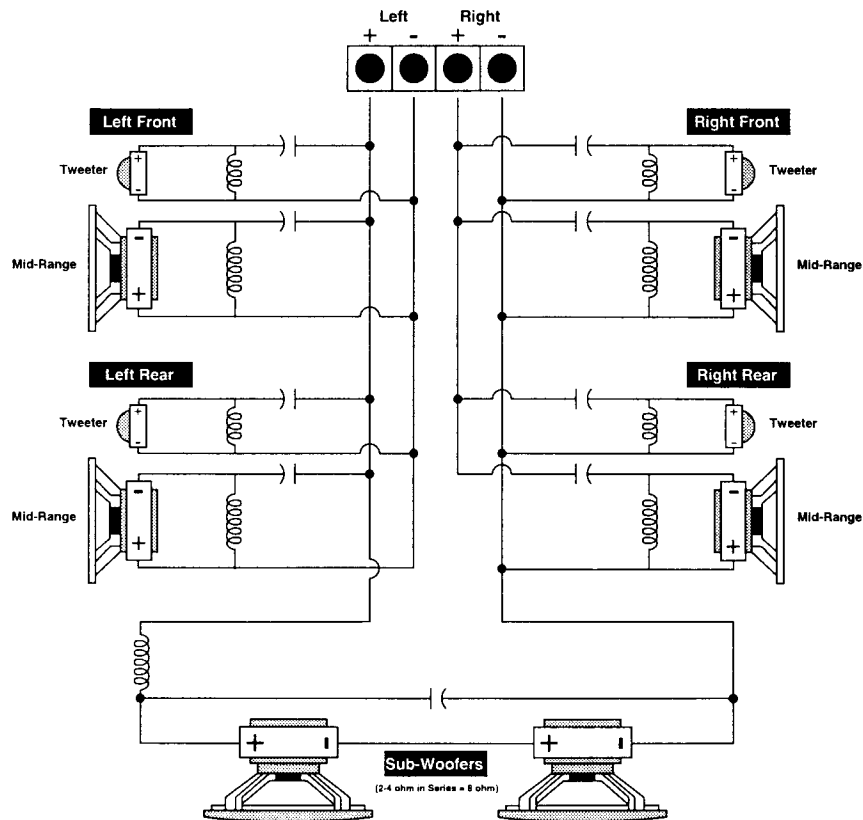
System 1 uses only stereo output into 2 (or 4) speakers.

# PHOENIX GOLD SYSTEM 2



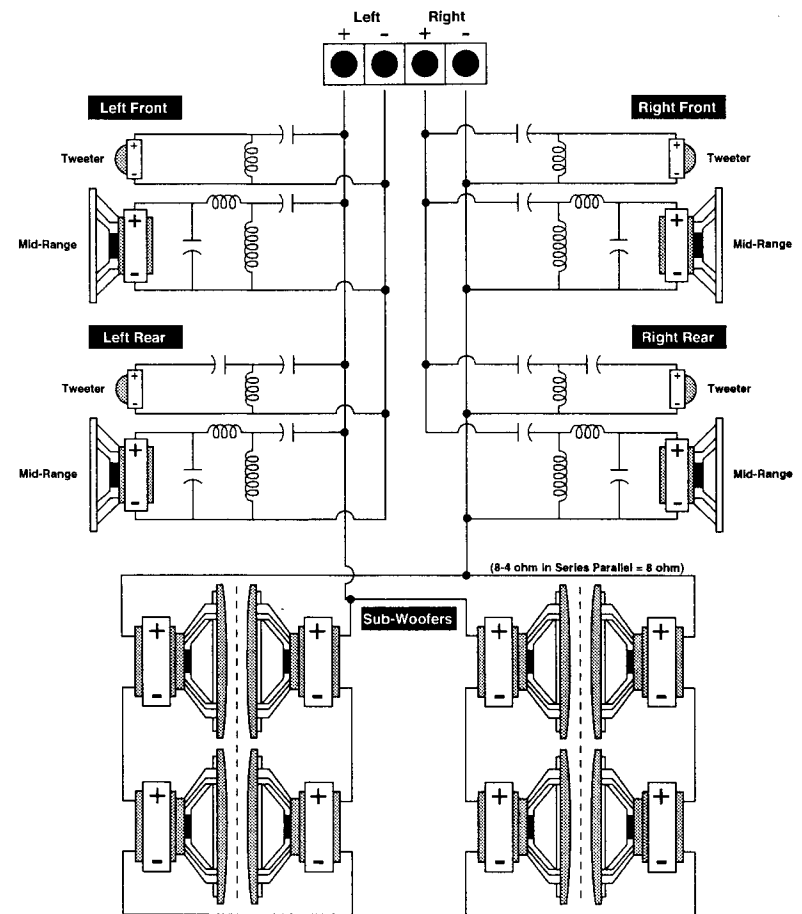
System 2 uses Tri-Linear™ output. Front and rear speakers are parallel with 6dB per octave passive crossovers. The subwoofer is connected across the bridged output of the M50 amplifier with 12dB per octave passive crossover.

## PHOENIX GOLD SYSTEM 3



System 3 uses Tri-Linear™ output: Front and rear speakers are parallel with 12dB per octave passive crossovers. The subwoofer is connected across the bridged output of the M50 amplifier with 12dB per octave passive crossover. **Note:** Midrange is “out of phase” to the woofer and tweeter so that the entire speaker system will be acoustically “in phase.” This is very typical of 3-way 12dB per octave networks.

## PHOENIX GOLD SYSTEM 4



System 4 uses Tri-Linear™ output: front and rear speakers in parallel with 12dB bandpass midrange crossovers and 12dB per octave high-pass tweeter crossover. The subwoofer is connected across the bridged output of the M50 amplifier. **Note:** The 8 woofers are connected series parallel with outside woofers out of phase to inside woofers. This is an “Isobaric” 7th order enclosure. Therefore, **no** passive crossover is needed as a 7th order box rolls the high frequency off at 36dB per octave.

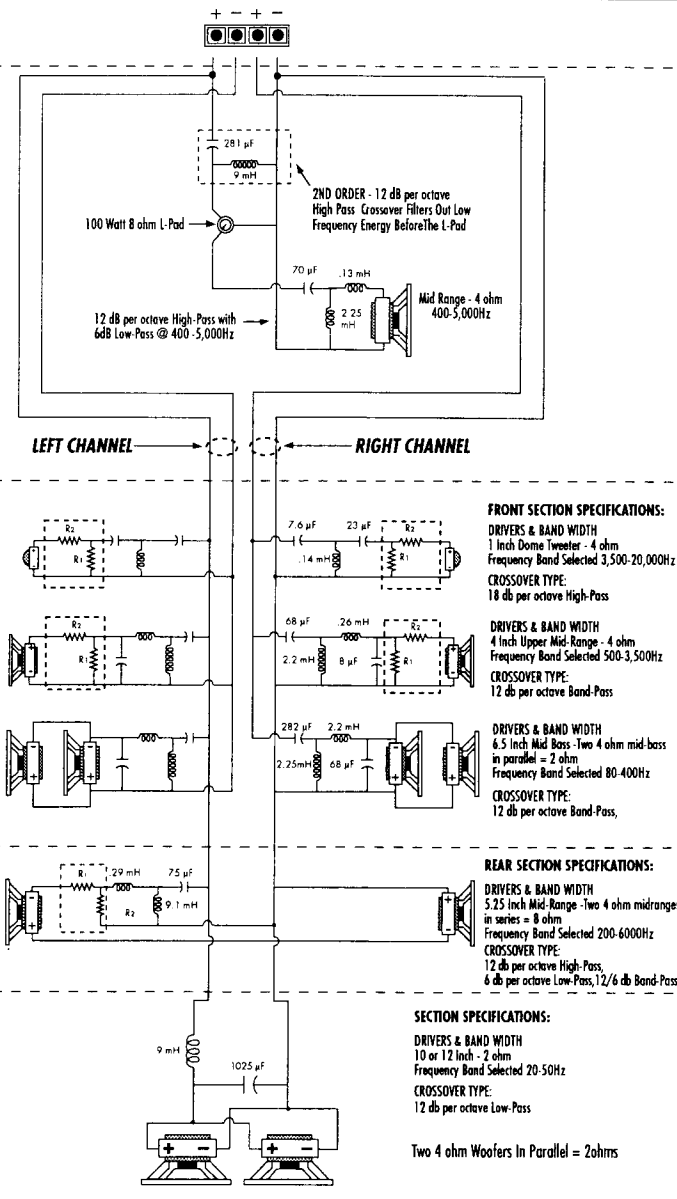
# PHOENIX GOLD SYSTEM 5

CENTER CHANNEL - (OPTIONAL)

FRONT - MID BASS, MIDS & TWEETERS

REAR-MONO

SUBWOOFERS



This System uses 4 mid-bass drivers to create the illusion that bass is coming from the front of the vehicle-not the rear! Also note that the rear channel is **mono**. And check out the optional center channel. This is an IASCA type system.

# AMPLIFIER ADJUSTMENTS

The M50 has both an input sensitivity adjustment and a bass EQ adjustment. Care should be taken to adjust these properly as they affect each other.

1. Start with **Bass** control at "0" and **Gain** control at "2". (See Figure 8).
2. Adjust the **Volume** control on your head unit (CD, Cassette, etc.) to 75% of maximum volume. (See Figure 9).
3. Turn the **Gain** control on the M50 towards ".2" until you hear the amplifier distort. The M50 "clips" very softly so this can sometimes be a difficult adjustment. Please listen carefully! (See Figure 10)

**Note:** If, after adjusting the input gain the bass sound quality is to your liking, it would be best to not adjust the bass further. Adding EQ through an external equalizer or the one built into the M50 can cause the amplifier to **distort** easier, or **overheat** faster.

5. If you desire more bass, adjust the **Bass** control towards +12dB. The adjustment range is from "0" to "+12dB". We recommend using as little Bass EQ as possible. Remember, boosting +12dB at 45Hz means the amplifier clips a 45Hz signal 3x faster.

**Note:** If you need to boost the **Bass EQ** to the maximum level +12dB to obtain the desired bass output, **something is very wrong!** Double check the wiring of your speaker to verify that the positive cables are going to the positive terminals on the speaker, and the amplifier. If the wiring is correct, the woofer and the enclosure may not be working together correctly. Check the design notes for your subwoofer enclosure.

## YOUR INSTALLATION IS NOW COMPLETE!

If you experience any problems do not hesitate to contact us at (503) 288-2008. We are here to help.

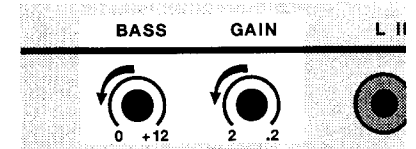


Figure 8: Bass & Gain Controls

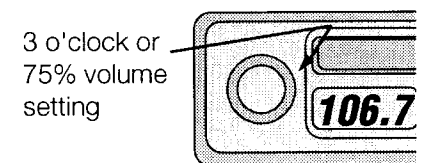


Figure 9: Head Unit

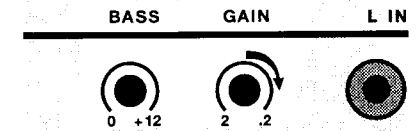


Figure 10: Gain Control

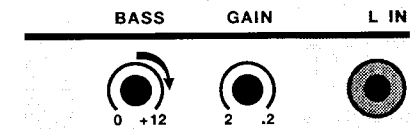


Figure 11 - Bass Control