Instruction and Installation Manual

# MINOTAUR
# DRACONIA
# DREADNOUGHT
# LEVIATHAN
# RA

Designed and manufactured in the
United States of America

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Zed Audio is proud to introduce our third line of innovative mobile amplifiers. The new products were carefully selected to fill the need of the car audio enthusiasts.

The first is **MINOTAUR** an all new single channel (mono block) rated at 500w into 4 ohm and 1000w into 2 ohm. This is not your normal "run of the mill" mono block since this is actually a full range amplifier with some unique features.
**DRACONIA** is the smaller of the new four channel offerings at 100w x 4 at 4 ohms and **DREADNOUGHT** is the "Bad Boy"rated at 225w x 4 at 4 ohms. These amplifiers are suitable for use in almost any system, small or large.
**LEVIATHAN** our six channel amplifier has been improved and some of the crossover frequency selections have been updated.
**RA** the last of the new products is a remote control/pre amplifier whose features are dedicated for sub-woofer duty.

## SOME FACTS ABOUT OUR AMPLIFIERS:

We use only high current large pack TO-247 MOSFETs in the power supplies. These are superior to the smaller TO-220 packages in their ability to dissipate heat.
The power supplies are fully regulated and so the amplifiers are independent of battery voltage (>12v).
Low ESR 105 deg C capacitors are used in the power supplies. Additional high frequency bypass is done with ceramic capacitors (the best choice by far for this application).
High speed (35nsec) rectifier diodes are utilized for the secondary supplies and all low voltage supplies use Schottky diodes which have zero reverse recovery time.
The main high current power supplies which feed the power amplifiers are choke type for superior filtering and noise rejection and again low ESR 105 deg C capacitors are used.
All amplifiers feature a two stage power supply for increased efficiency.
New super high speed low noise IC chips are used.
The class D amplifiers utilize the latest generation of low gate charge, high current MOSFETs.
**MINOTAUR** is an industry first with a 48dB/octave analog High Pass crossover.
The pre-amplifiers in all our amplifiers run off independent regulated supplies and drive the power amplifiers in a full balanced differential mode.
This method of internal connection eliminates ground loops which cause alternator whine. It also eliminates the need for balanced inputs of which we see many manufacturers using RCA connectors which were NEVER designed for balanced connection.
Clipping LEDs are featured on all amplifiers.
**MINOTAUR** has 4 LEDs each spaced at 3dB intervals. (0dB, -3dB, -6dB and -9dB)
All amplifiers which have equalizers use constant Q types for a more precise result.
RCA sockets are solid gold plated machined brass with teflon inserts.
The power connectors accept wire with a diameter of 7mm (0.275").
Low noise 1% metal film resistors are used in all gain and frequency dependent circuits.
All our amplifiers feature the usual plethora of protection circuits, such as DC, thermal and short circuit. The short circuit is auto resetting and requires no input from the user.
The ZED logo doubles as a power and a protection indicator, flashing in protect mode and solid under normal operating conditions.

# MYTHS, MAGIC AND FACTS

## Amplifiers: What are they and what do they do?

ALL amplifiers are basically power supplies! This will shock almost all who read this. Audio amplifiers are really a valve between the power supply and the speaker. This valve is "instructed" by the incoming audio signal to allow a given amount of the voltage and current from the power supply to reach the loudspeaker dependent solely on the amplitude and polarity of the incoming signal. This blows away the pre conceptions of all who read this of what amplifiers really are. Remember there are two main components in any amplifier, a power supply which is the sole source of power/energy and the "amplifier" which channels the power from the power supply by virtue of "commands" given by the driving audio signal. With this said let's see what's cookin' inside our black boxes.

So with these facts established, our class A, class B or class D amplifier channels POWER SUPPLY energy to the speaker but waste a lot or a little energy performing this feat(depending on the class of amplifier used).

The task of the amplifier is quite simple really. Take the input signal, make it larger in terms of voltage and supply enough current from the power supply to drive the loudspeaker. Remember the speaker's impedance is typically less than 8 ohms and greater than 1 ohm.

The task of increasing the voltage and current levels to that sufficient to drive a typical speaker is not difficult at all. The challenging part is how well the amplifier can do this. The frequency response and phase must be unaltered, and distortion must not be added to the signal. This of course is impossible to do perfectly but in the past 40 years we have come a long way and there are many fine amplifiers.

Amplifiers can be of two types, a voltage source or a current source. 99.99% of audio amplifiers are voltage sources. In other words the amplifier tries to hold its voltage output constant (assuming a steady signal being a sine wave) no matter what the load impedance. The ONLY way an amplifier can achieve this is to have zero output impedance (ie an infinite damping factor) and zero losses in the output stages. The first is somewhat achievable by introducing positive feedback which in theory will give the amplifier a NEGATIVE output impedance. Zero losses in the output stages are impossible to overcome. The prefect output transistor/MOSFET has not yet been invented and never will be!

A current source amplifier tries to keep the current through the load constant no matter the load/speaker impedance. Some simple examples on the following page.

Let us use a 50w amplifier as our example. We shall assume a lossless output stage and a perfectly regulated power supply capable of tons of current and enough rail voltage to supply 8 ohm loads..

The constant voltage amplifier will deliver 14.14 volts across whatever load we present to it. So at 8 ohms power is 25w, at 4 ohms it is 50w, at 2 ohms 100w...you get the idea so far?

The constant current amplifier will deliver 14.14 volts across a 4 ohm load (The design centre point) and this means we are running 3.5 amps through this load and thus the amplifier delivers 50 watts. OK now let us increase the load to 8 ohms. Cool things happen. The amplifier will deliver the same 3.5 amps into the 8 ohm load. The power formula is I x I x R (Current x current x load impedance). A “funny” thing has happened. The power is now 98 watts, so it has INCREASED from the 4 ohm load (opposite to what we are accustomed to with constant voltage amplifiers). Well now it is kind of downhill when we throw on a 2 ohm load. The output is 3.5 x 3.5 x 2 = 24.5 watts!

So what can we conclude from all of this? Well constant current type amplifiers are sort of distant cousins of tube amplifiers which traditionally have high output impedances. (Think of taking your amplifier and putting great big 2 to 4 ohm resistor in series with the output). A constant current amplifier behaves the same.

An interesting idea comes to mind to have a mixture of both constant voltage and constant current in the same amplifier. Keep your ears and eyes open for some future product from Zed with this feature.

Amplifiers, be they class A, B or D behave and sound better into higher load impedances like 6 or 8 ohms. Class A amplifiers buy virtue of their design do behave better at lower load impedances than the B and D versions but they are not immune to these ills..

This is the first time I bring up low impedance loads and it will not be the last.

The idea of trying to maximize the output power simply because the manufacturer states that his amplifier can deliver 8.24 Zillion watts into 1 ohm means nothing to us at Zed. Every one of these monster class D (They generally are not made as class B any longer) amplifiers has proved to be unreliable and sound just as bad. More about this on the following pages.

We rate our amplifiers at 2 ohms ONLY because we recognize that firstly 4 ohm speakers have impedance dips at various frequencies and that as much as we try to steer our customer to higher impedance loads, there will be a contingent that will insist on the 2 ohm route. We have done design to keep our amplifiers more linear into these 2 ohm loads however.

Class A and class B amplifiers do not have output filters and so the feedback network is always taken off from the output node of the amplifier. Class D amplifiers have a “monkey on their backs” in that they ALL have to have an output demodulator filter to get rid of the high frequency carrier. Class D amplifiers are simply Pulse Width Modulated power supplies where the modulation is the audio signal. How good or bad they sound depends on how the whole design is implemented.

Our class D amplifiers are of the self oscillating type which has proved to be simpler and better sounding than driven types (Where a fixed clock at some high frequency is used as the carrier). Analogous to FM or AM radio where the signal is transmitted at some high frequency, your radio picks up this signal (Which contains both the carrier and the audio) and then finally demodulates ie.  filters out the carrier leaving just the audio.

The absolute vast majority of sub woofer class D amplifiers sold today come from Asia and they typically use designs from one or two different companies. They all make one error, their feedback is taken BEFORE the output filter. What does this mean? Quite simply the deficiencies of the inductor and capacitor in the filter will contaminate the signal and the response will vary with frequency.
The reactance (AC resistance) of the coil which after all is in series with the speaker is calculated from this formula Xl = 2 x Pi x F x L.
Xl = Reactance = AC resistance
Pi = 3.14
F = Frequency at which we want to calculate Xl
L = Inductance of the coil.

Simple example: F is 100KHz and L is 150uH (150 micto Henry) typical of these amps.

Xl = 94.2 ohms at 100KHz
Xl = 0.0942 ohms at 100Hz
Xl = 0.0188 ohms at 20Hz.

The 94.2 ohms is great because at 100KHz we want it has high as possible for maximum rejection of the carrier. However we see in the narrow range from 20Hz to 100Hz is has varied by a ratio of 5 as to 1. We have not included the simple DC resistance of the coil which must be added to the 0.0942 and 0.0188 numbers. A typical coil in one of these amplifiers uses a mean turn length of about 50mm (2”) per turn and may have between 70 to 100 turns of wire. #15 wire (whether made from a single strand or many strands if finer wire) has a DC resistance of 3.18 ohms per 307 metres (1000’). So we will have about 70 x 2” of wire = 140” = 11.66 feet call it 12 feet for round numbers. Well 12 feet have a DCR of 0.038 ohms and this does not include the second series coil used in everyone of these Far Eastern made amplifiers. So giving the benefit of the doubt to the second coil lets give it a DCR of only 0.002 ohms so our total DCR of wire in SERIES with the speaker is 0.04 ohm. Well now what do we have here?

What we have is a big old amplifier with a 0.04 ohm “resistor” in series with the output. The DCR of the wire on the inductors is absolutely equal to a resistor with regards to straight DCR. The output impedance of the amplifier is at best 0.04 ohms and this does not take into account the output stage’s resistance which typically is at least 0.01 to 0.02 ohms. Rounding off let’s go for 0.05 ohms and this is at 20Hz. At 100Hz the value is 0.134 ohms.

Now I am not a big fan of the Damping Factor hoopla. What I object to is the claim of DF values for these “mega watt” and other class D offerings of 300, 500 and 1000 etc. At best the DF with 4 ohm at 20Hz is 0.05 + 0.0188 (do not forget the AC impedance of the coil) = 0.0688 ohms. Divide 4 by 0.0688 and we have a DF of 58 with a 4 ohm load, 29 with a 2 ohm load and just 14.5 with a 1 ohm load. At 100Hz the DF at 4 ohm is 4/0.134 = 29.8, at 2 ohm it is 14.9 and at 1 ohm 7.46....mmm interesting is it not.

As the saying goes, “make my day”. Please read the specifications of all of these amplifiers and I bet each and everyone will claim massive DF numbers and distortion in the “double 00’s”. The THD of an uncompensated output filter is quite high.

These Far Eastern class D amplifiers typically use a switching frequency of 100KHz or less. OK for sub woofer application but useless for full range (20Hz-20KHz) operation. Unfortunately even at 100KHz one has to use a pretty aggressive filter to attenuate the carrier. The inductors range from 80 to 200 micro Henry and the capacitors from 22mfd to 220 mfd.

Zed is not the first to use post filter feedback but it solves all of the above issues to a great degree. Here is what we incorporate. The distortion of the filter is reduced by the feedback factor and in our amplifiers is typically about 15 times. The DCR of our output inductors is an order of magnitude lower than the above, even with Draconia having the skinniest wire we h use less turns as our inductors are in the 22-30uH range. We use switching frequencies close to half a megahertz (500KHz) and so our filter parts are of lower values. Now any DCR in the inductor is taken care of by the feedback network and so does not appear as a series resistive element. Our DF values are modest even with reflected inductor DCR of about 0.002 ohms.

Finally we have low THD as the imperfections of the filter components are almost eliminated by the feedback being post filter. The frequency response of our class D amplifiers is flat from less than 10Hz to 25KHz within 0.1dB.

# MYTHS, MAGIC AND FACTS

Please read this paragraph very carefully. When typical bench testing of amplifiers is performed we generally use sine waves, a quite severe torture test for almost all amplifiers. The stress on both the power supply and the actual amplifier is far greater than with music or speech. Typically any amplifier driven to 1/8th of its absolute clipped power (1% THD) with sine waves, expends the same energy as music driving the amplifier to occasional clipping. Easy to verify, We use pink noise (Google it and see what it really is) to simulate music and this proves, at least to us that pink noise driving the amplifier to clip occasionally is the same as that 1/8th power deal. What this is all about is that the peak to average ratio of music is between 10 to 15 percent. In other words your 1,000w brand spanking new mega Dollar amplifier is only a very good 100 to 150w amplifier which is capable of musical peaks of 1000 watts ASSUMING that just occasional peaks of the musical waveform are clipped! You have all been duped over the years by the power issue. Now I must add this: When playing certain types of music there are times where the musical signal is remarkably similar to those brute force sine waves us engineers like to use for testing. Pipe organ music, of which I am a fan is one of these. A sustained organ note drives the amplifier much harder than typical music almost like a sine wave.

Class B amplifiers can be made more efficient by using some smart power supply technology. The “enemy” of the class B amplifier is the value of the power supply voltage required to deliver the specified output for that particular power.

The technologies available are beyond the scope of this manual but more about this issue Is available on our website at www.zedaudiocorp on the Techtalk link.

Back to our class D (not digital) amplifiers. These, as our analog cousins, are again power supplies BUT with a difference. They are Pulse Width Modulated (PWM) power supplies whose reference voltage is the incoming analog signal, ie a variable signal being music or sine waves which changed the width of the pulses. Sounds nice of course but due to the fact that the PWM operates at a very high frequency of typically greater than 250KHz in full range class D amplifiers, we use a reconstructive filter to remove the carrier frequency.

**Now for another “bombshell”. Class D amplifiers are NOT 90+% efficient as advertised by pretty much all companies who tout their wares. A well designed class D amplifier will be 90+% efficient based on two conditions. First that the amplifier is driven into some optimum impedance (typically greater than 2 ohms) and secondly that the amplifier be driven with a sine wave at just below clipping (typically 1% THD). Mmmmmm well this now opens a new can of worms, does it not?**

I would like to find the people who listen to sine waves. I am still looking! We all listen to music. Well music is transient in nature and the average signal level varies over quite a wide dynamic range. Thus our cuddly class D amplifier is NOT being driven at its optimum

Output level all the time, in fact very rarely. So referring back to the fact that the average level is about 10-15% of the maximum or peak power of the amplifier, the efficiency is substantially lower than the 90+%. Typically with a class D amplifier this figure is around 75% or less which is an order of magnitude better than class B amplifiers. This ability of a class D amplifier makes it a far more viable choice than class B amplifiers for producing efficient or green (might I say?) amplifiers.

The impedance of the speaker also determines the point at which the efficiency is optimized. Well as was said on a famous TV show “FOREGETABOUTIT”, this is a pipe dream. Speaker’s impedance curves are all over the map and too many car audio buffs love to drive their megawatt class D amplifiers into low impedances, like 1 and 2 ohms.

Well now that I mention “1 ohm”, I cannot resist getting into this subject. Scenario: Kid (or middle aged person) buys gizzilion watt amplifier with manufacturer’s specifications of x watts into 4 ohm, y watts into 2 ohm and z watts into 1 ohm. Well let’s take a wild guess and I bet you all that the vast majority will drive the amplifier into 1 ohm. Why? Easy, he feels that he is getting his “moneys worth” by doing this. OK let’s see what reality is. Said amplifier is maybe rated at say 600w into 4 ohm, 1000w into 2 ohm and 1500w into 1 ohm. We will assume that the speaker impedance is resistive. The difference between the 4 and 2 ohm power is 2.2dB, the difference between the 2 and 1 ohm power is 1.76dB and the difference between 4 and 1 ohm power is 3.9dB. So what do these numbers tell us. First if the speaker is 4 ohms vs 2 ohms, no way you can hear any difference. Same issue comparing 2 as to 1 ohm. I grant you that between 4 and 1 ohm there is almost 4dB difference BUT at what price and this difference is just percebtible! Two issues. Low impedance loads affect the amplifier’s sound quality adversely and this is quite easy to prove. Load an amplifier with a 4 ohm woofer and listen. Add parallel resistors to the speaker to make the amplifier “think” that it is driving a low impedance speaker and listen to the difference in sound quality. You will be surprised. This test is not 100% valid in fact as the resistive loads added, let the amplifier off the hook as the reactive components of the load are confined to the 4 ohm part. The idea of this test is to keep the loudness about constant but load down the amplifier.
The average person can just perceive a 3dB (doubling of power) difference and to actually double the sound pressure on your eardrum, you require TEN TIMES the amplifier power. Yes TEN TIMES!

The other consequence of driving amplifiers into these ridiculously low impedances is that the amplifier is stressed substantially more as compared to when driven into more sane impedances. Efficiency drops as the losses in the output stages increase dramatically even with “super efficient” class D amplifiers.
We at Zed are absolutely against these loads of less than 2 ohm. It serves ONLY to boost the ego of the owner of the car so he can quote numbers to his buddies.

# MYTHS, MAGIC AND FACTS

Our design philosophies have been influenced by both the professional and home audio markets. Traditionally the professional market has been driven by reliability with sound quality as second. The home market was the reverse. Today however both reliability and sound quality carry equal weight in both sectors. Cosmetics for obvious reasons are important in any sector. My experience in designing and building professional amplifiers has helped me in taking a similar approach in the design of mobile audio amplifiers. No matter how pretty or good sounding an amplifier may be, if it fails then it is a bad amplifier. The lesson learned many years ago was “silicon”, and use lots of it. All things being equal, if an amplifier drive circuit is stable, then adding an output stage (itself stable as well) with enough power devices will make the amplifier reliable. This assumes of course that mechanical issues are taken care of. Zed has always been a proponent of using a generous amount of power transistors in the output stages of our amplifiers. In addition we design at temperatures of 80 degrees Celsius. All semiconductors must be derated at these elevated temperatures and we use enough power devices for safe operation into the lowest load impedance the particular amplifier has been designed to drive.

## CABLES AND OTHERS.

Our personal opinion about “fancy” cables and exotic passive components may shock some of you. I have never been able to hear the difference between a cheap or an expensive RCA patch cord. My listening has been done using double blind A-B comparisons. Electrons are not very clever things and they have no knowledge of the type of material through which they are flowing at the speed of light (312,000 Km/second). The ONLY reason we recommend high quality double shielded RCA patch cords in mobile installations is to reject noise. My opinion about speaker cables is the same. As long as the wire is thick enough, it’s construction makes no difference. As long as the amplifier is stable into reactive loads with phase angles of up to 60 degrees, the amplifier is none the wiser what type of speaker cable is used.

The use of teflon, polypropylene, tantalum or other capacitors does not make a good sounding amplifier. There are too many other variables in the audio chain that one capacitor can make a difference. The use of metal film resistors is only of use in low noise circuits and where tolerance is of an issue. Never forget what the music signal had to go through to get onto your CD or vinyl. The signal began as a micro volt specimen at the microphone, sent through a high gain pre-amplifier, passed through equalization circuits, possible compressors, limiters or other processing gear and then mixed with all the other tracks. In analog days and today still, this signal was sent to a 24 track tape recorder again through a multitude of transformers, pre-amplifiers, equalizers and yikes the tape heads themselves. Then the signals were passed back through the tape deck’s playback circuits including the equalizer for playback, then back into the mixing console for mix-down to two track and then this was repeated again onto a two track tape recorder, then sent to the cutting head amplifier where the masters were then cut. A torturous journey one could say for this fragile audio signal.

# MYTHS, MAGIC AND FACTS

Oh I forgot some facts about cables I would like to mention.

This applies really to home stereo. The typical RCA patchcord cable length from CD player/Tuner to the pre amplifier is maybe 1.5 metres (4.8'). Even if the capacitance between the inner conductor and shield is 350pF (Pico Farads) the CD player or tuner has absolutely ZERO knowledge of this amount of capacitance. The same argument applies to mobile systems where yes the RCA cables are maybe 5 metres (16') in length and typically we use a stronger construction type of cable in the vehicle, the inter-conductor capacitance is again meaningless.

I measured a 6.5' length of really cheap RCA-RCA cable and the capacitance was 500pF. Example: The output impedance of the Head unit is say 1K ohm (On the high side in my opinion) and together with the cable capacitance of 500pF forms a low pass filter with an Fo (-3dB) of 318.471KHz! With a more typical output impedance of say 50 ohms this Fo moves to 636.942KHz. So using a 5m (16') decent quality well shielded RCA-RCA cable from the Head to the amplifiers should not cause any high frequency roll off that you can hear - unless you are a bat of course.
Here are two interesting takes on this issue.
Http://www.mmxpress.com/technical/interconnect_myths.htm
Http://www.audioholics.com/education/cables/skin-effect-relevance-in-speaker-cables

I read an interesting article from a guy "down under". He makes some interesting claims concerning cables one of them being that skin effect is audible. It is well known that skin effect (the tendency of current to flow only on the outside surface of the cable) only occurs at frequencies above about 100KHz. Now we are not bats (no I do not have a bat as a pet) and no music gets to 100KHz so the cable companies push this %#@&* to sell to unsuspecting consumers.

Semiconductors have more tolerance in their specifications than any capacitor or resistor.
A well known fact is that different types of capacitors work better at certain jobs than others.
Example, disc ceramic capacitors are better in high frequency compensation circuits than film types. Film types work better in audio frequency selective circuits than ceramics. So we at Zed choose our components to suit the application.

Finally this "fetish" that has been thrown around about low ESR 105C capacitors. If you are looking for long lasting electrolytic capacitors then choose the hideously expensive 10,000 to 15,000 hour types. I have not seen a rational manufacturer using these in a consumer product. To obtain low ESR (Equivalent Series Resistance) you can use a single low ESR capacitor OR use a few "regular ESR" types in parallel, the result is the same. Space restrictions force us to use low ESR types in many places but I have no aversion to those regular old 85C electrolytic capacitors.

# MYTHS, MAGIC AND FACTS

Zed does not recommend the use of power distribution blocks for the purpose of distributing the +12volt voltage to several amplifiers. The reason is that the vehicle's battery is the lowest AC impedance point in the power grid of the vehicle. We want each amplifier to draw it's current from this low impedance point. Thus any modulation on any +12v power cable (which is inevitable) is then shunted to ground by the massive capacitance of the battery. This is the reason that "star" grounding is used in grounding circuits/equipment so that ground current is drawn from a common point and thus no ground loop can occur. Fortunately for us, the body of a vehicle made of steel is so large, and is thus a very low impedance path for ground currents, that it is not necessary to ground all equipment at one point. In fact we do not advocate it at all as this would then necessitate the head unit's ground running all the way to the battery location and the amplifier's ground(s) also running all the way to the battery.
If multiple amplifiers are being used we highly recommend the use of separate ground points at the amplifiers' location. This spreads out the amount of current being drawn through one bolt connection.
However we do recognize the impractical issues of running separate +12v wires to the battery and so of course accept that distribution blocks will be used.

Stiffening capacitors. These are of NO use with our amplifiers due to the fact that We utilize fully regulated power supplies. The power supplies will compensate for small volt drops which exist on the +12v power cable. The amount of current drawn by a particular amplifier would drain a fully charged 1 Farad capacitor almost instantly. Consider the theory:
Energy(Joules) = Power(Watts) x Time(Seconds). The energy in a 1 Farad capacitor = 0.5CV.V = 0.5x1x12x12= 72 Joules. Let us assume an amplifier such as **MINOTAUR.** Let us assume that we are playing it such that the amplifier(into a 4 ohm load) is just clipping on the loudest musical peaks. This means that we are delivering 500 watts on peaks. The amplifier's average efficiency is about 75%. The peak to average power ratio is about 10% so average power is 10% of 500 = 50 watts. The input power is therefore 66 watts. If the 1 Farad capacitor was charged to 12 volt and we remove the main source of power -- the battery, the amp would remain playing for 1.075 seconds! (Put the numbers in the formula (E=PxT above and solve for time T). Now compare this to the battery. The amplifier will play for some hours (depends on actual battery of course) as compared to 1.075 seconds! So what good is a 1 Farad capacitor?

Power cables - Owing to the high efficiency of our amplifiers, #8 wire is sufficient for a 5 metre run from the battery to the amplifier. If a distribution block is used with multiple amplifiers, then #4 wire from the battery to the block is required. From the distribution block to each amplifier again #8 is all that is required.

# MYTHS, MAGIC AND FACTS

Damping Factor - This amplifier specification has been blown out of all proportion. What it means is the ability of the amplifier to resist a change in it's output voltage. The formula is DF= Speaker Z / Amplifier output Z (where Z is impedance). So many manufacturers have claimed ridiculous, and often false damping factors. A damping factor of 1000 implies that the output impedance of the amplifier is 0.004 ohms (4 ohm load). The only way to attain this figure is to apply masses of negative feedback (or use positive feedback) and too much feedback makes amplifiers sound harsh and clinical. Also damping factor changes with frequency. The lower the frequency the higher the DF number. Typically the DF can be ten times larger at higher frequencies.

Let us take this amplifier whose output impedance is 0.004 ohms (Zout). The speaker circuit is a series circuit and the following impedances(resistances) are in series with this 0.004 ohms. Let us assume that this DF measurement was made at the amplifier's speaker terminal. The first extra contact resistance is the speaker wire to the speaker terminal (WT ohms). Then there is that of the wire itself for two conductors (W). Next is the contact resistance of the wire to the speaker terminal (WS). Next there is the contact resistance of the wire from the speaker terminal to the voice coil (WV) and lastly there is the DC resistance of the voice coil itself (DCR). So what we have is a series circuit with the following resistances in series and adding up. WT+W+WS+WV+DCR+Zout. WT,W,WS,WV and Zout are very small indeed. Certainly less than 0.1 ohms. Whoa, look what has happened the EFFECTIVE DAMPING FACTOR has been reduced from 1000 to 40 by just taking into account those pesky unavoidable contact resistances. Now for the cruncher, remember that the DCR is also in series and is typically 3.2 ohms for a nominal 4 ohm speaker. So we must add 0.1+3.2 = 3.3 ohms and now EFFECTIVE DAMPING FACTOR is now a magnificent 1.212! (4 divided by 3.3)This is the real world. We see that the DCR of the speaker swamps all other resistances in the speaker circuit and the 0.004 ohms amplifier output impedance is almost meaningless. It has been found that a DF of about 20 is quite sufficient to dampen the voltage spikes from the speaker. An eye opener this one is it not? Good tube amps sound marvelous - low damping factors!!

Output Power of Amplifiers - This spec has been so badly abused it is not even funny. Peak power, Maximum power, Transient power, RMS power these are titles that have been given to the power spec of amplifiers. The above all mean nothing. Peak power needs to be associated with a time period, Maximum power is just nonsense, Transient power is even more nonsense and RMS power is just not a specification. The ONLY meaningful way to specify an amplifier's output power in watts is CONTINUOUS POWER. The formula for power is: (RMS volts x RMS amps) or (RMS volts x RMS volts/Impedance) or (RMS amps x RMS amps x Impedance). In each of these formulae there is an RMS number multiplied by another RMS number (or by itself) and RMS x RMS cannot = RMS. So THERE IS SIMPLY NO SUCH THING AS RMS POWER. RMS means root mean square and it is the same as saying $\sqrt{4} \times \sqrt{4} = \sqrt{4}$ Which we know is not true. The answer is just 4 with no root sign attached.

# MYTHS, MAGIC AND FACTS

Bridging two channels of an amplifier is not a magical thing. Most are mystified by the power figures quoted under the “bridge” column. It is actually very simple. When two channels are driving a common load, one channel is out of phase with the other by 180 degrees. So when one channel swings positive the other swings negative. There is a catch however. Each channel “sees” fifty percent of the common load and that means that each channel of the bridged pair must be capable of delivering current to this lower load impedance. Thus a 4 ohm bridged load presents a 2 ohm load to each of the bridged channels. The power into a 4 ohm load in bridged mode is twice the rated 2 ohm power per channel, the reason is that the power supply voltage is effectively doubled when two channels are bridged.

Harmonic Distortion - This specification has for years been a benchmark with which to compare one amplifier to another. This is all fine on the test bench where pure resistive loads are used and sinewaves are amplified. Unfortunately it tells us very little about the audible performance of an amplifier. Today it is relatively easy to build an amplifier with THD figures in the “triple oh” region, but what do they sound like. Normally not very good. To obtain these low THD numbers all we do is design an amplifier with high open loop gain. That is before negative feedback is applied. Once we apply a lot of global feedback, we improve all measured parameters such as THD, Noise, Frequency response and Damping factor. Our class B amplifiers are designed a little differently. We use very little global feedback but rather optimize each stage with local feedback. This allows us to design an amplifier with lower open loop gain and thus we only have to apply about 8dB of global feedback. Ultra low THD was not our goal but rather an amplifier which sounds the way we want it to. Other factors affect THD such as PCB layout, grounding and power distribution to the amplifier channels. Our class B amplifiers do however achieve very low distortion due to the fact that we follow the “rules” and their circuit design is conducive to low distortion. Class D amplifiers operate somewhat differently to Class B types.

Headroom

This term does not refer to how much room there is above your head! Rather it is a specification that signifies how good or bad the power supply is. Zed Audio has NEVER quoted a headroom specification. Why you may ask? Simple our amplifiers have no headroom, zero dB, zip dB, nada dB however you say it. A regulated power supply does not allow the amplifier to have any headroom. A quote from a well respected designer who said that amplifiers with many dB of headroom simply have poorly designed power supplies, either through ignorance or to save costs. When one sees a specification of an amplifier quoting a headroom figure of 3dB this means that the droop of the power supply is such that when unloaded it is capable of twice the power as compared to it’s loaded condition.

# MYTHS, MAGIC AND FACTS

Headroom - continued.

So a 100w/ch amplifier running into 4 ohms must develop 20 volts across the speaker terminal. This requires a net (under load) rail voltage of about +/- 33 volts. Now for it to have 3dB of headroom it must be capable of delivering 28.28 volts across the speaker terminal. This requires a rail voltage of +/- 43 volts. So the above power supply will droop a total of +/- 10 volts (a 23% droop!). This puts additional stress on the output devices (Mosfets or Bipolars) because they still have to deal with this higher rail voltage . To us this kind of power supply sounds like the amplifier is “breathing” and not the kind of amplifier we want to listen to. Regulated power supplies are more expensive to manufacture, are less efficient but we feel those are tradeoffs we can live with!

If one examines the specifications of an amplifier, it is relatively easy to tell apart those With well regulated power supplies and those with sloppy unregulated power supplies. The ratio of 4 ohm as to 2 ohm power will readily inform us of the quality of that power supply. Typically if the amplifier can double or almost double it’s continuous power rating from 4 ohm to 2 ohm at ALL battery voltages this is indicative of a well regulated power supply. There are a few manufacturers who manipulate the rail voltages at lower speaker impedances so that the 4,2 and 1 ohm power specs are the same. We believe that this is a cop out to save putting in a beefy power supply which is capable of the higher currents needed for these low impedance loads.

Fusing of amplifiers. Of all the amplifiers which we see at Zed, less than “5%” have correctly rated fuses installed. These are non Zed manufactured amplifiers. The result of this over fusing practice is that the power devices and printed circuit card burn up and save the fuse (Ever heard of Murphy’s Law)?

During the past year we have done quite a bit of testing with regards to how large a fuse is required. The rating of the fuse is dependent on two things, the impedance of the speakers and how long and how loud the music is to be played. The average power is about 10-15% of the maximum peaks. So add up all the channels and multiply by the power per channel. Divide this by 0.3 for an average efficiency of 30%. Let’s divide this by say 5 (20% average to peak ratio for some fudge factor) and this number divide by 12.

Example: A 100 watt x 4 at 4 ohms amplifier. We will assume that we will be playing it so musical peaks reach 100w/ch. Okay so 100 x 4 = 400. Divide by 0.3 = 1333 Divide by 5 = 266 and divide this by 12 = 22 amps. Use a 25 or 30 amp fuse.

Putting a 100 or 150 amp fuse * on an amplifier is useless. That guy Murphy says the amplifier will burn up to protect the fuse..... And it will.

* Of course very powerful amplifiers >2Kw require large fuses.

Subsonic filters and CLIPPING. The former are simply steep slope high pass filters with a frequency range between 10 to 50Hz. Their only function is to filter out those frequencies which lie below audibility. The woofer's cone will not "flop" around as it does without the use of the filter and because all the low frequency energy that we cannot hear is filtered out, the amplifier runs more efficiently since it does not have to amplify all those inaudible low frequencies. Remember one fact, ALL amplifiers are pretty dumb. They will amplify anything you put into them (assuming the amplifier's frequency response is wide enough) and whether we can hear a particular frequency range is not the amplifier's concern. Put in an inaudible frequency and the amplifier dutifully does it's thing. It does not care about the load. This is why tweeters are easily burnt when amplifiers are clipping. The amplifier generates high frequency harmonics and this energy is thrown to the unsuspecting tweeter. When an amplifier is driven into clipping it basically generates a square wave. This contains a large amount of energy but also due to the fact that the square wave sits at a positive (or negative) state for a "long" period of time, the natural cooling effect of a continuously moving cone/voice coil is inhibited and can lead to failure of a speaker. Typically woofers are more tolerant of clipped power than mids and tweeters due to the fact that they are more robust and that they do not respond to those high frequency harmonics very well (but do not be fooled, woofers can be hurt by these harmonics even if we cannot hear them). The inductive reactance is (2 x 3.14 x freq x inductance) and so the higher the frequency the higher the inductive reactance of the speaker becomes. However it's DCR does not change with frequency.

A quick point about the term DCR (resistance at DC). I believe that this term was coined because we all use a meter which operates with batteries and we measure the simple resistance of a resistor or piece of wire with this meter. We take this measurement at a frequency which is low enough so that if we increased the measurement time the result would be the same. So using an ohm meter which works at say 50Hz would yield the same result as long as the measured part has no AC reactive component.

# THE FOLLOWING PAGES SHOW SOME INTERESTING FACTS ABOUT SOUND, HEARING ISSUES, POWER AND MOST OF ALL DISPEL MANY OF THE ILL GAINED FACTS IN THE CAR AUDIO INDUSTRY.

| DECIBELS (dB) | POWER RATIO | VOLTAGE RATIO |
|---|---|---|
| 0.5 | 1.12 | 1.06 |
| 0.7 | 1.17 | 1.08 |
| 1.0 | 1.26 | 1.12 |
| 2.0 | 1.58 | 1.26 |
| 3.0 | 2.0 | 1.414 |
| 4.0 | 2.5 | 1.58 |
| 5.0 | 3.16 | 1.78 |
| 6.0 | 4.0 | 2.0 |
| 10.0 | 10.0 | 3.16 |
| 20.0 | 100 | 10.0 |

## Perceptions of Increase in Decibel level

| | |
|---|---|
| 1dB | Imperceptible change |
| 2dB | Imperceptible change |
| 3dB | Barely Perceptible change |
| 5dB | Quite Noticeable change |
| 10dB | Twice as loud |
| 20dB | Approximately four times as loud |

So as we can see a 1dB change in power results in a power increase of 26%which is absolutely inaudible. The 100w amplifier as compared to 125w - NO difference, or a 500w as compared to 625w, again NO difference.

2dB power increase a similar result  where the power increase is 58%! The 100w as compared to the 158w amplifier again nothing.

At a 3dB power increase (doubling the power) we have a barely perceptible change. So upgrading that 100w to a 200w amplifier is just barely audible in terms of loudness.

Now a 10dB power increase (10 times the power) results in a doubling of sound pressure on your ear drum.

PLEASE LISTEN TO YOUR MUSIC RESPONSIBLY - ONLY 1 SET OF EARS IS  GIVEN TO US.

| Table of sound levels $L$ (loudness) and corresponding sound pressure and sound intensity | | | |
|---|---|---|---|
| **Sound Sources Examples with distance** | **Sound Pressure Level $L_p$ dBSPL** | **Sound Pressure $p$ $N/m^2$ = Pa** | **Sound Intensity $I$ $W/m^2$** |
| Jet aircraft, 50 m away | 140 | 200 | 100 |
| Threshold of pain | 130 | 63.2 | 10 |
| Threshold of discomfort | 120 | 20 | 1 |
| Chainsaw, 1 m distance | 110 | 6.3 | 0.1 |
| Disco, 1 m from speaker | 100 | 2 | 0.01 |
| Diesel truck, 10 m away | 90 | 0.63 | 0.001 |
| Kerbside of busy road, 5 m | 80 | 0.2 | 0.0001 |
| Vacuum cleaner, distance 1 m | 70 | 0.063 | 0.00001 |
| Conversational speech, 1 m | 60 | 0.02 | 0.000001 |
| Average home | 50 | 0.0063 | 0.0000001 |
| Quiet library | 40 | 0.002 | 0.00000001 |
| Quiet bedroom at night | 30 | 0.00063 | 0.000000001 |
| Background in TV studio | 20 | 0.0002 | 0.0000000001 |
| Rustling leaves in the distance | 10 | 0.000063 | 0.00000000001 |
| Threshold of hearing | 0 | 0.00002 | 0.000000000001 |

# SETTING THE CONTROLS ON AMPLIFIERS

Level control - This control is the most misunderstood control on any amplifier. It's sole purpose in life is to level match the head unit's output voltage to the gain structure of the amplifier so that the user can use the head unit's volume control in the "best physiological position". To best understand this let us look at a simple example. Assume that the head unit is rated at 1 volt output. Now what this means is rather ambiguous. Does the head deliver 1volt with the volume control at maximum, at 75% or where? Unfortunately no head manufacturers supply this information. Also it depends on the modulation level of the program material. Be it a CD/Mini Disc or FM we have no control of this specification. Most consumers never want the volume control to be turned past 3 o'clock (We use a traditional rotary control for reference since all digital controls do not have the same amount of digits or "little blocks" on their LCD displays to show relative volume level). On head units which we have tested the results are all over the page so we shall assume the 3 o'clock position as the maximum we want the control to be turned to. So far you can see that the need for level matching is critical indeed as there are no standards from head manufacturers. So we now have this 1 volt level. What this means is that the output voltage from the head will approach 1 volt on musical peaks. Let assume we have an amplifier of 100 watts. This implies that we can deliver 20 volts across a 4 ohm load. Let us assume that the amplifier needs 1 volt in for the 20 volt out - a gain structure of 20x. So in this case with the head delivering 1 volt on peaks, the amplifier will deliver 100 watts into 4 ohms on the same musical peaks. Well this sounds all well and good but we have a small problem and it is that all heads are not rated at 1 volt, and all amplifiers have variable level controls. This actually means we can change the gain structure of the amplifiers from "x" to "y". With no standard levels we have to set the level control on the amplifier to "match" to that of the head. We have tested no head units whose output level corresponds with that of the printed specifications. Typically the output level is substantially lower than the specification. Here is our recommendation. With your favorite music playing set the amplifier's level control to minimum (CCW) and set the head unit's volume control to 3 o'clock. Assuming all crossover controls have been set, advance the level control on the amplifier until the music is as loud as desired. This is the only way to do this without the use of an oscilloscope. In multi way systems begin with the low frequency amplifier, set its level to a point where the bass is as loud as you want it, turn back the Hu's volume to a sane level, then repeat the level adjusting process on the midrange and tweeter amplifiers. You will have to tweak these level controls again several times to attain a good balance between the various amplifiers.

Crossover and equalizer controls - The crossover controls must be set to suit the speakers being used.
The equalizer controls can be set by ear or with instruments. This is a personal preference. Most users only have ears (duh) and not instruments so ears must suffice!

Quality control (QC) is a process which begins from the first designs entered into a computer and then never ends.

Zed is continually striving to improve the products which we design and manufacture.

All our semiconductors are purchased from either the manufacturer direct or through reputable distributors. Electrolytic capacitors which have the highest long term failure rate of any component are chosen for their durability and sonic qualities.

Each and every product manufactured at Zed is tested using Audio Precision test equipment. Software is written for each type of amplifier and then on final test the amplifier must pass these rigorous tests.
If not it is rejected and returned to the production line
for repair. Samples are pulled from the line for further testing.

Mechanical inspection is done throughout the manufacturing process. Before each amplifier is packed it is fully inspected again for any cosmetic flaws. Any damaged or any part which is out of specification is replaced.

Zed takes pride in what we design and manufacture and we trust that this shows in the final product.

Stephen Mantz

# INSTALLATION INSTRUCTIONS

Location:
Choose a suitable location in the vehicle which will allow sufficient airflow over the amplifier. The preferred mounting direction is with the heatsink fins in a vertical direction. However we do recognize that this is not always possible.

Mounting the amplifier(s)

These amplifiers can be mounted in one of two ways. The first is by using the supplied mounting feet. Each foot is bolted to the underside of the chassis using the supplied metric M4 bolts. Please use a phillips screwdriver which fits the head of the bolts correctly. Make sure that the bolts are tight but DO NOT over tighten them as you may strip the threads in the bottom of the heat sink.

Depending on the surface to which the amplifier is mounted use either wood screws or a machine screw with nut of either M5 or 10/32" size.

The second method is to forego the use of the four mounting feet and use metric M4 bolts to bolt directly into the threaded holes on the underside of the heat sink. This method requires that you determine the thickness of the mounting board and add 6mm (0.23") to it. Then select the correct length M4 bolt. If the bolt is too long you will feel it bottom out in the threaded holes. Please be careful so as not to damage the threads in the bottom of the heat sink. We supply four longer M4 bolts with each amplifier.

Fusing of amplifiers. Almost every amplifier I have worked on is OVER FUSED - period! Over fusing is just a silly thing to do in the first place as it affords ZERO protection and only results in printed circuit cards being burnt together with a bunch of expensive silicon. The formula is quite simple. For class A/B amplifiers add up the total wattage of all channels into the impedance into which they are driven. Divide this number by 18 and use the closest value fuse. Example a 100w x 4 at 4 ohm amplifier is 400w total. Divide by 18 = 22.22 so use a 25A fuse. A 1500w amplifier requires a 90A fuse. I prefer to make up a final fuse value by using several lower amperage fuses in parallel. This results in better thermal efficiency as the current flow is spread over several pieces of metal.

We advocate strongly to under fuse and if you find under hard drive that the fuses occasionally open up then it is way less drag on your wallet to replace some fuses with a slightly higher value.

A repeat here for those who did not read the "low impedance" point I made. The higher the impedance of the speaker (>4 ohm) the better the sound quality. These amplifiers are NOT SPL tools, they are for listening to good music at reasonable levels - protect your ears!

Use 8 or 4 ohm speakers and you will be surprised at the results.

# CONNECTING THE AMPLIFIER

Once the amplifier has been correctly mounted the electrical connections can now be made. The first step is to connect the loudspeakers. Using the appropriate size of wire (we recommend a min of #14) connect the speakers as shown in later diagrams, depending on which amplifier(s) are being installed. The next step is to connect the line inputs using high quality RCA-RCA cables. The source to which the line inputs are connected depends on the amplifier type and the particular installation. Again refer to later diagrams.

The next step is to connect the power inputs. The first is the ground wire. This wire is connected to the (-) connection on the 3 terminal power connector. Using #8 wire or larger(#4 max) insert one end into the connector's GROUND terminal after stripping off about 19mm (0.75") of insulation. Trim the wire to a maximum length of 1 metre (39") this ground wire (normally BLACK in colour) is then crimped (and preferably soldered) into an appropriate size ring lug. This lug is then bolted to the chassis of the car (normally in the trunk). The hole to which the lug shall be bolted must be rust and paint free. It is also a good idea to use a star washer between the lug and the chassis of the vehicle. We prefer the use of a machine bolt and nut rather than a self tapper. The torque that the machine bolt can exert is greater than that of a self tapper and due to the large currents flowing through this ground connection the contact resistance shall be lower with the machine screw.

Next is the remote turn on wire. This is normally connected to the remote output of the head unit. Using #14 wire, stripping one end to 19mm (0.75"), insert one end into the smaller centre hole of the power connector. Run this cable to the head unit's location and connect to the "remote out" terminal of the head. Please be sure to use a 0.25A fuse at the head. This fuse will blow if any portion of the remote wire is accidentally shorted to chassis ground.

Last is the +12volt connection. Using #8 (#4 max)or larger, strip the wire to 19mm (0.75") and insert in to the hole marked BATT (+) on the power connector. Run the cable (away from all audio cables) to the location of the vehicle's battery. At the battery location install the a fuse holder no further away from the battery (+) terminal than 300mm (12"). Insert this end of the +12volt power cable into the fuse holder. Making sure that the fuse is removed, connect the other end of the fuse holder to the battery's (+) terminal using appropriate high quality battery connectors. Insert the supplied fuse. DO NOT OVERFUSE as this can be a fire hazard.

The power connector on our amplifiers can accommodate wire with a copper diameter of up to 7mm (0.275").

# SPECIFICATIONS

| Specification | MINOTAUR |
|---|---|
| Continuous Output Power into 2 ohm ++ | 1000w x 1 |
| Continuous Output Power into 4 ohm ++ | 500w x 1 |
| Typical Output Power into 4 ohm per channel (1% THD) ++ | 650w x 1 |
| Continuous Output Power 2 AMPLIFIERS bridged into 4 ohm ++ | 2000w x 1 |
| Continuous Output Power 2 AMPLIFIERS bridged into 8 ohm ++ | 1000w x 1 |
| Minimum Speaker Impedance | 2 ohm |
| Minimum Speaker Impedance in Bridge Mode (2 amplifiers) | 4 ohm |
| Power Response at any power into 4 ohms | 10-60KHz -2dB |
| Frequency Response at rated power into 4 ohms | 10Hz-30KHz -0.1dB |
| Input Voltage range for rated power into 4 ohms | 0.25 to 8.6 volt |
| Input Impedance at 2KHz | 47K ohm |
| Noise below rated output (30KHz limited) | -103dB |
| Damping Factor at 20Hz with 4 ohms | >80 |
| Total Harmonic Distortion with 4 ohm 20Hz-20KHz From 1 watt to rated power. Typically less than 0.05% | <0.2% |
| Intermodulation Distortion | <0.2% |
| Phase response at 20KHz | Lagging 12 deg |
| Slew rate (volts per micro second)-In"Flat" mode | 12 |
| Low Pass Crossover (24dB/octave) | 45Hz to230Hz |
| High Pass Crossover (48dB/octave) | 10Hz to100Hz |
| Equalization (5 controls +/-12dB boost and cut) | 25Hz, 31Hz, 40Hz, 50Hz, 63Hz with constant Q |
| Phase Control | Variable from zero to -180 degrees |
| Line Outputs (Normal and Inverted phase) | Yes |
| Protection - Short Circuit, DC, Thermal | Yes |
| Power Source | 10-14.5v DC Negative Ground |
| Current Consumption with Sine wave at 4 ohms | 52A |
| Average current Consumption with Music at 4 ohms | 11 to 15A |
| Idling Current | <1.5A |
| Fuse rating with 4 ohm load | 25A-35A depending on usage |
| Fuse rating with 2 ohm loadl **** | 40A -60A depending on usage |
| Size W x H (247mmx55mm/9.7"x2.1") x L | 275mm/10.82" Excludes connectors |
| Shipping Weight (Kg/Lbs) | 5.9/13 |

++ Driving amplifiers with continuous sine wave power is very stressful and is not indicative of an amplifier's real world performance. We actually prefer to use PINK NOISE as our test signal as it very closely replicates typical music which is what our amplifiers were intended for in the first place. Our amplifiers will double the 4 ohm power at 2 ohm when driven with pink noise

**** Under normal operating conditions the fuse rating for 4 ohm loads will suffice for 2 ohm loads. If the amplifier is driven for long periods of time into 2 ohm loads I the fuse rating may be increased as shown. DO NOT OVER FUSE ANY AMPLIFIER.

# SPECIFICATIONS

| Specification | DRACONIA |
|---|---|
| Continuous Output Power into 2 ohm ++ | 200w x 4 |
| Continuous Output Power into 4 ohm ++ | 100w x 4 |
| Typical Output Power into 4 ohm per channel (1% THD) ++ | 130w x 4 |
| Continuous Output Power 2 channels bridged into 4 ohm ++ | 400w x 2 |
| Continuous Output Power 2 channels bridged into 8 ohm ++ | 200w x 2 |
| Minimum Speaker Impedance | 2 ohm per channel |
| Minimum Speaker Impedance in Bridge Mode (2 channels) | 4 ohm |
| Power Response at any power into 4 ohms | 10-60KHz -2dB |
| Frequency Response at rated power into 4 ohms | 10Hz-30KHz -0.1dB |
| Input Voltage range for rated power into 4 ohms | 0.26 to 8.0 volt |
| Input Impedance at 2KHz | 47K ohm |
| Noise below rated output (30KHz limited) | -98dB |
| Channel separation at 2KHz | >80dB |
| Damping Factor at 20Hz with 4 ohms | >80 |
| Total Harmonic Distortion with 4 ohm 20Hz-20KHz From 1 watt to rated power. Typically less than 0.05% | <0.2% |
| Intermodulation Distortion | <0.2% |
| Phase response at 20KHz | Lagging 12 deg |
| Slew rate (volts per micro second)-In"Flat" mode | 12 |
| Low Pass Crossovers (24dB/octave) | 55Hz to 4KHz |
| High Pass Crossovers (24dB/octave) | 55Hz-4KHz |
| Sub Sonic Filter (24dB/octave) | 11Hz to 48Hz |
| Equalization (Zero to +12dB variable control with constant Q) | Boost @40Hz with constant Q |
| Line Outputs | No |
| Protection - Short Circuit, DC, Thermal | Yes |
| Power Source | 10-14.5v DC Negative Ground |
| Current Consumption with Sine wave at 4 ohms | 42A |
| Average current Consumption with Music at 4 ohms | 8 to 15A |
| Idling Current | <1.5A |
| Fuse rating with 4 ohm load | 25A-30A depending on usage |
| Fuse rating with 2 ohm load **** | 30A -50A depending on usage |
| Size W x H (247mmx55mm/9.7"x2.1") x L | 275mm/10.82" Excludes connectors |
| Shipping Weight (Kg/Lbs) | 5.9/13 |

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**** Under normal operating conditions the fuse rating for 4 ohm loads will suffice for 2 ohm loads. If the amplifier is driven for long periods of time into 2 ohm loads I the fuse rating may be increased as shown. DO NOT OVER FUSE ANY AMPLIFIER.

# SPECIFICATIONS

| Specification | DREADNOUGHT |
|---|---|
| Continuous Output Power into 2 ohm ++ | 400w x 4 |
| Continuous Output Power into 4 ohm ++ | 225w x 4 |
| Typical Output Power into 4 ohm per channel (1% THD) ++ | 280w x 4 |
| Continuous Output Power 2 channels bridged into 4 ohm ++ | 800w x 2 |
| Continuous Output Power 2 channels bridged into 8 ohm ++ | 450w x 2 |
| Minimum Speaker Impedance | 2 ohm per channel |
| Minimum Speaker Impedance in Bridge Mode (2 channels) | 4 ohm |
| Power Response at any power into 4 ohms | 10-60KHz -2dB |
| Frequency Response at rated power into 4 ohms | 10Hz-30KHz -0.1dB |
| Input Voltage range for rated power into 4 ohms | 0.26 to 8.0 volt |
| Input Impedance at 2KHz | 47K ohm |
| Noise below rated output (30KHz limited) | -102dB |
| Channel separation at 2KHz | >80dB |
| Damping Factor at 20Hz with 4 ohms | >80 |
| Total Harmonic Distortion with 4 ohm 20Hz-20KHz From 1 watt to rated power. Typically less than 0.05% | <0.2% |
| Intermodulation Distortion | <0.2% |
| Phase response at 20KHz | Lagging 12 deg |
| Slew rate (volts per micro second)-In"Flat" mode | 12 |
| Low Pass Crossovers (24dB/octave) | 55Hz to 4KHz |
| High Pass Crossovers (24dB/octave) | 55Hz-4KHz |
| Sub Sonic Filter (24dB/octave) | 11Hz to 48Hz |
| Equalization (Zero to +12dB variable control with constant Q) | Boost @40Hz with constant Q |
| Line Outputs | No |
| Protection - Short Circuit, DC, Thermal | Yes |
| Power Source | 10-14.5v DC Negative Ground |
| Current Consumption with Sinewave at 4 ohms | 94A |
| Current Consumption with Music at 4 ohms | 18 to 28A |
| Idling Current | <1.5A |
| Fuse rating with 4 ohm load | 30A-40A depending on usage |
| Fuse rating with 2 ohm load **** | 40A -80A depending on usage |
| Size W x H (247mmx55mm/9.7"x2.1") x L | 410mm/16.14" Excludes connectors |
| Shipping Weight (Kg/Lbs) | 7.72/17 |

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**** Under normal operating conditions the fuse rating for 4 ohm loads will suffice for 2 ohm loads. If the amplifier is driven for long periods of time into 2 ohm loads I the fuse rating may be increased as shown. DO NOT OVER FUSE ANY AMPLIFIER.

# SPECIFICATIONS

| Specification | LEVIATHAN |
|---|---|
| Continuous Output Power into 2 ohm ++ | 300w x 6 |
| Continuous Output Power into 4 ohm ++ | 150w x 6 |
| Typical Output Power into 4 ohm per channel (1% THD) ++ | 180w x 6 |
| Continuous Output Power 3 pairs of channels bridged into 4 ohm ++ | 600w x 3 Channel pairs may be bridged independently |
| Continuous Output Power 2 channels bridged into 8 ohm ++ | 300w x 3 Channel pairs may be bridged independently |
| Minimum Speaker Impedance | 2 ohm per channel |
| Minimum Speaker Impedance in Bridge Mode (2 channels) | 4 ohm |
| Power Response at any power into 4 ohms | 10-60KHz -2dB |
| Frequency Response at rated power into 4 ohms | 10Hz-30KHz -0.1dB |
| Input Voltage range for rated power into 4 ohms | 0.25 to 8.6 volt |
| Input Impedance at 2KHz | 47K ohm |
| Noise below rated output (30KHz limited) | -100dB |
| Channel separation at 2KHz | >80dB |
| Damping Factor at 20Hz with 4 ohms | >80 |
| Total Harmonic Distortion with 4 ohm 20Hz-20KHz From 1 watt to rated power. Typically less than 0.05% | <0.2% |
| Intermodulation Distortion | <0.2% |
| Phase response at 20KHz | Lagging 12 deg |
| Slew rate (volts per micro second)-In"Flat" mode | 12 |
| High Pass Crossovers (24dB/octave) Channels 1+2 and 3+4 | 55Hz-4KHz |
| Low Pass Crossovers (24dB/octave) Channels 3+4 | 55Hz to 4KHz |
| High Pass Crossovers (24dB/octave) Channels 5+6 | 10Hz-105Hz May be used as a Sub Sonic Filter |
| Low Pass Crossovers (24dB/octave) Channels 5+6 | 40Hz to 235Hz |
| Protection - Short Circuit, DC, Thermal | Yes |
| Power Source | 10-14.5v DC Negative Ground |
| Current Consumption with Sinewave at 4 ohms | 94A |
| Current Consumption with Music at 4 ohms | 18 to 28A |
| Idling Current | <1.5A |
| Fuse rating with 4 ohm load | 30A-40A depending on usage |
| Fuse rating with 2 ohm load **** | 40A -80A depending on usage |
| Size W x H (247mmx55mm/9.7"x2.1") x L | 410mm/16.14" Excludes connectors |
| Shipping Weight (Kg/Lbs) | 5.9/13 |

++ Driving amplifiers with continuous sine wave power is very stressful and is not indicative of an amplifier's real world performance. We actually prefer to use PINK NOISE as our test signal as it very closely replicates typical music which is what our amplifiers were intended for in the first place. Our amplifiers will double the 4 ohm power at 2 ohm when driven with pink noise

**** Under normal operating conditions the fuse rating for 4 ohm loads will suffice for 2 ohm loads. If the amplifier is driven for long periods of time into 2 ohm loads I the fuse rating may be increased as shown. DO NOT OVER FUSE ANY AMPLIFIER.

# SPECIFICATIONS

| Specification | RA |
|---|---|
| Frequency Response | 15Hz-240Hz  Bandwidth Limited |
| Input Voltage range | 0 to 2.25 volt (can be factory adjusted to any setting)t |
| Input Impedance from 15Hz to 240Hz | 10K ohm |
| Output impedance | Approximately 100 ohms |
| Output voltage | Can drive a 600 ohm load at 9v RMS |
| Noise below 5 volt  output (30KHz limited) | -100dB |
| Total Harmonic Distortion 15Hz to 240Hz | Less than 0.008% |
| Intermodulation Distortion | Less than 0.01% |
| Low Pass Crossover (24dB/octave) | 45Hz to 230Hz |
| Sub Harmonic Synthesizer | Two bands, 32Hz and 45Hz |
| Level controls Sub harmonic Synthesizer | 32Hz, 45Hz and Master |
| Compressor Attack Time | 15msec |
| Compressor Release Time | 1 second |
| Threshold | Variable |
| System gain with no compression | Maximum of 12.3dB |
| Volume control | Variable from off to maximum |
| Power Source | 10-14.5v DC Negative Ground |
| Current Consumption with Music at 4 ohms | Less than 0.5A |
| Fuse rating | Internal 3A |
| Size W x H x D Chassis mm | 112.54 x 20 x 73 |
| Size W x H x D Chassis inches | 4.43 x 0.79 x 2.87 |
| Size front panel W x H mm/inches | 124.54/4.9 x 23.5/0.925 |
| Shipping  Weight (Kg/Lbs) | 0.45/1.0 |

# MINOTAUR

**MINOTAUR** is the first of our new generation of mono block/single channel amplifiers. These are capable of full range operation for those who demand high power for midrange and lower midrange drivers in multi way systems. However its primary goal is for sub woofers. The on board crossovers have been optimized for low frequency operation. Using the four (4) RCA inputs facilitates constant sub woofer fading by using head units with front and rear line outputs. For those who choose to only use two inputs, a switch combines the signals of the RCA inputs 1+3 and 2+4. Thus using the 1 and 2 inputs simply allows 3+4 to be pass through for easy daisy chaining of amplifier inputs.

An industry first 48dB/octave Linkwitz-Riley High Pass crossover serves as both a sub sonic filter and the HIGH PASS section of a BANDPASS crossover when used in conjunction with the on board LOW PASS crossover.

Variable phase shift and a 24dB/octave Linkwitz-Riley Low Pass crossover complete the first part of the signal chain.

A MODE switch configures the amplifier for 3 modes of operation. First when in FLAT mode the High Pass, Phase and Low Pass functions are bypassed and the signal is then only affected by the EQUALIZER and LEVEL controls. This mode has been designed for use with outboard processors. Second when in the PRE mode the full functions **MINOTAUR** are in circuit. Third when in the SLAVE mode the complete pre amplifier is bypassed and the main amplifier is fed from the #1 RCA input (refer to application drawings).

The five (5) band equalizer has been designed for constant Q operation. What this means is that the bandwidth of the boosted (or cut) signal remains constant no matter the amount of boost or cut. Pretty much all equalizers in mobile electronics use simple forms of equalizers wherein the Q(bandwidth) varies depending on the amount of boost (or cut) being of low Q (wide bandwidth) at low to moderate amounts of boost/cut and only attaining the designed Q at close to full boost/cut. Please refer to the diagrams on the next page.

In order to bridge two **MINOTAURS** we shall of course use two amplifiers, one being the MASTER and the other the SLAVE. The master's pre amplifier is used and the SLAVE has its pre amplifier bypassed via the MODE switch. The line output marked INVERT is used to drive from the MASTER to the SLAVE.

A further mode of operation is available when the NON INVERT line output is used on the MASTER. This line out is simply fed to the SLAVE and the two amplifiers each simply drive their own speakers with no bridging invoked.

Four (4) MINOTAURS may be connected in a parallel-bridge configuration when the need for ultra high power is required.  Refer to the later diagrams.

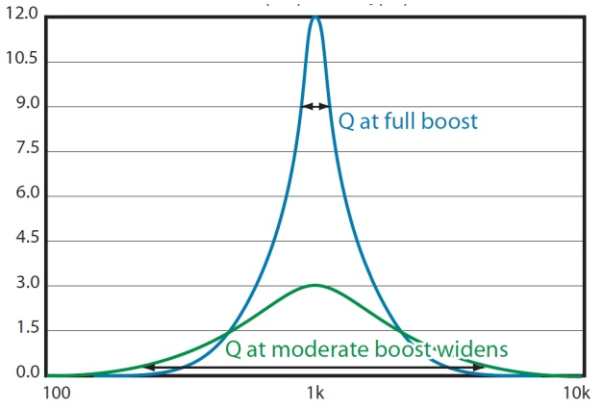



Figure 3. Conventional Graphic

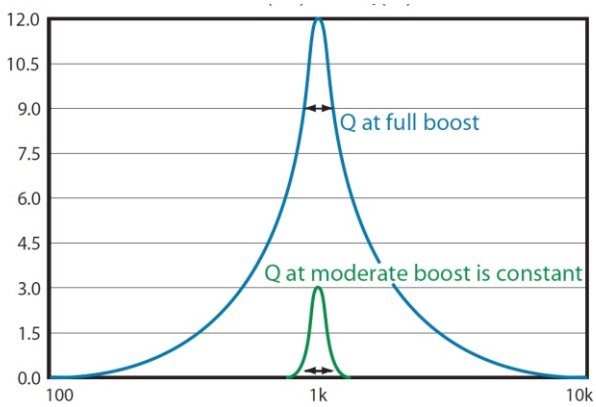



Figure 4. Constant-Q Graphic

Graphs showing the difference between conventional and constant Q equalizers

## LOW  IMPEDANCE LOADS - 1 Ohm and below - Our philosophy

WE ARE ABSOLUTELY 100% AGAINST THESE LOADS

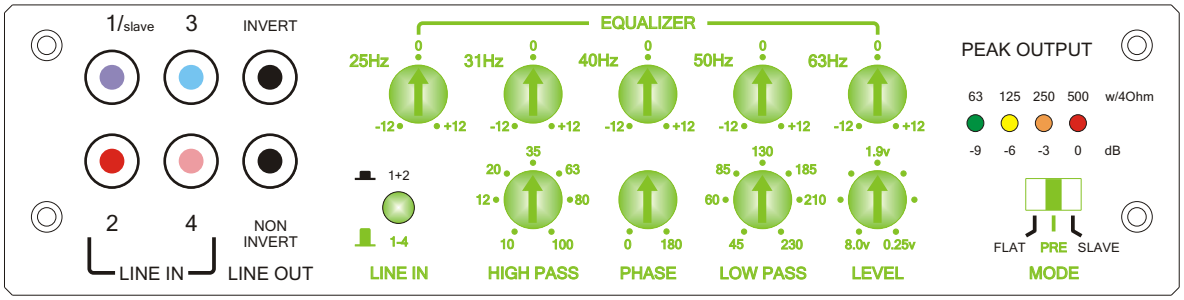
There is no reason to run a “daily driver” or SQ system into these loads. The aim is quality after all and not sound pressure.

We believe that the person who chooses to own one of our amplifiers has one interest only and that is sound quality.

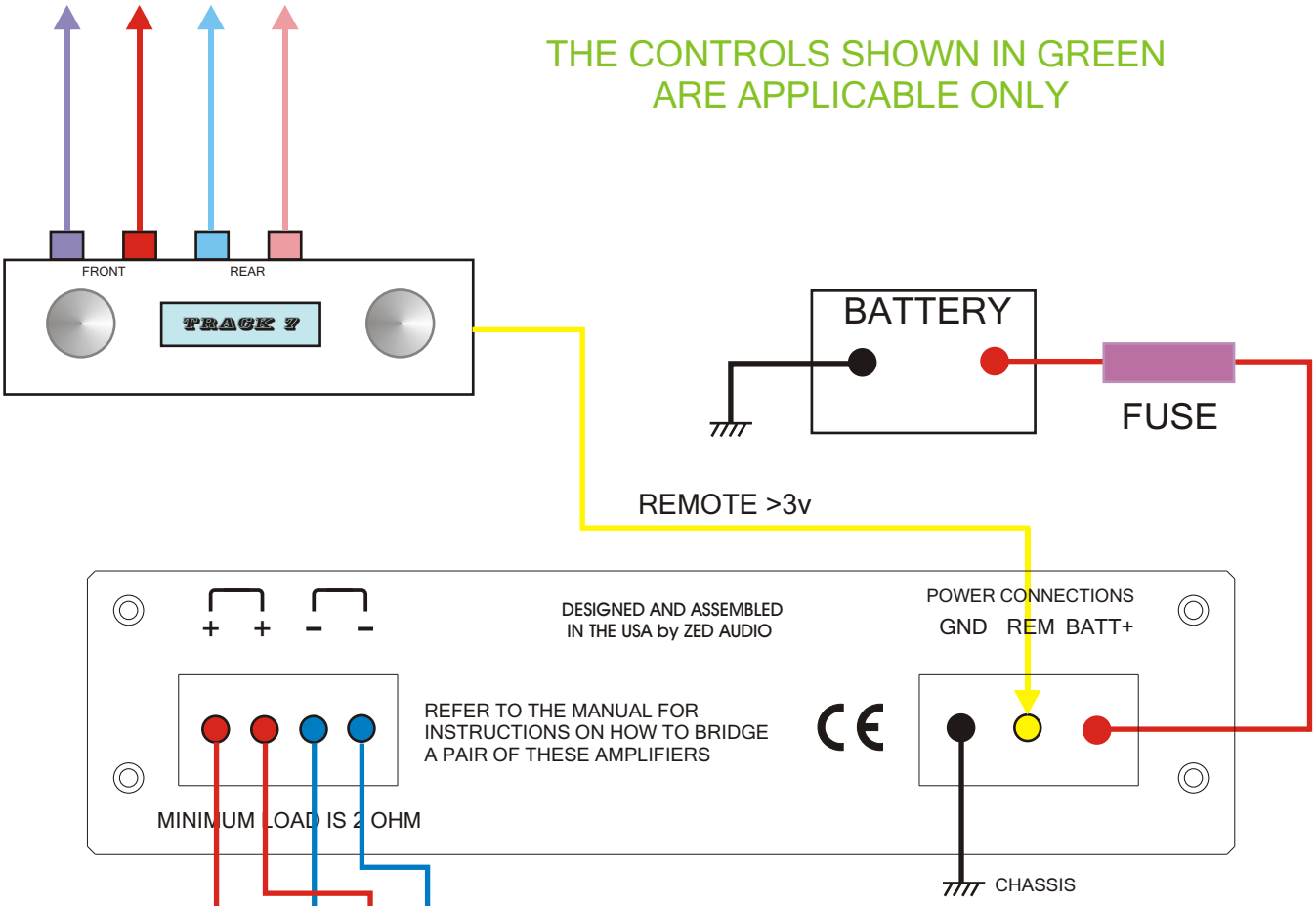
The amount of heat generated by an amplifier when driving 1 ohm or less is tremendous. The gain is simply an ego trip. The loss is reliability and sound quality. Yes MINOTAUR doubles its power from 4 to 2 ohm BUT this only represents a 3dB gain in power and in our opinion is not audible.

We recognize that many will drive 2 ohm loads and MINOTAUR has been designed for this. However we always urge our customers to choose their speaker impedance wisely especially when using DVC drivers.

**MINOTAUR** driving one or more speakers as a stand alone amplifier from a four output signal source.




THE CONTROLS SHOWN IN GREEN ARE APPLICABLE ONLY




A SECOND DRIVER MAY BE CONNECTED IN PARALLEL WITH THE FIRST DRIVER THE NET MINIMUM LOAD IS 2 OHMS SO USE TWO 4 OHM DRIVERS. (1,000w)

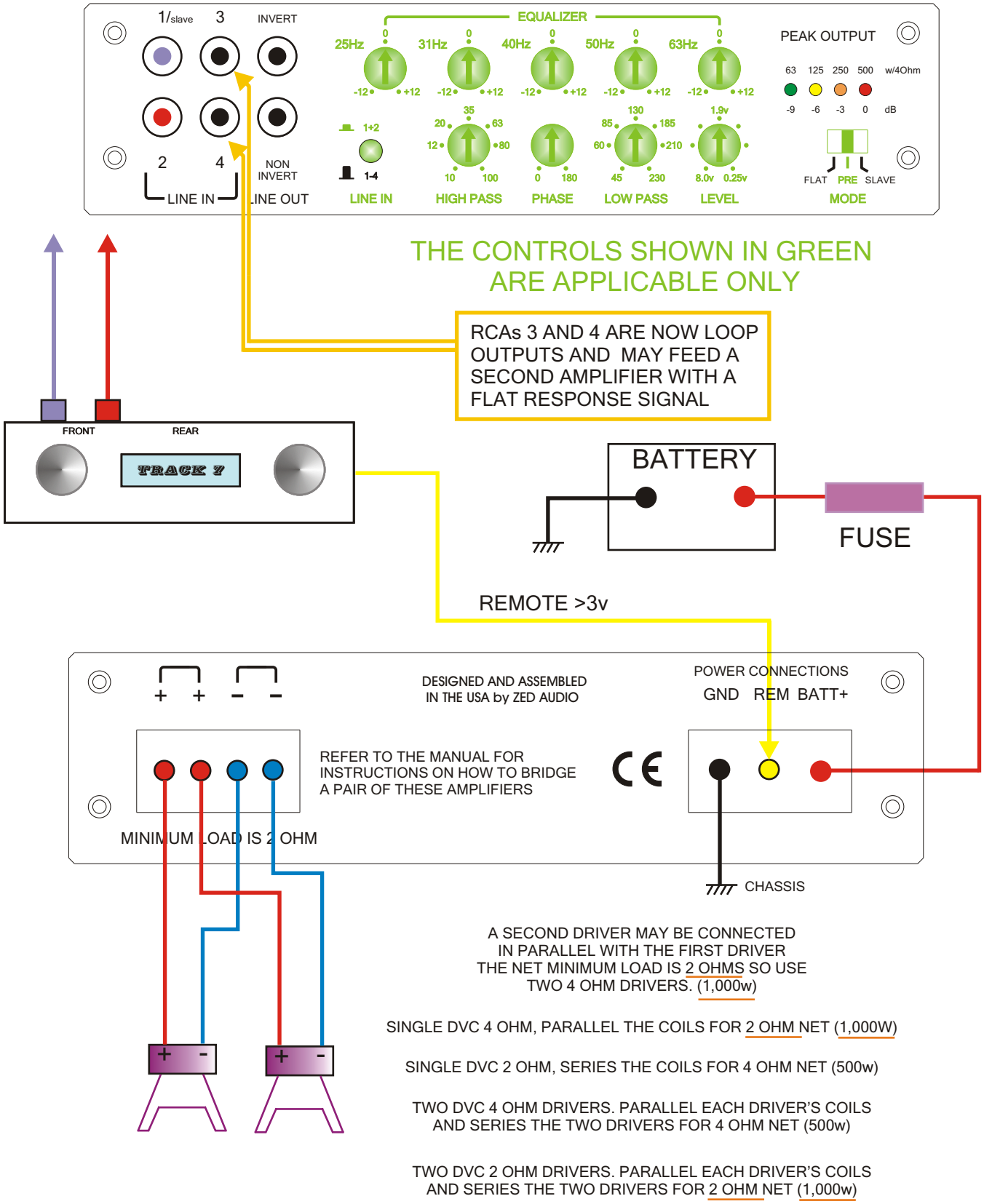
SINGLE DVC 4 OHM, PARALLEL THE COILS FOR 2 OHM NET (1,000W)

SINGLE DVC 2 OHM, SERIES THE COILS FOR 4 OHM NET (500w)

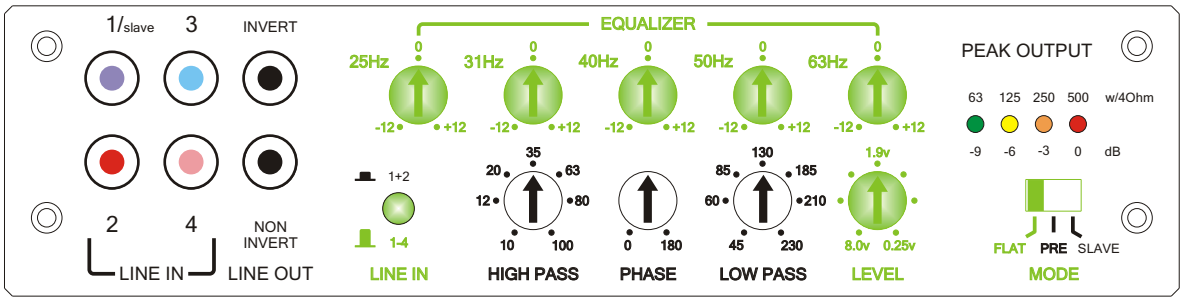
TWO DVC 4 OHM DRIVERS. PARALLEL EACH DRIVER'S COILS AND SERIES THE TWO DRIVERS FOR 4 OHM NET (500w)

TWO DVC 2 OHM DRIVERS. PARALLEL EACH DRIVER'S COILS AND SERIES THE TWO DRIVERS FOR 2 OHM NET (1,000w)

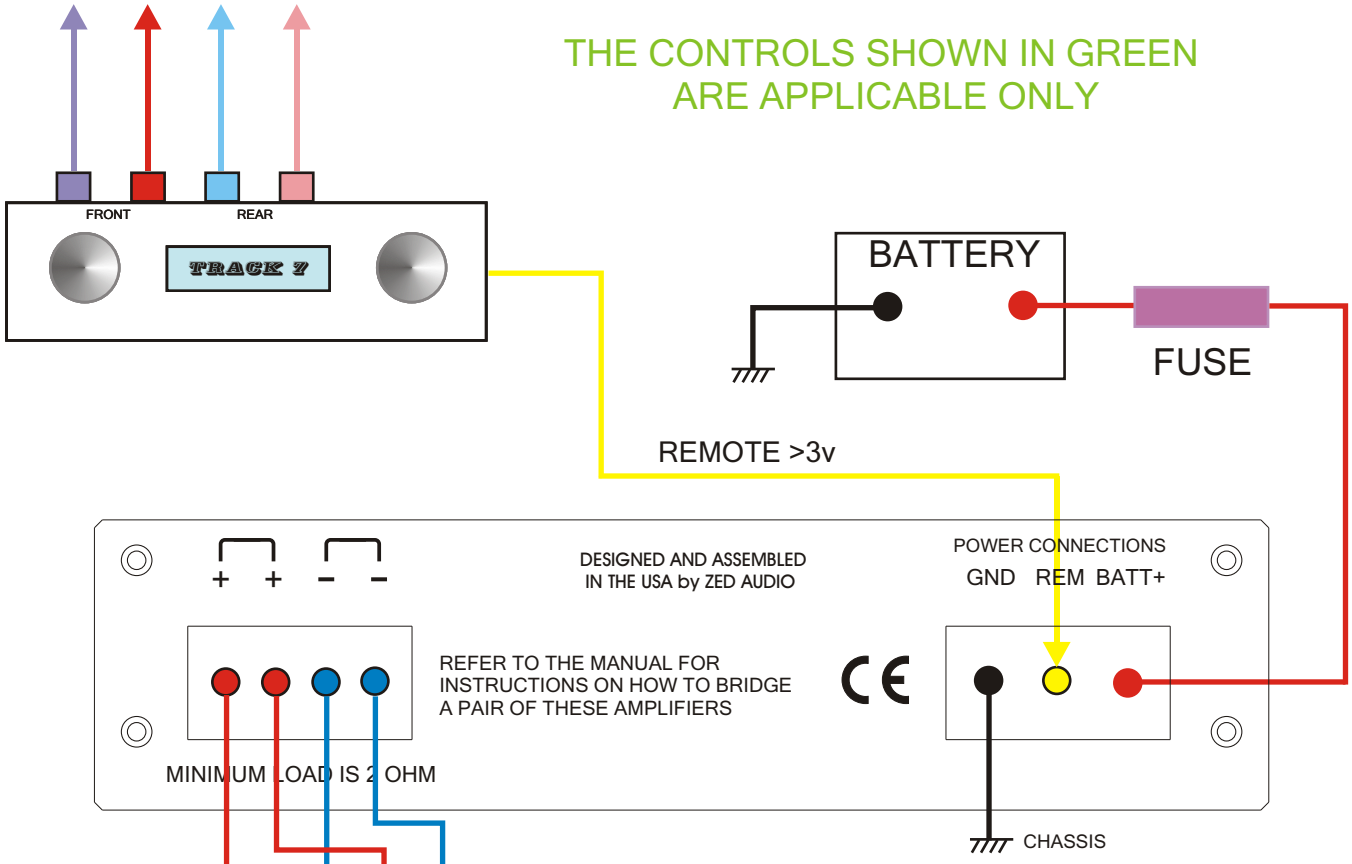
**MINOTAUR** driving one or more speakers as a stand alone amplifier from a two output signal source.



**MINOTAUR** driving one or more speakers as a stand alone amplifier from a four output signal source and set to FLAT mode. This drawing applies to any configuration where a single **MINOTAUR** is used.




THE CONTROLS SHOWN IN GREEN ARE APPLICABLE ONLY




A SECOND DRIVER MAY BE CONNECTED IN PARALLEL WITH THE FIRST DRIVER THE NET MINIMUM LOAD IS 2 OHMS SO USE TWO 4 OHM DRIVERS. (1,000w)

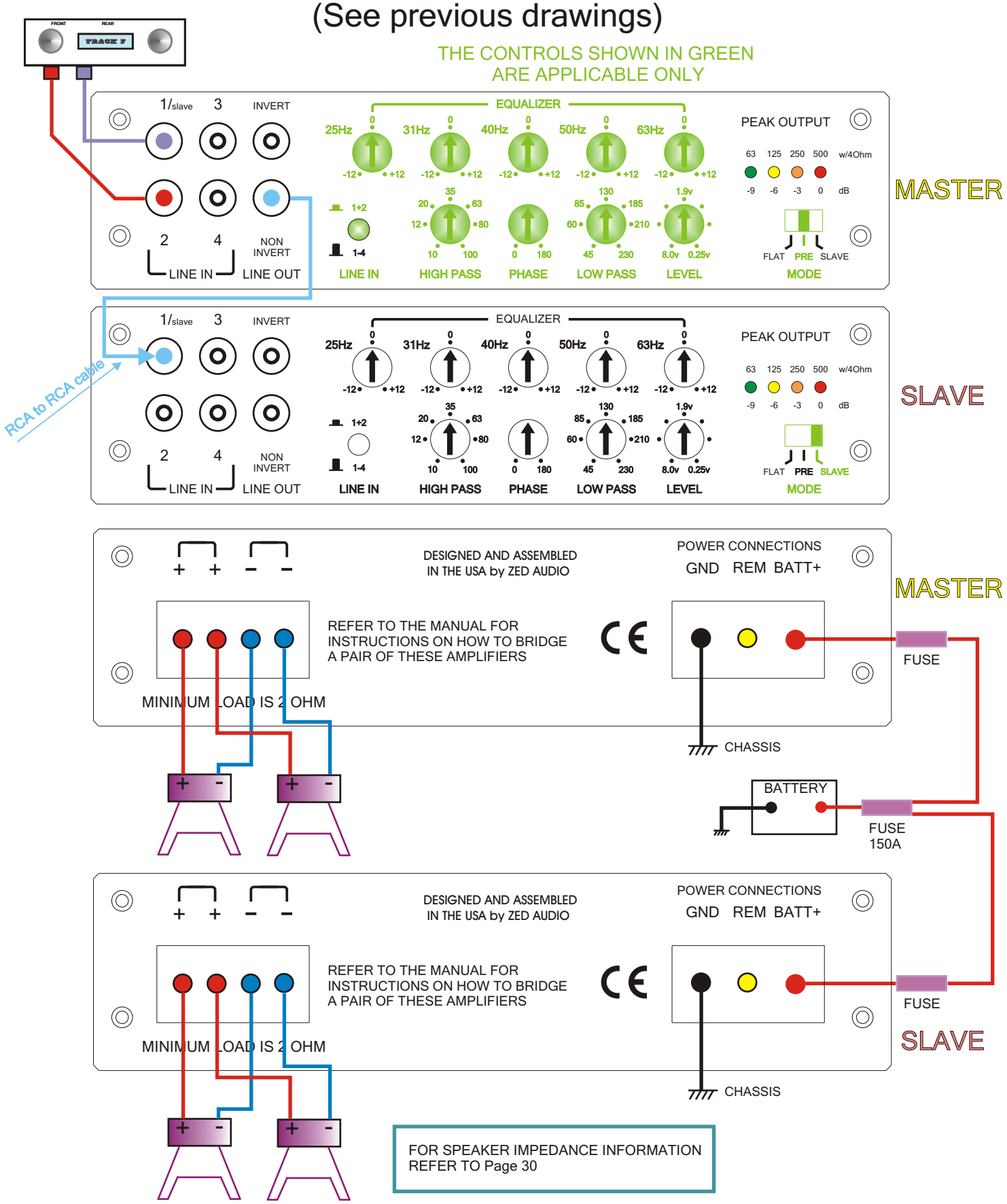
SINGLE DVC 4 OHM, PARALLEL THE COILS FOR 2 OHM NET (1,000W)

SINGLE DVC 2 OHM, SERIES THE COILS FOR 4 OHM NET (500w)

TWO DVC 4 OHM DRIVERS. PARALLEL EACH DRIVER'S COILS AND SERIES THE TWO DRIVERS FOR 4 OHM NET (500w)

TWO DVC 2 OHM DRIVERS. PARALLEL EACH DRIVER'S COILS AND SERIES THE TWO DRIVERS FOR 2 OHM NET (1,000w)

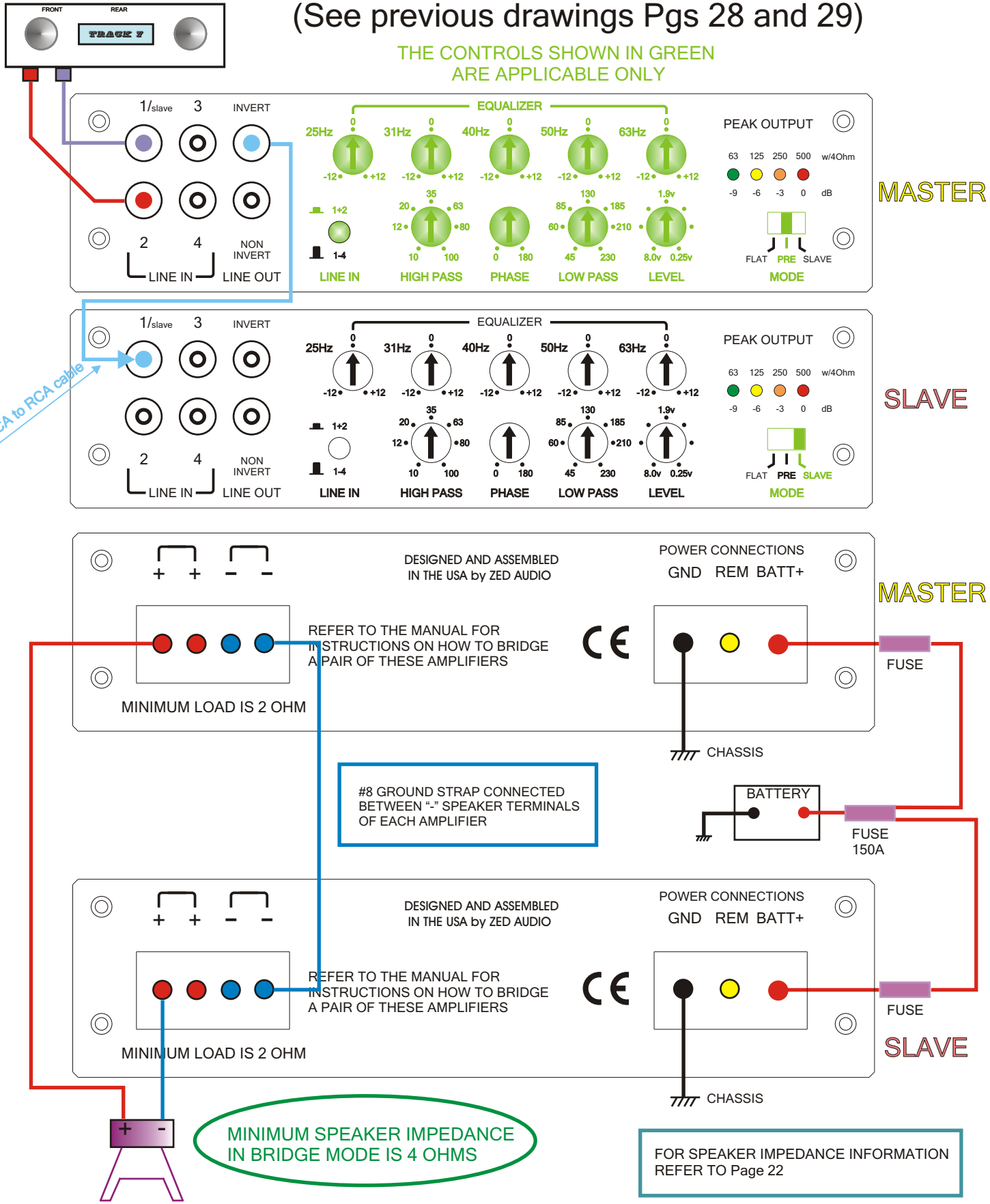
# TWO MINOTAURS driving one or more speakers each.
## Signal source shown as 2 but may be a 2 or 4 source
## (See previous drawings)



# TWO MINOTAURS bridged and driving one or more speakers

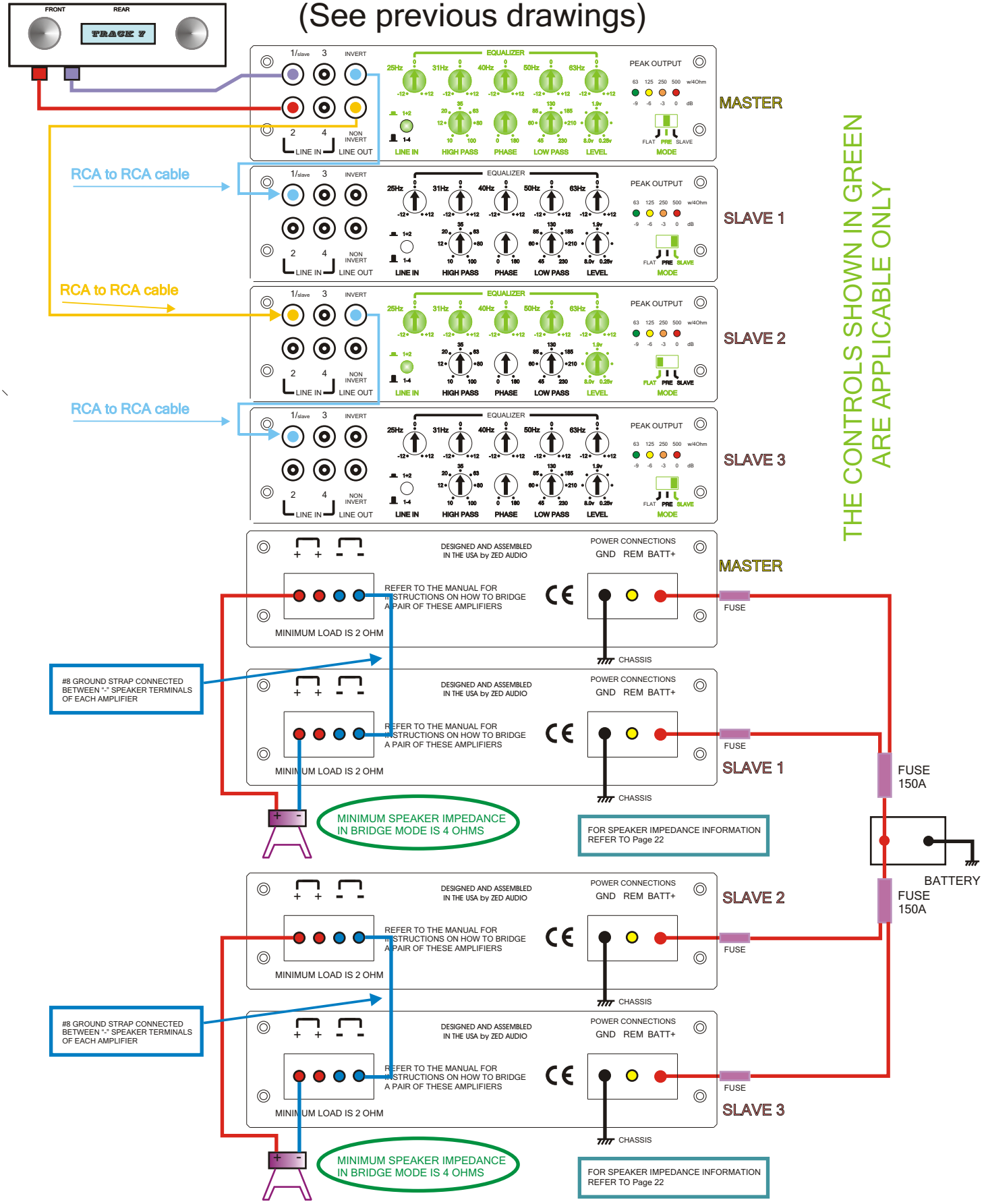
## Signal source shown as 2 but may be a 2 or 4 source

## (See previous drawings Pgs 28 and 29)



# FOUR MINOTAURS in a parallel/bridge mode configuration

## Signal source shown as 2 but may be a 2 or 4 source (See previous drawings)



## FOUR MINOTAURS in a parallel/bridge mode configuration continued.

The MASTERamplifier receives the signals from the source unit.
SLAVE 1 and the MASTER are bridged as a pair as per instructions on Page 32.

The MASTER drives from its NON INVERT line output to SLAVE 2
SLAVE 2 drives SLAVE 3 from its INVERT line output.
SLAVE 2 and SLAVE 3 are then connected in bridge mode.

The MASTER controls the crossover frequencies, the phase, the master level and the equalization.

SLAVE 2's LEVEL control shall control the relative level of the second bridged pair.
Leave the equalization controls on SLAVE 2 in their "0" positions.

# DRACONIA AND DREADNOUGHT

**DRACONIA AND DREADNOUGHT** are the first new 4 channel amplifiers. **DRACONIA'S** output is a modest 100w x 4 at 4 ohm but by no means a wimp when bridged as a 2 channel amplifier into 4 ohms where the amplifier delivers 400w/ch and 200w/ch into 8 ohms.
**DREADNOUGHT** at 225w x 4 at 4 ohm is the powerhouse and when bridged into 4 ohms delivers 800w/ch and into 8 ohms 400w/ch..
Versatility was one of the prime requirements in the design of these two amplifiers. They share the same features but for the difference in power.
Some basic features:
Channels 1+2 may be run in flat mode ie. No signal processing.
Channels 1+2 may be run in high pass, low pass or bandpass modes.
Channels 1+2 can be switched to use the signal path from channels 3+4.**
The LEVEL control of channels 1+2 sets the level for these two channels.
Channels 3+4 can be switched to use the signal from channels 1+2 inputs(2 input source)
Channels 3+4 may be run in high pass, low pass or bandpass modes.
Channels 3+4 can be switched to SUB mode where a sub sonic filter and 40Hz equalizer are switched into circuit. This SUB mode used the mono mix of all four inputs.
If only 2 inputs are used the gain is reduced by 12dB. This can be adjusted at the factory for zero insertion loss.

Each channel has its own LED to indicate channel clipping. When an LED flashed this indicates the onset of clipping. Typically one can accept about 1 to 1.5dB of clipping at low frequencies however our ears are more sensitive to clipping and mid and high frequencies.

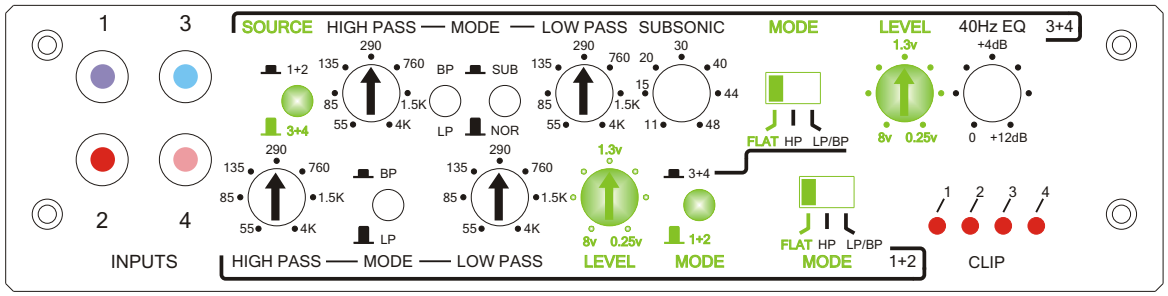
The overbuilt power supplies are run at 75KHz and **DRACONIA** uses six 110 amp power MOSFETs in the supply, **DREADNOUGHT** has twelve. Each amplifier employs a total of 13 regulated power supplies, so they are quite immune to changes in battery voltage.

A new generation of IC chips from National Semiconductor is used in the pre amplifier sections of both amplifiers. They contribute almost zero THD and they are extremely low noise.

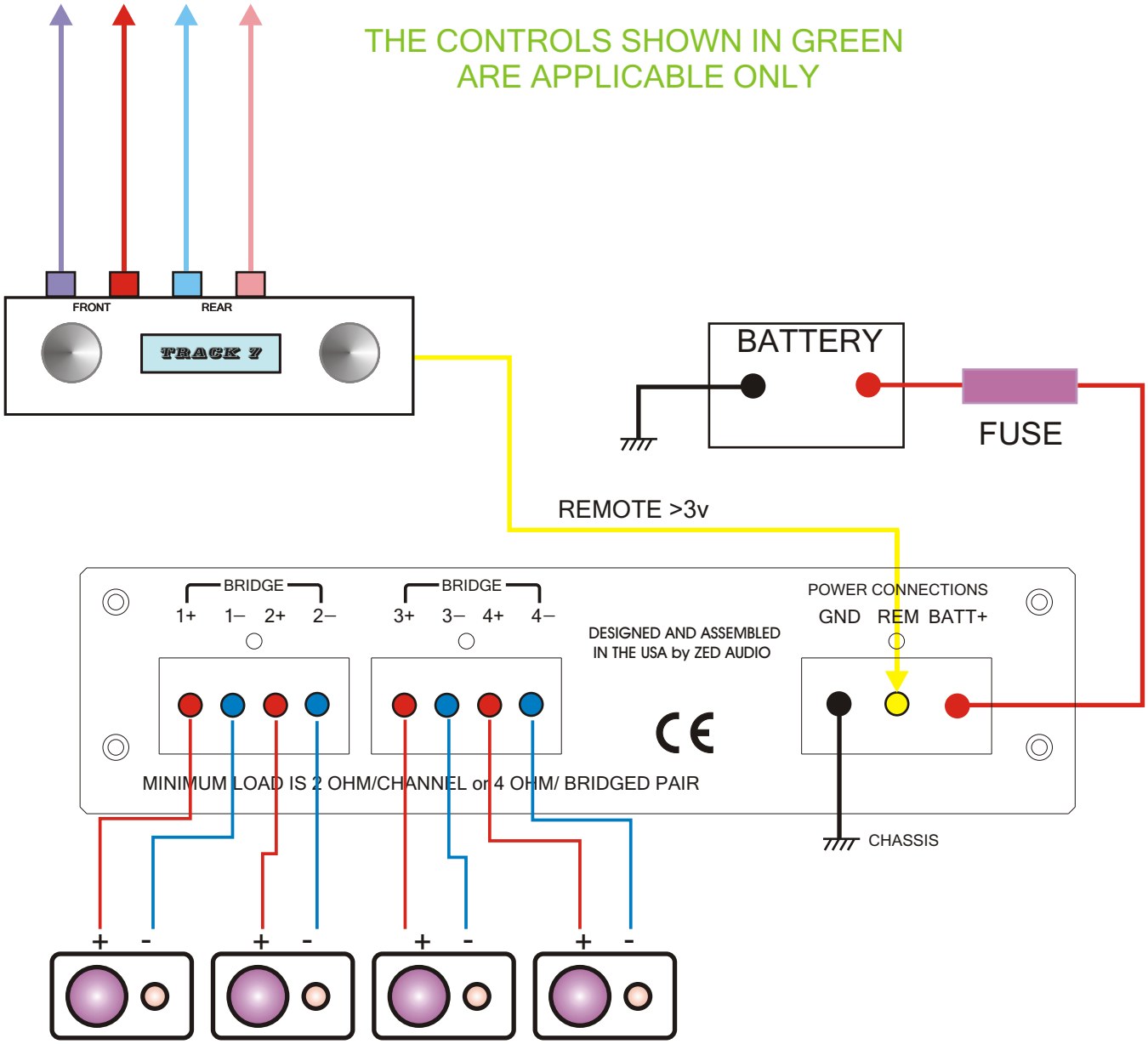
The class D amplifiers in **DRACONIA** use ultra low gate charge MOSFETs rated at 18 amps each. **DREADNOUGHT** employs a similar low gate charge part but these are rated at 50 amps each. The carrier frequencies used in the class D amplifiers varies between 400 and 500KHz which prevents inter channel frequency beating.

The ZED logo doubles as a power and a protection indicator, flashing in protect mode and solid under normal operating conditions.

# DRACONIA/DREADNOUGHT driving four channels all in FLAT mode using component speakers. Signal source is front and rear.

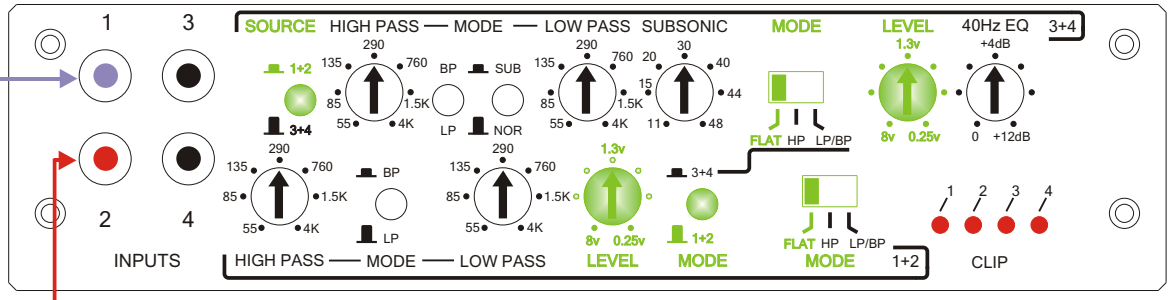



THE CONTROLS SHOWN IN GREEN ARE APPLICABLE ONLY

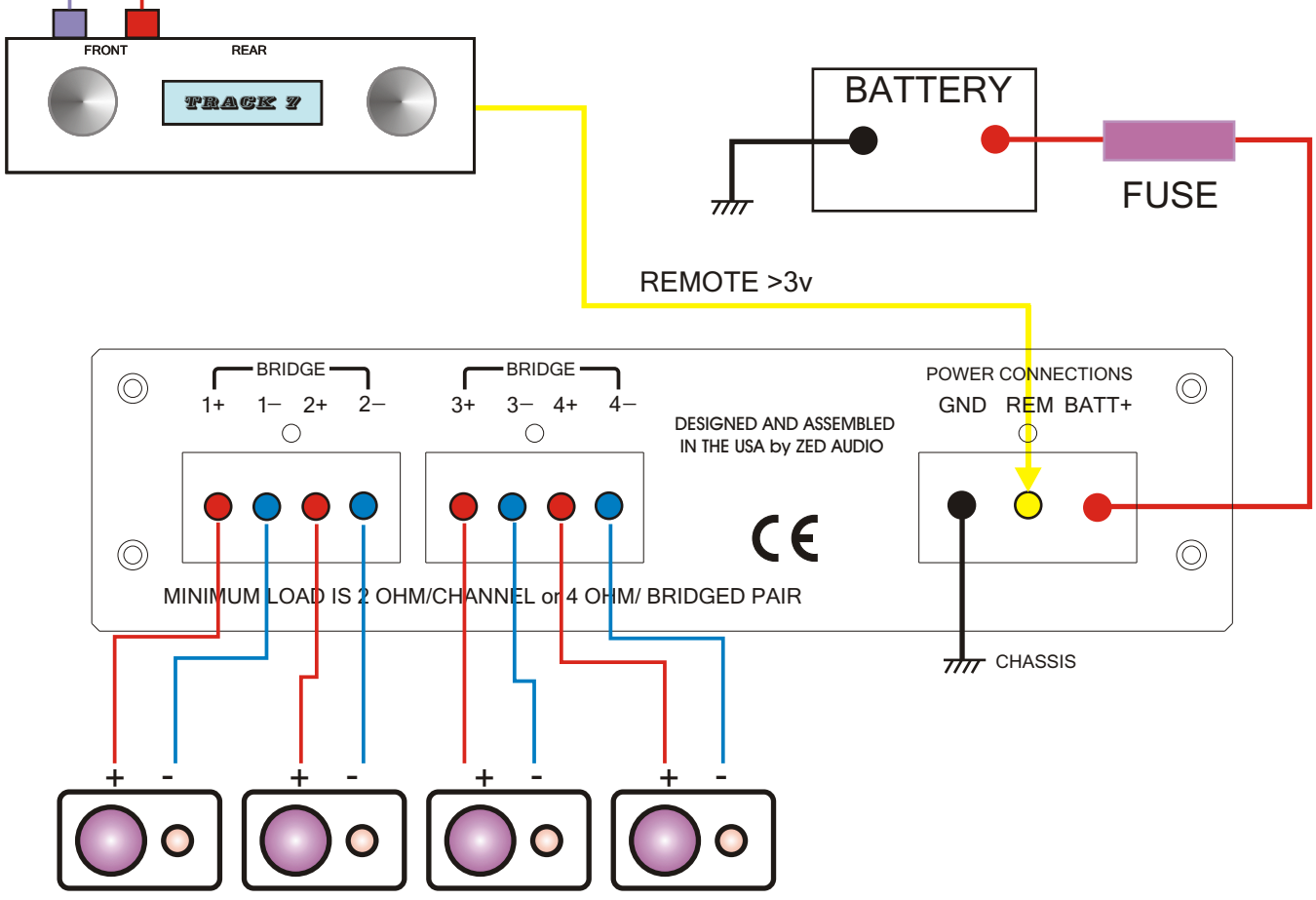


# DRACONIA/DREADNOUGHT driving four channels all in FLAT mode using component speakers. Signal source is TWO (2) channel.

IN THIS MODE THE SIGNAL IS ROUTED TO BOTH SETS OF CHANNEL PAIRS AND EACH CHANNEL PAIR IS INDEPENDENT

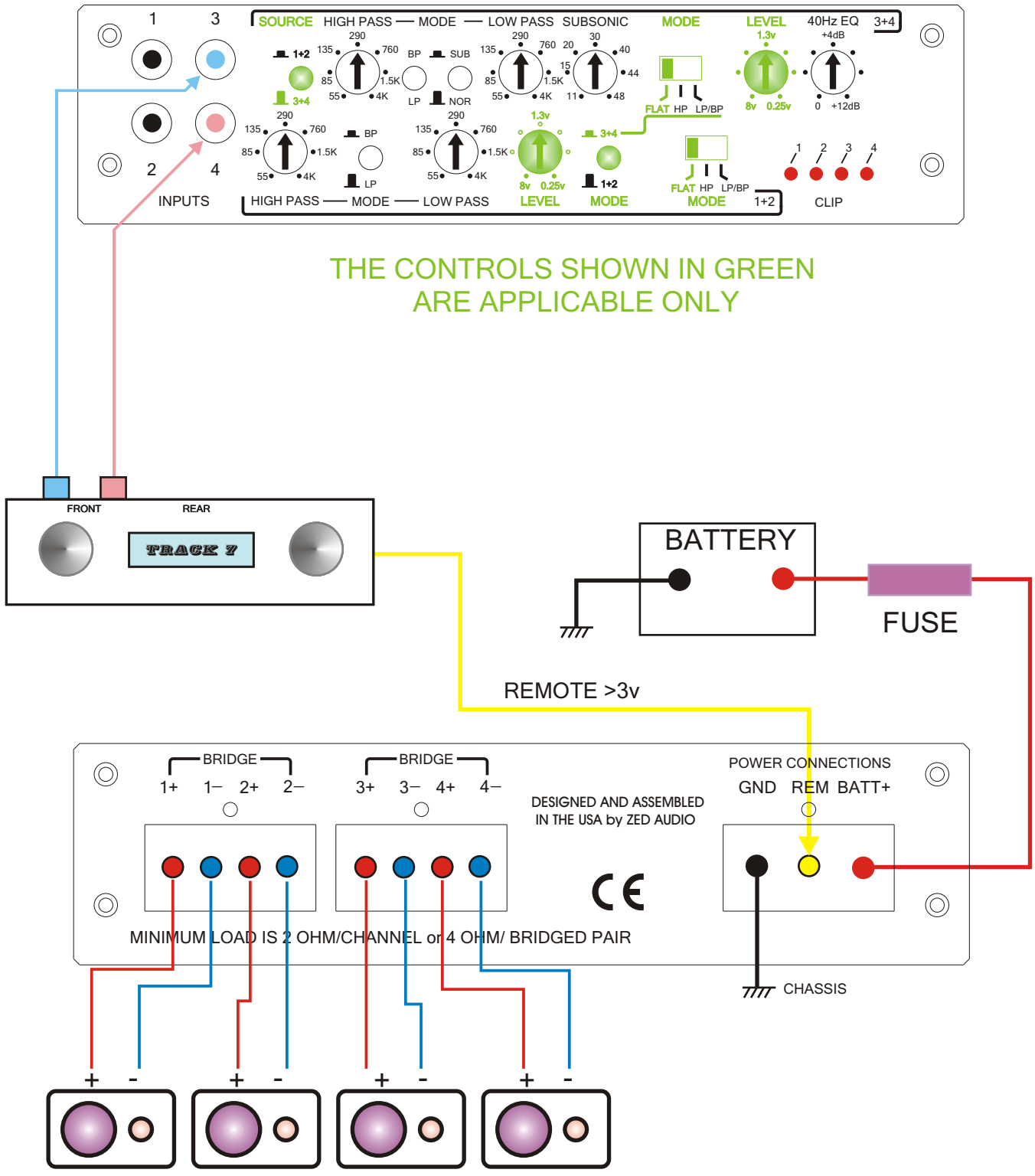



THE CONTROLS SHOWN IN GREEN ARE APPLICABLE ONLY



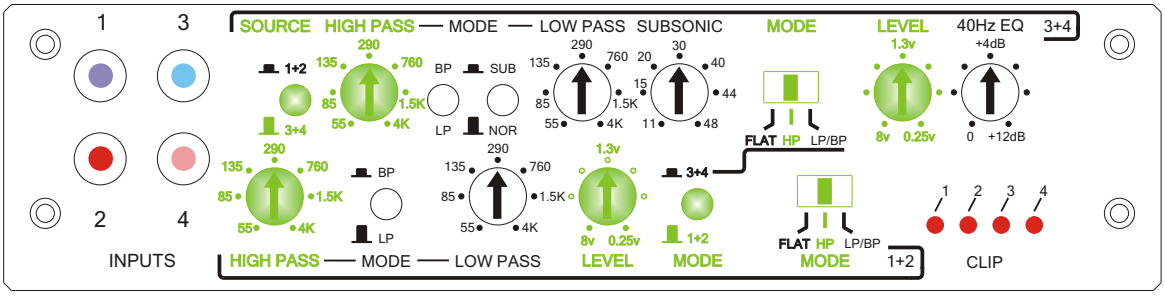
# DRACONIA/DREADNOUGHT driving four channels all in FLAT mode using component speakers. Signal source is TWO (2) channel from 3+4 inputs.

IN THIS MODE THE SIGNAL IS ROUTED TO CHANNEL 3+4 PRE AMPLIFIERS ONLY
BUT ALL FUNCTIONS OF 3+4 AFFECT 1+2 - LEVEL CONTROLS ARE INDEPENDENT

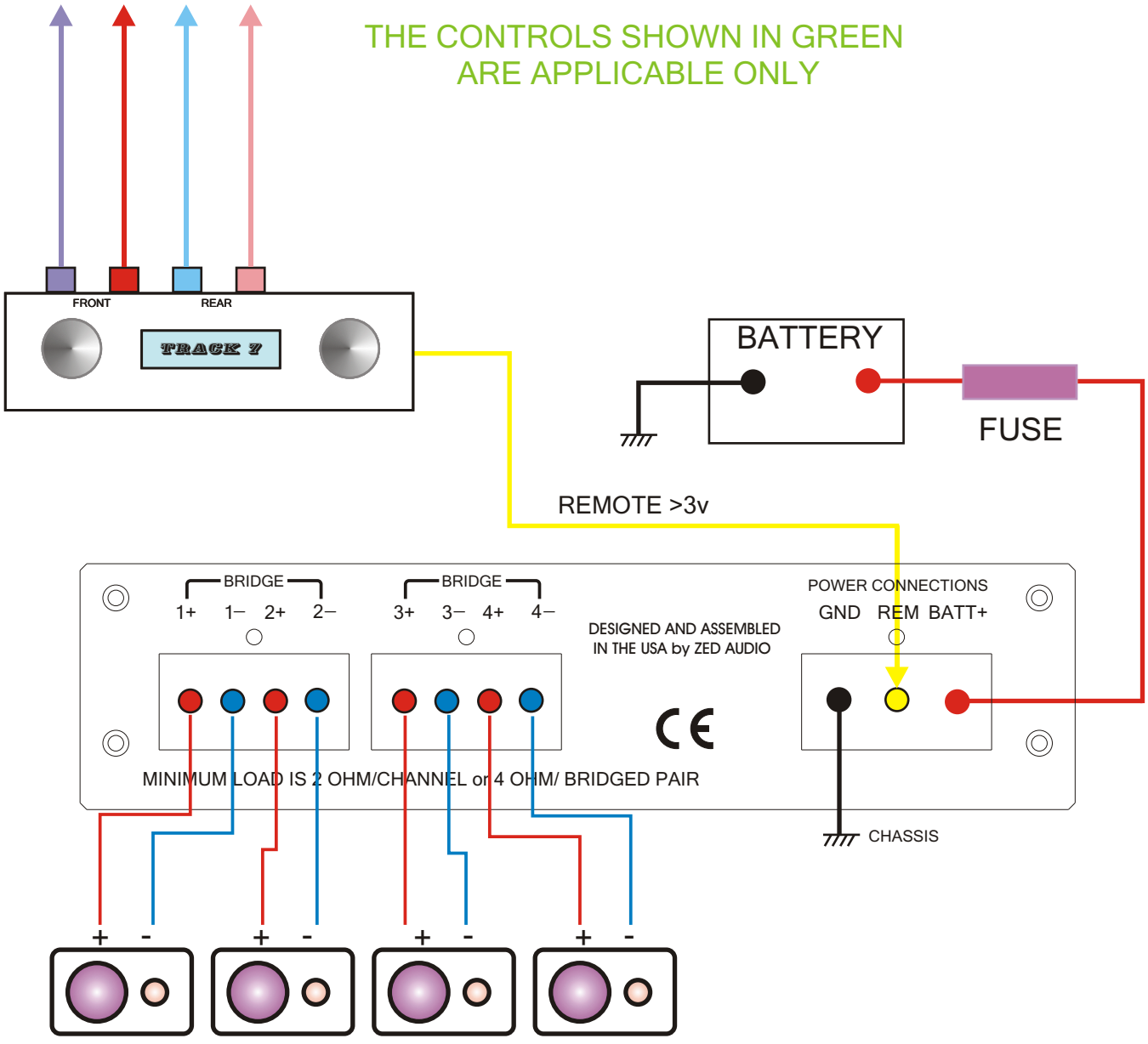


# DRACONIA/DREADNOUGHT driving four channels all in HIGH PASS mode using component speakers. Signal source is FRONT and REAR

THE SPEAKERS ARE NOT NECESSARILY COMPONENT TYPES,
THEY OF COURSE CAN BE TWEETERS

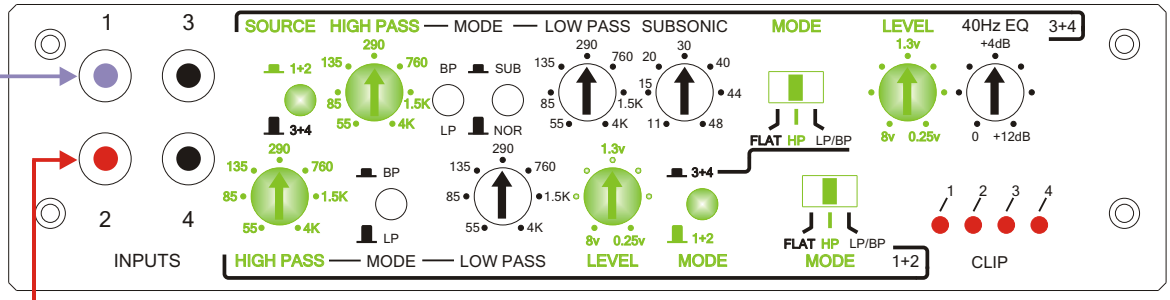



THE CONTROLS SHOWN IN GREEN
ARE APPLICABLE ONLY

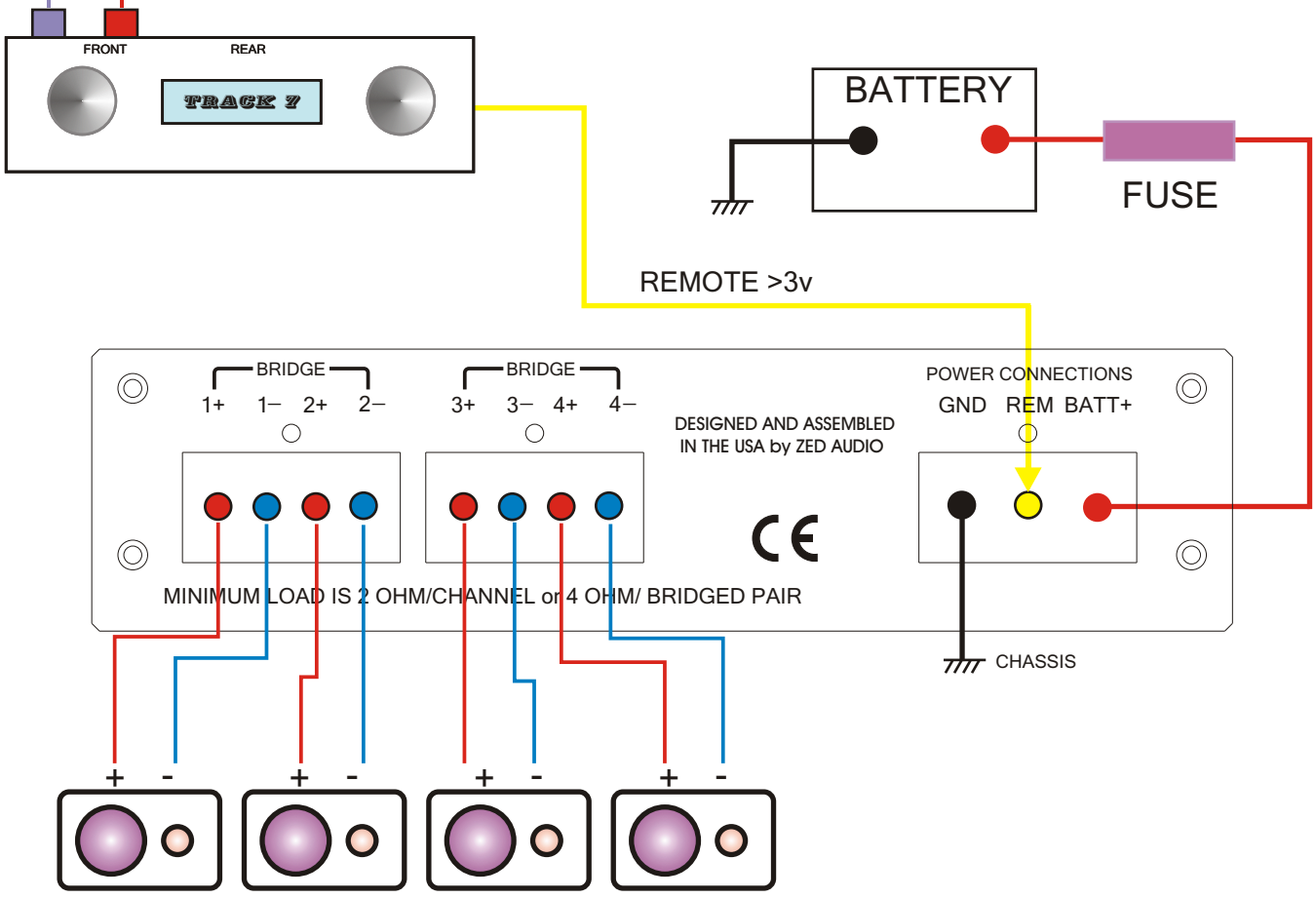


# DRACONIA/DREADNOUGHT driving four channels all in HIGH PASS mode using component speakers. Signal source is 1+2

THE SPEAKERS ARE NOT NECESSARILY COMPONENT TYPES,
THEY OF COURSE CAN BE TWEETERS

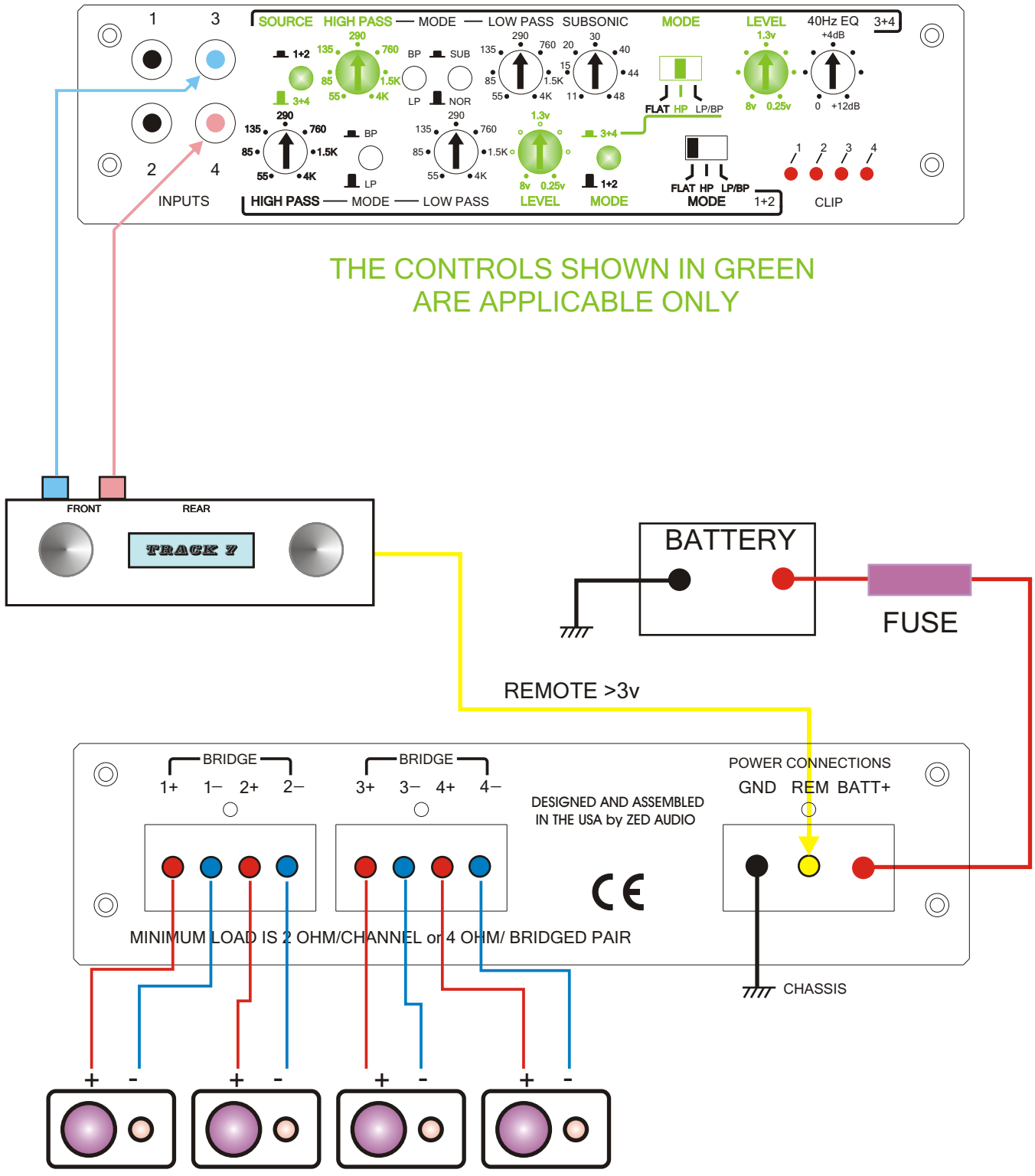



THE CONTROLS SHOWN IN GREEN
ARE APPLICABLE ONLY



# DRACONIA/DREADNOUGHT driving four channels all in HIGH PASS mode using component speakers. Signal source is 3+4

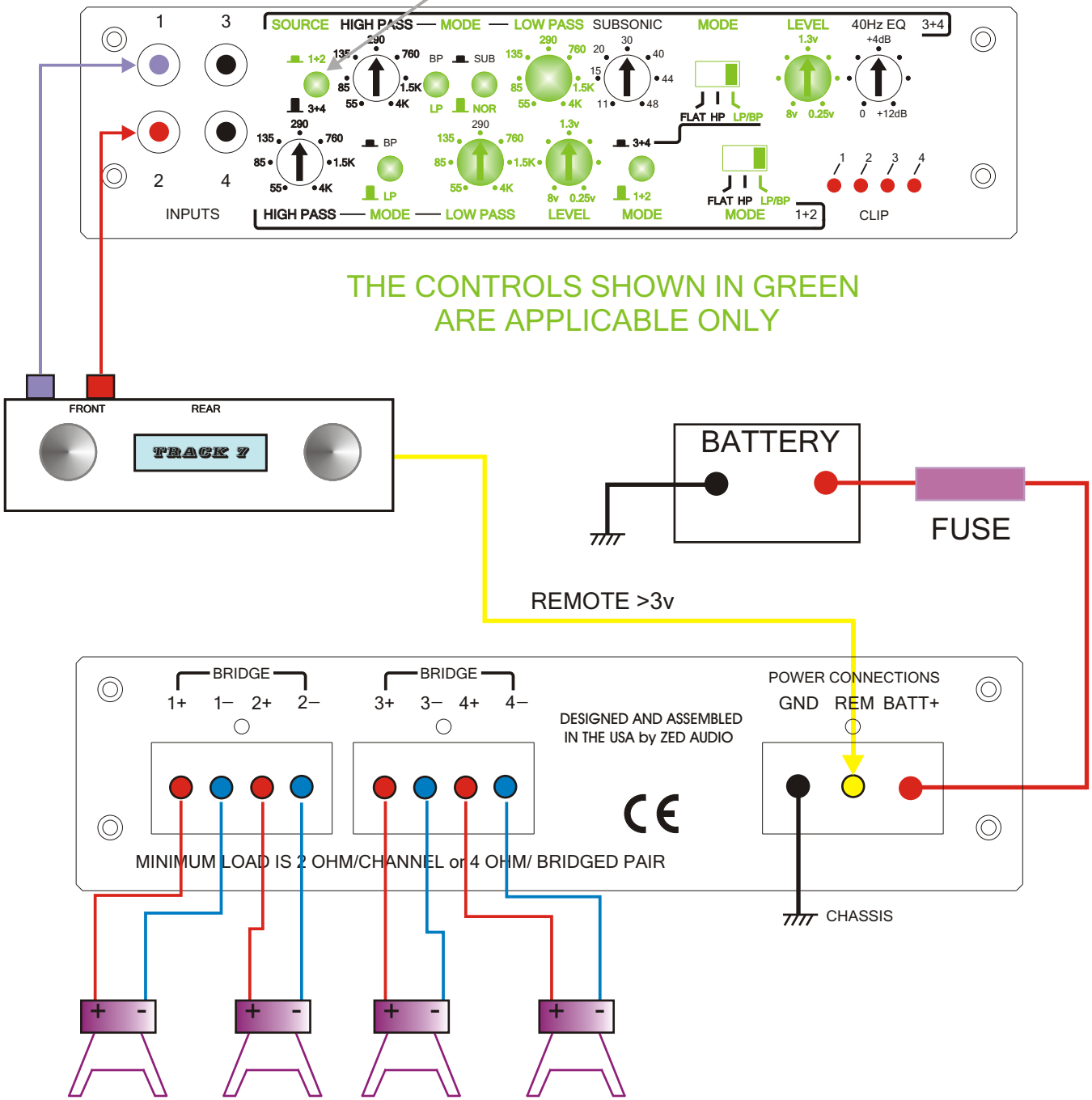
IN THIS MODE THE SIGNAL IS ROUTED TO CHANNEL 3+4 PRE AMPLIFIERS ONLY
BUT ALL FUNCTIONS OF 3+4 AFFECT 1+2 - LEVEL CONTROLS ARE INDEPENDENT



# DRACONIA/DREADNOUGHT driving four channels all in LOW PASS mode using woofers. Signal source is 1+2

THE TWO PAIRS OF CHANNELS USE THEIR OWN LOW PASS CROSSOVERS.

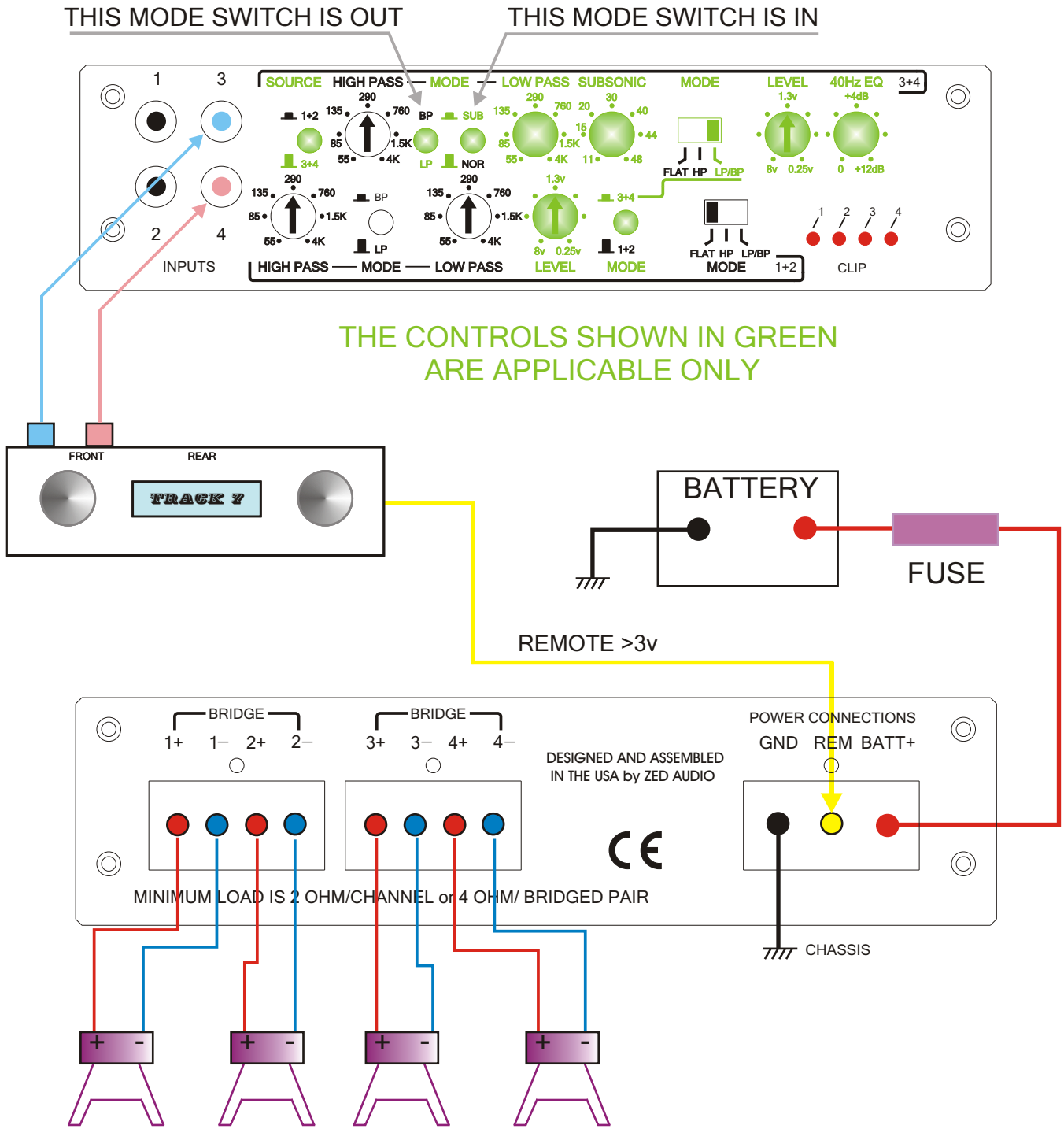
USING ALL FOUR INPUTS REQUIRES THIS SWITCH TO BE IN THE “3+4 POSITION AND SIGNALS MUST BE FED INTO CHANNELS 3+4 AS WELL USING Y ADAPTORS



# DRACONIA/DREADNOUGHT driving four channels all in LOW PASS (SUB) mode using woofers. Signal source is 3+4

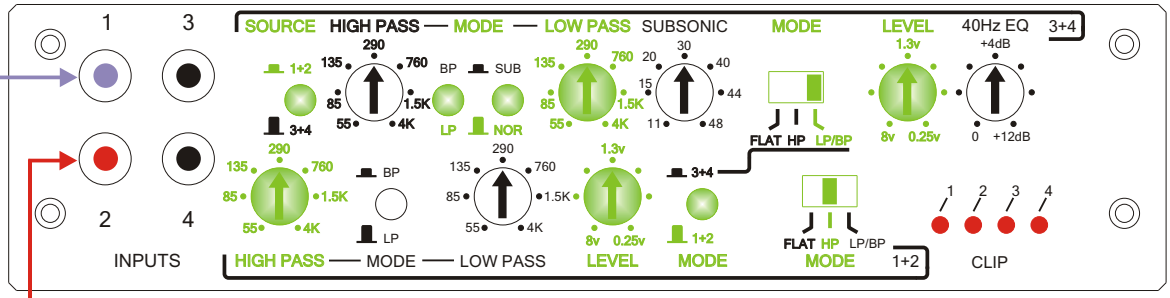
NOTE THAT CHANNELS 1+2 USE THE CROSSOVER AND EQ SETTINGS FROM 3+4 AND THE TWO LEVEL CONTROLS SET THE GAINS INDEPENDENTLY

WITH THE SWITCHES SET AS SHOWN BELOW, THE SIGNAL IS 12dB DOWN IN LEVEL. TO RETURN IT TO 0dB THE RCA INPUTS 1+2 MUST BE Y-ADAPTED WITH THE SIGNALS OF 3+4

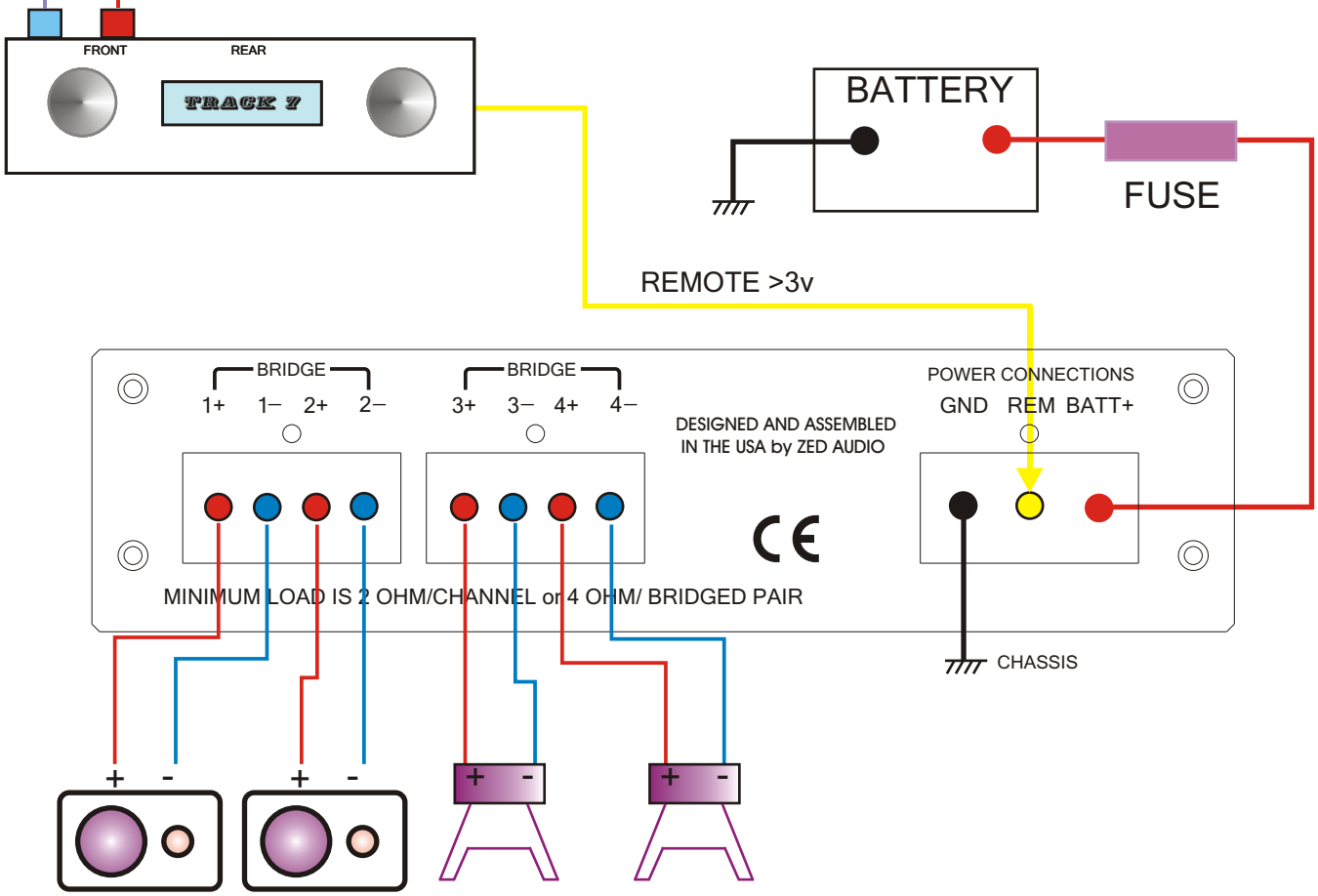


# DRACONIA/DREADNOUGHT driving four channels
# 1+2 in HIGH PASS and 3+4 in LOW PASS
# Signal source is 1+2

NOTE WITH THESE SETTINGS THE SUBSONIC AND 40Hz EQ HAVE NOT BEEN INVOKED ON CHANNELS 3+4

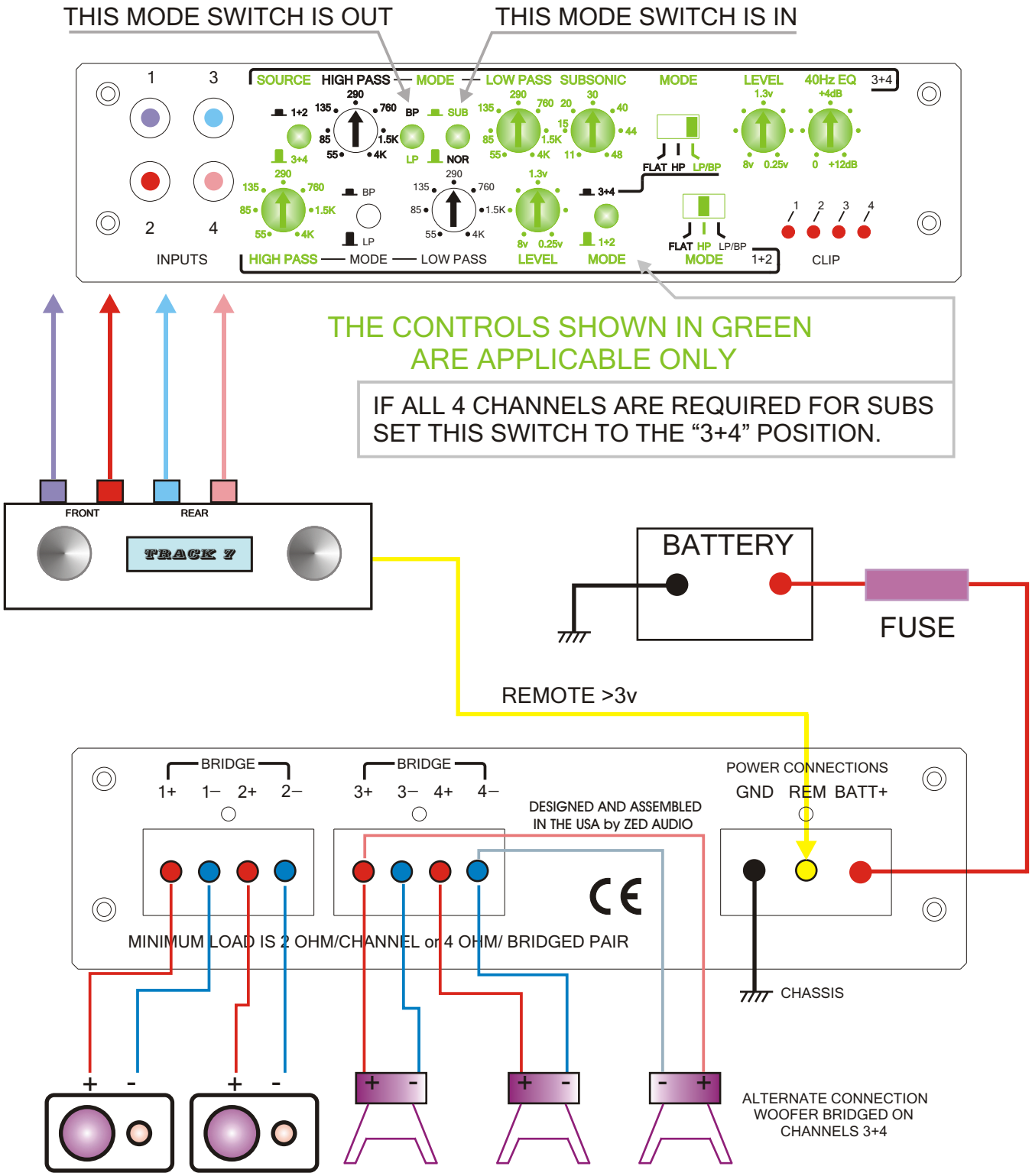



THE CONTROLS SHOWN IN GREEN ARE APPLICABLE ONLY



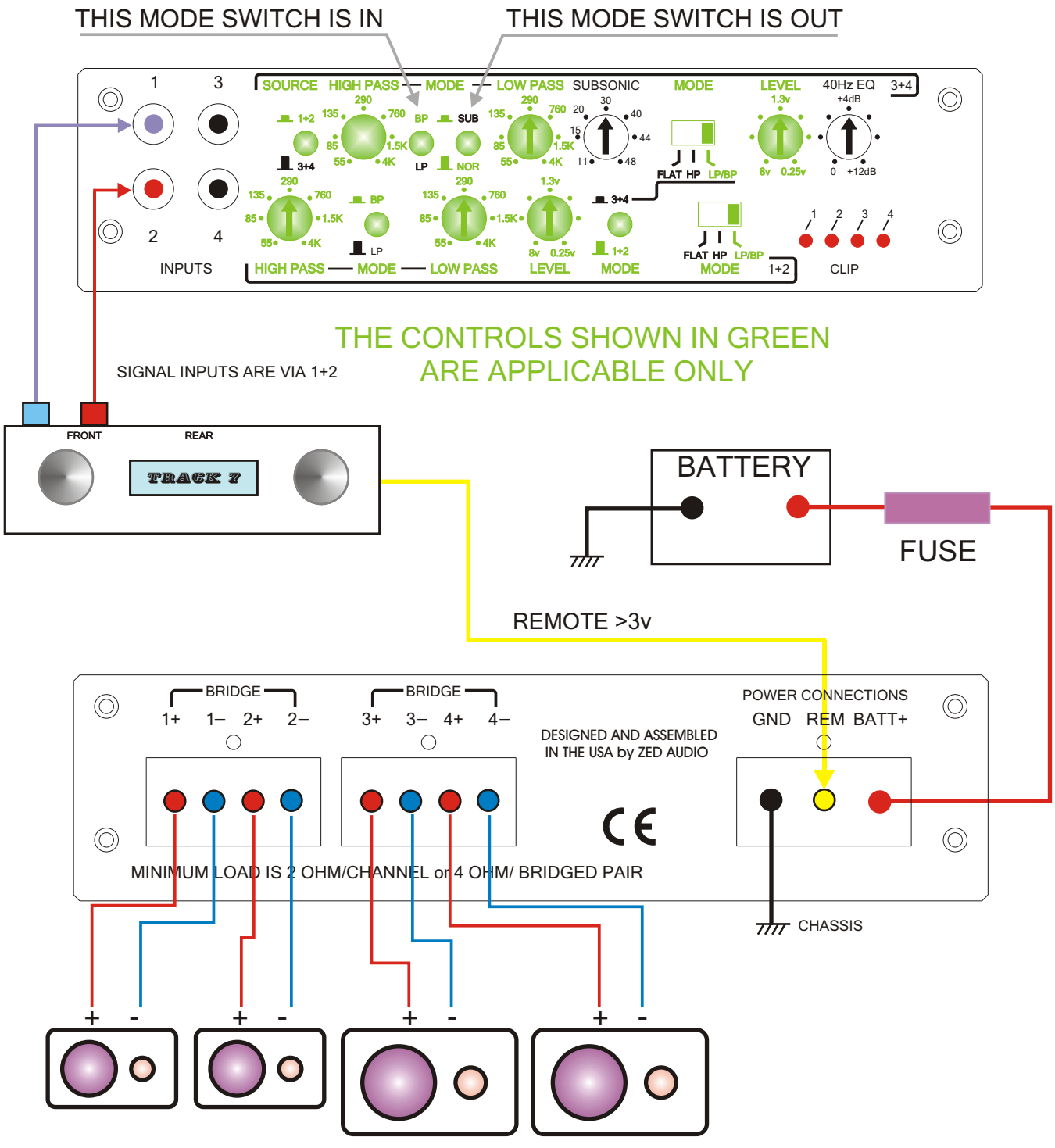
# DRACONIA/DREADNOUGHT driving four channels
# 1+2 in HIGH PASS and 3+4 in LOW PASS
# Signal source is 1+2 and 3+4

CHANNELS 3+4 PROCESS THE MIX OF INPUTS 1-4, THE SIGNAL IS MONO AND CHANNELS 3+4 MAY BE BRIDGED, CHANNELS 1+2 ARE IN STEREO



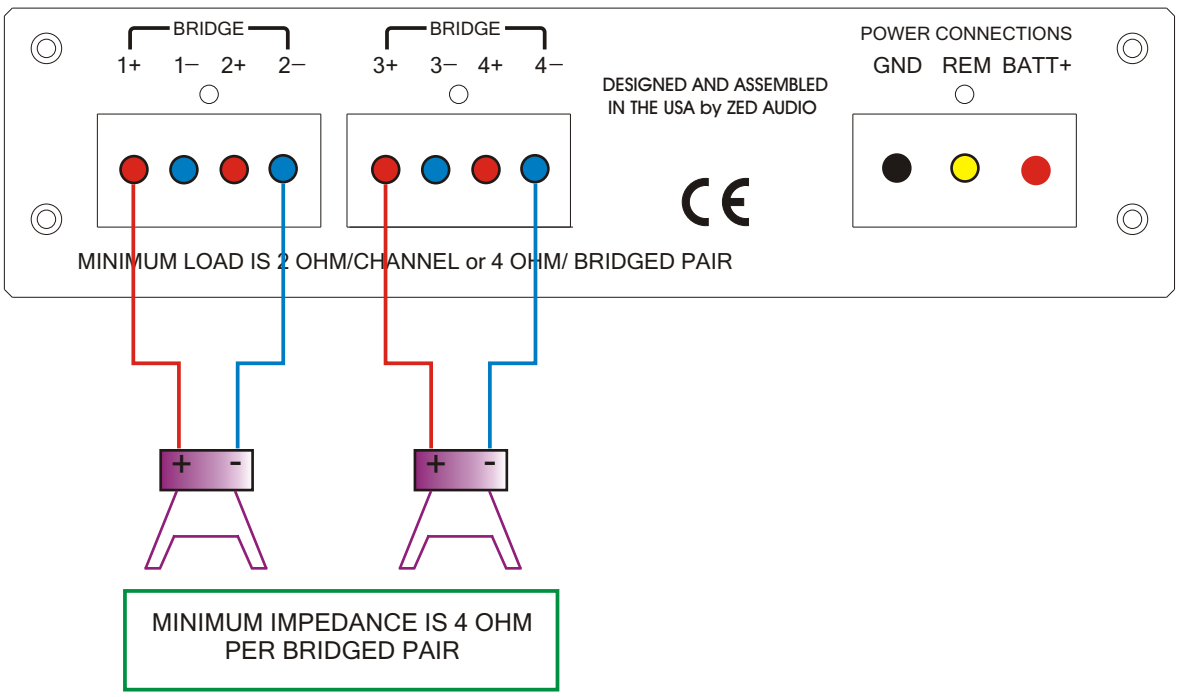
# DRACONIA/DREADNOUGHT driving four channels
## 1+2 in BAND PASS and 3+4 in BAND PASS
## Signal source is 1+2

CHANNELS 1+2 HANDLE THE UPPER MIDRANGE, 3+4 THE LOWER MIDRANGE
THE HIGH AND LOW PASS CROSSOVERS ARE SET TO SUIT THE DRIVERS

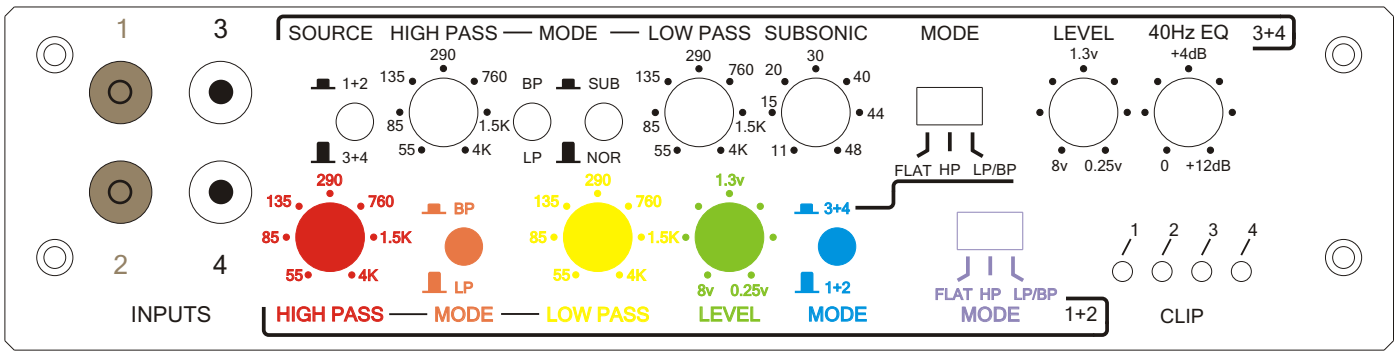


Any pair of channels may be bridged independently of the others where the minimum load impedance is 4 ohm per bridged pair.
For a pair of channels to be bridged it is required that the input signals of the channels be the same.
To bridge channels 1+2 a Y-Adaptor is required and of course the signal should be mono. However no harm can come to the amplifier if the signal content of the channels is not identical.
Running channels 3+4 in “sub” mode (see page 43) automatically ensures that 3+4 have the same signal as “sub” mode mono mixes the 3+4 input signals and send these to both power amplifiers.

Below is shown the bridged connection for the four channels.



# DRACONIA/DREADNOUGHT Front panel controls




INPUTS FOR CHANNELS 1+2

HIGH PASS CROSSOVER

MODE SWITCH CASCADES THE HP and LP CROSSOVER FOR A BANDPASS FUNCTION

LOW PASS CROSSOVER

LEVEL CONTROL

MODE SWITCH SELECTS THE SIGNAL FROM PREAMPS 1+2 OR 3+4 - IN "3+4" THE PROCESSED SIGNAL FROM 3+4 IS ROUTED TO THE MAIN AMPLIFIERS OF 1+2

MODE SWITCH SELECTS "FLAT", "HIGH PASS" and "LOW PASS/BANDPASS" FUNCTIONS

INPUTS FOR CHANNELS 3+4

SOURCE- ALLOWS CHANNELS 3+4 TO SELECT THE INPUT SIGNAL FROM 1+2

HIGH PASS CROSSOVER

MODE-SELECTS LP or BP FUNCTIONS - THE HP and LP CROSSOVERS ARE CASCADED

IN "SUB" MODE THE INPUT IS A MIX OF 1-4, THE SUBSONIC CROSSOVER AND 40Hz EQ ARE INSERTED

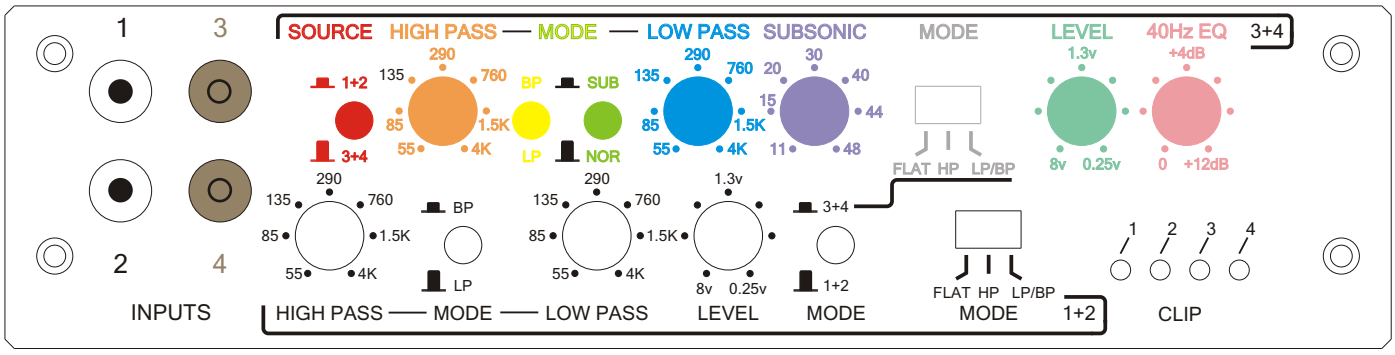
LOW PASS CROSSOVER

SUB SONIC CROSSOVER USED IN "SUB" MODE ONLY

MODE SWITCH SELECTS "FLAT", "HIGH PASS" and "LOW PASS/BANDPASS" FUNCTIONS

LEVEL CONTROL

40Hz CONSTANT Q EQUALIZER



# LEVIATHAN

We are proud to introduce the second generation of the **LEVIATHAN** amplifier. The previous generation **LEVIATHAN** proved that there is a need for multi channel amplifiers (>4 channels) in the mobile market. Several improvements have been incorporated into the new amplifier.

1) Channels 5+6 have an expanded high pass crossover frequency range of 11Hz to 105Hz which will now enable LEVIATHAN to be part of a 4 way system. Channels 1+2 will supply the tweeters- typically 3 to 4KHz and above, 3+4 the upper midrange - typically 200Hz to 3/4KHz and channels 5+6 will supply the lower mids from about 40-100Hz to 200Hz.
2) Channels 1+2 and 3+4 have had their crossover ranges extended to 55Hz for both low and high pass.
3) A next generation of power supply design is used with improvements in the areas of regulation and noise.
4) The pre amplifiers now employ an audiophile chip from National Semiconductor and we feel that these are superior to the Burr Brown chips used previously. The Burr Browns are outstanding chips in their own right but are now showing their age.
5) The class D amplifiers now operate at a higher carrier frequency (Between 400 and 500KHz) owing to the fact that we now use a new power MOSFET which has very low gate charge and is also rated at 50 amps. These MOSFETs have an on resistance which is one third that of the previous generation so the losses (= heat) are greatly reduced.

**LEVIATHAN** can perform in many roles. We shall now go through these permutations and see how they all stack up.

1) Run all six channels in FLAT mode. This will enable you to use an outboard processor of your choice including our upcoming full tube electronic crossover.
2) Run all channels in flat mode and bridge any or all of the 3 pairs of channels.
3) Run channels 1+2 in high pass independently of the other channels
4) Run channels 3+4 in high, low or band pass independently of the other channels. There are two crossovers available on channels 3+4 and switching the high and low pass to be in cascade allows for a band pass mode.
5) Run channels 5+6 in low pass mode using the dedicated RCA inputs.
6) Run channels 5+6 in low pass mode using the summed inputs of channels 1-4. The signal is now MONO and this mono signal is routed to the main channel 5+6 amplifiers.
7) Channels 1+2 can be switched to receive the mono low pass signal from channels 5+6
8) Channels 3+4 can be switched to receive the mono low pass signal from channels 5+6
9) For a tri-amplified system, channels 1+2 are run high pass, channels 3+4 bandpass and channels 5+6 low pass.
10) All six channels can be run mono low pass for those systems where there are many single woofers.

11) Run channels 1+2 as high pass and channels 3,4,5 and 6 as low pass for a typical front stage system.
12) Run channels 1+2 in high pass for the front stage, channels 3+4 in high pass for the rear fill and channels 5+6 for the subs.
13) Run channels 1+2 in high pass for the front stage tweeters, channels 3+4 in band pass for the front stage midrange and channels 5+6 for the subs.
14) A high power front stage system. Run Chs 1+2 as high pass in bridge (300w @ 8 ohm/600w @ 4 ohm), Chs 3+4 as high pass in bridge (300w @ 8 ohm/600w @ 4 ohm) and channels 5+6 as low pass.
15) Run channels 5+6 in bandpass mode for 4 way systems where 5+6 run the lower midrange drivers.

So as can be seen this amplifier can do quite a few things. For those of you who only choose to use four of the six channels, just leave all connections free to the channels you have chosen not use.

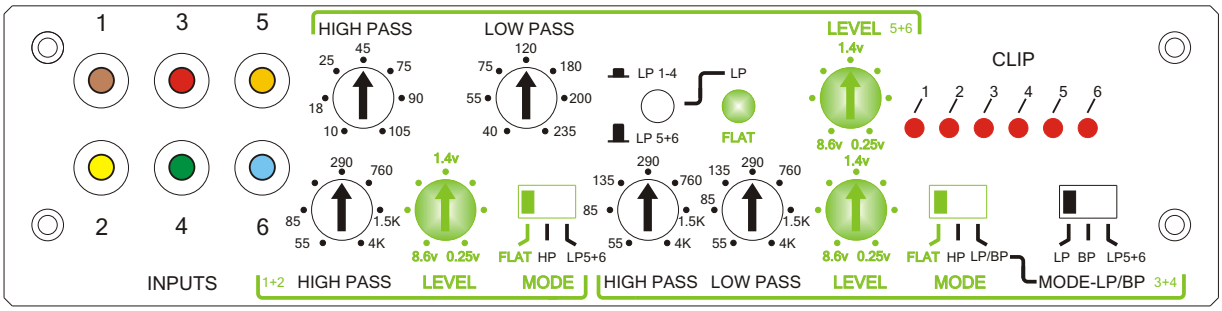
Some will ask why there are no switches to parallel the RCA input sockets. The answer is quite simple.....there is no place to add these switches! So those of you who may use **LEVIATHAN** as a two channel tri-amplified system you will have to use Y-adaptors or if you are bridging a pair of channels and need to feed both inputs with the same signal. Alternatively we can add the links before shipping and these links are easily removable. Please refer to the diagram at the end of the **LEVIATHAN** diagrams. We can supply these links on request or with your order.

**LEVIATHAN** uses ultra fast MOSFETs in each channel rated at 50A. The power supply incorporates the same 110A MOSFETs as are used in our other amplifiers except that 12 are used. The power supply in **LEVIATHAN** uses smart technology in the power supply and this increases the efficiency of the amplifier. Isolated ground pre amplifier with balanced drive is used.

The following diagrams show the many options available with **LEVIATHAN**. Referring to the above 16 options we believe that the following diagrams will allow most installers to configure **LEVIATHAN** correctly for each particular system.

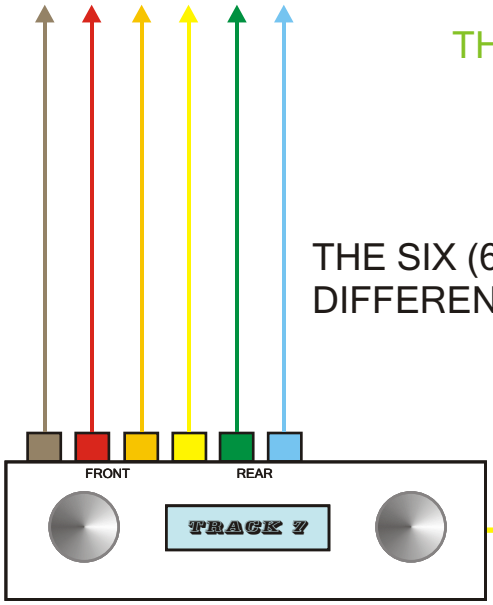
Important note: Do NOT power up **LEVIATHAN** or any of our amplifiers with the volume level high. The internal initializing circuits will “see” this as a fault condition and shut the amplifier down. The ZED logo will flash on and off and the amplifier will have to be powered down for >5 seconds and then reset. This has been done to protect all components in the system, including YOUR ears!

# LEVIATHAN run with all 6 channels with FLAT response

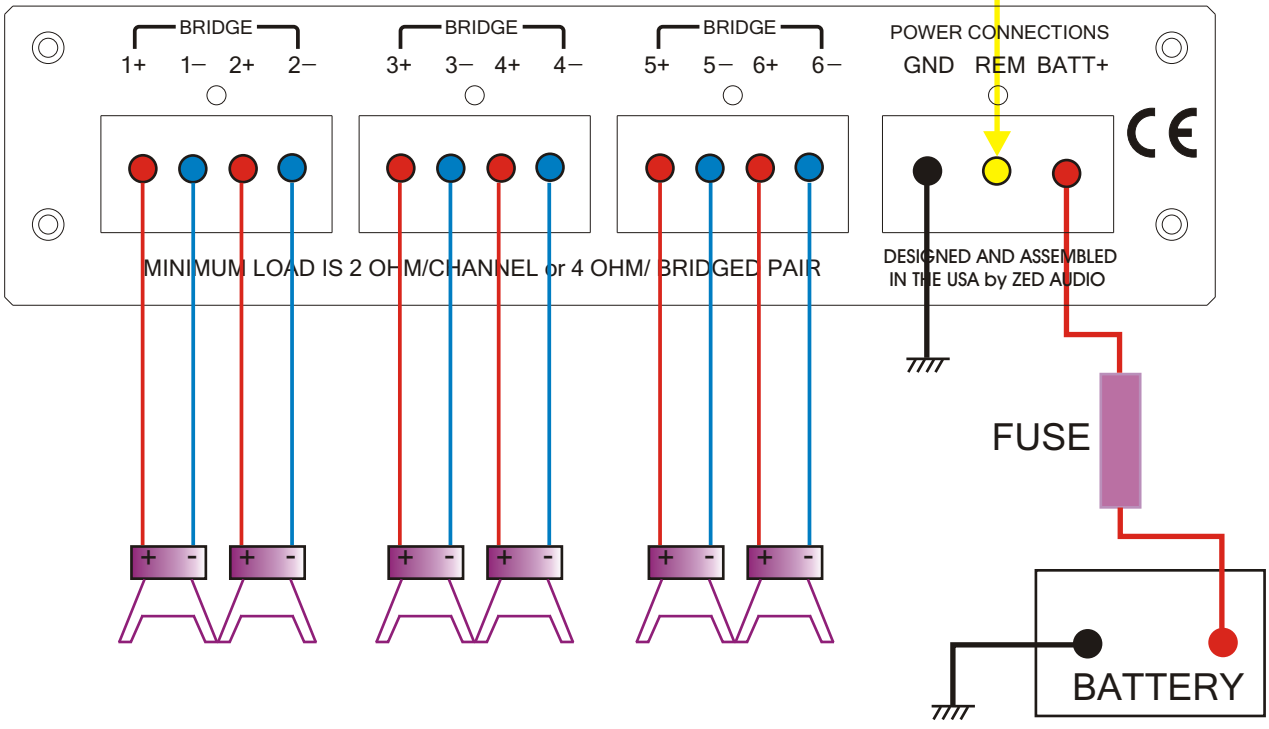



THE CONTROLS SHOWN IN GREEN
ARE APPLICABLE ONLY

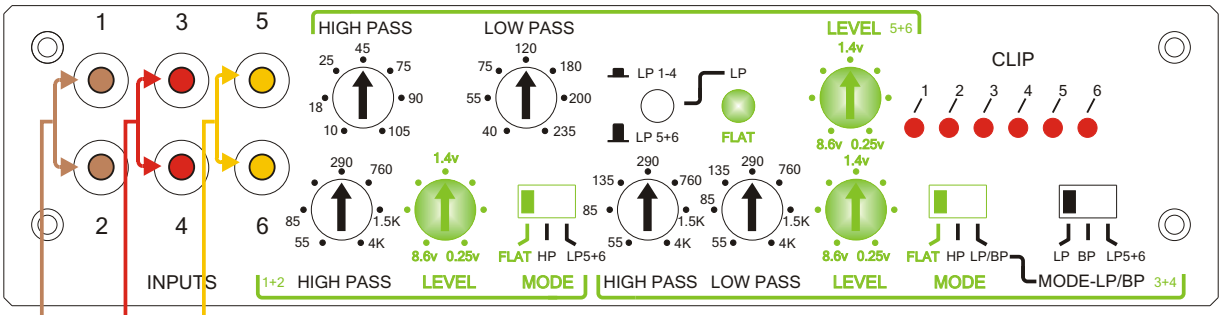
THE SIX (6) INPUTS CAN BE DRIVEN FROM SIX
DIFFERENT SOURCES OR Y ADAPTED AS REQUIRED




REMOTE >3v



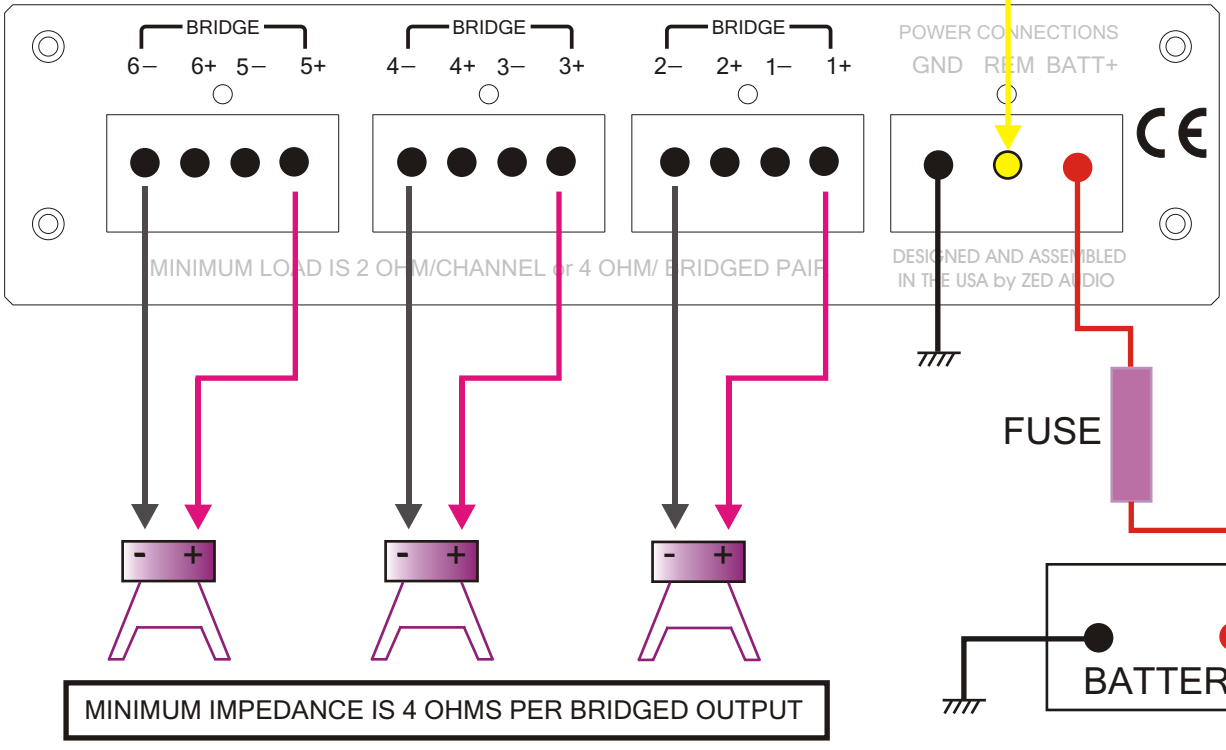
# LEVIATHAN with 6 channels in FLAT response and bridged



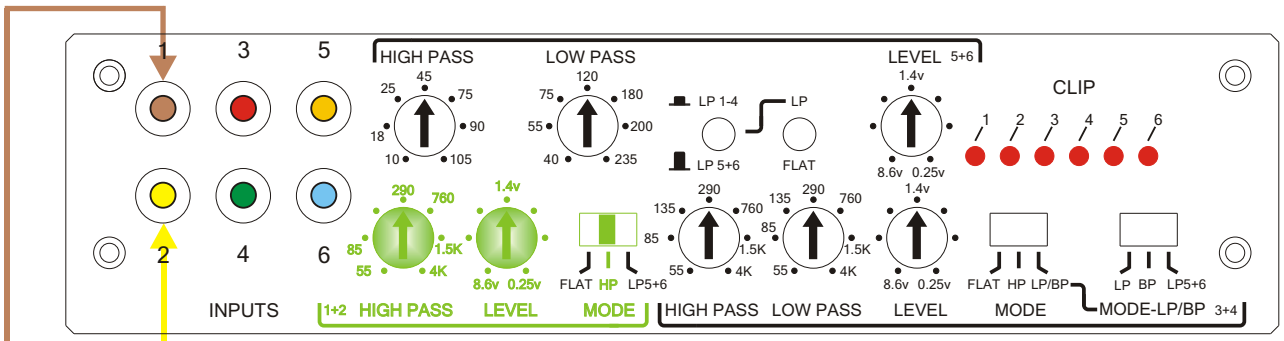

THE CONTROLS SHOWN IN GREEN
ARE APPLICABLE ONLY

THE THREE (3) INPUTS CAN BE DRIVEN FROM THREE
DIFFERENT SOURCES OR Y ADAPTED AS REQUIRED


REMOTE >3v

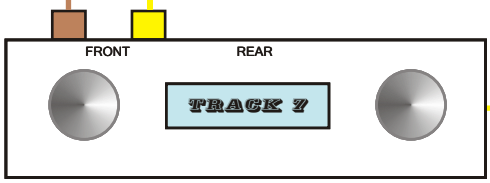


# LEVIATHAN with Chs 1+2 in high pass

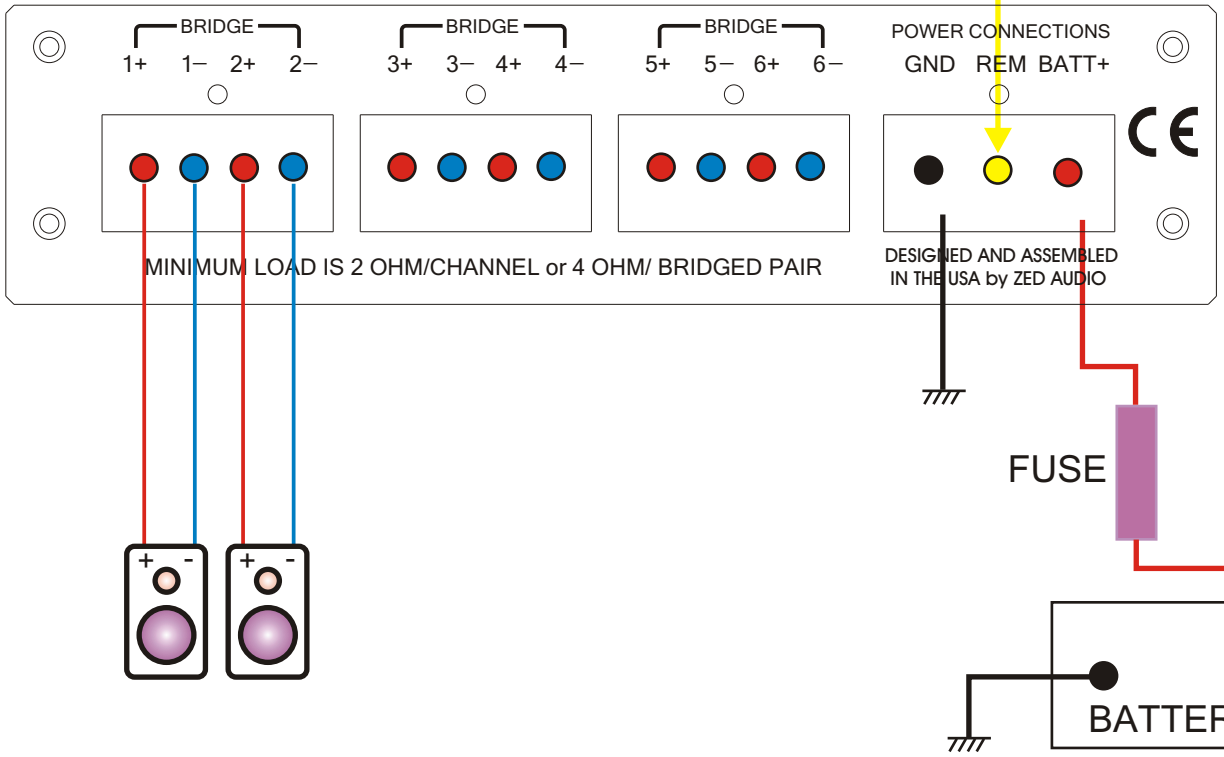



THE CONTROLS SHOWN IN GREEN
ARE APPLICABLE ONLY

THESE TWO INPUTS ARE DRIVEN FROM AN
APPLICABLE SOURCE



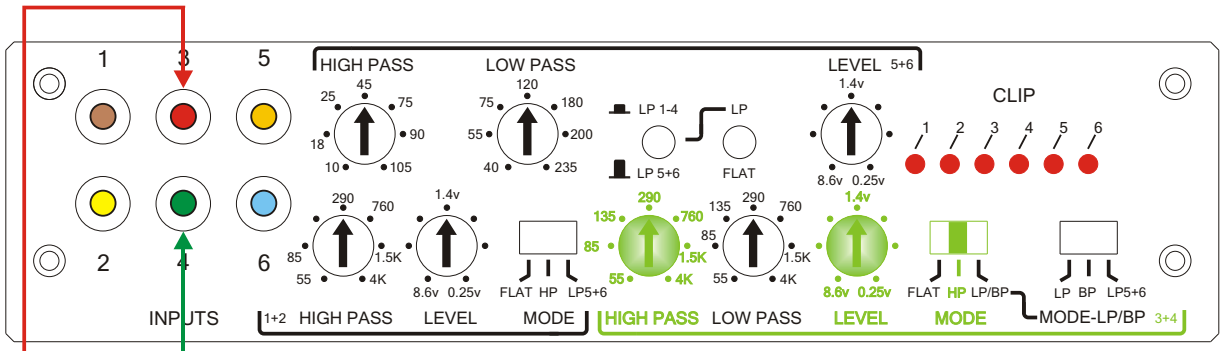

REMOTE >3v




FUSE

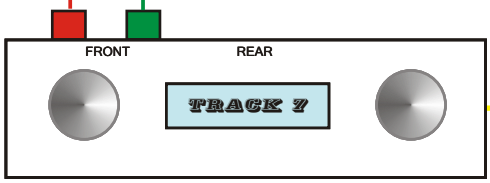
BATTERY

# LEVIATHAN with Chs 3+4 in high pass

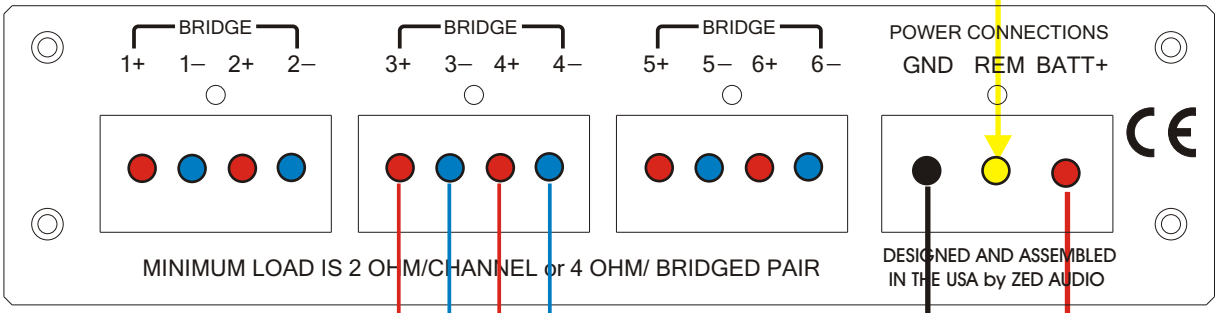



THE CONTROLS SHOWN IN GREEN
ARE APPLICABLE ONLY

THESE TWO INPUTS ARE DRIVEN FROM AN
APPLICABLE SOURCE



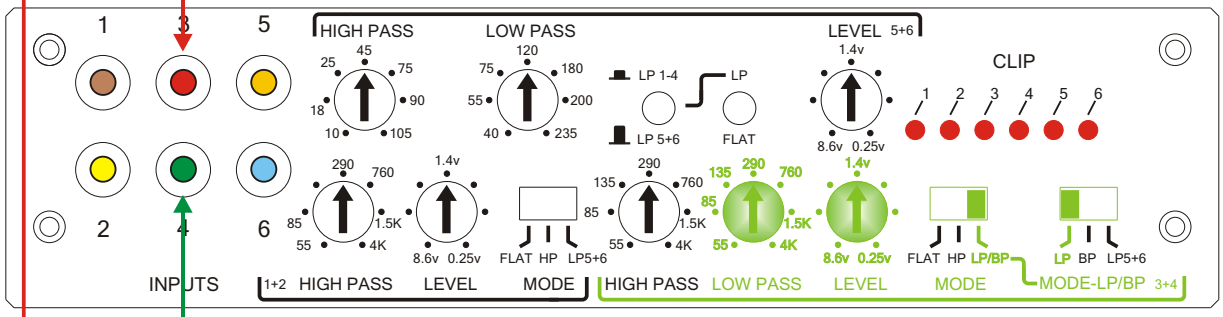

REMOTE >3v




FUSE

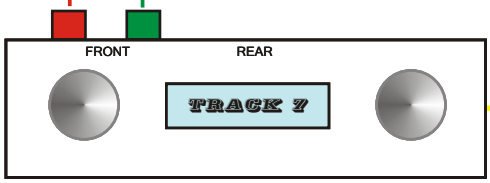
BATTERY

# LEVIATHAN with Chs 3+4 in low pass

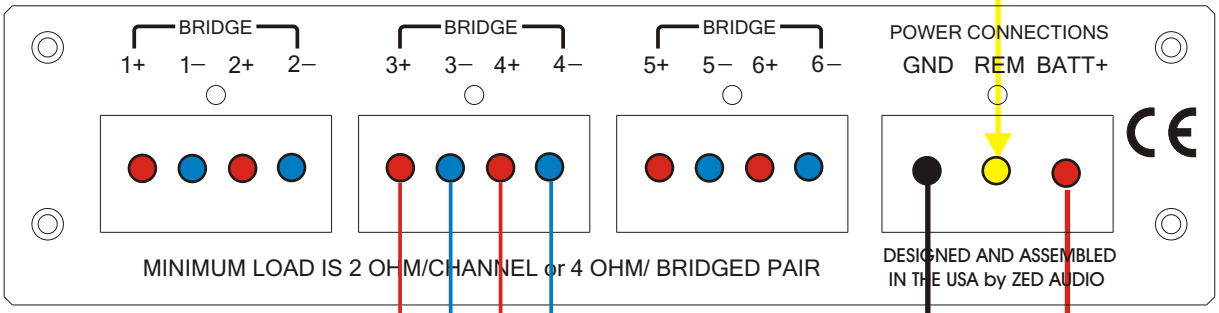


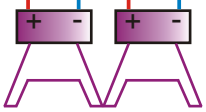

THE CONTROLS SHOWN IN GREEN
ARE APPLICABLE ONLY

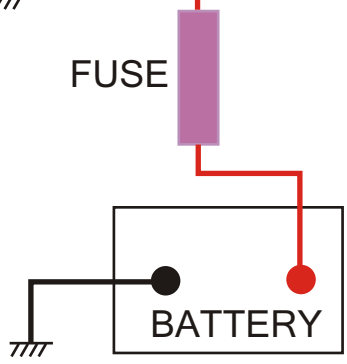
THESE TWO INPUTS ARE DRIVEN FROM AN
APPLICABLE SOURCE



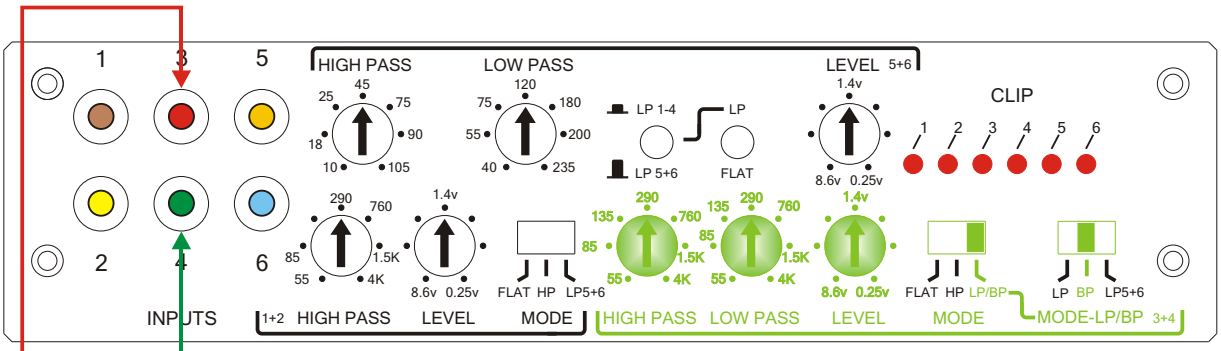

REMOTE >3v



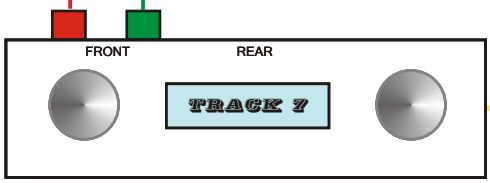


# LEVIATHAN with Chs 3+4 in band pass

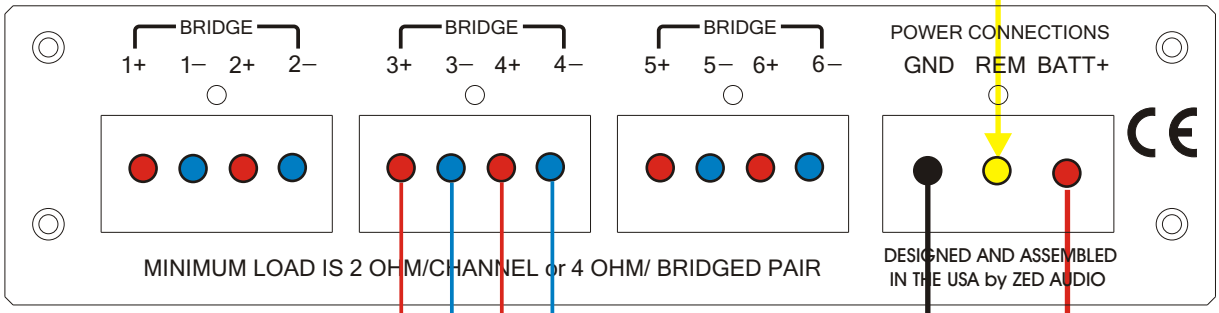


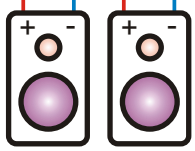

THE CONTROLS SHOWN IN GREEN
ARE APPLICABLE ONLY

THESE TWO INPUTS ARE DRIVEN FROM AN
APPLICABLE SOURCE

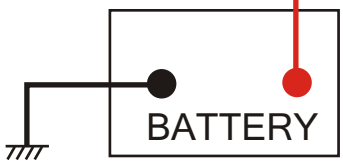



REMOTE >3v

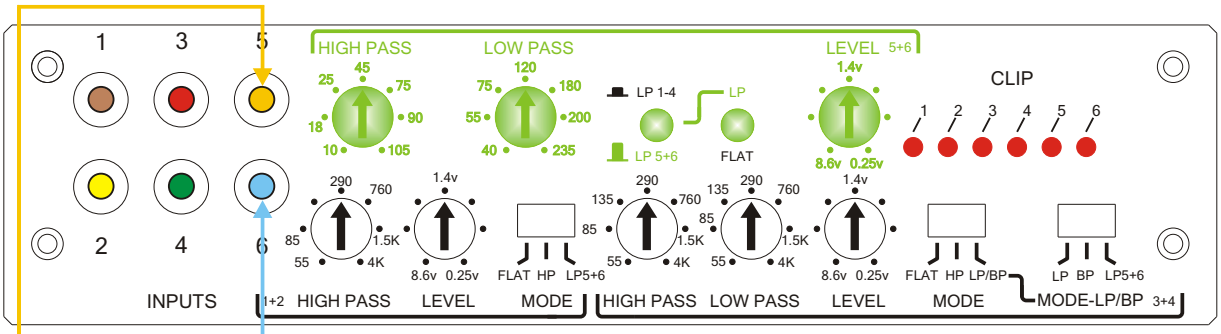


FUSE



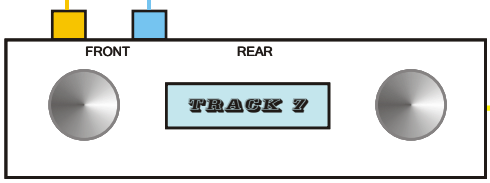
# LEVIATHAN with Chs 5+6 in low pass using 5+6 inputs



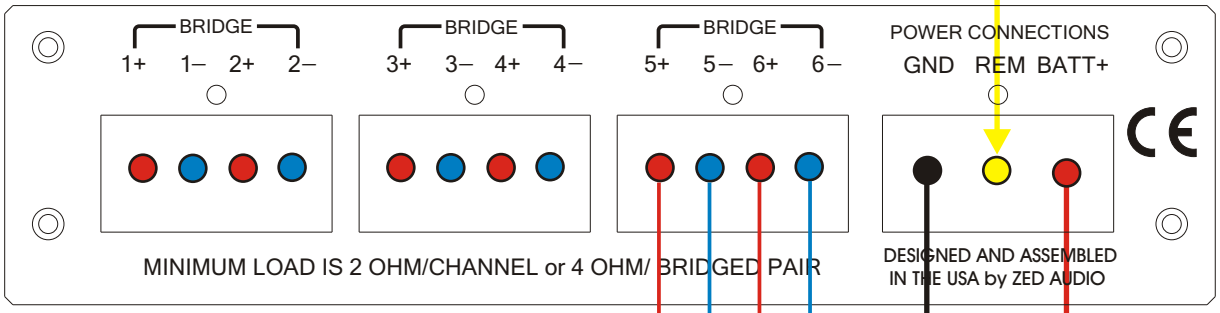

THESE TWO INPUTS MAY BE Y-ADAPTED AND THE CHANNELS RUN IN BRIDGE MODE

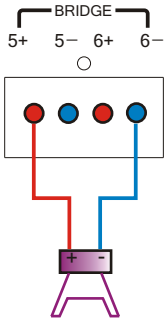
THE CONTROLS SHOWN IN GREEN ARE APPLICABLE ONLY

THESE TWO INPUTS ARE DRIVEN FROM AN APPLICABLE SOURCE




REMOTE >3v



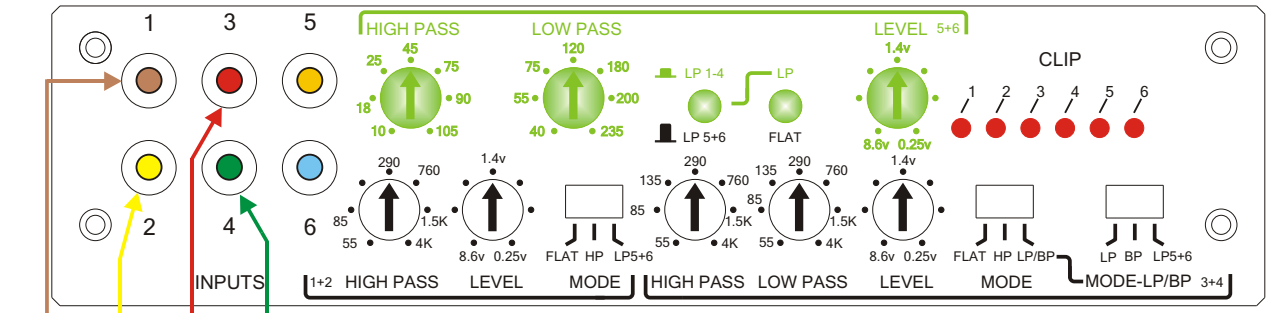




Chs 5+6 MAY BE RUN IN BRIDGE MODE (MIN SPEAKER IMPEDANCE IS 4 OHMS)

FUSE

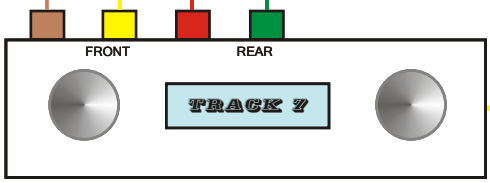
BATTERY

# LEVIATHAN with Chs 5+6 in low pass using INPUTS 1,2,3 and 4

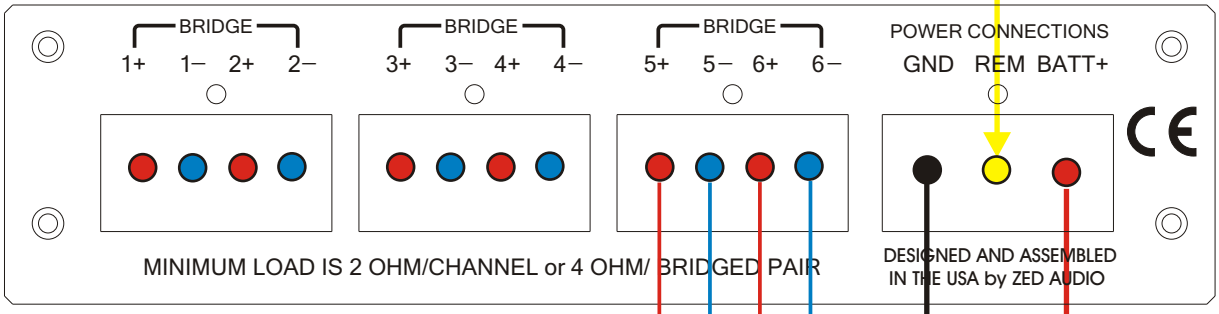


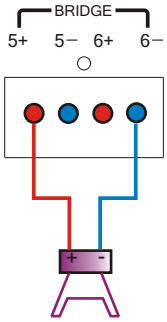

THE CONTROLS SHOWN IN GREEN ARE APPLICABLE ONLY

THESE FOUR INPUTS CAN BE DRIVEN FROM EITHER SEPARATE SIGNAL SOURCES (FRONT+REAR OUTPUTS FROM HU) OR FROM A MONO SIGNAL SOURCE

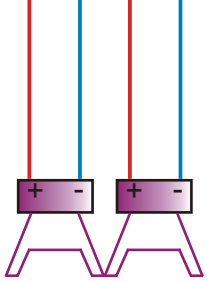



REMOTE >3v

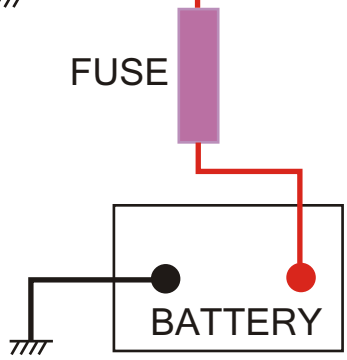


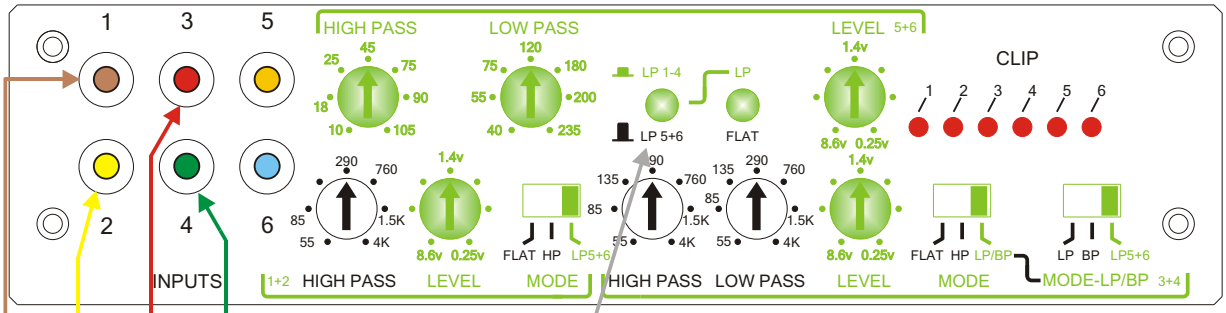

Chs 5+6 MAY BE RUN IN BRIDGE MODE (MIN SPEAKER IMPEDANCE IS 4 OHMS)



FUSE



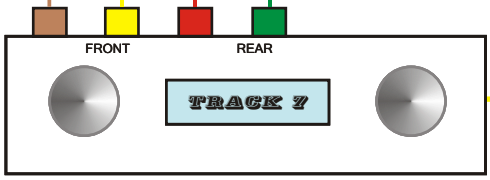
# LEVIATHAN with Chs 5+6 in low pass using inputs 1,2,3 and 4 and Ch 1,2,3 and 4 switched to LP5+6



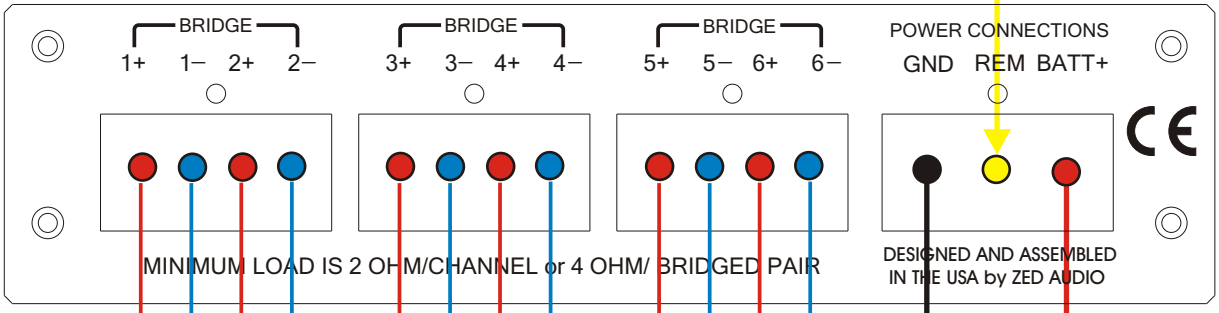

THE CONTROLS SHOWN IN GREEN ARE APPLICABLE ONLY

THESE FOUR INPUTS CAN BE DRIVEN FROM EITHER SEPARATE SIGNAL SOURCES (FRONT+REAR OUTPUTS FROM HU) OR FROM A MONO SIGNAL SOURCE

THIS DIAGRAM SHOWS LEVIATHAN AS A 6 CHANNEL SUB WOOFER AMPLIFIER DRIVEN FROM INPUTS 1-4. YOU MAY USE INPUTS 5+6 BY CHANGING THE POSITION OF THE INPUT SELECTOR ON Chs 5+6




REMOTE >3v

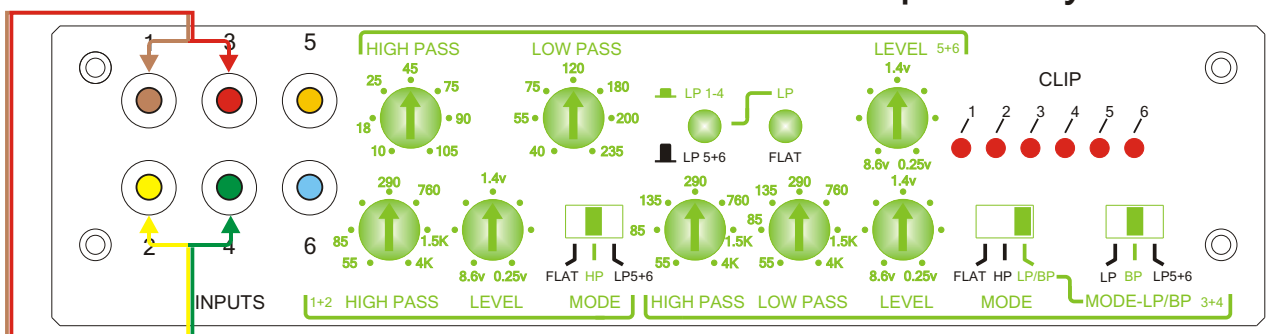



FUSE

BATTERY

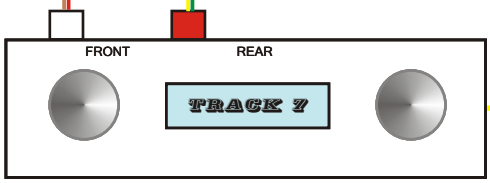
ANY PAIR OF CHANNELS MAY BE BRIDGED (MIN SPEAKER IMPEDANCE IS 4 OHMS)

# LEVIATHAN as a 2 channel tri-amplified system

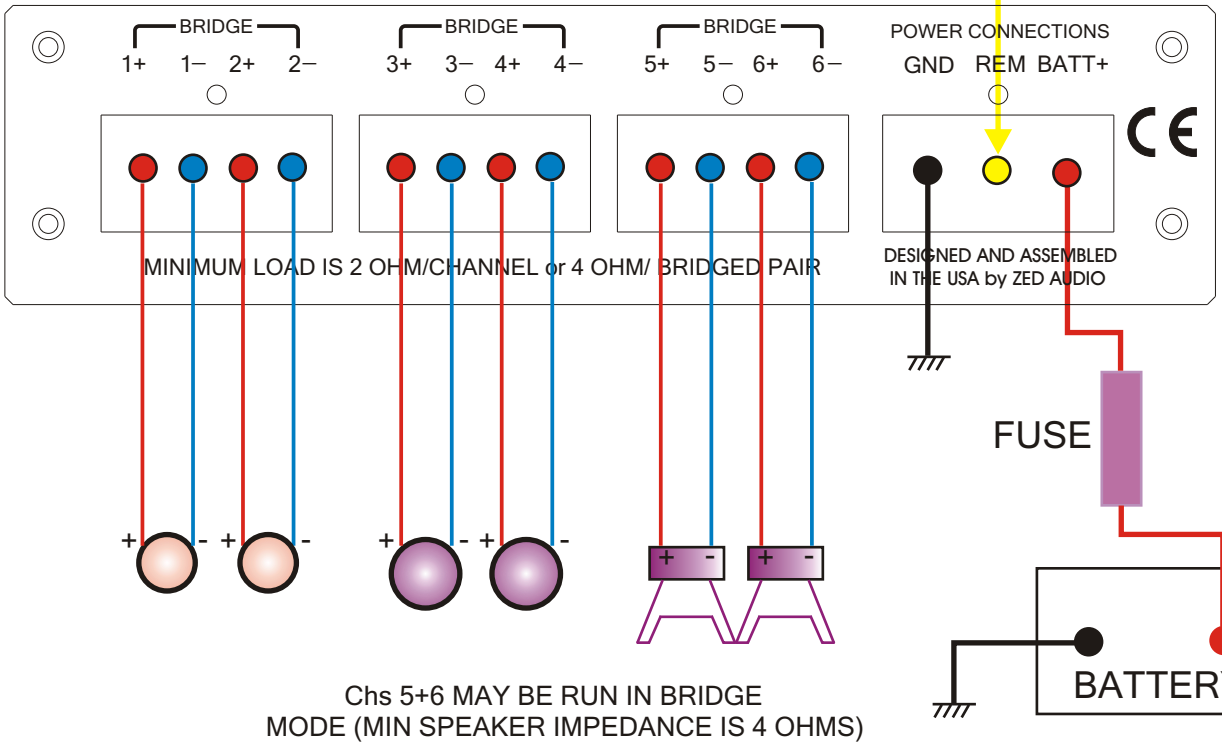



THE CONTROLS SHOWN IN GREEN
ARE APPLICABLE ONLY

THE 2 CHANNEL INPUT SIGNAL IS FED
THROUGH Y-ADAPTORS SO CHANNELS
1+3 ARE FED A LEFT SIGNAL AND 2+4 A RIGHT




REMOTE >3v

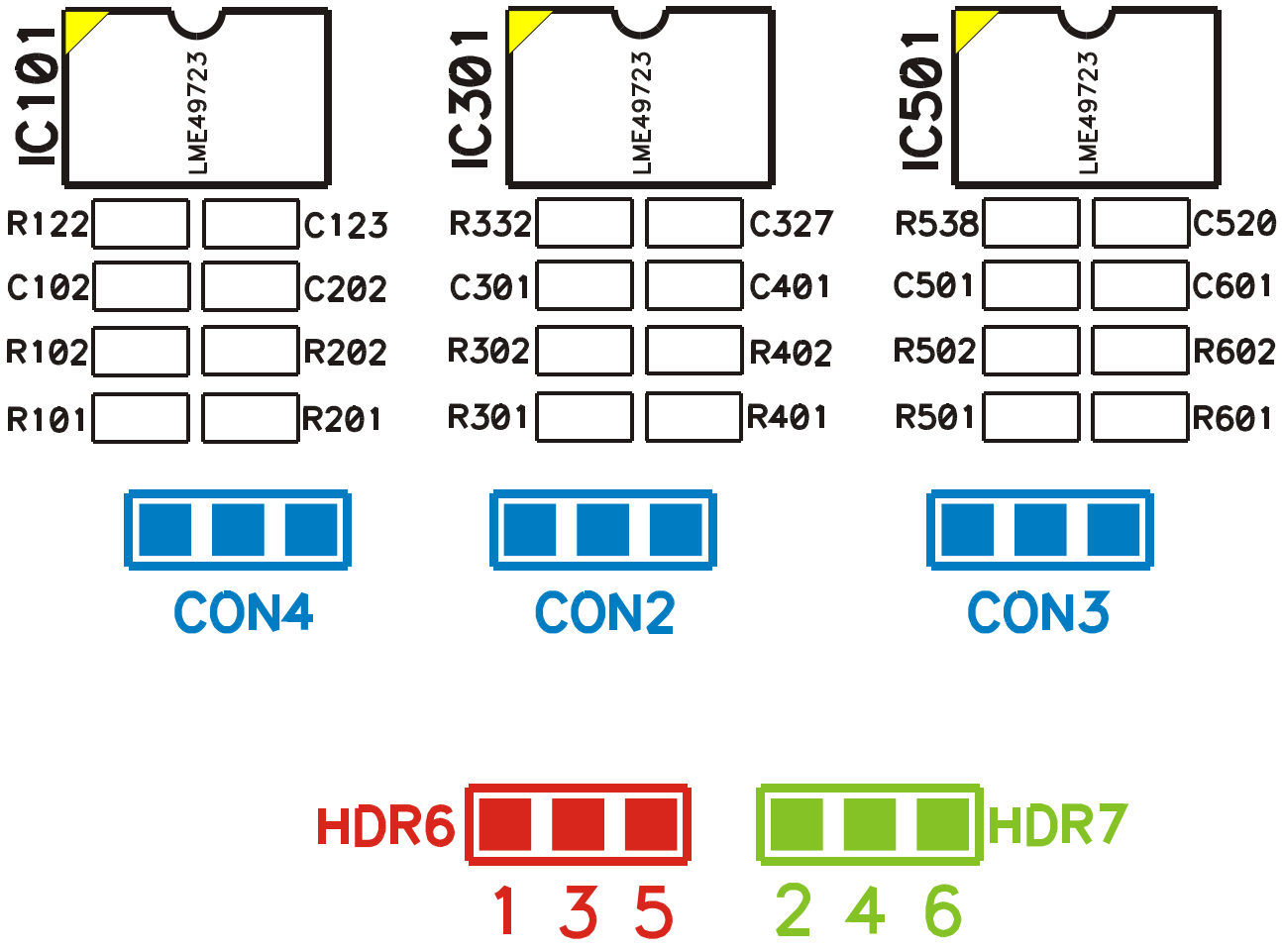



Chs 5+6 MAY BE RUN IN BRIDGE
MODE (MIN SPEAKER IMPEDANCE IS 4 OHMS)

**LEVIATHAN** jumper links to parallel the inputs instead of using external Y-Adaptors.

Remove the Lexan top and remove the three RCA connector plugs from the main PCB. These are plugged into connectors "CON4, CON2 and CON3" as shown below. When re inserting them they can only lock in in one direction.
HDR6 connects inputs 1 to 3 and 3 to 5 where HDR7 connects 2 to 4 and 4 to 6

These jumper links are available upon request



**RA** the Egyptian sun God was the inspiration behind this new product. He is considered the father of Gods, and was the most important and worshipped king of Gods in ancient Egypt..

We are sure that our humble version of RA will also be “worshipped”. It is truly a unique pre amplifier.

The purpose behind RA was to enable the user to have substantially more control over the sub woofer’s sound than just a simple remote volume control which is supplied with every mono block. These remote volume controls work in one of two ways, either a simple shunt potentiometer with the attendant problems of running low level audio up and down unshielded telephone cable. The second and more elegant way is to use a VCA (Voltage Controlled Amplifier) whose gain is varied by the application of a varying DC voltage. Thus only raw DC is run on the telephone cable. Unfortunately the VCAs used are noisy and have high distortion and the more exotic VCAs which perform well are never used owing to their high cost.

Another issue with these tethered remote volume controls is exactly that, they are tethered to their “mother” amplifier and cannot be used with a different manufacturer’s product.

Zed made a decision to design a stand alone remote which has no allegiance to any amplifier, it is universal. On board is a small switching supply which of course requires three wires (+12v, ground and remote) to power it. Our opinion is that the small inconvenience of having to run these three low current wires (#18 is quite sufficient) is well worth the results which **RA** will produce.

**RA** is a mono pre amplifier which receives a stereo signal and mixes it to mono. If desired a mono input may be applied to either the left or right inputs and the 6dB loss in gain due to the missing input may easily be made up by **RA** having extra built in gain. Alternatively a simple y-adaptor may be used to feed the signal to both inputs.

The first order of business once the signal is converted to mono is a 24dB/octave Linkwitz-Riley Low Pass crossover variable from 45Hz to 230Hz. We have included this crossover for one reason and that is if **RA** is used with an amplifier whose low pass crossover is not “up to snuff”.....well then **RA** will take over.

If the user decides to use the crossover in either the associated amplifier, signal processor or head unit all that is done is to set the low pass on **RA** to 230Hz which effectively removes it from the pass band.

Conversely if the user wants to use the crossover on **RA**, then the crossover on the amplifier, signal processor or head unit is turned up to its highest frequency or if a bypass switch is available to set it to the bypass position.

Once the signal leaves the low pass crossover it is routed to the Sub Harmonic Synthesizer. I bet that most have never heard of such a device but they are common in pro audio and have been made for car audio however in much simpler forms. The basic principle is to take a band of frequencies and synthesize them down to half their original frequency (one octave down). We have taken this one step further. The signal is fed into two separate filters, each tuned to a different frequency and these are individually synthesized and then via two level controls and a master level, the synthesized signals are mixed back with the original signal.

The two level controls at 32Hz and 45Hz may be set to suit the taste of the listener and then the master level sets the amount of synthesized signal mixed into the main signal path.  The effects of this are truly amazing.

The compressor follows and this to the best of our knowledge has never been incorporated in a car stereo product. Of course compressors are common fare in the pro audio industry. Owing to space limitations we were not able to include variable ATTACK, RELEASE and RATIO controls. Instead these parameters have been set for the band of frequencies which **RA** is processing, namely those below 100Hz. A variable THRESHOLD control is included with a front panel LED which flashes when compression begins.

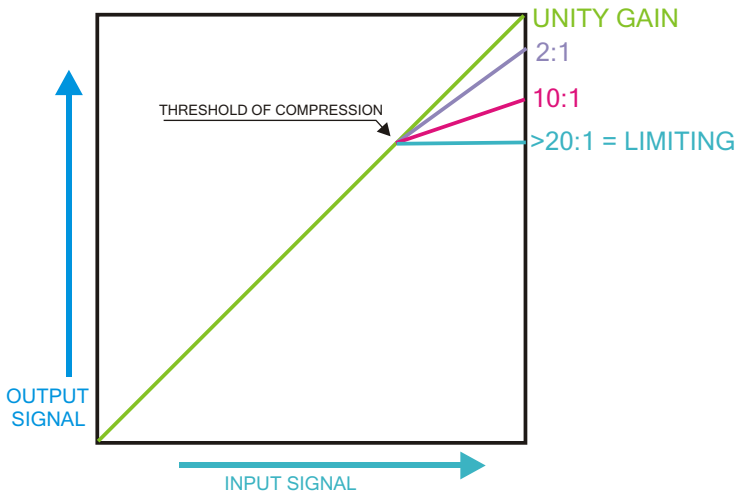
OK here is a short electronics lesson for those who want to know a little more about compressors.

Dynamic Range is the ratio of the specified maximum signal level capability of a system or component to its noise level; usually expressed in decibels. Human hearing has a very high dynamic range. A human is capable of hearing anything from a quiet whisper to the sound of the loudest jet aircraft. The difference can get to over 100 decibels (a factor of 10,000,000,000 in power!) If we want to reduce this dynamic range we use a downward compressor (commonly called a compressor). The compressor will “kick in” at a specified signal level determined by the THRESHOLD control. At this level the compressor will prevent the output level from increasing linearly with increasing input level.

On the next page is a graph showing the relationship between the input signal and the output signal. With the compressor out the ratio is 1:1 meaning that if the gain structure of the device is say 5x, put in 0.1v get out 0.5v, put in 1v get out 5v and so on. (No you cannot put in 10,000v and get out 50,000v)! If the gain structure was 1x, then put in 1v and get out 1v. The graph shown shows a 1x (unity gain) structure.

With say a ratio of 4:1 means that a signal that would be 4dB above the threshold is reduced to 1dB above by the compressor.

The THRESHOLD control on RA does not control the absolute level but only the signal level which enters the side chain of the compressor.




The ATTACK time determines how quickly the compressor can react to signals which are above the threshold. The RELEASE time determines how quickly the compressor releases the signal and return to normal gain. The RATIO control sets the ratio of input level to output level and typically compressors have ratio controls with ranges from 2:1 up to 12:1 dependent on the type of signal being compressed. **RA** also uses RMS sensing of the signal to control the compressor. Peak sensing is typically used in limiters (A limiter is just a compressor with a higher ratio setting and different attack and release times.

RA uses a hard “knee” at the compression threshold point meaning that compression instantly takes place and this form is best for low frequencies and percussive instruments such as drums.

Another use for this compressor is to prevent amplifier clipping from damaging the woofers and also to protect the amplifier. Setting the volume level to the loudest that you want, set the THRESHOLD control on **RA** so that the compressor LED flashes regularly.

The last control is the VOLUME control and this of course sets the level of the sub woofers. It also controls the “make up gain” required by the compressor so that even though the compressor is set to compress, the gain can still be increased but in a compressed mode. Remember that the final signal level reaching the speakers is also controlled by the level setting on the amplifier and that is why we include CLIPPING LEDs on all our amplifiers.

**RA** can be mounted in two ways, first by having a cut out in a panel which is slightly larger than the X-Y dimension of the chassis and the front panel is then bolted to the mounting surface. The second is to use the two mounting brackets and hang **RA** from a horizontal surface - or it may be mounted in a glove box with the mounting brackets forming a stand.

Please take care when playing your system at high volume levels as hearing loss is NON REVERSIBLE.

# Instructions for setting the Threshold control of the compressor.

The compressor's threshold control is relatively easy to set as long as one understands the various electronic "blocks" involved. Please read the following text carefully.

RA can be considered simply as a pre-amplifier, with variable gain (the front panel volume control) and a compressor circuit whose threshold has nothing to do with the amplifier which drives the sub woofers or where the gain setting is on the amplifier. The threshold control's setting is entirely dependent on the output level of the head unit (HU). It is not affected by the volume control of RA.

In this example setting the volume level on the HU to some arbitrary level will send a signal of say 0.4v on musical peaks from the HU to RA. Whether the Sub Harmonic Synthesizer is used or not does not affect this example. RA will amplify this signal by 12dB (4 times) to a level of 1.6v peak. The compressor's threshold control now uses this 1.6v peak signal to activate the compression system and the threshold control simply acts as a "volume" control for the compressor. It takes the 1.6v signal and depending on the setting of the threshold control instructs the compressor to activate and begin compressing the signal. Only when the RED LED on the front panel turns on does compression begin. The volume control on the front panel simply controls the output level of RA.

Now we must set the amplifier's level control so that all the parts work together.

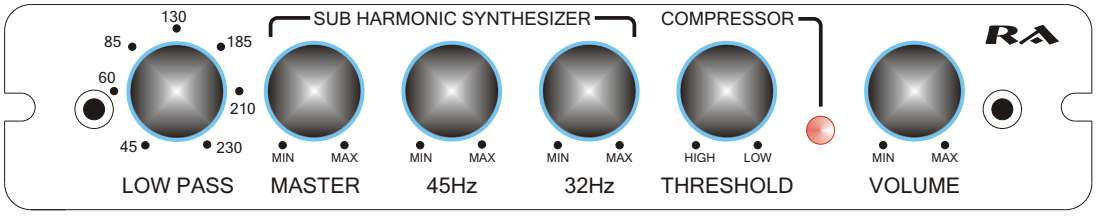
All Zed amplifiers have LEDs on their front panel to indicate that the amplifier channel is clipping. Our mono blocks have four LEDs set at 0dB (rated power), -3dB (half rated power), -6dB (one quarter rated power and -9dB (one eighth rated power).

In our example we have decided to have the compressor come in at say -3dB. How do we set up the various controls....easy!

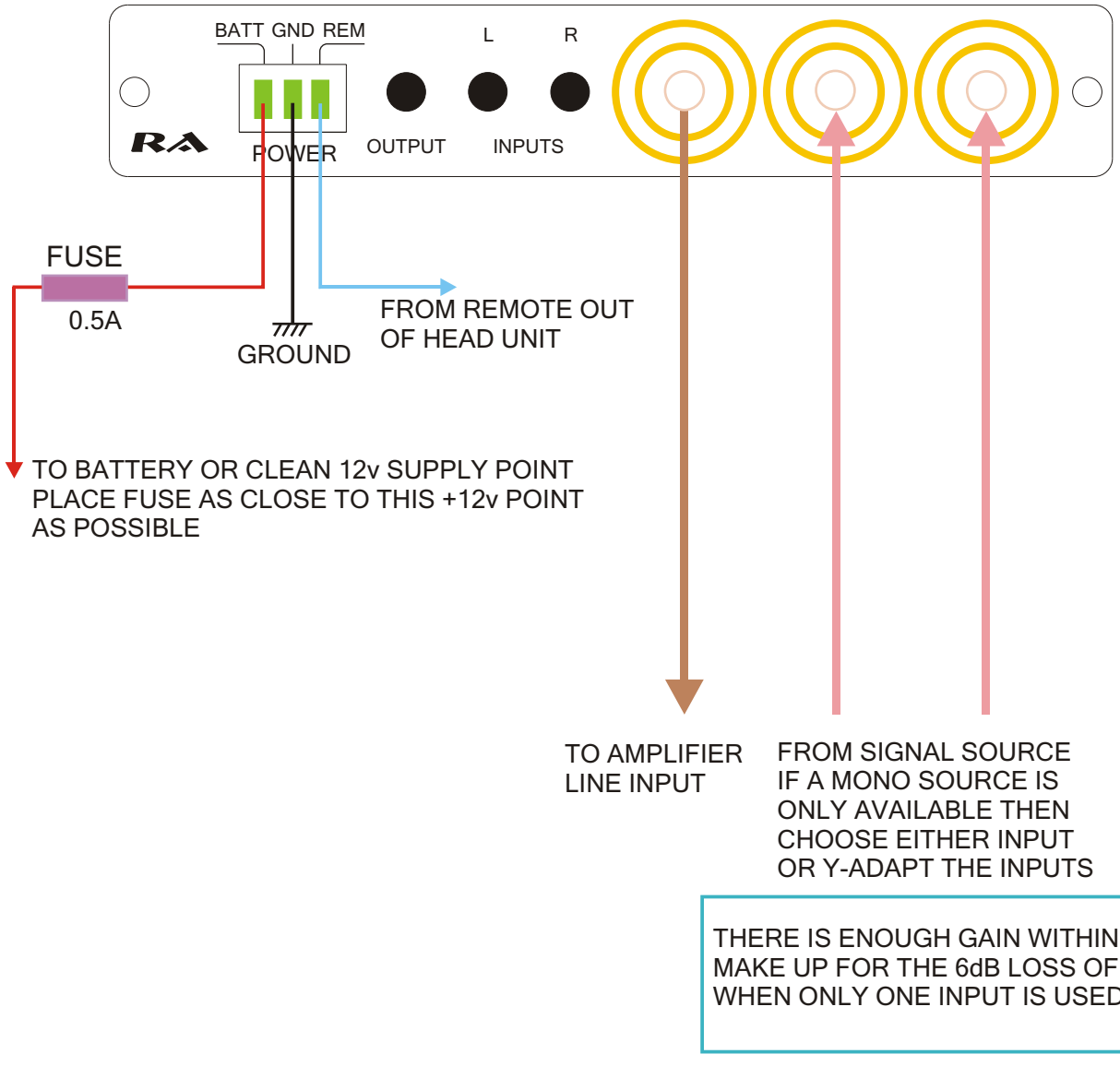
With NO compression set the Hu's volume control to the highest level you are comfortable with (suggestion about 85% of the maximum). Do the same with the volume control on RA. Now set the level control on the Zed mono block to a level where the -3dB LED is just lighting on the loudest musical peaks of your favourite bass CD. Now set the threshold control that the RED LED on the front panel turns on at these loudest musical peaks. If you want some extra compression (tighter bass) advance the threshold control so that the LED lights more often or even stays solidly lit (lots of compression).

If you set the level control on the amplifier so that the 0dB LED lights and you use the compressor, the net result is twofold, you have compression and you prevent the amplifier from clipping.

# RA Panel controls and connections




We feel the panel controls require no further explanation



Some suggested systems using various combinations of Zed amplifiers.

4 way using a **MINOTAUR** and a **LEVIATHAN**:
The **LEVIATHAN** is used for the lower mids (ch 5+6), upper mids (ch 3+4) and tweeters (ch 1+2), **MINOTAUR** is used for the sub woofers.

4 way using **DRACONIA** and **DREADNOUGHT**:
The **DRACONIA** is used for tweeters (ch 1+2), midrange (ch 3+4), **DREADNOUGHT** runs the lower mids (ch 1+2) and subs are handled by ch 3+4.

4 way using **DRACONIA** and **DRACONIA** or **DREADNOUGHT** and **DREADNOUGHT**:
As above but use the same amplifier type.

3 way using a **MINOTAUR** and either a **DRACONIA** or **DREADNOUGHT**:
**MINOTUAR** runs the subs, channels 3+4 of the four channel amplifier runs the mids and the channels 1+2 the tweeters.

High powered 3 way using two **LEVIATHANS**:
Each **LEVIATHAN** is run with channels 1+2 and 3+4 bridged for the tweeters and midrange (Yes over kill for the tweeters) and channels 5+6 bridged on each amplifier into either an 8 or 4 ohm sub.

Front stage only system using either **DRACONIA** or **DREADNOUGHT**:
Channels 1+2 drive the front component speakers and channels 3+4 run the subs in either two channel or bridged mode.

Medium or high powered multi sub woofer system using either **DRACONIA**, **DREADNOUGHT** or **LEVIATHAN**:
Many of our customers want to run multiple subs where each sub is not necessarily the same impedance or even make of driver.
**LEVIATHAN** - inputs to channels 5+6 only, set channels 1+2and 3+4 to “LP 5+6” on their respective MODE switches. ALL 6 channels will then follow the settings of channels 5+6 but LEVEL controls are independent for each channel pair.
**DRACONIA** or **DREADNOUGHT** - Set the MODE switch on ch 1+2 to the “3+4” position and set channels 3+4 to run in LP/BP on the slide MODE switch and to “SUB” on the push MODE switch.

**RA** may be used as a line level interface before any amplifier (or channels of a multichannel amplifier) which is being used for sub duty.

## Troubleshooting

| | |
|---|---|
| Amplifier will not power up. | Check for battery power at amplifier's power terminals.<br>Check for voltage at REMOTE terminal must be greater than 3 volts<br>Make sure protection LED is off. If it is on, turn the amplifier off for 5 seconds and then power up again. If LED comes on Again refer to notes below. |
| Amplifier gets hot | The amplifier is OK if you can keep your hand on the chassis with no discomfort.<br>Make sure the speaker impedance is correct. |
| High "hiss" heard in speakers | Remove the RCA plugs from the amplifier.<br>If hiss disappears the problem is the source.<br>Set the amplifier's level control as insensitive as possible.<br>It is best to drive the highest signal level from the head unit as possible. The higher this signal level the better the subjective S/N ratio is. |
| Protection LEDs flash | Remove speaker connections from amplifier.<br>Turn amplifier off for 5 seconds.<br>Turn on again, if LED is off the problem is with the speakers. Check for shorts on the cables and on each speaker.<br>If the LED comes on, the amplifier is faulty. |
| Engine noise | Check spark plug wires.<br>Check that RCA cables run away from power cables.<br>Use only high quality RCA cables. |
| Alternator whine | Check grounding of head unit.<br>Run head unit's +12 connections directly to the battery +12v terminal.<br>Make sure all ground connections are rust free.<br>Check that RCA cable grounds are not shorted to the chassis in their run from the amplifier to the head unit.<br>Disconnect the RCA cables from the amplifier.<br>If whine disappears the problem is upstream. |
| Sound is distorted | Check RCA cables for shorts<br>Check speakers and cables<br>Check amp level is matched to that of head unit. |

# Limited Warranty

This Zed Audio product is warrantied to the ORIGINAL purchaser against defects in material and workmanship from the factory. This warranty is for a period of 90 days from date of purchase from Zed Audio Corporation or an authorised dealer. This warranty is valid in the country in which it was purchased and is non-transferable. To obtain the two (2) year warranty requires the user to register the product with Zed Audio Corp. This registration must be mailed to us at the address on page 39 OR a scan of the information can be done and emailed to us at zedaudio@aol.com. Please refer to this registration form on the last page of this manual. You may print that page and use it to send to us.

This warranty covers only the product purchased from Zed Audio Corporation and does not cover damage to any other associated equipment or the vehicle(s) in which the equipment is/was installed.

This warranty does NOT cover damage due to incorrect installation, faulty or bad equipment associated with the installation.
This warranty does NOT cover any charges associated with removing the equipment from the vehicle.
If this product is tampered with or altered in any way by unauthorized personnel, or the serial number is removed/altered/defaced the warranty is null and void. There are NO exceptions to this.

To obtain factory service under the terms of this warranty, the purchaser must contact Zed Audio Corporation or an appointed service centre to obtain a Return Merchandise number which shall be issued by Zed Audio Corporation or an authorized agent. No product shall be accepted without this number. A copy of the original purchase receipt must be included with the product. This procedure must be followed otherwise the product shall NOT be repaired under warranty. There are NO exceptions to this.

Product returned for repair either out of warranty or if no receipt is included shall be charged at the current hourly rate.

Equipment returned under warranty shall have the return freight prepaid by the service centre. Any freight and insurance costs in sending the product in for service is the responsibility of the end user.

Equipment returned out of warranty shall have the return freight and insurance charges added to the cost of the service bill.

All incoming equipment is carefully inspected before any service or repair is attempted. The condition of the equipment is noted on the invoice. Please make sure that you pack your unit well before sending it back for repair/service.

All warranty claims shall be decided at the discretion of Zed Audio Corporation or an appointed representative.

Zed Audio Corporation reserves the right to make changes and/or improvements upon it's products. We do not assume any obligation to install such changes and/or improvements to existing equipment previously manufactured.

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## 30 day return policy

Zed Audio Corporation offers a money back guarantee for any of the products described in this manual. This 30 day money back guarantee has the following stipulations attached:

**The product must be returned with a copy of the original sales invoice.**
**The 30 day period is calculated from the date of shipment + 5 days.**
**The full purchase price shall be refunded less the original freight amount.**
**For any damaged or missing parts on the amplifier, including packaging materials the replacement thereof shall be deducted from the refund amount including the labour to replace these parts.**
**Amplifiers cannot be returned for reasons other than non performance of the amplifier.**

**PLEASE READ THIS CAREFULLY**

Please retain all packaging materials and documents in case the product is returned for a refund.
Zed Audio is not responsible for the freight from the consumer to Zed Audio when our refund option is exercised.

Every product built by Zed Audio goes through a series of exhaustive tests and so we are 100% sure that each and every product meets the advertised specifications. Please have a qualified person check the installation if for some reason there seems to be something not functioning correctly, or feel free to contact us and we shall attempt to solve the problem.

# REGISTRATION FORM

Name of owner:

Address:

Name of product(s) purchased:

Serial number:

Name and address from whom this product was purchased.

Date of purchase

Please do not forget to mail a copy of the retail invoice OR scan it an email to us.

If you are mailing us your registration, you may print a copy of this page

# New products scheduled for May/June release

**MINOTAUR** our 1,000w mono block will be joined by the 2Kw (2 ohm) version. **MEGALITH** or as we may call it **PTERODACTYL** will offer the same features as the **MINOTAUR**. A pair of these in bridge mode will deliver 2Kw into an 8 ohm load or 4Kw into a 4 ohm load. The amplifier will of course be a full range class D and for those who require some extra “oomph” for their tweeters this amplifier will be the ideal solution!

The amplifier section is a newly designed class D with servo control. It uses high voltage low gate charge MOSFETs and high speed control chips for low distortion and wide bandwidth.

The TUBE hybrid amplifier is the long awaited ultra high end offering from Zed.

Rated at 100w per channel x 4 at 4 ohm with an option to run 100w x 4 at 8 ohm (Yes a four channel) it will feature a fully tubed front end with High and Low Pass crossovers on channels 1+2 and 3+4. It will thus accommodate multi way systems of any type depending on how many amplifiers are used. The range of each crossover will be from 60Hz to 6KHz each crossover having a range switch so more accurate settings can be achieved. So in the x1 mode the crossovers vary from 60Hz to 600Hz and from 600Hz to 6KHz in the x10 mode.

The level controls for each pair of channels are multi-ganged types for both input overload and signal to noise control. These two controls are of the shunt type and are thus never in the direct signal path.

All the mechanical switches use silver plated contacts and of course the RCA connectors are our standard solid gold plated brass with teflon inserts.

The solid state power amplifiers are a radically new design which we have developed over the past year or so.

The power supply is by necessity complex owing to the many supply rails required for this amplifier.

The name is being kept secret until the launch date.