

# *Zenith*

## **10K4 2.5kW Amplifier**

### **User Manual**



**Order code: AMP80**

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## 2 APPROVALS



This equipment conforms to the requirements of the EMC directive 89/336/EEC, amended by 92/31/EEC and 93/68/EEC and the requirements of the Low Voltage Directive 73/23/EEC, amended by 93/68/EEC.

Standards applied: EMC Emission EN55103-1, E3  
EMC Immunity EN55103-2, E3, with S/N below 1% at normal operation level.  
Electrical Safety EN60065, Class I

## 3 WARNINGS

### 3.1 Explanation of graphical symbols



The lightning symbol within a triangle is intended to alert the user to the presence of un-insulated "dangerous voltage" within the amplifier's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to humans.



The exclamation point within a triangle is intended to alert the user to presence of important operating and service instructions in the literature accompanying the product.

#### 3.1.1 WARNING



To reduce risk of fire or electric shock, do not expose this apparatus to rain or moisture.

#### 3.1.2 CAUTION



To reduce the risk of fire or electric shock, do not remove screws. No user-serviceable parts inside. Refer servicing to qualified service personnel

### 3.2 Important safety instructions

Before using your amplifier, be sure to carefully read the applicable items of these operating instructions and the safety suggestions



1. Keep this manual for future reference.
  2. Heed all warnings.
  3. Follow all instructions.
  4. Do not use this unit near water.
  5. Do not spill water or other liquids into or on the unit. Do not operate the amplifier while wet or standing in liquid.
  6. Clean only with dry cloth.
  7. Do not block the air intake or exhaust ports. Install the unit in accordance with the instructions.
  8. Do not operate the amplifier near heat producing devices such as radiators, heat registers, stoves or other apparatus that produce heat. Always operate the unit with the chassis ground wire connected to the electrical safety earth. Do not defeat the safety purpose of a grounding-type plug. A grounding type plug has two pins and a third grounding prong. The third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
- 
9. Connect only to AC power outlets rated 200-240 V, 50-60 Hz.
  10. Do not use this amplifier if the power cord is broken or frayed. Protect the power cord from being walked upon or pinched particularly at the plugs and the point where it exits from the apparatus.
  11. Only use accessories specified by the manufacturer.
  12. The unit is intended to use in a 19" rack. Follow the mounting instructions. When a rack on wheels is used, use caution when moving the loaded rack to avoid injury from tipping over.
  13. Unplug this apparatus during lightning storms or when unused for long periods of time.
  14. Do not connect an amplifier output in parallel or series with any other amplifier's output. Do not connect the amplifier output to any other voltage source, such as battery, mains source, or power supply, regardless of whether the amplifier is turned on or off.
  15. Do not run the output of any amplifier back into another channel's input.
  16. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way such as:
    - ▶ Power-supply cord or plug is damaged.
    - ▶ Liquid has been spilled into the unit.
    - ▶ An object has fallen into the unit.
    - ▶ The unit has been exposed to rain or moisture.
    - ▶ The unit does not operate normally.
    - ▶ The unit was dropped or the enclosure is damaged.
  17. Do not remove top or bottom covers. Removal of the covers will expose hazardous voltages. There are no user serviceable parts inside and removal may void the warranty.
  18. An experienced user shall always supervise this professional audio equipment, especially if inexperienced adults or minors are using the equipment.
  19. The mains plug is used as the disconnect device and shall remain readily operable. If mounted in a 19" rack causing the mains plug not being readily operable, the mains plug for the entire rack must be readily operable.



### 3.3 User responsibility

#### 3.3.1 Mains connection grounding (earthing)



Your amplifier must be connected to an earthed socket outlet.

#### 3.3.2 Speaker output hazard



Power amplifiers are capable of producing hazardous voltages. To avoid an electric shock, do not touch any exposed speaker wiring while the amplifier is being operated. The external wiring connected to the speaker terminals should be installed by a qualified person or ready-made leads or cables of appropriate capacity should be used.

#### 3.3.3 Radio interference.



As the amplifier outputs produce high voltages, do not connect or disconnect speaker cables when the mains power is on. Also attach the safety cover on the speaker terminals for safe operation and to comply with electrical regulations.

This product uses radio frequency energy and if not used or installed in accordance with these operating instructions, may cause interference to other equipment, such as radio receivers. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the antenna.
- Increase the separation between the equipment and receiver.

- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

- Consult your dealer or an experienced radio/TV technician for help.

#### 3.3.4 Speaker damage



This amplifier is very powerful and can be potentially dangerous to both loudspeakers and humans alike. Many loudspeakers can be easily damaged or destroyed by overpowering, especially with the high power available from a bridged amplifier.

Always check the speakers continuous and peak power capabilities.

Even though the amplifiers front panel attenuators can be used to reduce the gain, it is still possible to reach full output power if the signal level is high enough.

#### 3.3.5 Maintenance

For safe operation and long-term reliability, the front panel dust filters as well as the inside of the amplifier should be cleaned out at regular intervals. If the dust filters and inside the amplifier are not maintained there could be safety reliability risks. There is also a risk that the amplifier will malfunction since the amplifier is dependent on a constant airflow from front to rear. If the dust filters are not cleaned and the amplifier malfunctions, any resultant problems will not be covered by the warranty.

## 4 WELCOME

### 4.1 Introduction

Thank you for choosing the Zenith 10K4 Amplifier for your sound reinforcement system. We are confident that you will be pleased with the performance, configuration flexibility, reliability, and long-term durability offered by Zenith products.

This manual provides a comprehensive guide to the features and functionality of 10K4 amplifiers. Please read through it to become fully acquainted with the many configuration options and multiple layers of protection circuitry. To facilitate timely installation and use of this 10K4 product, we have included a Quick Guide Overview (section 6). This brief summary, in conjunction with Installation (section 5), contains the basic information needed to safely install the amplifier and place it in service. However, we highly recommend reading through this manual in its entirety, beginning with Main Features and Technologies and continuing through Operation and Performance.

The power amplifier of 10K4 builds on the foundation with the same sonic signature - powerful, tight bass and transparent high frequency response. In addition, the 10K4 amplifiers establish new benchmarks for extremely high power and channel density.

### 4.2 Main features

The 10K4 amplifier incorporates a number of sophisticated technologies to ensure the best possible performance and many years of reliable operation. Familiarising yourself with these technologies will prove invaluable in setting up and optimising your loudspeaker system.

- **CPL**, (Current Peak Limiter) ensures that the amplifier's Output does not exceed the safe current handling parameters of amplifier components.
- **Temperature protection** is designed to protect the amplifier from damage through excessive heat.
- **VHF**, (Very High Frequency) protection circuits mute the output of the amplifier when non- dynamic continuous signals above 10KHz are detected.
- **DC protection** ensures destructive DC signals will not appear at the amplifier outputs. If such conditions occur an internal fuse opens and fault indication is displayed.
- **Low-impedance** (short circuit) protection provides a fault warning indication and shuts down the output stage when, for example, an input signal is present and a malfunctioning cable or driver is short circuiting the output.

- **High-impedance** warning reports an alert when, at the same time, output signal is high and no current draw is measured. This situation might occur when no speakers are connected, or when a driver is blown.

- **Low inrush current** ensures that the mains breaker will not trip when several power amplifiers are turned on simultaneously.

#### 4.2.1 Class TD amplifier and Regulated Switch Mode Power Supply (R.SMPS)

Class TD technology combines the efficiency of a Class D amplifier with the high sonic quality associated with Class B designs. Class TD also incorporates the same basic concepts behind Class H designs, but here they are refined and pushed to a higher level to achieve greater efficiency.

The Class TD output sections work with Zenith, Regulated Switch Mode Power Supply (R.SMPS) to create a superior overall power amplifier topology. R.SMPS ensures stable, full output power over an extremely wide range of mains voltage levels. Sagging or fluctuating mains voltage will not affect the power output delivered to the loudspeakers.

#### 4.2.2 Amplifier gain structure

For greater flexibility in system Integration, 10K4 amplifiers allow gain adjustment from +23dB to +44 dB in 3dB steps. This feature accommodates any combination of input device and loudspeaker type. For example, if the input signal is weak, the gain can be boosted to maintain maximum power output while avoiding a poor signal-to-noise ratio.

#### 4.2.3 Voltage Peak Limiter (VPL)

The Voltage Peak Limiter (VPL) feature allows user adjustments that determine maximum voltage output, thus matching the amplifier to the connected speaker load. Regardless of load impedance, the VPL feature can be set to ensure that neither temperature nor current limitations are exceeded before reaching the desired voltage threshold.

#### 4.2.4 Protection and performance optimisation

Appropriate and reliable power amplification is vital to any audio system. Inadequate or faulty power amplification could cause damage to the loudspeakers or in some cases to the power amplifiers themselves. To prevent any damage or costly service interruptions, 10K4 amplifiers offer advanced features to protect both internal circuits and any connected loads. These features even protect the mains fuse that, in extreme cases, could be overloaded.

#### **4.2.5 Amplifier hot swap modules**

The 10K4 amplifier is equipped with Hot Swap module technology. The output modules may be removed and replaced without the need to power down the amplifier.

#### **4.2.6 2Ω load overheat protection**

In the situation the amplifier is used to power 2Ω loads, the internal monitoring system will reduce the output power automatically to prevent amplifier overheat.

## 5 INSTALLATION

### 5.1 Unpacking

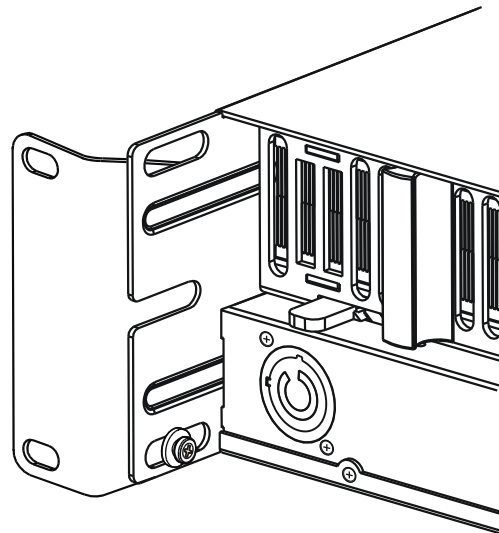
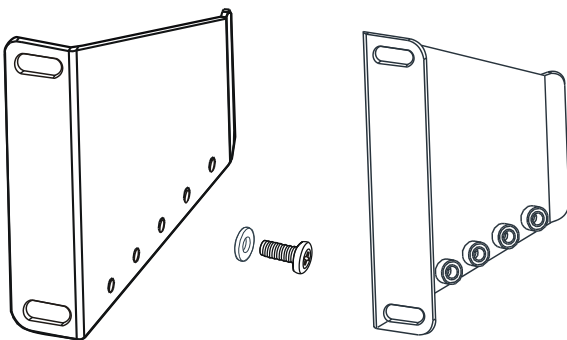
Carefully open the shipping carton and check for any noticeable damage. The 10K4 power amplifier is tested and inspected before leaving the factory and should arrive in perfect condition. If any damage is discovered, please notify the shipping company immediately. Only the consignee may institute a claim with the carrier for damage incurred during shipping. Save the carton and packing materials. Should you ever need to ship the amplifier, always use the original packaging materials.

### 5.2 Mounting

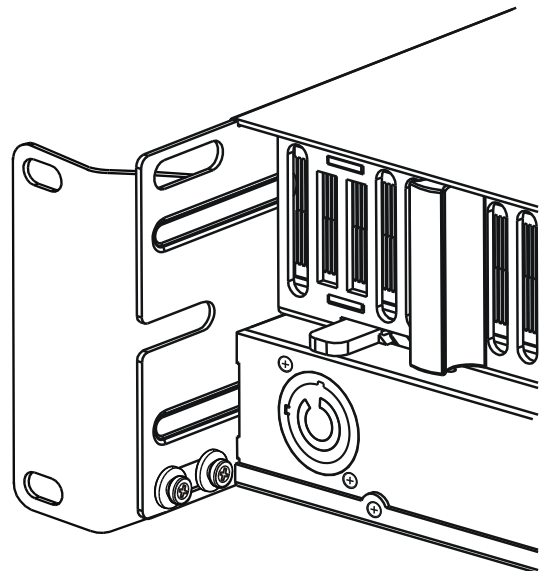
Free airflow from front-to-rear of the amplifier must be possible. Therefore, no doors or rack-lids should be mounted in front of or behind the amplifiers. Amplifiers may be stacked directly on top of each other. There is no need for spacing in between units, though this might enable more convenient installation of cabling on the rear panel. It is recommended that rear supports be mounted for maximum long-term stability. Rear support brackets are included.

#### 5.2.1 Rear support bracket

2 rear support brackets are included with the amplifier.



Alternative 1:  
Use screw and washer for fixed installation.



Alternative 2:  
Use two screws and washer for fixed installation.

## 5.3 Cooling

The amplifier uses a forced-air cooling system with airflow from front to rear, maintaining a low operating temperature within defined limits. Front-to-rear airflow is preferred as cooler air is present at the front in nearly all applications. (This allows higher continuous power levels without encountering thermal problems.) Never attempt to reverse the airflow. The amplifier modules require a pressure chamber between the fans and heat sink, and this effect functions only in one direction.

Make sure that there is an adequate air supply in front of the amplifier, and that the rear of the amplifier has sufficient space to allow the exhaust to escape. If the amplifier is rack-mounted, do not use covers or doors on the front or rear of the rack.

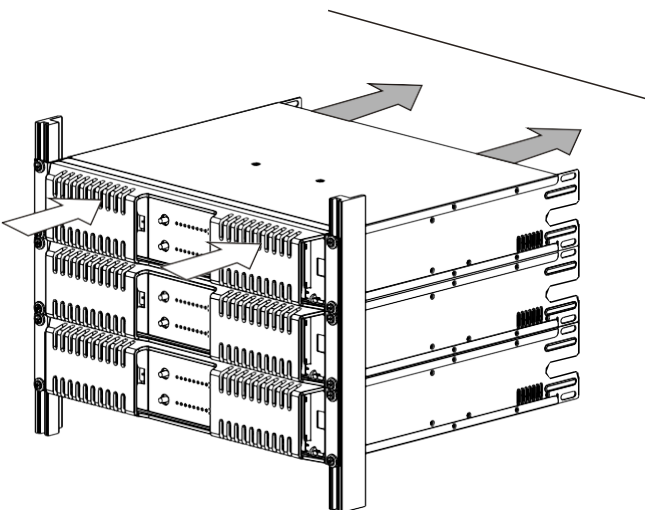
Should a heat sink overheat, the temperature sensing circuits will mute the overheating channel. If the power supply overheats, another sensing circuit will mute all output channels until the power supply cools to safe operating temperature. An early warning before shut down will be indicated on the front panel LEDs.

Always make sure that the dust-filters behind the detachable front panel are clean to ensure maximum possible airflow.

- If the amplifier malfunctions due to dirty dust filters, any required repairs are not covered by the warranty.
- The horizontal stacked, suggest the tail exhaust outlets up or to the vents.

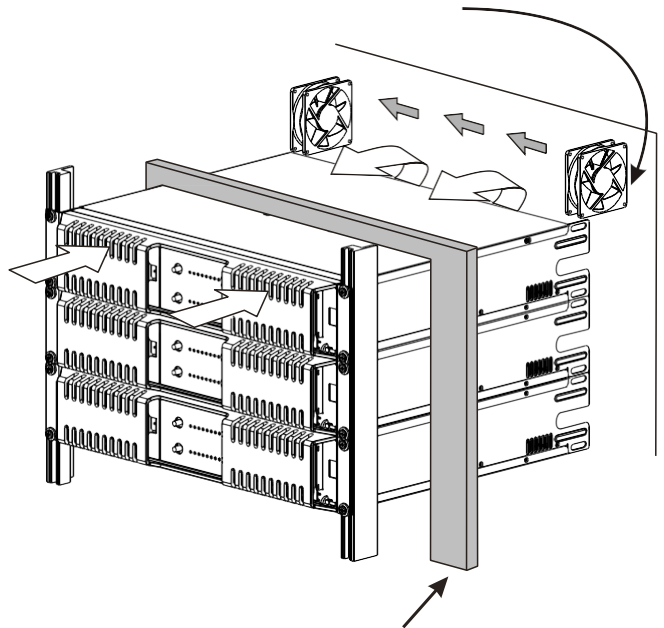
### 5.3.1 Rack installation

To prevent thermal overload, the following guidelines should be followed.



### 5.3.2 Ventilation

The 10K4 amplifier draws cool air in via the front panel and exhausts via the rear. Care should be taken to install away from devices with the opposite airflow direction.



- For installed rack systems or touring racks with enclosed rear panels, additional forced exhaust ventilation should be utilised.

## 5.4 Operating voltage



The label placed to the right of the mains cable on the rear of the amplifier indicates the AC mains voltage for which the amplifier is wired and approved: 230V. Connect the power cable only to the AC source type referred to on the label. The warranty will not cover damage caused by connecting to an incorrect type of AC mains.

10K4 switch mode amplifiers use primary switching. Because the mains power is rectified directly before the transformer, the amplifier is insensitive to mains frequency. It may be connected to 50 or 60Hz sources, and actually will operate on line frequencies from DC to 400Hz.

10K4 amplifiers use PowerCON mains input connections. If the power plug mounted at the factory is not appropriate for your country, it can be removed and the proper connector wired in its place as follows:

### Wire distribution:

Brown	LIVE
Blue	NEUTRAL
Green and yellow	EARTH (GROUND)



If you are not 100% confident of your competence to replace the mains plug, engage qualified personnel to do the job.

Once a suitable AC supply is connected, the amplifier can be turned on using the front panel power switch. The amplifier then goes through a soft-start. The fans will blow at high speed before dropping to idle, and the power, LED will illuminate.

Inrush power is controlled and limited during soft-start, enabling multiple amplifiers to be powered up simultaneously.

## 5.5 Grounding (earthing)

There is no ground lift switch or terminal on the 10K4 amplifiers. The signal ground is always floating, via a resistor, to chassis and therefore the grounding system is automatic.

In the interests of safety, never disconnect the earth (ground) pin on the AC power cord.

Use balanced input connections to avoid hum and interference.

# 6 QUICK GUIDE OVERVIEW

## 6.1 Front panel overview



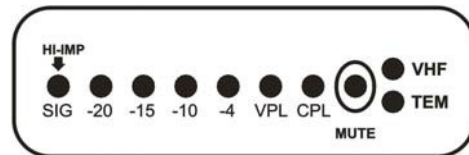
The amplifier's front panel presents the performance and fault condition indicators, power and remote switches, and a removable dust-filter cover. Level potentiometers provide individual attenuation for the amplifier channels. Range is 0dB to - infinity. (The 12 o'clock position indicates -10dB attenuation.) A convenient label strip with writing surface is provided adjacent to each level potentiometer.

To remove the dust-filter covers, loosen the thumbscrews located underneath the front handles. This allows removal of the dust-filters for cleaning. The covers may be made tamper resistant by replacing the thumbscrews with Philips head or safety Torx screw. Thread size is M3.

- The amplifier never should be operated without the dust-filters in place.

### 6.1.1 Front

The front panel LED area includes the following indicators per channel:



**VHF** - Very High Frequency protection active (output muted) (Red constant)

**TEM** - Temperature mute (Red constant)

**MUTE** - Channel muted due to a fault condition (Red)

**CPL** - (yellow constant with output muted):

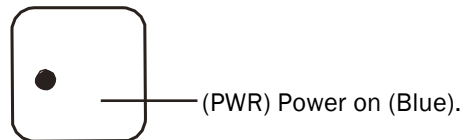
Low impedance/short circuit detection fault

**VPL** - Voltage Peak Limiter (VPL) active

**SIG** - Signal levels - 40dB (Sig) to -4dB

**HI-IMP** - High-impedance/open load detected (Re

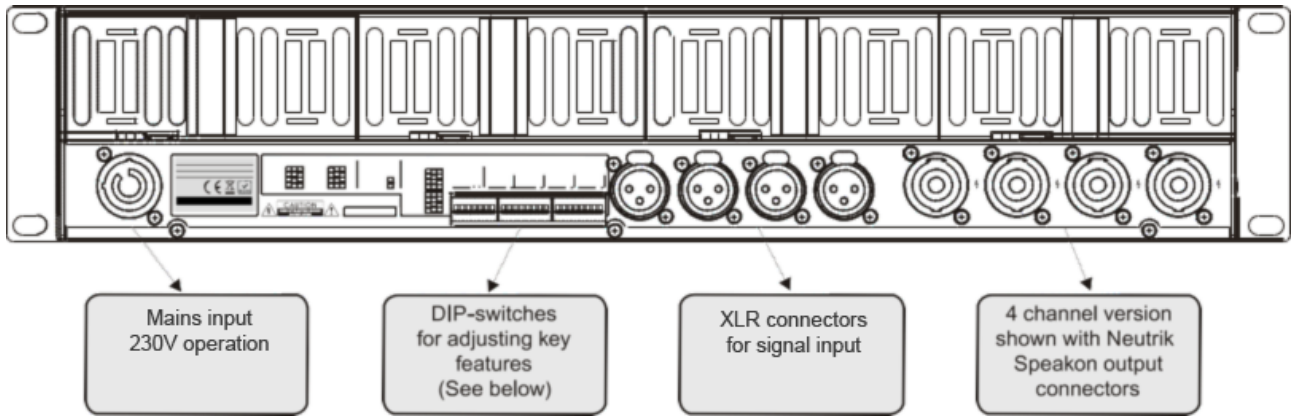
- When no VPL, CPL or PAL indicators are illuminated, and the VPL DIP-switch is set to maximum at the specified nominal load, the amplifier channel is able to deliver maximum rated output power.



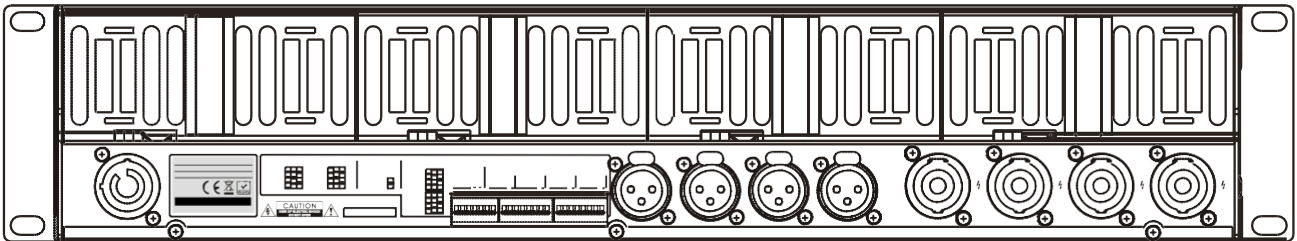
- It's normal for the LED to illuminate "BLUE" during power on.



## 6.2 Rear panel overview



Rear view of four-channel model fitted with SpeakON connectors

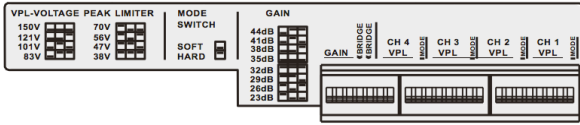




### 6.2.1 Configuration section

The 10K4 amplifier has selectable VPL values.

### 6.2.1 The DIP-switch features



The following features may be adjusted using the DIP-switches on the rear panel of the amplifier.

**Gain** - Globally set for all channels, from +23dB to +44 dB in 3dB steps.

**Fan masked** - When on, engages the intelligent fan feature; fan speed is lowered when no signal is present.

**Bridge A+B and C+D** - Switches the channel pairs into bridge mode operation an automatic - 6dB gain compensation is applied.

**VPL** - The Voltage Peak Limiter provides optimum peak voltage settings for each channel. Eight discrete levels are selectable.

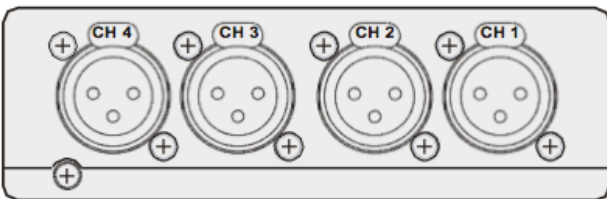
10K4	
VPL	VPL in Bridge Mode
150 V	300 V
121 V	242 V
101 V	202 V
83 V	166 V
70 V	140 V
56 V	112 V
47 V	94 V
38 V	76 V

**Mode** - Select VPL mode to either Hard or Soft operation. For channels driving sub-woofers and low-frequency drivers, it is recommended to use the hard setting for optimal operation. For mid and high frequency drivers, always select soft.

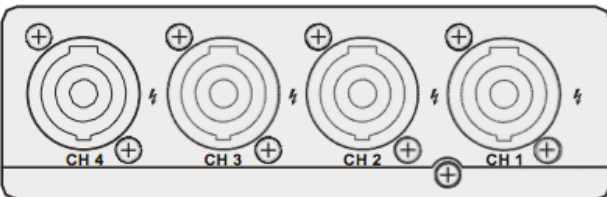
### 6.2.3 Input and output connectors

The amplifier of 10K4 is equipped with balanced XLR-F input connectors. SpeakON output connectors (SP). For specific configuration and wiring information, see section 7.4.

**Input connectors** - Audio inputs – four channel models



**Output connectors** - SpeakON outputs – four channel models



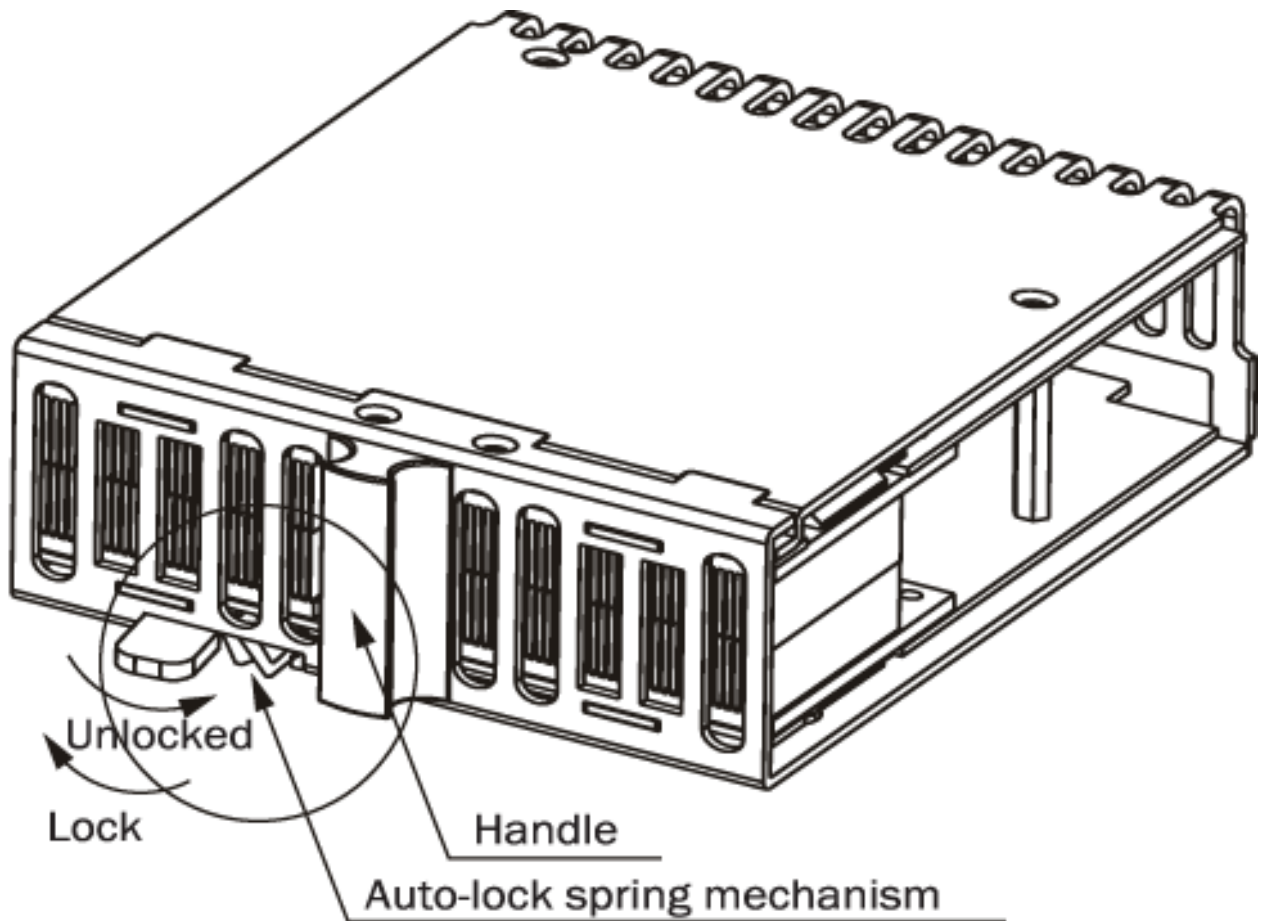
### 6.3 Changing the amplifier hot swap modules

**Push in:**

Move the plug in/out bar to the handle (right side), and then push into the bottom of slot directly. It's only can be used after an indicative sound from the auto-lock switch that means the module is positioned. (It is very important to make sure that the module has been pushed in completely.)

**Pull out:**

When need to pull out the module, stirring the plug in/out bar to the handle (right side), the module will draw out from the position automatically, and then pull out the module easily and simple.



- Change modules one at a time. Do not repeatedly insert/remove the modules.

# 7 OPERATION AND PERFORMANCE

## 7.1 Introduction

The following sections provide comprehensive information on amplifier connection, setup, operation, and performance. The detailed information included here is essential to realising the full functionality of the 10K4 amplifiers.

## 7.2 Operation precautions

- Make sure that the power switch on the amplifier front panel are set to off before making any input, output, and also before manipulating the DIP-s w itches on the rear panel.
- Make sure that the AC mains voltage is correct and matches the voltage printed on the rear panel of the amplifier (230V).
- Make sure that no signal is present at the input to the amplifier when powering up. An input signal could produce an unintentionally loud initial volume from the speakers.

## 7.3 Signal flow and headroom

### 7.3.1 Signal flow block diagram

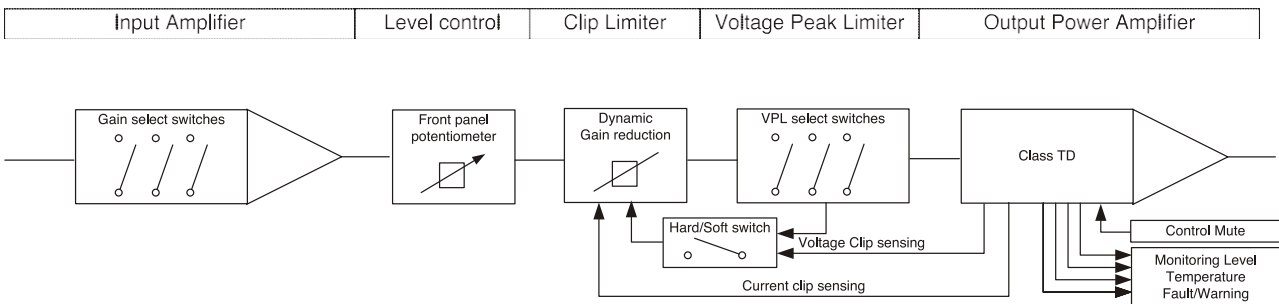
The input stage of 10K4 amplifiers has a high sensitivity to provide ample system headroom. This in effect means that the input stage is almost impossible to clip.

Overall amplifier input gain is adjusted using the input stage DIP-switches. Please note that the gain setting is global, affecting all channels. Following the input stage, the dedicated level control on each channel allows signal attenuation from 0dB to minus infinity.

The Current Peak Limiter (CPL) section dynamically limits the input signal based on three parameters: sensed current level, feedback from the output stage, and sensed voltage clip from the VPL (and output amplifier voltage clip if soft clip is activated). This ensures that power output is maintained within the design limits of the amplifier.

The adjustable Voltage Peak Limiter (VPL) sets the maximum output voltage and therefore also the maximum output power. Eight different voltage stages are available using the DIP-switches on the rear panel of all models.

The sophisticated output section monitors faults and generates appropriate warnings, which are displayed on the amplifier front panel. In the rare event that conditions are extraordinarily severe, the amplifier will shut down until the fault or problem setting has been rectified or adjusted. These sensing circuits are also employed to feed back voltage and current level information, via a side chain, to the limiters. Sensing circuits also transmit local amplifier module temperature and power supply temperature to the appropriate protection mechanisms. Read the Protection, Faults and Warnings section for further details.



### 7.3.2 Headroom, sensitivity and VPL/Gain settings

The input amplifier and limiter system is designed to accommodate extremes of performance. Typically, exceeding maximum input by much as +10dB will only result in a 1% increase in distortion. The following schematics illustrate how the adjustable VPL and Gain circuitry affect input sensitivity and output power.

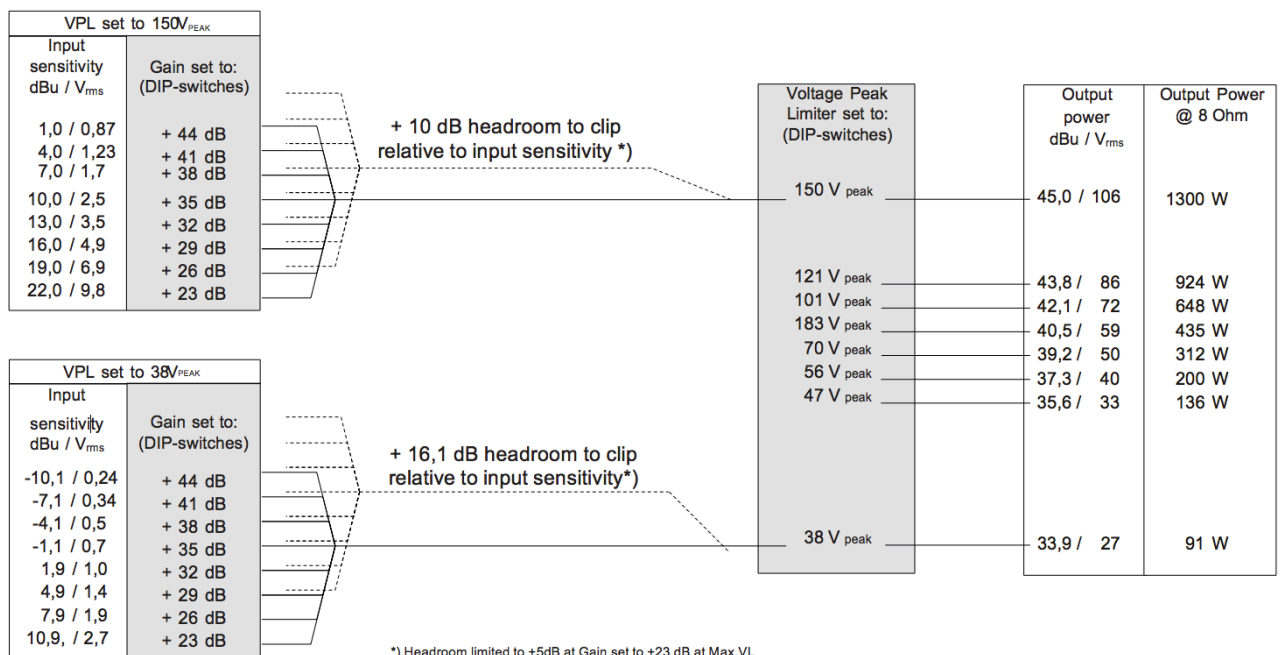
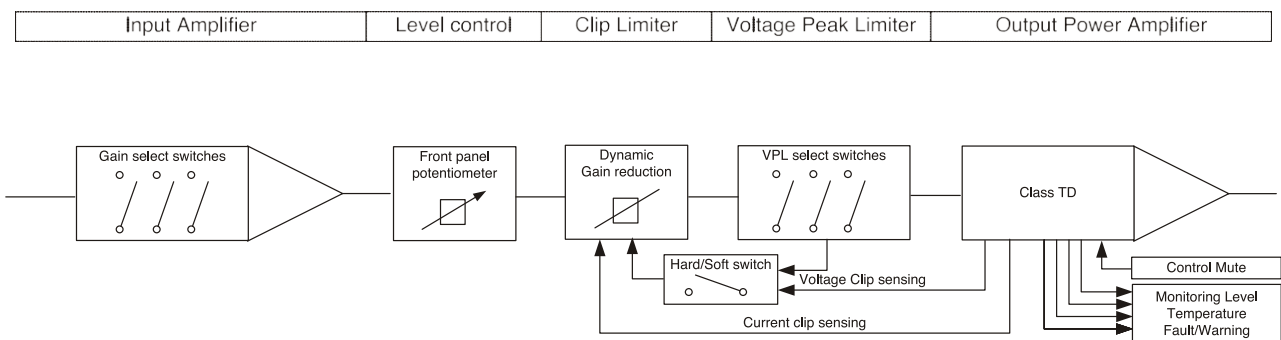
The chart to the follow of the drawing below show input sensitivity for a 10K4 with a 8Ω load and 150V peak (max.) and 38V peak (min.) respectively for the eight different gain stages between +23dB and +44dB. The resulting output power is displayed in dBu, Vrms and watts in the tables to the far right.

- The headroom available through the input stage to the clip limiter is shown by the dotted lines as +10 dB at 150V peak and +16.1dB at 38V peak. These lines illustrate the additional signal level that can be accepted at the input before any significant distortion will appear at the input stage.

- If you use the level potentiometer in the signal chain to reduce the level by an amount greater than the headroom relative to input sensitivity, and you drive the amplifier to clip level, you are in danger of clipping the input stage before the current or voltage peak limiters are activated.

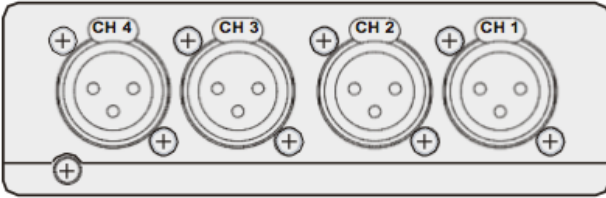
- When bridging two channels, you must add +6dB to the input sensitivity to achieve maximum output voltage due to the automatic - 6dB gain compensation inserted by the amplifier.

10K4 VPL and GAIN settings



## 7.4 Audio input and output

### 7.4.1 Balanced input connections

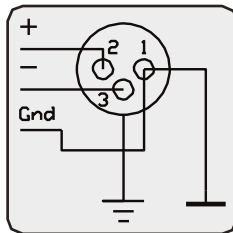


Audio inputs – four channel models

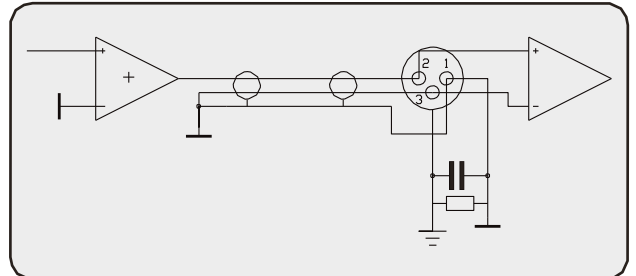
The XLR input connectors are electronically balanced, and wired according to the IEC 268 standard (pin 2 = hot). XLR input connectors should be wired as follows:

Pin 1	Ground/Shield
Pin 2	Hot (+)
Pin 3	Cold (-)

- When linking the same source signal to several input channels, be aware that there is a limit to the number of channels an output source can drive. A typical output source (e.g. a DSP crossover unit) can drive up to four amplifier channels before external line-drivers might be required to buffer the signal.



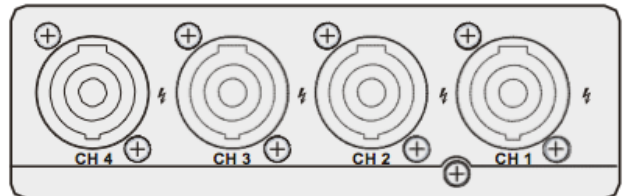
### 7.4.2 Unbalanced input connections



To connect an input to an unbalanced source, it is possible to connect pins 1 and 3 in the XLR plug at the amplifier end of the cable. However, a better method is to connect pin 3 to the shield at the source end of the cable, as this usually results in better hum and noise rejection. Balanced input connections are recommended whenever possible.

### 7.4.3 SpeakON output connections

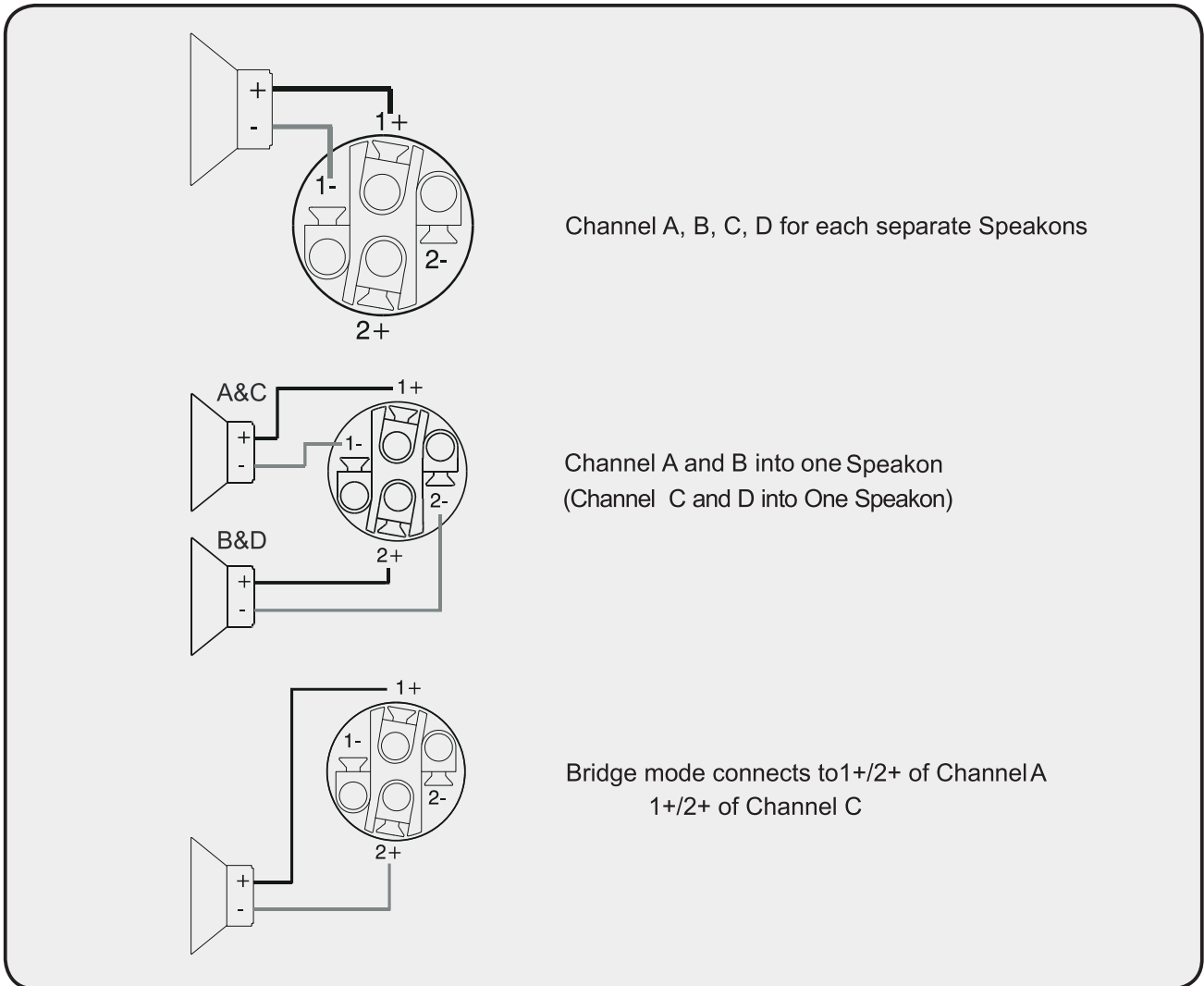
Amplifier is equipped with the Speakon output connectors.



SpeakON inputs – four channel models

**Four channel amplifiers** - Four -channel amplifiers are wired in the following manner. The right SpeakON connector, Channel A+B, provides outputs for both Channel A and Channel B. This output is useful when wiring the amplifier for bridged mono operation. See section 7.4.6. The left SpeakON connector provides an output for Channel B only.

Connect the + and - loudspeaker cables as shown in the illustrations below.



- Never connect an output terminal to ground, or to any other input or output. Observe relative loudspeaker polarity: loudspeakers connected in reverse polarity will exhibit degraded performance, particularly in bass frequencies, and may be damaged as a consequence.

- Use a high quality stranded loudspeaker cable, and keep cable runs as short as possible.

#### **7.4.4 Output bridge mode**

When bridged, the input source must be connected to input A (A+B) or C (C+D) respectively. Output SpeakON cables must be connected to the bridge on channel 1+/2+ of channel 1 and 3+/4+ of channel 4.

The main benefit of bridging the output is a doubling of output voltage. Bridging can be used to turn a four-channel by 10K4 amplifier, for example into a three-channel amplifier with 2 x 1300W and 1 x 4200W at 8 ohms or 2 x 2100W and 1 x 5000W at 4 ohms

Most power amplifier designs, when bridged, automatically introduce a +6 dB input gain boost which can lead the user to conclude that said amplifier delivers more than double the power when in bridge mode. This is clearly not the case, as the gain boost artificially enhances perceived power at the cost of headroom. The 10K4 amplifiers work on globally set constant gain, and automatically compensate the input gain by -6dB. For example, if the amplifier is configured in a three-channel mode, then the selected gain is maintained from input to output on all channels.

#### **7.4.5 Amplifier gain**

The amplifiers of 10K4 feature adjustable input gain. This versatility enables the amplifier to accommodate a multitude of system configurations with various input sources and speaker layouts.

Amplifier gain is set globally for all channels. The range is +23dB to +44dB in 3dB steps. Individual channel fine level adjustment is available using the potentiometers on the front panel.

The unique adjustable input gain feature of the 10K4 amplifier makes it easier to attain the optimum balance between headroom and signal-to-noise ratio in the signal path. A weak signal at the input might require the gain to be raised in order to achieve maximum output power with the lowest signal-to-noise ratio. A hot input signal, however, would require a lowering of the gain to avoid sending the amplifier into Voltage or Current clipping. See Appendix to review the table containing Gain versus VPL setting implications for input sensitivity and output power. Bridge mode operation automatically compensates by -6dB, keeping all channels at the same gain.

##### **7.4.5.1 Channel gain level (front panel pots)**

Individual channel gain (level) may be adjusted using the potentiometers located on the front panel. Range is from 0dB to infinity. The attenuation is -10dB.

- If the level control is used to attenuate to a lower level than the headroom relative to input sensitivity AND the amplifier input is driven into clip, there is a danger of clipping the input stage before the current or voltage peak limiters are activated.

##### **7.4.5.2 Amplifier sensitivity**

Sensitivity is defined as how many Volts (rms) or dBu (referred to 0.775V rms) are required to achieve full (maximum) output power. As the output power varies with the load impedance, 4 ohms is usually the common reference. Since the 10K4 amplifiers are capable of providing multiple maximum output power levels through use of the VPL feature, many sensitivity calculations may be required for a single amplifier.

### 7.4.6 Output Voltage Peak Limiter (VPL)

Voltage Peak Limiter (VPL) is a unique feature in 10K4 amplifiers. It is used to select the maximum power available on each output channel. VPL levels are set using the rear-panel DIP-switches; eight level positions are offered.

10K4	
V <sub>peak</sub>	V <sub>rms</sub>
150	106
121	86
101	72
83	59
70	50
56	40
47	33
38	27

The values for VPL are displayed as maximum Voltage Peak. To translate Voltage Peak into Vrms, you must divide the Voltage Peak values by 1.41 (see table). The VPL allows you to set the correct maximum output peak power for optimum performance with the connected speakers. The correct setting depends on the system type and the specific load connected to the channel. Since each channel can be configured to deliver either very high voltage peak power OR high current draw at low-impedances, it is important to set the VPL correctly.

If you choose a lower VPL setting, you only reduce the maximum output voltage. At the same time, this allows more current headroom for low-impedance loads. The amplifier thus runs at higher efficiency, with a significantly reduced risk of going into thermal protection.

### 7.4.7 Output Current Peak Limiter (CPL)

The Current Peak Limiter (CPL) ensures that the amplifier will not be damaged by forcing the amplifier to deliver current levels to the outputs that exceed the physical limits of the transistors. The CPL keeps the amplifier within the Safe Operating Area (SOA.)

The CPL is non-adjustable and has different limit values depending on model type.

CPL activity is indicated by illumination of an orange LED for each channel on the front panel.

A steadily illuminated orange CPL LED (with MUTE illuminated) indicates a short circuit situation (or very low impedance). The output will mute for 6 seconds before measuring the output impedance again. This will continue until the short circuit is fixed, at which time the output will automatically unmute. An input signal must be present to allow detection of short circuit or low-impedance conditions.



The problem can be solved by checking the input and output cables and examining the state of the loudspeaker load. If there is no short circuit present, then the condition may be rectified by lowering the VPL or input levels.



## 7.5 Protection, faults and warnings

### 7.5.1 Introduction

The 10K4 amplifier incorporates a sophisticated and comprehensive set of protection features. Faults and warnings are indicated on the front panel and reported.

### 7.5.2 Safe Operating Area Detector (SOAD)

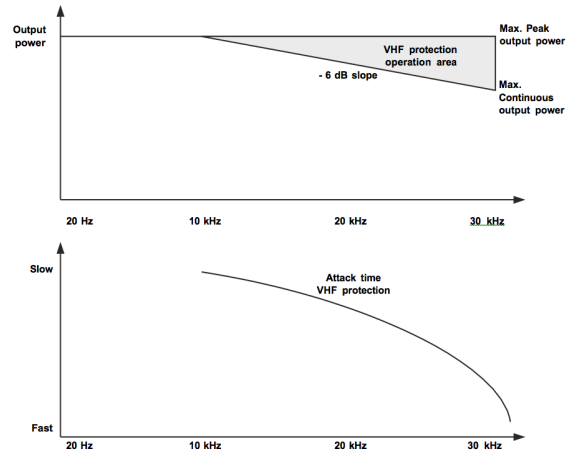
The Safe Operating Area Detector (SOAD) compares output voltage against output current to ensure that the output transistors are working inside their safe. The SOAD provides fault monitoring and input to the Current Peak Limiter (CPL). The SOAD has no dedicated indicator, and its operation is revealed only in conjunction with features such as the CPL.

### 7.5.3 Very High Frequency (VHF) protection

The 10K4 amplifier includes protection circuits that detect continuous Very High Frequency content in the input signal. The detection begins at approximately 10KHz and moves upwards to include ultrasonic signals. If VHF signals are detected, output will mute for 6 seconds before re-measuring. Once no continuing VHF signal is detected, the output unmutes and returns to normal operation. This feature recognizes that continuous full-scale VHF signals do not appear in natural sources such as music. Any such signals can therefore be considered as a fault when present. VHF protection is essential in avoiding damage to high frequency drivers.

The VHF protection operational area is dependent on output power level and frequency. The illustration below shows a decreasing threshold on the output power level, starting at approximately 10KHz and rising with a -6dB slope. This defines the VHF protection area. When continuous output power above the threshold line is detected the VHF protection becomes active.

The Attack time for the VHF protection is increasingly shorter at higher frequencies. For example, an ultrasonic continuous signal will cause the outputs to mute rapidly, where it will take several milliseconds for a 10KHz continuous signal to trigger the output mute. This is shown in the illustration above.



The VHF protection is NOT a limiter and does not alter the amplifier's frequency response. It is implemented solely to detect continuous VHF content. The amplifier will always pass VHF peaks at full power, with no effect on musical transients.

The VHF protection is indicated by a red LED on the amplifier front panel, with output muting for 6 seconds when in action.



If you bench test the amplifier using a continuous, full-scale sine wave input above 10KHz, the VHF protection will activate and prevent measurement of full peak output power. (Output will be muted long before maximum output power is attained.) To measure the true peak output power, use a burst signal.

### 7.5.4 DC protection

DC protection is implemented on each output to prevent damage to connected loudspeakers. DC present at the output will trigger muting and illuminate the fault LED indicator. Any DC present at the output indicates a hardware malfunction that requires servicing of the amplifier.

### **7.5.5 High impedance warning (open load)**

A high-impedance (open load) condition is indicated when an input signal above approximately -29dB is detected and no functioning loudspeakers are connected to the amplifier. The fault is indicated by a red Sig/Hi-imp LED. The indicator is green when a valid load is present under the same input signal conditions.

- Since the Hi - impedance detection initially triggers only when the input signal rises above -29dB, it might cause the indicator to first turn green, and then red, even in situations where no speaker is connected.

### **7.5.6 Low impedance protection warning**

A low impedance or short circuit fault is detected when current draw is high (Current Peak Limiter active) and when, simultaneously, output signal is low (-4dB LED does not illuminate). When this occurs, the amplifier protects the output stage from damage by muting the output signal and bypassing the circuits. Indication of this fault is a constant red illumination of the Current Peak Limiter (CPL) LED on the front panel. The protection will sequence at 6 second intervals to re-measure conditions. If the low-impedance fault is no longer detected, the amplifier will un-mute.

- If the CPL turns constant orange, the output is muted, and the -4dB signal LED is ON, then the amplifier has gone into maximum current protection. This situation is caused by an excessive input signal and is not due to a short circuit. Turn down the input signal to avoid or remedy this situation.

### **7.5.7 Temperature protection**

If the temperature becomes too high to continue safe operation, the overheated output channel(s) will be muted until the temperature returns to an acceptable level.

Fully active temperature protection (with muting) is indicated by a constantly illuminated TEM LED.

Temperature measurements will continue at 6 second intervals. The output will un-mute when the channel or power supply returns to a safe operating temperature.

### **7.5.8 Power Average Limiter (PAL)**

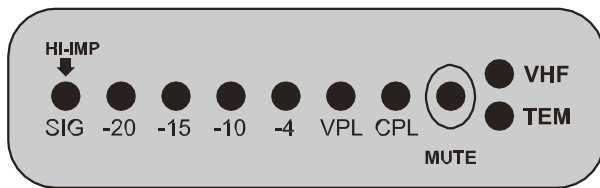
The Power Average Limiter (PAL) controls the current-drawing relationship between the power supply and the mains inlet. PAL limits the maximum average power consumption according to the power supply capabilities, ensuring that the PSU will not overload. In addition, in the larger models that potentially could pull more current from the mains than the mains fuses are specified to handle (more than 16 A), PAL limits the amplifier's maximum current draw to prevent blowing the mains fuse.

### **7.5.9 Soft Start**

High-powered amplifiers with inadequate inrush limiting can pull considerable current from the mains at turn-on. This can result in tripping of fast-acting mains breakers. Such is not the case with 10K4 amplifiers. The 10K4 amplifiers have very low inrush power as the capacitors are charged slowly and in a controlled manner ensuring that breakers will not trip.

## 7.6 Front panel monitoring and adjustments

### 7.6.1 Level indicators



The front-panel displays an array of ten LED indicators for level and status monitoring of each amplifier channel. Indications related to signal levels are as follows:

**Red CPL (Current Peak Limiter)** illuminating  
Indicates that output signal has reached the limit of the output devices and limiting is in effect.

**Green VPL/CLIP** indicates that signal has reached maximum output voltage. (Maximum voltage is determined by rear-panel VPL settings.)

**Green SIG to -4** Indicates output signal levels in normal operating range.

**SIG + HI-IMP (green/red)** - Indicates input signal above -44dB. Should the SIG indicator turn red, this indicates a high-impedance, or open connection has been detected at the output. Possible faults include a disconnected cable or malfunctioning loudspeaker. (In some cases a normal condition, such as a sub-bass enclosure with high-impedance at a certain frequency, can trigger this indication.) If the -10 dB LED illuminates and the HI-IMP LED turns orange, then the amplifier has detected an open load (no loudspeaker connected).

### 7.6.2 Level adjust

Level adjust potentiometers (one per channel) are located on the front panel adjacent to the LED display. The potentiometer's operational range is 0dB to minus infinity. Attenuation is logarithmic, with -10dB at the 12 o'clock position.

### 7.6.3 Mute indication

Individual channel Mute is indicated by illumination of the red MUTE LED provided for each channel.

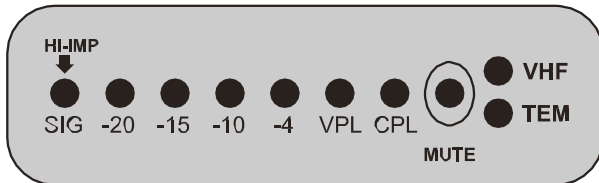
## 7.6.4 Performance, warning and fault indicators

Common indicators:



Power on/off (BLUE) indicates the mains power is switched on.

Channel indicators:



**CPL, Current Peak Limiter (red)** when constant indicates excessive current draw caused by a short circuit on the output or very low operational impedance. MUTE LED will illuminate and the output will mute for 6 seconds before re measuring the output impedance. This will continue until the short circuit is removed. CPL remains constant orange in a fault condition only when an input signal is present.

**Temperature (yellow)** amplifier goes into thermal protect (output muted), the TEM LED illuminates constant red and the yellow MUTE LED illuminates.

**VHF, Very High Frequency Protection (red)** indicates that potentially harmful continuous high frequencies have been detected on the input signal. The output is muted (MUTE LED on).

**Hardware fault** is indicated when both the CPL and TEM, VHF and MUTE indicators light up simultaneously. The amplifier requires servicing before placing back in operation.

## 7.7 2Ω load overhear protection

In the situation the amplifier is used to power 2Ω loads, the internal monitoring system will reduce the output power automatically to prevent amplifier overhear.

## 7.8 Amplifier hot swap modules

The 10K4 amplifier is equipped with Hot Swap module technology. The output modules may be removed and replaced without the need to power down the amplifier.

The module incorporates a lever system together with a card edge style connection system secured by an automatic spring locking mechanism.

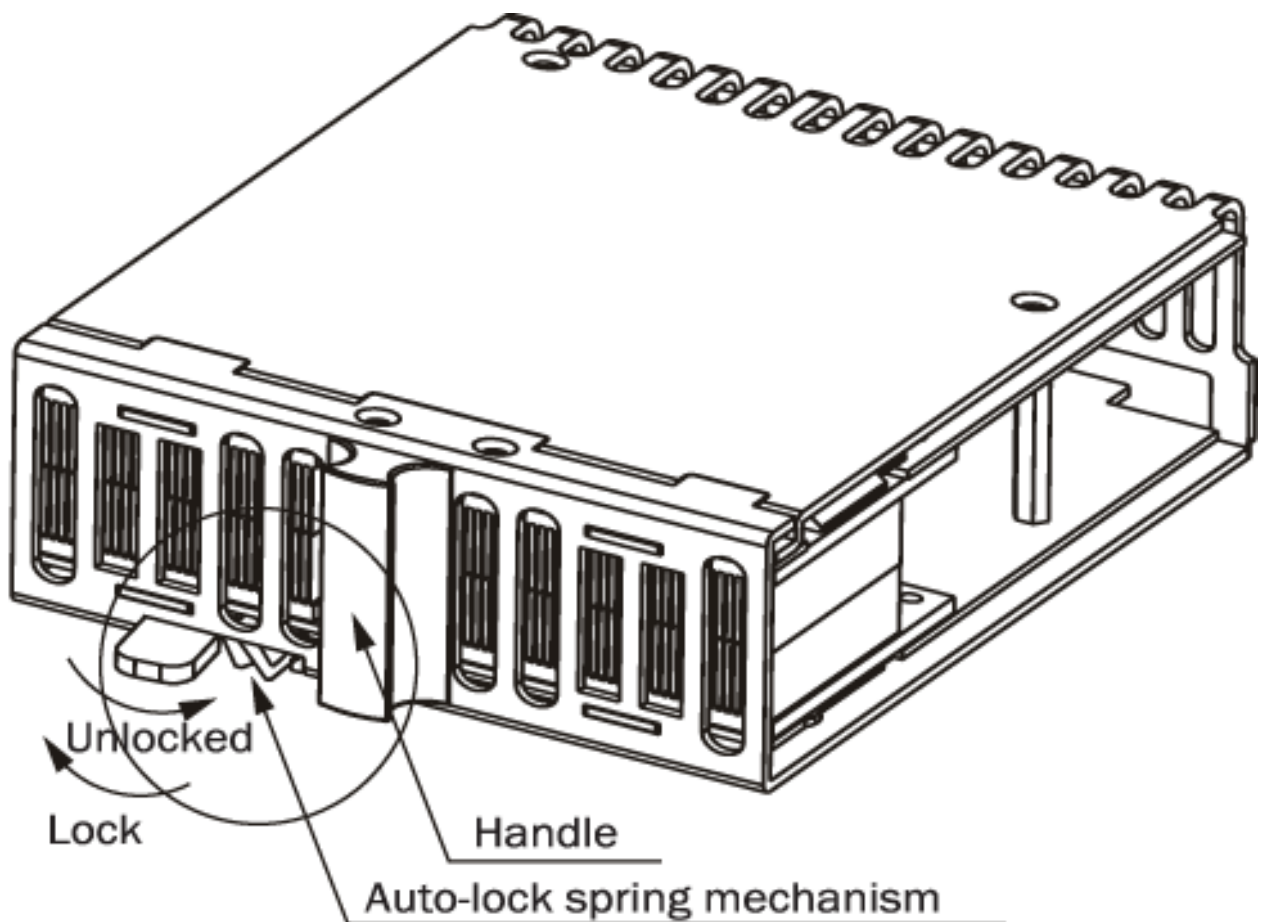
The 10K4 amplifier modules rely on all four modules being installed for cooling and air management to be effective. Do not operate the amplifier for extended periods without all four modules installed.

### Fitting:

Move the plug in/out bar to the handle (right side), and then push into the bottom of slot directly. It's only can be used after an indicative sound from the auto-lock switch that means the module is positioned. (It is very important to make sure that the module has been pushed in completely.)

### Removal:

When need to pull out the module, move the locking bar to the handle right side, the module will draw out from the position automatically, and then pull out the module easily and simple.



- Change modules one at a time. Do not repeatedly insert/remove the modules.

## 8 APPENDIX

### 8.1 Maintenance

During normal operation your 10K4 amplifier will provide trouble-free service. The only user maintenance required is to periodically vacuum clean the foam dust-filters behind the front grille.

In some extreme cases it may be necessary for authorized service personnel to clean the inside of the amplifier. These conditions usually occur after prolonged use in extreme environments such as those using cracked oil, smoke machines. If you are using y our amplifier in a heavy-duty application, it is recommended to have your

amplifier serviced at regular intervals purely as a preventative action.

## 9 TECHNICAL SPECIFICATIONS

Following are the 10K4 technical specifications. These figures are accurate at the time of printing but please note that all figures are subject to change without notice. For the most accurate and current information available, please visit [www.prolight.co.uk](http://www.prolight.co.uk)

The Zenith amplifier range has been designed and engineered to work in demanding environments including installation and touring with military endurance. Oversized multi-speed fans and large heat sinks improve heat dissipation, while the SMPSU optimises the amplifiers efficiency while reducing the weight. The 10K4 and 13K2 lightweight power amplifiers from Zenith feature high efficiency TD class technology for high power output to weight ratio, and are housed within compact 2U chassis. With up to 6500W per channel these power amplifiers are ideal for rental or large installations. Suitable for driving into 2Ω loads, the amplifiers are equipped with an extensive set of protection circuits for reliable operation.

- 4 x 660W RMS @ 16Ω
- 4 x 1300W RMS @ 8Ω
- 4 x 2100W RMS @ 4Ω
- 4 x 2500W RMS @ 2Ω
- 2 x Bridge 4200W RMS @ 8Ω
- 2 x Bridge 5000W RMS @ 4Ω
- Performance with gain 35dB, VPL: 150V
- VPL selectable per channel 150, 121, 101, 83, 70, 56, 47, 38V
- VPL selectable when bridged 300, 242, 202, 166, 140, 112, 94, 76V
- Voltage peak limiter mode (per channel) hard/soft
- Amplifier gain selectable (all channels) 23, 26, 29, 32, 35, 38, 41, 44dB (default gain 35dB)
- Level adjustment (per channel): front-panel potentiometer, detented from ∞ to 0dB
- Input connectors (per channel): 3-pin XLR, electronically balanced
- Output connectors (per channel): Neutrik speakON
- Output bridge mode per two channel's A and B bridge, A as the input source, C and D bridge, C as the input source
- Cooling system: Three fans, airflow design from the front to the rear for temperature control
- Status indication: Signal present/high-impedance: -20dB, -15dB, -10dB and -4dB output signal, Voltage Peak Limiter (VPL), Current Peak Limiter (CPL), Very High Frequency (VHF), high temperature, fault, mute
- Power average limiter
- Protection circuits: Soft start, Voltage Peak Limiter (VPL), Current Peak Limiter (CPL), Very High Frequency (VHF), high temperature and load fault
- Inrush current draw: 5A max.
- Dimensions: 88 x 483 x 425mm
- Weight: 13.5kg

Note 1: Automatic -6dB gain compensation when bridging channels.

Note 2: PAL can reduce the maximum output power to keep the power supply operating safely, and/or to prevent excessive current draw tripping the mains breaker.

Note 3: The amplifier will be fully operational at bridge mode 2Ω loads, but due to physical constraints in the construction, the max. output power will not be significantly higher than running individual channels and therefore not stated here.

# 10 SAFETY ADVICE AND WARRANTY INFORMATION

## WARNING

### FOR YOUR OWN SAFETY, PLEASE READ THIS USER MANUAL CAREFULLY BEFORE YOUR INITIAL START-UP!

- Before your initial start-up, please make sure that there is no damage caused during transportation.
- Should there be any damage, consult your dealer and do not use the equipment.
- To maintain the equipment in good working condition and to ensure safe operation, it is necessary for the user to follow the safety instructions and warning notes written in this manual.
- Please note that damages caused by user modifications to this equipment are not subject to warranty.



#### IMPORTANT:

The manufacturer will not accept liability for any resulting damages caused by the non-observance of this manual or any unauthorised modification to the equipment.

- Never let the power cable come into contact with other cables. Handle the power cable and all mains voltage connections with particular caution!
- Never remove warning or informative labels from the unit.
- Do not open the equipment and do not modify the unit.
- Do not connect this equipment to a dimmer pack.
- Do not switch the equipment on and off in short intervals, as this will reduce the system's life.
- Only use the equipment indoors.
- Do not expose to flammable sources, liquids or gases.
- Always disconnect the power from the mains when equipment is not in use or before cleaning! Only handle the power-cable by the plug. Never pull out the plug by pulling the power-cable.
- Make sure that the available mains supply voltage is between 240V AC, 50/60Hz.
- Make sure that the power cable is never crimped or damaged. Check the equipment and the power cable periodically.
- If the equipment is dropped or damaged, disconnect the mains power supply immediately and have a qualified engineer inspect the equipment before operating again.
- If the equipment has been exposed to drastic temperature fluctuation (e.g. after transportation), do not connect power or switch it on immediately. The arising condensation might damage the equipment. Leave the equipment switched off until it has reached room temperature.
- If your product fails to function correctly, stop use immediately. Pack the unit securely (preferably in the original packing material), and return it to your Pro Light dealer for service.
- Only use fuses of same type and rating.
- Repairs, servicing and power connection must only be carried out by a qualified technician. THIS UNIT CONTAINS NO USER SERVICEABLE PARTS.
- This fixture is for professional use only - it is not designed for or suitable for household use. The product must be installed by a qualified technician in accordance with local territory regulations. The safety of the installation is the responsibility of the installer. The fixture presents risks of severe injury or death due to fire hazards, electric shock and falls.
- WARRANTY: One year from date of purchase.

#### OPERATING DETERMINATIONS

If this equipment is operated in any other way, than those described in this manual, the product may suffer damage and the warranty becomes void. Incorrect operation may lead to danger e.g: short-circuit, burns and electric shocks etc.

In case of malfunction this unit should be returned for service or inspection.

Do not endanger your own safety and the safety of others!

Incorrect installation or use can cause serious damage to people and/or property.

***Zenith***