





FOR VORTEX MODELS: 2.6, 4 & 6

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CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN



CAUTION - HIGH VOLTAGE HAZARDS
EXIST WITHIN THIS PRODUCT.
PLEASE REFER ALL SERVICING TO
AUTHORISED PERSONNEL



THE LIGHTNING FLASH WITH ARROW HEAD SYMBOL, IS INTENDED TO ALERT THE
USER TO THE PRESENCE OF UNINSULATED "DANGEROUS VOLTAGE" WITHIN THE
PRODUCT'S ENCLOSURE THAT MAY BE OF SUFFICIENT OPERATING
MAGNITUDE TO CONSTITUTE A RISK OF ELECTRIC SHOCK TO PERSONS



THE EXCLAMATION MARK IS INTENDED TO ALERT THE USER TO THE
PRESENCE OF IMPORTANT AND MAINTENANCE (SERVICING)
INSTRUCTIONS IN THE LITERATURE ACCOMPANYING THE APPLIANCE

CAUTION - RISK OF ELECTRIC SHOCK DO NOT OPEN

WARNING - TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS
APPLIANCE TO RAIN OR MOISTURE

1.0 Read Owner's Manual

When shipping the **VORTEX** amplifier, always use the original shipping carton and packing materials. For maximum protection, repack the unit as it was originally packed at the factory.

2.0 Environments

Use this amplifier only in E1, E2, E3 or E4 environments according EN55103-2.

3.0 Ventilation

Slots and openings in the cabinet are provided for ventilation, to ensure reliable operation of the product and to protect it from overheating. These openings must not be blocked or covered. This product should not be installed unless proper ventilation is provided or manufacturer's instructions have been adhered to.

4.0 Water & Moisture

Do not use this product near water (for example, in a wet basement or near a swimming pool)

5.0 Cleaning

Unplug this product from the wall outlet before cleaning. Do not use liquid or aerosol cleaners.

6.0 Power-cord Protection

Power-supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon them or against them, paying particular attention to cords and plugs, and the point where they exit from the product.

7.0 Lightning

For added protection of this product during storms, or when it is left unattended and unused for long periods of time, unplug it from the wall outlet. This will prevent damage to the product due to lightning and power-line surges.

8.0 Object And Liquid Entry

Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short out parts that could result in a fire or electric shock. Never spill liquid of any kind on the product.

9.0 Accessories

Do not place this product on an unstable cart, stand, tripod, bracket, or table. The product may fall, causing serious injury, and serious damage to the product. Any mounting of the product should follow the manufacturers instructions, and should use a mounting accessory recommended by the manufacturer.

10.0 Connecting

When you connect the amplifier to other equipment, turn off the power and unplug all of the equipment from the supply source. Failure to do so may cause an electric shock and serious personal injury. Read the owner's manual of the other equipment carefully and follow the instructions when making the connections.

11.0 Sound Volume

Reduce the volume to minimum before you turn on the product to prevent sudden high levels which may cause hearing or speaker damage.

12.0 Damage Requiring Service

Unplug this product from the mains supply and refer to your dealer/distributor under the following conditions:

- When the power-supply cord is damaged
- If liquid has been spilled, or objects have fallen into the product
- If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions as an improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to

restore the product to its normal operation.

- If the product has been dropped or damaged in any way.
- When the product exhibits a distinct change in performance this indicates a need for a service.

13.0 Servicing

Do not attempt to service this product yourself as opening or removing covers may expose you to dangerous voltage or other hazards. Please refer to your dealer/distributor.

14.0 Replacement Parts

When replacement parts are required, be sure the dealer/distributor uses replacement parts specified by the manufacturer. Unauthorized substitutions may result in fire, electric shock or hazards.

15.0 Safety Check

Upon completion of any service or repairs to this product, ask the dealer distributor to perform safety checks to determine that the product is in proper operating condition.

EC Declaration of Conformity in accordance to EC Directives:
electro-magnetic compatibility (Council Directive 89/336/EEC,
as amended by Directives 92/31/EEC and 93/68/EEC);
low-voltage electrical equipment (Council Directive 73/23/EEC)

Manufacturers Name:

CAMCO Produktions- und Vertriebs- GmbH

Manufacturers Address:

Fischpicke 5
57482 Wenden
Germany

Declares that the product with the model name:

CAMCO Power amplifier **VORTEX 2.6**, **VORTEX 4** and **VORTEX 6**

Conforms to the following standards:

- EN60065 Security
- EN55103-1 Emission
- EN55103-2 Immunity

The operating conditions and application environments presupposed
in the operating instruction are to be kept accordingly.

Wenden, 26.10.2000



Joachim Stöcker

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P.4 SAFETY

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1.1 Welcome to CAMCO

Established in 1983, **CAMCO** has gained worldwide experience with professional sound reinforcement technology. Within the audio market, **CAMCO** specialises in the production and marketing of high quality power amplifiers and sound systems for use both on tour and in static installations.

The success of the **LA, DL** and **DX** series power amps has made the **CAMCO** name synonymous with professional quality, high performance and utterly reliable power amps.

CAMCO's commitment to research and development, seen not just in the area of materials and technology but also most importantly in its highly skilled and motivated workforce, is one of the keys to its ongoing success.

With its all-new **VORTEX** power amp series, **CAMCO** is pioneering a new dimension in professional power amp construction. The seamless combination of groundbreaking technology with secure and proven elements is the hallmark of the new series.

Welcome to the new world of professional power amplifiers -

WELCOME TO CAMCO!

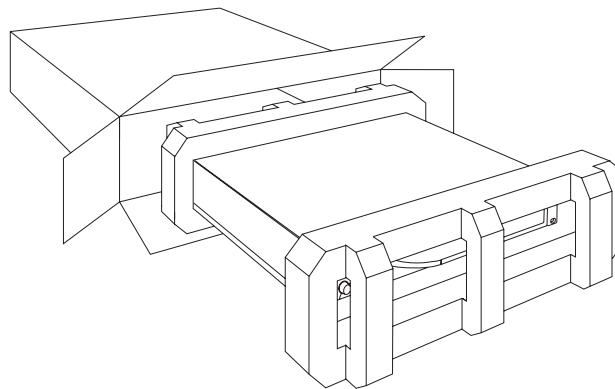
1.2 Unpacking

Please unpack and inspect your new amplifier for any damage that may have occurred during transit. If damage is found, notify the transportation company immediately. Only you the consignee may initiate a claim for shipping damage. **CAMCO** will be happy to cooperate fully as needed. Please save the shipping carton as evidence of damage for the shipper's inspection.

Even if the amplifier has arrived in perfect condition, save all packing materials so you will have them if you ever need to transport the unit.

NEVER SHIP THE AMPLIFIER WITHOUT THE ORIGINAL PACKING MATERIALS.

When shipping the **VORTEX** amplifier, always use the original shipping carton and packing materials. For maximum protection, repack the unit as it was originally packed at the factory.



1.3 The amplifier

The **VORTEX** is a Class-H power amplifier with a power output of 3 kW per channel / 2 Ohm load (6 kW in mono / 4 Ohm load) for **VORTEX 6**, 2 kW per channel / 2 Ohm load (4 kW in mono / 4 Ohm load) for **VORTEX 4** and 1300 W per channel / 2 Ohm load (2,6 kW in mono / 4 Ohm load) for **VORTEX 2.6**.

It is supplied by Switched Mode Power Supplies (SMPS). These SMPS's radically reduce the weight and size (only 2U) of the amplifier. Using SMPS, the 3 - symmetrical supply voltages (2- symmetrical supply voltages for **VORTEX 2.6**) of the power amplifier are more stable than the power supplies used in conventional amplifiers.

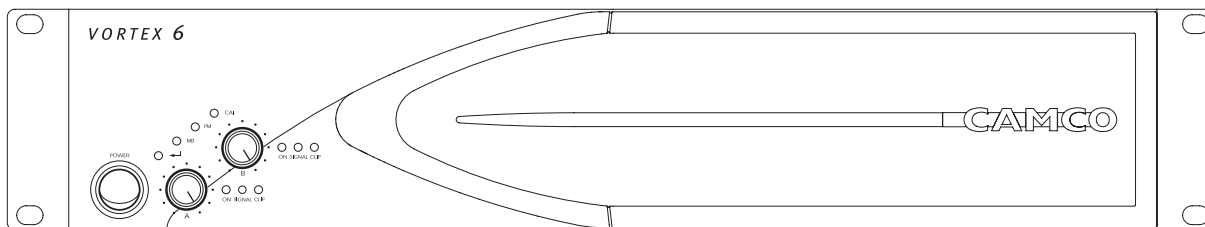
The **VORTEX** also uses a microprocessor for controlling and monitoring the power amp. Controlling a power amp designed for use in modern sound systems, has four main advantages over more traditional power amp systems:

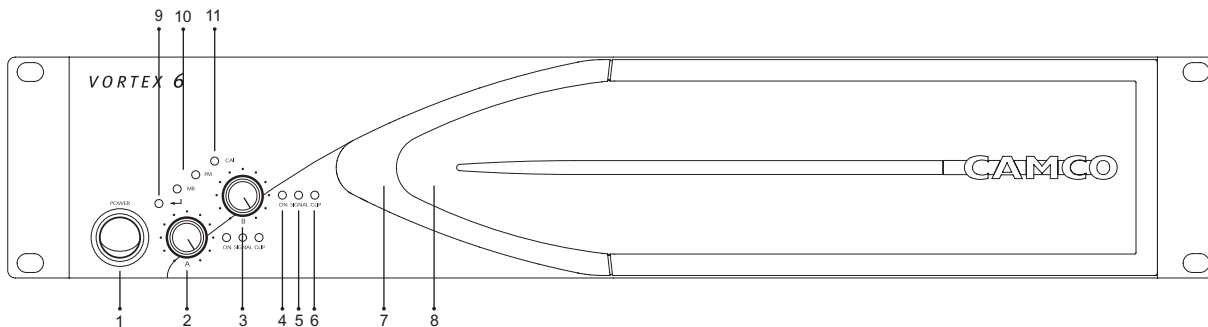
- Reduced Distortion
- Improved Noise Characteristics
- Integrated Remote Control
- Indication of protection or failures by different LED sequences

The **VORTEX** has been designed as an intelligent and powerful product for performing specialised tasks within a complex audio system. Users can adapt the power amp to meet their specific audio requirements before use. Controls mounted on the front and the rear of the **VORTEX** allow access to the functionality.

Since some of the externally mounted controls have multiple functions, it is important that users should familiarise themselves with the entire range of controls and programmable features before using the power amp.

If you have questions about features of the **VORTEX** power amp that are not covered by the basic descriptions in this manual, **CAMCO** would be pleased to offer you further information. Alternatively, contact your dealer/distributor.



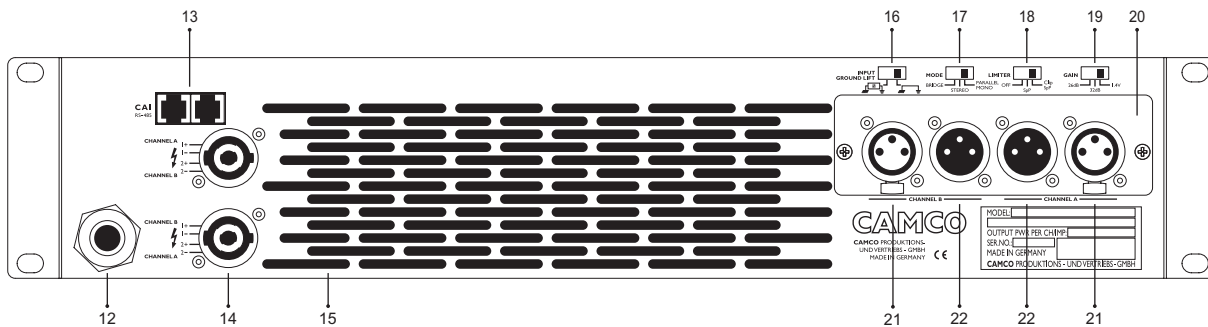


VORTEX - The Front

- 1 ON / OFF Switch
- 2 Volume Control - Channel A
- 3 Volume Control - Channel B
- 4 On / Failure Indicators
- 5 Signal Indicators
- 6 Clip / Output Current Indicators
- 7 Removable Air Filter System
- 8 Cooling Air Inlet Vents
- 9 Enter-Switch (behind Front Panel)
- 10 Operating Mode Indicators
- 11 CAI Status Indicator

VORTEX - The Rear

- 12 AC Power Cable
- 13 CAMCO Audio Interface (C.A.I.)
- 14 Speakon Connectors
- 15 Cooling Vents
- 16 Input Ground Lift Switch
- 17 Operating Mode Selector
- 18 Limiter Switch
- 19 Gain - Selector
- 20 Extended User Interface (E.U.I.)
- 21 XLR - Line Inputs
- 22 XLR - Line Outputs



3.1 On/off Switch

NOTE: This switch does not isolate the appliance from mains.

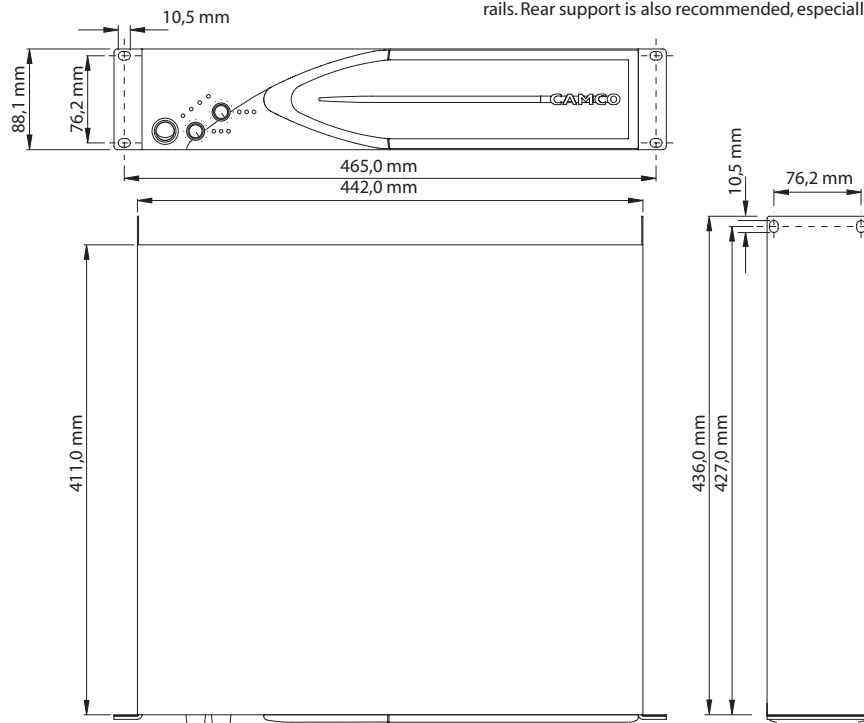
It initiates start-up by activating the inrush current limiter. When the amp is connected to mains, only the line-filter and the input of the silicon controlled rectifier (fused) are energised.

3.2 Precautions

When mounting or connecting the amp always disconnect it from mains.

3.3 Mounting

Use four screws and washers when mounting the amplifier to the front rack rails. Rear support is also recommended, especially in mobile and touring use.



3.4 Cooling

Under normal operation of the power amp, overheating should never be a problem. The temperature of the cooling air will depend on the immediate environment (e.g. an enclosed rack, direct sunlight) and on whether the front filter is clogged. If the amp is installed in a case, the open area at the back of the case must be at least 140 cm². This area should be in line with the amp. If this can not be achieved a forced ventilation system has to be used. The air is taken in from the front and out through the back, it is of course essential that while the power amp is running air is able to circulate around it freely.

3.5 Ground Lift

The input signal ground (pin 1 for all 4 XLR's) is tied to the ground potential in the mains supply. Opening the ground lift switch causes this connection to be broken. This allows ground loops that sometimes occur in practice to be eliminated. The ground potential of the power amp and therefore of the loudspeaker outputs is independent of the switch setting and remains at the ground potential of the mains supply.

Removing the mains connector ground - as often practiced - is not only illegal but pointless too, since in practice it never produces any improvement!



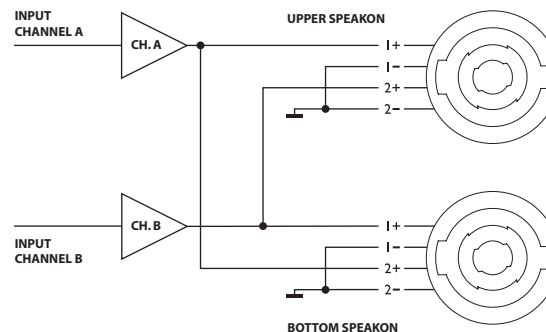
**DO NOT REMOVE MAINS CONNECTOR GROUND
IT IS ILLEGAL AND DANGEROUS**

3.6 Wiring

3.6.1 SPEAKON Connection

4 Ohm speaker cabinets in parallel

Use the contacts in both SPEAKON connectors for each channel. If not, this may cause permanent damage of the connectors, depending on the music material.



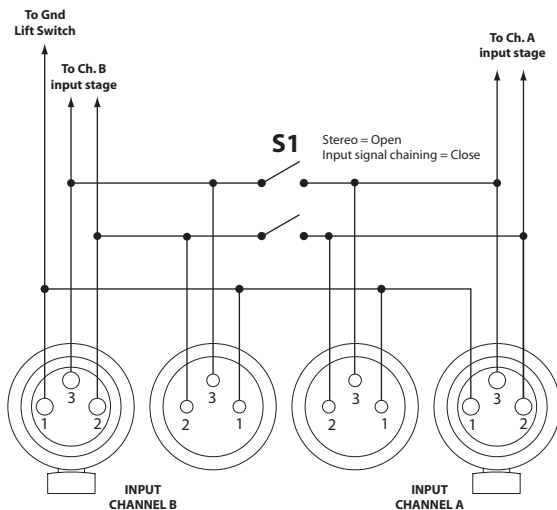
3.6.2 E.U.I. and XLR Connection

XLR: Pin 1 Ground (or lifted via 15 Ohm resistor)

Pin 2 Hot

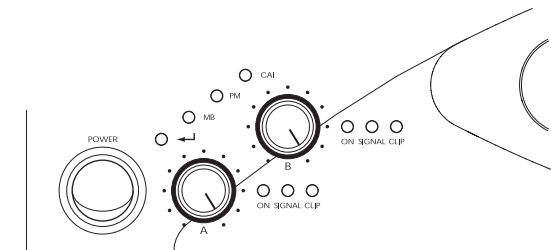
Pin 3 Cold

Always use symmetrical (balanced) shielded cable to connect the amplifier wherever possible.



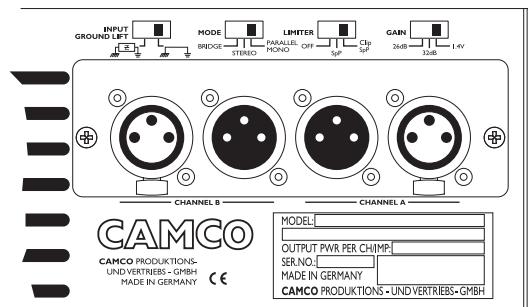
3.6.3 Mode Indicators

On the front panel there are two yellow LED's to indicate the mode that is set. In stereo mode none of them will be lit. In Parallel Mono the (PM) LED will be lit and in Mono Bridge, the (MB) LED will be lit.



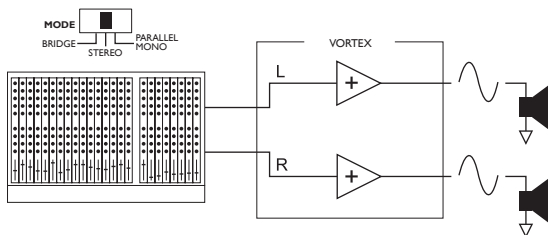
3.6.4 Mode Switch

The switch on the rear panel changes the operating mode. Moving this switch will shutdown the amplifier and restart it in the new operating mode.



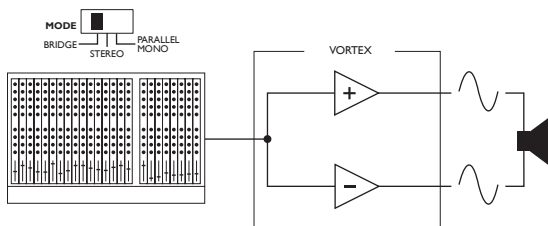
3.6.5 Stereo Operation

Two fully independent amplifier channels (normal operating mode).



3.6.6 Bridge-Mono Operation

One-channel mono bridged operation.



The second channel processes the same input signal, but with reversed phase. The (single) load is connected between the two positive channel outputs using a suitable connected SPEAKON connector. While the total output of the amplifier remains the same, both the available output voltage and the minimum impedance that can be connected are doubled, as compared with stereo operation. Only Channel A-Input is active. A signal feeding Channel B will have no effect on the output.

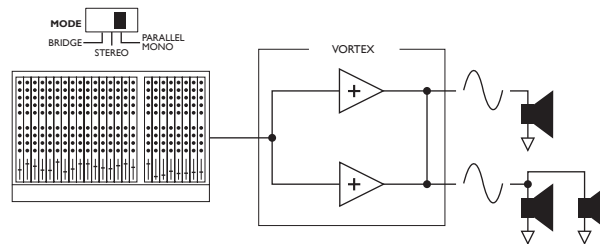
WARNING!

RMS output voltages as high as 230 V are available at the output.

Wiring to the speaker loads must conform to NEC Class 3 safety standards.

3.6.7 Parallel-Mono Operation

Parallel operation of the two channels together.

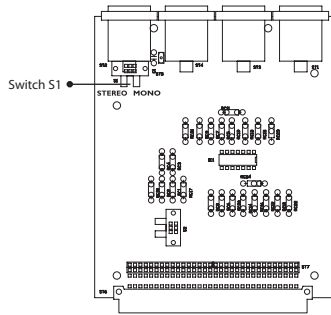


The output terminals of the two channels are configured in parallel using an internal relay. The (single) load is connected either to the output of channel 1 or to that of channel 2 (as if in stereo). While the total output of the amplifier remains the same and the output voltage level is also the same as in stereo operation, the minimum impedance that can be connected is reduced by half due to the fact that current capability is doubled. Only Channel A-Input is active. This mode is useful when powering 3 speaker cabinets in parallel. A load balancing is achieved in this case.

NOTE: For parallel mono operation, to prevent damage of one SPEAKON connector and to reduce loss of power because of contact or cable resistance, it is highly recommended to wire speaker loads using both 2 channel SPEAKON connectors with all contacts connected.

3.7 Input Signal Chaining

The input signals can be hard-wired in parallel using a switch on the E.U.I. (See 3.6.2, *Switch 1, 5.1, Extended User Interface and 5.1.1, Input Signal Parallel Switch*). This serves as a replacement for an external short XLR female - XLR male cable for parallel linking the signal inputs.

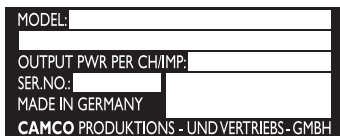


CAUTION:

Linking channels together can cause damage to system components if for example two inputs are used with separate 'LF' and 'HF' feeds. If the amplifier is to be used for 'LF' and 'HF', ensure this switch is set to STEREO Mode before switching on.

4.1 Precautions

Only connect the VORTEX amplifier to a appropriate AC circuit and outlet, according to the requirements indicated on the rating plate label.



NOTE: Even under normal conditions the mains current can reach levels (up to 60 A / 230 V and 120 A / 115 V); this could cause lamps to flicker if connected to the same mains as the amp. The impedance of the AC circuit should be less than 0,157 Ohms to avoid flicker according to EN61000-3-11. Ask / inform your local power provider. Don't even think about measuring this with your ohmmeter. This may damage your meter, caution - high voltage hazards!

4.2 Controls

4.2.1 Volume Control

A microprocessor-controlled DCA (Digital Controlled Attenuator) with a control resolution of 12 bits per channel is integrated into the signal path. This means that the signal is not subject to an A/D followed by a D/A conversion with associated losses. Each channel is governed by a linear potentiometer with 41 notched settings. These settings have been selected to correspond to human hearing characteristics (logarithmically) and therefore guarantee an optimal range of settings for practical applications. Each channel can be set individually except when operating in mono mode whereby only ChA is active.

Using an intelligent DCA control (Digital Controlled Attenuator) instead of the "conventional" VCA results in considerably reduced distortion as well as

improved noise characteristics. The implementation is comparatively simple: the volume potentiometers pass the relevant control information (quieter or louder depending on the adjustment made to the potentiometers) to the microprocessor. The microprocessor then adjusts the power amp output using various strategies implemented in software. In addition to improved technical parameters, this approach allows a significant reduction in the number of components and circuits required.

The volume pots are also used to set the CAI-address.

(See 5.2.3, CAI Address Settings)

4.2.2 Gain Selector

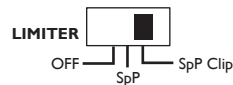
A switch on the rear of the **VORTEX** allows the maximum amplification attainable to be set directly in the input stage.



The **VORTEX** amplifier has a 26 dB and 32 dB voltage gain setting along with a 1.4 V sensitivity setting.

4.2.3 Limiter Switch

This switch is located at the rear of **VORTEX**. It allows you to set the mode of the limiter. There are three modes:



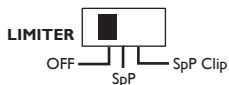
Right position:

Clip Limiter: ON & Speaker Protect: ON



Middle position:

Clip Limiter: OFF & Speaker Protect: ON



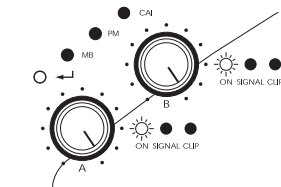
Left position:
Clip Limiter: OFF & Speaker Protect: OFF

(See 4.4.1, Clip Limiter and 4.4.3, Speaker Protect Limiter)

4.3 Indicators

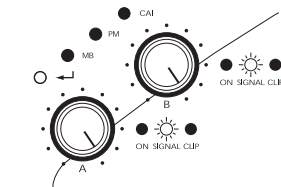
4.3.1 On / Failure Indicators

Under normal operation, after the amp has started, the green power LEDs are permanently lit. A variety of different sequences of flashing LEDs are used to indicate other operating states and errors in one of the channels of the power amp. (See 6.0, Trouble Shooting)



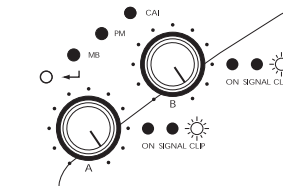
4.3.2 Signal Indicators

The green signal LED is illuminated when the voltage level at the output reaches approx. 4 V; this corresponds to a power of approx. 4 W at an impedance of 4 Ohms.



4.3.3 Clip / Output Current Indicators

The clip LED's are bi-coloured: green / red. Each colour indicates a different status.



The green section is subject to analogue control. The brightness is proportional to the output current in the channel. The LED is visibly lit above around 1 Amp, while full brightness corresponds to the maximum rated current. If the LED is lit red only, no load is applied to the outputs or Clip is active with a duty cycle of more than 10 %.

When under load, there is also a certain current that flows when controlling the power level; the green section will be lit appropriately. If the power level is taken to the limit, the green and red sections will appear mixed, resulting in a shade of yellow that depends on the current. If the microprocessor detects a clip signal with a duty cycle of more than 10 % within a time interval of 50 ms, then it suppresses the green section so that the clip LED appears only red. Careful analysis of the various dependencies when comparing channels that are subject to identical control (possibly in several different power amps) will allow conclusions to be drawn about the inherent impedances. This can aid the detection of incorrectly wired components and faults in loudspeakers at an early stage.

4.4 Power Amp Protection Systems

4.4.1 Clip Limiter

If the power amp is overdriven, the clip detection circuit triggers the microprocessor. The processor reduces input signal level by controlling the DAC. The strategy is implemented in software. For sinusoidal signals the microprocessor limits the input signal level with the result that the non-linear distortion factor never exceeds 1 %.

The clip limiter can work on each channel independently (except in mono-operation).

To disable the Clip Limiter, see 4.2.3, Limiter Switch.

4.4.2 Under Impedance Limiter

As a result of incorrectly connected or defective loads, under impedance or even short circuits may be presented to one or both power amp channels. In order to detect an under impedance, the microprocessor calculates the resultant impedance. If an impedance of less than 1.33 ohms/channel is detected, the microprocessor limits the signal to the power amp until a subsequent measurement indicates that impedance has risen to a safe level. Whenever the under impedance limiter is active, the corresponding channel's power LED is turned off. *(See 6.0, Trouble Shooting)*

4.4.3 Speaker Protect Limiter

Whenever the Safe Operation Mode (SOA) protection of the power amp switches back the current rail there could be a small clipping at the output; but the microprocessor is also triggered by this protection and will reduce the signal level immediately to minimise the effect.

User can decide either to use speaker protect or not. When you use this amp for low frequencies (SUB bass / bass) and you want to squeeze the absolute

maximum out of it, switch Speaker Protect off. For all other applications (e.g. Full Range) it's recommended to switch Speaker Protect on.

4.4.4 SOA Protection

Whenever the power transistors leave their Safe Operation Area (SOA), the SOA-protection in stereo mode switches back the current rail of the respective power stage. In mono modes the rails of both channels are switched back.

4.4.5 DC Protection

Each output of the power amp is constantly monitored for persistent DC voltage levels. If the 3 V thresholds are exceeded at any of the outputs, the channel at that output will be automatically disconnected. The microprocessor performs a sophisticated strategy to locate the cause of DC. If short-term DC is detected, the amplifier will recover and continue to operate. DC can be located in the Output stage, Driver stage or at the input of the amplifier.

Output stage

When DC is located in either output stage, the amp stops the main SMPS and mutes the amp where DC was detected. The On-LEDs will show a different flash sequence. *(See 6.0, Trouble Shooting)*

Driver stage

When DC is located in the driver stage only the defective channel's output stage and DCA are muted. The other channel still works. The On-LED of the defective channel will start the flash sequence. *(See 6.0, Trouble Shooting)*

Amplifier Input

When DC is located at the input stage only the DCA of the affected channel is muted. (The other channel continues to operate normally). If the DC signal at the input vanishes the microprocessor will de-mute the affected channel and the amplifier will work as usual again.

4.4.6 DC Servo

To Prevent DC-Offset at the Speaker output the VORTEX is fitted with two DC-Servos. (Hence there are no capacitors in the signal path!)

4.4.7 Power Amp Over Current Protection

Over current is permanently controlled in the output stage. There are two limiting levels of over current depending on output voltage. These limits will be set automatically. This improves reliability without degrading sound quality when driving complex loads.

4.4.8 Power Amp Thermal Protection

The microprocessor uses several sensors in the amp in order to ascertain temperature data. If the microprocessor detects a temperature of more than 85 °C at the heat sinks, the input signal on that channel is reduced.

The power LED of the overheated channel will start a blinking-sequence (See 6.0, Trouble Shooting)

4.5 Mains Protection

4.5.1 Inrush Current Limitation

Within 2 seconds of the amplifier being switched on, the inrush current limiter will increase mains current from nearly zero to nominal value. This value depends on program material, output level and speaker loads.

4.5.2 Mains Over Voltage Detection

Mains over voltage detection is always operative. When the mains voltage exceeds approx. 267 V (230 V operation) or 134 V (110 V operation), the amplifier will be switched off. When the mains voltage returns to nominal value, a soft start occurs.

4.5.3 Mains Failure Detection

Mains failure detection is always operative. When the mains supply is interrupted for about 2 mains cycles, the amplifier will be switched off. When the mains voltage returns to a normal value, a soft start occurs.

4.5.4 Fuse Protection

Depending on the load impedance and type of signal levels, the effective mains current can, even during normal operation, reach a level several times higher than its nominal value for short periods. Repeated peaks of this nature will also cause the average value to increase. In such cases, the internal mains fuse and external 16 A circuit breaker acts as a "bottleneck", and would trip if the average current remained too high for an extended period. In order to avoid this unsatisfactory operation, the mains fuse is simulated inside the amplifier and provides the microprocessor with information. Prior to the point when the circuit breaker would trip, a signal is sent to the microprocessor, which then instantaneously reduces the signal level. After the known recovery time for the fuse has elapsed, the signal is again adjusted to its normal level. This offers reliable operation of a 6 kW **VORTEX** on 16 A Mains at 230 V and 30 A at 115 V.

4.6 Main SMPS Protections

4.6.1 Main SMPS Over Current Protection

Main SMPS (Switched Mode Power Supply) Transformer current is continuously monitored. If over current occurs, the main SMPS immediately stops working. Should there be an internal failure, this feature prevents other parts being damaged.

4.7 Fans

The fans mounted in the **VORTEX** operate permanently, but as long as the temperature remains below 40 °C they run at their slowest speed and can hardly be heard. The highest detected temperature from either channel controls the speed of the fans: above 40 °C the speed is increased until it reaches its maximum value.

4.8 Filter Cleaning

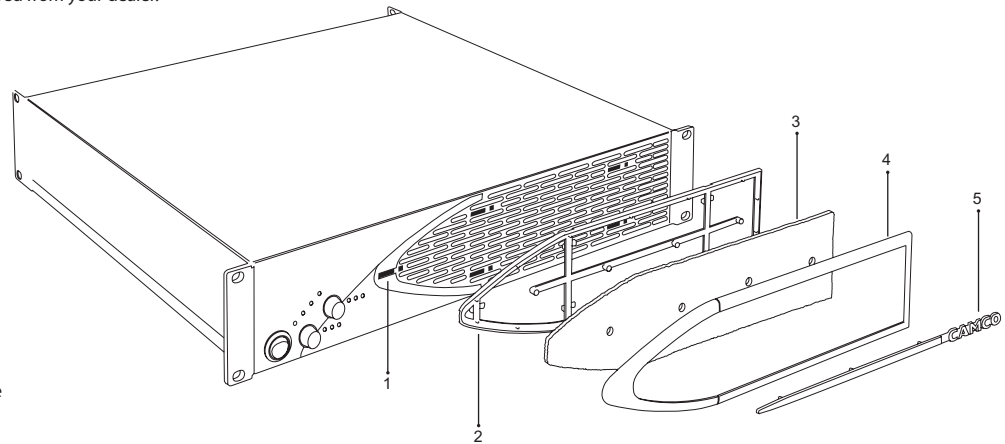
A removable filter system is provided on the air intakes to the cooling system. If the filter becomes clogged, the unit will not cool as efficiently as it should and may produce output levels that are lower than normal due to high heat sink temperatures.

To clean, gently slide the whole plastic filter assembly to the left and release from the front panel. Carefully unclip the outer moulding to reveal the filter. Clean the filter with a mild dishwashing detergent and warm water. Once dry, insert the filter back into the cradle and cover with the surround moulding. Slide the whole assembly to the right to secure onto the front panel.

Spare filter assembly's may be ordered from your dealer.

VORTEX Filter Assembly

- 1 Clip Apertures
- 2 Injection Moulded Cradle
- 3 Foam Filter
- 4 Injection Moulded Surround
- 5 Injection Moulded **CAMCO** Badge



5.1 E.U.I. (Extended User Interface)

The E.U.I. slot contains the Rear XLR Panel and the Input Signal Parallel switch as standard. Other input cards are available (See 5.1.3 Accessories) Always switch off and unplug the **VORTEX** from mains, when working on the E.U.I.

The switches described below are not readily accessible and cannot be checked visually from the outside. To remove the E.U.I. unscrew the two Phillips head screws at the left and right end of XLR-Panel and carefully slide out the E.U.I. To refit the E.U.I. into the **VORTEX**, carefully insert the PCB in the guide-rail (left/right) and slide it in.

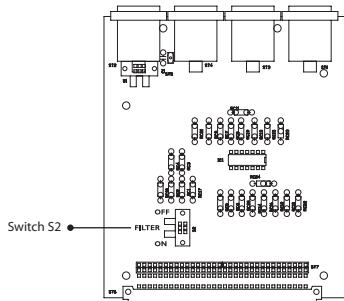
Don't forget to replace the screws!

5.1.1 Input Signal Parallel Switch

If you want to hard-wire the XLR input connectors together on the E.U.I., just change from Stereo to Mono using switch S1. Be careful when you do this! (See section 3.7, *Input Signal Chaining*)

5.1.2 Filter On / Off Switch

If a filter is present on the E.U.I. this can be activated or bypassed using switch S2.



5.1.3 Accessories

Different types of filters are available. For further information contact your dealer or **CAMCO**

5.1.4 What Are The Possibilities Using The E.U.I.?

The E.U.I. is a very powerful interface, which allows access to most of the system parameters. For example: volume, input signal, mute, output current, clip signal, temperature and more. It makes it possible to utilise filters, remote control, signal processing, and more... Please contact your dealer or **CAMCO** to customise the E.U.I. according your wishes.

5.2 C.A.I. (Camco Audio Interface)

5.2.1 Camco Audio Interface

C.A.I. is a bus system, in which all significant device functions can be monitored externally and remotely controlled using a master PC. Up to 99 devices can be controlled in parallel in each phase of the bus system, which simply consists of a two-core insulated cable. The master can serve several phases for larger applications. For more information, please contact your dealer or distributor.

5.2.2 Wiring

To connect the **VORTEX** to your C.A.I. - system use a fully-wired telephone-type cable with RJ12 connectors. For longer distances use high grade cable like for RS485, DMX512 for AES/EBU digital audio. You can chain several **VORTEX** amplifiers using the second C.A.I. Connector on each amplifier. A linear network topology is recommend with 100 Ohm termination at its end. Please refer to RS 485 specifications.

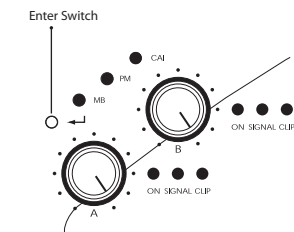
5.2.3 C.A.I. Address Settings

The C.A.I. address selection procedure will not affect the operation of the **VORTEX** but whilst this procedure is active, the Volume cannot be adjusted by using the Pots.

NOTE: Ensure you return both pots to their original position after address selection is complete, otherwise the amplifier will change its volume level to the new pot positions!

5.2.4 To Activate CAI Address Selection Procedure

Briefly press the ENTER -Switch. This push button switch (Enter - Switch) can be accessed through the 3mm hole in the front panel located between the main power switch and the LEDs.



After briefly pressing the Enter-Switch the actual address will be displayed by the power LEDs.

- Flashing of Power LED channel A indicates the tens,
- Flashing of Power LED channel B indicates the units of the address.

For example: different address setting LED sequences:

Address	Power LED Channel A/ TENS	Power LED Channel B/ TENS
01 (factory settings)	0* flash	1* flash then short pause
25	2* flashes then short pause	5* flashes then short pause

These sequences are repeated for 30 seconds (timeout). Then the Power LEDs return to their normal function.

To change CAI address, turn the appropriate Volume Potentiometer to the required address (Volume Pot Ch A => TENS, Volume Pot Ch B => UNITS).

To adjust the address you can use the scale markings of the potentiometers. You will find the digits 0,1,2,3,4,5,6,7,8,9 on the 10 scale spacing .

The current selected address will be immediately displayed BUT not automatically stored or activated! After each turn of pot you have another 30 seconds to timeout. You can leave this procedure without saving the new address by briefly pressing the Enter-Switch or waiting for timeout (as described above). To store and activate the new address you have to press the Enter-Switch for 3 seconds. This new address is stored in an EEPROM, which holds the information even if the amp is subsequently disconnected from mains. Be sure to set the CAI-Master-PC to this new address. If not, the communication will be interrupted.

5.2.5 CAI Status Indicator

This green LED indicates the presence of communication between PC and the amp.

5.2.6 Overview Or Remote Controls CAI

CAI allows:

- To control the output-level of each channel independently (exception: mono modes, only channel A is affected)
- To mute each channel independently (exception: mono modes, only channel A is affected)
- To switch the **VORTEX** into STANDBY mode (and back again)
- To monitor temperature, output-signal, clip, output-current.

6.1 On LED Flashing Sequences

When switching on the amp the Power LEDs flash twice accompanied by a flash of clip LEDs. This is normal for the 'Start' sequence of the **VORTEX**.

When switching off the amp the Power LEDs flash several times followed by a flash of clip LEDs. This is normal for the Shut Down sequence of the **VORTEX**. (It is the same as the loss of the mains voltage.)

In the following table you will find the possible LED sequences of the ON-LEDs:

Operating Status	LED Sequence (X) = flash, (-) = off	Description of repeated sequences
Normal (no failure)	Permanently lit	
Power fail (i.e. switch off)	...X-----X-----X-----X...	Short 50 ms flash + 950 ms pause
High Temperature: signal attenuation	...-XXX-XXX-XXX-XXX-XXX-XXX-XXX-XXX-...	750 ms flash + 250 ms pause
Over Temperature: main SMPS off	...X--X--X--X--X--X--X--X--X--X--X--...	250 ms flash + 750 ms pause
DC: reason unknown	...X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-X-...	250 ms flash + 250 ms pause
DC: input-signal-fault	...--X-X-X--X-X-X--X-X-X--X-X-X--...	3 * flashing + 0.5 s pause
DC: fault in driving-stage	...--X-X-X-X--X-X-X-X--X-X-X-X--X-X-X-...	4 * flashing + 0.5 s pause
DC: power-stage defect	...--X-X-X-X-X-X-X-X-X-X-X-X-X-X--...	5 * flashing + 0.5 s pause
Power-stage defect without DC	...--X-X-X-X-X-X-X-X-X-X-X-X-X-X-...	6 * flashing + 0.5 s pause
Main SMPS off: (unless Hi Temp/Power Fail)	...--X-X--X-X--X-X--X-X--X-X--X-X--...	2 * flashing + 0.5 s pause

6.2 Examples of LED Sequences

LED sequence: Ch1 : ...XXX-XXX-XXX-XXX-XXX-XXX-XXX-XXX-...

Ch2 :Permanently lit.....

Failure: Ch1: high temperature with signal attenuation

Ch2: normal operation

LED sequence: Ch1 : ..X-X-X-X-X--X-X-X-X-X--X-X-X-X-X--.....

Ch2 : ..X-X--X-X--X-X--X-X--X-X--X-X--X-X--X-X--...

Failure: Ch1: DC, power-stage defect

Ch2: main SMPS off

6.3 Problem: No Sound**Indication: On LEDs not lit****Clip/Output Current Indicators not lit**

- Check AC plug.
- Confirm that AC outlet works by plugging in another device.

Indication: On LEDs lit**Signal LEDs not lit**

- Make sure the signal source is operating and try another cable.
- Check Position of Volume Pots.

Indication: On LEDs lit**Signal LEDs responding to signal level**

- Check the speaker wiring for breaks.
- Try another speaker and cable.

Indication: On LED(s) sequence

The amplifier is in protective muting. Refer to On LED - flashing sequences table to find out the cause for the mute.

- Overheating will cause protective muting.
- Check for proper ventilation. If the fan isn't running the amplifier requires servicing.

6.4 Problem: No Sound or Sound is too Low**Indication: On LED not or sporadically lit****Signal LED off****Clip/Output Current indicator lit green or red**

Under Impedance Limiter is active. The load impedance is abnormally low or shorted.

- Unplug each speaker one-by-one. If the On LED indicates normally when you disconnect a cable, that cable or speaker is shorted.
- Take care not to use too many speakers in parallel, which would result in -

an impedance that is too low for normal operation!

Indication: On LED(s) Sequence

Please refer to the On LED sequence table to find out which protection is active.

- High temperature will cause an attenuation of output level so that under normal conditions the amp will never mute!
- DC will cause the amp to mute or shut down.
- Switch off the **VORTEX** and unplug the source from the amp's input to prevent DC entering the amp via the signal source. Then switch on the **VORTEX**. If the On-indicator shows the same sequence, the amp will need to be serviced by a qualified technician.

All other LED sequences that shut down or mute the VORTEX indicate a serious internal fault. At this point, turn the VORTEX off, remove AC power and have the amplifier serviced by a qualified technician.

6.5 Problem: No Channel Separation

- Check the mode indicators on the front panel.
- Make sure the mode-switch on the rear panel is in the stereo-position.
- Make sure other equipment in the signal path such as mixers and preamps are set for stereo, not mono.
- On the E.U.I., check the Input Signal Parallel Switch is in the stereo-position.

6.6 Problem: Distorted Sound**Indication: On LED lit****Signal LED responding to signal level****Clip/Output Current indicator lit only green**

- A faulty speaker or a loose connection could cause this. Try another speaker and check the wiring.
- The signal source might be clipping. Keep the **VORTEX** volume pots at least halfway up so that the source does not have to be overdriven.
- Try changing input sensitivity from 1,4 V to 32 dB or 26 dB at the Gainswitch.

6.7 Problem: Music Sounds Frequency Filtered

- If you have installed an optional filter module on E.U.I check the filter on/off-switch to be in off-position.

6.8 Problem: Hiss

- Unplug the amplifier input to confirm that the hiss is coming from the source or from a device upstream.
- Erratic or popping noises indicate an electronic fault in the offending unit.
- To keep the noise floor low, operate the primary signal source at full level, without clipping.
- Avoid boosting the signal further between the source and the amplifier.

6.9 Problem: Squeals and Feedback

- Microphone feedback should be controlled with mixer controls. If noise continues to build up with no microphone gain, there is a serious fault in the signal processors or cables. Working in succession from the signal source towards the amplifier and check each device in the signal path by reducing its gain or by unplugging it.

	VORTEX 2.6	VORTEX 4	VORTEX 6
Output Power			
1 kHz, THD < 0,1 %, in bridged mono mode	1 x 2600 W / 4 Ω 1 x 1500 W / 8 Ω	1 x 4000 W / 4 Ω 1 x 3000 W / 8 Ω	1 x 6000 W / 4 Ω 1 x 4200 W / 8 Ω
1 kHz, THD < 0,1 %, both channels driven Duration limited by fuse / thermal protection for RL < 8 Ohm in stereo mode or RL < 16 W in bridged mono mode Measurement at 2 Ohm without preconditioning (EN 60269-3)	2 x 1300 W / 2Ω 2 x 750 W / 4 Ω 2 x 450 W / 8 Ω	2 x 2000 W / 2Ω 2 x 1500 W / 4 Ω 2 x 920 W / 8 Ω	2 x 3000 W / 2Ω 2 x 2100 W / 4 Ω 2 x 1200 W / 8 Ω
1 kHz, THD < 1 %, both channels driven	2 x 1500 W / 1,8 Ω		
Circuitry			
	Bipolar, Class H 2-step high efficiency circuit	Bipolar, Class H 3-step high efficiency circuit	Bipolar, Class H 3-step high efficiency circuit
Signal to Noise-Ratio			
20 Hz - 20 kHz, 8 Ω load, unweighted	>103 dB	>105 dB	>107 dB
A-weighted	>106 dB	>108 dB	>110 dB
Power Consumption @ 230 V			
(both channels driven)	Idle 1 A / 60 W	Idle 0,8 A / 50 W	Idle 1 A / 60 W
Multiply currents by 2 for 115 V	8 Ω 3 A / 9 A / 320 W 1250 W	8 Ω 4,4 A / 16,2 A / 550 W 2500 W	8 Ω 5,5 A / 21 A / 700 W 3200 W
¹⁾ 1/8 of max Output Power with pink noise to represent typical music signal	4 Ω 4,3 A / 15 A / 510 W 2200 W	4 Ω 6,5 A / 28 A / 880 W 4300 W	4 Ω 8 A / 35 A / 1100 W 5800 W
²⁾ max. rated Output Power (see above)	1.8 Ω 7,2 A / 30 A / 1005 W 4800 W	2 Ω 10 A / 40 A / 1450 W 6600 W	2 Ω 12 A / 60 A / 1800 W 9400 W

Frequency Response	20 Hz - 20 kHz \pm 0,15 dB 8 Ω load, 1 dB below rated power
Input Impedance	40 k Ω balanced
Voltage Gain	selectable: 26 dB, 32 dB, or 1,4 V input sensitivity
Protection Circuits	inrush-current limitation, protection circuits against power on/off transients, temperature monitoring of transformers and heat-sinks, output DC protection, power transistor control, temperature dependent SOA protection, intelligent mains fuses protection
Limiter	switchable peak-limiter
Fan	2 temperature dependent speed-controlled axial fans
Ground-Lift	input ground-lift switch on back panel
Indicators	LED's for ON, SIGNAL, CLIP, indicating additionally Output Current and faults for example like DC and High Temp
Input Connectors	3-pin XLR, male and female per channel, pin 2 = inphase
Output Connectors	one 4-pole SPEAKON connector for each output channel (bi-amping possible)
Modes of Operation	STEREO, BRIDGE MONO and PARALLEL-MONO
Options	Extended User Interface / E.U.I. - modules for any kind of EQ
THD+N (typical) 20 Hz - 10 kHz, 8 Ω load 3 dB below rated power	< 0,01 %
SMPTE (typical) 20 Hz - 20 kHz, 8 Ω load 3 dB below rated power	< 0,01 %
Damping Factor 8 Ω load, 1 kHz and below	> 400
Dimensions (WxHxD)	483 x 88,9 x 420 mm (19",2U)
Net Weight	12,4 kg
Shipping Dimensions (WxHxD)	600 x 600 x 205 mm (0,074 m ³)
Shipping Weight	15 kg

Subject to technical alterations without prior notice

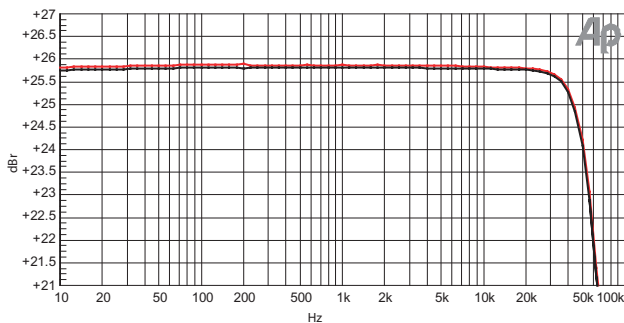


Figure 7.1
Gain vs. frequency (Ch1, Ch2)
(Measurements of a typical performance)

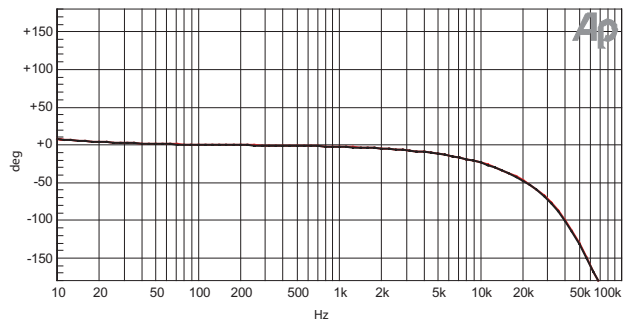


Figure 7.3
Phase vs. frequency (Ch1, Ch2)
(Measurements of a typical performance)

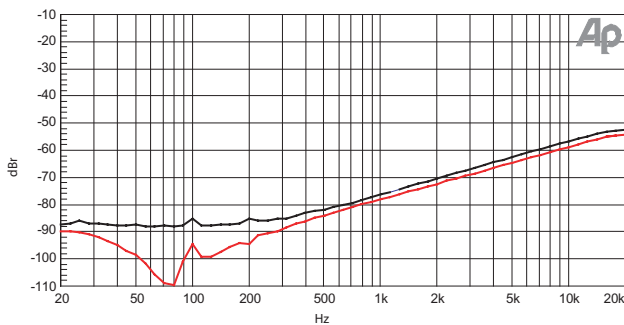


Figure 7.2
Channel separation vs. frequency @ 10 W / 4 Ohm (Ch1 => Ch2, Ch2 => Ch1)
(Measurements of a typical performance)

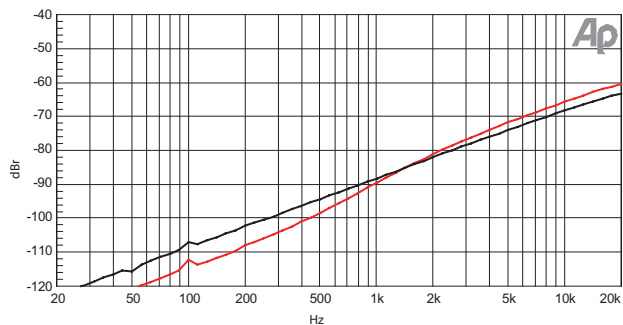


Figure 7.4
Common mode rejection ratio (Ch1, Ch2)
(Measurements of a typical performance)

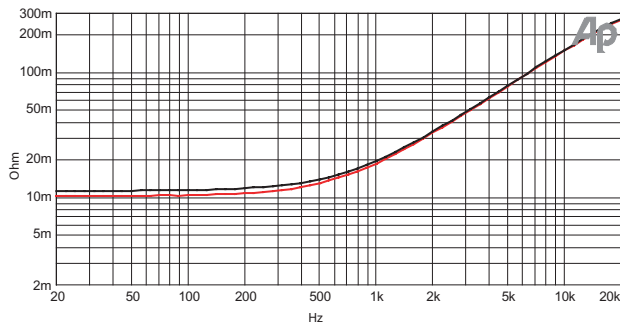


Figure 7.5

Output impedance vs. frequency @ 1 Amp RMS injected current. (Ch1, Ch2)
equivalent 11 mOhm + 2.1uH (Measurements of a typical performance)

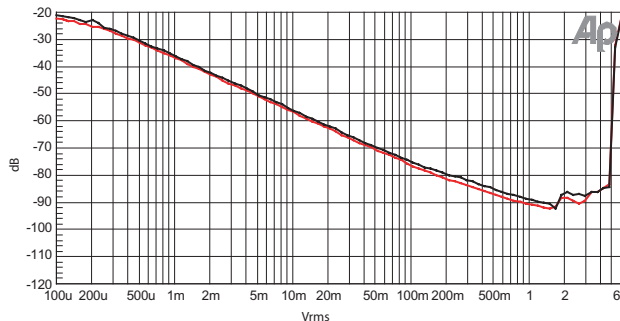


Figure 7.6

THD+N @ 1 kHz, 4 Ohm load vs. input voltage (Ch1, Ch2)
(Measurements of a typical performance)

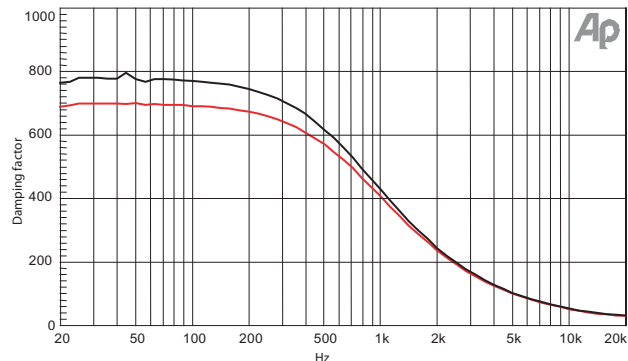


Figure 7.7

VORTEX 6 damping factor into 8 Ohm
equation: $\text{damping factor} = \text{loaded impedance} / \text{amplifier output impedance}$
(Measurements of a typical performance)

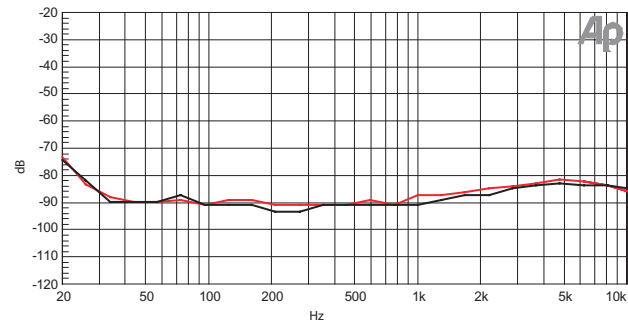


Figure 7.8

THD+N vs. frequency (BW 22 kHz), 3 dB below clip, 4 ohms (Ch1, Ch2)
(Measurements of a typical performance)

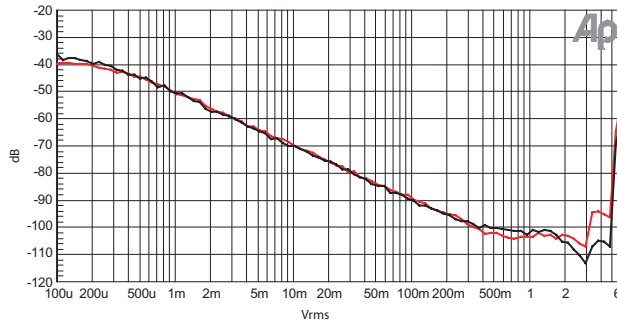


Figure 7.9

CCIIF difference frequency method (10,5 kHz and 11,5 kHz) vs. inputlevel @ 4 Ohms (Ch1, Ch2) (Measurements of a typical performance)

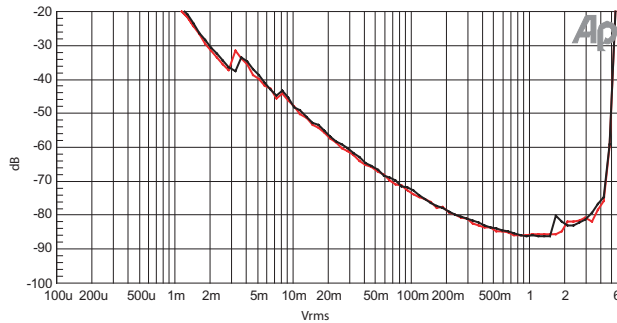


Figure 7.10

SMPTE intermodulation distortion (60 Hz and 7 kHz) @ 4 Ohm vs. input level (Ch1, Ch2) (Measurements of a typical performance)

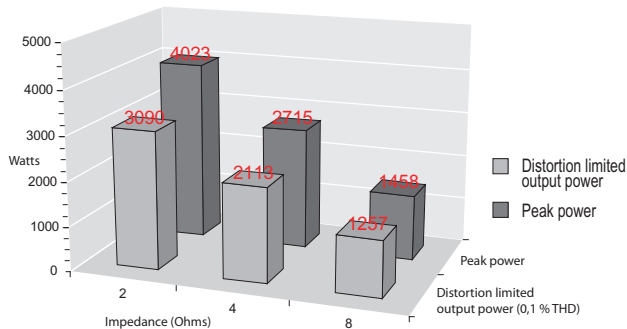


Figure 7.11

VORTEX 6 (Measurements of a typical performance)

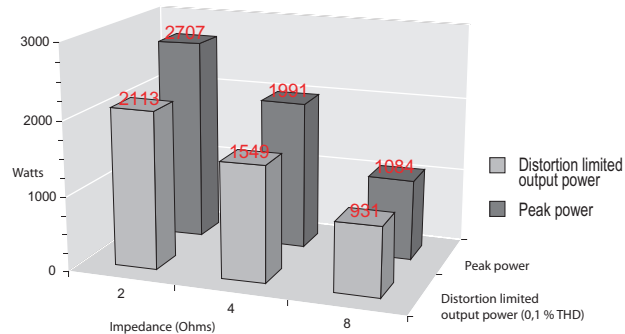


Figure 7.13

VORTEX 4 (Measurements of a typical performance)

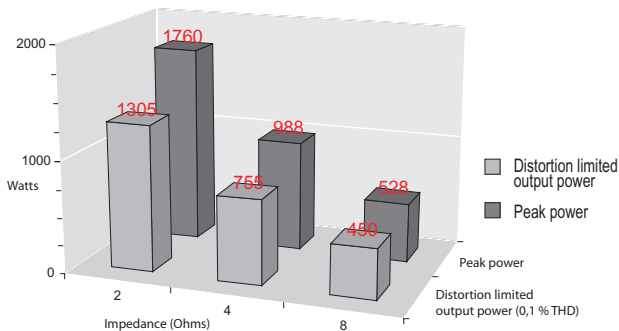


Figure 7.12

VORTEX 2.6 (Measurements of a typical performance)

8.1 Summary Of Warranty

CAMCO guarantees the **VORTEX** Amplifier to be free from defective material and/or workmanship for a period of three years from the date of sale. Provided that the amplifier is returned to your distributor/dealer in a factory pack with a copy of the proof of purchase, i.e., sales receipt, **CAMCO** will repair faulty products under this warranty when a defect occurs under normal installation and use.

This warranty provides that examination of the returned product must indicate, in our judgment, a manufacturing defect.

8.2 Items Excluded From This Warranty

CAMCO is not liable for any damage caused by shipping accidents, misuse, abuse, operation with incorrect AC voltage, operation with faulty associated equipment, modification, or alteration without prior factory approval, service by an unauthorised service center, and normal wear and tear. Amplifiers on which the Serial Number has been removed or defaced are not eligible for warranty service.

8.3 What Camco Will Do

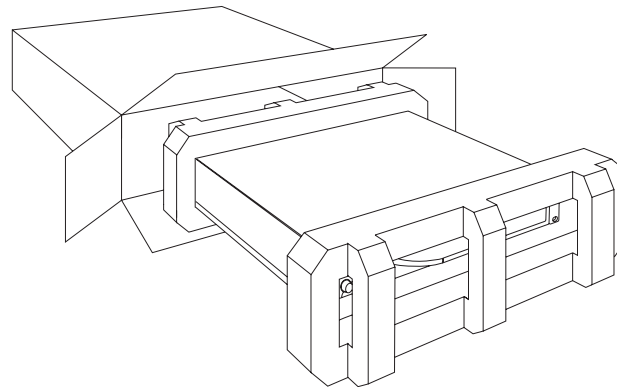
CAMCO (or its appointed agent) will rectify any defect, regardless of the reason for failure (except as excluded), by repair, replacement, or refund, as it sees fit.

8.4 How To Obtain Warranty Service

You must notify your dealer/distributor of your need for warranty service. All components must be shipped in a factory pack.

8.5 Camco's Product Improvement

Due to **CAMCO's** policy to continuous product improvement, specification is liable to change without notice. Please consult your distributor/dealer or **CAMCO** direct for clarification if necessary.



**PLEASE ENCLOSE THIS COMPLETED FORM WITH THE AMPLIFIER
DO NOT SEND SEPARATELY**

9.1 Owner's Information

Company Name: _____

Contact: _____

Address: _____

Telephone: _____

Facsimile: _____

eMail Address: _____

Model: _____

Serial Number: _____

Purchase Date: _____

9.3 Expired Warranty

If the warranty has expired, payment will be:

Cash/Cheque

VISA

MasterCard

9.4 Shipping Address

To transport the amplifier, we recommend that you use the original packing materials. Please return the amplifier to the following address or your nearest **CAMCO** appointed distributor.

9.2 Nature Of Problem

Please describe the conditions that existed when the problem occurred and what attempts were made to correct it: _____

Other equipment in your system: _____

Our web site: **www.camco.de** provides a complete list of dealer/distributors.

CAMCO Produktions-und Vertriebs-GmbH, Fischpicke 5, D-57482 Wenden, Germany



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