

# **CAMCO MANUAL DX SERIES AMPLIFIER**

## **CAMCO DX12 & CAMCO DX24**

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## 1. GENERAL INFORMATION

You have chosen a CAMCO Power Amplifier. We would like to thank you for your confidence in us and our product.

The Power Amplifier was handmade in the Federal Republic of Germany. All the components were carefully chosen. Although the amplifier was designed to allow straightforward and uninterrupted operation, improper handling or incorrect installation could destroy the power amplifier or connected appliances.

### ! STOP - DON'T SWITCH THE UNIT ON YET!

These operating instructions are intended to help you set up, install and use the DX Power Amplifiers. Even if you are familiar with electronic equipment, please read the following pages carefully before you actually start using the appliance. Please keep this manual in a safe place.

#### THE FOLLOWING ARE ESSENTIAL:

Observe all instructions given on the appliance and adhere to them strictly.

Protect the appliance from ANY TYPE of moisture.

Be as careful as possible when it comes to set up the entire system, especially the power amplifier. Only do connection work with the APPLIANCE SWITCHED OFF.

Only use the MAINS VOLTAGE SPECIFIED on the type plate.

Unplug the appliance before opening it (There is a risk of a severe electric shock from the voltage inside the unit. There are NO user-serviceable parts inside).

Have any modifications performed by an authorised service centre or the manufacturer ONLY. Otherwise ALL WARRANTY CLAIMS LOSE THEIR VALIDITY.

Keep the appliance strictly away from unauthorised persons, especially children.

#### **NEVER:**

operate the appliance when it is damp!

remove the protective earth (on the plug and never tape the ground connections)!

connect the input and output of a power amplifier with one another!

connect the amplifier outputs of one or more amplifiers with one another or with any source of voltage (mains or battery), even if the appliance is switched OFF!

### 1.1 Unpacking

Your DX Power Amplifier is delivered in packaging specially designed for this particular appliance.

Check the cardboard box and its contents IMMEDIATELY to see if there are any signs of damage. If you should detect any damage, inform the forwarding agent without delay and ask for the damage to be documented. Claims can only be made against the forwarding agent by the consignee. Keep the box and all packaging material and transport documents CAREFULLY so that they are available for the forwarding agent to check.

We recommend that you should always keep the original packaging and all accompanying documents, especially the invoice, receipt of purchase with the serial number and the operating manual.

If you should have to send in the power amplifier to the manufacturer at a later date, it is in your own interest to keep the box.

## 2 GENERAL DESCRIPTION

All the units in the DX Power Amplifier series are designed and built to achieve high economic efficiency coupled with maximum service life even under the toughest conditions, even at maximum load.

Professional, computer-aided design throughout the entire development phase, careful selection of components, and various test cycles before the appliance is delivered guarantee that these power amplifiers live up to these targets at all times.

The amplifiers in the CAMCO DX series are in 2-channel design. They were designed for professional applications and can be operated in conjunction with all commercially available appliances without problems. The amplifiers are enhanced by simplicity of operation, years of trouble-free application and premium audio characteristics. Typical applications include tours, high-quality sound systems for discos and studios or fixed installations in conjunction with our computer remote control system WinCai.

In addition to the standard equipment of the serial models, the DX Power Amplifier series also features numerous optional accessories and fittings which are listed in the chapter entitled 2.6 Options.

### 2.1 Mechanical construction

The housings of the DX series correspond with the 19-inch standard for racks (in accordance with DIN 41494); they occupy 3 height units, this means 133 mm.

This manufacturing technique of the DX series amplifiers gives maximum stability. The fully flat cover is screwed on. This provides a large aperture providing access for assembly and maintenance. The surface seal affords reliable protection against environmental influence and scratches. There are two large, hand-friendly handles at the front of the unit. For a more solid fixing you have the possibility to fasten the amplifier on the backside as well.

Numerous signal-processing modules (crossovers, equalisers etc.) and preamplifier modules can be plugged in at the rear of the unit, protected from damage and unauthorised access. The integrated PCB is called "Extended User Interface", in short E.U.I.

The power amplifier is among other things appropriate for use in active sound reinforcement systems without external crossovers. Internal active crossovers can be built in as options, please ask your supplier.

### 2.2 Electrical construction

Operational safety and easy maintenance were paramount features when this unit was being designed. A modular construction principle was the method of choice, with the internal wiring largely plug able. The advanced electronic circuitry has been divided up between various PCBs in different functional groups.

The input connectors are mounted to the E.U.I. Module. Furthermore the signal filtering is located on this removable PCB. Via a 64 pin connector all important information are handed over to the input PCB. Here are situated the input balancing circuit, the switches for the limiters, the different input sensitivities and operating modes. In addition, the entire signal processing circuitry, the VCAs for LEVEL and LIMIT. Below this board there is the main PCB. It is responsible for the fan and the temperature regulation of the complete amplifier, the stabilisation of the two supply voltages for the control electronics and the fan. Furthermore it accommodates the filtering of the 4 symmetrical supply voltages of the two power amplifier channels, the safety electronics for thermal overload and DC, the control circuit for opening and closing of the loudspeaker relays, the loudspeaker relays with the connections to the output connectors, and the preamplifier stages with the pre-drivers and the integrated TPU module (Transistor Protection Unit).

Underneath the main board you find the heat sink with the two power block PCBs and the transistors. To achieve excellent audio properties we decided on a fully complementary transistor circuit with bipolar power transistors which are designed for heavy loads and high voltages. By using 2-stage power packs and parallel wiring of power transistors for each voltage supply, a very high maximum output power was achieved (see below). This conservative construction principle is a guarantee for a long service life and trouble-free operation of the power amplifier, even under tough conditions.

The mains PCB, behind the mains switch at the front right, contains the current inrush limiters and the connections for the mains line, mains switch and mains transformers. The switch for selecting the mains voltage is accommodated here as well. No mains fuses are necessary inside the amplifier, because of the use of automated fuses in the mains switch.

## 2.3 Power supply

A very large customised manufactured current-inrush limited temperature-controlled toroidal-core transformer have been used with one primary and six secondary windings for each channel. Four separate secondary windings for the power part and two secondary windings for the control electronics per channel. (See 2.4 and 4. for details of current inrush limitation).

The filter electrolytic capacitors of the 4 symmetrical supply voltages for the power part are located on the main PCB. (see 2.2).

## 2.4 Protective circuitry

All power amplifiers in the DX series feature complex protective circuitry which monitor all sensitive components to protect the power amplifier itself along with connected units or loudspeakers from damage:

- Limitation of the current inrush means that the amplifier can be operated on standard fuses (>3.2.2 mains lead).

- The loudspeakers are switched on delayed. Especially sturdy relays were selected to disconnect the loudspeakers from the power amplifier in case of a protection situation.

- The toroidal-core main transformer and the large heat sink are temperature-monitored. If necessary, the loudspeaker relay will be opened. (See >4. Safety electronics for more details).

- The TPU module (Transistor Protection Unit) protects the power transistors from too high currents caused by too low load impedance or short circuits on the output. (See >4. Safety electronics for more details).

- The DC safety module protects the load connected from being destroyed by DC. (See >4. Safety electronics for more details).

## 2.5 Ventilation

The power amplifiers of the DX Series are forced-air-cooled. The low-noise DC axial fan features temperature-speed control and is located at the rear behind a stable protective grille. Up to 200 m<sup>3</sup> air per hour are suctioned in at the rear of the unit, from where it passes the transformers, rectifiers and heat sink before it leaves the unit again throughout the front panel.

## 2.6 Options

Numerous options are available in addition to the standard equipment of the models in the DX series. Plug-in circuit boards for signal processing are accommodated at the Extended User Interface (E.U.I-Module). This special board can be modified by the factory or the user at any time, also at a later date. At the moment, the following options are available:

- Input balancing with transformers in accordance with IRT;

- WinCAI, CAMCO Audio Interface (Computer remote control and monitoring);

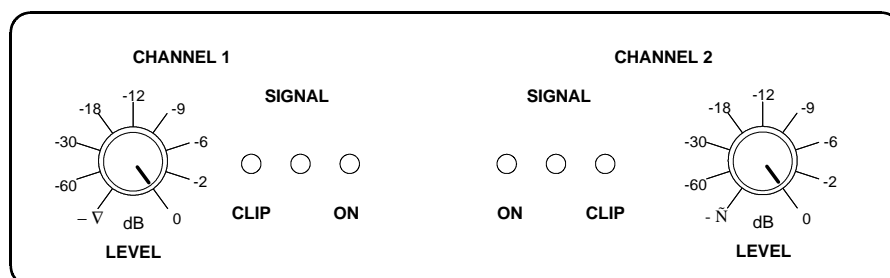
- Filter boards per channel for set-up of high-passes, low-passes or band-passes to meet customers' specifications;

- EQ cards for equalisation of special loudspeaker systems;

### 3. FUNCTIONAL DESCRIPTION

#### 3.1. Description of the front panel

The most important control and display elements are located on the front panel. They apply to the two power amplifier channels:



LEVEL control range 300 degrees in 40 steps. Turning this control clockwise increases the output level. As a help for calibrating the level you find a description of the corresponding attenuation in dB.

CLIP indicator - LED lights up as soon as the appropriate amplifier channel is overdriven and the Clip limiter is activated.

ON indicator - 2 functions: the LED lights up once the amplifier channel has been switched on. The LED flashes on and off when the loudspeaker relay has been opened.

##### 3.1.1 Mains switch

Before starting up the two amplifier channels via the mains switch, please check the following:

whether the mains voltage corresponds with that specified on the unit's type plate. There are two different mains voltages internal switch able, 115 V or 230 V AC ( $\pm 10\%$ );

whether all input and output wiring connections have been completed;

whether both LEVEL controls have been turned down;

These precautionary measures protect your loudspeakers from any overload which might occur in the event of feeding in a very high signal.

Only mechanical switch types are used as mains switches. The advantage of this is that the appliance does not have to be switched back on again in the event of a power failure, thus making a manual reset unnecessary.

##### 3.1.2 ON display

When you have switched on the amplifier channels, the ON LED indicates that power is being supplied to the channel.

If none of the LED's light up once the appliance has been switched on, this might be due to the following fault:

no power supply from the mains outlet

Please check that the appliance has been plugged in properly and check that power is being supplied from the mains outlet. If so, but the LED's still have not lit up,

**! SWITCH OFF THE UNIT IMMEDIATELY AND CONTACT THE MANUFACTURER OR AN AUTHORISED SERVICE CENTRE!**

If the LED is flashing evenly, this shows that one amplifier channel's loudspeaker relay is open. This may be due to one of the following causes:

DC at the amplifiers input or output as a result of a fault;

The temperature of the heat sink or the mains transformer has reached a temperature of 95°C. The relay contacts close automatically once the temperature has dropped to 85°C again.

### 3.1.3 SIGNAL indicator

The SIGNAL LED indicates a -30 dB point relative to the clipping point, regardless of the mains voltage and the connected load. This LED gives the user a better control of the remaining headroom of a channel or a complete system.

### 3.1.4 CLIP indicator

The CLIP LED indicates the exact clipping point, regardless of the mains voltage and/or the connected load.

The symmetrical supply voltages of the power pack of an amplifier limit its output power. If an amplifier is overdriven by a too high input signal, the output signal tries to exceed the value of the supply voltages. At this moment, the amplifiers 'clips'. This results in a dangerous situation for the connected loudspeakers. The Peak Limiter intervenes here by automatically limiting the output signal - this is indicated by the CLIP LED of the channel in question.

### 3.1.5 The GROUND ON/OFF switch

There are two holes on the right side of the front panel, near the mains switch. With any kind of tool with a width of less than 3 mm, for instance a small screwdriver, you can push the internal ground switch. Pressing a tool through the upper hole will switch ground on, pushing it through the lower hole will disconnect the wire shield from the appliance ground. Factory set is GROUND ON

In position ON, the signal is connected with protective ground.

In position OFF, the signal is disconnected from protective ground.

### **! THE AMPLIFIER HOUSING IS ALWAYS GROUNDED REGARDLESS OF THE SWITCH SETTINGS!**

NOTE: If the power amplifier is equipped with the option of transformer balancing, it complies with VBG4 according to VDE 0860 (correspond to IEC 659). In this case the GROUND ON/OFF switch does not function.

## 3.2. Description of the rear panel

### 3.2.1 Fan

All the power amplifiers of the DX series are equipped with an temperature-speed-controlled cooling DC axial fan (see 2.5). The air is suctioned in at the rear of the unit and emitted at the front.

An NTC component monitors the temperature inside the unit and controls the fan speed level less and noiseless from a temperature up from around 50°C. The fan reaches its maximum speed at around 65°C. This means that the air throughput is adapted to meet the actual temperature conditions in question, reducing the quantity of dust and dirt which is suctioned in.

The quantity of dust and dirt can be further reduced by using filter mats in front of the fan. If you decide to use filter mats of this type, make sure that they are cleaned regularly and carefully e.g. in soapy water.

Units with forced cooling like those of the DX series must be cleaned inside from time to time to remove dust and dirt, even if filter mats are used. Please make sure that the unit is cleaned in regular intervals because otherwise perfect function of the appliance cannot be guaranteed. Have this work performed by a specialist.

### 3.2.2 Mains lead

Before starting up the unit for the first time, please check that the mains voltage corresponds with the voltage specified on the type plate on the appliance itself. All power amplifiers of the DX series are designed for operation with the standardised voltages in the world, namely 230 V AC and 115 V AC with a frequency of 50 / 60 Hz.

**! THERE IS NO WARRANTY FOR DAMAGE CAUSED BY INCORRECT MAINS VOLTAGE.**

The mains voltage can be easily selected inside the appliance by removing the top cover plate (16 screws, PZ 1) and switching the mains voltage selector to the required value. The switch looks similar to the mains switch and is located on the mains PCB behind the front panel. You find it on the bottom left side of the PCB when you look from the front side into the amplifier.

The fixed mains lead of about 1.4 metres length is equipped with a plug to comply with requirements in the federal republic of Germany. If the power amplifier is to be used in other countries, you may have to use an authorised adapter or exchange the plug on the cable.

**! THIS WORK MUST BE PERFORMED BY A SUITABLY QUALIFIED ELECTRICIAN ONLY!**

The new plug must also be authorised for the voltage and current as specified on the type plate. The colour coding on the mains lead is as follows:

color	function
brown	LIVE (switched)
blue	NEUTRAL (not switched)
green / yellow	PROTECTIVE EARTH

If so required, the amplifier is optionally available with different mains lead or a different plug.

So-called hum loops can arise despite correct mains connection. This results in very loud humming noise in the loudspeaker system.

**! NEVER GET RID OF HUM LOOPS BY DISCONNECTING PROTECTIVE EARTH!**

(>See GROUND OFF/ON for more details on how to avoid hum loops).

The rated power consumption of CAMCO amplifiers are:

Model	Rated Maximum Power Consumption	You should calculate with a current consumption of	Power cord wire diameter
DX12	600 W	6,3 A @ 230 V AC or 12 A @ 115 V AC	1.5 mm <sup>2</sup>
DX24	1200 W	12 A @ 230 V AC or 24 A @ 115 V AC	2.5 mm <sup>2</sup>

Theoretically, the value of the rated current is exceeded momentarily several times when the unit is actually switched on, but integrated inrush current limiters reduce the current peak down to 8 A which permits operation of the unit with even commercially available fuses.

### 3.2.3 The switches

#### 3.2.3.1 The MODE switch

At the CAMCO DX series amplifiers you can choose three different operating modes, the standard « Stereo Mode », the high voltage « Mono Bridged » mode and the high current « Parallel Mono » mode. The mode of operation depends on the power requirements and the impedance of the provided loudspeaker cabinets.

#### 3.2.3.2 The GAIN switch

At the CAMCO DX series amplifiers you can select one of three different input sensitivities, respectively three different voltage gains. The switch settings are: 26 dB voltage gain (factory set), 32 dB voltage gain and 1.4 V input sensitivity. Here is list with the corresponding gains and input sensitivities:

Amp type	26 dB means	32 dB means	1.4 V means
DX12	3,2 V	1,6 V	33 dB
DX24	4,4 V	2,2 V	36 dB
	Input Sensitivity	Input Sensitivity	Voltage Gain

Note: Every increase of the gain will decrease the signal to noise ratio!

#### 3.2.3.3 The LIMITER switch

In some applications it may be necessary to switch off the built in peak limiter. In normal use, with limiters, the distortion is less than 0.5 % even when the Clip LED is flashing. If the loudspeaker system or a pre connected controller allows the use of an amplifier with more than 0.5 % THD you can switch off the limiter. In this case you should be aware that the parameter curve (THD vs. power) at clip level is very steep and you will have only a small improvement of the usable signal, but a strong increase of distortion.

### 3.2.4 Inputs and connectors

Both channels have their own pair of parallel-wired 3-pole XLR . This means that you can use one of the two connectors as an input into the amplifier, leaving the other available for daisy-chaining.

The DX series amplifiers have balanced inputs. Pin 2 represents the XLR inphase connection; this means that if you feed in a positive signal on Pin 2 of the XLR, there is also a positive signal on Pin 1+ of the corresponding output connector. If you apply a negative signal on Pin 2 of the XLR, a negative signal appears also on Pin 1+ of the output connector.

Unfortunate wiring, such as in the proximity of dimmers or other generalised phase controls, motors, transformer substations etc. can cause interference into your system. You will hear loud humming or crackling noise in the loudspeakers. Balanced wiring suppresses these noises quite significantly, whereby it does not really matter if the balancing circuit is electronic or executed via transformers. The common mode rejection ratio is, admittedly, normally slightly higher when transformers are used, i.e. the interference are suppressed somewhat more effectively. This method also has the advantage of signal isolation. This is the only way for you to operate parts of your system in floating mode.

For its transformer balancing, CAMCO uses toroidal-core transformers with a balancing attenuation level of 60 dB or higher at 15 kHz, in accordance with IRT. Electronic balancing results in a balancing attenuation level of 55 dB or higher at 15 kHz.



If you intend to use unbalanced wiring, you should connect Pin 1 and Pin 3 of your unbalanced XLR input plugs. Otherwise the following disadvantages arise:

With electronic input balancing, the frequency response is maintained but the maximum output power is reduced by a few dB.

With transformer input balancing, the output power reduction depends on the frequency. This means not only power loss but impaired quality as well.

The pin assignment of the XLR input connector is as follows:

Pin 1 of the Input XLRs correspond to wire shield;

Pin 2 of the Input XLRs correspond to "Inphase";

Pin 3 of the Input XLRs correspond to "Outphase".

### 3.2.5 Outputs and connectors

For each power amplifier channel, there is a 4-pole SPEAKON connector as a loudspeaker output. On both 4-pole SPEAKON connectors is the other channel connected as well, this allows Bi-amping of one cabinet, for instance an active two way loudspeaker. There is also an additional 4-pole SPEAKON connector for the Mono Bridge mode (1-channel mode).

Use flexible, double insulated loudspeaker cable and make sure that the resistance of the lead is as low as possible. It should only play an insignificant role in the overall system of amplifier - cable - loudspeaker. This helps to prevent power loss and increases the impulse response of the sound reproduction.

Our contribution as manufacturers was to equip the power amplifiers in the DX series with a very small internal resistance. That means that the loudspeaker is controlled exactly in accordance with the signal wave form, and acceleration or braking of the membrane is performed with precision. This prevents uncontrolled overshooting which is particularly audible in the low frequency range.

This phenomenon is referred to as the DAMPING FACTOR in the specifications. Normally speaking, it is the quotient from a load impedance of 8 ohms and the internal resistance of the amplifier. For example with the CAMCO DX12 amplifier, the internal resistance is less than 20 milliohms; therefore the damping factor is  $8\Omega / 0.02\text{ ohms}$ , better than 400:1.

The resistance of the loudspeaker cables can be influenced decisively by the length and cross-section of the cable and by the number and type of connectors used. The design of the cable (number and cross-section of the individual stranded wires) does not influence the line resistance in the frequency range used. It only affects the flexibility of the cable.

SPEAKON cable connectors are suitable for a cable cross-section of up to 4 mm<sup>2</sup> max.

You can calculate the resistance of cables by using the equation:

resistance [Ohms] = specific resistance [Ohm x mm<sup>2</sup>] x length [m] / cable diameter [mm<sup>2</sup>]

$R [\Omega] = 0,0178 [\Omega\text{mm}^2] \times L [\text{m}] / A [\text{mm}^2]$

The recommended cable cross-section depends on the power consumption of the connected loudspeakers and the length of the lead. To connect loudspeakers of medium power capacity up to 400 watts and for leads up to 20 metres, the cross-section should not be smaller than 2.5 mm<sup>2</sup>. Higher power or longer leads require a cross-section of at least 4 mm<sup>2</sup>.

Keep the loudspeaker cables as short as possible. Place the loudspeakers and amplifiers as close together as possible, laying longer input signal and mains cables if need be. This decreases power loss and enhances the impulse response of the sound reproduction.

Every plug or screw connection between the amplifier and the loudspeaker does not only increase the overall resistance of the cable, it is also a risk factor as regards function. Therefore you should only use insulated, non-interchangeable, interlock able, and step-safe connectors on your loudspeaker and extension cables. They should have as low a contact resistance as possible and meet the requirements as regards voltage and current.

XLR and SPEAKON connections have proved their worth in professional applications for many years.

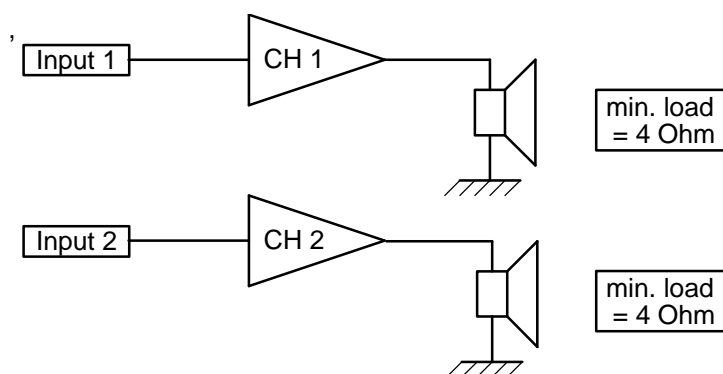
When wiring your system, ensure that the loudspeaker connections are correct made, especially the phase relationship. A 'flat' sound with too little bass or a poor stereo image are sure signs that parts of your loudspeaker system are connected out of phase. To facilitate correct connections, the plug and screw connectors to amplifiers, passive crossovers, individual loudspeakers or loudspeaker cabinets should be marked. Red cables and connections correspond with the markings « + », « plus » and « inphase », black cables and connections with « - », « minus » and « outphase ».

### 3.2.5.1 STEREO Mode (Two-Channel Mode)

Make sure, that the mode of operation switch is set to STEREO.

The amplifier is now working with 2 independent channels:

A signal at INPUT CHANNEL 1 creates a signal at the output OUTPUT CHANNEL 1 if the LEVEL control 1 is turned up. Accordingly, a signal at INPUT CHANNEL 2 creates a signal at OUTPUT CHANNEL 2 if the LEVEL control 2 is turned up.



To commence operation of your CAMCO DX Series amplifier as a two-channel amplifier, proceed as follows:

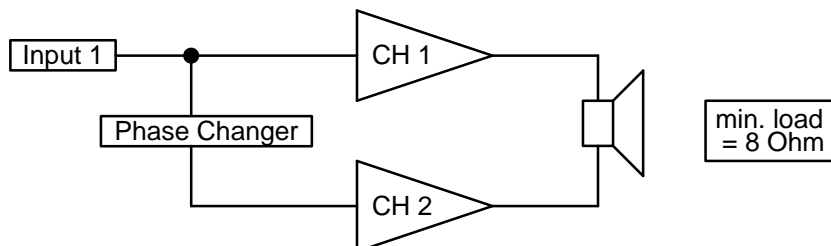
1. Turn both LEVEL controls off (anticlockwise);
2. Switch the power amplifier OFF;
3. Set the MODE switch into STEREO position;
4. Set LIMITER switch as required;
5. Set GAIN switch as required;
6. Set GROUND ON/OFF switch as required;
7. Connect inputs;
8. Connect loudspeakers;
9. Switch the power amplifier ON;
10. Set LEVEL controls of channel 1 & 2 as required;

In two-channel mode, neither of the impedance of the two output connections should be less than 4 Ohms!

### 3.2.5.2 BRIDGE (1-channel mode)

Make sure, that the switch MODE is set to BRIDGE.

In Mono bridged mode, both power amplifier channels work with the same input signal, but with inverse phases. The result is a doubling of the output voltage and thus double the power on the double impedance.



#### IMPORTANT!

- ! **If the power amplifier is to be operated in Mono bridged mode, ONLY input socket INPUT CHANNEL 1 may be used; NO SIGNAL must be applied to the input socket INPUT CHANNEL 2. Only LEVEL control of channel 1 serve to control the loudspeakers, LEVEL control of channel 2 is without function.**

The control with the lower volume setting assumes the more important role. The loudspeaker output in Mono bridged mode is the 4-pole SPEAKON connector OUTPUT BRIDGE.

To commence operation of your CAMCO DL Series C amplifier as a single channel amplifier in Mono bridged mode, proceed as follows:

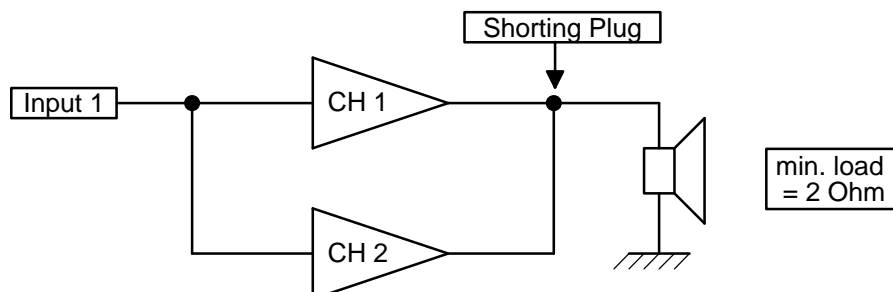
1. Turn both LEVEL controls off (anticlockwise);
2. Switch power amplifier OFF;
3. Set switch MODE into BRIDGE position;
4. Set LIMITER switch as required;
5. Set GAIN switch as required;
6. Set GROUND ON/OFF switch as required;
7. Connect ONLY INPUT 1!
8. Connect ONLY SPECIAL SOCKET OUTPUT BRIDGE for your loudspeakers
9. Switch the power amplifier ON;
10. Set LEVEL control of channel 1 as required;

In Mono bridge mode, the impedance on the output connector should not be less than 8 Ohms!

### 3.2.5.3 PARALLEL-MONO (1-channel mode)

Check that the switch MODE is set at Parallel-Mono.

In Parallel-Mono mode, both power amplifier channels work with the same input signal, but parallel at the outputs. The result is a doubling of the output current and thus double the power on half impedance.



#### IMPORTANT!

- ! If the power amplifier is to be operated in Parallel-Mono mode, **ONLY** input socket **INPUT CHANNEL 1** may be used; **NO SIGNAL** must be applied to the input socket **INPUT CHANNEL 2**. Only **LEVEL** control of channel 1 serve to control the loudspeakers, **LEVEL** control of channel 2 is without function.

To commence operation of your CAMCO DX Series amplifier as a single channel amplifier in Parallel-Mono mode, proceed as follows:

1. Turn both LEVEL controls off (anticlockwise);
2. Switch power amplifier OFF;
3. Set MODE switch into PARALLEL-MONO position;
4. Set LIMITER switch as required;
5. Set GAIN switch as required;
6. Set GROUND ON/OFF switch as required;
7. Connect **ONLY** INPUT 1!
8. Connect the Shorting Plug to OUTPUT 2
9. Connect your loudspeakers to OUTPUT 1, see sticker on back plate as well
10. Switch power amplifier ON;
11. Set LEVEL control of channel 1 as required;

In Parallel-Mono mode, the impedance on the output connector should not be less than 2 Ohms!

### 3.2.7 GROUND ON/OFF - no function in VBG4 model

The GROUND ON/OFF switch is located on the front side near the mains switch. You find it behind the two holes on the front plate. It represents a simple solution for ground loop problems.

In ON position, push with a small tool through the upper hole, signal ground and protective earth are connected. In OFF position, lower hole, signal ground and protective earth are disconnected.

For normal operation, this switch should be set at GROUND ON. Interference on the signal wiring caused by motors, dimmers or transformers can be removed via ground potential. This often reduces the effects of the interference so efficiently that no further measures are necessary.

There are, however, some situations where it may be necessary to disconnect ground and protective earth. After set-up of an entire sound reinforcement system (e.g. consisting of mixing desk, equaliser and crossover in the hall, along with amplifiers with controllers on the stage), so-called ground loops may arise. This example is intended to illustrate the problem more clearly; there is a signal connection between the various units with the same ground reference point, but the protective earth connection has differing reference points. If the two systems are connected in more than one point, the so-called hum loops arise. There are various ways for you to avoid this occurring:

First of all you can cable the entire system floating and balanced. This is the most convenient way, but it is admittedly rather cost-intensive.

Another possibility is to i.e. to have star-shaped earth cabling. This guarantees uniform earth potential for all units.

It may be enough simply to disconnect the connection between signal ground and protective earth in one or more places, thus interrupting the 'loop', e.g. on the GROUND ON/OFF switch on the amplifiers.

#### **IMPORTANT!**

- ! REGARDLESS OF THE SETTING OF THE SWITCHES, THE AMPLIFIER HOUSING IS ALWAYS CONNECTED WITH PROTECTIVE EARTH! NEVER TRY TO REMOVE EARTH LOOPS BY DISCONNECTING THE PROTECTIVE EARTH!**

## 4. PROTECTIVE CIRCUITRY (IN MORE DETAIL)

The power amplifiers in the DX series are equipped with sophisticated protective circuitry which monitor all sensitive modules permanently to protect the power amplifier itself and connected units or loudspeakers from damage as far as possible. For this reason we have installed the following protection mechanism:

1. Inrush-current limitation;
2. protection circuits against power-on and power-off transients;
3. temperature monitoring of transformers
4. temperature monitoring of heat sinks;
5. DC protection of the outputs;
6. Output current limiter;

With this protections the loudspeaker cabinets are efficient guarded from DC and "turn on crack". The amp itself is protect against overheat, under impedance, short circuit or open line failure.

The temperature management system constantly monitors the temperature in the toroidal-core main transformers. If the temperature should exceed  $95^{\circ}\text{C} \pm 10\%$ , the load connected on the output is not disconnected, but the input stage VCA decreases the input signal until there is a temperature balance.

There is also an additional thermal overload cut-out integrated in the transformers. This is activated at temperatures in excess of  $120^{\circ}\text{C}$  if the above-mentioned overload should fail.

The temperature of each power amplifier channel is monitored by its own NTC component. If the temperature exceeds  $95^{\circ}\text{C} \pm 10\%$ , the input stage VCA decreases the input signal until there is a temperature balance.

A new powerful TPU (Transistor protection Unit) was developed to protect the power transistors as efficiently as possible and to guarantee them a long service life. This current limiter permanently monitors output current and output voltage and adjusts them variably with a time delay of around 30 milliseconds if certain limits are exceeded.

To protect the connected loudspeakers effectively from DC, a DC safety module monitors both output channels. If DC of 5 V or higher is measured, (due to a fault in the power amplifier itself or due to DC on the input), a relay switches the output off immediately.

A new and very service friendly feature is the switch with automated fuses. In the past it was necessary to open an amplifier and change the fuses if the main fuses were blown. With the CAMCO DX series amplifier you just have to turn ON the mains switch and the show can go on in a few seconds.

## 5. SET-UP and INSTALLATION

Careful planning of the amplifier's working area is always important, no matter whether it is to be used stand-alone or in more complex rack systems.

### PLEASE AVOID THE FOLLOWING:

- a location with too high ambient temperatures, dust build-up or excessive humidity
- operation of fog machines, exhaust air ventilators and similar units near the fan's input area at the rear of the power amplifier
- permanent vibrations
- excessive induction and/or magnetic fields and transmitters near the power amplifier

### PLEASE OBSERVE THE FOLLOWING:

- There must be sufficient air supply at the rear of the unit (especially applicable if the unit is to be operated in a rack).

## 6. TECHNICAL DATA

TECHNICAL SPECIFICATIONS DX12 AND DX24						
	DX24			DX12		
OUTPUT POWER	2 Ω / 8 Ω Mono	4 Ω	8 Ω	2 Ω / 8 Ω Mono	4 Ω	8 Ω
Peak Power	5,360 W	2,680 W	1,440 W	2,460 W	1,230 W	820 W
Crest Factor 1:10	3,840 W	2,300 W *1,960 W	1,310 W *1,190 W	2200 W	1100 W *970 W	690 W *630 W
1 kHz Sinus (1 kHz, THD + N < 0,1 %)	2,800 W	1,840 W *1,400 W	1,150 W *960 W	1,420 W	960 W *710 W	610 W *510 W
	* Both Channels driven			* Both Channels driven		
CIRCUITRY	bipolar, providing two power supply voltages					
FREQUENCY RESPONSE	20 Hz - 20 kHz ± 0.05 dB, 1 dB below maximum performance					
SIGNAL TO NOISE - Ratio	< - 101 dB			< - 96 dB		
GAIN	Switchable 26 dB , 32 dB or 1.4V					
DAMPING FACTOR	> 400:1 at the outputs					
INPUT IMPEDANCE	20 kΩ balanced					
PROTECTION CIRCUITS	Inrush-current limitation, protection circuits against power-on and power-off transients, temperature monitoring of transformers and heat sinks, DC protection of the outputs and output current limiter					
MODES OF OPERATION	Stereo, Mono-Bridge and Parallel-Mono					
LIMITER	Switchable Peak-Limiter					
FAN / GROUND LIFT	Temperature-Speed-controlled axial fan / Groundlift at the front					
INDICATORS	LEDs for ON / SIGNAL / CLIP					
INPUT CONNECTORS	XLR Male / Female					
OUTPUT CONNECTORS	Speakon					
OPTIONS	Extended User Interface / E.U.I. - Modules					
POWER REQUIREMENTS	internal selector for 115 V AC or 230 V AC ± 10 %					
POWER CONSUMPTION	2,000 W			1,000 W		
WEIGHT	27 kg			18 kg		
DIMENSIONS (WxHxD)	483 x 133 x 468.5 mm (19", 3U)			483 x 133 x 368.5 mm (19", 3U)		

We wish you a long time of satisfactory application with our amplifier. But if there is any question left, don't hesitate to call your local dealer or distributor. If this is not possible for what reason ever, call CAMCO on + 49-2762-4080 in Germany or send an e-mail to the following address: [Postmaster@Camco.de](mailto:Postmaster@Camco.de).