USER MANUAL HEADLINES

LAB 2002
USER MANUAL

Unpacking

Carefully open the shipping carton and check for any noticeable damage. Every LAB.GRUPPEN amplifier is tested and inspected before leaving the factory and should arrive in perfect condition. If found to be damaged, notify the shipping company immediately. Only the consignee may institute a claim with the carrier, for damage incurred during shipping. Be sure to save the carton and packing materials for the carrier's inspection.
It is also advisable, to save the carton and packing material, even if the amplifier is undamaged. Should you ever need to ship the amplifier, use the original packing.

Warnings

Read this before you are operating your amplifier:

- Do not use this amplifier if the power cord is broken or frayed.
- Always operate the unit with the chassis ground wire connected to the electrical safety earth.
- Do not parallel or series connect an amplifier output, with any other amplifier 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.
- Do not run the output of any amplifier back into another channel's input.
- Do not block the air intake or exhaust ports. Do not operate the amplifier near heat producing devices such as radiators, stoves etc.
- Do not spill water or other liquids into or on the unit. Do not operate the amplifier if suspected or standing in liquid.
- Do not remove top or bottom covers. Removal of the cover will expose hazardous voltages. There is no serviceable parts inside and removal may void warranty.
- Keep this manual for future reference.

User responsibility

1. **Speaker damage**

Your 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 if the gain is reduced by using the amplifier's front panel attenuator, it is still possible to reach full output power, if the input signal level is high enough.

2. **Speaker output hazard**

Power amplifiers are capable of producing hazardous output voltages. To avoid electrical shock, do not touch any exposed speaker wiring, while the amplifier is operating. See page 6 about outputs for proper connection of speakers.

3. Radio interference

This product has been tested, and complies with the limits for the European Electro Magnetic Compatibility (EMC) directive. These limits are designed to provide reasonable protection against harmful interference between electrical equipment. This product uses radio frequency energy, and if not used or installed in accordance with the operating instructions, it may cause interference to other equipment, such as radio receivers. However, there is no guarantee for no interference even if the amplifier is EMC approved.
If the amplifier cause interference, which can be easily determined by turning the amplifier on and off, the user can correct the interference by one or more of the following steps:

1. Increase the proximity between the equipment.
2. Connect the AC cord to an outlet on a different circuit from that to which the affected unit is connected.
3. If a radio receiver is interfered (normally amplitude modulation); reorient the antenna.
4. Check if the affected unit complies with the EMC limits for immunity, (CE-labelled).

If not, address the problem with the manufacturer or supplier. All electrical products sold in the EC must be approved for immunity against electromagnetic fields, high voltage flashes, and radio interference.

Introduction

Thank you for purchasing a LAB.GRUPPEN power amplifier. The amplifier you have chosen is the culmination of many years of Research and Development. This amplifier makes amplification more controllable instead of the traditional "Boring black box" you have become accustomed to.
Please take some time and read this manual to familiarize yourself with the advanced features of this amplifier.

The front panel

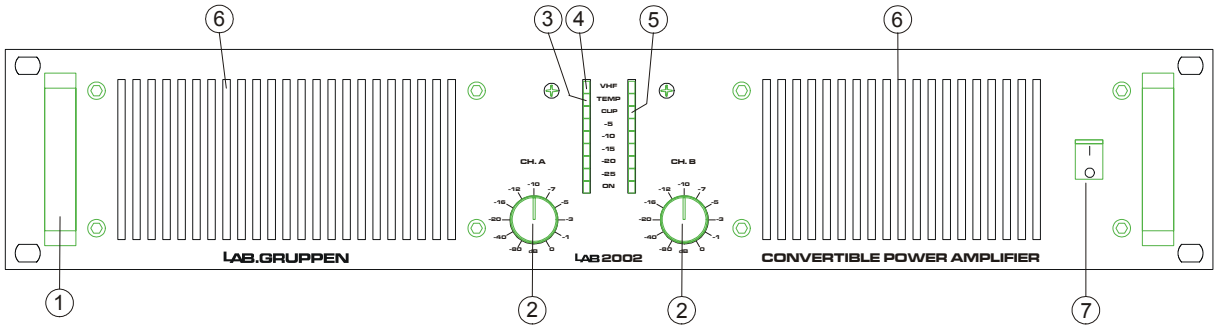


Figure 1. Front panel

1. Carry/protection handle

Both handles can be used to carry the amplifier, they also act as protection for the front panel. If so desired they can be removed (by removing the screws behind the front panel) for fixed installations, or racks where the front covers are to shallow.

2. Input level attenuators

These controls are used to alter the signal level entering the amplifier. They are calibrated in dB to help set up active loudspeaker systems or cut down unwanted noise from the input signal.
(See page 8).

3. Over temperature protect indicator.

This indicator is lit if the amplifier tries to operate above its maximum operating temperature(90°C). The indicator first comes on as a warning to either turn down the input level or check the cooling arrangements after which point the amplifier will mute the input signal. When the cooling fans have returned the output heat sinks to the normal operating temperature the input signal is unmuted.

4. VHF protect indicator

This indicator lights when constant signals, above 12 kHz at full power, are present at the output terminals. When this happens the input signal is muted and the process cycles until the VHF signal is no longer present. (See page 9).

5. Clip/limit indicator

This indicator tells when the amplifier output is clipping or limiting. The two different states can be told apart:

- When the clip limiter is engaged it flickers briefly. (See page 9).
- When the clip limiter is not engaged it lights for a longer period.

6. Fan grill filter.

A foam filter is located behind the front panel to prevent dust entering the amplifier.

7. Power actuator

This is used to start the amplifier.
(See page 4 and 8)

The rear panel

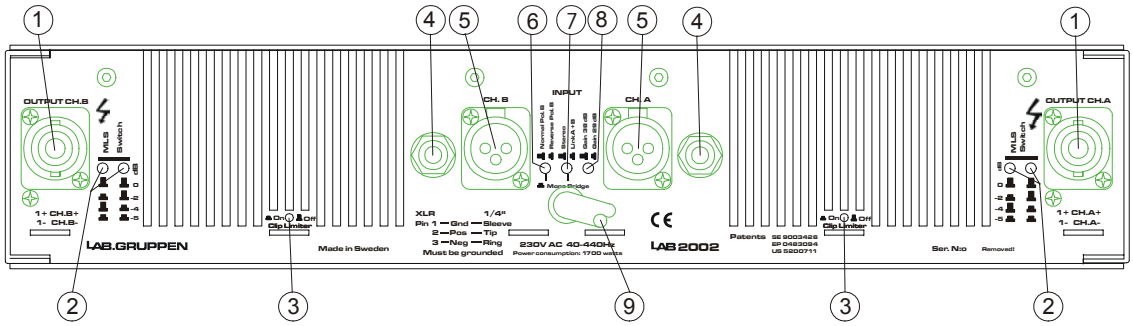


Figure 2. Rear panel

Please refer to diagram on page 3

1. Speaker connector
This type of speaker connector may be unfamiliar to some users. A full description is found in the operation section. (See page 6).

2. Minimum load selector (MLS™) switches
These switches are used to select the minimum nominal speaker impedance the amplifier is going to drive. (See page 7).

3. Clip limiter switch.
Turns the clip limiter on and off. (See page 9).

4. Input jack
Alternative to using input XLR or for linking inputs with other amplifiers. (See page 6).

5. **Input signal XLR** (See page 5).

6. Phase reverse switch for channel B
For reversing the input signal phase of channel B to allow bridged operation. (See page 7).

7. Link switch
Allows a single input to drive both channels simultaneously. (See page 7).

8. Gain select switch
Allows amplifier gain to be switched between 29dB and its normal gain at 0.775mV input sensitivity. (See page 8).

9. **AC line cord** (See this page)

Installation

1. Mounting
The amplifier is two rack units high (2U) and will mount in a standard EIA 19 inch rack. Amplifiers may be stacked directly on top of each other. There is no need for spacing between units. If it is the intention to fill a rack with amplifiers, we recommend racking is started from the bottom of the rack. It is also recommended that rear supports are used for amplifiers mounted in the middle of the rack, especially if used as part of a portable system.

2. Cooling
Your amplifier uses forced air cooling system to maintain a low and even operating temperature. All LAB.GRUPPEN amplifier, which are fan ventilated, have front to rear cooling. There are several reasons for this, one is that there's usually cooler air outside the rack than inside and therefore the amplifiers can run at higher continuos power levels without thermal problems. Never try to reverse the air flow, as the Intercooler® need a pressure chamber between the fans and heat sink, and this only works in one direction of the air flow (see Design features on page 8).
Should a heat sink get too hot, its sensing circuit will mute the hot channel. If the power supply overheats, another sensing circuit will mute all output channels, until it cools down to a safe operating temperature.
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 allows the exhaust to escape. If the amplifier is rack mounted, do not use covers or doors on the front or rear of the rack.
For fixed installations with a central cooling system, usually found in fixed installations with a dedicated rack room, it may be necessary to calculate the maximum heat emission. Refer to Power consumption on page 5.

3. Operating voltage
A label just below the mains cable on the rear of the amplifier indicates the AC mains voltage, for which the amplifier is wired. Connect the power cable only to the AC source referred to on the label. The warranty will not cover damage caused by connecting to the wrong type of AC mains.
For converting a 230 volt amplifier to 115 volt or vice-versa, see Appendix A.
LAB.GRUPPEN switch mode amplifier use primary switching, i.e. the mains is rectified directly before the transformer, which means that the power supply is insensitive to the mains frequency and will operate from DC to 400 Hz.
The amplifier is supplied with an approved European AC line connector. If this connector is not appropriate for your country, it can be cut off and wired to a suitable connector in the following way :

BROWN	**LIVE**
BLUE	**NEUTRAL**
GREEN/YELLOW	**EARTH**

Once the AC connector is connected to a suitable AC supply, the amplifier can be started with the AC actuator. When you power up the amplifier it takes a couple of seconds to check its circuits (this is known as the "soft start" or "slow start" sequence), the fans then blow at high speed before going onto "idle" and the 2 bottom green LED’s come on to show the output circuits are receiving the correct rail voltage.

4. Grounding

There is no ground lift switch or terminal on this amplifier. The signal ground is always floating via a resistor to chassis and the grounding system is automatic. If a potential above 0.6V presents itself between signal ground and chassis ground, a short circuit is introduced between the two, thereby enabling electrical protection. If a unit in the system is faulty, its mains fuse will blow, due to this automatic ground system.

If however you wish to tie the signal ground to chassis, connect the XLR-connector's shell lug to pin 1. In the interest of safety never disconnect the earth pin on the AC cord.

For all units that are EMC approved (radio interference), there is an AC mains filter. This filter needs the chassis ground for reference, otherwise a current loop is formed via the signal ground.

Use the balanced input to avoid hum and interference.

5. Power consumption

There are three ways to determine the power/current consumption of the amplifier:

First, the peak current draw at full output power. Under this condition the power will trip the wall breaker within 30 second and the amplifier will operate for less than 2 minutes before thermally limiting. During this time, the temperature of the power supply will be stabilised at a temperature that will have no effect on the insulation rating of the AC line cord.

Secondly, the maximum expected average current under worst case program material which is 1/3 of full power according to the FTC-standard. At this level the music will be in the state of constant clip and is therefore the highest power level one can obtain without completely obliterating the program.

At last, the "normal operating power", as measured according to the safety standard IEC 65 and used by a majority of safety agencies. The normal operating power is measured using pink noise, with an average output power equal to 1/8 of full power. The one eighth of the total power is as loud as you can play music while making some attempt to avoid obvious clipping. It also corresponds to a headroom of 9dB, which is very low for an audio program.

In 2 ohms operation, the protection of the amplifier circuit will not permit long term current draw and the component temperature rise will stabilises well below the rating.

	MAX OUTPUT POWER				**MAINS INPUT POWER**		
			Power	**Full Power**	**1/3 Power**	**1/8 Power**	**Idle**
				sine wave	note 1	note 2	
LAB 2002	8 ohms	2X	1100	3100	1300	700	130
	4 ohms	2X	1400	4300	1700	900	130
	2 ohms	2X	1400	4700	1700	900	130
note 1	Average power with music as program source				Normal" music power with 9dB headroom,		
	The amplifier driven to clip level			**note 2**	IEC standard power rating.		

Table 1.

The current draw can be calculated by dividing the mains input power by the mains voltage.
We recommend you to design the power distribution for at least the current at 1/8 power and 1/3 power for heavy duty demands like discos etc.

The heat power can be calculated as the following example:
We consider a headroom of at least 9dB and a 4 ohms load on an amplifier producing 1400 watts per channel.
The 1/8 power per channel is then; 1400 / 8 = 175 watts, total output; 2 x 175 = 350 watts.
The power consumption according to the chart above is then 900 watts.
The heat power produced is the difference between the power consumption and output power;
900 - 350 = 550 watts per amplifier.

6. Input connections

XLR Input connectors are balanced and wired according to the **IEC 268**, that is pin 2 hot, and wired in the following way:

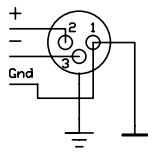


Figure 3. XLR input connector pinout

PIN 1 GROUND/SHIELD
PIN 2 HOT
PIN 3 COLD

There are also TRS jacks for linking etc. They are wired as follows:

TIP HOT
RING COLD
SLEEVE SHIELD/GROUND

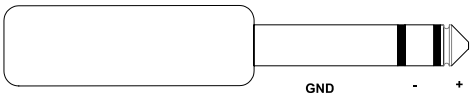


Figure 4. TRS phone plug

The input impedance is high enough (20 kohms balanced) to allow "daisy-chaining", or multiple parallel input connections. To daisy chain, use the TRS jacks provided on each channel. The input circuits also have a high enough headroom, to accept the maximum output level from virtually any low level signal source.

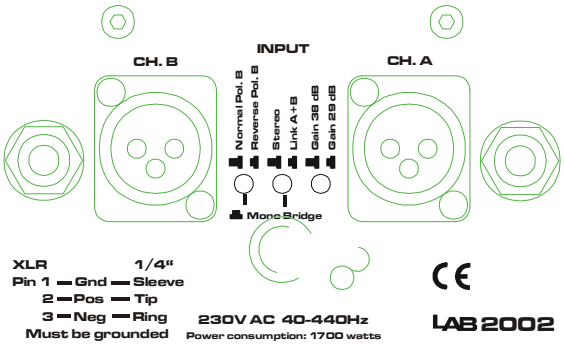


Figure 5. Rear panel connectors

Do not use XLR and TRS jacks on the same channel simultaneously for mixing or other purposes.

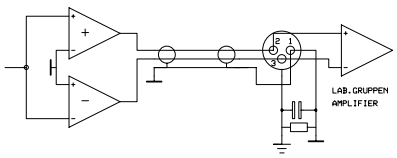
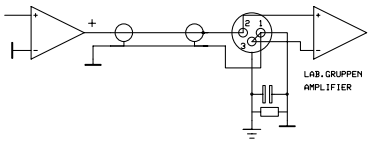


Figure 6. Balanced line

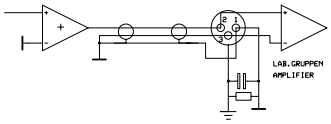
To connect an unbalanced source, tie pin 3 (ring on TRS jack) down to the shield of the connector. If you leave one pin disconnected, you will lose 6 dB in



gain.

Figure 7. Unbalanced line connection

A more optimal method for handling unbalanced sources is shown in Figure 8.This is similar to the connection for balanced lines, but pin 3 is tied down to shield, at the source side instead. The hum and noise rejection for the cable is equivalent to that for a balanced line. To minimize hum in the audio, use balanced inputs whenever possible.



F*igure 8. Balanced line with unbalanced equipment*

7. Connecting speakers

Speaker connections are made via the two **Neutrik *NL4*FC Speakon** connectors (1).
They are the only connectors currently available to meet the EC safety requirements. They are wired in the following manner:

Pin -1 Speaker ground.

Pin +1 Speaker positive.

Pin -2 No connection.

Pin +2 No connection.

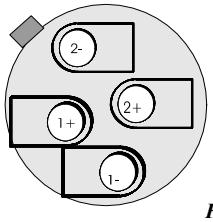


Figure 9. Speakon connector

Please note that this is the standard wiring convention for Speakon connectors adopted world-wide.
Never connect either output terminal to ground or to some other output or input terminal (see warning on page 2).
For normal two-channel operation, connect each speaker load across the outputs positive and ground terminals. **Pay attention to speaker polarity; loudspeakers connected out of polarity degrade sound quality and may be damaged as a consequence.**
Keep the speaker cable wires as short as possible, and use a good quality stranded speaker cable. Do not use shielded wire, such as microphone or guitar cable. Remember that the speaker cable robs the power of the amplifiers in two ways:
Increases the load impedance and introduces resistive power losses, so called I^2R losses.

8. Impedance matching (MLS-switches)

The MLS switches is located on the rear panel. The MLS (Minimum load select) switches offer a impedance matching, so you can drive the LAB 2002 in 2 ohms without increased heat losses.

As stated earlier the LAB 2002 can produce at least 1100 watts into any impedance between 1.5 and 8 ohms. This is done with the aid of the **MLS™** switches (2).
The fixed positions shown in Table 2. guarantee 1400 watts but higher powers can be achieved

Utilising higher **MLS™** positions when connected to lower impedance's see Table 2.
As you can see from Table 2 the LAB 2002 can produce in excess of 1400 watts.

LAB 2002		MLS SWITCH SETTING			
LOAD	CONFIGURATION	-5 dB	-4 dB	-2 dB	0 dB
16 ohms	Stereo (2 channel)	160 W	180 W	340 W	520 W
8 ohms	Stereo (2 channel)	300 W	350 W	650 W	1100 W
4 ohms	Stereo (2 channel)	570 W	680 W	1100 W	1400 W
2 ohms	Stereo (2 channel)	1040 W	1200 W	1200 W 1400 W [2]	1900 W [2] 1400 W [1] 2900 W [2]
16 ohms	Bridged mono	600 W	700 W	1300 W	2000 W
8 ohms	Bridged mono	1200 W	1400 W	2200 W	2800 W
4 ohms	Bridged mono	2100 W	2400 W	2400 W	2800 W[1]

[1] Component tolerance dependent
[2] Continuous power, one channel driven or peak power both channels driven.
(Thermal protection may occur at high continuous power).
Power in watts (EIA 1 kHz, 1% THD)

Table 2.

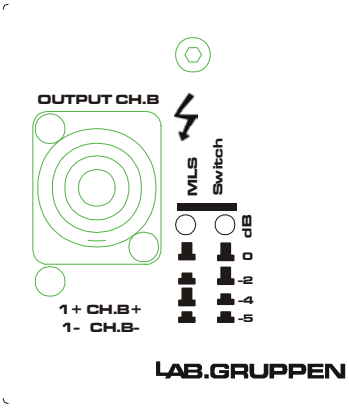


Figure 10. MLS switches on rear panel

MLS™ positions can be different for each channel and a variety of combinations can be achieved see Table 3.

Channel	Impedance	MLS	Power	Comments
A	8	-2dB	650W	Power
B	8	-2dB	650W	reduction
A	4	0dB	1900W	High peak
B	4	0dB	1900W	power
A	8	0dB	1100W	Power
B	2	-4dB	1200W	matching
A	8	-2dB	650W	Power
B	4	0dB	1900W	sharing

Table 3.

The way to find the best **MLS™** position for your application is by experimentation, the amplifier is very well protected (even down to 0.3 ohms), but where speed is of essence stick to the fixed positions.
The thing to remember with the LAB 2002 that it is a power converter and when you select **MLS™** positions you are allocating a portion of power from 3000 watts.

Operation modes

1. Stereo operation

For stereo (dual channel) operation, leave the Link and Phase reverse switches in the undepressed position. In this mode, both channels operate independently of each other, with their level attenuators controlling their respective levels.
Never connect either output terminal to ground or in parallel. The recommended minimum nominal impedance, for stereo or tandem operation, is 2 ohms per channel.

2. Tandem mono

For tandem (dual channel-single input) operation , depress the Link switch. Both channels can now be driven by a signal, at either input connector. The output connection is the same as in stereo mode.

You can use either TRS connectors for linking out etc**. Do not use the remaining XLR and TRS connectors for mixing or other purposes.** Both level attenuators are active, allowing you to set different levels for each channel.
Never connect either output terminal to ground or in parallel.

3. Bridged mono

To bridge the amplifier, depress the Link switch (7) and Phase reverse switch (6). Both channels are then driven by a single signal at either input. You can use any remaining input connectors for linking etc. Do not use the remaining XLR and TRS as input jacks simultaneously for mixing or other purposes.

To obtain an output, connect the speaker leads to **pin +1 on channel A Speakon to speaker positive terminal and pin +1 on channel B Speakon to speaker negative terminal . Do not connect either of the -1 (negative) pins of the Speakons. Do not connect speakers to channel A or B in the normal manner in bridge mode, as this can cause serious damage**.
The recommended minimum nominal impedance for bridged mono is 4 ohms (equivalent to driving both channels at 2 ohms).
Driving bridged loads of less than 4 ohms may cause a thermal overload.

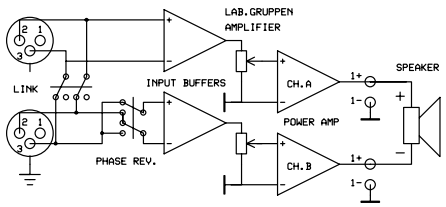


Figure 11. Bridge mono connection

Both level attenuators must be at the same position. We recommend you to put them in the 0 dB (full) position.

4. Stereo reverse

This mode is similar to the Tandem mono mode. Apart from depressing the Link switch , you also depress the Phase reverse switch, like in the Bridge mono. Channel B is now phase reversed. To compensate for that, connect **pin +1 on channel B Speakon to speaker negative terminal and pin -1 on channel B to speaker positive terminal**.

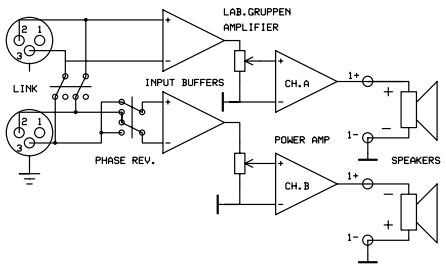


Figure 12. Stereo reverse mode

Channel A output is connected as in the normal stereo mode. By having channel A and B operating in opposite polarity, the energy storage in the power supply is more efficient. This means that the amplifier can deliver up to 10% more power than in tandem mono mode. This is significant for signals below 100 Hz (sub bass etc.).

Operation

1. Operation precautions

- Make sure that the power switch is off before making any input or output connections or operating the switches on rear panel. See pages 4-6 about installation.
- Make sure that the AC mains is correct and the same as that is printed on the rear panel of the amplifier. See pages 4-5 , about operating voltage and power consumption.
- Make sure that the switches on the rear panel for operation modes ,clip limiters, and the MLS™ switches are in the correct position. See pages 6-7, about operation modes, page 9 about clip limiters and page 7 for the MLS switches.
- It is always a good idea to turn down the gain controls during power up, to prevent speaker
- damage, if there is a high signal level at the input.

2. Powering up -Soft start

When you power up the amplifier it takes a couple of seconds to check its circuits (this is known as the "soft start" or "slow start" sequence), the fans then blow at high speed before going onto "idle" and the two bottom green LED's come on to show the output circuits are receiving the correct rail voltage.

3. Input attenuators

The two input level attenuators on the front panel, alter the signal level for their respective amplifier channel in all modes. They are calibrated in dB to help setting up active loudspeaker systems or cutting down unwanted noise from the input signal.
In bridged mode, both controls must be in the same position, so that the speaker load will be shared equally between the channels.

4. Gain switch

The gain switch located on rear panel is for changing the input sensitivity of the amplifier. This can be handy when using low or high nominal input signals e.g. most professional mixing consoles operate at a nominal level of +4dBu therefore use the 29dB position (depressed switch), to give you plenty of fader movement. On the other hand, for a disco mixer that operates at a nominal level of 0dBu, use the upper position setting, which has a sensitivity of 0 dB for full power in 4 ohms.

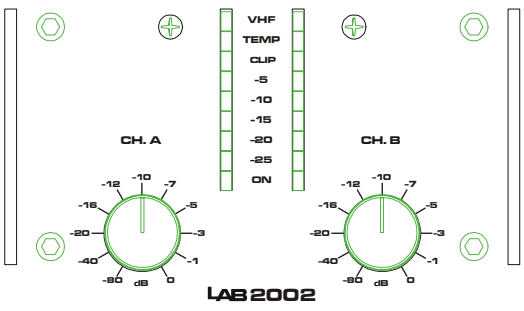


Figure 13. Front indicators

5. Indicators

The two bottom green ”ON” LEDs indicate that the output circuits are receiving the correct rail voltage.
The **”-25 dB”** LEDs glow when the output signal is greater than -25dB, 0dB is referenced to full output power. These LEDs also act as signal present indicators.
The rest of the green LEDs forms a bar for output levels from -20dB to -5dB.

The **Clip/limit indicator** tells when the amplifier output is clipping or limiting. The two different states can be told apart:

- When the clip limiter is engaged it flickers briefly.
- When the clip limiter is not engaged it lights for a longer period.

The remaining yellow LEDs indicate if any protection circuits are activated. These are described below.

Protection features

Each LAB.GRUPPEN amplifier has many advanced protection features, that will protect both the amplifier and the speakers connected to it, should a fault condition arise. Under normal use these features are inaudible. All protection circuits are independent.

Clip limiter

The clip limiter is included to prevent dangerous clip signals reaching the speaker and damaging it. It works by monitoring the output and comparing the distortion produced between the input and output of the amplifier. If the distortion exceeds 1%THD for any reason (voltage or current clipping), the limiter reduces the input signal proportionally. Note that, if the signal is distorted or clipped before it reaches the amplifier, the clip limiter will not be activated.
Under normal operation the clip limiting is inaudible. The limiter can be turned On or Off by depressing the relevant clip limit switch (2). Some manufacturers of Loudspeaker processors do not recommend the use of clip limiters in amplifiers, as they tend to upset the tracking of the processor’s limiters.
Apart from this one exception, **LAB.GRUPPEN** recommend leaving the clip limiters switched "on" (button depressed).
As a by-product, when the amplifier comes out of a protect condition, the output level has a slow rise time -the effect is like turning the gain up slowly.

Thermal protection

When the amplifier is driven very hard into low impedance, the cooling fans go into high speed. If the conditions that cause this continue, the temperature indicator(s) will light as an indication that the amplifier will soon thermal out.
After five seconds the amplifier will go into thermal protect, by muting the input signal. After 15-20 seconds the amplifier will cool down the **Intercooler**® and the cycle will begin again.
Thermal protection starts when the **Intercooler**® reaches a temperature above 90^0 C

VHF protection

When a signal of more than 12kHz, at full output power, is present at the output connectors for more than five seconds, the VHF protection mutes the input signal (this is indicated on the front panel (4) labeled VHF). After five seconds the cycle starts again.
This is a useful feature as there are currently no commercially available compression drivers that can take 500 watts of power at 10 kHz!! this circuit is inaudible under normal use, however it can be turned off.
If the VHF protection is required to be turned off i.e. for studio monitors, please consult your supplier, as this is a non-user adjustment.

Short circuit protection

All LAB.GRUPPEN amplifiers are completely short circuit protected. The protection circuit permits very high peak currents, but still holds the output devices within the safe operation area. If a short circuit is maintained, the channel affected will eventually go into thermal protection and the cycle will start again.

AC mains voltage protection

If the AC mains voltage is outside the allowed operation voltage (over or under voltage) , the power supply will shut down itself. When the mains voltage is above the minimum start voltage and below its maximum operating voltage the amplifier will restart again.
It takes a couple of seconds to check its circuits (this is known as the "soft start" or "slow start" sequence), the gain will slowly and gradually raised back to normal, and the fans then blow at high speed before going onto "idle". The two green ”ON” LED’s indicate when then power supply is operating properly.

D.C. protection

There are two types of **DC** protection:
Fuses on the supply branches of each channel (this is an **IEC 65** requirement).
A Crowbar bar protection that shorts the output. Both these circuits come into effect once a **DC** level of 10 volts or more is detected on either channel.

Design features

Cooling

The **LAB.GRUPPEN amplifier** runs very cool due to a patented heat sink called **Intercooler™** . The output devices (bi-polar) are mounted directly on a copper heat sink thereby avoiding thermal losses normally found when using mica washers (the heat sink is mounted horizontally in front of a pressure chamber) The air flow is constant along the whole heat sink,
thanks to a horizontal pressure chamber in front of it, (in a conventional tunnel design the end of the heat sink opposite to the fan invariably gets hotter than that directly in front of the fan). When cool air hits the geometric fins of the **Intercooler™**, turbulence is produced thereby enabling efficient cooling.

Light weight

The **switch mode amplifiers** has a very good power to weight ratio, (280w/Kg) making it one of the most powerful 2u amplifiers available.. The light weight is achieved not only by the PSU, but the **Intercooler™** and the 9 piece anodized alloy chassis contribute greatly, rear rack supports are unnecessary in most applications.

Switch mode power supply (SMPS)

Switch mode power supplies are the modern solution to the problems of size and weight. However, early examples of SMPS used in power amplification were not ground breaking, and l

literally adopted the type of supply found in many computers today. The LAB.GRUPPEN SMPS is different in that it is regulated.
How is this achieved? In contrast to other designs, that use push pull or series resonant converters we have managed to produce a SMPS that has the same characteristics as a conventional supply. We have avoided the pitfalls of push-pull converters, by eliminating the need for limiting on the secondary side of the switch transformer. This is achieved by using sense windings, injecting a magnetic pulse from the AC- line during a pulse time segment which is separated from the output charge current pulse.

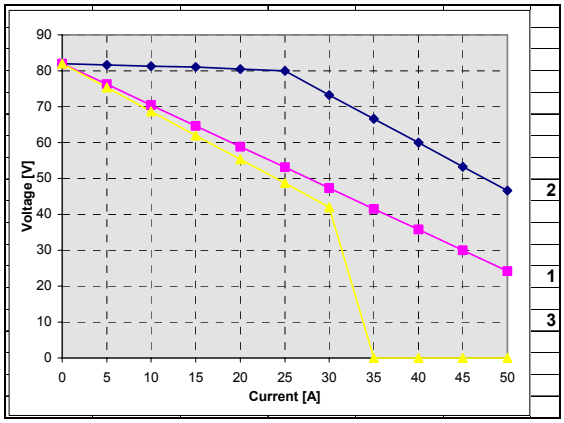


Figure 14. Current-voltage characteristic of different power supply topologies.
1) Conventional power supply show voltage drop due to internal resistance
2) Regulated power supply used by LAB.
3) Unregulated switch mode power supply with current limiting.

Whilst the SMPS may sound complex it is actually very straight forward with high reliability. The net result is good bass and fast response. Because the supply is regulated, the power amplifier will produce the same power output even if the AC line falls by more than 20% !
Efficiency is also assured, and in the case of the LAB 2002 this is especially apparent ; its power supply draws only 4 kW and yet it produces 2 x 1400 W (in a conventional amplifier this would yield only 2 x 650 W- nearly 3 kW are wasted as heat.
Traditional PSU's behave erratically at certain frequencies, during low frequency cycles (bass), particularly in clip conditions, their output impedance's rise thereby producing uncontrollable speaker cone movement. Under these conditions clip states are more audible.
LAB.GRUPPEN SMPS produces its rated power output at all frequencies regardless of speaker demands and AC line conditions.

Minimum Load Switches (MLS(TM))

Thanks to the regulated SMPS, the maximum power available for the output stages can be adjusted without increased heat dissipation or efficiency loss. This allows users to match the output power with the loudspeaker impedance.
The LED bargraph is also adjusted to give a correct reading. Because the amount of power delivered into a load is dictated by its impedance (at 2 ohms you use the least voltage but use the most current), you can cheat with the MLS switches thereby enabling powers in excess of the normal power rating to be produced.

Safety approvals
LAB.GRUPPEN amplifiers are designed to meet the **IEC65** (now called EN 60 065), a stringent electrical safety approval from the **International Electro-technical Commission.** The **IEC65** is recognized world-wide with most countries having an equivalent.

EMC approvals
EMC stands for Electro Magnetic Compatibility. This implies that the equipment should have low emission of radio frequencies, directly as electromagnetic fields in the air, and as conducted from the cables from and to the unit. The unit should also be able to handle electromagnetic fields, high voltage flashes, and radio interference, coming into the unit via the air or cables.

Emission
The regulation now cover the frequency range from 150 kHz to 300 MHz. The maximum level radiated from a unit has to be below 100 μV, (0.0001 V).

Immunity
The equipment should be able to handle three different types of interference:

- Electrostatic discharges up to 8 kV, hitting the chassis or cables.
- Transients and bursts up to 1 kV, conducted through the cables to the unit.
- Electromagnetic fields up to 3 V/m, radiated on the unit and the cables in the frequency range of 27 - 500 MHz.

We have extended the tests in two cases and chosen a standard used for heavy industrial situations. First, we have tested conducted disturbances in the frequency range 150 kHz - 80 MHz, by injecting 3V amplitude modulated (80%) signals into all the cables (inputs, outputs and mains). This covers noise from AM transmitters, which are still in use in some areas. Secondly, we have extended the range for electromagnetic fields to 26 - 1000 MHz, with a level of 6 V/m and 80% AM modulated.
In the range 895 - 905 MHz, we test with a field strength of 35 V/m and 100% pulse modulation. This emulate the signals from a mobile phone close to the unit. In all cases the noise plus distortion is below 1%, at normal operation level, (normal operation level is 1/8 of full power or -9 dB under clip point according to IEC 65).

EMC-declaration

This audio power amplifier conforms with the EMC-directive and relates to the following standards:
EN 55 103-1, E3
EN 55 103-2, E3
EN 60 065, class I

Appendix A
Mains voltage selection

LAB 2002 is normally shipped for 230 volt AC operation only. For export there is a 115/230 volt AC option available. To check if the amplifier is equipped with this option, please follow these steps:

1. Make sure that the LAB 2002 is unplugged from the mains voltage.
2. Remove the top and bottom cover.
3. If the four electrolytic capacitors close to the front are rated 385VDC, the amplifier is for 230 volt operation only
4. If the four electrolytic capacitors close to the front are rated 200VDC, the amplifier has the 115/230 volt option.
5. Locate the jumper(s) on the solder side of the circuit board close to the mains switch.
6. To select the desired mains voltage, install the jumpers as shown in Figure 15.
7. For 230 volt operation; use a T 15A fuse (slow blow), for 115 volt change to a T 30 A fuse (slow blow).
8. Replace the amplifier top and bottom cover.
9. For 115 volt operation; stick a ”115 VAC” label on top of the 230 VAC label on rear panel.

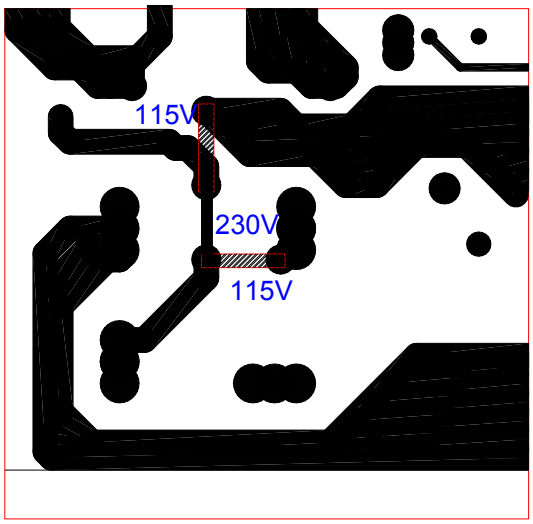


Figure 15. 230VAC or 115 VAC selection

Warning: This modification should only be made of an experienced service technician.

Maintenance

Under normal use the amplifier should give years of trouble free service. The only user maintenance required from the user is to vacuum the front grill periodically.

In some extreme cases it may be necessary for your supplier to clean the inside of the amplifier. These conditions usually occur after prolonged use in environments using "cracked- oil" smoke machines.

If you are using your amplifier for heavy duty use i.e. concert touring or industrial music it is recommended that you have your amplifier serviced every 3 years, purely as a preventative measure

Troubleshooting

These are typical things to check if you think your amplifier is faulty:

Fault: No output.

If the output bargraph is functioning there is nothing wrong with the amplifier, and the likely cause is an unsecured Speakon.

Check that the VHF protection is not activated. If it is, remove possible high frequency oscillations from the relevant input.

Fault: The amplifier goes into thermal protection when driven at low level.

Check that your loudspeaker has not got a short circuit in its windings, (this can occur when the speaker coil gets warm).

Fault: The amplifier goes into protect with power indicators off.

Check that the AC line voltage is not outside the amplifier’s operating range (130-260 volts). Over/under-voltage protection may have occurred.

If the amplifier is connected by mistake to a 3 phase supply (415v), an internal non-resetable fuse or resistor may have blown. Then return the amplifier to your supplier.

Fault: The amplifier does not respond even after checking above items.

In the unlikely event, that there is a non-user rectifiable fault, return the amplifier to your supplier or an approved service centre.

Lab Gruppen cannot be held responsible for damage or injury, as a result of the top cover being removed.

Warranty and disclaimers

- **General**

This product is manufactured by LAB.GRUPPEN and is warranted to be free from defects in components and factory workmanship under normal use and service, for a period of one year from the date of original purchase.
During the warranty period, LAB.GRUPPEN or its nominated agents, will undertake to repair, or at its option, replace this product at no charge to its owner, when failing to perform as specified, provided the unit is returned undamaged and shipping pre-paid, to factory or authorised service facility.
No other warranty is expressed or implied.
This warranty shall be null and void, if the product is subjected to:
1) Repair work or alteration by person other than those authorised by LAB.GRUPPEN or its agents.
2) Shipping accidents, war, civil insurrection, misuse, abuse, operation with incorrect AC voltage, operation with faulty associated equipment and normal wear and tear. Units, on which the serial number has been removed or defaced, will not be eligible for warranty service.
3) LAB.GRUPPEN shall not be responsible for any incidental or consequential damages, with respect to the products warranted.

LAB.GRUPPEN reserve the right to make changes or improvements in design or manufacturing, without assuming any obligation to change or improve products previously manufactured.

- **International**

Please contact your supplier for this information, as rights and disclaimers may vary from country to country.

Technical assistance and services

- **International**

If your LAB.GRUPPEN product needs repair, contact your LAB.GRUPPEN dealer or distributor, or contact LAB.GRUPPEN by fax, to obtain the location of the nearest authorised service centre.

- **Factory services**

In the event that your LAB.GRUPPEN product needs factory service, you shall contact LAB.GRUPPEN service department for return instructions and a Return Authorisation number.
Please note on product return:

1. Use the original packing
2. Include a copy of the sales receipt, your name, return address, phone number, fax number and defect description.
3. Mark the Return Authorisation number on the outside of the packing.
4. Ship the product prepaid to:

LAB.GRUPPEN
Gullregnsvägen 16
434 44 Kungsbacka
SWEDEN

Telephone: **+46 300 562800**
Fax **+46 300 562899**
e-mail **info@labgruppen.com**