

PROFESSIONAL POWER FOR TOURING PROFESSIONALS
fP Series



Evolution

A hundred years ago most people thought Jules Verne was crazy when he said that some day boats would carry people underwater and airships would transport people to the moon. Today submarines roam the seas and astronaut Neil Armstrong's walk on the moon is ancient history.

Less than two decades ago, touring audio professionals everywhere thought that serious lightweight power amplifiers were a pipedream. They were noisy, anemic-sounding and simply unreliable.

Switch Mode Technology: Fast-forward twenty years and Lab.gruppen has changed things forever. To date, hundreds of Lab.gruppen owners using thousands of Lab.gruppen amplifiers know from personal experience that Lab.gruppen switch mode technology and Class TD output technology is simply superior to conventional designs. With fat bottom-end, outstanding mids and silky smooth highs, Lab.gruppen performs day in, day out.



A ferrite transformer used in the fP Series (upper) versus a conventional iron transformer typically used in conventional designs (lower).

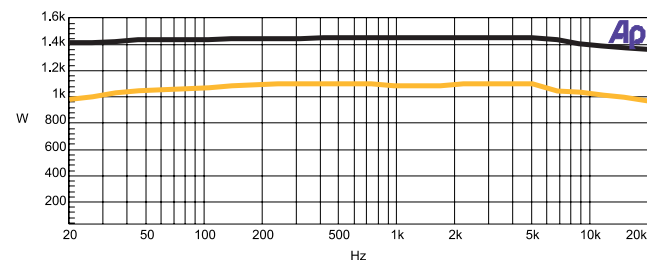
Professional Power

Looking at the power specification of amplifiers, the first question always asked is 'How much?' The numbers on the specification sheets can often be ambiguous. The real question should be 'For how long?'

The Federal Trade Commission (FTC) requires that a power amplifier must provide one-third of its nominal maximum output power for at least one hour to meet its criteria. Except, most average amplifiers are only able to deliver one-eighth of their quoted power for more than a few minutes before going into protection. Lab.gruppen believes that a professional amplifier should meet, at a minimum, FTC test requirements.

All Lab.gruppen fP Series amplifiers are designed to meet or exceed this stringent test, performing at more than one-third of their nominal power for periods longer than an hour.

To Lab.gruppen 'professional' is more than just a word.



AP printout shows that R.SMPS™ delivers improved power delivery at sub-bass frequencies versus conventional designs. Upper curve: fP 3400, R.SMPS™, Class TD. Lower curve: conventional amp, toroidal transformer, Class H. The graph is not frequency response but shows maximum power delivery versus frequency at less than 1% THD. The output of the fP 3400 remains almost perfectly linear throughout the entire power bandwidth while the conventional amp sags significantly at both low and high frequencies. While the conventional amp used in this test is considered to be "one of the best amps for bass" in the business, the test results clearly show that the fP is even better.



6400 W into 2Ω – weighing 10 kg / 22 lbs

Regulated Switch Mode Power Supply (R.SMPS™)

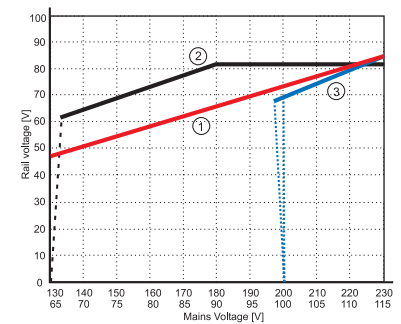
R.SMPS™ is a key element in all Lab.gruppen products. A masterpiece of engineering, its fundamental efficiency and simplicity enable us to create such compact and lightweight amplifiers. The fact that it is a regulated design guarantees its ability to produce consistent transients and undistorted bass, regardless of fluctuation in mains voltage.

Compact and Efficient: The transformer is much smaller than those found in classic conventional amplifiers. Yet through the use of an enhanced ferrite power transformer core (fP = 'ferrite Power'), huge magnetic field storage is maintained at a capacity equivalent to its traditional heavy iron-core counterpart.

Due to the efficiency of the power supply, the amount of current required from the mains supply is considerably reduced, dramatically lowering the risk of tripping the mains fuses/breakers mid-show.

Reliable Power: In real world conditions, all too often the mains voltage can drop significantly below nominal levels. It

may happen due to regional problems, unstable generators or long cable runs. With an fP Series amplifier and its R.SMPS™ the supply can drop down to as much as 20% below nominal mains voltage and the amp will continue to deliver full output power.



Characteristics of different power supply designs:

1) The rail voltage of a conventional power supply (typically toroidal iron transformer) drops proportionally with mains voltage sag.

2) The Lab.gruppen R.SMPS™ used in the fP Series provides stable voltage rails even when mains voltage drops, as low as 90 Volts (@115V nom.) or 180 Volts (@230V nom.).

3) The rail voltage of other typical SMPS drops severely due to semiconductor losses. Current limiting or low-voltage conditions shut down the supply

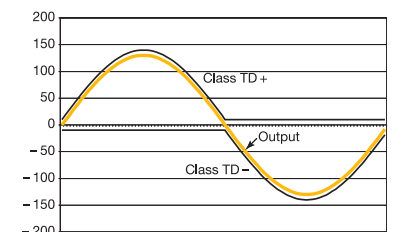
Class Matters

When it comes to high power, we cannot forget about class. Class AB, Class H, and even Class D are all familiar amplifier topologies. At Lab.gruppen, we developed a class of our own. Our flagship amplifiers, fP 6400 and fP 3400, utilize our own patented Class TD design.

The Evolution of Class TD: Class TD could be called 'the evolution of Class D', where 'TD' stands for 'Tracking Class D'. Simply put, the power supply tracks the audio signal at all frequencies and supplies the required rail voltage while also reserving additional headroom. The voltage and current delivered to the output stage is therefore exactly the precise amount of energy required in real-time. This process is extremely efficient, as only a tiny portion of energy is turned into heat at the output stage.

Our Class TD represents a quantum leap in amplifier design. For high-power amps it proves to be the ultimate solution for all the existing design compromises. Class TD combines the

reliability and sonic performance of Class AB and the efficiency of Class D. The quality of the output signal remains high due to the proven Class AB component of the design. The entire audio path is analog and is never routed through the



Both superb sound quality and high efficiency are made possible thanks to Class TD technology.

switching portion of the circuit. Therefore the signal never suffers from the side effects of being chopped into bits, such as the ripple commonly found in the audio signal of a Class D or PWM output. To make life even easier, Class TD works perfectly under all conditions. The amp maintains its flat frequency response with all complex loads even as low as 2W (nominal). It is mono-bridgeable, reliable, and it does not interfere with any other RF equipment.

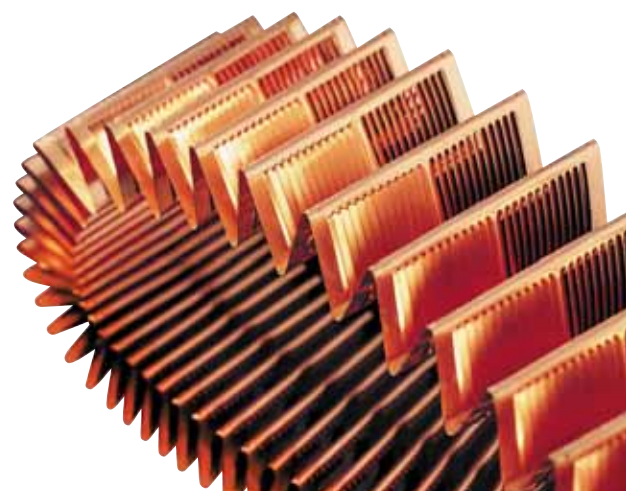
Remaining Cool

To say that amplifiers get hot is an understatement. Anyone who has ever used one knows all too well that heat is an amplifier's worst enemy. Drive most amplifiers hard for very long and they will overheat, resulting in thermal protection: they either cut back power, quit working during the middle of a show or blow up altogether.

With heat being a potentially big problem, Lab.gruppen approached the problem by developing simple solutions for a complex set of problems. First, and rather than just managing the heat, Lab.gruppen chose a path that reduces the amount of heat generated in the first place.



Output drivers are located side-by-side in the airstream.



Pure copper Intercooler® fins.

Intercooler®: This is Lab.gruppen's ultra-efficient compact cooling system. At the heart of the Intercooler® system is the unique pure copper heat sinks. Optimized for maximum surface area and greater air turbulence, they offer far superior heat dissipation than traditional aluminum designs. Complimenting the pure copper heat sinks are speed-controlled fans that force air through the heat-sinks front to rear. All output transistors receive the same cooling effect, as they are all positioned perpendicular to the flow.

As a result of this technology, Lab.gruppen is able to develop a product that packs the greatest amount of power in a chassis sized smaller than ever thought possible.



The parallel airflow through the Intercooler®.



Removable dust filter on the front panel.

The Weight Loss Program

Some call their amplifiers lightweight but we consider Lab.gruppen amplifiers to be the benchmark of lightweight. Losing weight without side effects is an art, and at Lab.gruppen our engineers fully understand this art.

6400 W and only 22 lbs (10 kg): Our most powerful amp, the fP 6400, delivers 6400 watts with ease, is just 2U high, only 14" (347 mm) deep and weighs a mere 22 lbs (10 kg).

Engineering Weight Loss: Eliminating the big and heavy iron transformer provides the biggest weight savings. Through creative engineering weight reduction is also gained from the implementation of our efficient, weight-saving Regulated Switch Mode Power Supply and space-saving Intercooler®.

Ultimate Touring Amp:

Lab.gruppen fP Series amplifiers are so light and efficient that their compatibility for touring applications is unsurpassed. Even in the harshest of environments, they keep on performing making them the perfect solution for permanent installed systems as well.



The Convertible Power Amplifier

Wouldn't it be great if you could tell an amplifier how to match its output to the load it will see? Certainly, it makes a big difference to the amplifier if the speaker impedance is 16Ω or 2Ω, or something in between.

Matching Load System (MLS™): Usually the average amplifier is under much greater stress when driving a low impedance load, such as 2Ω. At high power this amplifier is likely to run too hot and go into protection. Lab.gruppen's fP Series amps aren't average amplifiers. MLS™ (Matching Load System) gives you the ability to control power transfer into specific speaker loads.

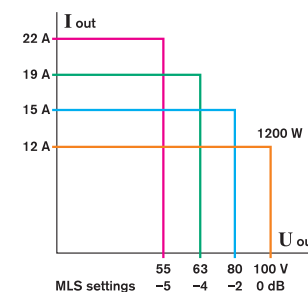
A typical problem: If an average amplifier delivers a maximum output voltage of 100 V and a maximum output current of 12 A to an 8Ω loudspeaker, this equates to 1200 watts in output power. If a second speaker is added in parallel, the impedance drops to 4Ω and the amplifier will try to provide double the current, 24 A. If the amplifier does not have an adequate power supply capability then stress is placed on the system. As the amplifier continues to try and provide current beyond its limit, it will run hotter and hotter, then the signal will distort and eventually thermal shut down will follow.

The Lab.gruppen solution, Convertible Power: With most fP models* you will find MLS™. The MLS™ is accessed via a set of rear panel switches. The output voltage may be reduced in fixed increments to accurately match known loads. When engaged the voltage/current ratio is "converted". MLS™ reduces the output voltage of the amplifier increasing its ability to deliver more current and provide the same output power for different loads.

Take the equation in the above example: 100 V x 12 A = 1200 W may be converted to 80 V x 15 A = 1200 W, or 55 V x 22 A = 1200 W.

The great benefit of MLS™ with its unique 'Constant Power Conversion' is that at low impedances the overall efficiency is improved. The amplifier operates cooler and is unlikely to run into protection. The most important result of this is that it just sounds much better.

MLS™ also permits output power management. This enables the amplifier to be used in several applications. An amplifier in the fP Series may be configured to prevent smaller speakers or HF drivers from being over-powered. For example, a single amp can now be properly configured for a bi-amped floor monitor speaker system. The same amplifier could then be



Four possible MLS settings of an fP 6400, each area representing the same amount of output power. MLS allows constant power if you choose.

reconfigured in bridge mono mode to drive subwoofers in the main front of house system. One amplifier with MLS™ provides the flexibility of many and without taking up the extra space.

* Found in fP 6400, fP 3400, fP 2600, and fP 2400Q.



Current Technology

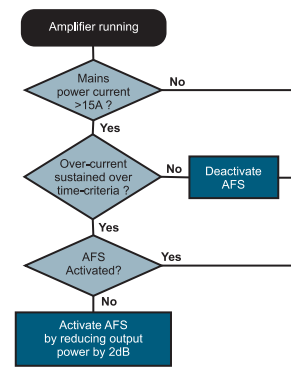
How much current is a 6400-watt amp going to draw? 60 A from a 115 V mains line? 30 A from a 230 V line? It's enough to be concerned about tripping the breaker mid-show.

Mathematically, the above calculation is correct. While a musical signal might demand the amplifier to deliver as much as one-third of its maximum power, most audio signals require less. The remaining power provides headroom for dynamic peaks. In the real world full power is only needed for very short moments. Our R.SMPS™ power supply, with its energy storage, is a great buffer for these short peaks. The mains breaker can easily handle the excess of the current.

Thanks to Lab.gruppen's efficient amp design the average mains current draw of an fP 6400 is in between 12–28 A @ 115 V (or 6 A–14 A @ 230 V respectively), which isn't a problem for a standard breaker.

Automatic Fuse Saver (AFS™): If the amplifier does attempt to draw a higher current, then the AFS™ (Automatic Fuse Saver) kicks in. AFS™ engages automatically and limits the mains current draw to a level that will not trip the mains fuse/breaker.

* = AFS™ is utilized in the fP 6400.



Like all protection features in Lab.gruppen amplifiers, AFS™ is seamless, transparent and requires no action by the user.

Gain Flexibility

A professional amplifier should fit nicely into any sound system. The reality is that some fit much better than others. The critical question when integrating an amplifier into a system is: 'What's the gain structure?' There are many ways of addressing the gain structure of the system, however, the Lab.gruppen way is the simplest and most flexible. On the rear panel is an easily accessible Multiple Position Gain Switch. Selecting one of eight gain settings, ranging between 20 dB and 41 dB, enables you to maximize headroom and eliminate clipped signals.

With eight fixed gain positions the Lab.gruppen amplifiers can be precisely matched to the gain requirements of virtually any loudspeaker system controller.

The fixed gain positions allow the front panel controls to be set at their maximum position, yet the overall gain is restricted using the rear panel mounted switch. This feature protects the whole gain structure from system tampering by 'unauthorized fingers'.

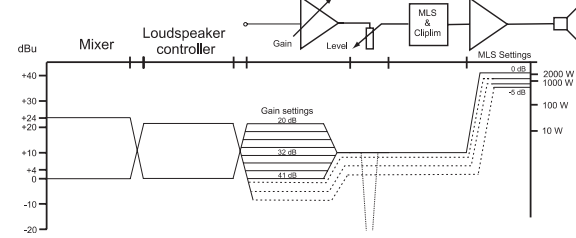


Diagram illustrates multiple fixed gain setting switches.



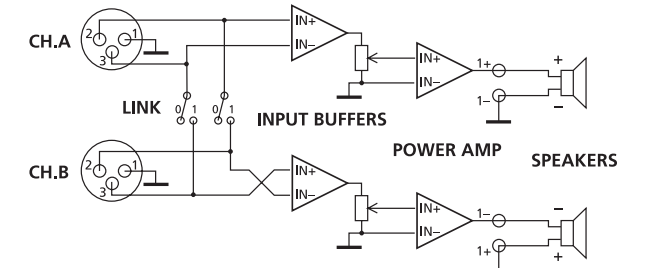
Simply In and Out

The Neutrik Combo® input jacks make balanced connection to both worlds, XLR and 1/4" TRS plugs, as simple as it gets. Using the additional male XLR connectors, multiple amps can be linked together.



Neutrik Combo® input jacks adapt to both worlds, XLR or 1/4" phone plugs.

Paralleling the inputs on the same amp is accomplished with a simple flip of a switch. No external cables are required and the switch is conveniently located on the rear panel. All outputs are via Neutrik Speakon® connectors safe and world standard.



Simple I/O diagram

Ultimate Protection

Lab.gruppen fP Series amplifiers have all the necessary protection built in, not just to protect themselves but their loads as well. The protection circuitry has an automatic reset, so you do not need to do anything. In fact, the only additional protection needed might be hearing protection...

Thermal Protection: In the rare event that the amplifier detects a thermal rise that may exceed its safe operating region, then Thermal Protection will mute the affected amp channel until it has cooled down. Recovery is automatic.

Adaptive Limiting System (ALS™): Our smart ALS™ is an 'Adaptive Limiting System' that continuously monitors the output signal for excessive current supply. If this is detected then the current is automatically cut back. This is a dynamic system and is tailored by your choice of MLS™ setting.

Clip Limiter: If for any reason, a distortion level above 1% THD appears in between the input and output, a Clip Limiter will reduce the signal proportionally. The only requirement for correct operation is that the input signal is not overdriving the amplifier channel input. The Clip Limiter is the only protection that you can manually defeat by recessed switches on the rear.



High-frequency drivers are well protected by the automatic VHF-protection.

VHF Protection: If the VHF Protection circuit detects a spurious signal at the output, above 12 kHz, at full power that lasts longer than five seconds, the specific amplifier channel will mute. This is a critical feature that protects HF drivers from oscillation.

AC Mains Voltage Protection: All fP Series amps are immune to a broad range of fluctuations in mains voltage. However, if the mains voltage drops below or rises above the allowed limits, the amplifier will mute itself thanks to its AC Mains Voltage Protection circuitry.

DC and Short Circuit Protection: Naturally all Lab.gruppen amplifiers are fully DC faults and Short Circuit protected.



Recessed bypass switch per channel for the clip limiter.



Indicators for VHF and temperature protection.



Lab.gruppen's EMC testfacilities. 8,000 volts are being "shot" with this gun for testing

Rear Panel

1. Neutrik Speakon® output connectors. Channel A and B: wired pins 1+ and 1-. (Channel B is also present on pins 2+ and 2- in the Channel A connector.)
2. Minimum Load System (MLS™) switches.
3. Clip Limiter switch (bypass).
4. Electronically balanced inputs (Neutrik Combo® XLR jacks).
5. Link outputs (XLR male jacks).
6. Multiple Gain Switches. Setting gain for both channels individually from 20 dB to 41 dB in 3 dB steps.
7. Link and Bridge switches.
8. Mains power cord. Approvals: CE, ETL and CSA (UL standards).

Front Panel

25. Removable clip-on dust filters.
26. Input level attenuators.
27. Protection indicators.
28. Over-temperature indicators.
29. Clip indicators.
30. LED bar indicating the output level.
31. Power ON indicator.
32. Mains power switch.
33. AC indicator, showing if AC line voltage is present.
34. AFS protection indicator.



TOP VIEW

9. Class TD: "Tracking Class D" power converter.
10. 50 A switching MOS transistors operating at 800 kHz.
11. Intercooler® cooling system made out of copper.
12. Linear Class AB power amplifier, ensures low noise and low distortion.
13. 160 V DC tank capacitors.
14. Cooling fans, controlled in speed proportionally to temperature.
15. Low voltage regulator.
16. Massive ferrite transformer stores magnetic energy.
17. Mains power line RFI-filter.
18. 160 V DC tank capacitors.
19. Primary tank capacitors.
20. Faraday's tube.
21. Fast Recovery Epitaxial rectifiers.
22. Regulated Switch Mode Power Supply control processor.
23. Output power adjustment.
24. Insulated Gate Bipolar Transistor Array Cooler.

Technical Data

	fp 6400	fp 3400	fp 2600	fp 2200	fp 2400Q Four channels
Max output power¹⁾					
8 Ω per channel	1300 W	1100 W	430 W	350 W	380 W
4 Ω per channel	2300 W	1500 W (1900 W 2), 3))	840 W	650 W	590 W 3), (700w 2), 3))
2 Ω per channel	3000 W (3200 W 2), 3))	1700 W (3000 W 2), 3))	1200 W (1540 W 2), 3))	1100 W	500 W 4), (650w 2), 3), 4))
8 Ω bridged	4600 W	3000 W	1680 W	1400 W	760 W 4), 5)
4 Ω bridged	6000 W	3400 W	2400 W	2200 W	1020 W 4), 5), (1280 W 2), 3), 4), 5))
Max output voltage					
8 ohms load	104 V _{rms}	91 V _{rms}	59 V _{rms}	53 V _{rms}	54 V _{rms}
Peak voltage, no load	149 V	132 V	85 V	77 V	81 V
Distortion etc.					
THD 20 Hz - 20 kHz and 1 W to full power	0.1 %	0.08 %	0.04 %	0.03 %	0.07 %
THD at 1 kHz and 1 dB below clipping	0.04 %	0.03 %	0.01 %	0.006 %	0.02 %
DIM 30 at 3 dB below clipping	0.06 %	0.06 %	0.008 %	0.008 %	0.008 %
Hum and noise					
	< -110 dB	< -110 dB	< -110 dB	< -110 dB	< -107 dB
Channel separation at 10 kHz					
	70 dB	70 dB	70 dB	70 dB	70 dB
Output impedance					
Slew rate	60 mΩ	60 mΩ	30 mΩ	30 mΩ	30 mΩ
	20 V/μsec	20 V/μsec	60 V/μsec	40 V/μsec	60 V/μsec
Inputs					
Gain selectable [dB] ⁵⁾	20, 23, 26, 29, 32, 35, 38, 41	20, 23, 26, 29, 32, 35, 38, 41	20, 23, 26, 29, 32, 35, 38, 41	20, 23, 26, 29, 32, 35, 38, 41	32
Impedance	20 kΩ	20 kΩ	20 kΩ	20 kΩ	20 kΩ
Common mode rejection	50 dB	50 dB	50 dB	50 dB	50 dB
Front panel					
Gain controls	31 pos detent	31 pos detent	31 pos detent	31 pos detent	31 pos detent
Indicators per channel:					
Clip	Red LED	Red LED	Red LED	Red LED	Red LED
Output headroom indicators	5 green LED's	5 green LED's	5 green LED's	5 green LED's	2 green LED's
Protect (Short & VHF)			Yellow LED	Yellow LED	
Protect (Short, temp & VHF)					Yellow LED
VHF	Yellow LED	Yellow LED			
Over temperature	Yellow LED	Yellow LED	Yellow LED	Yellow LED	
Rear panel					
Input connectors	Neutrik Combo	Neutrik Combo	Neutrik Combo	Neutrik Combo	Neutrik Combo
Link connectors	XLR male	XLR male	XLR male	XLR male	N/A
Clip limiters	On/Off, each ch.	On/Off, each ch.	On/Off, each ch.	On/Off, each ch.	On/Off, each ch.
MLS switch [dB]	0, -2, -4, -5	0, -2, -4, -5	0, -3	N/A	0, -3
- corresponding to [V _{rms}]	104, 84, 70, 62	91, 75, 58, 52	59, 45	53	55, 41
- when bridged [V _{rms}]	208, 168, 140, 124	182, 150, 116, 104	118, 90	106	110, 82
Link switch	Ch. A-B	Ch. A-B	Ch. A-B	Ch. A-B	Ch. A-B, B-C, C-D
Power					
Operation voltage, 230V/115V	130-265V/65-135V	130-265V/65-135V	130-265V/65-135V	130-265V/65-135V	130-265V/65-135V
Soft Start	Yes	Yes	Yes	Yes	Yes
Peak inrush current	5 A	5 A	5 A	5 A	5 A
Full output power at 4 ohms, 230V/115V	180-265V/90-130V	180-265V/90-130V	180-265V/90-130V	180-265V/90-130V	180-265V/90-130V
Minimum start-up voltage, 230V/115V	175V/95V	175V/95V	175V/95V	175V/95V	175V/95V
230 V or 115 V versions	Yes	Yes	Yes	Yes	Yes
Current draw at 4Ω and 230V/115V					
Idle, no load at output	1.0/2.0 Arms	1.0/2.0 Arms	1.0/2.0 Arms	0.9/1.8 Arms	1.4/2.8 Arms
1/8 of full power (-9 dB)	6/12 Arms	5/10 Arms	6/12 Arms	5/10 Arms	6/12 Arms
1/3 of full power (-5 dB)	14/28 Arms	11/22 Arms	9/18 Arms	8/16 Arms	9/18 Arms
At full power (0 dB) at 1 kHz 1 % THD	20/40 Arms	26/52 Arms	16/32 Arms	14/28 Arms	16/32 Arms
Dimensions					
Width	483 mm (19")	483 mm (19")	483 mm (19")	483 mm (19")	483 mm (19")
Height	88 mm (3.5")	88 mm (3.5")	88 mm (3.5")	88 mm (3.5")	88 mm(3.5")
Depth	347 mm (13.7")	347 mm (13.7")	287 mm (11.3")	287 mm (11.3")	316 mm (12.4")
Weight					
	10.0 kg (22 lbs)	10.0 kg (22 lbs)	8.0 kg (18 lbs)	7.9 kg (17 lbs)	8.6 kg (19 lbs)

Approvals:

CE:	Immunity: EN 55 103-2, E3, with S/N below 1 % at normal operation level Safety: EN 60 065, class 1	1) Both channels driven, MLS = 0dB. Measured with 33% duty cycle (33ms 1kHz sinusoidal burst). 2) One channel driven or peak power both channels driven. 3) Thermal protection may occur at continuous high power.
ETL listed:	Conforms to ANSI/UL STD 6500 and Certified to CAN/CSA E60065-00	4) MLS = -3 dB. 5) Per bridged channel pair. Channels A/B and C/D may be bridged independently.
FCC:	Complies with Class B digital device, Part 15 of the FCC Rules	6) +6dB when bridged.

Lab.gruppen reserve the right to alter functions or the specifications without prior notice.

LAB.GRUPPEN
INNOVATIVE POWER SOLUTIONS