PLM 20K44 / PLM 12K44 / PLM 5K44



PLM+ Powered Loudspeaker Management System

The PLM+ range is the flagship touring platform by Lab.gruppen and sets the benchmark for Powered Loudspeaker Management Systems. PLM+ combines four channels of amplification with unrivalled signal processing and audio management, allowing complete integration in the devices and offering many unique functions not found in other amplifier and DSP “combined” platforms.

PLM+ has been designed with total integration at the core of the system, allowing complete control and monitoring of the whole platform ecosystem – including networking, audio I/O, signal processing, amplifiers, power supply and connected mains supply – delivering unique operational benefits and system control for the user via Lake Controller, CAFÉ and Third Party Protocol integration.

Building on the TEC Award winning PLM 20000Q, PLM+ offers up to 4 x 5000 Watts output power (PLM 20K44), twice the processing power and throughput, and a whole host of additional features and improvements designed to offer real world benefits. PLM+ makes any production life cycle easier to specify, smoother to run, more efficient to control and monitor - at the system design stage, during the show, and right through to final load out. Proven at all levels of concert touring, the PLM+ series incorporates road tested and environmentally conscious technologies.

The PLM12K44 and 5K44 offer a touring technology first: Rational Power Management (RPM™), a new proprietary Lab.gruppen innovation that rationalises power allocation between channels to optimise performance and potentially minimise amplifier inventory

As with previous generations of PLM, the new PLM+ models benefit from the proven package of onboard Lake Processing and Dante™ digital audio networking, plus redundant audio inputs as well as onboard load monitoring to fulfill the requirements of mission-critical live sound applications, where the show must go on, no matter what.

PLM+ Features and Benefits

- 4 x 1250 W nominal output power for a total of 5000 W (5K44)
  4 x 3000 W nominal output power for a total of 12000 W (12K44)
  4 x 5000 W nominal output power for a total of 20000 W (20K44)
- Any channel is capable of delivering up to 5900 W power output, from total available power (2000 W for 5K44)
- 2U chassis weighing only 11.4 kg (5K44), 16.5 kg (12K44), 17 kg (20K44)
- Four ‘Lake Class’ analog inputs with Iso-Float™ ground isolation
- Two AES3 on XLR digital inputs (4 audio channels)
- Eight dual-redundant Dante network audio inputs and outputs with AES67 support
- Compatible with PLM, Lake, LM Series and D Series
- Rational Power Management (RPM) - Flexible power output allocation across channels of the 5K44 and 12K44 models to match requirements, enabling more efficient use of amplifier inventory
- Copper-finned Intercooler with transverse-mounted output devices (12K44 and 20K44 only)
- Rugged - road tested construction
- Unique universal, Regulated Switch-Mode Power Supply (R.SMPS™) maintains stability despite mains voltage fluctuations
- Best-in-class Power Factor Correction (PFC) helps maintain full output during extended power bursts
- Current Draw Modelling (CDM™) reduces mains peak draw
- Breaker Emulation Limiter (BEL™) - Tailors PLM+ Series to the available mains distribution
- Under-Voltage Limiting (UVL) enables continued operation with mains voltage sags as low as 65 V
- Power Average Limiter (PAL) with software-controlled Breaker Emulation Limiter (BEL) prevents mains fuse tripping
- Amplifier Design: Class TD® output stage (Class D for 5K44)
- Digitally controlled and recallable ‘amplifier gain’ adjustable in 0.1 dB steps
- Digital output attenuation in 0.25 dB steps from -inf to 0 dB
- Digitally implemented, zero-overshoot Inter-Sample Voltage Peak Limiting (ISVPL) adjustable in 0.1 V steps from 17.8 to 194 V (150 V for 5K44)
- LoadSmart load verification
- Extensive loudspeaker preset database (LoadLibrary™)
- LoadPilot™, Dual Pilot tone Generating and Monitoring
- CAFÉ Integration
- Dante low-latency digital network included as standard
- Full support for Dante Controller
- Lake’s exclusive classic/linear-phase/FIR speaker processing platform with four throughputs
- Group control with Raised Cosine™ MESA EQ™ asymmetric filters
- LimiterMax™ peak and RMS limiters
- Comprehensive clocking management system with low latency sample rate conversion
- Multiple and redundant inputs with programmable fallover
- Primary and secondary network connections
- High-resolution daylight viewable front-panel LCD display
- Moisture resistant silicone touchpad for front-panel display mode selection and menu navigation

PLM+ SERIES: Technology Overview

Proven Lab.gruppen Technologies

Reliability, durability, sound quality and pure power remain the fundamentals for any touring amplifier, and in this regard PLM+rigorously maintains Lab.gruppen's industry-leading reputation. The 12K44 and 20K44 amplifiers output stages are the Lab.gruppen patented Class TD® which couples the efficiency of Class D topologies to the sonic purity of Class A/B designs. The 5K44 uses a newly developed Class D technology design with increased efficiency and sustained sonic performance.

Equipped with the Intercooler cooling system (12K44 and 20K44 only), these amplifiers dissipate heat more effectively and eliminate "end of tunnel" output device over-temperature problems. PLM+ also offers a full suite of protection features, including thermal "show-must-go-on" limiting, short circuit protection, excessive average current limiting, sustained VHF (very high frequency) protection, DC protection and voltage-and current-clip limiting. None of the limiters introduce slow, long term gain changes that can risk altering the balance of a tuned system.

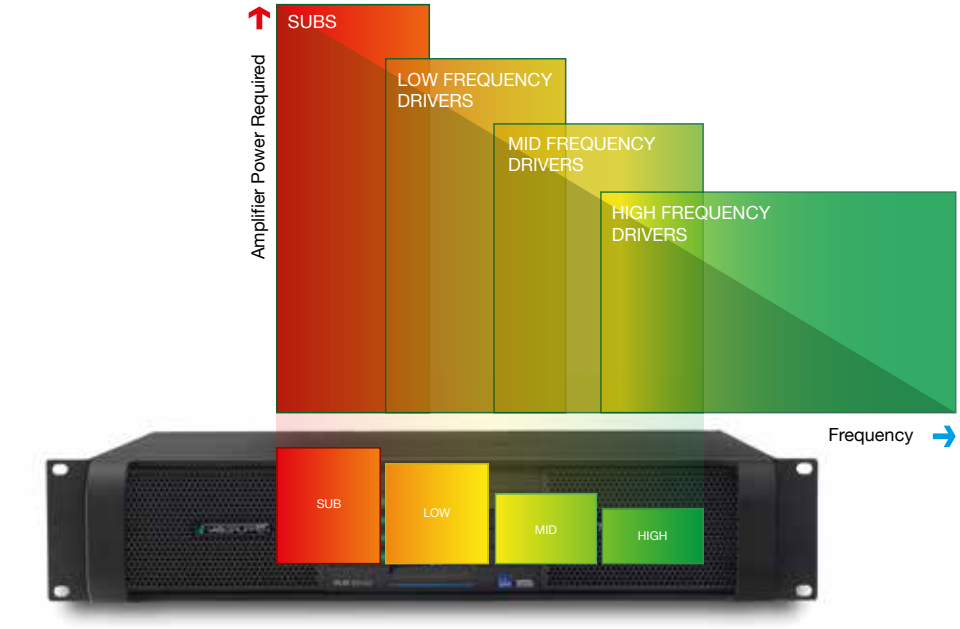
A Breaker Emulation Limiter (BEL) prevents power interruption while Under-Voltage Limiting (UVL) allows continued operation despite severe voltage drops. The Regulated Switch Mode Power Supply (R.SMPS) connects to any mains supply in the world. The design also incorporates power factor correction (PFC) to reduce peak current draw from the mains. In addition, the inherent rail regulation maintains stable rail voltages during extended bursts; extreme low-frequency beats will not affect mid- and high-frequency headroom.

Rational Power Management (RPM)

On top of the outstanding performance users have come to expect from a PLM, the PLM+ series also contains Rational Power Management (RPM), a proprietary Lab.gruppen technology that gives system designers and techs unprecedented freedom to allocate the output power available on each channel for optimum performance with specific load conditions. This enables the user to minimize equipment costs, reduce rack space and improve long-term energy efficiency – all without compromising sonic performance.

RPM enables the re-allocation of total output power capacity among the four channels. For example, any channel of the 12K44 model can supply up to 5900 W, with the provision of keeping within the total power outtake of 12000 W (up to 2000 W for the 5K44). The maximum output channel(s) can be used for power-hungry low-frequency systems, while the remaining output power can be allocated as needed for the mid-frequency and high frequency drivers, providing a smarter and more efficient way to distribute total power across any large scale PA.

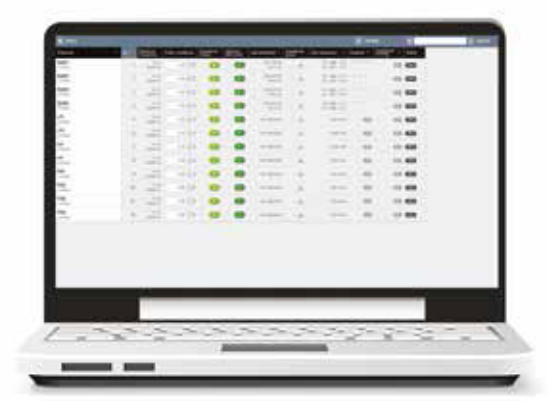
From within the CAFÉ software, RPM allows the desired power demand to be calculated for the various loads in several different ways. RPM then analyses the desired power in relation to the channel and device constraints across the two PLM+ models, and guides the system designer towards the most effective way to power the PA.



PLM+ Series - Amp channels power adjusted to match the loudspeaker requirements

CAFÉ and RPM for Green Credentials

PLM+ can be configured and monitored using Lab.gruppen's CAFÉ (Configuring Amplifiers For the Environment) software suite. In addition to providing comprehensive system surveillance and configuration of RPM and other amplifier features such as ISVPL and Breaker Emulation Limiter (BEL), CAFÉ also includes valuable help to save the environment. In combination with the RPM configuration CAFÉ can accurately predict, based on the true SPL and speaker requirements of the individual loads for the given project, estimations of average mains current draw and generated heat in BTU. With PLM+ Series' innovative power supply technologies (true Power Factor Correction utilizing Current Draw Modelling) the required mains draw is already best in class in relation to burst power output, but in combination with the BEL the mains draw can also be safeguarded to the predicted level. The end result is precise mains management and thermal control, which allows more accurate (rather than over-specified) provision of mains distribution, cabling and cooling. This technology suite reduces lifetime running costs and minimizes environmental impact. It also reduces demands on UPS systems.



Windows® 10

Mac

CAFÉ and Equipment Specification Predictor (ESP)

CAFÉ also features an innovative design aid – the Equipment Specification Predictor (ESP). ESP examines the system SPL and speaker requirements for a given project and aids in transforming that data into circuit and amplifier channel requirements. On a system level, CAFÉ supplies a recommendation for optimized placement of channels into amplifiers for the most cost effective solution. The recommendation includes model and quantities of PLM+ Series required with most rational use of amplifiers, minimizing wasted headroom.

Lake Processing

PLM+ devices provide extraordinary input flexibility, the legendary power of exclusive Lake processing algorithms, comprehensive control and load monitoring via Lake Controller, and seamless integration into Dante digital audio networks with AES67 support. All PLM+ models incorporate four full-featured Lake Processing modules, with four discrete channels of audio throughput input to output. Audio signals are selectable from four channels of analog (with Iso-float ground isolation), four channels via AES3 digital inputs and eight dual redundant Dante networked inputs with AES67 support. Input signals are individually selectable for each channel, with programmable failover to a lower prioritized input.

The full-featured, on-board Lake processor includes group control with Raised Cosine MESA EQ asymmetric filters to match the responses of any loudspeaker system. LimiterMax peak and RMS limiters set the industry standard for loudspeaker protection and sonic transparency.

The included Lake Controller software provides a unified interface for control of Lake functions and for comprehensive monitoring of both amplifier status and connected loudspeaker loads. Optimized for a wireless tablet PC, Lake Controller is easy and intuitive to operate, with the "feel" of real-time analog faders and controls. Lake Controller also features seamless integration with third party, real-time sound system measurement, optimization, and control software packages. Users can measure spectrum and transfer function and adjust system EQ at the same time, using the same user interface.

Lake Processing also offers classical crossovers (selectable up to 48 dB per octave) as well as linear-phase crossovers capable of slopes exceeding 180 dB per octave for greater control to limit lobing and off-axis cancellation.

PLM+ SERIES: Technology Overview



Lake Controller Software

Lake Controller software provides a unified interface for control and monitoring of all functions of the PLM+, including control and monitoring of exclusive PLM+ features: digital input gain and attenuation and load verification and performance monitoring via LoadSmart. The flexible Lake Controller software environment can control extensive networks of powered loudspeaker management systems from a single computer. The user interface is based on discrete processing modules, with each module assigned to power outputs defining single or sets of band-limited drivers (e.g. low, mid, high, subs). Adjustments can be made in real time to any parameter of any module on the network.

Group Control

Modules may be assigned to groups representing subsystems in larger systems, such as main arrays, delays, and fills in an arena system. Because each module can be assigned to more than one group, Lake Controller can simultaneously address multiple groups for global adjustments as needed while maintaining independent control of separate subsystems and individual components. The Lake Controller software is optimized for a wireless Tablet PC. The same Lake Controller interface can be used to operate PLM Series, LM Series, and D Series as part of a unified system.

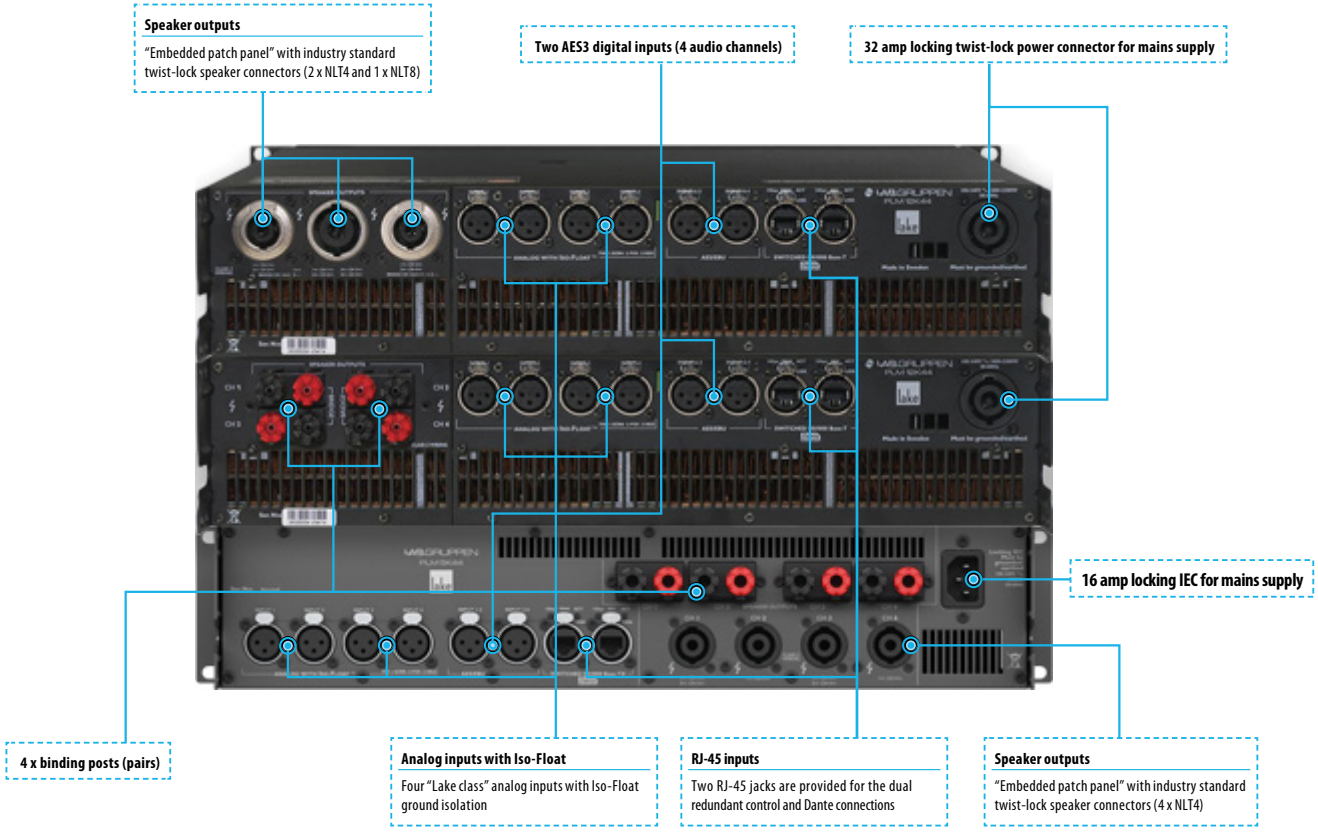
Another feature is seamless integration with third party real-time sound system measurement and optimization software packages. Users can measure spectrum and transfer function while simultaneously adjusting system EQ on the same user interface.

Dante and AES67 Audio Network

PLM+ Series Powered Loudspeaker Management systems are equipped with Dante, a self-configuring digital audio networking solution from Audinate®, based on the newest developments in networking technology. Dante provides reliable, sample-accurate audio distribution over Ethernet with extremely low latency. Dante incorporates Zen™, an automatic device discovery and system configuration protocol which enables PLM+ Series products and other Dante-enabled products to find each other on the network and configure themselves.

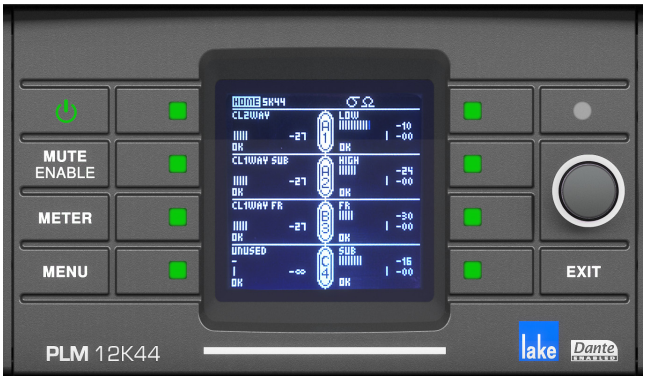
PLM+ seamlessly incorporates any of the eight available Dante input channels into the Lake Modules, while simultaneously transmitting eight unprocessed Dante channels onto the network. PLM+ also supports AES67, a new open standard to easily connect devices together and share audio.

The PLM+ Series also has the possibility to convert between AES67 and Dante, and can accordingly work as a bridge between the two different network protocols. It can input 8 channels of AES67 and transmit them out again as 8 Dante channels or vice versa, and in any combination of Dante and AES67 channels.



Connectivity

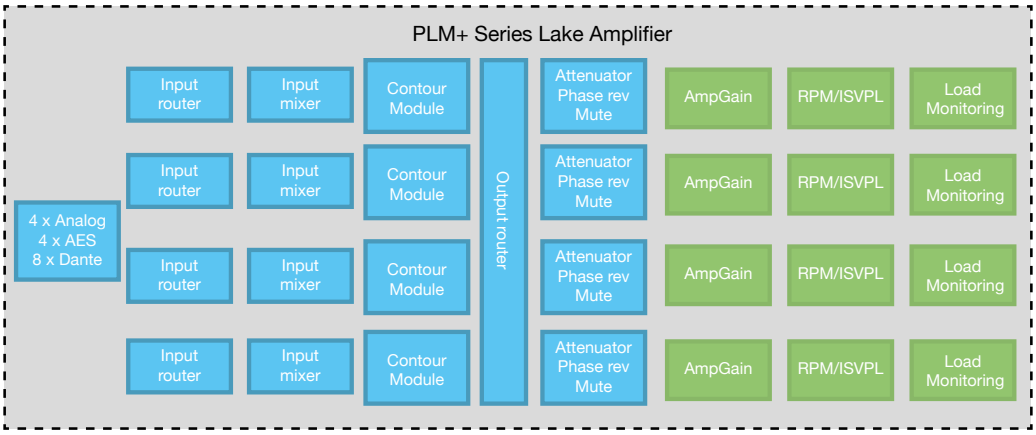
The PLM 20K44 and 12K44 are available with either binding posts or an 'embedded patch panel' with industry standard twist-lock speaker connectors (2 x NLT4 and 1 x NLT8). The 5K44 is equipped with both binding posts and twist-lock speaker connectors (4x NLT4). Common connectors include: 4 x analog inputs across 4 x XLR-F connectorswith switchable Iso-Float, 4channels of AES/EBU across 2 x XLR-F connectors, 2 x RJ-45 forlinking or redundancy. A 32 amp twist-lock power connector (16 amp locking IEC for 5K44) is used for mains supply.



Front Panel Interface

The front panel is the "local control center" for the PLM+. An intuitive, menu driven interface allows quick access to key functions using the moisture resistant silicone touchpad. Information is clearly displayed on the daylight-readable, 2.5-inch LCD panel. The soft-button keypad and precision rotary encoder provide control of processing and amplification functions, with key lock available.

PLM+ SERIES: Technology Overview



System Block

The input section (inputs, input router and input mixer) allows for mixing capabilities as well as redundant and prioritized inputs with automatic switch-over in case of signal failure. Up to four Lake Processing modules provide user EQ and loudspeaker processing, including LimiterMax limiting. Each power output channel provides individual channel processing, including ISVPL limiter, RPM and load monitoring.

Specifications

	PLM 5K44	PLM 12K44	PLM 20K44
General			
Processing / Network	Lake / Dante		
Numbers of amplifier channels	4		
Total burst power all channels (share among channels with RPM)	5000 W	12000 W	20000 W
Max. Output Power (all ch.'s driven) 1)			
2 ohms	900 W	3000 W	4400 W
2.67 ohms	1250 W	3000 W	5000 W
4 ohms	1250 W	3000 W	4400 W
8 ohms	1250 W	1900 W	2300 W
16 ohms	700 W	950 W	1150 W
Hi-Z 70 V	1300 W	3000 W	3300 W
Hi-Z 100 V	1250 W	3000 W	4700 W
Max output power single channel 1)			
2 ohms	900 W	4400 W	4400 W
2.67 ohms	1250 W	5900 W	5900 W
4 ohms	1750 W	4600 W	4600 W
8 ohms	1350 W	2300 W	2300 W
16 ohms	700 W	1150 W	1150 W
Hi-Z 70 V	1450 W	3300 W	3300 W
Hi-Z 100 V	2000 W	4700 W	4700 W
Amplifier output modules (all models, all channels)			
Peak output voltage	150 V	194 V	194 V
Max output current	30 A	67 A	67 A
Rational Power Management (RPM)	Any channel has potential to deliver the max single channel output power		
Default voltage limitation (can be lifted with RPM configuration	145 V	175 V	194 V
Protection features	Current Average Limiter (CAL), Very High Frequency Protection (VHF), Direct Current Protection (DC), Short Circuit Protection, Current-Clip Limiter, Voltage Clip Limiter, Temperature protection		
Audio Performance (Amplifier platform with digital input)			
THD + N 20 Hz - 20 kHz for 1 W	< 0.05 %	< 0.05 %	< 0.05 %
THD + N at 1 kHz and 1 dB below clipping	< 0.04 %	< 0.04 %	< 0.04 %
Dynamic range	> 112 dB	> 114 dB	> 114 dB
Channel separation (Crosstalk) at 1 kHz	> 70 dB	> 70 dB	> 70 dB
Frequency response (1 W into 8 ohm, 20 Hz - 20 kHz)	+ /- 0.05 dB	+/- 0.05 dB	+/- 0.05 dB
Internal sample rate / Data path	96 KHz / 32 bit floating point	96 kHz / 32 bit floating point	96 kHz / 32 bit floating point
Product propagation delay AES 96 kHz / analog input	1.61 / 1.68 ms	1.61 / 1.68 ms	1.61 / 1.68 ms
Lake processing			
Loudspeaker processing	Up to 4 modules of Classic/linear-phase/FIR cross-over, EQ, delay, LimiterMax™ - peak and RMS limiters		
System tuning	Group control with Raised Cosine™ MESA EG™ asymmetric filters		
Input redundancy / Matrix	Automatic 4 level input redundancy / 4 input mixers		
System integration	Comprehensive 3rd party protocol over UDP Ethernet		
Measurement & Analysis			
Pilot tone generation and analysis	Yes		
Load impedance analysis	Yes		
Real Time Analyzer (RTA), 3rd party integration	Yes		
Dante Audio Network			
Dante I/O	8 X 8 (shared with AES67)		
Network topology / redundancy	Flexible topology / Supports daisy-chained and Dual redundant networks		
Sample rates / transport	48, 96 kHz / Uni + Multicast		
Network latency	0.25, 0.5, 1.0, 2.0, 5.0 ms		
AES67 Audio Network			
I/O	8 X 8 (shared with Dante)		
Network topology / redundancy	Flexible topology / Supports daisy-chained networks		
Sample rates / transport	48 kHz / Multicast		
Network latency	2 ms		
Device Presets			
Local memory locations for the settings of the product	100		
AES Inputs			
Inputs	4 AES inputs		
Supported sample rates/ resolution	44.1, 48, 88.2, 96, 176.4, 192 kHz / up to 24 bits		
Sample rate conversion THD + N 20 Hz - 20 kHz unweighted	0.00003 %		
Analog Inputs			
Inputs	4 high quality inputs with Iso-Float™ ground isolation		
Maximum input / digital reference	+ 26 dBu / +21 dBu		
Sampling rate / resolution	96 kHz / 24 bit		
Input impedance balanced / unbalanced	20 k / 10 k ohm		
THD + N (typical at 1 kHz unweighted)	0.00022 %		
THD + N (typical at 20 Hz and 20 kHz unweighted)	0.00033 %		
Limiters			
Adjustable Inter-Sample Voltage Peak Limiter (ISVPL)	17.8 - 150 V, step size 0.1 V	17.8 - 194 V, step size 0.1 V	17.8 - 194 V, step size 0.1 V
Current Peak Limiter < 300 ms	30 A peak	67 A peak	67 A peak
Current Average Limiter (CAL) > 300 ms	15 Arms	33 Arms	33 Arms
LimiterMax (rms and peak limiters)			
MaxRMS (rms voltage limiter)	Yes		
MaxPeak (peak voltage limiter)	Yes		

Specifications

	PLM 5K44	PLM 12K44	PLM 20K44
Amplifier gain	22 - 44 dB, step size 0.1 dB		
Digital attenuator	- Inf to 0 dB, step size 0.25 dB		
Rear-panel interface			
Analog inputs	4 x 3 pin XLR, electronically balanced		
AES inputs	2 x 3 pin XLR		
Output connectors	Industry standard twist-lock speaker connector (4 x NT4) and 4 binding posts (pairs)	Industry standard twist-lock speaker connector (1 x NLT8, 2 x NLT4) or 4 binding posts (pairs)	
Auto 100/1000, Auto Uplink	2 x RJ-45		
Control and monitoring interface	Via Ethernet for Lake Controller software, or DLM (the 3rd party protocol)		
Detachable mains cord	Detachable locking 3-pin IEC rated at 250 V / 16A	Industry standard twist-lock speaker connector 32 A	Industry standard twist-lock speaker connector 32 A
Cooling	Four fans front-to-rear airflow temperature controlled speed	Three fans front-to-rear airflow, temperature controlled speed	
Front-panel interface			
Display	2.5 inch, Black / white, daylight readable LCD		
Fault / Warning / Limit / Clip indicators	RGB LEDs and detailed fault description on display		
Mute and soft function buttons	8 provided		
Standby Power button	On / Standby		
Mute Enable button	Enables muting of outputs and inputs via soft-button keypad		
Meter button	Toggles through meter views		
Menu button	Provides a menu driven interface for full function front panel control		
Rotary Encoder	Yes		
Exit button	Provides a “back” function		
Mains power			
Nominal voltage	100 - 240 V AC 50- 60 Hz	100 - 240 V AC 45- 66 Hz	100 - 240 V AC 45- 66 Hz
Operating voltage	70 - 265 V AC		
Mains wall plug	Selectable order CEE 7/7 “Schuko” 230 V / 16 A, NEMA 5-15 125 V /15 A BS1363-A 250 V / 13 A, IA16A3 250 V / 16 A, AU/NZ 250 V / 10 A, JP 125 V / 15 A, CPCS-CCC 250 V / 10 A	NEMA L5-30 “Twist lock” 125 V / 30 A, and CEE 7/7 “Schuko” 230 V / 16 A	NEMA L5-30 “Twist lock” 125 V / 30 A, and CEE 7/7 “Schuko” 230 V / 16 A
Power supply features			
Soft start / Inrush power	Yes		
Power Factor Correction (PFC)	>0.98 for mains power > 300 W	>0.98 for mains power > 400 W	
Regulated switch mode power supply	Yes		
Breaker Emulation Limiter (BEL)	Configurable current threshold and breaker profile		
BEL max current threshold	15 A	25 A	32 A
Power Average Limiter (PAL)	Yes		
Under Voltage Limiter (UVL)	Yes		
Mains under voltage and overvoltage protection and mains glitch tolerance	Yes		
Dimensions			
Rack rail to rear panel	W: 483 mm (19"), H: 88 mm (2 U), D: 424 mm (16.7")		
Overall depth including handles and rear support	D: 498 mm (19.6")		
Weight	11.4 kg (25,1 lbs)	16.5 kg (36 lbs)	17 kg (37 lbs)
Finish	Black painted steel chassis with black painted steel / aluminium front		
Approvals	CE, ANSI / UL 60065 (ETL), CSA C22.2 NO. 60065, PSE, RCM, FCC and CCC	CE, ANSI / UL 60065 (ETL), CSA C22.2 NO. 60065, PSE, RCM, FCC and BIS India	

Note 1): Lab.gruppen burst power (1 kHz, 25 ms burst power @ 150 BPM, 12 dB Crest factor)

All specifications are subject to change without notice.

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