Network Configuration Guide

PLM™ Series

Powered Loudspeaker Management™ systems

Rev. 1.0.5
Item no. NCG-PLM

LAB.GRUPPEN

1 CONTENTS

2.1 Overview

Thank you for choosing the Lab.gruppen PLM Series of Powered Loudspeaker Management systems for your sound reinforcement needs. We are confident that you will be pleased with the performance, unique features, configuration flexibility, reliability, and long-term durability offered by PLM Series products.

This document covers only information related to network configuration. For information on PLM Series installation and operation, and use of the Dolby® Lake® Controller (DLC) PLM Edition software, please consult the other documentation included with your PLM Series product: The Dolby Lake Controller User Manual, the Dolby Lake Controller User Manual PLM Edition Addendum, the PLM Series Operation Manual, and the PLM Series Quick Start and Field Reference Guide.

This document and the PLM Quick Start and Field Reference Guide supply most of the information you will require to install your PLM Series products and configure a network. We do, however, highly recommend reading through all the of the product documentation on the included CD ROM in their entirety. As you become thoroughly familiar with all aspects of the PLM Series, you may learn about features and options that will affect your choices of operational modes or loudspeaker system configurations.

The Lab.gruppen PLM Series utilizes proven Dolby Lake Processor technology and expands upon it, providing a suite of load verification and performance monitoring features. The power amplification section builds on the foundation of the road-tested FP+ and legendary fP Series, providing the same sonic signature – powerful, tight bass and transparent high frequency response. In addition, the PLM Series establishes new benchmarks for high power and channel density in tandem with digital signal processing, system management and protection features found in no other product.

Thank you again for placing your confidence in Lab.gruppen.

2.2. Ethernet Fundamentals

The PLM Series implements a full Ethernet stack, providing all the standard features and benefits of an Ethernet device. As with all Ethernet-based devices, some specific cable requirements apply, and there are inherent limitations to the number of network nodes and cable lengths supported. An overview of basic Ethernet system requirements is presented in section 5.3 of this guide.

It is assumed that the user has a basic understanding of Ethernet-based networking technology. (A level of knowledge equivalent to that needed for configuring a home or small office network should be sufficient for most PLM Series applications.) Also, it is assumed the user is familiar with basic networking terminology (e.g. bandwidth, port, node). A number of more advanced terms specific to PLM Series applications are included in section 7 (References and Definitions).

2.3 PC Configuration

In most network configurations that include switchers or routers of the types recommended, it should not be necessary to manually configure network settings in the host computer used for the Dolby Lake Controller PLM Edition software application. The network should automatically detect the host computer and all connected PLM Series units, and then set the IP address, network speed and communication protocols without user intervention.

In applications where switches or routers of the recommended type are not used, and instead the PLM Series units are connected directly to the network port of the host computer, it may be necessary to manually configure your network connection by entering an IP address. Instructions for this are given in the Dolby Lake Controller Manual, section 2.3.

In Windows Vista, navigation to the IP dialog box differs from that given for Windows XP in the Dolby Lake Controller Manual. For Vista, the following navigation is suggested:

1. From the Start menu, open the Control Panel. Under Network and Internet, choose View Network Status and Tasks.

2. Underneath Network, to the right of Connection / Local Area Connection, choose View Status.

3. In the dialog box, click on Properties, and click Continue in the warning dialog.

4. 4. In the Local Area Connection Properties, select Internet Protocol Version 4 (TCP/IPv4) and click on the Properties button below.

5. Proceed as in Dolby Lake Controller Manual, section 2.3.2, step 4.

3.1 Networking Overview

Designed for use on an Ethernet network, the PLM Series Powered Loudspeaker Management system allows configuration, control, and monitoring of multiple PLM Series devices from a PC running DLC PLM Edition software. The user can control the networked devices over either a wired or a wireless connection. Additionally, the PLM Series' incorporation of the Dante digital audio protocol permits distribution of multichannel digital audio (up to 24-bit, 96 kHz) as well as control data via the same network.

NOTE

Network configurations containing a mixture of PLM Series devices, Dolby Lake Processors, Lake Contour™ and Mesa Quad EQ™ processors are supported, and can be controlled simultaneously within the DLC PLM Edition software environment. Also, it should be noted that a PLM Series device or Dolby Lake Processor can be utilized as a "break in" point for the introduction of an analog or AES digital audio signal to the system; this signal then can be passed on via Dante throughout the rest of the network.

3.2 Dante Audio Network

The Dolby Lake processor integrated in the PLM Series incorporates a Dante audio networking interface, allowing the connections to the PLM Series to be reduced to a single Cat-5e cable which carries all audio and control information.

Dante, developed by Audinate®, permits the transmission of professional-quality multichannel audio over an Ethernet network. Dante overcomes the problems associated with earlier Ethernet-based digital audio systems, including clock synchronization issues, lack of true plug-and-play functionality, and channel count limitations. Additionally, Dante can coexist with TCP/IP network traffic and other standard control protocols.

NOTE

All conductors must be terminated to the RJ45 connector at both ends of any cable used for Dante network connectivity.

3.3 Rear Panel Connections

The PLM Series has two Ethernet ports for use in creating free-topology Ethernet-based networking systems. The ports, located on the back panel (see figure 1), use Neutrik® EtherCon® RJ45 connectors. Two LEDs above each port indicate connection to a valid network (LINK) and the presence of network activity (ACT).

Both Ethernet ports are 10/100BASE-T with auto-sensing and auto-uplink. The 10/100 auto-sensing function automatically configures the Ethernet port to operate at either 10 MHz (10BASE-T) or 100 MHz (100BASE-T). The auto-uplink feature automatically senses the cable type, allowing for either a pass-through (straight) or crossover Ethernet cable to be used.

NOTE

Although standard Cat-5 Ethernet cables can be used to interconnect PLM Series devices, switches, wireless access points and routers on the network, Cat-5e Ethernet cabling is strongly recommended due to its increased bandwidth capacity.

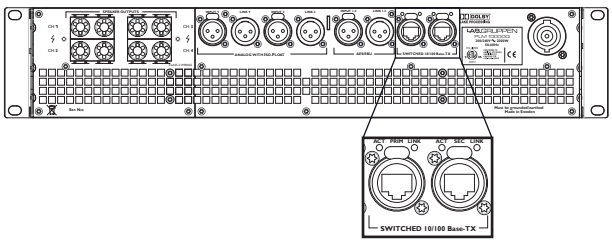

Figure 3.3: Dual Ethernet ports are located on the PLM rear panel

4.1 SPF Overview

Critical network configurations (such as those transporting audio signals) should avoid "Single Point of Failure" (SPF) scenarios to the greatest extent possible. SPF failures can occur when a network has been designed in such a way that failure of a single part of the network can cause the entire network to fail or cease operation. A network that has not been designed with the appropriate fail-safe measures to avoid SPF issues can suffer a breakdown in the transport of audio and control data, resulting in the worst case scenario for any professional sound engineer: dead silence.

The use of redundant network and audio cabling and switches, as well as the careful selection of the proper network topology for your application, are effective tools in avoiding SPF issues.

The PLM Series has been designed with special features to help prevent this type of system-wide network breakdown. These include:

- Auto input priority switching (managing multiple signal sources)
- Support for redundant device sources (e.g. the same device providing both analog and AES sources simultaneously to the network)
- Support for redundant network paths (via redundant rear panel Ethernet ports on the PLM)

4.2 Automatic Priority Input Switching

The user-selectable automatic input priority switching feature in the DLC PLM Edition software is located on the I/O Config tab of the Input Configuration page (see figure 4.1). Four levels of input priority are offered, each of which can consist of Analog, AES 1, AES 2, and Dante. In the event of a loss of signal to the first priority input, the system will instantly switch to the next designated priority input and restore audio connectivity to the system.

Full information on how to select user input priorities is contained in section 9.12.3.1 of the PLM Series Operation Manual.

Figure 4.1: Priority input settings are located in the Input Configuration page

4.1.1 Signal type redundancy

Use of this topology allows a PLM to receive audio and control signals from a source device using different output types, i.e. a device which can output both analog and AES signals simultaneously. These signals are then designated as priorities in the auto input section. Again, please refer to section 9.12.3.1 of the PLM Series Operation Manual for more detailed information on setting input priorities.

4.1.2 Signal source redundancy

This priority scheme consists of two sources, in two locations, acting as prioritized sources in the same network. Source redundancy also allows the user to set up two different devices (e.g. PLMs), feed both with the same input signal (analog or AES digital), and then have both transfer this signal onto Dante. Redundant signals are thus transferred to the network. All PLMs that are required to access this signal can do so as long as one of the two PLMs connected to the source device remains on the network. All remaining PLMs on the network must be configured to access these same two devices as the primary and secondary signal sources.

An alternate use of this function is to have a higher prioritized source as an override. For example, an AES signal could be distributed as a fire alarm input that can then override the normal material distributed via Dante and/or analog.

4.2 Network Port Redundancy

In this application, the second network port on a PLM's rear panel can be configured to be redundant to the first port. If a parallel network is created, and the source is connected to both networks, then any single cable failure or switch failure can be overcome without any loss of audio signal in the network. It is also possible to survive multiple hardware failures with this topography; however, this capability will depend on the network configuration that is used. More information about possible configurations is found in section 5.

5.1 PLM Series Network Cabling

The common cable categories used for high bandwidth network connectivity are Cat-5e and Cat-6; these are preferred choices for PLM Series network use. However, Cat-5 may be used in limited applications, as explained below.

Cat-6, as the designation implies, is the newer standard, and it is designed to accommodate high-speed networks up to 250 MHz. The 10000BASE-TX standard (using 2 pairs) requires Cat-6 cabling. Cat-6 is fully compatible with all PLM Series network applications (including use with Dante) as it accommodates all current Ethernet protocols.

Cat-5e (using 4 pairs) supports 1000BASE-T applications, and is also fully suited to all PLM Series applications, including Dante.

Cat-5 cabling meets the requirements for the PLM Ethernet control network. However, the higher ratings of Cat-5e and Cat-6 are recommended for use as the backbone between switches, particularly if Dante is being used.

Cat-3 or Cat-4 cables may still be in use in some installations. Neither of these satisfies the bandwidth requirements of 100BASE-TX or 1000BASE-T networking, and should not be used with PLM Series networks.

Table 5.1 can be used as a guide when specifying maximum recommended lengths for Ethernet cables within a PLM network:

	Spectral Bandwidth	Max Length	LAN
Cat-5	100 MHz	100 m	100BASE-TX
Cat-5e	100 MHz	100 m	100BASE-TX 1000BASE-T
Cat-6	250 MHz	100 m	1000BASE-TX

Table 5.1: Recommended PLM network cable lengths

5.2 PLM Series Topology Overview

Thanks to the auto-sense and auto-uplink features of the PLM Series' Ethernet ports, connecting multiple units is a simple task. A free-topology network can be implemented easily, including external switches or hubs as required.

Following are some examples of various network configurations that can be used when setting up a PLM network.

5.2.1 Daisy-chained devices

If a daisy chain network system (see figure 3) is implemented, the secondary Ethernet connectors on PLM Series devices can be used as "loop-thru outputs" to send the audio and/or control signal to the next unit in the chain (i.e. in the same rack). As an example, a system utilizing a Dolby Lake Processor as a "break in point" would find the DLP typically connected to the Primary Ethernet port of the first PLM in the rack. The signal would then travel from the Secondary Ethernet connector of this PLM Series unit to the Primary Ethernet connector of the next unit in the system, and so on.

Care must be exercised in implementing a chain topology network, as the number of PLM Series devices being connected in this way will have a critical bearing on network performance parameters such as overall latency. Also, the use of single layer cabling to connect the network will introduce the possibility of Single Point of Failure issues, which should be avoided at all costs when operating critical systems Therefore, this topology is NOT recommended at all for applications using Dante and it is NOT recommended for applications with more than 10 PLMs, even when not using Dante.

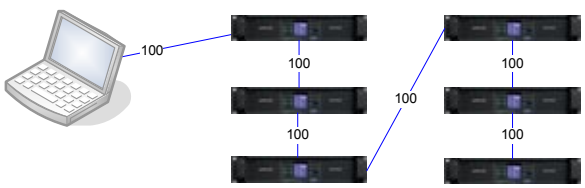

Figure 5.2.1: Daisy chain network topology

5.2.2 Star or Hub-and-Spoke networks

An alternative approach is to implement a network with Star topology, also referred to as 'hub-and-spoke' or 'radial' topology, using a number of Ethernet switches. (See figure 5.2.2.) In such a network, a group of PLMs (typically those inside the same rack) are connected directly to a switch also housed in the rack. These local switches are then connected to a "central" switch.

If dual redundancy mode is used, then a completely parallel secondary network can be created. The primary network would connect the primary port of each Dante equipped device (PLM or DLP) and the secondary network would connect all the secondary ports.

The dual redundancy mode has the benefit that any single switch can fail without causing an audible interruption in the network. However, the control and monitor PC will have to be manually switched between the primary and the secondary network if a failure on one network layer should occur.

NOTE A dual redundancy configuration doubles the number of switches and cables needed. Also note that the Dolby Lake Processor (DLP) does not support this redundancy scheme via dual rear panel Ethernet connectors, so one DLP per network layer would be required.

5.2.3 Daisy-chained switches

In such a topology, each group of PLM Series units (typically those inside the same rack) have a switch inside the rack to which each has a direct connection. These "local" switches are connected in a daisy chain (figure 5.2.3). Systems of this type can be made quite large if the switches are using 1000BASE-T (Gigabit Ethernet), and although this is a very convenient system when it comes to wiring, a topology of this type can potentially develop SPF issues.

5.2.4 Daisy-chained switch ring

This is an enhanced variant of the above that can be created if the switches support RSTP, or Rapid Spanning Tree Protocol. (See section 7, **References and Definitions**, for more information.) The benefit of this configuration is that, if there is a cable failure, the network will recover; all devices on the network (PLMs, switches, routers, etc.) will still be able to communicate. If a switch fails, all devices will remain connected to the network, with the exception of those devices that are directly connected to the failed switch. If Dante is being used, there will be a brief audible interruption in the sound (5 ms – 2 s), the length of which will depend on the size of the system and the vendor of the switch.

NOTE The PLM's own internal switches do not support RSTP. Care must be taken to not create a ring (closed loop) with the PLM's rear panel connectors.

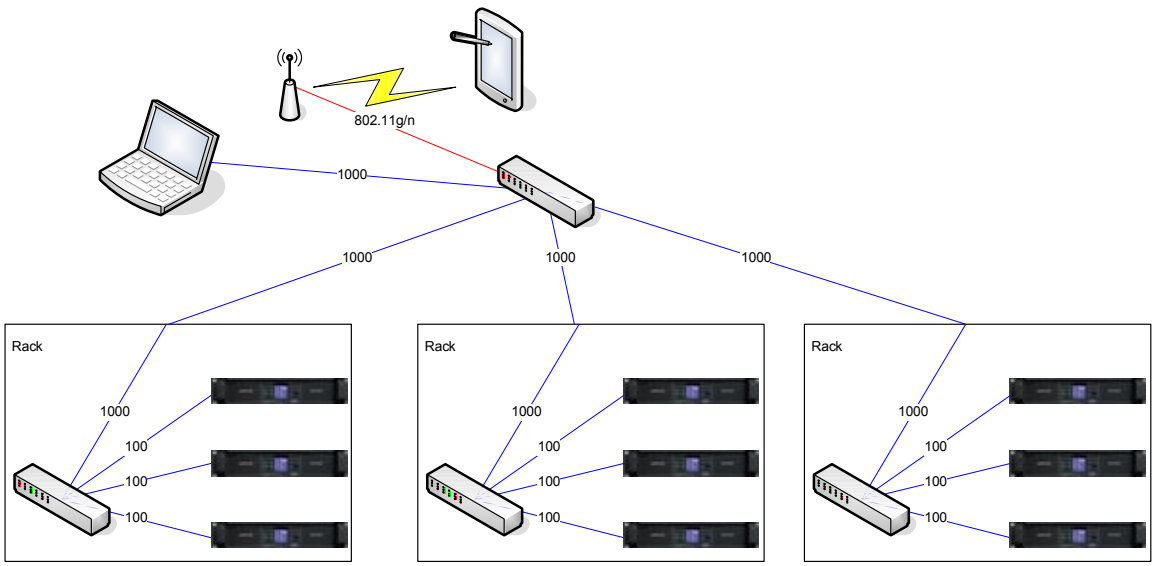

Figure 5.2.2: Two level star topology

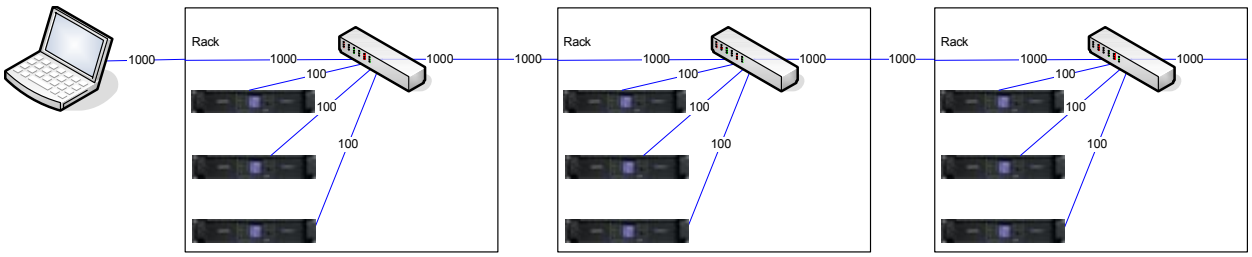

Figure 5.2.3: Daisy chained switches

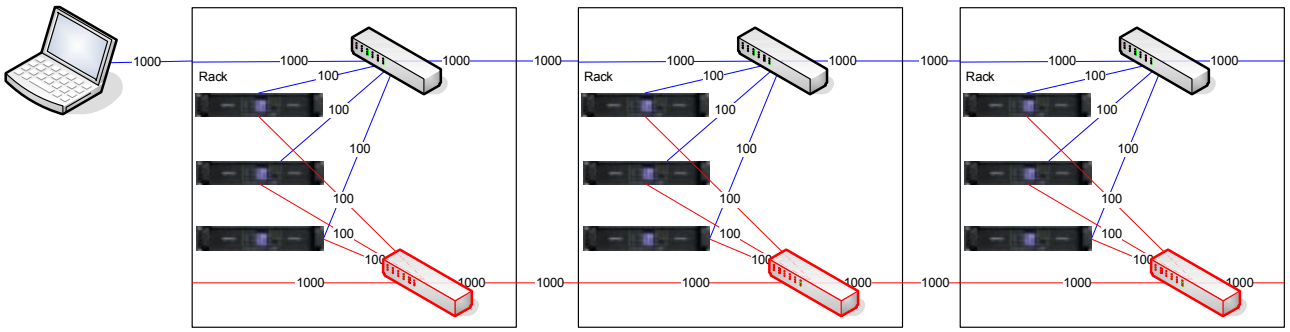

Figure 5.2.5: Dual daisy chain switch topology

5.2.5 Dual daisy-chained switches

This is a hybrid that combines the ease of wiring of the daisy chain topology with the 100% avoidance of SPF issues in the dual redundant star/spoke configuration (figure 5.2.5). It is simply two "daisy chained switch" networks in parallel: the primary and secondary networks are connected independently using the dual redundant mode in the PLMs.

NOTE

If the control computer only has one network card, it can be connected to only one of the network layers. The solution to this situation can be as follows:

- Manually disconnect from the "blue" network layer and connect to the "red" network layer instead if one or more PLMs are inaccessible via the blue network (see figure 5.2.5). This can be done easily by using a simple hardware switch box.

- A more advanced solution would be to equip the PC with two identical network cards and appropriate drivers so that it can be connected to both networks simultaneously.

5.2.6 Other combination networks

In larger system network topologies, a good solution may be to place a group of local switches in each "zone", which are first interconnected to form a "local area network" (e.g. Stage Left). These area networks are then interconnected with a main backbone. A different topology for the main backbone than that of the local area network may be chosen, depending on your specific application and resources.

Figure 5.2.6 shows an example of a combined network utilizing both Star and Daisy Chained switch ring topologies.

5.3 Ethernet Cabling Limitations

The maximum cable length allowed between any two devices on a network is defined by the Ethernet protocol and is limited to 100 meters (330 feet) for copper connections. The term "devices" includes:

- The host PC running the Dolby Lake Controller PLM Edition software
- Any switch on the network
- Any access point
- Any PLM

Optical fiber can be used if longer distances are needed. Multi-mode fiber supports up to 550 meters (1800 feet) and single mode supports even longer

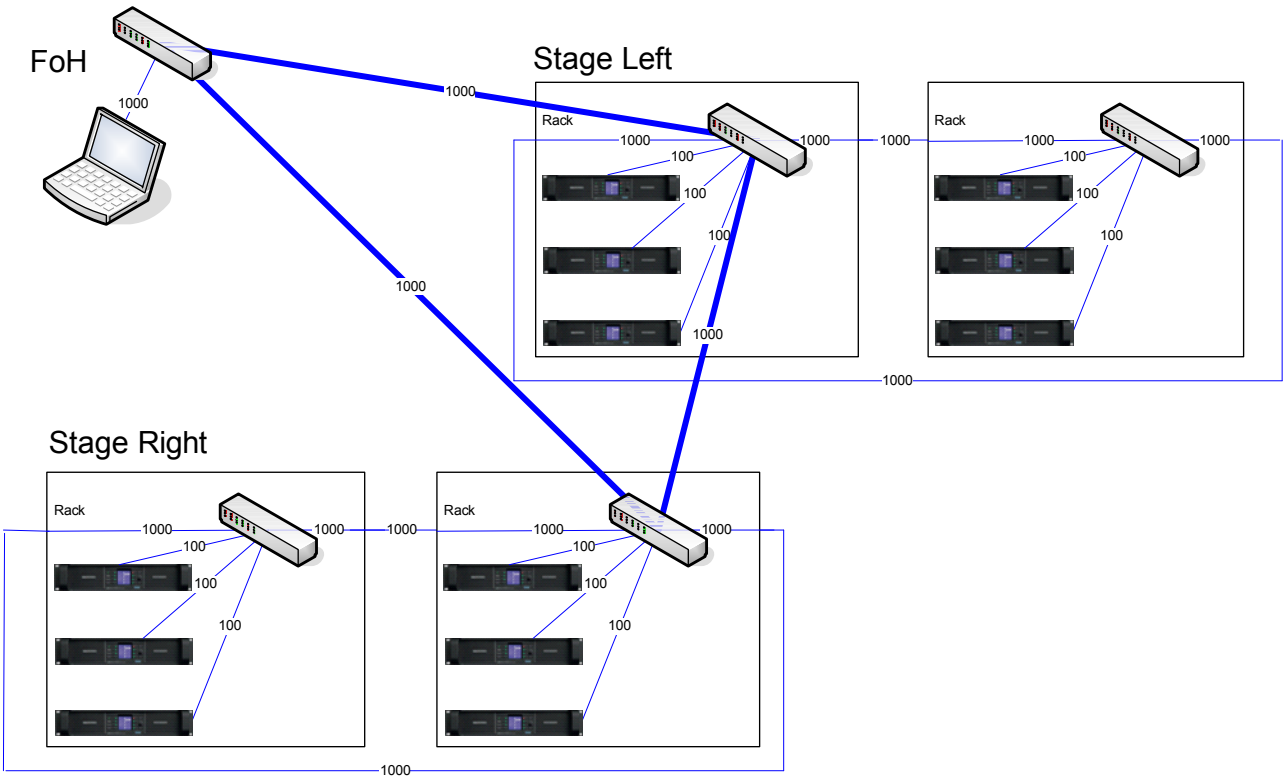

Figure 5.2.6: Combined network topology

distances. The recommended LinkSys switch can be upgraded with SFP modules to support fiber connections (See section 7, **References and Definitions,** for more information on SFP.)

		Link speed [Mbps]	
	System type	1*	2**
	Source	100	100
	Backbone	100	1000
	Sink	100	100
		Network diameter [# of "hops"]	
Latency setting 1 **0.8** ms		14	62
		1	4
		1	1
Latency setting 1 **1.3** ms		2	9
		4	19
		14	>20
Latency setting 2 **4.0** ms		56	256
		9	45
		7	34
* PLM/DLP without external switches or with 100 Mbps switches (not a recommended setup!)			
** Recommended PLM only example with Gigabit switch backbone			

Table 5.4: PLM network diameter guide

5.4 PLM / Dante Network Size Limitations

The information below is provided to give an overview of the terminology and concepts that are used when describing a PLM network and its functions. Further explanations of terminology used can be found in section 7, **References and Definitions**.

A cable connection from one network port to another is often referred to as a **hop**.

The maximum size of a network is often referred to as the network diameter. The optimal network diameter is defined by the time it takes for a packet to get from one device to another across the furthest point in the network, in terms of communication time.

Most of the time consumed in the path, generally referred to as **latency**, is the hardware reaction and transmission time. The time consumed for the packets to travel over the network Ethernet cables themselves is very small in comparison. If we assume 100 m copper cables for all hops, we can present some simple rules for how many hops are permitted from any Dante source device to any of its recieving

devices (or sinks) for a given latency setting. Table 5.4 shows the limits for a Dante system with PLM Series devices as the sinks.

The recommended system is shown in grey in Table 5.4. It has a DLP or PLM as the source (100 Mbps) and PLM Series devices as sinks. The first and last hops are 100 Mbps; all other hops, including those between switches, are 1000 Mbps.

If the latency is assumed to be 1.3 ms we can have 34 hops from the source devices to any PLM. If we assume 3 x PLMs per rack in any variant of the daisy chained switch topologies (ring or dual chain), we could then support a system with 33 racks, giving 99 PLMs (396 channels).

If the topology is layered or star/spoke, the system could be even larger. The DLC PLM Edition software user interface is designed to display 125 PLM Series devices on an XGA screen.

A system of this size has been assembled and verified by Lab.gruppen engineering at our factory location.

5.5 Wireless Network Topologies

Adding wireless networking to the system provides portable, centralized control to a distributed network of PLM Series devices (as well as other Dolby Lake processors.) A wireless network greatly enhances the flexibility of control of a large audio system, as the control location is not fixed. A wireless access point simply works as a gateway between the wired network and wireless devices. A Tablet PC running the Dolby Lake Controller PLM Edition software then communicates with the access point wirelessly, allowing control of the system from anywhere in the venue that is within wireless range

Wireless connections are generally slower than wired connections, and can result in varying degrees of Ethernet performance. Connection quality can depend on the distance and angle to the access point as well as the presence of any surrounding interference. Strong interference may lead to loss of connection.

Booster antennae are highly recommended for use in larger venues; however local legal restrictions may apply in some countries. Please contact your Lab.gruppen distributor for advice if necessary.

5.6 Improving Wireless Accessibility

Primary and Secondary PC
In applications where maintaining control and monitoring throughout the event is critical, and yet where mobile control access is also desired, users should have a primary control PC connected via wire in conjunction with a wireless secondary PC.

Multiple access points, single SSID
Two or more access points can be connected to the same network as long as they are given the same SSID, the name used to identify a particular LAN within range of a PC. (See section 7 References and Definitions for more information.) The user can then move freely around the venue and maintain connection to the network via the closest access point.

5.7 Using Dante in Conjunction with Wireless Networks and Low Bandwidth Devices

For Dante to operate on a network link, the network has to provide a bandwidth of at least 100 Mbit/s. Hence Dante does not operate over wireless links. In order to attach a wireless accesspoint to a Dante enabled network, special attention needs to be taken to make sure the Dante packets do not flood the wireless link. A switch that is configured to filter out the Dante packets must be installed at the boundary of the wireless network.

Dolby Lake legacy products such as Contour and Mesa Processors are 10 MBit/s devices. If these devices are to be connected to a Dante enabled network, the same type of filtering of Dante packets is necessary. Please refer to the Audinate document "AUD-ANO-ACL_Filtering_SRW224G4-V2.4.pdf" for further details regarding filtering of Dante packets.

6.1 General Recommendations

Critical networks such as those used in professional audio systems require infrastructure hardware offering the high level of connectivity and reliability essential for critical, data-intensive applications.

Additionally, this hardware needs to be robust enough to survive the rigors of repetitive loading and unloading, and frequent connection and disconnection. Lab.gruppen has evaluated a number of hardware manufacturers in regard to use within a PLM Series network. Our findings have resulted in the following hardware recommendations. Of course, there are any number of scenarios involving systems of various sizes, logistical and routing requirements, so these recommendations are to be considered as guidelines only.

In addition to the recommendations provided, other products may be equally suited to PLM Series applications. Lab.gruppen will continue to evaluate and verify network products as the market for network devices changes rapidly. Updated information will be posted at www.labgruppen.com/plm.

6.1.1 Network switches / routers: LinkSys SRW224G4

Depending on the configuration selected, the appropriate network switch or router will have enough ports to accommodate direct connection to each PLM in the rack as well as connections from rack to rack where required in the system-wide configuration.

Switches manufactured for mounting into a standard 19 inch equipment rack are generally considered more appropriate to withstand the rigors of loading and unloading that can be part of a sound system's daily use.

In systems that **DO NOT utilize Dante**, Lab.gruppen is not providing a specific recommendation. In general, however, a switch with RSTP is recommended. This greatly increases reliability in case of any loss of information or connection failures. It is also a good practice to use switches that allow monitoring of links over the network.

In systems where Dante is used, the switch should have 1000BASE-T (or better) for switch-to-switch connections. The switch must support the DiffServe Code Point (DSCP) protocol, and it must implement strict priority control over at least the top two priority levels. (3Com is an example of a provider that typically prioritizes only the top level.) See References and Definitions in section 7 for more on DSCP. Internal switch forwarding latency of 4 µs or less is recommended.

Several switches have been tested by Lab.gruppen and not all behave according to their datasheets. Some others that comply with general specifications have a tendency to drop packets, and therefore cannot be recommended.

LinkSys SRW224G4

- 19 inch rack-mountable
- 24 x 10/100 switched RJ45 ports
- 4 x 10/100/1000 switched RJ45 ports
- 2-SFP slots for use with fiber optic connections
- RSTP supported
- Secure remote monitoring software available (freeware)
- Approved by Audinate, developers of the Dante network
- Manufacturers link: www.linksys.com

6.1.2 Recommended wireless access point: LinkSys WAP200

Access points utilizing the 802.11g or 802.11n formats are recommended both for their diversity and bandwidth. A PoE-type (Power over Ethernet / 802.3af) access point that can be powered over its Ethernet connection is also a good idea, as it is very easy to place at an optimal location since only one cable is needed for both network connectivity and power. (See in section 7 References and Definitions for more information.)

If the switch doesn't have PoE, then a mid-span PoE adapter is needed as well.

LinkSys WAP200

- 802.3af compatible
- 256 bit secure encryption
- RangeBooster™ technology increases range and decreases dead spots using standard antennae
- Good results even with obstructive objects in broadcast path
- Accepts standards-based PoE (IEEE 802.3af) or external DC power
- Manufacturer website:
  www.linksys.com or www.3com.com

6.1.3 Recommended network cabling: Belden 1305A

NOTE

Although Belden 1305A is a stranded-type cable providing high resilience against failure from repetitive bending or stressing, it exhibits a loss of 26.4 dB instead of the 24 dB that is stated in the Cat-5e requirements. This limits the recommended length to 90.9 m. Please be aware that Lab.gruppen has not verified performance at the maximum length.

Belden 1305A Cat-6 cable

- 4 pair / 8 conductor
- Wire pairs are glued together to resist bend failure
- Approved for both indoor and outdoor applications
- Operating temperature of -20 C to +60 C
- Manufacturer website: www.belden.com

6.1.4 Recommended network connectors: LEMO-type multipin connector

The Neutrik EtherConRJ45 connector has come into wide use in the touring business. However, Neutrik only guarantees the performance of the EtherCon for 1000 mating cycles.

In order to provide a more reliable long-term solution, Lab.gruppen recommends the circular metal push-pull connector from LEMO®. These connectors are rated to withstand 5000 mating cycles, and are available in both crimped and soldered versions.

LEMO connectors

- Rated at 5000 insertions
- Operational from -50 C to + 200 C
- Nickel / brass construction
- Manufacturer website: www.lemo.com
- Recommended part numbers:

- **Female panel connector** PEG.2K.308.CYMC75

- **Male cable connector** FGG.2K.308.CYCC75Z

- **Female panel connector** PHG.2K.308.CYMC75Z

NOTE

In order to use the LEMO connector one must use the following pin out. Pins 4 and 6 are “shifted”. If the connector is made with a pin-to-pin wiring configuration, the connection will work for 100BASE-TX, but not for 1000BASE-T.

RJ-45	LEMO	
1	1	orange/white
2	2	orange
3	3	green/white
4	6	blue
5	5	blue/white
6	4	green
7	7	brown/white
8	8	brown

The following definitions will help the user better understand some specific terms used in this guide, and in other PLM Series technical documentation. Lab.gruppen has made every effort to make sure that the information here is correct and accurate.

Term	Description
Auto-sensing	The Ethernet ports on the PLM automatically determine the base speed of the network connection (10Base-T or 100Base-T) and configure themselves appropriately.
Auto-uplink	The Ethernet ports on the PLM are able to operate with either straight or crossed network cables. This ability to connect correctly with either type is termed auto-uplinking.
Backbone	Large Ethernet networks are often implemented with a very high speed "trunk" part of the network topology feeding the main switches, which in turn support smaller, lower-speed local networks. The term backbone is used to describe such a trunk.
Crossed network cable	An Ethernet cable in which four of the eight conductors (pins 1, 2, 5 & 6) are not wired pin-to-pin. Such a cable is required in conventional IT networks to connect two PCs together without using a hub or switch. The auto-uplink feature of the PLM's Ethernet ports allows crossed cables to be used if wished. See also Straight network cable.
Differentiated Services Code Point (DSCP)	DSCP is a networking architecture that specifies a simple, scalable mechanism for classifying and managing network traffic to provide Quality of Service (QoS) guarantees on IP networks. DSCP can be used to provide low-latency, guaranteed service to critical traffic such as audio or video, while providing best effort traffic guarantees to non-critical services such as control or status information.
Dual-network topology	A network topology consisting of two (usually) identical networks, one connecting to the Primary Ethernet ports and the other to the Secondary ports. Although more complex to implement, the advantage of using a dual-network system is one of greatly improved reliability as one complete network remains operational if the other should fail.
Hop	A cable connection from one network port to the next network port.
Latency	The small but finite delay incurred by audio signals when they are transformed into the digital domain, processed digitally, and then converted back into analog signals. In the Dolby Lake system, latency is assured to be constant.
MAC address	In addition to an IP address, every device on an Ethernet network has a MAC address. This address is fixed at the time of manufacture, and is effectively the permanent identifier of the physical unit. MAC stands for Media Access Control
Packet	A packet is a formatted block of data consisting of both control data and user data, also known as the payload. Control information provides data needed by the network to deliver the user data (payload) and assure data integrity. Each packet travels over the network as a discrete and uninterrupted block of data.
Power over Ethernet (PoE)	Power over Ethernet is a system for transmitting electrical power over a twisted pair cable along with the data. It is functionally similar to the phantom powering of microphones over audio cables. PoE allows powering of remote network switches and other appliances without the need of a separate power supply and AC mains wiring.
Rapid Spanning Tree Protocol (RSTP)	RSTP is a data communication protocol that enables fast restoration of service following failure or interruptions on a network link. Based on the old Spanning Tree Protocol, it retains the plug-and-play benefits while providing far faster recovery of network connectivity.
SFP (Small Form-factor Pluggable)	SFP is an optical transceiver used in data communications. It interfaces a network device to a fiber optic cable, allowing the network to carry large amounts of data over long distances with minimal latency.
SSID	A Service Set Identifier, or SSID, is used to identify the particular 802.11 wireless LAN to which a user wishes to attach. A client device receives messages from all access points within range. Selection of the access point can be pre-configured within the client device, or chosen by a user from a displayed list of SSIDs. Multiple access points will have the same SSID if they provide access of the same LAN.
Star	A network topology which uses a network switch to connect to individual PLMs. Each PLM connects to one port on the switch with its own cable; thus the network looks like a star when drawn as a diagram with the switch at the centre.
Switch (Ethernet)	An Ethernet switch allows several Ethernet devices to be connected to a network using a star topology. More intelligent than the earlier hubs (which they now largely replace) , switches route packets of data only to the units for which they are intended, and also perform other system housekeeping and control functions.

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