



OPTOCORE



Operating Manual for OPTOCORE STAGE UNIT LX4AP and OPTOCORE FOH UNIT LX4B-96k

Optical Digital Network Devices
with A/D and D/A Converters

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Important Safety Instructions

- Please read this manual carefully.
- Please keep this operating manual in a safe place.
- Heed all warnings.
- Follow all instructions.
- This device may only be used in accordance to the information provided in this operating manual. Ensure that all recommendations, especially the safety recommendations as detailed in this operating manual, are followed before and during the usage of the device.
- Do not use this device near water, for example, in moist or damp rooms.
- Clean only with a dry cloth.
- Do not block or cover any ventilation slits. Install the device in accordance to the operating manual.
- Do not install or place the device near any heat source such as radiators, power-amplifiers, stoves, or any other heat producing equipment.
- Protect the power cord from being walked on, crushed, pinched, or damaged in any other way. Pay special attention to plugs and sockets of the device.
- Never switch on power amplifiers before the complete system is stable and the level meters of the OPTOCORE CONTROL software indicate a normal level.
- Do not place this device on an unstable table, tripod, cart, etc. The device may fall, causing serious damage to the device.
- The device can be disconnected from the power supply by using the appropriate switch or by pulling the plug. These must be freely accessible at all times. The device has to be disconnected during lightning storms or when unused for long periods of time.
- The device must be grounded; any disconnection of the grounding is not permitted.
- The switched-mode power supplies operate with high voltage. Coming into contact with them can lead to considerable electric shocks, which may result in death.
- Only use attachments specified by the manufacturer.
- This device contains no user serviceable parts: only refer to authorized, qualified service personnel for any servicing.
- Your warranty will be voided if you tamper with the internal components.

Purchaser Information

- **Operating Manual**

Please read this manual – if you call for technical support, we'll assume that you have. Study the operating manual carefully in order to familiarize yourself with the device and its operation. It contains numerous information and hints for the proper use of the device.

It cannot be excluded that this operation manual shows typographical mistakes or misprints; it is however regularly revised.

Modifications, which serve the purpose of technical improvement of the device, may be carried out without prior notification.

- **Transport and Shipping**

Always ensure the careful handling of the device. If possible transport or shipping should always occur in special, shock-absorbing transport cases. If these are not available we recommend well-upholstered packaging such as the coated carton in which the device was delivered.

We strongly advise not to use simple flight-cases without rack-in-rack mounting.

- **Environments**

This device can be used in E1, E2, E3, E4, or E5 environments (as listed below) according to the harmonized European standards EN55103-1 and EN55103-2 "Electromagnetic compatibility – Product family standard for audio, video and audio-visual and entertainment lighting control apparatus for professional use"

E1-Residential

E2-Commercial and light industrial

E3-Urban outdoors

E4-Controlled EMC environment e.g. broadcast and TV-studio

E5-Heavy industry

The product is intended for the use in moderate climate.

- **Ventilation**

Do not block or cover the fan on the back of the devices. Install the device in accordance to the operating manual. Leave sufficient ventilation space (at least approx. 200 mm \cong 7,87" free space behind the rear-panel) and care for free air movement near the fan. Keep the rear of the rack open during operation. Do not set up the device close to equipment producing a lot of heat, for example power-amplifiers. Leave enough space (minimum $\frac{1}{2}$ RU) to any heat emitting device. The devices may be placed on top or beneath other Optocore products, except DD32, without additional space.

Should a malfunction of a fan occur, the FAN LED will light continuously red, or will flash if the fan is blocked. Operation of the devices with insufficient cooling can damage electronic components.

- **Water and Moisture etc.**

To prevent fire or shock hazard do not expose device to the effects of direct sunlight, dust, water, or rain during operation or storage.

- **Cleaning**

Only use a dry linen cloth to clean the device. In case of strong soiling moisten the cloth using a little water and a small amount of household detergent. Never use cleansing agents containing solvents to clean the device.

- **Operating and Storage Temperature**

Operating temperature: 0°C ...50°C \cong 34°F ... 122°F; ensure proper ventilation

Storage temperature: -20°C ...60°C \cong -4°F ... 140°F

- **Power Supply**

The device can be disconnected from the power supply by using the appropriate switch or by pulling the plug. These must be freely accessible at all times. The switched-mode power supplies operate with high voltage. Coming into contact with them can lead to considerable electric shocks, which may result in death.

Never disconnect the main plug by pulling the cable, always pull the plug itself.

Power-supply cords should be routed in such a way that they are not likely to be walked on, crushed, pinched, or damaged in any other way. Pay special attention to the plugs and the sockets of the device.

Replace a damaged power cable immediately.

The device must be grounded; any disconnection of the grounding is not permitted. Always ensure the correct grounding of the device via the main plug. Never cover the grounding terminal of the plug by means of insulation material!

- **Fuse**

The main fuse cannot prevent an unexpected malfunction of electrical components; it is rather there to protect the user and its environment from damage. Therefore never try to replace the main fuse by any other than the specified D1.6 A type (1.6 A, slow behavior). Never try to repair or bypass a blown main fuse.

- **Lightning**

For additional protection of this device during lightning storms, or when it is left unattended and unused for a long period of time, unplug the power line. This will prevent damage to the device due to lightning and power line surges. A complete disconnection from the mains power supply can only be achieved by removing the plug from the mains socket.

- **Eye Safety**

This product is a Laser Class 1 product. It complies with IEC 60825-1, FDA 21 CFR 1040.10, and 1040.11.

- **Interference of external objects and/or liquids with the device**

Never push objects of any kind into the device through openings in the casing. They may come in touch with dangerous voltage points or short out parts that could result in a fire or electric shocks. Never spill liquid of any kind on the device.

- **Cables and Accessories**

Only use attachments specified by the manufacturer.

Only use high quality cable material to connect the device. For the optical data connection exclusively use the specified optical waveguide cables. If not in use, ensure that the optical connectors of both, device and waveguide are closed with the provided lids.

Do not place this device on an unstable table, tripod, cart, etc. The device may fall, which can cause injury and serious damage to the device. Any mounting of the device should follow the manufacturer's instructions, and should use mounting accessory recommended by the manufacturer.

- **Servicing**

Do not attempt to service this device yourself.

This device contains no user serviceable parts: only refer to authorized, qualified service personnel for any servicing.

The opening of the device is not required for operation as there are no user serviceable components located inside the device. The operation of an opened device is not permitted. It can lead to damage of components due to the absence of required ventilation. The device may not be serviced, altered or modified without authorization of Optocore or an Optocore authorized distributor / dealer. Only qualified service personnel may carry out repair and maintenance work. The warranty will be voided if unauthorized manipulation occurred.

CE-Conformity

This document confirms that the products LX4AP / LX4B – 96k, bearing the CE (Communauté Européenne) label, meet all requirements in the EMC directive 2004/108/EG laid down by the Member States Council for adjustment of legal requirements. Furthermore the product complies with the rules and regulations of the low-voltage directive 2006/95/EG. This product bearing the CE label complies with the following standards, ratified by CENELEC (Comité Européen de Normalisation Electrotechnique):

Electromagnetic compatibility – Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use

**EN 55103-1, Emission
EN 55103-2, Immunity**

The authorised declaration and compatibility certification lies with the manufacturer and can be viewed on request. Responsible as manufacturer is:

OPTOCORE GmbH, Lohenstr. 8, 82166 Munich-Gräfelfing, Germany
represented by Marc Brunke, Managing Director

N.B. The awarding of the CE label confirms the compliance with legal directives issued for the manufacture and marketing of electronic and electrical devices. As such the CE label is not a "seal of quality" but rather proof that the device bearing the CE label is conform with the electromagnetic compatibility standards laid down in the above named testing regulations.

Munich, 22.04.2008



Marc Brunke

Eye Safety

This product is a Laser Class 1 product. It complies with IEC 60825-1 and FDA 21 CFR 1040.10 and 1040.11.

LX4AP / LX4B – 96k: A/D and D/A CONVERTER UNITS

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Device Description

Congratulations on your purchase of a LX4AP or LX4B Optical Digital Network Device. The LX4AP and LX4B will quickly convince you with its advantages and will facilitate your day-to-day work.

The LX4AP is an OPTOCORE® OPTICAL DIGITAL NETWORK SYSTEM device with an analog interface. The A/D and D/A converter unit provides 48 microphone or line level inputs and 16 analog return outputs. It was developed as a network device for highest performances, able to convert the analog signals generally found on stage, which require a wide dynamic range, negligible distortion and extremely low noise. The LX4B with 48 analog outputs and 16 analog line inputs is optimized to function as A/D and D/A converter FOH unit, as interface between an analog console and the Optocore network. The outstanding SMD production of the LX4AP / LX4B fulfills the demand of highest digital standards occupying only six rack unit of a 19" rack (LX4AP), respectively three rack units (LX4B). The FPGA (field programmable gate array) based concept of the internal logic circuitry permits updating of the hardware via the units remote ports, ensuring a continual state-of-the-art device. With regards to transmission quality, the components and circuitry meet the highest standards of demands. The conception of the LX4AP and LX4B has been developed in close collaboration with professional users from the fields of broadcast, live-sound and studio. Due to its multiple advantages, it can be used everywhere where high performance and high security networks are required.

The LX4AP can be considered as a stage box. It is the perfect device to be used on the stage, wherever a considerable amount of analog input channels are required and can be combined with all the other Optocore devices such as DD32(E) YG2 card, DD4ME, PTP32E, etc. 48 XLR input channels stand for 48 microphone channels, each including microphone pre-amp, phantom power and selectable gains in 1 dB steps from 0dB to +66dB. 16 XLR return channels with a selectable channel level of 0dB to -10dB round off the device. A headphone jack is supplied to monitor the signal of every in- and output channel on stage. The analog signals are leveled by high quality pre-amps and converted by premium A/D technology.

The front panel offers the possibility to control and switch the signal levels in banks of eight channels. Furthermore the LCD display enables information on the status of every single channel as well as bank information. In addition to audio signals, the LX4AP provides a CVBS video input as well as two RS485 interfaces usable for a wide range of data standards such as RS422, DMX, MIDI, CAN-Bus. The rear panel supplies 2 x 48 channel splits on 6 x 8 channel multi-pin jacks. The analog post-preamp signals can be send at line level to two other mixing systems, e.g. a monitor console and a recording system. No additional equipment such as split boxes are necessary. For return signals 16 XLR analog outputs are available at the back of the device.

The LX4B offers all features needed at FOH. This is the device to be used beside any analog console when used in the Optocore network or where a considerable amount of analog outputs channels are required. 48 line level outputs are available at multi-pin connectors. The level can be adjusted (0 dB / -10 dB). 16 analog line level inputs with level adjustment (0 dB / +10 dB) provide the return path. Two RS485 ports, a video output and interfaces for upgrading and control (RS232 / USB) are implemented as well.

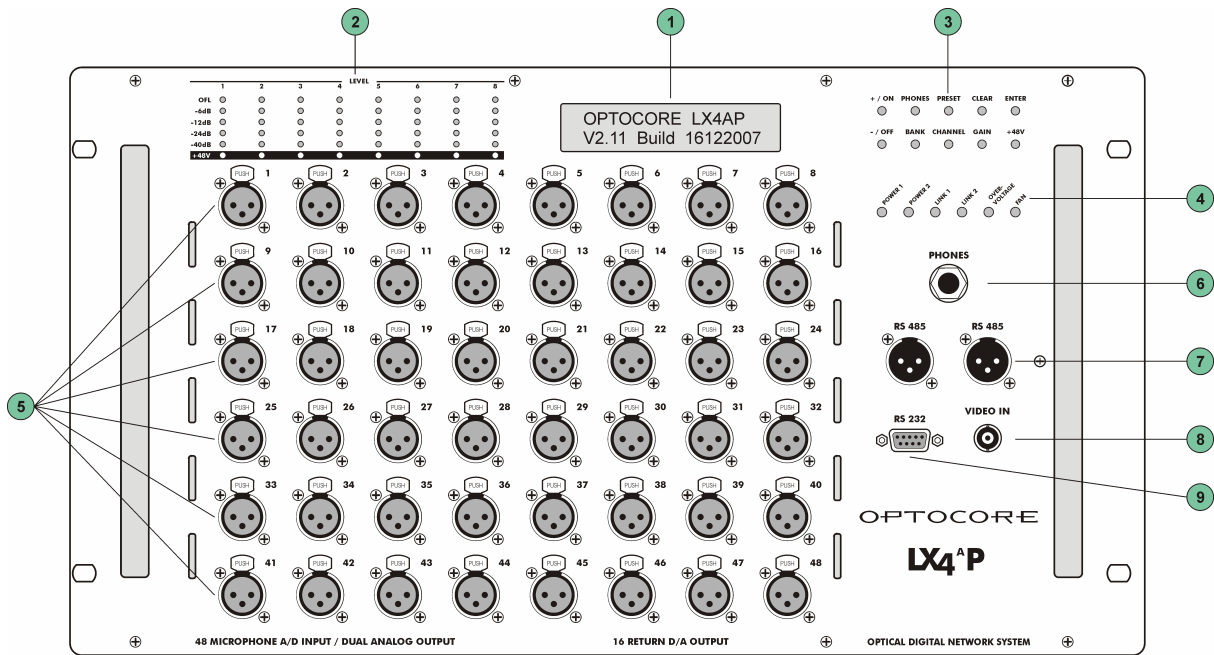
The combination of LX4AP and LX4B is the perfect solution when analog I/Os are needed at FOH and stage. The advantages of an optical fiber connection instead of an analog multi-conductor cable are magnificent. No losses due to resistance, capacitance or inductance can occur. Nor disturbances inflicted by cables such as power lines or other devices will influence the audio signals. Galvanic isolation between the devices is given, thus ground loops do not exist. In addition, latency caused by the digital devices and transmission is extremely low. Depending on the fiber optic transceivers distances from 700 m up to 70 km can be covered.

Two duplex SC connectors at the rear panel of the devices enable the signal transport onto optical fiber cables and onwards to the next devices. A redundant ring can be established by linking the SC connectors in parallel to ensure a secure signal transport. In addition short optical fiber cables can be used to cascade several LX4APs or LX4Bs. For rough applications such as touring and live productions the 1U OptoCon panel, with rugged and secure fiber optic connectors, can be added to the rack in order to assure a highly reliable connection between FOH and stage.

The dual power supply unit, with automatic switchover, permits a redundant power supply and safeguards against malfunctions of the unit if one power supply fails to run.

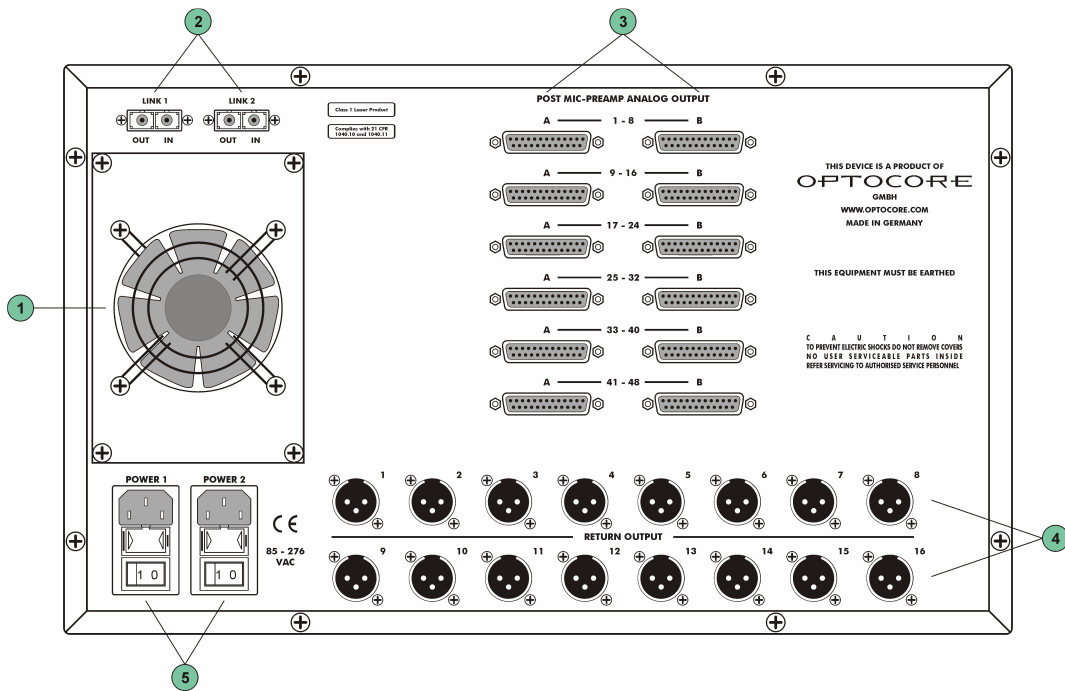
OPTOCORE CONTROL software can be used to change the configuration or define own settings. It provides easy access to all configuration and control tools, including routing, naming, gain setting, and phantom power activation, storage and recall of configurations on the computer, off- and online mode, real-time level display of the individual channels in online mode. Control of the LX4AP preamps from Yamaha digital consoles is possible as well.

LX4AP Front Panel



- 1 Vacuum fluorescent display:** 2 x 24 characters
- 2 LED-bargraph-display for signal levels and phantom power status:** Different colors provide an intuitive overview:
 Green: -40 dB / -24 dB / -12 dB
 Yellow: -6dB
 Red: 0dB and Overflow
 Red: phantom power +48 V activated
- 3 User interface: push-button controls** Integrated control unit for bank and channel selection, gain and phantom setting, and headphone volume adjustment
- 4 LED-display for status information**
PWR 1 LED: Status of power supply 1(green = ok / red = malfunction)
PWR 2 LED: Status of power supply 2(green = ok / red = malfunction)
Link 1 LED: Communication is established via LINK 1 (rear panel)
Link 2 LED: Communication is established via LINK 2 (rear panel)
OVERVOLTAGE LED: Indicates over-voltage(> 300 V_{AC})
FAN: Status of fan(green = ok / red = malfunction)
- 5 48 balanced MIC/LINE-inputs:** 48 female XLR inputs with preamp and analog 1 dB steps for level adjustment, and switchable phantom power. Each row represents one bank of 8 channels.
- 6 PHONES:** Jack plug for channel monitoring
- 7 2 x RS485 connector:** Male XLR RS485 AUXILIARY PORTS for control data transmission
- 8 VIDEO IN:** BNC Video input for composite video
- 9 RS232-connector:** With embedded USB, for remote controlling and upgrading via PC

LX4AP Rear Panel



1

Fan

2

LINK 1:

Full-duplex, full bandwidth SC-type optical interface for data transmission

LINK 2:

Full-duplex, full bandwidth SC-type optical interface for data transmission

3

POST MIC-PREAMP ANALOG OUTPUTS

A:

48 Line level, post preamp outputs at female D-Sub-25 connectors

B:

48 Line level, post preamp outputs at female D-Sub-25 connectors

4

RETURN OUTPUT:

16 male XLR line level outputs (two different output levels:
0 dB/-10 dB)

5

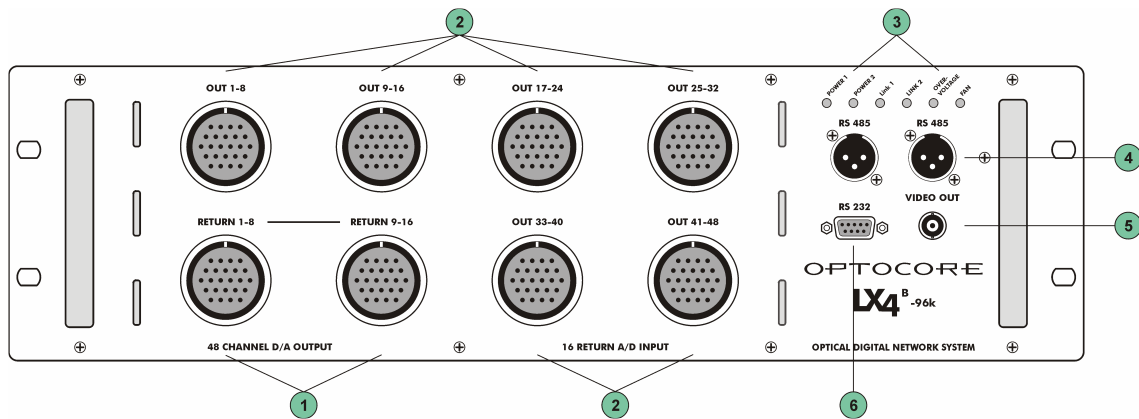
POWER 1:

Mains input for power supply 1 (100 ... 240 V)

POWER 2:

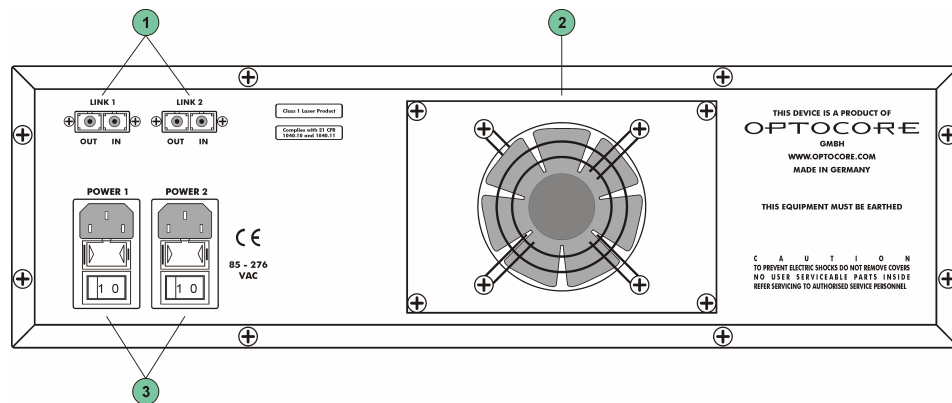
Mains input for power supply 2 (100 ... 240 V)

LX4B Front Panel



- | | |
|--|--|
| <p>1</p> <p>RETURN</p> | <p>2 x MIL-C 5015 24-pin connectors, 16 Line level inputs (two different input levels: 0 dB/+10 dB)</p> |
| <p>2</p> <p>OUT</p> | <p>6 x MIL-C 5015 24-pin connectors, 48 Line level outputs (two different output levels: 0 dB/-10 dB)</p> |
| <p>3</p> <p>LED-display for status information
 PWR 1 LED:
 PWR 2 LED:
 Link 1 LED:
 Link 2 LED:
 OVERVOLTAGE LED:
 FAN:</p> | <p>Status of power supply 1(green = ok / red = malfunction)
 Status of power supply 2(green = ok / red = malfunction)
 Communication is established via LINK 1 (rear panel)
 Communication is established via LINK 2 (rear panel)
 Indicates over-voltage(> 300 V_{AC})
 Status of fan(green = ok / red = malfunction)</p> |
| <p>4</p> <p>2x RS485-channels</p> | <p>Male XLR RS485 AUXILARY PORTS for control data transmission</p> |
| <p>5</p> <p>VIDEO OUT</p> | <p>BNC Video output for composite video</p> |
| <p>6</p> <p>RS232-connector</p> | <p>With embedded USB, for remote controlling and upgrading via PC</p> |

LX4B Rear Panel



1

LINK 1: Full-duplex, full bandwidth SC-type optical interface for data transmission

LINK 2: Full-duplex, full bandwidth SC-type optical interface for data transmission

2

Fan

3

POWER 1: Mains input for power supply 1 (100 ... 240 V)
POWER 2: Mains input for power supply 2 (100 ... 240 V)

Device Details

Fiber Optic Connection

The OPTOCORE® OPTICAL DIGITAL NETWORK SYSTEM uses a digital Time Division Multiplex technology (TDM) with a fiber channel based 8B10B-NRZI-coding. Static time slots guarantee the synchronous transmission of all channels at any time with no demand for dynamic bandwidth. All signals attached to the audio, video, word clock and auxiliary ports of the device are transmitted simultaneously on one fiber. The second fiber of one LINK-Interface is used to receive data. The second LINK-Interface has the same features as the first; therefore, one of the LINK-Interfaces can always be used for redundancy.

A/D and D/A Converter

24-bit converters and sample rates of 48 kHz or 96 kHz ensure the high-quality conversion of analog audio signals. (Level definition: 0dB ≡ +18dBu ≡ 0dBFS)

LX4AP

Each of the 48 analog mic/line inputs and 16 return outputs are electronically balanced and XLR connected. Each input includes microphone preamps with selectable gain between 0 dB to 66 dB in steps of 1 dB. Phantom Power (+48V) can be activated individually at each input.

All return outputs can be adjusted in two steps of 0 dB and -10 dB of maximum level. Monitoring of selected channels is possible using the headphone jack.

The 48 microphone inputs are equipped with two electronically balanced analog split outputs. The Post Mic-Preamp Analog Outputs on the rear panel provide the signals after pre-amplifications at a level of -10 dB, the maximum output level is +8 dBu. They are organized in two column of six D-Sub-25 labeled A and B. Each female D-Sub-25 connector includes eight channels.

Each output has its own amplifier stage. This guaranties that a short-circuit on a channel caused by external equipment does not influence the proper function of the other outputs or the channel transmission in the network

LX4B

All of the 48 analog line outputs and 16 return inputs are electronically balanced and equipped with male MIL-C 5015 24-pin multi-connectors. Each output can be adjusted in two steps of 0 dB and -10 dB, and each of the return inputs can be adjusted in two steps of 0 dB and +10 dB.

RS485 Auxiliary Ports

The auxiliary ports provide two RS485 interfaces to establish a maximum of two half-duplex connections or one full-duplex connection between the devices. A wide range of bi-directional and unidirectional standards can be connected, such as RS485, CAN-Bus (bi-directional), or RS422, DMX, MIDI (unidirectional). The interfaces will sense automatically whether they send or receive control data. OPTOCORE CONTROL software is used for setting the destination of each interface.

Video Ports

A video input (LX4AP) or output (LX4B) is integrated for the transmission of composite video signals.

Power Supply

The device is equipped with two power inputs and power supply units. If one power supply fails, due to malfunction of the feeding power line or the power supply unit itself, the device will automatically switch over to the other power supply unit. In order to make the power supply redundant, both power inputs must be connected to the mains supply, if possible to different phases, power supply systems, or even better, one of them to an uninterrupted power supply (UPS).

The power supply units operate with mains voltage of 100 ... 240 V and frequency of 50 ... 60 Hz. Thus the device can be used throughout the world without any adjustments or transformers.

The power supply units are 400 V_{AC} tolerant and provide an electronic inrush current limitation. The OVP (Over Voltage Protection) LED on the front will indicate over voltage at > 300 V, simultaneously suppressing the normal function of the device. When the OVP LED is lit, immediately disconnect the device from the power line to prevent any damage to the device. Both power inputs have a fuse, replaceable without opening the device.

Never bypass the fuse and only use the specified type.

Be aware that the switched-mode power supplies operate with high voltages! Coming into contact with them can lead to considerable electric shocks that may result in death! To prevent electric shocks do not remove any covers!

Transmission Delay

The Optocore system delay including the matrix is fixed to 41,6 μ s for all channels. The transport delay per Optocore unit (<200 ns) in the network is insignificant. The transmission delay is constant from any point to any point. Overall delay depends on converters and fiber cable length, with 'normal' cable lengths of <700 m it can also be considered as marginal.

Converter Delay

The delay caused by the AD Converter is 0,82 ms @ 48 kHz and 0,41 ms @ 96 kHz. At the DA Converter it is 0,59 ms @ 48 kHz and 0,29 ms @ 96 kHz

Control

All system and device parameters can be set on a PC connected to the device via the D-Sub-9 connected RS232 input. The embedded USB-port is also available for remote controlling by OPTOCORE CONTROL software as well. This includes the routing and naming of all in- and output channels, the activating/deactivating of phantom power, level adjustment and the level metering of any in- and output channel, as well as the storage and recall of different network configurations to and from PC hard-disk.

Controlling of all devices is achieved from any point within a network via computer using OPTOCORE CONTROL.

Third party protocols for device controlling can be used, if previously adapted by Optocore. An example is the control of the LX4AP preamps from a Yamaha device or console.

Additionally the LX4AP provides control facilities on the front panel. The 8-channel, 5-character, bank-orientated LED level meter, the Vacuum fluorescent display and the 10 push-button keyboard of the LX4AP allow an easy monitoring and user adjustment of the basic functions directly at the device. The gains of the analog inputs and outputs can be adjusted, the phantom power can be activated, etc. The information shown in the display are organized in banks of eight channels. Regarding the LX4AP each bank represents the eight channels of the XLR inputs or outputs in a row:

Bank	Channel	
1	Input	1 - 8
2	Input	9 - 16
3	Input	17 - 24
4	Input	25 - 32
5	Input	33 - 40
6	Input	41 - 88
7	Output	1 - 8
8	Output	9 - 16

The LED bargraph-dispay shows the signal levels and phantom power status of the selected bank.

Parameters set manually at the device can be read in by OPTOCORE CONTROL.

Channel Allocation

The standard channel allocation in a network is as follows:

Audio	256 Channels @48 KHz
RS485 Data	32 Channels
Video	3 CVBS Video Channels *
Ethernet	100 MBit Fast Ethernet *

* If the network is used for the transport of Ethernet compatible data the capacity is reduced to one CVBS video channel plus 100 Mbps Fast Ethernet.

Connecters and Cables

Optical Connection

The dual optical LINK-interfaces are equipped with duplex SC connectors. Standard SC cables with two fibers can be used. Worst-case reach is 700 m with multimode transceivers and a 50 µm fiber, whilst with monomode transceivers and a 9 µm fiber, up to 70 km are possible. For rugged applications, e.g. touring and other temporary installations, Expanded Beam Connectors mounted on 1 RU panel are available, along with matching, inter-connection cables transported on cable drums. (Please refer to Product_Brochure_2007.pdf available at www.optocore.com).

Split Outputs

Each split output (Post Mic-Preamplifier Analog Output) channel of the LX4AP requires a twisted pair with a common braided shield for the incorporated pairs. The pin-out of the D-Sub-25 is shown in Connection Tables.

RS485 Connection

According to the RS422/RS485 hardware standard, each channel requires a twisted pair. A common braided shield should enclose the pairs. Standard microphone cables with female XLR can be used.

RS232-Connection

Shielded, standard 1-modem cable is sufficient for the RS232 port.

USB-Connection

The USB interface is integrated into the RS232 port of the devices. An adapter according to the pin-out in Connection Tables is necessary.

Connector Hood Quality

Applied locking screws for the D-Sub-types must be acc. to 4-40 UNC. Care should be taken in selecting the right types of connector hoods in order to fulfill the requirements of EMI-radiation directives. Full metal connector hoods should be used, approved acc. to VDE 0871, FCC 20780 and EMC directive 2004/108/EG, providing an reduction > 40 dB on 30 MHz up to 1 GHz. The shielding harness of the cable should have complete contact to the connector hood.

Mains-Connection

Standard power cords with IEC C13 socket can be used.

Starting Up

Software Installation

Installation requirement for the software is a functioning computer system with Microsoft® Windows 95/98/2000/NT/XP/Vista® operating system. The computer should be equipped with an USB interface for configuration and remote controlling, and a RS232 interface (or an appropriate USB / RS232 converter) for firmware upgrade. COM 1...4 can be used with a transfer rate of 57 600 Baud. Monitor resolutions of 800 x 600 or 1024 x 768 with 16 Bit color rendering are recommended to view the program. The installation requires approx. 2.5MB of hard-disk space and is carried out in the usual Windows-program manner.

Please note that the serial interfaces on computers are not usually capable of “Hot Plugging”. Switch off the computer to avoid damage before establishing the serial connection between the Optocore device and the computer.

The set-up software *OCSETUPXXX.EXE* is available on CD or can be downloaded from www.optocore.com. OPTOCORE CONTROL for configuration and remote controlling, and OPTOCORE UPGRADE for firmware upgrading are installed on a PC or Laptop by double-clicking on the *OCSETUPXXX.EXE*. The set-up executable program is self-extracting and provides the OPTOCORE CONTROL SETUP WIZARD. It will establish the necessary directories, a desktop icon for the OPTOCORE CONTROL and firmware upgrade software.

The uninstall procedure of OPTOCORE CONTROL can be carried out with the *ADD OR REMOVE PROGRAMS* tool of Windows, which is usually found under *START / CONTROL PANEL*.

For details about features and handling of OPTOCORE CONTROL please refer to the *HELP* menu of the software. We strongly recommend getting familiar with the OPTOCORE CONTROL software.

Optocore Network Setup

Before connecting a LX4AP or LX4B to any other device and before establishing the optical LINK connection make sure that all devices have a basic set-up in order to be able to operate correctly. For operation safety reasons, some settings (e.g. “ID”) may only be made when locally connected to a device.

All devices in the network must operate with the same firmware version. The firmware version can be revised under *SET / LOCAL SETTINGS*. The update of the firmware is done with the OPTOCORE UPGRADE software under *START / PROGRAM / OPTOCORE / UPGRADE*. Please refer to the *HELP* Menu for further information. For Firmware upgrades the PC has to be connected via the RS232 Port on the front of the device. Note that any special control mode e.g. “Yamaha Emulation Mode” must be switched off before firmware upgrade.

The best approach to check the settings is to connect locally to every single device of the Optocore network with a PC using either RS232 or USB connection, run the OPTOCORE CONTROL software and enter menu *SET / LOCAL SETTINGS*. This dialog enables the definition of the ID, ports, etc.

- **General:** Set each device in the optical network to a unique ID. Device IDs must be unique in the entire Optocore network. Usually the device with the lowest ID and a word clock input will determine the clock of the network. It is advisable to assign ID 1 to the device with word clock input connected to the most important console, e.g. the FOH console.

MASTER PRIORITY allows to force a device to act as word clock master of the network. The device with the lowest ID, a checked *MASTER PRIORITY* and a word clock input will act as master.

Devices with a word clock input such as DD32E, PTP32E, DD4ME, DD6NE, YG2, always must have priority before devices without word clock input such as DD32, LX4AP, LX4B.

- **Clock Setup:** All devices in the network must work with the same sample rate.
- **RS485 Ports:** The RS485 Setup is used to define which signal is given out at the specific port of the device. It is not necessary to define any inputs. The RS485 XLR on the left is defined as Port 1, the RS485 XLR on the right is Port 2.

To illustrate the setting of the ports in OPTOCORE CONTROL here is an example: An LX4B with ID 3 gets a data signal from an external device, e.g. a DMX signal from a lighting console, at Port 1. This data signal shall be given out at Port 1 of a LX4AP with ID 4.

No adjustments have to be done at the LX4B because this is an input. The Port can be set to *DISABLED*. The definition of the ports as *DISABLED* only declares that they are not used as outputs. Data received at the disabled ports will be transported to any destination by the fiber optic connection.

At the LX4AP with ID 4 and output of the data signal at Port 1 the RS485 setup is:

OPTOCORE

Local settings for	Device (where the data is received)	Port (where the data is received)
ID4 / Port 1	ID 3	Port 1

The pin assignment of an adapter XLR RS485 / XLR DMX is shown in Connection Tables. Watch for proper polarity of the signal on both sides independently; the input as well as the output.

- **Video / Ethernet setup:** In order to use the Optocore network for Ethernet transport, the option has to be activated at every device in the Optocore Network, even if the device itself is not equipped with a local Ethernet port. If a device such as the DD6NE or the YG2 card is part of the network and is used for Ethernet transport, activate the check box *OPTOCORE ETHERNET TRANSPORT*.

Click on *WRITE* first, confirm with *OK*, and then click *CLOSE* to exit the dialog.

After performing this basic setup with every device you may now connect the optical LINK cables between all Optocore devices.

Check your setup by connecting to any device using either RS232 or USB connection, running the OPTOCORE CONTROL software and starting *ONLINE MODE* in the *SET* menu. The entire network at its current state is now displayed in the control software. Check the *LOG WINDOW* for any error messages. All Optocore devices memorize the current setup, even if they are switched off or disconnected from the power supply.

Never switch on power amplifiers before the complete system is stable and the OPTOCORE CONTROL level meters indicates a normal level.

Hardware Connection

An exemplary network with four devices is shown in Fig. 1. It is established by creating a (non-redundant) loop simply through "daisy-chaining" the units and monitoring the three status LEDs of each device, as revealed through the signal flow in diagram. There is no need to worry about the sequence of neither IDs nor which of the two LINKS of a device is used for connection. The only condition is that an optical input must be connected to an optical output. During the self-configuring of the network, the system word clock master is automatically assigned. In this example the LX4AP with ID1 is master as long as no other device is determined to act as master by activating *MASTER PRIORITY* in the software. If the LX4AP and LX4B are previously configured, the network is ready to work. With a PC connected to any unit in the loop and by running the OPTOCORE CONTROL software, the network may be analyzed, supervised, parameters may be changed and the matrix can be accessed for signal-routing.

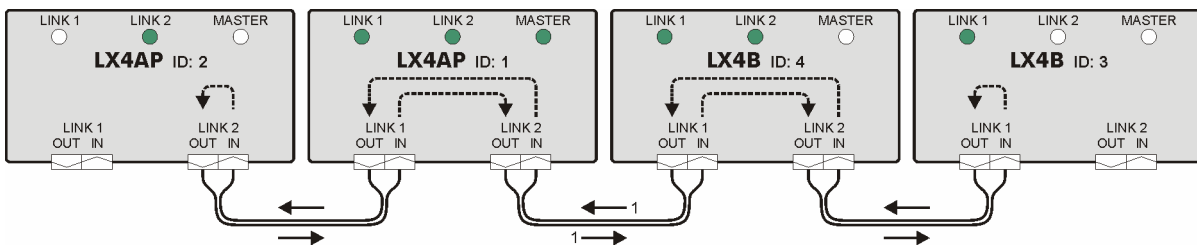


Fig. 1: Two LX4AP and two LX4B in a non-redundant network

A second redundant reverse loop can be additionally created with only one more connection from the last unit of the chain back to the first, as demonstrated by the signal flow diagram in Fig. 2.

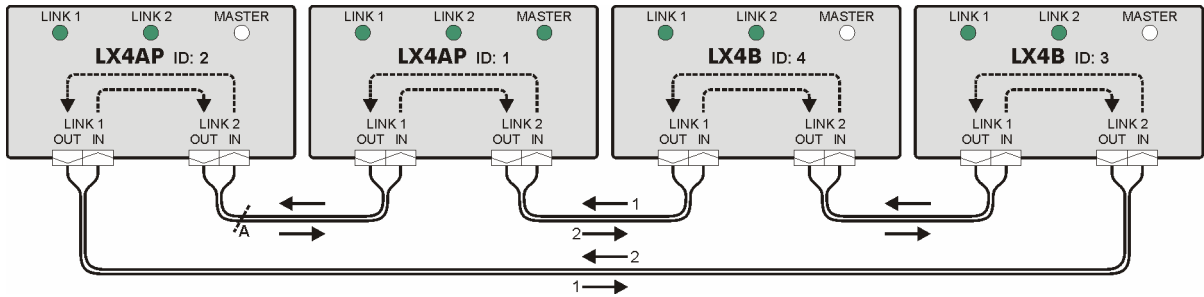


Fig. 2: Two LX4AP and two LX4B in a redundant network

In case an interruption occurs at position **A** as illustrated above, this will only result in a loss of redundancy. This also applies to the very unlikely case of a device failure. The redundancy of the ring can be reestablished simply by connecting the in and out fiber with the help of an adapter and a new device can be integrated at any time.

Connecting Consoles and Audio Devices

Multi-Conductor System

To establish an optical fiber based multi-conductor system the stage unit LX4AP may work together with a FOH unit LX4B, if analog outputs and return inputs are necessary, or with a digital I/O unit DD32(E) or PTP32E configured as 48 output / 16 return input, if digital in- and outputs are of importance. The complete multi-conductor system can easily be extended to a maximum of 256 input channels @ 48 kHz with the audio interfaces needed by the application, with several LX4AP or, e.g. DD32(E)s if AES/EBU interfaces are required, the DD4ME to provide MADI interfaces or the Mini - YGDAI card YG2 / YS2 for Yamaha device. The system may also be extended by units of the X6-series, each inserting a further 16 audio channels via a DD32(E) to the optical fiber network.

Using Optocore with an Analog Console

The easiest way to integrate an analog console into a network is to use a LX4B with 48 analog outputs and 16 analog inputs for return channels. One LX4B at FOH and one LX4AP on stage connected by fiber form a 48 send and 16 return system as shown in Fig. 3.

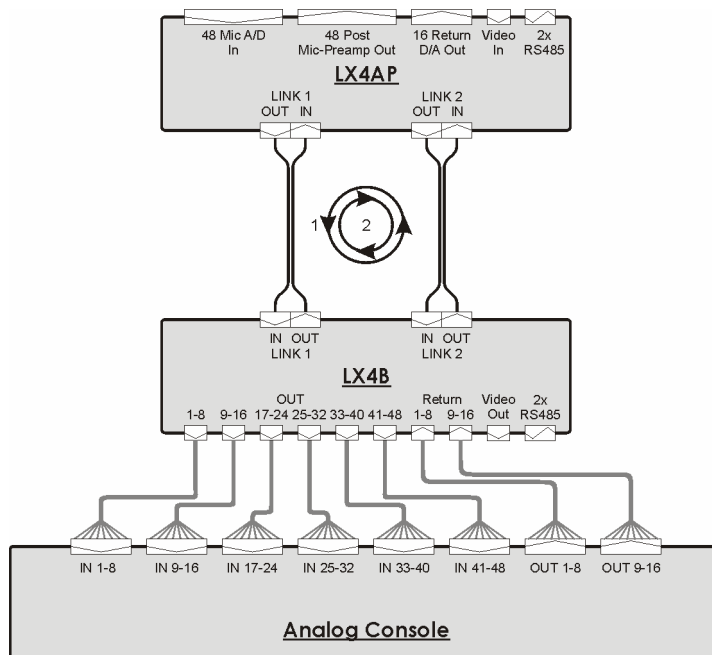


Fig. 3: Analog console with LX4B and LX4AP

The inputs and outputs of the LX4B are equipped with male MIL-C 5015 24-pin connectors, each providing 8 symmetrical analog channels. Six adapters MIL-C 5015 female to eight XLR male and two adapters MIL-C 5015

to eight XLR female are needed if the console is equipped with XLR interfaces.

The maximum output level of the LX4B is 18 dBu (\equiv 0 dBfs \equiv 0dB). Most line and microphone inputs of consoles can handle this input level. If not, the level can be adjusted to -10 dB (\equiv 8 dBu) using OPTOCORE CONTROL. It is not necessary to use the gain control of the console's preamps to amplify the signals because the signal from the microphones are amplified before they are A/D converted and transmitted via fiber. They arrive with line level at the console.

The maximum input level of the LX4B is also 18 dBu (\equiv 0 dBfs \equiv 0dB). If the output level of the console is to low, it can be amplified by +10 dB using OPTOCORE CONTROL.

All adjustments like setting IDs and matrix, adjusting the levels according to the console can be prepared before an event. The user interface of the LX4AP enables the control of all mic preamp parameters without any connected PC. Therefore, a PC is not essential during a straightforward application. A PC and OPTOCORE CONTROL provide a more comfortable and sophisticated LX4AP user interface; it enables the monitoring of all signals and adjustment of LX4AP and LX4B parameters from FOH, when the PC is connected to the LX4B via the RS232/USB interface.

If more channels are needed, e.g. 96 sends and 32 returns, a second LX4B and LX4AP can be placed at FOH and on stage as shown in Fig. 4. Only short fiber optical patch cables are necessary to connect the two LX4B at FOH and two LX4AP on stage. The long distance between FOH and stage is still accomplished with one pair of fiber and a second one for redundancy.

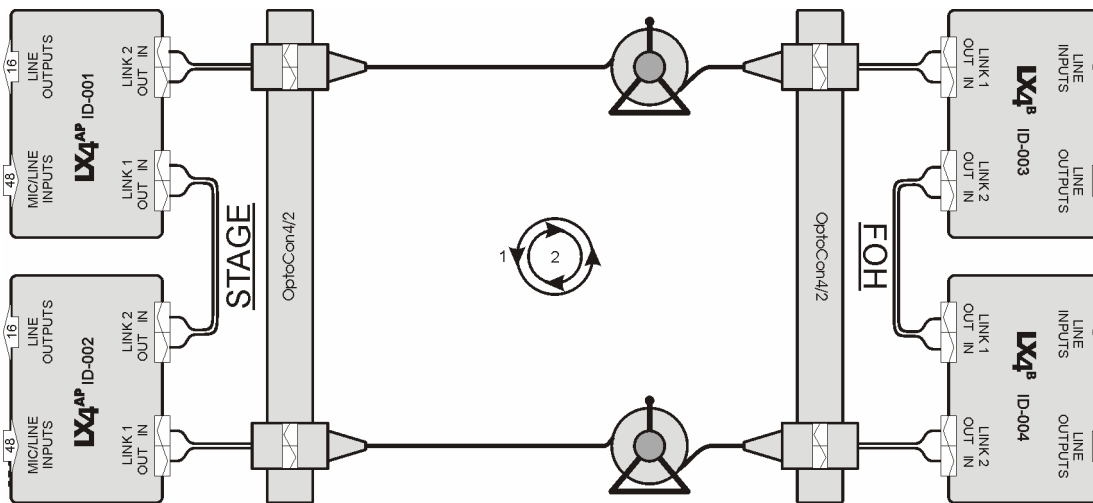


Fig. 4: System with 96 send and 32 return channels

Using Optocore with a Digital Console

Most digital consoles and devices provide AES3 interfaces at the device itself or at a FOH rack. Some digital devices also provide MADI interfaces.

This first example shows the principle wiring of a console with AES3 interfaces. With an LX4AP on stage the configuration is intended for 48 send and 16 return channels. For other configurations all AES ports offer the flexibility to act as inputs or outputs in groups of four AES signals. So any combination such as 64 send / 0 return, 60 send / 4 return4 send / 60 return, 0 send / 64 return channels is possible.

In this example the DD32E must be the word clock master of the network as the device features an external word clock input.

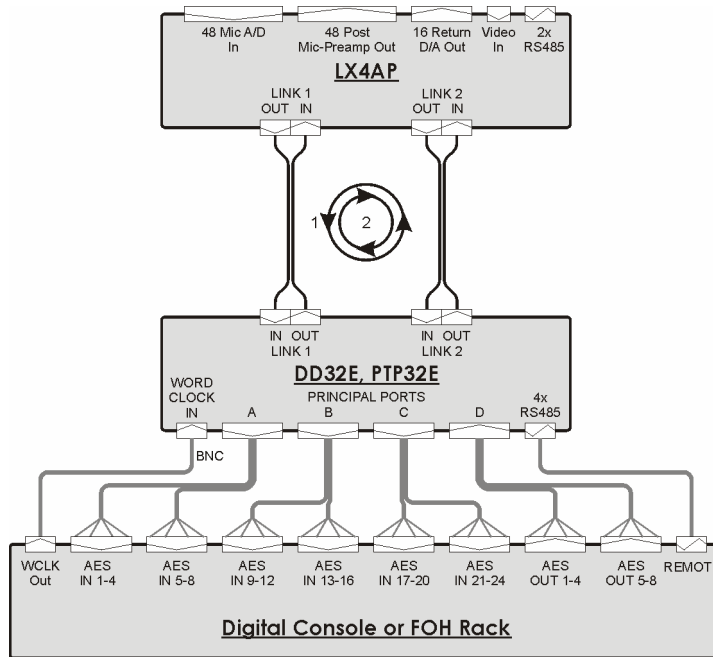


Fig. 5: Digital console with DD32E or PTP32E and LX4AP

Using Digital Consoles with Optocore Interface

Integrating a console into an Optocore network is rather simple, if the console itself is equipped with an Optocore fiber interface. It just has to be connected to the other Optocore devices via fiber optical cables. This example shows a Yamaha console with one YG2 and two YS2 cards in the YGDAI-slots. The YG2 card is connected to a LX4AP transporting the 48 send and 16 return channels via the fiber connection. The LX4APs pre-amps can be controlled through Yamahas HA remote signal either picked up from the external connector at the console or through the YGDAI slot (e.g. Yamaha LS9). The YS2 and the YG2 exchange the signals by a synchronous CAT5 interface. The word clock of the system can either be generated internally or can be taken from the slot, so that the console is the word clock master.

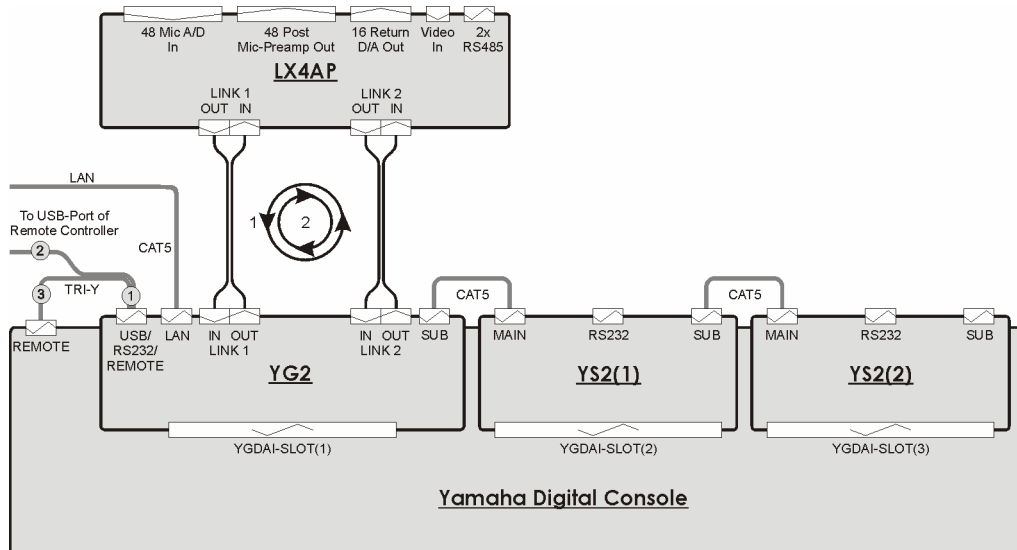
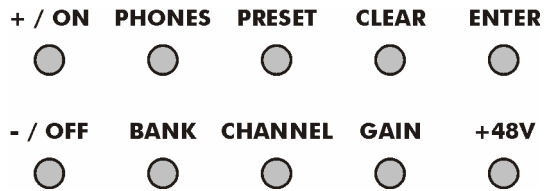


Fig. 6: Yamaha Console with YG2 / YS2-Cards and LX4AP

The YG2 card is capable to insert up to 64 audio channels in and extract 64 audio channels out of the Optocore network simultaneously. Inserted into the device slots the YG2 and YS2 exchanges a maximum of 16 IN / 16 OUT audio channels according to the Yamaha Mini - YGDAI standard. The cards can be switched between 8/16 channel mode on the Mini - YGDAI slot via software.

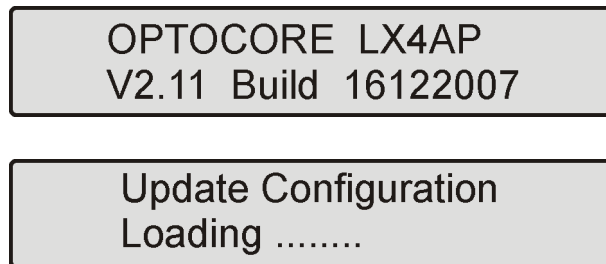
LX4AP User Interface

The following paragraphs explain the operation of the LX4AP by using the push-button controls on the front panel:

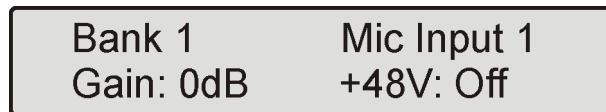


Starting

During the boot process the display on the front panel of the LX4AP shows the current hard- and firmware status and indicates the booting:



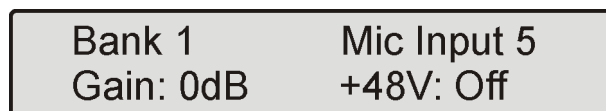
After the boot process is finished the first display window is shown:



The parameters **Gain** and the activation of the phantom power **+48V** may differ from the example display. They depend on the actual setting.

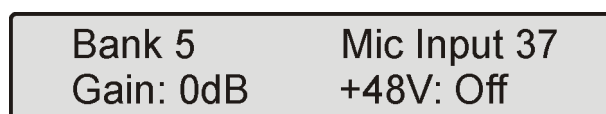
Channel Selection

Pressing the **CHANNEL** button activates the **+ / ON** and the **- / OFF** keys in the channel selection mode. By using these keys, the channels are changed forwards or backwards in single steps. The channel chosen is shown in the display. It can be altered and monitored by using the phones output. After pressing the **+ / ON** button 4 times the display will change to:



Bank Selection

Pressing the **BANK** button changes the mode of the **+ / ON** and the **- / OFF** keys to the bank selection mode. Now the channels will be stepped forwards or backwards in groups of eight. The level LEDs are always activated corresponding to the selected bank. After pressing the **+ / ON** button 4 times the display will change to:



Beyond **Mic Input 48** or **Bank 6** the display shows the **Return Output** channel groups of the LX4AP:

Bank 7 Return Output 1
Gain: 0dB

Gain / Level Adjustment

First the respective channel has to be chosen. Whilst holding the **GAIN** key depressed, the gain can be chosen by pressing the **+ / ON** and the **- / OFF** keys. The following gain adjustments are possible in the different channel groups. The reference level is 18 dBu \equiv 0 dB \equiv 0 dBFS:

Mic Input LX4AP	Gain: 0 dB - 66 dB in steps of 1 dB
Return Output LX4AP	Gain: 0 dB / -10 dB

Phantom Power

All microphone inputs of the LX4AP provide 48 V phantom power. The phantom power can be activated individually for each channel.

First the respective channel has to be chosen. Whilst holding the **+48V** key depressed, the phantom power for the designated channel can be switched on or off by using the **+ / ON** or the **- / OFF** key.

Bank 6 Mic Input 48
Gain: +40dB +48V: On

Precautions have to be taken in order to ensure that the phantom power is not accidentally switched on. It can damage the connected device. Phantom power is generally not used in conjunction with unbalanced signal sources. Prevent a ground connection of a single microphone input pin, when the phantom power is active!

Preset

The **DEVICE ID** and the setting of **MASTER PRIORITY** are shown.

Device ID: 1
Master Priority: ON

CLEAR and **ENTER** have no function at present.

Bargraph Display

The signal level of the eight channels of the selected bank are shown in the LED bargraph-display.

	1	2	3	4	LEVEL	5	6	7	8
OFL	○	○	○	○		○	○	○	○
-6dB	○	○	○	○		○	○	○	○
-12dB	○	○	○	○		○	○	○	○
-24dB	○	○	○	○		○	○	○	○
-40dB	○	○	○	○		○	○	○	○
+48V	●	●	●	●		●	●	●	●

The optimum gain adjustment should not exceed a level of -6 dB. An insufficient signal-to-noise ratio can be expected with a level below this range while levels above run the risk of signal clipping. An occasional, slight crossing of the 0dB (OFL) mark can be regarded as unproblematic.

Phones Volume

Pressing the **PHONES** key displays a figure (1...10) indicating the momentary volume status of the headphone output. It can be altered using the **+/ON** or the **-/OFF** key while keeping the **PHONES** key depressed.

Phones Volume:
7

Phones Output

For signal monitoring a set of stereo headphones can be connected to the Phones jack of the LX4AP. The audio signal of the channel shown in the display is available at this output.


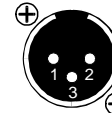
INTERCOM SYSTEMS

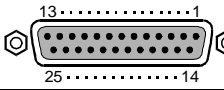
Due to the electrical isolation of an optical fiber based transmission system, the typical, wide-spread, current-fed, intercom systems, which provide a supply voltage to their "slave-devices", cannot be supported in a LX4AP system.

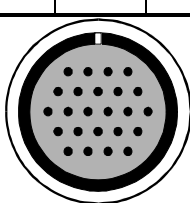
In order to prevent damage do never connect a current driven intercom system to the input or output channels.

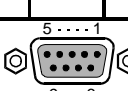
Connection Tables

LX4AP / LX4B Ports

Pin-out	LX4AP: Balanced Mic/Line Inputs, Return Outputs			LX4AP, LX4B: RS485	
	Channel		GND		
	Pin	+	2	1	
		-	3		
<p>XLR female  </p> <p>XLR male</p>					

Pin-out	LX4AP: Balanced Post Preamp Analog Outputs											
	Channel	1	2	3	4	5	6	7	8	NC	GND	
	Pin	+	24	10	21	7	18	4	15	1	13	2, 5, 8, 11, 16, 19, 22, 25
		-	12	23	9	20	6	17	3	14		
<p>D-Sub-25- female  Locking system acc. to 4-40 UNC</p>												

Pin-out	LX4B: Balanced Mic/Line Outputs, Return Inputs										
	Channel	1	2	3	4	5	6	7	8	NC	GND
	Pin	+	A	G	D	M	Q	W	T	Z	F, B, J, K, N, R, Y, U
		-	E	C	H	L	P	S	X	V	
<p>MIL-C-5015-24- female </p> <p style="text-align: center;"> ABCD EFGHJ KLMNPQ RSTUV WXYZ </p>											

Pin-out	LX4AP,LX4B: RS232/USB-Port									
	Channel	RS232		USB		NC	Brid- ged	Power		Use 1-modem cable, male – female, to connect to PC. <u>Consider non-standard pinning!</u>
		RXD	TXD	+	-			+5V S	GND	
	Pin	3	2	1	6	4, 9	7, 8	9	5	
<p>D-Sub-9- female </p>								Locking system acc. to 4-40 UNC		

DMX Connection

RS485, 3-Pin-XLR		DMX, 5-Pin-XLR		PIN 4 & 5 of the 5-pin-DMX-XLR are not normally connected and if connected are expected to carry a second DMX-connection
1	GND	1	GND	
2	BUS +	3	DMX +	
3	BUS -	2	DMX -	

Technical Specifications

Analog Audio Inputs	Analog → ADC		LX4AP, LX4B	
Mic inputs & Line inputs	LX4AP & LX4B		LX4AP: 48	& LX4B: 16
Termination Impedance	Mic & Line channels	balanced	5 kΩ	& 10 kΩ
Gains & Steps	Mic. channels	1 dB steps	0 dB – 66 dB	
	Line channels	2 steps	0 dB / 10 dB	
Maximum input level	All channels	@ 0 dB Gain	18 dBu	
	Mic. channels	@ 66 dB Gain	-48 dBu	
Distortion THD+N	All channels	@ 0 dB Gain	≤ 0.002%	≡ ≤ -94.0dB
	Mic. channels	@ 50 dB Gain	≤ 0.025%	≡ ≤ -72.0dB
Noise & SNR	All channels	@ 0 dB Gain	≤ -95 dBu	& ≥ 113 dB
	Mic. channels	@ 50 dB Gain	-77 dBu (typ)	& -127 dB (typ)
CMR	All channels	@ 1 kHz	≥ 60 dB	
		@ 16 kHz	≥ 54 dB	
Crosstalk	All channels	@ 1 kHz	≤ -112 dB	
		@ 16 kHz	≤ -92 dB	
Audio bandwidth	dep. on sample freq.	@ ≤ -1 dB-drop	15 Hz...21 kHz, 42 kHz	
Converter Resolution			24-bit	
Sample Rate	F_s		48 kHz, 96 kHz	
Delay			0.82 msec	@ 48 kHz
			0.41 msec	@ 96 kHz

Analog Audio Outputs	DAC → Analog		LX4AP, LX4B	
Return & Line outputs	LX4AP & LX4B		LX4AP: 16	LX4B: 48
Source Impedance			20 Ω	
Drive capability	Into ≥ 600Ω		18 dBu	≡ 6.16V _{RMS}
Level loss	Into 600Ω		0.3dB	
Gain & Steps	2 steps		0 dB	& -10 dB
Maximum output level			18 dBu	& 8 dBu
Distortion THD+N	@ 0 dB Gain		≤ 0.002%	≡ ≤ -94.0dB
Noise & SNR	@ 0 dB Gain		≤ -96 dBu	& ≥ 114 dB
	@ -10 dB Gain		≤ -105 dBu	& ≥ 113 dB
CMR	Any frequency		≥ 60dB	
Crosstalk	Any frequency, any channel		≤ -112dB	
Audio bandwidth	dep. on sample freq.	@ ≤ -1 dB-drop	DC...21 kHz, 42 kHz	
Converter Resolution			24-bit	
Sample Rate	F_s		48 kHz, 96 kHz	
Delay			0.59 msec	@ 48 kHz
			0.29 msec	@ 96 kHz

Complete Audio Channel	Analog → A/D → Light → D/A → Analog		LX4-System	
Distortion THD+N	All channels	@ 0 dB Gain	≤ 0.0028%	≡ ≤ -91.0dB
	Mic. channels	@ 50 dB Gain	≤ 0.025%	≡ ≤ -72.0dB
Noise & SNR	All channels	@ 0 dB Gain	≤ -94 dBu	& ≥ 112 dB
	Mic. channels	@ 50 dB Gain	-77 dBu (typ)	& -127 dB (typ)
Equivalent input noise	Mic. channels	@ 50 dB Gain	-127 dBu	
Audio bandwidth	dep. on sample freq.	@ ≤ -1 dB-drop	15...21 kHz, 42 kHz	
Delay			1.44 msec	@ 48 kHz
			0.72 msec	@ 96 kHz

Post Preamp Analog Outputs	LX4AP		LX4AP	
Balanced outputs	LX4AP		2 x 48	
Source Impedance			20 Ω	
Drive capability	Into ≥ 600Ω		8 dBu	≡ 1.95V _{RMS}
Level loss	Into 600Ω		0.3dB	
Maximum output level			8 dBu	
Audio bandwidth	@ -1 dB		15 Hz...60 kHz	
Distortion THD+N	@ 0 dB Gain		≤ 0.0018%	≡ ≤ -94.0dB
Noise & SNR	@ 0 dB Gain		≤ -107 dBu	& ≥ 115 dB
	@ 50 dB Gain		-87 dBu (typ)	& -127 dB (typ)

Headphones	LX4AP		LX4AP	
Termination impedance			≥ 2 x 8 Ω	
Maximum power	into a load of 2 x 8 Ω		2 x 150 mW	
Noise	unweighted, BW 22 Hz...22 kHz		≤ 0.0032% ≡ ≤ -90.0dB	
Distortion THD+N	@ -1 dBFS		≤ 1.0% (0.3% typ.)	

OPTOCORE

Auxiliary Ports	Convention EIA / TIA-485	LX4AP, LX4B
Data channels	Digital control data	2
Data rate		Up to 10 Mbps
Impedance	Termination	330 Ω
	Source	≤ 10 Ω
Drive level	Output	≤ 2 V _{DD}
Zero level	Referring to GND	+ 2.5 V
Sense level	Input	≥ 400 mV _{DD}
Max. voltage at bus terminals	Referring to GND, including common mode voltage	- 7 V ... + 12 V
	Differential voltage	≤ 6 V _{DD}

RS232 Port	Convention EIA / TIA-232	LX4AP, LX4B
Data channels	Digital control data	R x D, T x D
Data rate		57 600 Baud

USB Port	Remote control input / No transmission purposes	LX4AP, LX4B
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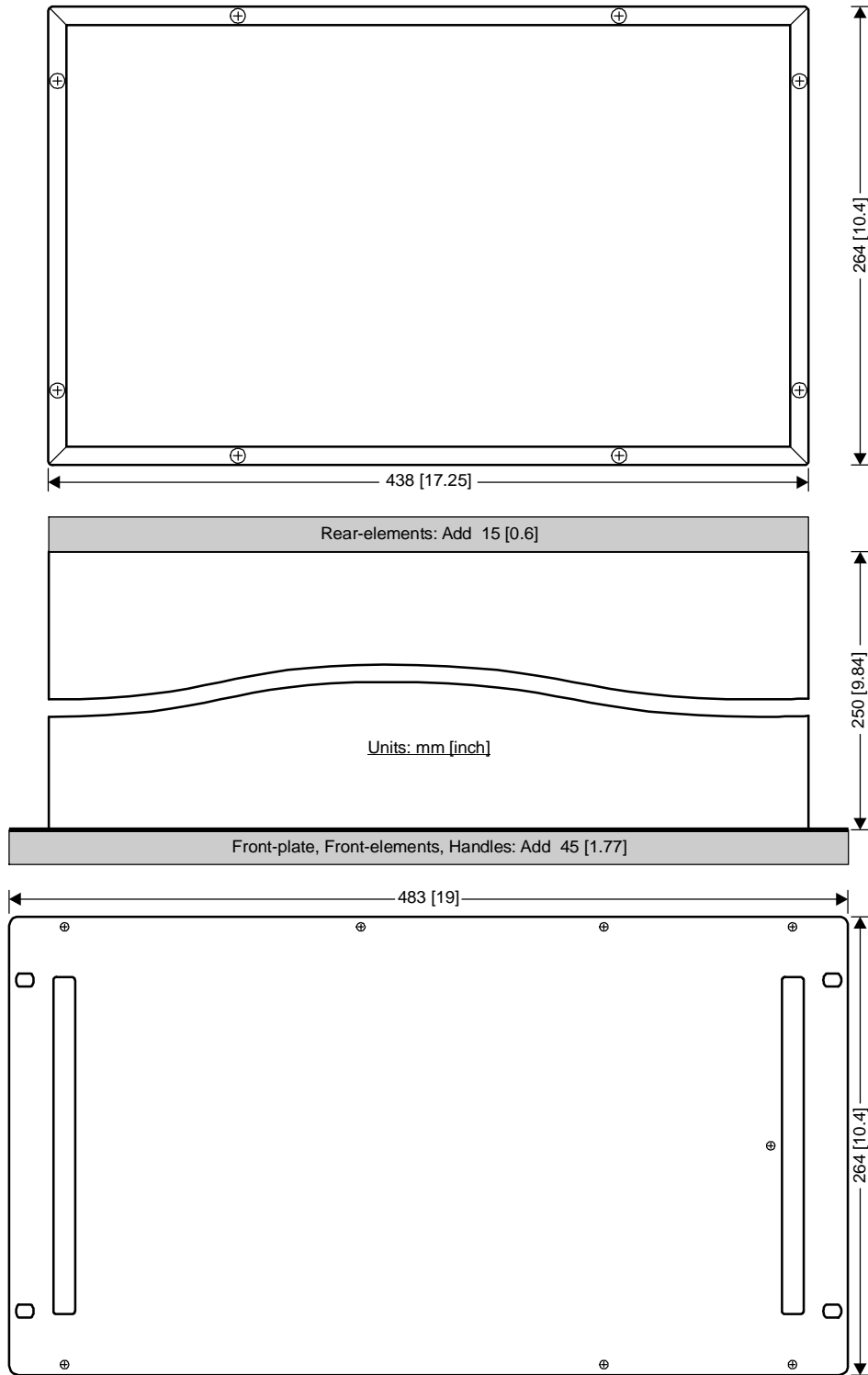
Video	Hardware standard 75 Ω / BNC	LX4AP, LX4B
Channels	LX4AP	1 x input
	LX4B	1 x output
Format		Composite Video
Maximum voltages	Output	1.286 V _{pp} ... 1.412 V _{pp} (max)
	Input (Headroom 0.81 dB)	1.412 V _{pp} ≙ 198 IRE
	Reference	1.286 V _{pp} ≙ 180 IRE
Impedance	Input, output	75 Ω
Bandwidth		6 MHz

Link	Input, Output, Dual – Full bandwidth	LX4AP, LX4B
Connection		Duplex SC
Protocol		Optocore
Transmission		Full duplex
Data rate		2 x 1 Gbps
Optical wave guide cable lengths	Multimode fiber 50 μm	≤ 700 m
	Multimode fiber 62.5 μm	≤ 350 m (not recommended)
	Monomode fiber 9 μm	≤ 70 km (on request)

Power supply	2 independent power supplies with function check and automatic switch-over	
Type	Switch-mode, universal input	
Mains voltage	100 ... 240 V, 400 V _{AC} tolerant	
Frequency	50 ... 60 Hz	
Power consumption	LX4AP: 85 VA-idle, 120 VA-peak; LX4B: 60 VA-idle, 105 VA-peak	
Fuse	D1.6 A, slow behavior, glass 5 mm x 20 mm, acc. to UL 48-14	
Inrush current limit	≤ 16 A	
Protection circuit	400 V _{AC} tolerance, over-voltage, over-current and over-temperature monitor	
Security classification	Class 1: basic insulation, connected to the protective grounding conductor	
Security regulations	Harmonized European standard EN60065	
Mains connector	Including EMI-filter, a fuse and spare-fuse, acc. to IEC-950	
Fan	1500rpm, noise 12dB(A)	

Dimensions and Weight

Dimensions LX4AP

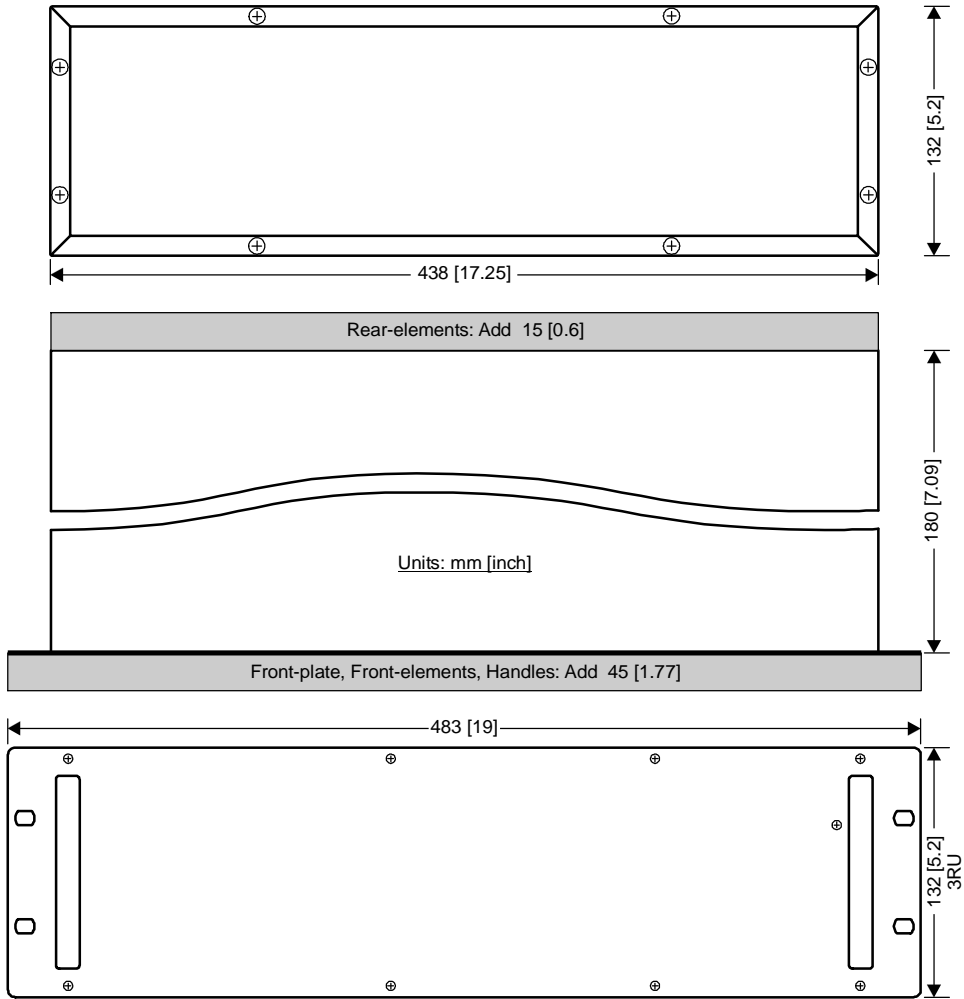


Weight LX4AP

14.4 kg \equiv 31.75 lbs

OPTOCORE

Dimensions LX4B



Weight LX4B

8.4 kg \approx 18.5 lbs

Specifications and appearance are subject to change without notice.

Warranty and Liability

Summary of Warranty

Optocore LX4AP and LX4B devices are warranted against defects in material and workmanship for 24 months.

This warranty covers the original purchaser only and is not transferable. Valid evidence for warranty is the official Optocore invoice issued by the distributor / dealer.

Optocore will, at its discretion, repair or replace a defective product, providing that the defect has appeared under normal operating conditions.

This warranty does not cover damage from acts of God, accident, abuse, neglect, contamination, unauthorized modification or misuse, operation outside of the environmental specifications for the product, improper site preparation or maintenance, or abnormal conditions of handling. This would include over-voltage failures, and conditions outside of the products specified ratings, problems with buyer-supplied software or interfacing, or normal wear and tear of mechanical components. Optocore or its distributor / dealer will acknowledge the evaluation of warranty after inspection.

Devices on which the Serial Number has been removed or defaced are not eligible for warranty service.

Failure to properly package and protection of the product during shipping may void this warranty.

How to Obtain Warranty Service

To return a defective product, please contact your distributor / dealer. Our web site: <http://www.optocore.com/> provides a complete list of Optocore distributors / dealers.

Always ensure the careful handling of the device. If possible transport or shipping should always occur in special, shock-absorbing transport cases. If these are not available we recommend well-upholstered packaging such as the coated carton in which the device was delivered.

We strongly advise not to use simple flight-cases without rack-in-rack mounting.

Declaration of Liability

Optocore accepts no liability for damage caused to other devices through operation of LX4AP and LX4B devices.

Optocore is not liable for any damage caused by shipping accidents, misuse, abuse, operation with incorrect AC voltage, operation with faulty peripheral equipment, or improper or careless installation of the device.

Optocore accepts no claims for compensation whatsoever (e.g. cancellation of events).

Shipping Contents

The standard shipment of a LX4AP device contains the following:

- 1 LX4AP
- 1 SC-SC Patch cable (2m)
- 2 D1.6A (1.6A, slow behavior) replacement fuses per device, inserted next to the operational fuses in the power supply inlets.
- Operating manual

The standard shipment of a LX4B – 96k device contains the following:

- 1 LX4B
- 1 SC-SC Patch cable (2m)
- 2 D1.6A (1.6A, slow behavior) replacement fuses per device, inserted next to the operational fuses in the power supply inlets.
- Operating manual

Any additionally purchased equipment such as optical wave-guide cables in required lengths, D-Sub cables and adapters, RS232 cables, and international electric cables have been supplied on your request and your purchase order and cannot be listed in the above.

Company Information

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