Instruction Manual

Serial Control 4-Zone HiFi Amplifier
Model LC444

Document Status		
Client:		Nexus
Status:		Controlled external release
Authorised by:		DJA
Comment Closure Date:		30 July 2010
Revision History		
Version	**Date**	**Changes**
1	27 July 2010	Initial Release
2	19 August 2010	Added Bank Set Table
3	15 Dec 2010	Improved table 1
4		

Table of Contents

1 Introducing the LC444

1.1 Brief Overview

The Model LC444 features four independent stereo audio amplifiers, each capable of selecting one of four sources, in the one enclosure. The amplifier is entirely controlled by serial RS232 data, either from a host computer or smart home controller. Basic control is also available from some configurations of Leaf Matrix systems via a suitable Leaf interface.

The front of the LC444 features only the power LED. All connections; audio signal sources, speakers, RS232 control and mains power are made at the back of the LC444. Static configuration switches are also at the rear of the amplifier.

The LC444 is designed for 19" rack mounting, but may be used in a stand free application.

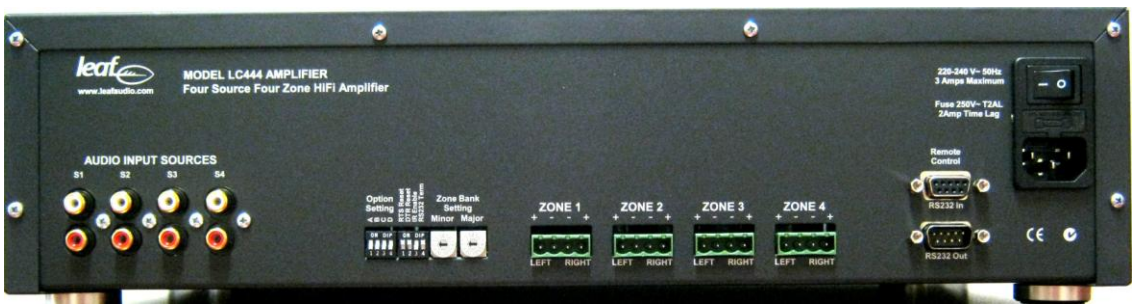
The LC444 is easy to set up and simple to use. The installer however, must be experienced in programming similar products and have a thorough understanding of binary and hexadecimal numbering systems.

1.2 LC444 Front Panel

The LC444 front panel features the power LED. Strictly speaking this is an amplifier health indicator. It fades in and out in intensity over a five second interval indicating that all internal operation is correct.

1.3 Amplifier Rear Panel

All connections to the LC444 amplifier; audio signal sources, speakers, RS232 control and mains power are made at the back of the unit. There are also configuration switches which are accessible at the rear of the amplifier.

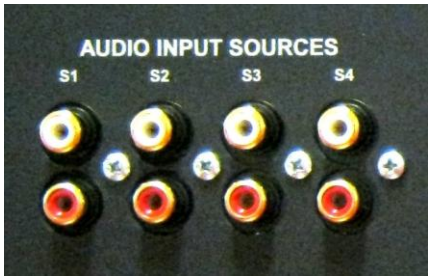


1.4 Amplifier Rear Panel Connections

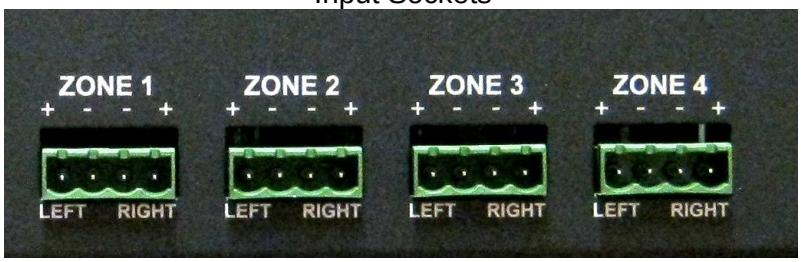
The LC444 provides the following connections :

- Four stereo source inputs with RCA connectors.
- Four stereo speaker outputs with modular connectors.
- RS232 control input via DB9 female socket wired DCE.
- RS232 loop-through output via DB9 male socket wired DTE.
- Mains power input via three-pin IEC socket, fuse holder and switch.

The following pictures show the layout of connectors on the rear panel:

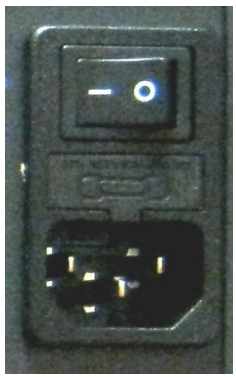


Input Sockets



Output Connectors

Serial Control Connectors



IEC Mains Socket, fuse holder and switch

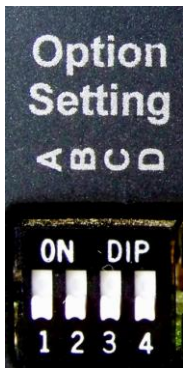
1.5 Amplifier Rear Panel Configuration Switches

The LC444 provides switch settings for the following static parameters:

- 4 Option Switches
- RTS and DTR Reset Controls
- IR Enable
- RS232 Loop Termination
- Zone Bank Setting

1.5.1 Option Switches

The option switches are used to set particular operational variations.



Switch A: No function at this time, reserved for future or special implementation

Switch B: No function at this time, reserved for future or special implementation

Switch C: Enables USB compatibility mode. When a USB to RS232 adaptor is used, put this switch in the ON (up) position to increase the serial message abort timeout. When using RS232 derived straight from a standard source, leave this switch in the OFF (down) position.

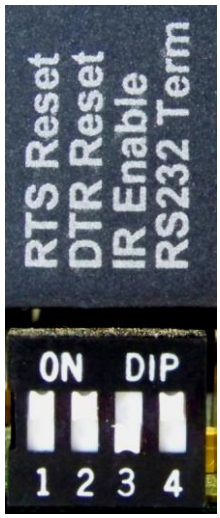
Switch D: Enables LAB compatibility mode for when Audio feeding the amplifier is extracted from a **Leaf Matrix system** with one or more **LAB44** audio breakout units.

When Switch D is ON (up) the LC444 locks the source selection to the zone selection. That is, the source selected will always be equal to the zone selected.

Ie: Amplifier Input source 1 to Zone 1
Amplifier Input source 2 to Zone 2
Amplifier Input source 3 to Zone 3
Amplifier Input source 4 to Zone 4

1.5.2 RTS and DTR Reset Controls:

Rear panel configuration switch settings allow RS232 control of the amplifier reset function by either or both DTR and RTS signals. The reset function may be disabled by setting both switches to the off position.



1.5.3 IR Enable

Leaf offers an IR Control option as special build only. Putting the rear panel IR Enable switch in the On position has no effect on standard LC444 Amplifiers.

1.5.4 RS232 Loop Termination

To cater for loop-through control of multiple RS232 Leaf devices, the LC444 provides an RS232 Out socket for daisy-chaining of devices. Use a 9-pin Male-Female 1:1 standard lead for connection from the host controller and to all other devices in the chain. Do not use a so-called null-modem cable. The last device in the daisy chain must have its RS232 Termination switch on. For the LC444, this is done by placing the RS232 Term switch on the rear panel in the up position.

1.5.5 Zone Bank Setting

The LC444 can be set to respond to any Zone Bank address (in blocks of 4) from physical Zones 1-4 (default) up to physical Zones 253 -256.

The required Zone Bank is selected by the 2 rotary Zone Bank switches

Refer to the table in appendix B for the required Switch Settings.

1.6 Amplifier Serial Control

The LC444 is designed to be controlled by RS232 signals from equipment such as a home automation system or other third-party equipment.

1.6.1 Control Physical Interface

The control input to the LC444 is via DB 9 female (socket) connector wired Data Communications Equipment (DCE):

Pin	Signal	Direction
1	DCD	DCE → DTE
2	TxD	DCE → DTE
3	RxD	DTE → DCE
4	DTR	DTE → DCE
5	Gnd	-
6	DSR	DCE → DTE
7	RTS	DTE → DCE
8	CTS	DCE → DTE
9	RI	DCE → DTE

Note that:

- DTR is looped-back to emulate DSR and DCD.
- Neither hardware (RTS/CTS) or software (XON/XOFF) handshake is required or supported.

1.6.2 Control Electrical Interface

The serial data electrical format is detailed in Appendix A: Specifications.

1.6.3 Control Signaling Interface

Control codes are sent to the LC444 from the PC or other RS232 serial device. The data is sent in binary (not ASCII) form. The source numbering is physical, that is it numbers from 1 up. The zone numbering is logical, that is it numbers from 0 up.

Data is sent in packets, with each packet consisting of 3 contiguous bytes:

- The first byte is an opcode byte specifying the action to be performed,
- the second byte contains additional parameters (most often the source).
- the third byte is to determine which zone is to be controlled

i.e. each packet from the controller to the interface is of the format:

		Bit							
		D7	D6	D5	D4	D3	D2	D1	D0
Byte	1	Opcode							
	2	Additional Parameter (usually source *)							
	3	Zone to be controlled							

* Byte 2 data is used on some commands to specify a value.

For example: Volume set, Treble set, Bass Set.

1.7 Table 1: Opcodes supported by the LC444 Amplifier

Opcodes	Description
Global Commands	
Global On	Turn all zones on with the specified source (**)
Global Off	Turn all zones off
Zone Specific Commands	
Zone On	Turn the specified zone on with the specified source
Zone Off	Turn the specified zone off
Volume Inc	Increment the specified zone volume 1 step of steps 0-100
Volume Dec	Decrement the specified zone volume 1 step of steps 0-100
Volume Abs Set	Set the specified zone absolute volume to a step value 0-100 (byte 2) subject to the limitations of Volume Max Set
Volume Max Set	Set maximum permitted zone volume step (0-100)
Volume Max Clear	Clear the maximum permitted zone volume
Treble Inc	Increment the specified zone treble 1 step of steps 0-100
Treble Dec	Decrement the specified zone treble 1 step of steps 0-100
Treble Abs Set	Set the specified zone absolute treble to a step value 0-100 (byte 2)
Treble Flat Set	Set the zone treble flat (equivalent to step 50)
Bass Inc	Increment the specified zone bass 1 step of steps 0-100
Bass Dec	Decrement the specified zone bass 1 step of steps 0-100
Bass Abs Set	Set the specified zone absolute bass to a step value 0-100 (byte 2)
Bass Flat Set	Set the zone bass flat (equivalent to step 50)
Loudness On	Turn the zone loudness on
Loudness Off	Turn the zone loudness off
Mute Deploy	Turn the zone mute on
Mute Cancel	Turn the zone mute off
Mute Toggle	Toggle the zone mute
Query Commands	
Query Volume	Query the zone volume setting
Query Bass	Query the zone bass setting
Query Treble	Query the zone treble setting
Query Loudness	Query the zone loudness setting
Query Mute	Query the zone mute setting
Query Zone Aud	Query the zone audio source setting
Query Responses	
Return Volume	Return the step value (0-100) of the specified zone volume (Hex0x00-0x64)
Return Bass	Return the step value (0-100) of the specified zone bass
Return Treble	Return the step value (0-100) of the specified zone treble
Return Loudness	Return the zone loudness setting (Hex0x5E(ON) or 0x5F(OFF)
Return Mute	Return the zone mute setting (Hex0x5A(ON) or 0x5B(OFF)
Return Zone Aud	Return the zone audio source setting (Hex0x01-0x04)

** Source selection may be locked to the Zone by Dip Switch D.

Refer to the document Nexus / Leaf Serial Codes for details of binary values of all opcodes and values declared by Nexus / Leaf.

1.8 Storage of Settings

Non-volatile FLASH memory is used to store all operating parameters. This includes Zone Source selection and zone volume and tone settings.

It is important to note however, that backup to permanent memory does not happen immediately after each and every change of any parameter, it only takes place after a period of 20 seconds of no activity after a change has taken place. Thus it is important not to power down the unit immediately after making changes to the amplifier settings.

2 Startup Guide

The following steps are required to configure the amplifier for use:

- Connect the signal sources (e.g. tuner, CD, DVD etc) to the 4 source inputs on the back panel.
- Connect the speaker leads to the speaker modular sockets supplied and plug these into the amplifier speaker outputs. Observe correct speaker polarity when making these connections.
- Connect the RS232 lead from the host controller to the Remote Control socket.
- Set the RS232 Termination as required.
- Set the Zone Bank Minor and Major settings as required to select the base address for the LC444 in the target system.
- Connect the mains lead to the mains supply and plug it into the LC444 IEC mains socket. Refer to the specifications in the Appendix to check supply voltage compatibility.
- Switch the amplifier on using the switch located above the IEC power socket on the rear panel.

The LC444 is now ready for use.

Appendix A: Specifications

Parameter	Specification
Output Power Capability	400W (100W per zone)
Number of Stereo Output Zones	4
Load Impedance (per Channel per Zone)	4 to 16 Ohms
Operating Temperature Range	0 to 40°C
Storage Temperature Range	0 to 90°C
Operating Humidity Range	20 to 90% RH Non-condensing
Storage Humidity Range	20 to 90% RH Non-condensing
Cooling	Convection and fan-forced
Number of Stereo (Source) Inputs	4
Audio Input Connectors	Dual RCA Sockets
RS232 Remote Control	DB9 Female, wired DCE
Baud Rate	9600 Baud
Format	8, N, 1
Data format RS232	Byte Non-Inverted
Power Supply	220 to 240Vac, 50Hz
Maximum Supply Current	3A / 240Vac
Power Connector	3-pin IEC socket
Fuse Type	M205 Time-lag 250V~ T2AL
Mounting Clearances	1RU above and below amplifier
Dimensions (W x D x H)	485 x 300 x 120 (3RU)
Weight	6Kg

Appendix B: Bank Settings

Physical Zone Range	Set Bank Switch Settings	
	Minor	Major
1-4	0	0
5-8	4	0
8-12	8	0
13-16	C	0
17-20	0	1
21-24	4	1
25-28	8	1
29-32	C	1
33-36	0	2
37-40	4	2
41-44	8	2
45-48	C	2
49-52	0	3
53-56	4	3
57-60	8	3
61-64	C	3
65-68	0	4
69-72	4	4
73-76	8	4
77-80	C	4
81-84	0	5
85-88	4	5
89-92	8	5
93-96	C	5
97-100	0	6
101-104	4	6
105-108	8	6
109-112	C	6
113-116	0	7
117-120	4	7
121-124	8	7
125-128	C	7
129-132	0	8
133-136	4	8
137-140	8	8
141-144	C	8

Physical Zone Range	Set Bank Switch Settings	
	Minor	Major
145-148	0	9
149-152	4	9
153-156	8	9
157-160	C	9
161-164	0	A
165-168	4	A
169-172	8	A
173-176	C	A
177-180	0	B
181-184	4	B
185-188	8	B
189-192	C	B
193-196	0	C
197-200	4	C
201-204	8	C
205-208	C	C
209-212	0	D
213-216	4	D
217-220	8	D
221-224	C	D
225-228	0	E
229-232	4	E
233-236	8	E
237-240	C	E
241-244	0	F
245-248	4	F
249-252	8	F
253-256	C	F

Leaf Model LC444 Amplifier
Important Safety Information

CAUTION

TO REDUCE THE RISK OF ELECTRIC SHOCK DO NOT REMOVE THE COVER.
NO USER SERVICEABLE PARTS INSIDE.
REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.
FOR CONTINUED PROTECTION AGAINST RISK OF FIRE, REPLACE ONLY WITH THE CORRECT TYPE OF FUSE.
DISCONNECT SUPPLY CORD BEFORE CHANGING FUSE.

WARNING

SHOCK HAZARD. DO NOT OPEN.
TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.
EQUIPMENT MUST BE CONNECTED TO A MAINS SOCKET OUTLET WITH PROTECTIVE EARTH CONNECTION.

MAINS LEADS

This appliance is supplied with a non-rewireable mains lead.
Replacement mains leads can be obtained from Nexus Technologies Pty Ltd.

General Safety Instructions

1. Read instructions. Read the safety and operating instructions before operating the appliance.
2. Retain instructions. Retain the safety and operating instructions for future reference.
3. Heed warnings. Observe all warnings on the appliance and in the operating instructions.
4. Follow instructions. Follow all operating and use instructions.
5. Water and moisture. Do not use the appliance near water, for example near a washbowl, sink or in a wet basement.
6. Ventilation. Site the appliance so that its location or position does not interfere with its proper ventilation. For example, the appliance should not be situated close to surfaces that may block the ventilation openings, or placed in a sealed, unventilated rack that may impede the flow of air through the ventilation openings.
7. Heat. Site the appliance away from heat sources such as radiators, heaters, stoves, or other appliances (including other amplifiers) that produce heat.
8. Power sources. Connect the appliance to a power supply only of the type described in the operating instructions or marked on the appliance.
9. Cleaning. The product should be cleaned only as recommended by the manufacturer.
10. Objects and liquid entry. Do not let objects or liquids fall into the product. Do not expose the product to dripping or splashing.
Do not place a vessel containing liquid on top of the product.
11. Damage requiring service. The product should be serviced by qualified personnel if:
a) The power cord or plug has been damaged.
b) Objects or liquid have fallen into the product.
c) The product has been exposed to rain.
d) The product does not appear to operate normally or exhibits a marked change in operation.
e) The product has been dropped or the enclosure damaged.
12. Servicing. Do not attempt to service the product beyond that described in the operating instructions. All other servicing should be referred to qualified service personnel.

Replacing the Fuse in the Mains Socket / Switch Assembly

This appliance is fitted with a replaceable fuse. If the fuse has blown it can be replaced as follows:
a) Turn off the appliance and remove the power lead.
a) Pull out the fuse cover/carrier.
b) Remove and dispose of the blown fuse.
c) Fit a new fuse into the carrier and push the carrier back into the socket / switch assembly.

Refer to specifications for fuse rating and type.
Fit only the type and rating specified.