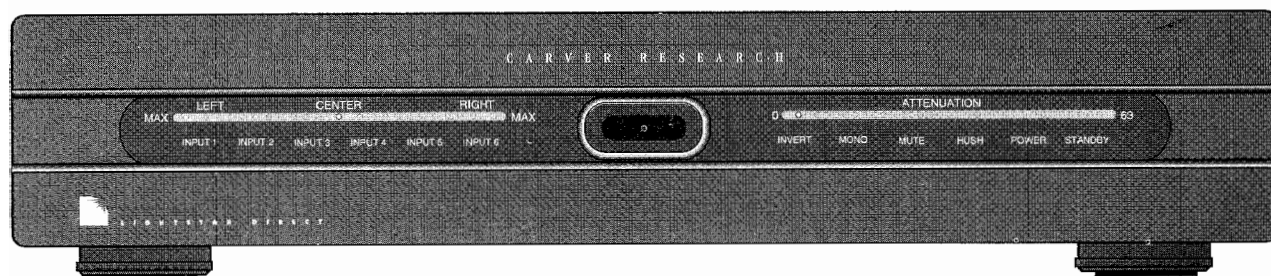


C A R V E R R E S E A R C H



L I G H T S T A R

LIGHTSTAR DIRECT

Active/Passive Stereo Preamplifier with Remote Control

Owner's Manual

For Free Distribution

NOT FOR RESALE

1. Safety Instructions

1. Read Instructions -- All the safety and operation instructions should be read before the Component is operated.

2. Retain Instructions -- The safety and operating instructions should be kept for future reference.

3. Heed Warnings -- All warnings on the Component and in these operating instructions should be followed.

4. Follow Instructions -- All operating and other instructions should be followed.

5. Water and Moisture -- The Component should not be used near water - for example, near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool, etc.

6. Ventilation -- The Component should be situated so that its location or position does not interfere with its proper ventilation. For example, the Component should not be situated on a bed, sofa, rug, or similar surface that may block any ventilation openings; or placed in a built-in installation such as a bookcase or cabinet that may impede the flow of air through ventilation openings.

7. Heat -- The Component should be situated away from heat sources such as radiators, or other devices which produce heat.

8. Power Sources -- The Component should be connected to a power supply only of the type described in these operation instructions or as marked on the Component.

9. Power Cord Protection -- Power-supply cords should be routed so that they are not likely to be walked upon or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles, and the point where they exit the Component.

10. Cleaning -- The Component should be cleaned only as recommended in this manual.


11. Non-use Periods-- The power cord of the Component should be unplugged from the outlet when unused for a long period of time.

12. Object and Liquid Entry -- Care should be taken so that objects do not fall into and liquids are not spilled into the inside of the Component.


13. Damage Requiring Service -- The Component should be serviced only by qualified service personnel when:

- A. The power-supply cord or the plug has been damaged; or
- B. Objects have fallen, or liquid has spilled into the Component; or
- C. The Component has been exposed to rain; or
- D. The Component does not appear to operate normally or exhibits a marked change in performance; or
- E. The Component has been dropped, or its cabinet damaged.


14. Servicing -- The user should not attempt to service the Component beyond those means described in this operating manual. All other servicing should be referred to qualified service personnel.




CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN



CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK
DO NOT REMOVE COVER (OR BACK)
NO USER-SERVICEABLE PARTS INSIDE
REFER SERVICING TO QUALIFIED SERVICE PERSONNEL




The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure, that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

PORTABLE CART WARNING



Carts and stands - The Component should be used only with a cart or stand that is recommended by the manufacturer. A Component and cart combination should be moved with care. Quick stops, excessive force, and uneven surfaces may cause the Component and cart combination to overturn.

15. To prevent electric shock, do not use this polarized plug with an extension cord, receptacle or other outlet unless the blades can be fully inserted to prevent blade exposure.

Pour prévenir les chocs électriques ne pas utiliser cette fiche polarisée avec un prolongateur, une prise de courant ou une autre sortie de courant, sauf si les lames peuvent être insérées à fond sans laisser aucune partie à découvert.

16. Grounding or Polarization — Precautions should be taken so that the grounding or polarization means of the Component is not defeated.

17. Internal/External Voltage Selectors — Internal or external line voltage selector switches, if any, should only be reset and re-equipped with a proper plug for alternate voltage by a qualified service technician. See an Authorized Carver Dealer for more information.

18. Attachment Plugs for Alternate Line Voltage (Dual voltage models only) — See your Authorized Carver Dealer for information on the attachment plug for alternate voltage use. This pertains to dual-voltage units only.

This apparatus does not exceed the Class A/Class B (whichever is applicable) limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

ATTENTION — Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de class A/de class B (selon le cas) prescrites dans le règlement sur le brouillage radio-électrique édicté par le ministère des communications du Canada.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING – TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

CAUTION: TO PREVENT ELECTRIC SHOCK, MATCH WIDE BLADE OF PLUG TO WIDE SLOT, FULLY INSERT.

ATTENTION: POUR ÉVITER LES CHOC ÉLECTRIQUES, INTRODUIRE LA LAME LA PLUS LARGE DE LA FICHE DANS LA BORNE CORRESPONDANTE DE LA PRISE ET POUSSER JUSQU'AU FOND.

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2. Introduction

Carver Research is Carver Corporation's platform for the introduction of new leading-edge technologies in their most advanced form.

The Lightstar Direct is an audio preamplifier/control center designed for ultimate quality stereo reproduction. To assure absolute signal purity and zero distortion, the Lightstar Direct operates in true passive balanced mode, using a computer controlled stepped attenuator to set volume and balance with unmatched precision. In this mode of operation, the audio signal traverses a minimal and "silicon-free" path from source to destination.

Audio equipment using unbalanced connections are also accommodated with high-quality interface circuitry. Thus the benefits of the Lightstar Direct design philosophy are universally available regardless of the interface used by associated pieces.

The Lightstar Direct Preamplifier was designed as a companion piece for the Lightstar Reference Power Amplifier, although it can be used with any amplifier with excellent results.

All preamplifier functions are controlled with the hand-held Infrared Remote Control. There are no controls or switches on the front panel; only indicators that let you know the current status of the preamplifier. The Remote Control's ergonomic design makes it easy to use, even in subdued lighting.

The Lightstar Direct Preamplifier has three balanced inputs, three unbalanced inputs, and balanced and unbalanced outputs. When the balanced inputs and outputs are used, the Lightstar Direct provides a passive path for the audio signal. No semiconductor devices are used (silicon-free), only resistors to attenuate the signal and relays to switch the signal path as required. This provides a distortion-free path for the audio signal, neither adding to or subtracting from the signal.

An advanced Motorola microcontroller is used to supervise all internal preamplifier activities. Great care was taken to isolate the digital control signals from the analog audio signals to maintain the purity of the original signal.

The Lightstar Direct Preamplifier from Carver Research affords a new and advanced blend of elegance, sophistication, and simplicity to the discriminating audiophile. It was designed and manufactured in Lynnwood, Washington by a select team of audio professionals with a lifetime commitment to providing the world's finest components for music reproduction and home entertainment. Thanks for placing your confidence in Carver Research. We know your new preamplifier will provide many years of listening enjoyment.

3. Features and Specifications

Lightstar Direct Special Features

- Six input selections
 - 3 balanced
 - 3 unbalanced
- Balanced and unbalanced stereo outputs
- Tape output connections provided
- Balanced signal path operates in true passive balanced mode (silicon-free) to assure absolute signal purity and zero distortion
- Unbalanced inputs are interfaced with high quality Analog Devices "Butler" amplifiers at the input, and a precision Burr-Brown instrumentation amplifier at the output
- Gold-plated teflon insulated RCA input jacks and balanced input jacks with gold-plated contacts for low resistance connections
- Selected input appears at both balanced and unbalanced outputs
- Computer-controlled stepped attenuator to adjust volume and balance, using quality Holco resistors and precision relays with bifurcated gold-over-silver plated contacts
- All remote control and switching functions are controlled by a sophisticated Motorola microprocessor
- RC5 remote control bus connections
- Toroidal power transformer for low EMI radiation (low hum)
- Five separate power supply regulators for maximum efficiency and solid regulation
- Complete isolation of audio signal path from digital display and control signals
- Table-top/hand-held infrared remote control
- Selectable absolute polarity inversion
- Front panel display indicates relative balance, attenuation from 0 to 63 dB, input source selected and status



Specifications

Frequency Response:

Balanced DC to > 100kHz
 Unbalanced 10Hz to 100kHz
 (+0, - 0.5 dB worst case)

Output Impedance:

Balanced 600 ohms
 (internal termination)
 Unbalanced 600 ohms

Phase Response:

Balanced: 0°
 Unbalanced +12°, -6°
 (20Hz - 20kHz worst case)

Attenuation Range:

0 to -63 dB

Gain:

20 dB (unbalanced output only; internal jumper provided to change to 0 dB)

Distortion:

0.005% typical

Mute Level:

> -70 dB typical

Signal-to-Noise Ratio:

Unbalanced In to Unbalanced Out -92 dBV
 Balanced In to Balanced Out -118 dBV
 Wideband, referenced to 1 Volt Output

Power Consumption:

25 watts

Left/Right Separation:

100 dB midband
 90 dB @ 20kHz

Power Requirements:

120VAC/60Hz (USA and Canada)
 Other voltages as required for export

Channel-to-Channel Separation:

110 dB midband
 90 dB @ 20kHz

Size (H x W x D):

4.3" x 19" x 15.5" (overall)
 109mm x 483mm x 394mm

Common-Mode Rejection:

> 60 dB

Net Weight:

16 lbs. (7.3 kgs)

Shipping Weight:

20 lbs. (9.1 kgs)

Input Impedance:

Balanced 600 ohms
 Unbalanced > 100 kohms

Carver Corporation constantly strives to incorporate new methods, materials, and technologies in order to further improve the quality of our products. Thus all features and specifications are subject to change without notice.



4. Unpacking

Carefully unpack your Lightstar Direct Preamplifier and keep the original carton and packing materials for future moving, shipment or long-term storage.

After removing the preamplifier from its packing box, please check for any visible signs of damage that were not apparent from the outside of the box. If you do encounter what appears to be concealed damage, please consult your Carver Research Dealer before proceeding to further unpack or install the unit.

You will find a 5/64" Allen Hex Key packed with your Lightstar Direct Preamplifier. Please save this key in a safe place. You will need it to open the back cover of the Remote Control, to replace the batteries. It is also used to remove the screws from the top cover if you should need to change the gain setting on the unbalanced outputs (see page 12).

Important Paperwork

Make sure to save your sales receipt. Your receipt is extremely important to establish the duration of your Limited Warranty, and for insurance purposes.

5. Installation

Location

The Lightstar Direct Preamplifier was designed without the need for ventilation slots, so airflow around the chassis is not a concern. However, the Lightstar Direct should be placed away from direct sources of heat, such as heating vents and radiators. Excessive heat is the single greatest source of both short-term and long-term component failure.

The preamplifier can be placed in an equipment rack or cabinet. If the cabinet doesn't have an open back and an amplifier is placed in the cabinet, make sure there are vent holes. The situation you want to avoid is placing your equipment in a sealed cubby hole. That creates a static air space where temperatures can rise quickly.

Be sure to position the preamplifier so that it is within view of the listening position. This is necessary to ensure that the infrared remote control can be used to transmit commands to the Lightstar Direct. (This is not necessary if the preamp is being controlled from another unit via the RC5 bus connection – see page 14).

Model:	Lightstar Direct
Serial Number:	_____
Purchased at:	_____
Date:	_____

Next, make a note of the serial number which is located on the back of the preamplifier. Record it in the space provided above for convenient reference.

Finally, take a moment to fill out and return the Customer Registration Card packed with the preamplifier and return it to Carver. This allows us to keep you informed of new products and technologies as they become available.

Other important precautions to follow include:

- Do not expose the unit to rain or moisture
- Protect from exposure to direct sunlight. Sunlight contains infrared light and can interfere with the reception of infrared commands issued from the remote control.
- Avoid excessive exposure to extreme cold or dust.
- If a fluid or foreign object should enter the unit, disconnect the power plug and contact an authorized dealer or service center. Do not pull out the plug by pulling on the cord; grasp the plug firmly.

Front and Rear Panel Descriptions

The Lightstar Direct's chassis is constructed of heavy-walled extruded aluminum, up to 1/4" thick. The solid construction and detailed metalwork give it an elegant look that matches the Lightstar Reference power amplifier in quality and appearance.

Front Panel Features

1. Infrared Receiver and Indicator

A blue indicator LED is located in the center of this infrared receiving "eye". There are actually two receiving eyes hidden behind this infrared transparent window for greater reliability, one on either side of the blue indicator LED. Whenever an infrared command is received from the remote control, the blue LED will illuminate to let you know that the command was received and understood by the microcontroller.

Note: All internal functions are controlled by a microcontroller inside the Lightstar Direct. These functions are carried out by switching one or more electronic relays inside the preamplifier. Thus you will hear a single click or a series of soft clicks coming from inside the Lightstar Direct whenever a remote control command is transmitted and received.

2. Input Selection Indicators

There are six indicators labeled INPUT 1 through INPUT 6 that illuminate with high output yellow LEDs to show you which input has been selected.

3. Balance Indicator

An array of 23 LEDs is used to show the relative level of balance between the right and left channels. The CENTER LED is green, showing that the output to both channels is equal. As the balance is panned to one side or the other with the balance button on the

remote control, yellow LEDs on either side of center illuminate to show how far off-center the balance is set. Each LED represents 1 dB of attenuation in the opposite channel. In other words, pressing the BALANCE Left button causes the right channel to attenuate in 1 dB increments, up to 10 dB. Pressing the button one more time causes full attenuation (63 dB) in that channel, and the red MAX LED illuminates.

The balance button must be pressed for each increment of balance offset.

4. Attenuation Indicators

An array of 33 LEDs is used to show the level of attenuation at the outputs of the Lightstar Direct (the greater the attenuation, the lower the volume). When the attenuation is set to "0", there is no attenuation to the signal. The output level is the same as the input level (in passive balanced mode) or at +20 dB (in active unbalanced mode). Pressing the VOLUME "-" button on the remote control causes the output level to attenuate in 1 dB increments. Each LED represents 2 dB of attenuation, so you will notice that as the volume is turned down, the attenuation indicator alternates between showing one LED and showing two LEDs illuminated. When two LEDs are lit, the actual attenuation is halfway between the value represented by each of the LEDs.

Since this indicator shows the amount of attenuation, as the LEDs move from left to right the attenuation increases and the volume decreases. The LED on the far right represents 63 dB of attenuation, which is the maximum amount of attenuation available (except for MUTE). Continuing to press the VOLUME Down (-) button will result in no further attenuation.

You can press and hold down the VOLUME up or VOLUME down button to quickly get to the volume level you desire.

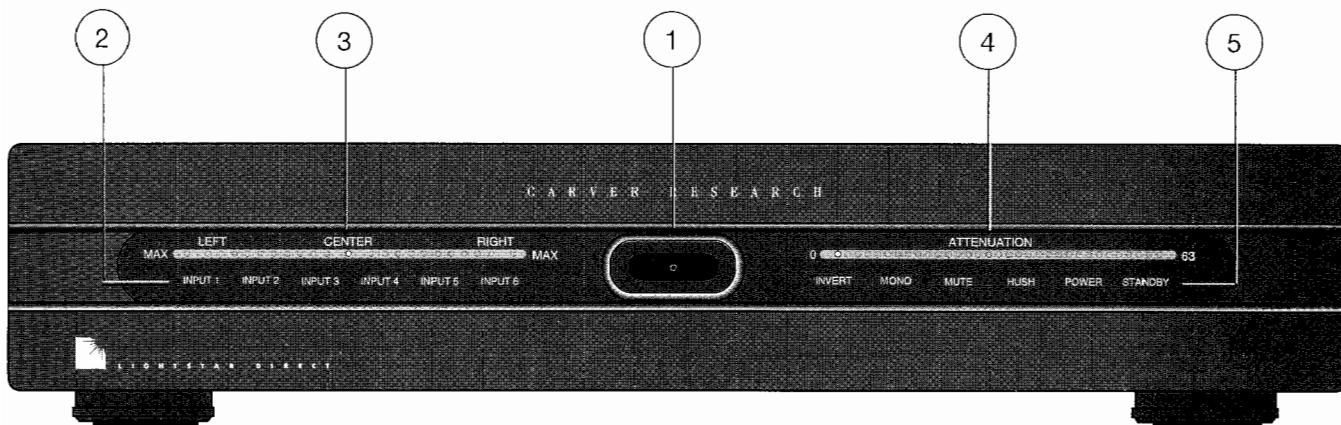


Figure 1. Lightstar Direct Front Panel View



5. Status Indicators

These six indicators show a variety of modes of operation in which the Lightstar Direct can be placed.

INVERT – The output of the Lightstar Direct is normally in phase with the input. Pressing the INVERT button on the remote control will cause the INVERT indicator to illuminate and invert the phase of the output so that it is shifted 180° from the input (see *INVERT* on page 16).

MONO – When the MONO button is pressed on the remote control, this indicator lights and the left and right channels are combined together. This signal is then output equally to both the left and right outputs.

MUTE – The MUTE button causes the output of both channels to turn off. The MUTE indicator on the front panel comes on to remind you when the preamplifier is muted.

HUSH – This indicator lights briefly when the Lightstar Direct is first turned on to indicate that the outputs are muted until the power supply is fully charged and all circuits are ready to operate.

The HUSH indicator also lights briefly when the power switch is turned off, indicating that the outputs are muted as the power supply discharges. This will prevent any turnoff thumps from propagating through the power amplifier and into the speakers.

POWER – This indicator illuminates while the preamplifier is on and operational (not in Standby mode).

STANDBY – When the Lightstar Direct is first turned on it automatically defaults to STANDBY mode and the STANDBY indicator illuminates. Press the STANDBY button on the remote control to bring the preamp into operating mode (the STANDBY indicator will turn off and the POWER indicator will turn on).

Rear Panel Connections

6. INPUTS

There are six stereo inputs to the Lightstar Direct. Inputs 1, 2 and 3 are balanced XLR-type connectors. They have gold-plated contacts for minimal contact resistance and low susceptibility to oxidation and corrosion over time. Inputs 4, 5 and 6 are unbalanced RCA-type connectors. They are also gold-plated for minimal contact resistance.

Note: The selected balanced or unbalanced input appears at both the balanced and unbalanced outputs.

Balanced Inputs

The balanced inputs follow a passive circuit path throughout the Lightstar Direct. The audio signal never passes through an active semiconductor device that could alter the signal. The signal path is composed of copper wire, copper traces (on the printed circuit boards), precision resistors and electronic relays with gold-over-silver plated contacts. The purity of the signal remains unchanged from input to output.

Unbalanced Inputs

The unbalanced inputs commence with a high quality Analog Devices input buffer using a new input design patented by Analog Devices called a Butler amplifier. This circuit converts the single-ended unbalanced signal to a balanced signal, so the Lightstar Direct can properly control the signal. The Butler amplifier combines the accuracy and low-noise performance of bipolar transistors with the speed and sound quality of JFETs. This yields better THD and noise performance than previous audio operational amplifiers.

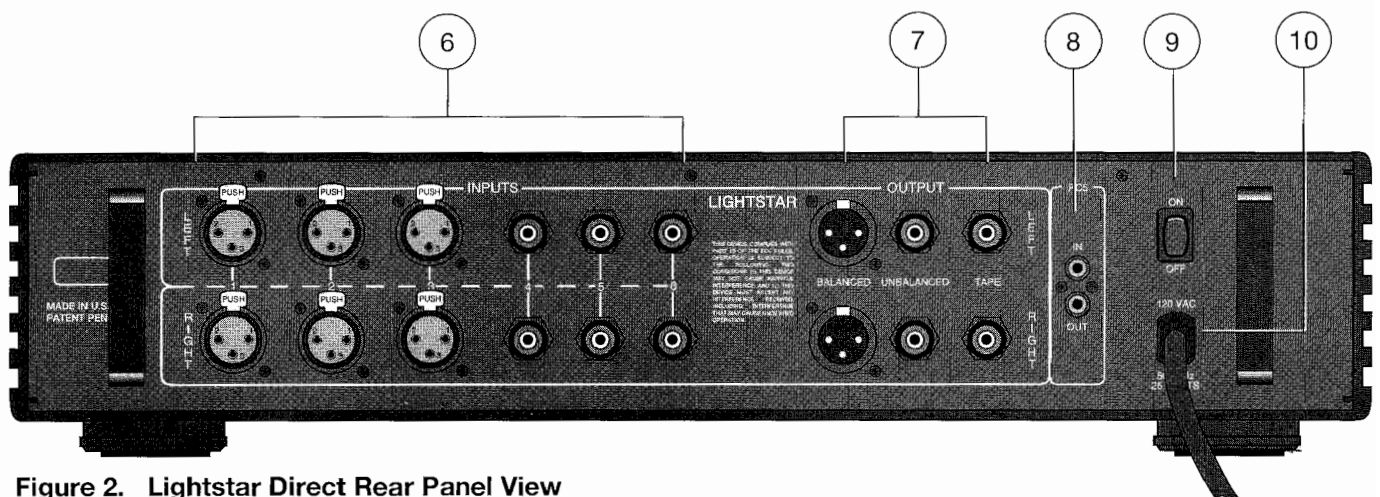


Figure 2. Lightstar Direct Rear Panel View

Passive vs. Active

What is the difference between a passive signal path and an active one? Simply put, the signal passes through some kind of amplification device in an active path, and it doesn't in a passive path.

A typical preamplifier has several stages where the signal passes through an amplifier. The input buffer, the tone controls, the balance and main volume stages, and finally the output stage are all implemented using either discrete transistors, tubes or integrated circuits. Each of these stages of amplification can introduce some noise and distortion to the signal. Although modern design and integrated circuit

technology provide low noise and low distortion, it is nonetheless a concern for audio purists whose goal is the preservation of the purity of the audio signal throughout the signal path.

A passive signal, by definition, uses no amplification in the signal path; no transistors, no integrated circuits, nothing to add noise or distortion to the signal. The Lightstar Direct uses high-quality relays to switch the signal path, and precision resistors to attenuate the signal – all passive devices – nothing else. In this way, the purity of the signal is preserved from input to output.

7. OUTPUTS

There are two sets of stereo outputs on the Lightstar Direct, balanced and unbalanced. As with the input connectors, these connectors all have gold-plated contacts.

The signal from the selected input source appears at both the balanced and unbalanced outputs, regardless of whether the input is balanced or unbalanced.

Balanced Output

These provide a true balanced output which can be connected to the balanced input jacks of a power amplifier. There is no gain from the balanced or unbalanced inputs to balanced output, only attenuation that is determined by the amount indicated on the front panel.

Unbalanced Output

The balanced signal inside the Lightstar Direct is converted to an unbalanced output by a precision instrumentation amplifier with a DC servo circuit to minimize DC offset. This circuit also provides 20 dB of gain to the signal. However, there are two internal mini-link jumpers that can be changed to reduce the gain at the unbalanced outputs to 0 dB (see instructions for changing the unbalanced gain on page 12).

Tape Output

The tape outputs are taken from the signal path just prior to the stepped attenuator circuit. The signal is then passed through an active differential amplifier which converts the balanced signal to a single-ended (unbalanced) output. Thus the signal that is sent to the tape deck is at the same level as the signal at the input.

⚠ Important Note: The signal at the Tape Output is determined by the selected Input Source. It is necessary to prevent the input to which the Tape Deck (or other recording device) is connected from appearing at the Tape Output in order to prevent a potentially damaging feedback loop.

The Tape Input can be programmed to prevent it from appearing at the Tape Output. Simply press and hold down the button on the Lightstar Direct Remote Control that corresponds to the Input to which the Tape Deck is connected for 10 seconds. For example, if the Tape Deck output is connected to Input 6 on the Lightstar Direct, press button number 6 on the Remote Control for 10 seconds. You will hear a soft click inside the Lightstar Direct that lets you know that channel 6 has been selected as the tape input. Now the tape deck's output signal will be prevented from being "fed back" to its own input.

8. RC5 Bus Connections

These jacks are used to connect other equipment that is RC5 compatible to the Lightstar Direct. The RC5 bus system allows all equipment connected to the bus to be controlled through the infrared receiving "eye" of any one individual component. Any infrared command received through the "eye" is transmitted down the RC5 bus to all equipment connected to it. If the command is recognized by any component on the bus as a valid command, then the command will be carried out. For this reason, the blue LED responds to any valid RC5 command, not just those which control the preamp.

9. Power Switch

When the preamplifier is first switched on, the HUSH indicator will illuminate for about 1 second and then the Lightstar Direct will go into Standby Mode. You **must push** the Standby button on the remote control to activate the preamplifier. When it enters operating mode, it does so with the same settings that it had the last time it was used.

10. Linecord

Connect the linecord to a properly configured outlet providing the line voltage specified for your model. We do not recommend the use of an extension cord with the Lightstar Direct. However, if one must be used, use at least an 18 AWG polarized cord.

⚠ **Note:** Carver Research does not recommend a particular brand or type of interconnect cable. Much has been written concerning the benefits of relatively expensive “audiophile” cable compared to the average “hookup” type cable that is often supplied with audio source components. Carver Research believes that this issue should be discussed with your Carver Research dealer, who can help you determine the best choice for your own individual system.

Preamp-to-Amp Connection

The output of the Lightstar Direct should be connected to the input of a power amplifier.

Balanced Output Connection

If the amplifier has balanced input connectors, use balanced cables between the LEFT and RIGHT BALANCED OUTPUT of the Lightstar Direct and the balanced input of the amplifier.

Again, Pin 2 is the non-inverting (hot, “+”) output, and Pin 3 is the inverting (cold, “-”) output. Pin 1 is for the shield.

⚠ **Note:** Carver Research subscribes to IEC 268 and EIA Standard RS-221-A regarding the standard for the transmission of a balanced signal. Although it would cause no harm if a component in the signal chain reversed the configuration of Pin 2/Pin 3, it would invert the absolute polarity of the signal. Check the owner’s manuals for the other components in your system to find out if they follow the Pin 2 hot (+) and Pin 3 cold (-) standard.

What is Absolute Polarity?

Absolute polarity is attained when the phase of the sound being recorded is reproduced identically upon playback. Sound is comprised of waves of energy moving through the air, where a compression (wave of high pressure) is followed by a rarefaction (wave of low pressure). The faster the compressions and rarefactions, the higher the frequency of the sound. For absolute polarity to be preserved, when a compression hits the microphone (where it is converted into an electrical signal), the event should produce a compression front from the loudspeaker. Extensive listening tests have determined that some people can hear a difference when the absolute polarity has been reversed.

If either the input source or the amplifier does not follow the standard [i.e. Pin 2 cold (-), Pin 3 hot (+)], use the INVERT button on the remote control to reverse the polarity inside the Lightstar Direct. This will preserve the absolute polarity of the signal.

Unbalanced Output Connection

If the amplifier has unbalanced input connectors, use high-quality RCA-type audio cables to connect the RIGHT and LEFT OUTPUT of the Lightstar Direct to the unbalanced input of the amplifier.

The unbalanced output of the Lightstar Direct is factory set for 20 dB of gain (from input to output with “0” attenuation). Most amplifier inputs require this amount of gain in order to provide a reasonable range to adjust between soft listening levels and loud listening levels with the volume control.

Balanced vs. Unbalanced

What is the difference between a balanced line and an unbalanced line? Physically, a balanced line requires three wires. Two of the wires carry the signal high (+) and low(-), and the third is a shield wrapped around the two signal wires which is connected to chassis or signal ground. A 3-pin XLR-type connector or a 1/4” TRS phone plug are used in audio equipment for balanced line connections, the female for inputs and the male for outputs.

At one time there was some confusion about which pins to use for signal high and signal low, but it has since become standardized by IEC 268 and EIA Standard RS-221-A, to which Carver Research adheres. Pin 2 is signal high (+), pin 3 is signal low (-) and pin 1 is the grounded shield connection.

An unbalanced line, on the other hand, requires only two wires. Although both wires carry the signal, one serves double duty as a shield, and is connected to chassis or system ground. An RCA-type phono connector is most commonly used to make unbalanced connections in audio equipment.

A balanced line has several advantages over an unbalanced line. The most important advantage is its ability

to reject electro-magnetic interference (EMI) induced into the connecting cable. This becomes more important as the length of the cable increases.

The first line of defense against EMI is the shield. The better the shield, the harder it is for EMI to get through to the two inner signal conducting wires. A tightly braided shield generally provides better EMI rejection than a foil shield (a foil shield is good at reducing RFI - Radio Frequency Interference).

The second line of defense is the differential nature of the signal itself. Without getting too technical, the balanced signal is transmitted in a way that causes the signal to be amplified when the signal on Pin 2 is equal and opposite to the signal on Pin 3. But if the signal is equal and in phase on both Pin 2 and Pin 3 (as is the case with induced EMI), then it is cancelled out.

One other main advantage of a balanced line is its resistance to ground loop hum. If the ground potential between two pieces of equipment is different, then an audible hum can be heard in the output. A balanced signal is floating with respect to ground, so any difference in ground potential will have no effect on the output.

Some amplifiers may not require this much gain. For example, the Lightstar Reference Power Amplifier has a high gain setting for connecting the output of a CD player or D/A converter directly to the input of the amplifier. If you find that the attenuation needs to be increased a great deal (40 dB or more) to arrive at a comfortable listening level, you may want to change the gain at the unbalanced output of the Lightstar Direct to 0 dB. This is easily accomplished by moving two jumpers inside the Lightstar Direct.

To change the unbalanced outputs to 0 dB output level:

1. Turn off the power switch on the Lightstar Direct and unplug from the AC outlet. (Even though all primary wiring is safely contained within the Lightstar Direct, this is an essential safety practice to follow whenever opening an electronic device.)
2. Remove five screws from the top cover using a 5/64" Hex driver (provided), being careful not to scratch the cover.
3. Locate jumpers J10 and J11 on the Main Board (see Figure 5). Move the blue mini-link jumpers to pins 2-3 as shown in the Figure.
4. **DO NOT** remove the plexiglass shield covering the power supply section for any reason.

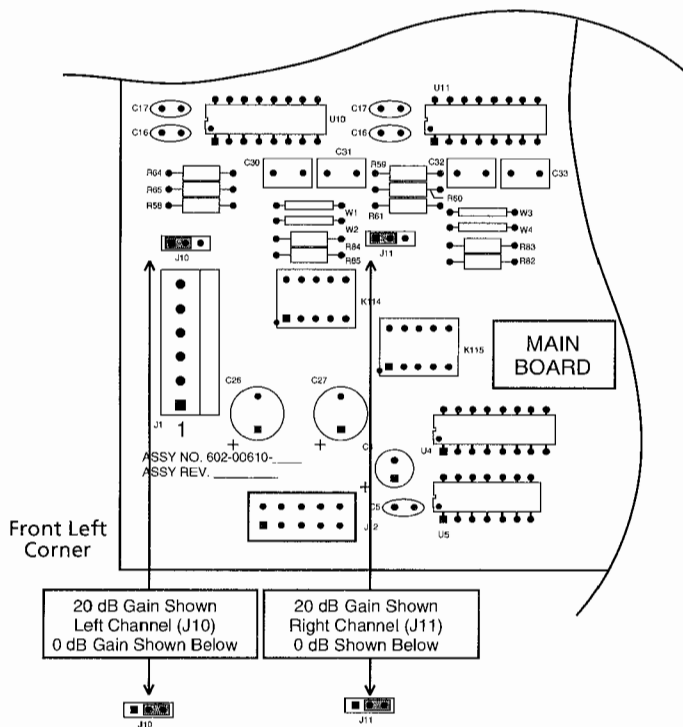


Figure 5. Unbalanced Output Modification

System Configurations

This is a diagram of some typical connections that you might make in your installation. It demonstrates how the inputs and outputs on the rear panel of the Lightstar Direct are interconnected with other audio components.

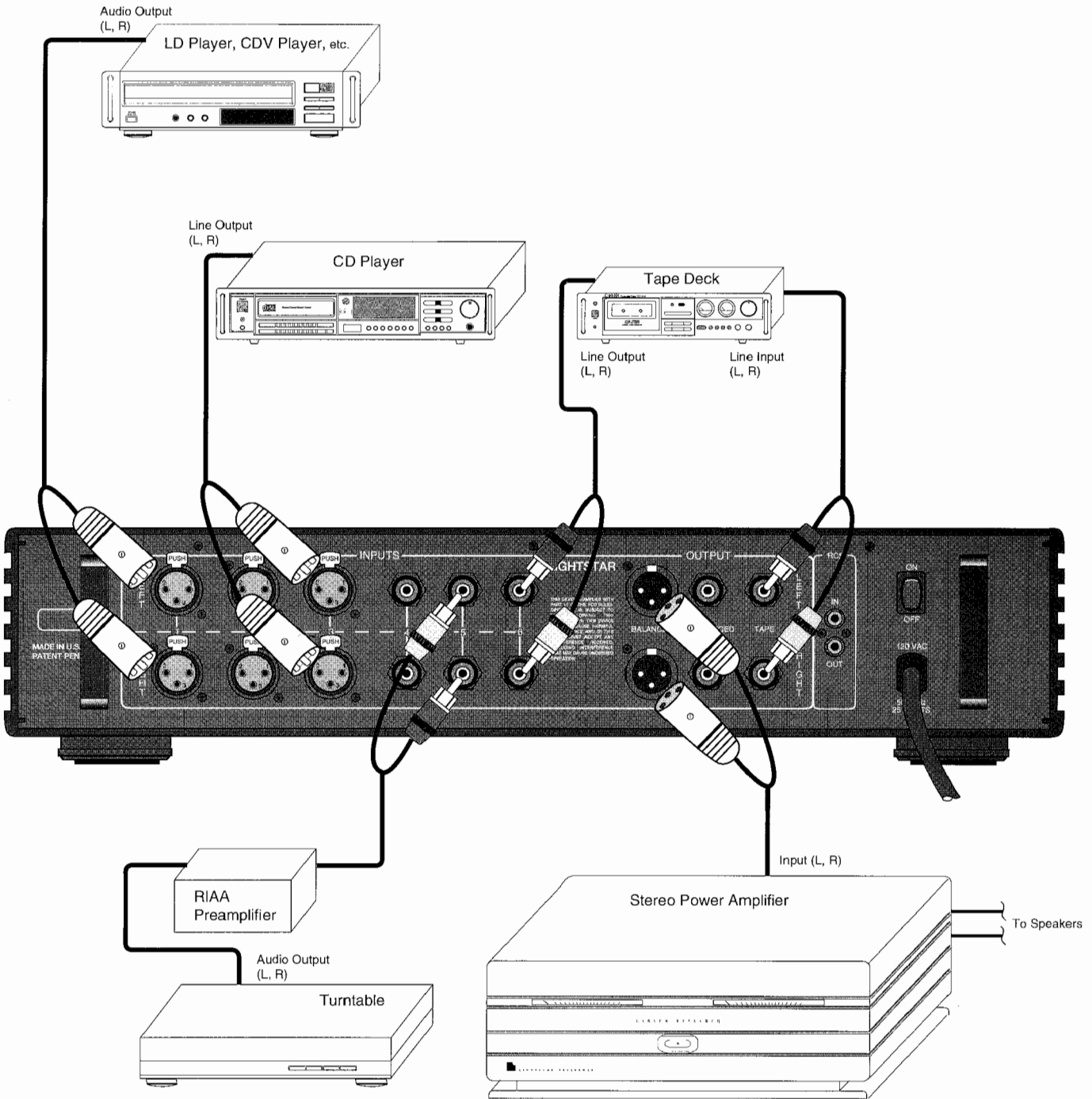


Figure 6. Normal Stereo Connections

6. Operation

There are no controls on the Lightstar Direct other than the power switch on the rear panel. All operations are controlled using the Lightstar Direct Remote Control.

The Lightstar Direct Remote Control

The Lightstar Direct Remote control is designed to be placed on a table near your favorite listening position. It contains two powerful infrared transmitters that have a wide range of coverage. Often you will find that the remote control need not be pointed directly at the Lightstar Direct preamplifier in order for the infrared command to be received and recognized. However, this is dependent on several variables, including the amount of white surfaces nearby, the texture of the surfaces and the distance between the remote control and the Lightstar Direct.

The remote control is guaranteed to operate reliably within 20 feet in front of the Lightstar Direct and at an angle of 30° to either side.

Battery Replacement

The remote control is supplied with the batteries already installed. It uses four "AA" size batteries which should last for at least one year under normal operation. If you begin to experience unreliable operation with the remote control, it may be time to change the batteries. To be safe, you might want to consider changing the batteries in the remote control once a year, at the same time you normally change the batteries in the smoke alarm(s) in your home.

To replace the batteries, remove one screw on the back of the remote control with a 5/64" hex driver (provided). Slide the two bottom panels apart to expose the battery compartment. Replace with four "AA" size batteries and replace cover. Be sure to observe the correct polarity when installing the batteries, as indicated inside the battery compartment.

Lightstar Direct Remote Control Operation

The infrared commands transmitted by the Lightstar Direct Remote Control are RC5 compatible.

A quick note on input/output levels

Input and output levels for audio equipment are usually divided into three categories.

Phono Level: This is a very low level signal that comes from the cartridge of your turntable. Because of its extremely low voltage, it has a special input connection provided on most preamplifiers and receivers. It provides extra gain to increase the signal, as well as playback RIAA equalization to restore the flat frequency response that was altered by the equalization used in making phonograph records. Only a turntable should be connected to the PHONO input jacks.

Line Level: This is the signal level that comes out of almost all audio components produced today, except for power amplifiers. It ranges from several millivolts to a few volts (AC). The Lightstar Direct is designed to work with line level signals.

Speaker Level: This is the signal level that comes out of the speaker output terminals on a power amplifier or receiver. It can range from several volts to several tens of volts (AC). Some high powered amplifiers can reach voltage levels approaching that present on a household AC outlet! These connections should only be made to a speaker.

RC5 Remote Control Bus

RC5 is a protocol developed by Philips to provide unified remote control of consumer equipment. Each possible remote control function is assigned a standard code, consisting of a 14-bit code word. The RC5 protocol can handle up to 4096 separate commands.

The RC5 codes can be transmitted in two ways. The first way is directly from the hand-held remote control, using infrared light. Simply point the remote control toward the component you wish to control and push the button on the remote.

RC5 provides a second method of transmission, which is over a daisy-chained bus connection. It is not required to connect the (RC5 compatible) components together with the RC5 bus, but it provides added flexibility in positioning and controlling your system. Only one component needs to be visible to control the entire system. Its infrared pickup can read the commands for all the components connected to the chain and transmit them to the appropriate device over the RC5 bus.

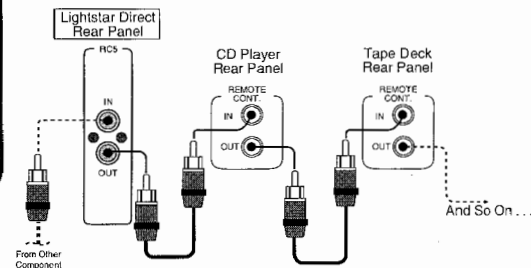


Figure 7. RC-5 Connection

Refer to each individual component's owner's manual to see if the unit is RC5 compatible. To connect components to the remote bus, connect the RC5 OUT jack on the rear panel of the Lightstar Direct to another component's RC5 IN jack using a normal RCA-type patch cord. Connect the RC5 IN jack on the back of the Lightstar Direct to another component's RC5 OUT jack. Any number of components may be "daisy-chained" in this manner; the connection sequence is not important. If a connected component has an INT/EXT switch next to the remote jack, switch it to the EXT position.

Stepped Attenuator vs. Rotary Potentiometer

A stepped attenuator has several advantages over the more common rotary potentiometer. A rotary pot is constructed of a resistive element applied to a substrate, over which a wiper is rotated to adjust the amount of resistance between the wiper and one end of the resistive element. This technique introduces friction noise into the signal path. For a stereo volume control, a single shaft is used to turn the wipers on two potentiometers (dual-ganged pot), one for each channel. Due to variations in tolerance between the two resistive elements, they can vary by as much as $\pm 20\%$ from each other, resulting in up to 3.5 dB difference between channels.

A stepped attenuator uses a number of switches (in the Lightstar Direct case, electronic relays) to switch discrete resistors into the signal path, thus reducing its level incrementally. The individual resistors can be high precision, resulting in improved accuracy in both absolute attenuation and interchannel balance. The Lightstar Direct uses high-quality Holco metal-film resistors (made in England), with 1% tolerances in their rated values. This allows for precision adjustment of level in 1 dB increments.

1. IR Window

This is where the infrared transmitter is located. Aim this side of the remote control toward the Lightstar Direct when issuing a command.

2. BALANCED INPUTS 1 - 2 - 3

These buttons are used to select inputs 1, 2 and 3, which are the three balanced input channels.

3. UNBALANCED INPUTS 4 - 5 - 6

These buttons are used to select inputs 4, 5 and 6, which are the unbalanced input channels.

Note: The input select buttons are not labeled by input source type (e.g. CD, TAPE, VCR, etc.). Instead they are simply numbered so that they remain flexible enough to allow you to connect any audio input source you wish to any of the inputs 1-6 on the Lightstar Direct. You may wish to write down the order in which the components are connected to the Lightstar Direct on a small card or slip of paper until you have memorized the configuration.

4. BALANCE L/R

This button is used to adjust the relative volume level between the left and right channels. This might be used to adjust the balance between the left and

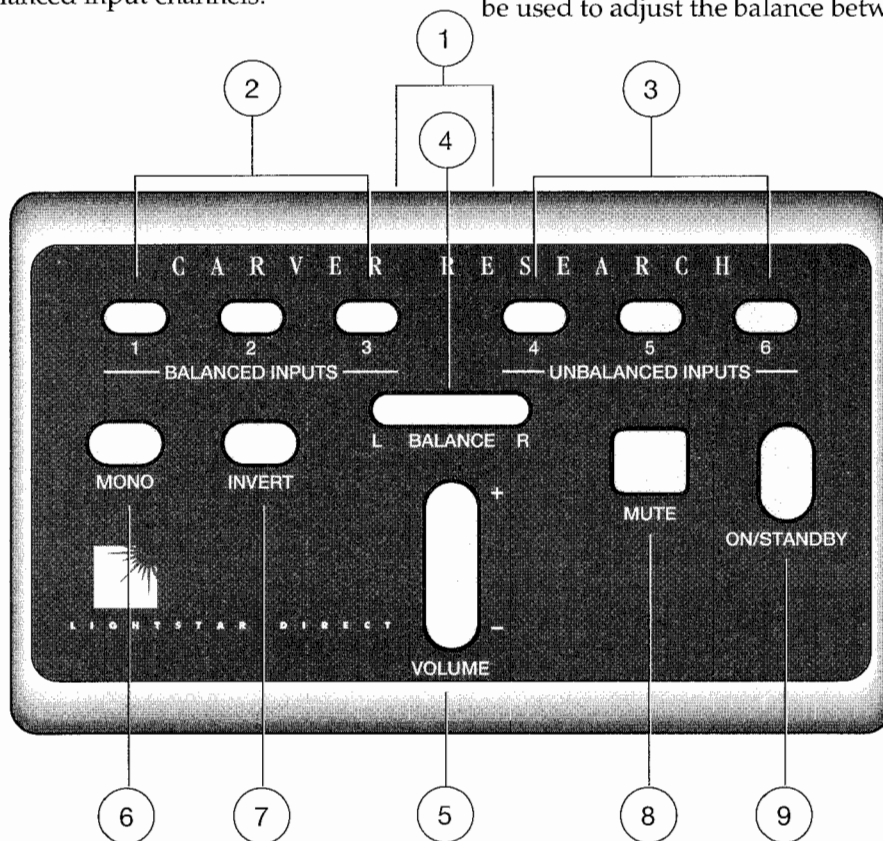


Figure 8. Lightstar Direct Remote Control

right speakers if you are sitting closer to one speaker than the other. Sometimes certain program material contains an imbalance between channels that could be compensated for by using the balance control.

Pressing the "L" side of the button increases the attenuation on the right channel in 1 dB steps, making the left channel louder with respect to the right channel. Pressing the "R" side of the button increases the attenuation on the left channel in 1 dB steps, making the right channel louder with respect to the left channel.

The BALANCE control can be adjusted up to 10 dB of attenuation on each side. The last step of balance attenuation applies the maximum of 63 dB of attenuation to the channel.

Note: The maximum attenuation available with the Lightstar Direct is 63 dB. Therefore, if the attenuation is set to 54 dB or more, the range of the balance control becomes limited. For example, if the attenuation is set to 55 dB, then the balance range becomes limited to 8 dB of attenuation per side (55 dB + 8 dB = 63 dB). At full attenuation (63 dB), the balance control no longer operates.

Conversely, if for example the balance is set 3 dB to one side, the attenuation range will be limited to 60 dB.

5. VOLUME +/-

Use this button to adjust the amount of attenuation at the output in 1 dB steps. Pushing the "-" side of the button increases the attenuation, reducing the volume. Pushing the "+" side of the button decreases the attenuation, increasing the volume.

Press the button once and let go to adjust in 1 dB steps. Press and hold the button to rapidly adjust the volume. Each indicating LED represents 2 dB of attenuation. When 2 LEDs are lit, the amount of attenuation is halfway between that represented by each of the LEDs. When the LED on the far right of the ATTENUATION indicating bar is lit, the maximum attenuation of 63 dB has been reached.

6. MONO

Pressing this button combines the stereo left and right channels into a single monophonic channel, which is then output to both the left and right balanced and unbalanced outputs. Both monophonic outputs are identical.

When switching a stereo signal into mono, some slight loss of overall signal level may be noticeable. This is a normal characteristic of the simple combining circuit used in the Lightstar Direct.

7. INVERT

Press this button to change the polarity of output with respect to the input. Normally, when the voltage is instantaneously rising at the input, the voltage is rising at the output as well. When the INVERT function is activated, when the voltage is instantaneously increasing at the input, the voltage is decreasing at the output.

This can be used to compensate for an inversion between components due to the Pin 2/Pin 3 configuration. Or it can be used to simply recreate the correct absolute polarity of the original musical event.

8. MUTE

Press this button to instantly reduce the volume at the output of the Lightstar Direct to inaudibility. Pressing the button again will return the volume to its original level.

Note: Pressing the VOLUME or the BALANCE button when the Lightstar Direct is muted will disengage the Mute function.

9. ON/STANDBY

This button is used to toggle between Standby mode and operating mode.

When the Lightstar Direct is switched to Standby, it consumes very little power. It is designed to be left in the Standby mode between listening sessions. Even in Standby, the Lightstar Direct will continue to relay any RC5 command it receives to other components wired to the RC5 bus.

Note: If the Lightstar Direct is not going to be used for several days or weeks, we recommend that the power switch on the rear panel be switched off.

7. In Case of Difficulty

If you're having trouble or suspect a problem with the Lightstar Direct, try some simple troubleshooting before contacting your Carver Research dealer or an Authorized Carver Service Center. Most likely, the problem lies elsewhere in the system or with a button or control inadvertently left in the wrong position.

No Sound, No Power.

This is usually an indication of a power supply problem, either the power line itself or one of the system component's power supply.

1. Lightstar Direct power is switched off.
2. Linecord is disconnected.
3. Poor fit between the plug and wall receptacle. Try removing and reinserting the plug.
4. Power off at wall receptacle. You can test the wall receptacle by plugging in a lamp or AC tester.
5. Lightstar Direct is plugged into a switched outlet. Plug the linecord directly into an AC wall outlet.
6. Lightstar Direct internal fuse has blown. Contact Carver Customer Service (see page 18).

Power On, Low Output or No Output.

Low or no output problems are usually related to signal-sources, bad cables or partial output shorts. If the items listed below check out, then the problem may be internal to the Lightstar Direct.

1. Make sure the Lightstar Direct is in operating mode and not in Standby.
 2. Make sure the MUTE function is not activated on the Lightstar Direct.
 3. Check the input source to make sure it is working correctly. If the source unit has a headphone jack, you might use a set of headphones to check the operation of the source component.
 4. Make sure that the correct input source has been selected on the Lightstar Direct.
 5. Turn off your stereo system and check the input source-to-preamplifier cable connections. Try another cable that is known to be good.
 6. Move the preamp-to-amplifier cable connections to another amplifier that you know is working to verify that it is not a power amplifier problem.
 7. Turn the power amplifier off. Check the speaker connections. Be sure that there are no small strands of wire touching similar strands coming from the other wire in the cable. If you use banana plugs, be sure that the setscrews in the plug are securely tightened.
 8. If speaker fuses are installed in the loudspeakers or the speaker cables, verify that they are not blown.
 9. Make sure the speakers are functioning correctly.
- ⚠ **Note:** There is an internal jumper that can be changed to program the gain at the unbalanced outputs for either 0 dB or +20 dB. If the power amplifier has been changed, verify that this gain is correctly set for the input requirements of the new amplifier.

Sound cuts off when volume control is turned up.

1. Check speaker wires for a short (bare wire from one connector touching another).

2. Check speakers for damage that may have caused an internal short.

No sound in one channel or one channel has distorted sound.

1. Check the BALANCE control and make sure that it is in the center position.
2. Turn the power amplifier off. Then check speaker wire connections by momentarily switching LEFT and RIGHT speaker cables at the amplifier's speaker output terminals. After turning the amplifier back on, see if the same loudspeaker is dead or distorted. If it is, the fault lies with the speaker cable or the loudspeaker.
3. If speaker fuses are installed in the loudspeakers or the speaker cable, verify that they are not blown.
4. If, after following step 2, the dead channel DOES switch sides, the problem may be in the amplifier, the Lightstar Direct, signal source or connecting cables. You can check for a possible cable problem by substituting a good set of cables.

Playback is mixed with hum.

1. Check or replace the connecting cables.
2. Make sure that each connector is securely seated into its jack.
3. Signal cables may have been routed too closely to AC cables, power transformers, motors or other EMI inducing device.
4. If using balanced cable, try disconnecting the shield from Pin 1 at the source end. This will disconnect the chassis ground connection between the two devices but still maintain the integrity of the shield.
5. If a CATV cable is connected to the system, try disconnecting it. If the hum goes away, call your cable carrier or Carver Customer Service.

No output to tape deck.

Tape input channel must be programmed correctly (see page 9 - *Tape Output*).

Popping noise from speakers when volume is adjusted, especially when using a balanced source.

The balanced output of the source product has excessive DC voltage "offset". Contact the manufacturer of the source product.

Blue LED illuminates frequently when remote control is not being used.

Stray infrared light from the sun or a strong incandescent lamp is falling on the IR pickup window.

Attenuation will not step all the way down to 63.

To preserve the stereo image, the volume range is constrained by any balance adjustment you may have made. For example, if the balance is set 3 dB to one side, the attenuation is then held to a maximum of 60 dB (3 dB less than usual). This constraint prevents the stereo image from shifting at the extremes of the attenuation setting.

Balance will not adjust all the way to one side.

If the overall attenuation is set below 53 dB, the balance adjust will be constrained to the difference between the attenuation setting and 63. For example, if the attenuation is set to 60 dB, the balance will only adjust 3 dB to each side.

8. Care and Service Assistance

Care

You'll want to wipe off the Lightstar Direct's front panel and chassis from time-to-time with a soft, dry cloth. If you have something stubborn to remove, use a mild dish soap or detergent sparingly applied to a soft cloth. Don't use alcohol, ammonia, or other strong solvents.

Make every effort to keep your preamplifier away from high external temperatures, moisture and airborne substances that can leave greasy deposits and dust.

Do not drop the preamplifier. If you suspect a problem, try system troubleshooting first. Frequently, a problem lies elsewhere in the system or even in the connection cables.

Service Assistance

We suggest that you read the LIMITED WARRANTY completely to fully understand your warranty/service coverage. Please promptly complete and return the CUSTOMER REGISTRATION CARD. Also be sure to save the sales receipt in a safe place. It will be necessary for warranty service.

If your Carver Research product should require service, we suggest you contact the Dealer from whom you purchased your unit. Should the Dealer be unable to take care of your needs, you may contact the Carver Technical Service Department by phoning 1-800-521-4333 or by writing to us at the Factory address shown at the right. We will then direct you to the nearest in our national network of Authorized Warranty Service Centers or give you detailed instructions on how to return the product to us for prompt action.

When shipping your Carver Research product, please use the original packing container in which you received it. Our packing materials are specially designed to provide the best possible protection from shipping damage. If you no longer have the original carton, contact Carver Customer Service and we will send you a new one at no charge.

If you should have questions or comments, please write to the Factory address given below. Please include the model and serial number of your Carver Research product, your complete address and a daytime phone number.

Factory Address

Carver Corporation Service Department
P.O. Box 1237
Lynnwood, WA 98046-1237

(206) 775-6245
or
1-800-521-4333

*Customer Service and
Technical Information*

(206) 775-9180
service@carver.com

*Customer Service Fax
Internet*

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CARVER

CARVER CORPORATION LIMITED WARRANTY

CARVER RESEARCH AUDIO PRODUCTS

Product	Warranty Period
All Carver Research Audio Products	5 years

YOU MUST RETAIN AND PROVIDE YOUR SALES RECEIPT TO OBTAIN COVERAGE UNDER THIS LIMITED WARRANTY. The Warranty Period begins from the date of first consumer purchase from an Authorized Carver Research Dealer.

WHAT IS COVERED: THIS WARRANTY COVERS DEFECTS IN MATERIAL AND WORKMANSHIP ONLY. This Limited Warranty DOES NOT extend to: (1) Damage caused by shipment; (2) damage caused by accident, misuse, abuse, failure to perform owner maintenance, or operation contrary to the instructions in the Carver Corporation owner's manual; (3) units on which the serial number has been defaced, modified or removed; and (4) damage resulting from modification or attempted repair by any person other than authorized by Carver Corporation.

WHAT WE WILL PAY FOR: Carver will pay all labor and material expenses for items covered under this Limited Warranty. See the next section concerning shipping charges.

WHAT YOU MUST DO TO OBTAIN WARRANTY SERVICE: In the event your Carver Research product requires service, write to Carver Corporation (Attention: Customer Service Department), P. O. Box 1237, Lynnwood, Washington 98046-1237 or call the Customer Service Department directly at (206) 775-6245. You will be directed to an Authorized Carver Research Service Station or receive instructions to ship the unit to the factory. Please save the original shipping carton and packing materials in case shipping is required. Please DO NOT ship Parcel Post. Include a complete description of the problem, the associated components and connections, and a copy of the purchase receipt. Initial shipping costs are not paid by Carver Corporation; return shipping costs will be pre-paid if repairs were covered by the scope of this warranty.

Shipping Address

CARVER CORPORATION
20121 - 48th Avenue West
Lynnwood, WA 98036

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We suggest that you attach your purchase receipt to this Warranty and keep both documents in a safe place.

Thank you for your choice of a Carver Corporation product.

NOTE: The preceding warranty is exclusive to the United States and its possessions and territories. Please see your Carver Research dealer or distributor for the correct warranty information in your area or locale.

August 1, 1994



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