

LX-1

Stereo Selector

USER MANUAL

BURK
TECHNOLOGY

LX-1 User Manual
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1 Introduction

The LX-1 Stereo Selector simplifies and improves studio and transmitter systems by providing elegant selection and mixing of program sources. Featuring quality; flexibility and easy to use, the LX-1 can serve a number of station needs.

Designed to be the final "gateway" for broadcast systems, the LX-1 can serve as the hub of a multi-studio complex, or as the switching center for satellite, network and studio feeds. As a master control switcher, it can be controlled from a central point, by remote control, or from each studio it serves. Where desired, each studio can have its own air control and ON-AIR indicator.

Low cost, ease of interface and machine-follow audio capability make the LX-1 a good choice as a console input extender, or as a switcher for automation or production systems.

The usefulness of the LX-1 is enhanced by full remote control capability, external processor switching, a SAFE mode and memory retention during power loss.

FEATURES & BENEFITS

- Select or mix from six stereo input sources.
- Control and read the status of the unit from the front panel, through the individual source connectors on the rear panel, or by remote control.
- Control cart, tape and satellite feeds with machine-follow audio.
- Match input levels of -10, 0, +4 or +8dBu. (Note: In this manual levels are expressed as dBu, except where a 600W load is known to exist.)
- Use the LOOP function to switch a processor in/out of the program path. Monitor program level on the dual 12 segment bar graph display.
- Distribute identical MAIN and SUB out-puts.
- Prevent accidental switching by locking out all control functions with the "safe" mode.

SWITCHING QUALITY

With the coming of the LX-1 it is time to do away with outmoded patch cords and relays. The LX-1 provides versatile and foolproof operation and a cleaner audio path.

The LX-1 sets new standards for switcher audio performance. It uses noiseless "soft" switching to give clean program transitions. Instead of the "chopping" action of relays, switches, patch cords and typical electronic switchers, the LX-1 makes a controlled transition from one source to the next. The turn-on and turn-off transitions are never audible as such. The audio simply appears or disappears. This effect is particularly impressive when working from live or digital sources. Clean audio appears out of dead silence.

When a channel is turned on, its audio is passed through the LX-1 with very low distortion, typically a few thousandths of a percent. When a channel is switched off, the LX-1 yields typically 100 dB of isolation. This assures there will be no audible noise or crosstalk from fast forwarding of tape or hot inputs. Off is OFF.

HIGH NOISE REJECTION FROM ALL SOURCES

Not only is the LX-1 a very low-noise device, its extraordinary 100dB common-mode rejection will reduce hum and noise from ground loops and station cabling. An important design goal was achieving high noise rejection from unbalanced sources such as consumer CD and DAT machines. This performance, and the ability to accept typical "HI-FI" levels, makes the LX-1 the best way to integrate consumer and semi-professional equipment into a studio environment.

MATCHING STANDARD LEVELS

It is recommended practice to calibrate all distribution signals to a standard level, typically +4 dBu. Unfortunately, manufactures do not always adhere to standards. For example, a cart machine may be designed for "0" output level. Jumpers on the LX-1's audio board for each channel may be set to standard levels of -10, 0, +4 and +8 dBu.

FRONT PANEL OVERVIEW

The front panel switches (READY, LOOP, MIX and channels 1-6) have built-in status lights. The dual 12-segment three color program level displays feature peak-hold on the upper five segments.

The LX-1 uses convenient Mini Combicon connectors that require only a screwdriver for assembly. No crimping, soldering or special tooling is needed.

REAR PANEL OVERVIEW

The rear panel has audio and control connectors for each of the six inputs as well as MAIN-SUB and LOOP audio outputs. The LX-1 output stages more closely simulate high quality output transformers than typical designs and will drive high levels into complex loads, such as long audio lines and complex studio wiring.

Full remote control capability is provided through the 'A' and "B" remote control connectors on the rear. As an added convenience, power is provided for lighting LEDs for external status indication.

BOARD OVERVIEW

The LX-1 circuitry is contained on three circuit boards:

- Audio board and power supply
- Logic board
- Display board

CONTACTING BURK TECHNOLOGY

Customer Support

Visit the Support section of our website at www.burk.com/support/ for troubleshooting tips, documentation and downloads. If you still need help, please contact Burk Technology Customer Support:

Phone: 978-486-3711
Fax: 978-486-0081
Email: support@burk.com

Sales

For information on Burk Technology's line of transmitter remote control systems and accessories, please visit our website at www.burk.com, or contact a sales representative:

Phone: 800-255-8090 (Main Office)
800-736-9165 (Kansas City)
Email: sales@burk.com

2 Installation

GENERAL

Carefully unpack the LX-1 and save the packing material. The LX-1 should be installed in a well-grounded equipment rack. High common-mode rejection, good case shielding and general immunity to RF and magnetic fields make installation easy; however, good engineering practices should be followed. The LX-1 and audio lines should be kept away from large power transformers, RF generating devices and equipment that may produce inductive line transients. The filtered power entry module and a well isolated toroidal power transformer contribute to freedom from electrical noise.

Unless otherwise requested and marked, the LX-1 is wired for operation at 117 vac nominal, 50/60 Hz; 30 watts. The toroidal power transformer allows operation from UPS or inverter. See the power supply schematic, page 30, for 230 volt strapping.

MEMORY

The LX-1 has memory retention that should be adequate for normal station shutdowns and power outages; however, it is best not to power it from a switched power source. The best practice is to leave the unit powered continuously. If power is off too long, the LX-1 will reset all functions to off and default to "safe."

CONNECTORS

The LX-1 uses Mini Combicon connectors. These simplify installation and wiring changes. The connectors are actually removable terminal strips. Wire strippers and a small blade screwdriver are the only tools needed to attach the connectors.

CAUTION: The LX-1 uses six and twelve pin connectors for both audio and control functions. It is imperative that plugs (removable terminal strips) are inserted into the correct rear panel connectors. Interchanging audio and control connectors, especially the remote control connectors, can damage the LX-1 and external devices.

We recommend labeling each plug connected to the LX-1. A "Sharpie" marking pen is ideal for this purpose.

The top row of 6-pin rear panel connectors are for channel control. They provide Ready tally, channel ON indication, start and stop pulses and permit channel selection. The two 12-pin connectors on the top row permit full remote control.

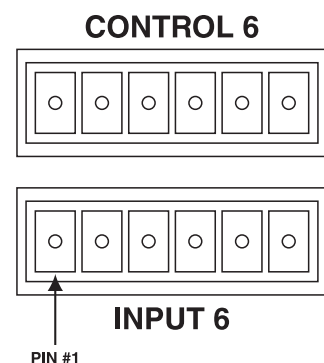


Figure 1: Input Connectors

The audio connectors are located along the lower portion of the rear panel. The six 6-pin connectors are the channel audio inputs and the two 12-pin connectors are for program output and Loop functions. PIN #1 Pin #1 of all connectors is located to the left. See figure 1.

AUDIO WIRING

The audio input and output connectors have ground terminals for each balanced line. This permits use of separate cables (Belden 8451) or more convenient two pair cables that have a single shield drain (8723). Refer to input connector wiring, figure 2 (below).

1	2	3	4	5	6
L+	L-	GND	R+	R-	GND

Figure 2: Audio Input Connector Wiring

RECOMMENDED PRACTICES

The "hot" front-end the LX-1 uses a multi-stage "instrumentation amplifier" with a 50KW load impedance. The LX-1 should bridge input devices. Most non-reactive devices (solid-state amplifiers and consumer devices) do not require termination. In some cases termination is required to maintain correct output level. Source devices that require termination should be terminated with the proper resistor.

In general, studio systems with self-terminating outputs and bridging inputs are easier to work with and deliver higher performance. Avoid the use of pads at the input and output of the LX-1. Pads may reduce total system dynamic range and common-mode rejection.

Balanced sources should be handled as if the LX-1 input is a transformer. Generally, the shield should be connected to the LX-1 audio input ground terminal and left open at the source end. Both the LX-1 and the sources should be connected to a secure ground. A "star" or "transmission" ground system is recommended. That is, there should be only one path from each device to station ground.

It will be observed in practice that the 100dB plus CMR of the LX-1 will tend to make grounding and shielding less critical. This, however, is no license to violate good engineering practices. It is possible, for example, that input lines will have unequal noise voltages induced on the signal legs.

CONNECTING UNBALANCED SOURCES

Unbalanced sources present a special case. Since the LX-1 inputs are high impedance, and high common-mode rejection is maintained even with unequal source impedances, unbalanced sources should be treated the same as balanced sources.

The best way to connect unbalanced sources, like consumer CD players, is shown in figure 3 (right). The + input line is connected to the "hot" side of the source while the - line is connected the ground of the unbalanced source. The cable shield is tied to the ground terminal of the LX-1. Both the LX-1 and the source should be tied to the same system ground. Only one ground should be used for each device.

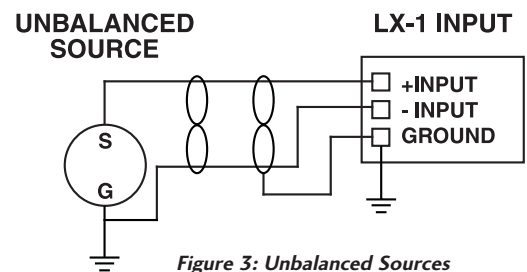


Figure 3: Unbalanced Sources

Wired this way noise voltages along the shielded audio line will still be canceled. In addition, the typically low impedance of the source, when connected to the high impedance of the LX-1, will cause ground effect noise to be attenuated by the LX-1, 5 high common-mode rejection.

SETTING AUDIO LEVELS

There is a natural tendency to want level tweaks at various points within the audio system. This temptation should be resisted. A house level should be established and strictly adhered to. Ideally, each source should be calibrated to a house level, such as +4dBu.

Installation of the LX-1 is a good time to think through your house audio level practices. We strongly recommend that a house level standard be established FIRST. Field tests have demonstrated that the duplication of level tweaks throughout an installation can deteriorate total system performance. Your station can measure better and sound better if the least amount of amplification and the least amount of attenuation is used in the program path.

For example, a line-level network, news or satellite feed should not be padded down to mic level so that it can be fed into a console mic channel. The LX-1 offers a better solution. Using it to select from among several high level sources will give cleaner sound, simplify program switching and it may even free up a console.

The gain structure of the LX-1 is very accurate and stable. If input sources have been properly calibrated earlier in the system, only level range adjustment should be required in the stereo selector. The input sensitivity of the LX-1 can be set for standard levels of -10, 0, +4 or +8 dBu.

Level programming should be done at the time of installation. Remove the unit's top cover and locate the six pairs of 2 x 4 headers along the front of the main (lower) printed circuit board. Each input has headers for left and right channels. The header pairs are numbered 1 to 6.

Jumpers on the headers are used to set channel input sensitivity. A position guide is printed on the circuit board near input two. Move the push-on jumpers for left and right channels to the desired position. For example, for a +4 dBu input set the jumpers to the second position from the left. See figure 4 (right).

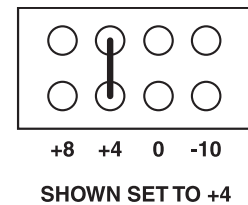


Figure 4: Input Jumpers

SELECT ALTERNATE JUMPERS

When input jumpers are set correctly, all inputs will produce the same internal level on the LX-1's mixing busses. This internal level will produce +4 dBu or +8dBu at the output, depending on the setting of the output level jumpers.

The LX-1 12-segment program level bar displays may be used as a convenient aid for trimming the source levels. This is especially handy when a level meter is not available, or would be inconvenient to use.

Normal program output level, or "0," is indicated by the left and right channel yellow LEDs. "0" on the display indicates either +4 or +8 dBu output. The point where the LED comes on is a very accurate indication of "0" level. There is a very narrow "flutter" range as the LED comes on. This, plus the visibility of the distinctive yellow LED, permits accurate level setting even from across the room.

The next step is selecting the nominal program output level of the LX-1. This can be either +4 or +8 dBu. The output level jumpers are located to the left of the main buss jumpers near cable connector J 1. For +4 dBu output the jumpers should be on the two outer pins. For +8 dBu the jumpers should be on the two inner pins. See figure 5 (next page).

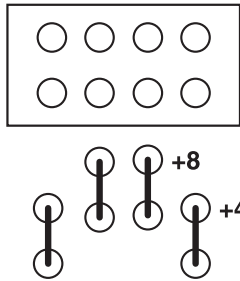


Figure 5: Output Jumpers

While the cover is removed from the LX-1, you should decide how the SELECT mode will function. In the normal SELECT mode (while MIX is not on) selecting a new source will switch to that source and cancel the previously selected choice. Selecting the same source again will not do anything. When the S1 jumper on the logic board is moved from SEL to ALT, the LX-1 will respond to channel selection by alternately turning the selected channel on and off. See figure 6.

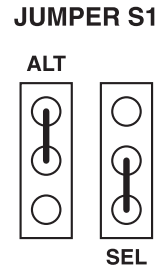


Figure 6: Select Jumper

Once the levels have been programmed, and jumper S1 set, you can replace the cover and proceed to completing installation.

Note: When replacing the top cover, be sure to place the short screw in the front center hole.

AUDIO OUTPUTS

The LX-1 has outputs for left and right MAIN, SUB and LOOP functions. The MAIN and SUB outputs are identical feeds driven by separate amplifiers that deliver either +4 or +8 dBu at meter "0." The LOOP output is +4 dBu and duplicates the signal on the mixing bus.

When LOOP is not active, the mixing bus is passed to MAIN and SUB outputs. When LOOP is on, the signal on the LOOP input connector is passed to the MAIN and SUB outputs.

The LOOP function is intended to switch an external audio processor in or out of the program path; however, it can be used for many other purposes such as switching an EAS generator. Its ability to be controlled remotely, and the fact that the LX-1 will return to normally selected audio when LOOP is turned off add to the usefulness of the LX-1.

Note: A hardware modification is needed for the LX-1 to use with an EAS Encoder/Decoder.

The "600W" Main and Sub outputs can drive 300W loads with only slight effect on maximum output level, and no loss of level below maximum output. The Loop output load should not be less than 600W. The LOOP input is 25KW bridging, at +4dBu.

The output stages of the LX-1 are more complex than the conventional push-pull arrangement. Grounding an output leg of the LX-1 will have little effect on output level, except that maximum power output will be reduced to half.

Lowest distortion and noise will be achieved when the LX-1 outputs drive balanced loads but the LX-1 can directly feed unbalanced inputs. Simply connect the unbalanced input between ground and the + signal line.

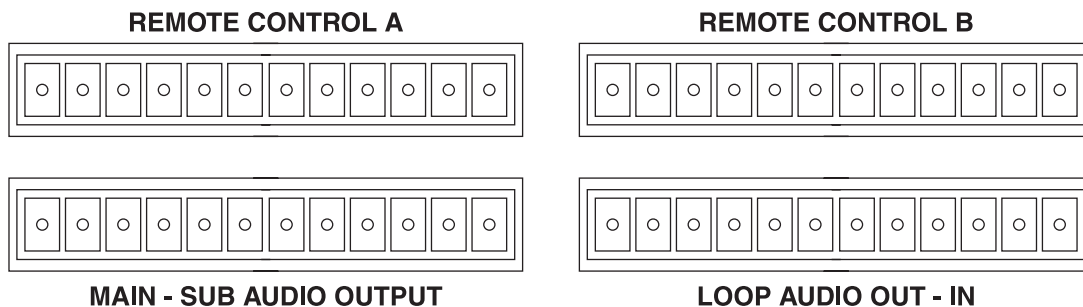


Figure 7: Output and Remote Connectors

AUDIO OUTPUT CONNECTORS

Main-Sub Outputs

MAIN						SUB					
1	2	3	4	5	6	7	8	9	10	11	12
L-	L+	GND	R-	R+	GND	L-	L+	GND	R-	R+	GND

Figure 8

Loop Output-Input

LOOP OUT						LOOP IN					
1	2	3	4	5	6	7	8	9	10	11	12
L-	L+	GND	R-	R+	GND	L-	L+	GND	R-	R+	GND

Figure 9

The flexible output configuration of the LX-1 can be a real problem solver. A typical example would be feeding MAIN audio to a transmitter and using SUB audio for studio distribution. The separate outputs could also feed a second transmitter.

In AM/FM stations the LX-1 could continuously feed an FM transmitter via the LOOP output while an AM feed could be sent from the MAIN outputs. The LOOP function, under remote control, could then switch between simulcasting FM on AM, or select from a separate AM source via the LOOP input.

Another use for the LOOP function is for selecting an alternate program source when it is desired to return to the previously selected source. This is an ideal way to generate an EAS test. Another possibility is relaying EAS tests under control of the originating station.

Note: A hardware modification is needed for the LX-1 to use with an EAS Encoder/Decoder.

The LX-1 is ideal for use at unattended transmitter sites. By remote control the LX-1 could select a satellite down link or automation feed and switch back to the studio feed.

There are times when a monophonic feed is needed for an AM transmitter. There is a simple way to achieve this with the LX-1. An L+R feed can be derived by making a simple resistive combiner using four 300Ω resistors. See figure 10 (below).

DERIVING L+R

The balanced left and right LX-1 outputs are combined to form an L+R feed. The combining pad loss is less than 4 dB when driving a 6000 loads. This circuit can be attached to either program output (MAIN or SUB) or the LOOP output.

It is possible to drive this combiner in parallel with the normal 6000 load. Since the pad will reduce channel separation to approximately 30dB, it is suggested that it be attached to an output that is not feeding an FM transmitter.

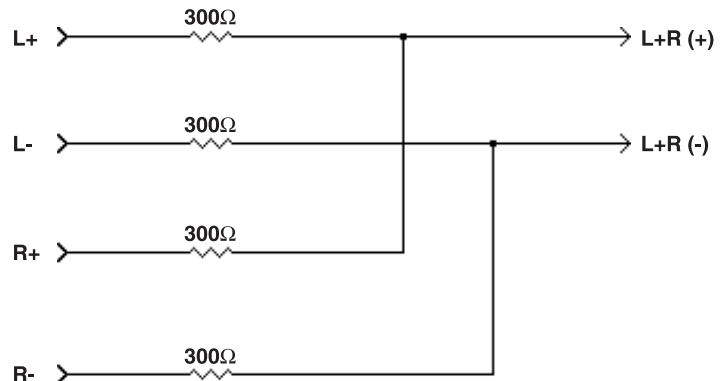


Figure 10: Deriving L+R

CONTROL CONNECTOR WIRING

Each of the six channel control connectors provides tally of READY and channel selection. See figure 11, Channel Control Wiring Momentarily switching pin 3 to ground will select the channel. Pin 6 is control common.

READY toggle is available on Remote Control connector 'A," pin 10. Pins 1 and 11 of remote control connector 'A," the left most of the two 12-pin remote connectors, have 6 VDC available for driving external LEDs. Current limiting resistors of 3300 to 4700 must be used in series with each external LED. See figures 11 -15.

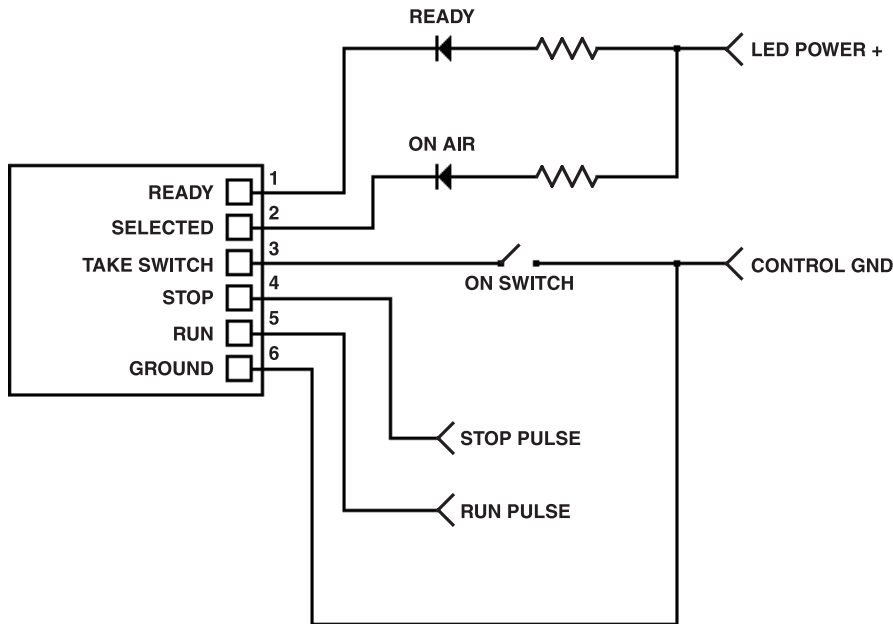


Figure 11: Channel Control Wiring

Each of the six control connectors provide start and stop pulses for controlling external devices. When a channel is switched on, an open collector output on pin 5 will pulse low. When a channel is switched off, pin 4 will pulse low.

The start and stop pulses are approximately one second long. Lamp control and start and stop pulses are open collector outputs that can sink 250 mA., 28 volts. See figure 15 for methods of interfacing these control functions to other equipment.

Control Connector Wiring

PIN	USE
1	READY LIGHT
2	CHANNEL ON LIGHT
3	TAKE SWITCH
4	STOP PULSE
5	RUN PULSE
6	GROUND

Figure 12

REMOTE CONTROL CONNECTIONS

A full remote control interface adds to the flexibility of the LX-1. Control is possible from either the channel control connectors or from the remote control connectors. This flexibility allows the LX-1 to be controlled from external control panels or the station's remote control system, or both.

Open-collector status outputs on the remote control connectors are separate from those for the front panel and those provided on the channel control connectors. All control circuits have a common ground.

Remote Control Connector "A" provides mode control and system status. Note that switch connections for a given function are wired in parallel. LOOP and MIX lights appear twice on this connector. Pins 3 and 4 can be used to extend the capability of control connectors 1-6. Pins 5 and 7 are for remote control system use. Remote control connector "B" provides status outputs and controls for the six audio channels.

Remote "A"

PIN	USE
1	6 VDC @ 250 mA*
2	GROUND*
3	LOOP LIGHT*
4	MIX LIGHT*
5	LOOP LIGHT
6	LOOP SWITCH
7	MIX LIGHT
8	MIX SWITCH
9	READY LIGHT
10	READY SWITCH
11	6 VDC @ 250 mA
12	GROUND

Figure 13

Remote "B"

PIN	USE
1	CH 1 LIGHT
2	CH 1 SWITCH
3	CH 2 LIGHT
4	CH 2 SWITCH
5	CH 3 LIGHT
6	CH 3 SWITCH
7	CH 4 LIGHT
8	CH 4 SWITCH
9	CH 5 LIGHT
10	CH 5 SWITCH
11	CH 6 LIGHT
12	CH 6 SWITCH

Figure 14

*Pins 1-4 can be used to extend the flexibility of the control connectors for channels 1-6 by providing LOOP and MIX light outputs. Except for common ground, these pins are electrically isolated from LOOP and MIX light outputs (pins 5, 7) for remote control system use.

LOGIC OUTPUT CONNECTIONS TO EXTERNAL DEVICES

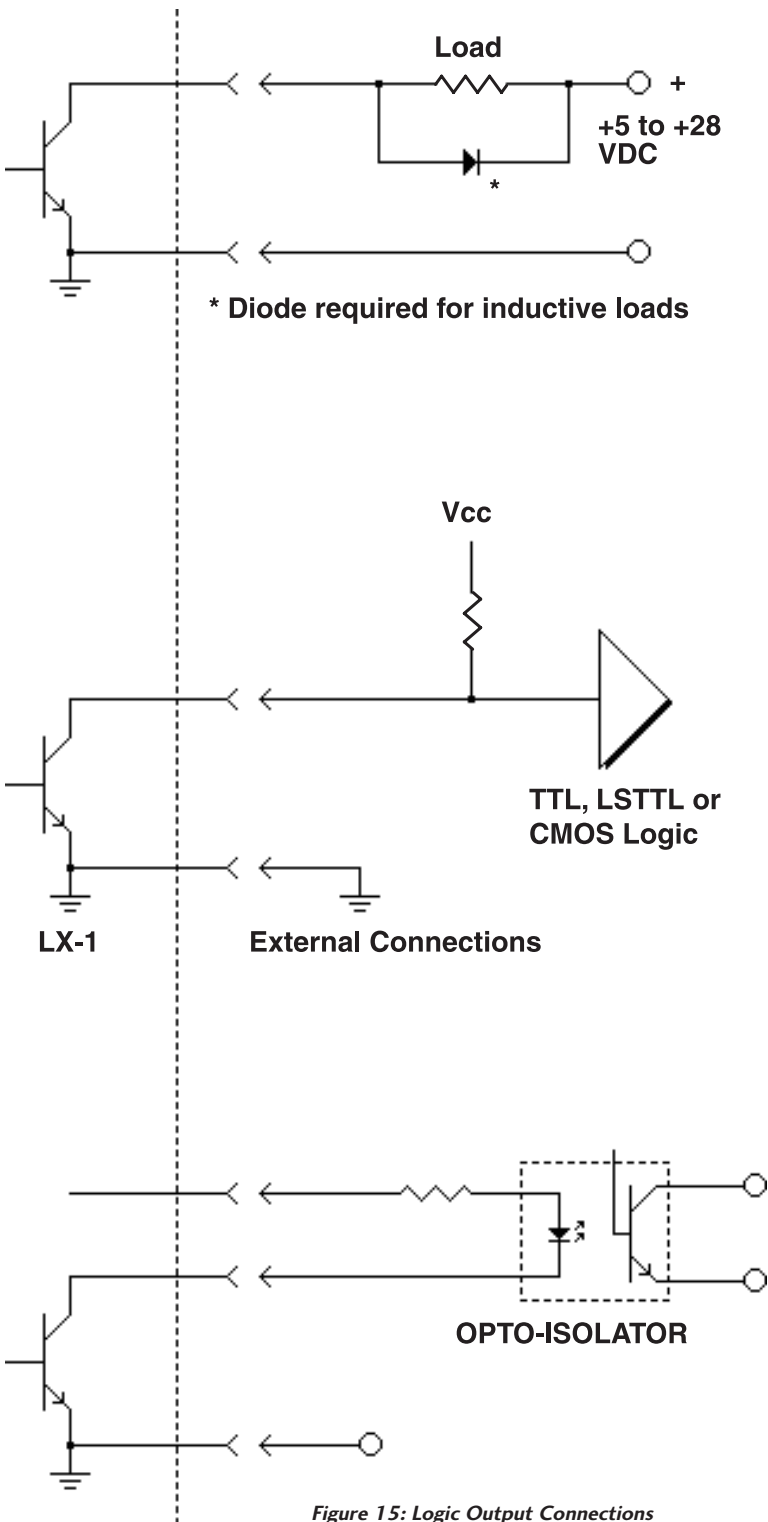


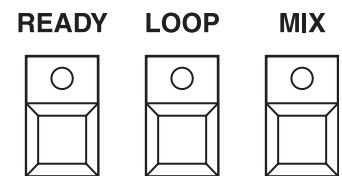
Figure 15: Logic Output Connections

Methods of interfacing the open-collector outputs of the LX-1 to external lamps, status indicators and machine start and stop circuits.

3 Operation

When the LX-1 Stereo Selector is first powered up, and has lost memory, it defaults to the SAFE mode. All lights, all channels, LOOP and MIX will be off. In this mode the LX-1 will only respond to a command to enter the READY mode.

To enter the READY mode, press the READY button on the front panel, or execute a READY command from the remote control connector. The READY light will light and the LX-1 will now accept all commands.



READY MODE

The READY mode provides security for those times when all switching is to be disabled. When used as a master control switcher it may be desirable to set READY off until just before switching is desired. This feature is useful when each studio has its own selection button. Accidentally pressing a button will not then switch studios. In the READY mode channel selection, LOOP and MIX control is possible from the front panel or from remote locations. Momentary closure on any channel select pin will select that channel and illuminate the selection status indicators (front panel lights and remote control status).

When the MIX light is off the LX-1 functions as a one-at-a-time input selector. Once a source is on, further attempts to select that source will have no effect. This is the normal, or SELECT mode, of operation.

SELECT ALTERNATE MODES

The LX-1 can be programmed for alternate action (press on, press off) in the select mode. This is accomplished by moving the jumper on 51 on the logic board from SEL to ALT. See figure 6, page 8, "SELECT ALTERNATE JUMPERS." This feature is handy when a source needs to be repeatedly turned on or off while in the SELECT mode.

MIX MODE

The MIX mode allows combining multiple sources. Each channel selection is independent. Selecting a channel that is off will turn it on. Selecting a channel that is already on will cancel that selection. The MIX mode may be switched on and off with no effect on the state of selected channels at that instant.

The LX-1 uses two 12-segment color coded bar graphs to display program levels from -20 to +8. The LX-1 is calibrated at the factory to indicate 0 dB at +4 dBu output. The actual output level will depend upon the setting of the output level jumpers. See page 8 on how to set the jumpers. The display lights green over the lowest 7 segments, yellow at "0," and red for the upper 4 segments. The upper five segments have a peak-hold feature.

BAR GRAPH DISPLAY

Left and right displays may be calibrated by means of trimmers V1 and V2 located on the LX-1 Display board. V1 adjusts the sensitivity of the right channel, V2 the left channel. To calibrate the displays, feed a 1 kHz tone at the desired output level as measured at the output terminals. Carefully adjust the trimmers so that both displays turn on at the desired level.

4 Technical Description

AUDIO BOARD

The audio circuitry of the LX-1 is contained on the main, or lower, circuit board. The circuit blocks are the power supply, input conditioning and switching, the mixing and output stages and the loop circuitry.

POWER SUPPLY

Power enters the LX-1 through a filtered and fused power entry module on the rear panel. An encapsulated toroidal transformer provides 12 volts for logic use and \pm 22 volts for the audio circuitry.

The 12 volt winding is bridge rectified by D 1, D4, D 5 and D8. A 2700 uF capacitor, C3, filters the rectified voltage and applies it to two 6 volt regulators, U3 and U4. U3 provides 6 volts for external connector use and is current limited to 500 mA. U4 provides 6 volts for the logic board. Unregulated 12 volts is supplied to the front panel display board.

See schematic page 30, Power Supply.

AUDIO CIRCUITRY

The 118 volt audio power supply consists of bridge rectifier diodes D2, D3, D6 and D7, filter capacitors C1 and C2 and regulators U1 and U2.

See schematic pages 23-24, Audio Input Section and Output and Loop.

HIGH PERFORMANCE FRONT END

The high-performance input stages of the LX-1 are designed for wide dynamic range and noise immunity. These goals have been achieved by using SSM 2141 ICs in a novel configuration. The 2141 is a laser-trimmed precision differential amplifier with a gain error of only .001%. The left and right input stages use three 2141s. Each polarity of the input audio is fed to a separate 2141 connected as a non-inverting amplifier with an on-chip 6dB loss resistive divider. The polarity pairs are then coupled to a 2141 connected as a differential line receiver. High common-mode rejection is maintained by the extremely low gain error of the 2141.

This arrangement has several advantages over conventional designs. The polarity pairs present a high impedance load and isolate the differential line receiver from the source impedance of external devices. Isolation is crucial since a 50 source impedance imbalance can reduce common-mode rejection by 20dB!

Attenuating the input signal prior to summing cancels out the 6dB gain that normally occurs in summing. In this way the input capability of the LX-1 is increased by 6dB over normal designs. This, combined with operating at +/-18 volts increases the input range of the LX-1 without compromising common-mode rejection.

The differential amplifier outputs are coupled through decoupling caps to the SSM 2402 dual "T" analog switches. The 2402 has ramped turn-on and turn-off, click-free operation and very high audio performance. Off isolation of the switch is typically 120dB across the audio band. Actual isolation depends on the circuit board layout.

AUDIO SWITCHING

The channel analog switches are controlled by circuitry on the logic board. A logic high will turn the switch on. Control is received from the logic board through J1.

MIX BUS

The output of the analog switches feed the mixing bus through resistors determined by the 2 X 4 programming headers. A resistance of 10KW will produce unity gain, or +4dBu input sensitivity.

The two sections of A16 form the left and right virtual earth mixers. The output of A16 drives the LOOP output amplifiers (A1, A2), the meter driver (on the Display board) and analog switch A5.

LOOP CIRCUITRY

The left and right LOOP inputs are processed directly by differential amplifiers A1 and A2. The output of A1 and A2 feed analog switch A4. The outputs of analog switches A5 (controlling mix feed to the output) and A14 (controlling LOOP feed to the output) are paralleled and coupled to A3 the selectable gain program amplifier. This amplifier, A13, provides phase inversion and gain adjustment for +4 or +8dBu output. Jumpers near A13 are used to set the gain of A13 to unity or 4dB.

Analog switches A4 and A5 receive complementary logic from the logic board -when one is on the other is off. A4 and A5 form the switching necessary for operation of the LOOP mode.

The mix bus amplifier, A16, directly drives the inputs of the LOOP output amplifiers. The SSM 2142 ICs produce balanced output that behaves more a transformer than typical active balanced outputs. LOOP output is fixed at +4dBu.

OUTPUT CIRCUITRY

The MAIN and SUB output amplifiers are driven by A13, the adjustable gain program amplifier. In this case, however, pairs of 2142s are driven for each output. This parallel arrangement can produce +30dBm with very low distortion. Output source impedance is 25W and is ideal for driving studio wiring and telco lines.

DISPLAY BOARD

The display board, mounted behind the front panel, holds the three mode switches, the six select switches and the audio bar-graph displays. Switching is accomplished by contact closure to ground. For each function, front and rear panel switches are wired in parallel. All switches are de-bounced on the logic board.

Front panel status lights are diode isolated from the status lines on the individual rear panel logic connectors. Status lines for remote control use, those on remote connectors 'A' and 'B,' are isolated from all other status lines.

Left and right audio is sampled from the mixing amplifiers and feeds two Sanyo LB1412 display drivers. Multi turn trimmer V1 calibrates the right channel display and V2 the left.

The color coded 12-segment bar displays are driven by the open collector outputs on the LB1412. The display drivers and the LEDs are powered from the unregulated 12 volt output of the low voltage supply on the audio board.

See schematic page 29, Display Board.

LOGIC BOARD

The logic board controls all switching functions of the LX-1 . A 1 Farad capacitor powers the CMOS circuitry during power outages and normal station downtime.

Power for the logic board comes from dual 6 volt regulators on the audio board via J1 . One regulated line supplies power to the rear panel remote control connectors for external status lights. The other regulator powers the front panel lights and the circuitry on the logic board.

See schematics pages 25-28, the Logic Board.

LOGIC POWER

Diode D19 on the logic board couples power to the CMOS circuitry. DI 9 drops the regulated 6 volts to near 5 volts and prevents power drain through the power supply when main power is off When power is applied, DI 9 charges the two 1 Farad "Gold" capacitors C13 and C14. The capacitor will power the heart of the logic board for approximately a day when power is removed, thus retaining its state until power is applied.

When the LX-1 is powered up, U29 tests the voltage across C13 and C14. If this voltage is low enough that memory is not reliable, U29 executes a power on clear (POC) that will clear all logic states to off and set the LX-1 to the safe mode.

R35 and R36 form a voltage divider across the main power input to the logic board. When power is off a power-off command (PWOFF) is generated. The purpose of PWOFF is to extend memory time by disabling current-draining circuitry when power is off AND gates U11, U12 and U27 hold the inputs of the peripheral drivers to logic "0" when power is off The LX-1 will not accept control commands when power is off.

SWITCHES

All switch inputs are de-bounced by RC networks and Schmitt triggers on the logic board (IC U 13 and U20.) READY, LOOP and MIX modes use alternate action latches U2 1 and U22. A momentary low state from the switches generate alternate action at the output of the latches. The combination of READY, PWOFF and POC manage the state of the LOOP and MIX latches. READY will be set to off if POC has occurred.

LOOP LOGIC

The LOOP function requires that analog switches A14 and A15 always be in opposite states. This is accomplished by using the complementary outputs of U22, the LOOP latch. Normal program or LOOP input is selected by the alternate action of A14 and A15. A14 and A15 always break before making connections, thus eliminating transients during LOOP mode switching.

READY LOGIC

The READY toggle is produced by alternate action latch U21A. READY must be true, logic 1, for other switching to occur. The READY line drives three peripheral drivers (U28). A separate driver is used for the front panel, control connector and remote control READY status. The drivers are isolated by AND gate U27B.

SWITCH LOGIC

The six selection switch lines (channels 1-6) from front, rear panel and remote control inputs, are debounced by RC networks and Schmitt trigger U13. NAND gates, which monitor the READY line, serve to invert the switch logic and to inhibit control when the READY is not true.

The six switch lines feed U15, a priority encoder. Decoder U16 sets the selected channel's latch (U17 - U19). Pin 15 of encoder U15 changes state whenever a channel button is pressed. Sensing this change, NAND gates (U24 and part of U23) generate a reset pulse of required timing. U25 and U26 reset the output latches.

CHANNEL LATCHES

When a channel is selected, the latch for that channel is held at logical 1. This turns on the analog switch on the audio board for that channel. The latch also activates a dual one-shot that produces start and stop pulses for external devices. Since the output of the one-shot is logical 1 only during the pulse time, an AND gate between the latched output and the peripheral driver effectively removes the load from the CMOS supply when power is off.

A

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PC BOARD

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PARTS LIST: AUDIO BOARD

ITEM	DESCRIPTION	LOCATION	BURK P/N
IC: SSM-2141P	DIFFERENTIAL LINE RECEIVER	A1-A2, A17-A22, A24-A29, A31-A36, A38-A43, A45-A50, A52-A57	41702141
IC: SSM-2142P	DIFFERENTIAL LINE DRIVER	A3-A12	41702142
IC: SSM-2412P	DUAL ANALOG SWITCH	A14, A15, A23, A30, A37, A44, A52, A58	41702412
IC: NE5532AP	DUAL OP AMP	A13, A16	41715532
IC: MC78M06CT	6 VOLT REGULATOR, 500 MA	U3, U4	43007006
IC: MC7818CT	POSITIVE 18 VOLT REGULATOR	U1	43007818
IC: MC7918CT	NEGATIVE 18 VOLT REGULATOR	U2	43007918
IC: 1N4007	SILICON RECTIFIER	D1-D10	40014007
CAPACITOR	47 PF MONOLITHIC CERAMIC	C37, C41	12221470
	100 PF MONOLITHIC CERAMIC	C31, C32	12221101
	0.1 MFD MONOLITHIC CERAMIC	C4-C30, C38, C40, C43-C115	12221104
	10 MFD 50V ALUMINIUM	C39, C42, C116-C131	10110106
	100 MFD 50V ALUMINIUM	C33-C36	10110107
	2700 MFD 35V AL	C1-C3	10110278
RESISTOR	1 K Ω , 1/4W, 1%	R1, R2, R16, R17	20210010
	2 K Ω , 1/4W, 1%	R28, R32, R40, R44, R52, R56, R64, R68, R76, R80, R88, R92	20220010
	3.01 K Ω , 1/4W, 1%	R19, R20	20230110

continued on next page...

PARTS LIST: AUDIO BOARD (continued)

ITEM	DESCRIPTION	LOCATION	BURK P/N
	5.9 K Ω , 1/4W, 1%	R25, R29, R37, R41, R49, R53, R61, R65, R73, R77, R85, R89	20259010
	6.34 K Ω , 1/4W, 1%	R27, R31, R39, R43, R51, R55, R63, R67, R75, R79, R87, R91	20263410
	10 K Ω , 1/4W, 1%	R3, R4, R6, R7, R10, R11, R15, R18, R26, R30, R38, R42, R50, R54, R62, R66, R74, R78, R86, R90	20310010
	20 K Ω , 1/4W, 1%	R9, R12, R13, R14, R23, R24, R35, R36, R47, R48, R59, R60, R71, R72, R83, R84	20320050
TRANSFORMER	TYPE 6445	T1	30406445

PARTS LIST: DISPLAY BOARD

ITEM	DESCRIPTION	LOCATION	BURK P/N
IC: LB1412	DISPLAY DRIVER	A1, A2	42001412
DISPLAY	CUSTOM DISPLAY		43021225
CAPACITOR	1 MFD 50V AL	C1, C6	10130105
	2.2 MFD 50V AL	C2, C4	10130225
	4.7 MFD 50V AL	C3, C5, C7	10130475
RESISTOR	820 Ω 1/4W 5%	R7, R12	20182050
	1.5 K Ω 1/4W 5%	R3-R6, R8-R11	20215050
	4.7 K Ω 1/4W 5%	R2, R13	20247050
	1 MEG Ω 1/4W 5%	R1, R14	20510050
VARIABLE RESISTOR	100 K Ω TRIMMER, 12 TURN	V1, V2	23110104

PARTS LIST: LOGIC BOARD

ITEM	DESCRIPTION	LOCATION	BURK P/N
IC: CD4011UB	QUAD NAND GATE	U14, U23, U24, U25, U26	41514011
IC: CD40106	HEX SCHMITT TRIGGER	U13, U20	41540106
IC: MC34164	VOLTAGE MONITOR	U29	41534164
IC: 74HC148B1R	PRIORITY ENCODER	U15	41514148
IC: 74HC138N	DECODER	U16	41514138
IC: 74HC107N	DUAL LATCHES	U17-U19, U21, U22	41514107
IC: HC123N	DUAL ONE-SHOT	U5-U10	41514123
IC: 74HC08	QUAD NAND GATES	U11, U12, U27	41516008
IC: ULN2003A	PERIPHERAL DRIVER	U1, U2, U3, U28	41022003
DIODE	1N4007	D1-D23	40014007
RESISTOR	180 Ω 1/4W 5%	R35	20118050
	220 Ω 1/4W 5%	R36	20122050
	330 Ω 1/4W 5%	R1-R3, R37-R42	20133050
	22 K Ω 1/4W 5%	R16, R18, R20, R22, R24, R26, R28, R30, R32	20322050
	43 K Ω 1/4W 5%	R34	20343050
	100 K Ω 1/4W 5%	R17, R19, R21, R23, R25, R27, R29, R31, R33	20410050
	220 K Ω 1/4W 5%	R4-R15	20422050
CAPACITOR	0.1 MFD MONOLITH CERAMIC	C16-C33	12221104
	10 MFD 50V AL	C1-C12, C15	10110106
	1 FARAD GOLD CAP	C13, C14	10001010