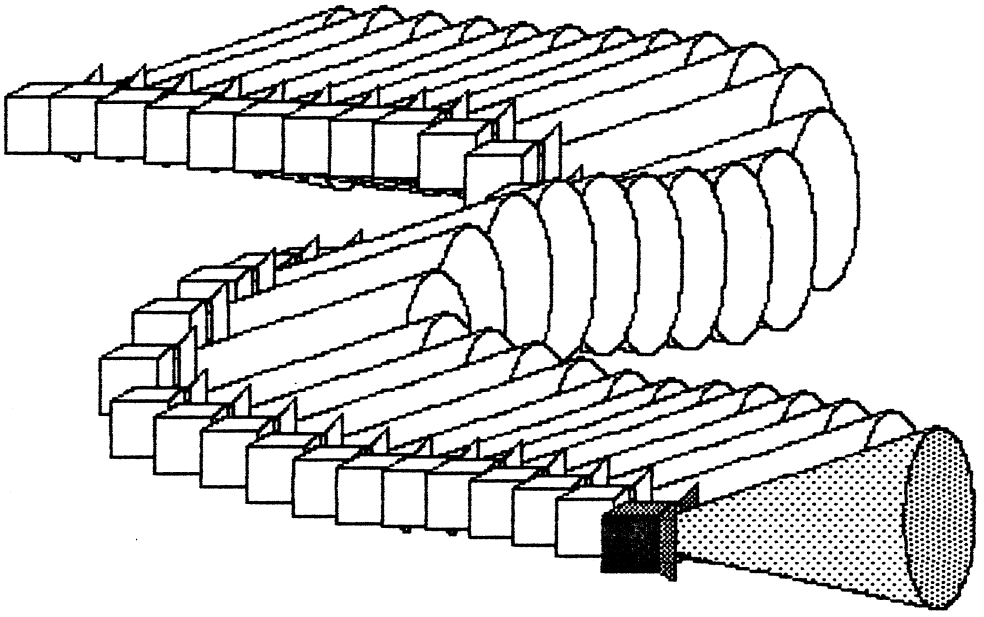
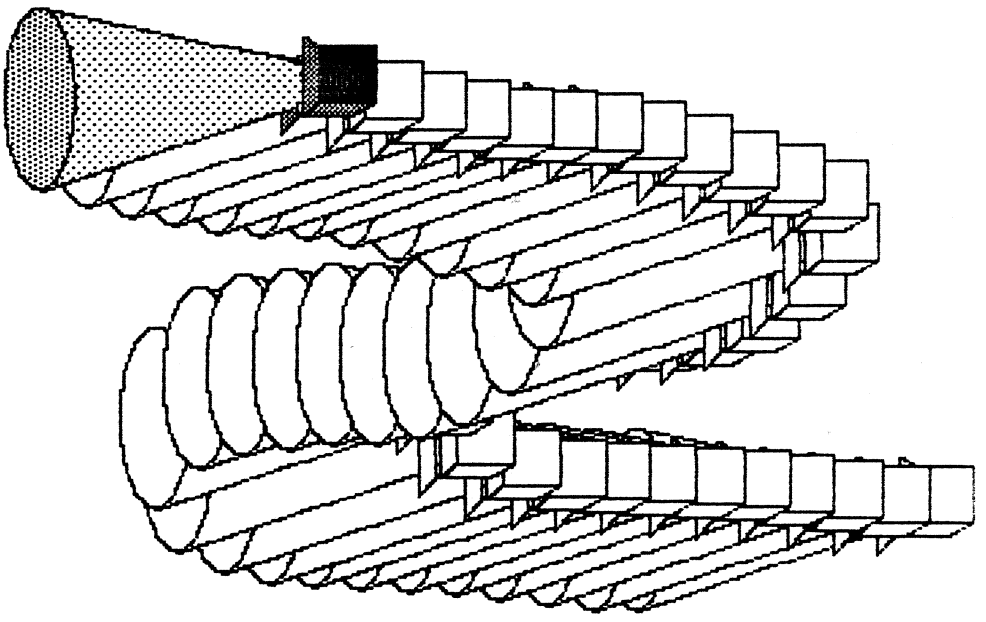


J.L.Cooper
Electronics

Midi Lighting Controller (MLC-1)



Owners Manual

MLC-1: Brief Introduction

Your J.L.Cooper MLC-1

allows for the controlling of a lighting system by a MIDI sequencer system. The assumption behind the development of the MLC-1 is that more and more groups are using a MIDI sequencer as part of their act to augment their sound. Once the decision to perform "in sync" with the sequencer has been made, then it makes sense to allow the sequencer to handle as many of the "syncronized" elements of the performance as possible.

The typical lighting system consists of three principle units: The Control Unit, the Dimmer Packs, and the lights themselves.

The Control Unit usually has a set of fader controls, one for each light channel. It outputs a Control Voltage for each of the lighting channels. This voltage is typically in the range of 0 Volts to +10 Volts for full off to full on respectively. Keep in mind that this voltage **is not** powering the lights directly. It is strickly a low-power voltage used only to tell the next element, the Dimmer Pack, what to do.

The Dimmer Pack takes the control voltage, isolates it, and in turn controls the kilowatts to the lights.

The MLC-1 replaces the Control Unit. It has fader controls just like on a simple system, but as the fader controls are moved up and down, MIDI information representing these motions is sent out for recording by the sequencer.

During playback of the MIDI data, the MLC-1 decodes this data and produces a voltage in a 0 to +10 Volt range, one output for each of the lighting channels (not to be confused with MIDI channels!)

A Simplified Proceedure--

1. Record all music parts into the sequencer.

2. Set the MLC-1 to an un-used MIDI channel. Attach Dimmer Packs to control outputs of the MLC-1 and lights to output of Dimmer Packs. Put the MLC-1 into the "MAN" mode.

3. Put sequencer into an overdub mode so that you can record from the MLC-1 while listening to playback of music.

4. Using the music as cue, bring up and down the faders as necessary. For instance, if the guitarist is going to take a solo at a particular point, bring up his spot fader then. Or if there is a slow mood change at measure 28, do so on the faders. If there are too many changes, just overdub on the sequencer.

5. Now put the sequencer into playback, put the MLC-1 into "AUTO" and watch the lights magically sync to the music.

The MLC-1 converts the fader motion into a series of MIDI NOTE ON commands with the fader number represented by different MIDI notes and the position of the fader represented by the MIDI Velocity information.

By using this universal system of MIDI NOTE ON commands, compatibility with virtually any MIDI sequencer is assured. The only requirement is that Velocity is recorded, which is the case with all known units. This does not mean that there never will be a low-cost sequencer in the future without velocity, so you should ask before buying.

MLC-1 : Theory of Operation

Record Path:

Refer to Figure 1. The set of 12 Lighting Faders each have a voltage applied to them. The fader will therefore have a voltage proportional to its position as an output. The whole set of faders are fed into a circuit that can quickly select one of them and convert its voltage into a digital number that can be used by the microprocessor. So at any given instant, the microprocessor "knows" the position of each of the faders.

The microprocessor actually tests the faders about 100 times a second. Each time it does this test, it compares the position of the fader against the position 1/100th of a second earlier. If it finds that the position has changed, then it will form a MIDI NOTE ON command, and send it to the UART. The note number used for the command is based on the fader number (each light has its own note number) and the MIDI Velocity value is based on the new position of the fader.

The UART (Universal Asynchronous Receiver/Transmitter) converts the command from the microprocessor into the one-bit-at- a-time serial form required for MIDI. The output of the UART goes into a current driver that in turn is used as the actual MIDI output.

In addition, there are four auxilliary switches on the front of the MLC-1 which are also tested 100 times a second by the micro processor. They each act as a push-on/push- off control. If the micro-processor sees a change in status for the aux. switches, it will form a MIDI NOTE ON Command just like the faders did. In this case, the Velocity value will be either of two values, depending on whether the Aux. is on or off.

This description has so far ignored the Master Fader and Flash controls. The Master Fader changes the value of the voltage fed to the set of faders as a whole, and the Flash buttons instantaneously changes the voltage output for a given fader to full value while held down.

Playback Path:

Refer to Figure 2. Incoming MIDI commands are first electrically isolated by the Opto- Isolator, which also converts the MIDI current into a voltage. This voltage is then fed into the input of the receiver section of the UART. The UART converts the serial data of the MIDI command into a form more easily handled by the microprocessor.

If the microprocessor decodes a MIDI NOTE ON command on the same channel as chosen by the internal switch, and in the proper note range, it takes the MIDI Velocity value and places it into a memory location depending on which actual note number of the command.

On a periodic basis (about 100 times a second) the microprocessor goes thru this list of locations and applies the number found there to a Digital to Analog converter (DAC). The DAC converts this number into a voltage, which is then temporarily stored in a circuit called a Sample and Hold. As the name implies, this circuit "Holds" the voltage until the next update, 1/100th of a second later. There are twelve Sample and Holds, one for each of the lighting channels. Each receives the proper voltage from the DAC in turn, but the output stays steady because of the "Hold" feature.

The set of twelve control voltage outputs go directly to connectors on the rear of the MLC-1. These voltages are of a low-current nature, not at all suitable for the powering of even a small light. To convert this low-power voltage into high-power, an external Dimmer Pack is used. Most brands of Dimmer Pack may be accommodated. The only requirement is that it have a separate input for each lighting channel (NOT Multiplexed like with the SUNN system) and that the input control voltage range be roughly 0 to +5 up to +15 Volts. An internal switch allows Packs with 0 Volts for full on.

In addition, a set of four ON/OFF AUX. Voltages are available. These are also low power, but are powerful enough to drive a low-power relay to fire a flashpot, advance a slide projector, turn on a strobe unit or whatever.

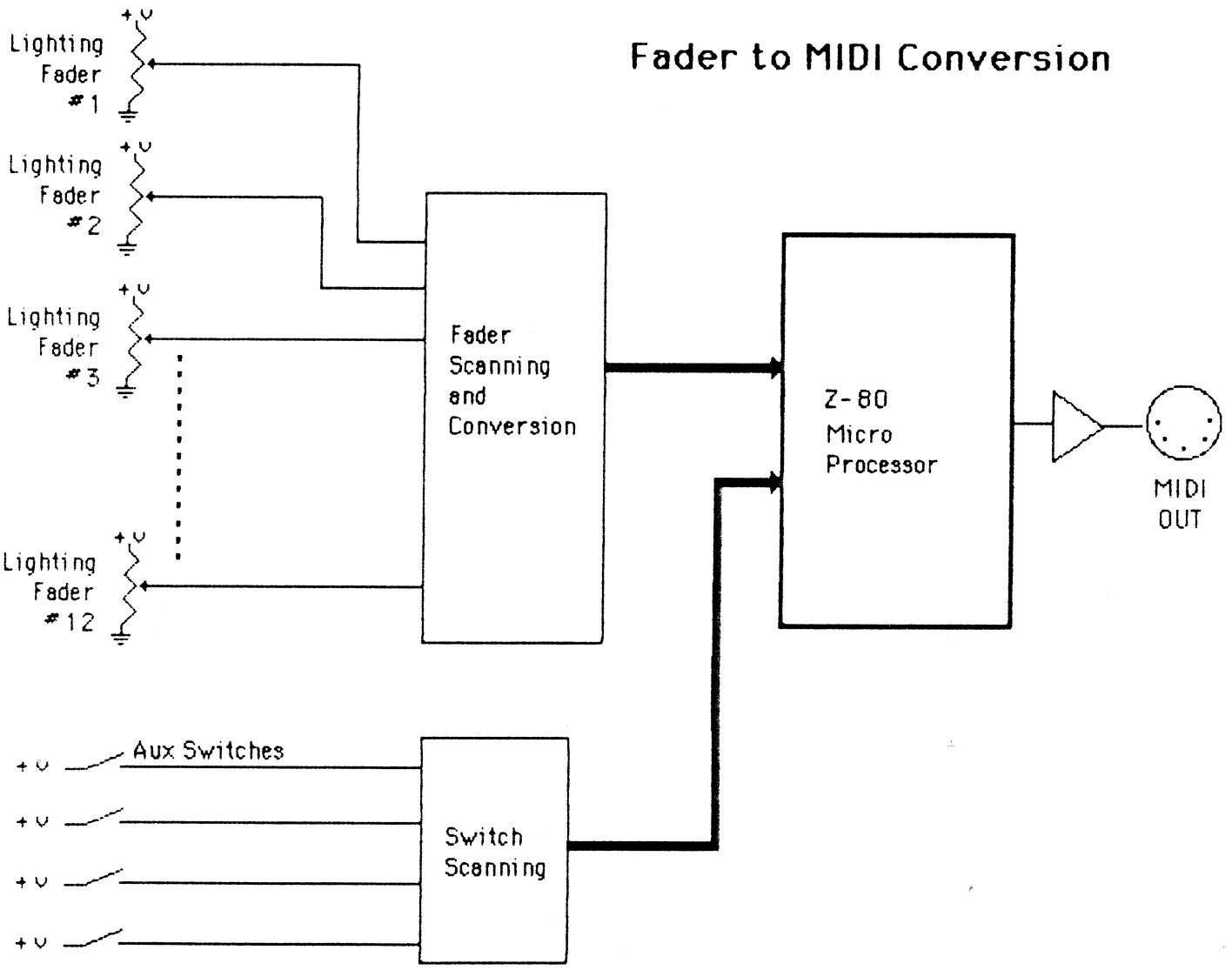

Fader to MIDI Conversion
Lighting Fader #1
Lighting Fader #2
Lighting Fader #3
Lighting Fader #12
+ v
Fader Scanning and Conversion
Z-80 Micro Processor
MIDI OUT
Aux Switches
Switch Scanning

Fig 1

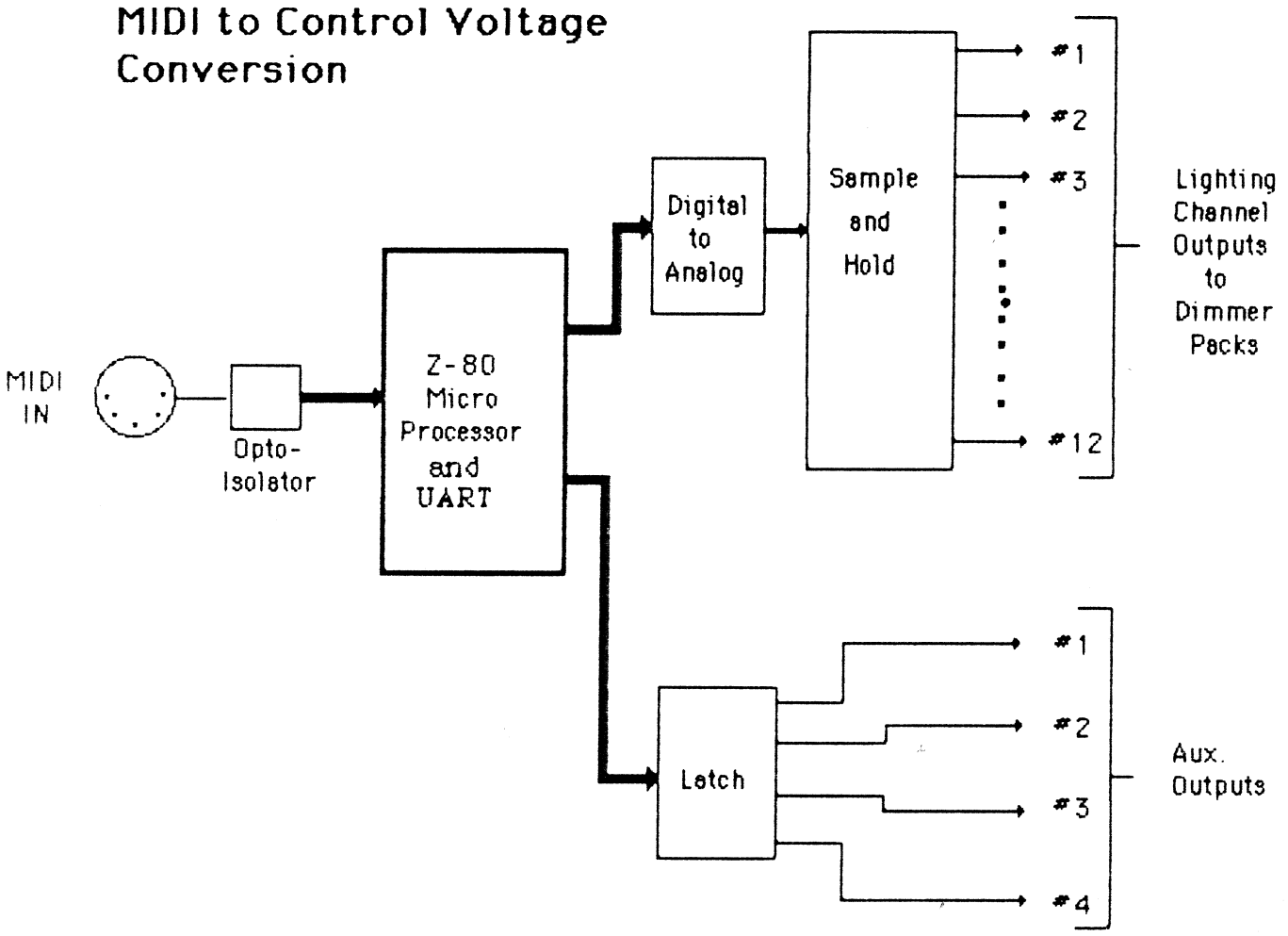
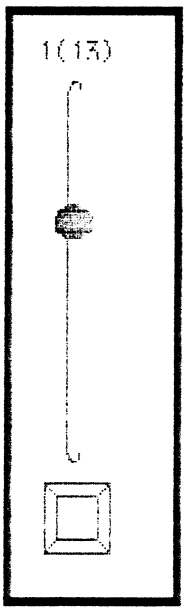

MIDI to Control Voltage Conversion
MIDI IN
Opto-Isolator
Z-80 Micro Processor and UART
Digital to Analog
Sample and Hold
#1
#2
#3
#12
Lighting Channel Outputs to Dimmer Packs
Latch
#1
#2
#3
#4
Aux. Outputs

Fig. 2

Controls-

The front panel controls of the MLC-1 either set the mode of operation (MODE SWITCH and BANK Switch), allow for the pro- gramming of the MIDI Sequencer (Faders, AUX Switches, and Blackout Switch), or indicate current status (LEDS).



The FADER control's main purpose is to "teach" the MIDI sequencer how a given light channel is to behave. As the FADER is moved up and down, MIDI NOTE ON commands are sent from the MLC-1 to the sequencer as indication of the FADER's position. The sequencer will store these NOTE ON commands exactly as if the data was coming from a synth, taking note of the exact moment that each command is received. Upon playing back the sequence, the MLC-1 will translate the NOTE ON data back into a control voltage suitable for driving a Dimmer Pack, and hence a light. Each of the FADER controls sends its own MIDI NOTE number, and the position of the FADER is represented by the MIDI VELOCITY sent with the NOTE. If the MLC-1 is equipped with the EXPANSION board, an additional twelve light channels may be controlled by going into the BANK 2 mode. While in BANK 2, the FADERS send different MIDI NOTE numbers, allowing the data to go to the correct light channel during playback. The numbers in parenthesis indicate the lighting channel numbers while in BANK 2.

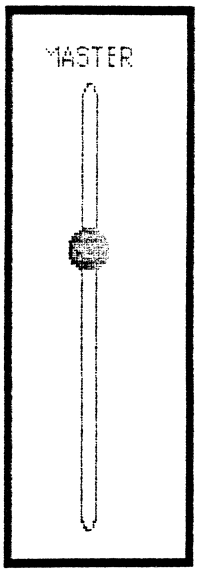
The Button below the FADER control is the FLASH BUTTON, which brings the output of its corresponding fader control to full brightness instantly as long as it is depressed. This is useful for quick changes to punctuate a musical phrase with light.

Movement of the FADER ALWAYS result in the sending of MIDI NOTE ON commands thru the MIDI OUT jack. In addition:

While in the MLC-1 is in MAN MODE, the FADER controls also directly control the corresponding control voltage output to allow visual monitoring of the lighting. Incoming MIDI data is ignored.

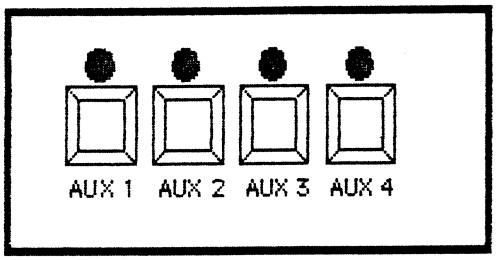
In the MIX MODE, movements of the faders will result in modification of that light's output even during playback of a sequence. As soon as a new MIDI NOTE ON command is received for a particular lighting channel, that control voltage output will immediately reflect this new level.

In AUTO MODE, movement of the FADER continues to send out MIDI NOTE commands, but is ignored by the corresponding light channel control output.

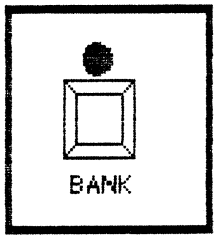


The MASTER FADER control acts on all FADER controls in the current BANK at the same time. That is, while in BANK 1, the MASTER FADER acts upon lighting channels 1 thru 12, and upon lighting channels 13 thru 24 while BANK 2 is active (assuming the MLC-1 EXPANDER is installed.) The MASTER FADER is particularly useful for bringing up a whole scene at the same time. While this would be possible by over-dubbing the sequence one FADER at a time, the MASTER FADER is a useful short-cut. The FLASH buttons continue to function even if the MASTER FADER is down all of the way.

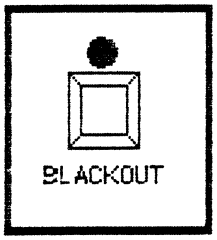
Controls- Continued



The set of four AUX Switches controls the ON/OFF functions of the AUX outputs. When the LED is ON, the corresponding AUX output is at a high level. If the MLC-1 is in the BANK 2 mode, the AUX Switches affect the BANK 2 AUX outputs, and the LEDS show that status.

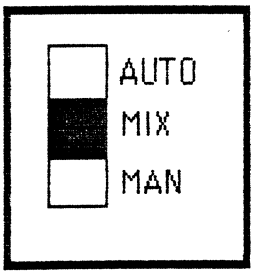


If the MLC-1 is equiped with the expansion board, it is capable of controlling up to 24 channels of lighting and 8 AUX channels. To allow the 12 faders and 4 Aux swithces to control the extra channels, a concept of BANK 1/ BANK 2 is used. The normal channels 1-12 are controlled when the unit is in BANK 1, indicated by the BANK LED being off. The movements for these first twelve channels are loaded into the sequencer first. Then, the BANK button is pushed to go to BANK 2, and the movements for the second bank (channels 13-24) are recorded by over-dubbing on the sequencer. Keep in mind that the status of the BANK is not important during the playback process. The MIDI NOTE ON commands will automatically end up going to the correct light channel.



The BLACKOUT switch has two functions, depending on whether you are in record or playback. In the record mode, the blackout switch acts as an instant Master Fader control to immediately bring all lighting channels up or down at once. This may not be compatible with all sequencers, since the MLC-1 is sending ALOT of data at once- if it doesn't work on your system, you should use the Master Fader for this function.

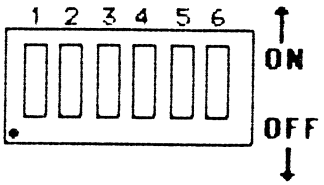
In the playback mode, the blackout button acts as a sort of Panic Button, killing all lighting information instantly. This is particularly useful if you should attach the MIDI cables while data is flowing, or do anything else that would jumble data or confuse the MLC-1. The BLACKOUT switch is momentary acting in this mode. Any subsequent MIDI NOTE commands will act on the correct channel.



The MODE SWITCH changes the way that the playback circuity behaves. MIDI NOTE data is sent from the MLC-1 no matter which position this switch is on. If the switch is in the MAN position, the playback (ie. the output control voltages) is directly controlled by the fader controls, ignoring any MIDI data that comes in. This would be the most likely position to use when recording from the faders to the sequencer, so that you can see the results of your fader moves. In the AUTO position, the control voltages strickly follow the MIDI data, ignoring anything done with the faders. This would be a likely mode for normal playback.

Finally, the MIX postion combines the MAN and AUTO mode. Any incoming MIDI data will control the output control voltages as in AUTO, but changes made to the position of any of the faders will be reflected in the output control voltages, as with MAN. If a change in a fader position is made, the output control will stay at that value UNTIL a new MIDI command for that channel is received, at which point the output assumes that new value.

Internal Controls



MIDI Channel	Sw. 1	Sw. 2	Sw. 3	Sw. 4
1	off	off	off	off
2	on	off	off	off
3	off	on	off	off
4	on	on	off	off
5	off	off	on	off
6	on	off	on	off
7	off	on	on	off
8	on	on	on	off
9	off	off	off	on
10	on	off	off	on
11	off	on	off	on
12	on	on	off	on
13	off	off	on	on
14	on	off	on	on
15	off	on	on	on
16	on	on	on	on

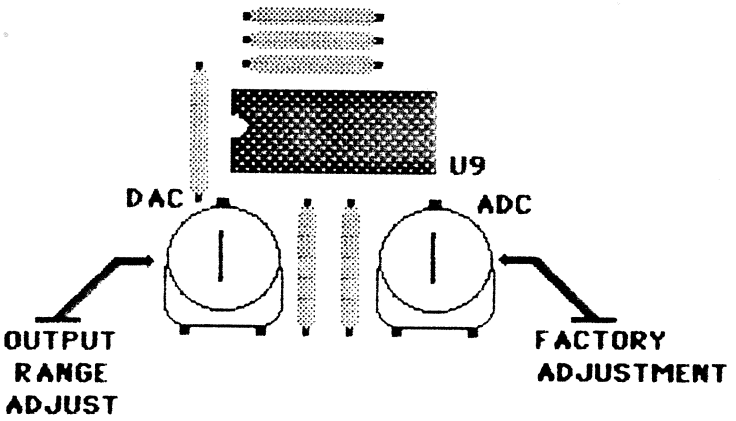
Sw. 5 - ON= Note ON/OFF Pairs sent
OFF= Only Note ON sent

It is probably safest to leave this switch in the ON position. If storage space is tight, you might try this switch in the OFF position. This will cut storage requirement by half, but might possibly confuse a given make of sequencer by sending unpaired NOTE ON commands.

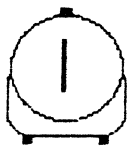
Sw. 6 - ON= INVERTED Control voltage Output
(0 Volts = Full On)
OFF= NORMAL (0 Volts = Off)

Most models of Dimmer Packs use 0 Volts as the control voltage for Light Off, and an increasing positive voltage for increasing light level. For these Packs, Switch 6 should be OFF. Certain models such as the SPECTRUM QEP-15 and -20 use 0 Volts for full ON and increasing voltage for decreasing light level. For these Packs, Switch 6 should be ON.

The MIDI Channel number is set with Switches 1 thru 4 as shown in the chart above. In general, you want to put the MLC-1 on a channel that won't interfer with any other synth MIDI channel. As shipped, the MLC-1 is set on Channel 1. Naturally, the setting will affect both sending and receiving Channels.



There is no "standard" among Dimmer Packs for the full-on control voltage. It tends to be factory set to anywhere from 0-5 Volts up to 0-15 Volts. In many cases, there are internal adjustments that allow this range to change. As shipped from J.L. Cooper, the MLC-1 is set for a 0 to 15 Volt range. To adjust this, hook-up the MLC-1 to the Dimmer Pack, and it to the light with the MLC-1 cover off. Put the MLC-1 into the MAN MODE and slowly bring up a FADER. If the Max light level seems to be reached while the FADER is only part-way up, turn the DAC trimmer CounterClockways a little and try again. This adjustment also effects the AUX outputs.



PREHEAT

The PREHEAT trimmer adjusts the minimum (light off) voltage that is sent as a control voltage. This minimizes the "shock" that a light experiences when first turned on. This is caused by a large surge of current that passes thru a cold filament. To adjust this, all lights and dimmer packs must be hooked up. Take all dimmers full down, and bring up the PREHEAT control until the first light just becomes visibly on. **NOTE:** this adjustment also effects the AUX output. It may upset the operation of some external switching device if the PREHEAT is turned up too high.

System Hook-Up

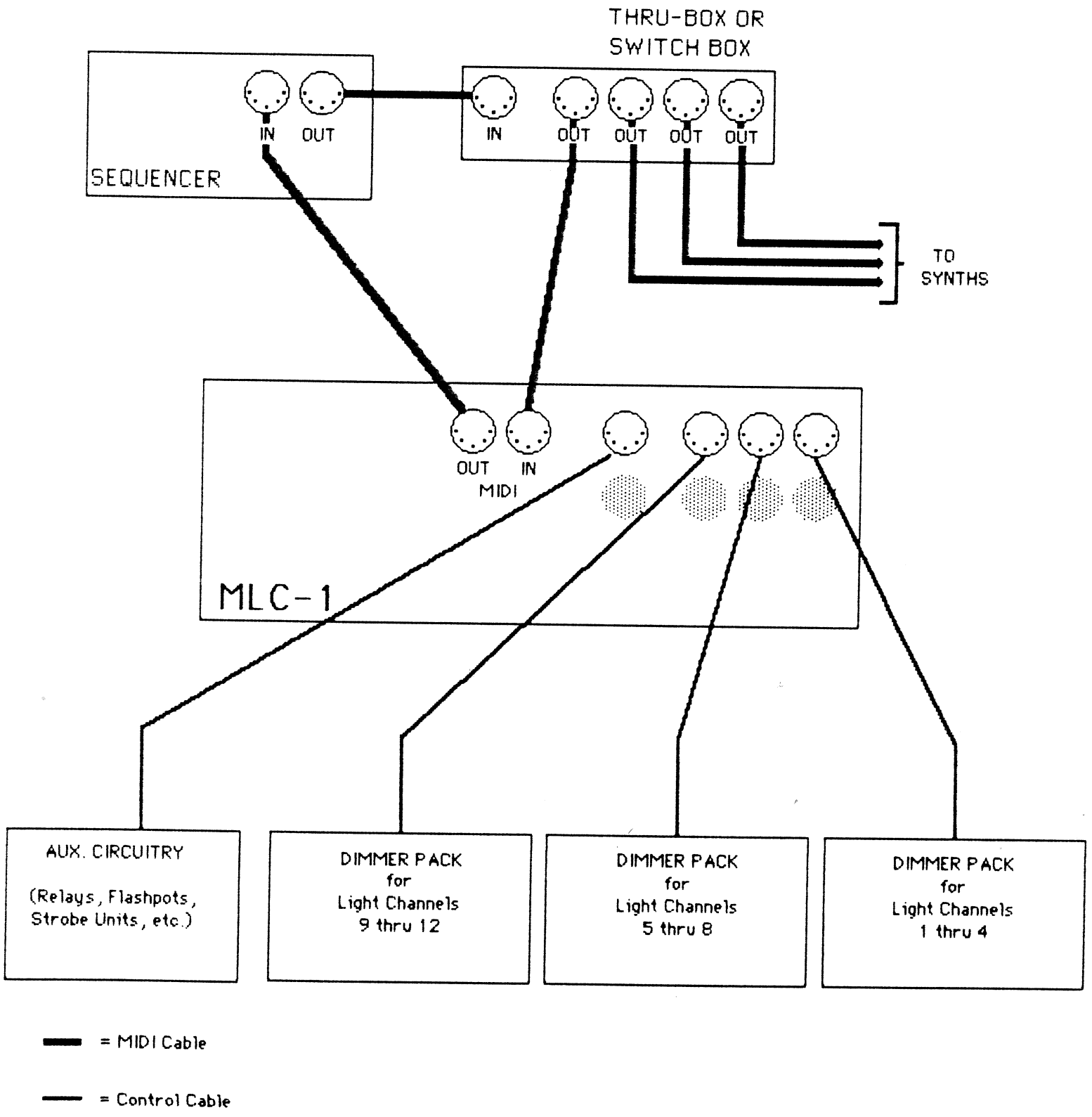


Fig 3

OUTPUT Connections

The Control Voltage outputs appear four at a time via the rear panel DIN connectors. Unfortunately, their is NO standard for connection to various makes of dimmer packs. Therefore, an adapter cable must be made depending on which make you use. To the right is the pin-out for each of the connectors on the rear. Following is a list of known dimmer pack adapter cable wiring.

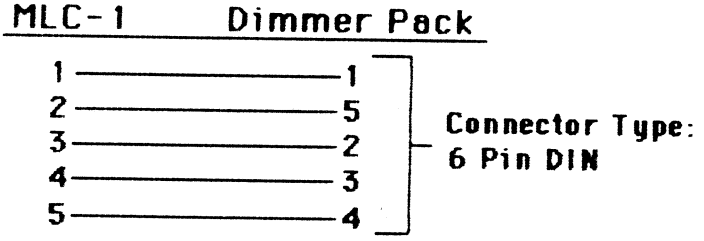
Armed with this information, your local friendly technician should have no trouble in fabricating the desired cable. Alternately, the maker of the dimmer pack will probably be able to provide your needs.

Control Voltage
Output Connector
PIN-OUT

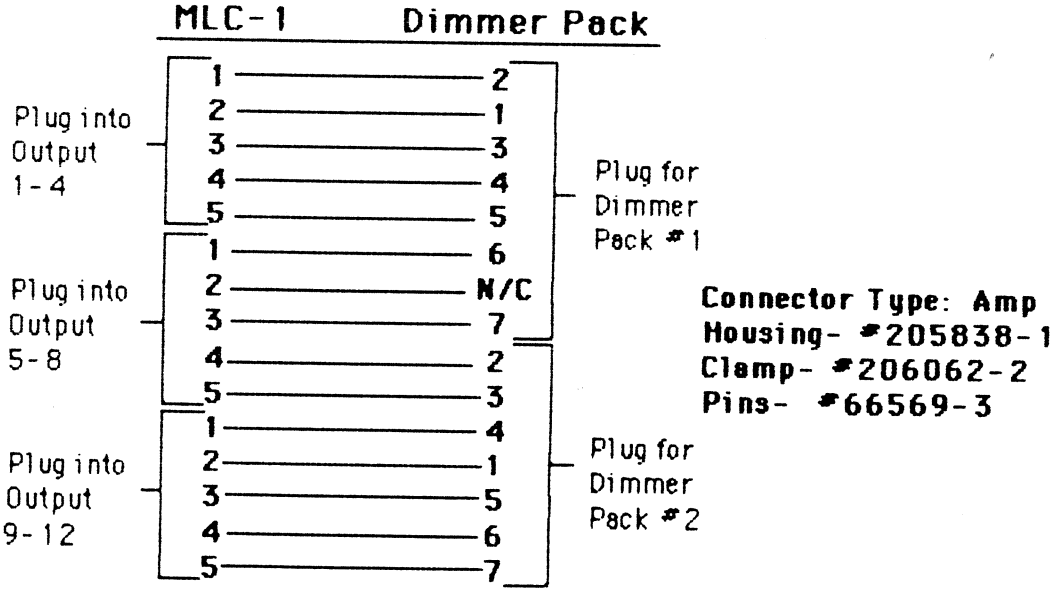
1-- Chan 1 (or 5 or 9)
2-- GROUND
3-- Chan 2 (or 6 or 10)
4-- Chan 3 (or 7 or 11)
5-- Chan 4 (or 8 or 12)

CONNECTOR- Standard 5 Pin DIN

ETA LIGHTING- Model #1251 and 1252



SPECTRUM- Model OX-12 and OX-24



SPECTRUM- Model QEP-15 or -20

MLC-1	Dimmer Pack
1	2
2	1
3	3
4	4
5	5

Connector Type:
Cinch Jones P3306
or equiv. (6 Pin Male)

Note- DIP Switch #6 should be switched "ON" for correct operation.

Applied Electronics Inc.
Model MiniPack 1200

MLC-1	Dimmer Pack
1	1
2	8
3	2
4	3
5	4

Connector Type:
12 Pin Cinch Jones

Applied Electronics Inc.
Model DimPack 2400

	MLC-1	Dimmer Pack	
To Output Connector 1-4	1	1	To Dimmer Pack #1
	2	8	
	3	2	
	4	3	
	5	4	
To Output Connector 5-8	1	5	
	2	N/C	
	3	6	
	4	1	To Dimmer Pack #2
	5	2	
To Output Connector 9-12	1	3	
	2	8	
	3	4	
	4	5	
	5	6	

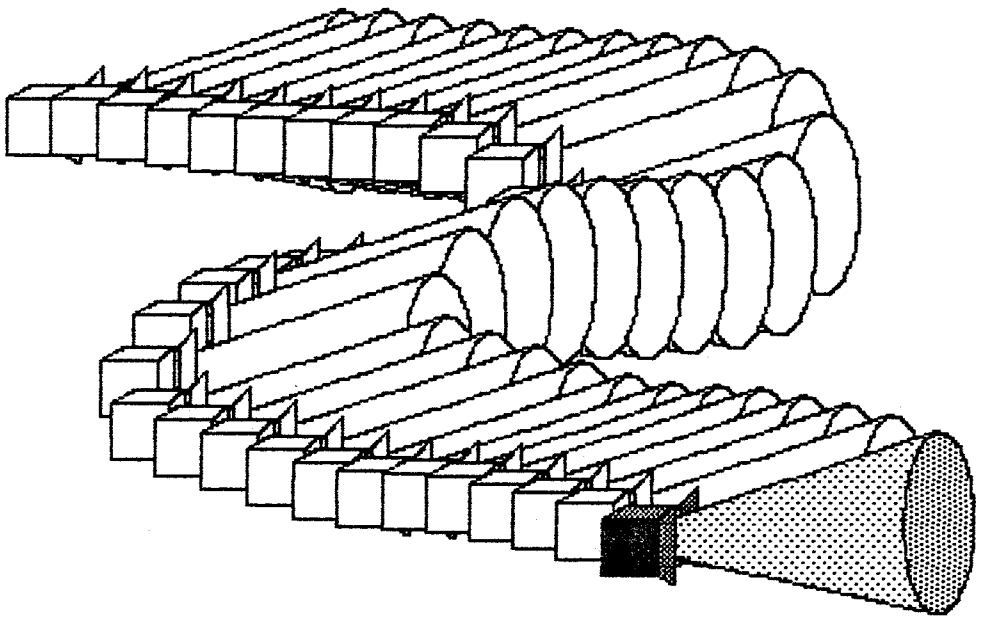
Connector Type:
12 Pin Cinch Jones

Leprecon LD-360

Use same pinout as the Applied Electronics DimPack 2400 EXCEPT use 8 Pin Cinch Jones plug.

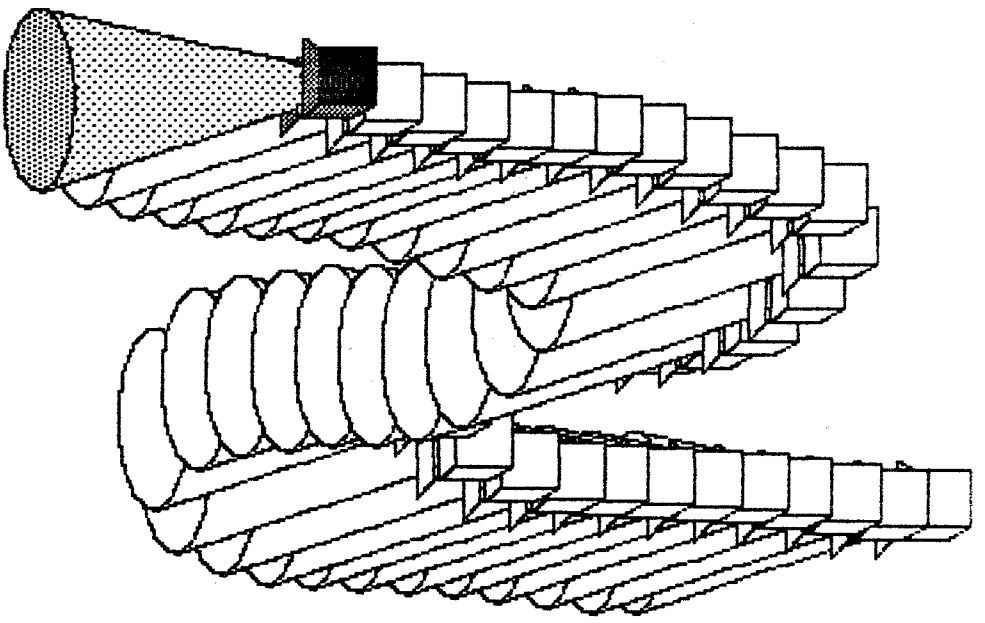
LSS Model M3000 and M3000P

Use same pinout as the Applied Electronics DimPack 2400 EXCEPT us 10 Pin Cinch Jones plug. In addition, an internal jumper inside the LSS unit should be removed for 0-10 Volt operation. Consult owners manual or LSS for details.



J.L.Cooper
Electronics

Midi
Lighting
Controller
(MLC-1)



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