LEPRECON®

PRO LIGHTING EQUIPMENT

LD-360M AND LD-360M-HP
USER'S MANUAL

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MIDI FEATURES

What is a "Channel" anyway?

The LM-850 console has 54 "Control Channels" in 3 banks of 18 faders.
The LM-850 Soft-Patch lets you control each of 108 "Dimmer Channels" from any control channel.
Channel level data for these 108 channels is sent to dimmers thru the console's MIDI, DMX or Analog outputs.
Each LD-360M Dimmer Pack has Six "Dimmer Pack Channels" which can be set to respond to any six sequential Dimmer Channels.
There are sixteen "MIDI Channels" in a MIDI output on which the LM-850 can send data, and to which each pack can selectively respond.

Basic System Hook-Up

Integrating the LM-850 into a standard lighting system is a simple process. A convenient system can be set up using MIDI-controlled dimmers, such as Leprecon's LD-360M and LD-360M-HP. In this situation the three MIDI Dimmer Interface outputs are used to send data to the dimmers (see Figure 1). Any number of dimmers can be used, and all should be set to the same MIDI channel as the console's MIDI dimmer output. Each dimmer must be assigned a specific "starting address" so that its channels are assigned to the correct control channels. Dimmers having the same starting address will be controlled simultaneously by the same console faders.

PICTURE

Multiple MIDI dimmers can be connected either to the three Dimmer outputs on the LM-850's rear panel (all three work in parallel-it doesn't matter which is used), or the dimmers can be daisy-chained. In this situation, the console's MIDI Out To Dimmers is connected via a normal MIDI cable, to the MIDI In of the first dimmer. Then, a second MIDI cable is run from the MIDI Thru of that dimmer to the MIDI In of the next dimmer, and so on. So a MIDI dimmer can be plugged into either a Dimmer MIDI Out from the LM-850 or into the MIDI Thru of any other connected dimmer. You will need to make sure that the console's Dimmer Output is assigned to "MIDI" and once again that both the console and the dimmers are all on the same MIDI channel. At this point, you should be able to plug lamps into the dimmers, and begin operating the board.

MIDI Implementation

Normal Control
The dimmer output channels can be controlled by any one of the MIDI continuous controllers 00 through 120. The LM-850 console will control the dimmers using exclusively MIDI continuous controllers 00 through 107, allowing each channel to be set at any of 128 discrete levels from the light off (0) to full on (127).

Stand Alone Operation

The MIDI dimmer will also respond to MIDI note ON, MIDI note OFF, and velocity messages. While those commands are not usually generated by the console, they allow for controlling the dimmer directly from standard MIDI controllers such as keyboards, sequencers, MIDI percussion, or drum machines. When used in this fashion, a dimmer is turned on by MIDI note ON message. The note number determines which dimmer is addressed according to the starting address switch (If the address switch is set at 11, the 1st dimmer in the pack will respond to note 11, the 2nd dimmer will respond to note 12 etc.). The "velocity" value of the note ON sets the brightness of the light. A dimmer remains on until turned off by a note OFF message.
Even for a very short note ON note OFF sequence, a dimmer will turn on for at least 200 ms. This will allow drum machines or MIDI percussion systems to produce perceivable flashes of light. Even in this stand alone application, the MIDI dimmer will still respond to MIDI continuous controller commands having the same number as the dimmer identity number.

MIDI Channel

MIDI channel 1-16 and OMNI on-off can be set by dip switch…see previous description. Since too much data can slow down MIDI system response time, it is advisable to run a separate MIDI circuit for the lighting system, which will carry only lighting data. The synthesizers, etc. would be on other MIDI circuits, so their response time would be unaffected by demands for lighting data transmission. Most systems should therefore be run in channel 1, OMNI ON.

Playing Sequenced Cues Without the LM-850

For specific applications, it is possible to use the LM-850 to program a show where the console would not be used at all for playback, if MIDI dimmers are being used. The dimmers can be plugged into the MIDI Out from the sequencer just as the LM-850 normally would, and they will respond to the data as if the console were in place. This method can be used for setups where minimal equipment is desired, but it does have some limitations. First of all, it leaves no margin for changing the show in any way, without connecting in the LM-850 once again. Secondly, it leaves no way to manually being up any lights if this becomes necessary (other than by controlling them, say, with a keyboard driving the dimmers). It also requires lots of MIDI data, which may slow down complex shows.

The gist of this technique is that the show is recorded from the LM-850, and the sequencer is fed from the MIDI Dimmer Out rather than from the System Out. Anything that the console does-scene changes, chases, etc., -will be recorded by the sequencer. The console can send out this data in either CONTinous controller or NOTE mode. Again, the former is the most efficient. Be sure that on playback, the dimmers are set to the same MIDI channel that the sequencer data was recorded on. The sequencer then mimics the LM-850's output, driving the dimmers directly-and the 850 is not needed unless real time intervention is required.

Dimmer Control Assignment

The LD-360M and LD-360M-HP MIDI dimmer packs have 6 dimmer circuits built-in. Each dimmer pack has a MIDI input and MIDI thru connector. Each pack also has an identity number assignment switch. This switch is used to assign a Starting Address to each dimmer pack from 00 to 99. If a 6 channel dimmer pack is assigned the starting address 10, the 1st dimmer in the pack will respond as dimmer

channel 10, the 2nd dimmer as number 11, the 3rd as number 12 etc. Its address range will be channel 10 thru 15. In a typical configuration, the control console and a number of dimmer packs will be connected together in a daisy-chained system. The switchable Starting Address allows the console to address each specific dimmer pack in the chain. If two or more dimmers are set to the same channel number, they will react together to controls sent for this dimmer channel number. The user should therefore set up each dimmer pack with an address range in order to control each dimmer channel independently. Multiple dimmer packs can be addressed in sequence or can share or overlap control channels, so several dimmer pack channels can be set to respond to a control channel.

MIDI Channel Assignment

MIDI channels are software or "virtual channels", over which a MIDI device can selectively send or receive over one MIDI cable. An LD-360 MIDI Dimmer will respond only to information sent on the MIDI Channel to which it is assigned, unless it's OMNI switch is ON, in which case it will respond to dimmer levels sent on any MIDI Channel. The LM-850 MIDI Lighting Console can be set to transmit MIDI Dimmer Data on any MIDI Channel between 1 and 16. After resetting the MIDI Channel switches the dimmer must be powered down and up again before the change will be recognized.

Units are shipped set to OMNI, MIDI Channel 1. (All dip switch positions down)…and in most cases should remain at this setting, with the address switch reset as needed. (See above.) Please do not reset the MIDI channel dip switches until you are familiar with MIDI and your system setup.

MIDI Channel Assignment Table

Panel Layout Diagram

The LD-360M has one power cord, and the 360M-HP has two cords (and breakers and filters)…one for dimmer channels 1-3, and one for dimmer channels 4-6. NOTE that if the available electrical service is Three-Phase…both power cords of an HP pack must be plugged into separate circuits which are connected to the same phase. Plugging the second power cord into a different phase of three-phase will cause the second three channels to fade improperly.
The packs 20 amp magnetic circuit breaker protects the pack from overloads, and responds more quickly than a fuse or thermal breaker should there be a load fault, short, etc.

DIAGRAM

Using MIDI Thru connections to daisy chain LD-360M dimmers

The MIDI specification carefully and strictly defines the MIDI line driver and receiver hardware to be used, and the impedance's to be maintained. In order to be real MIDI ports, MIDI inputs must load the line fully, and MIDI THRU ports must therefore be actively buffered in any equipment which has a THRU port.

This is the reason that any MIDI device, including our LD-360M MIDI dimmer, will stop passing the MIDI signal from its IN to its THRU port when it is not powered. This means that if a string of dimmers are daisy-chained in series, turning off any dimmer will block the MIDI control signal from passing to the subsequent dimmers in the chain.

If this is a problem, there are several solutions. First, you can use the MIDI OUTS on the LM-850 controller to feed three MIDI dimmers directly, without daisy chaining. If it is desired to run one MIDI cable from the console to the general location of the dimmers and then split the signal to the dimmers, you can buy a "MIDI THRU Box" from several manufacturers, which buffers the MIDI signal and outputs it from a number of THRU ports, which can then be connected directly to the MIDI dimmers.

MIDI buffer boxes, patchers (smart buffer boxes), and many other neat MIDI signal splitting, merging, filtering and patching gizmos are available from lots of companies including J.L. Cooper, KMX (2x8 merge-select box from $175.00 list), Digital Music, etc. Check a copy of Electronic Musician for manufacturer's names and addresses, reviews, and mail order distributors or stop by your local music store specializing in MIDI equipment.

MIDI Control Cables

MIDI control cables are two conductor plus shield with male 5 pin 180' DIN connectors on each end. Pin 1 and shell = shield, pin 5 = data (sink), pin 4 = +5v drive source. The MIDI standard specifies a maximum of fifty foot cables, but with the use of low capacitance cable such as we supply, runs of hundreds of feet are reliable. The LM-850 console has high current output drivers which allow even longer cable lengths. All MIDI inputs are opto-isolated, so ground loops and associated problems are minimized.

DIMMER FEATURES

Load Capacity

The LM-850 MIDI and MIDI-HP dimmers are identical as far as control connection is concerned. They differ in load capacity only. Either pack can control a maximum of 15 amps (1800 watts) of lamp load on any one channel…but the maximum total pack load is limited to 15 amps or 2400 watts per power cord by the noise filter current capacity and the heat dissipation capability of the chassis.

Because the most generally available electrical outlet in the U.S. is the parallel blade U-ground, we have supplied the packs with this type of power plug. The maximum current rating of these connectors as specified by the National Electrical Code is 15 amps…so the total load per cord cannot exceed this capacity without a connector change.

**NOTE-The 360-HP versions are designed for economy and are not designed for 100% duty cycle full power operation! Please do not operate at 100% load all full up for over 5 minutes. Allow 5 minutes 50% up or less cool down period.*

Power Increase

If the connector on the end of the power cord is replaced with one rated for 20 amps, and a 20 amp circuit is supplied, the total available pack capacity will be the full 20 amps. The HP version would require both power plugs be changed.

LD-360M Appendix 1

MIDI Basics

The MIDI (Musical INSTRUMENT Digital Interface) protocol is a very well developed and versatile "language" which was originally developed to allow synthesizers from different manufacturers to communicate with each other. By means of a simple cable connection, a keyboardist could play a "slave" keyboard remotely from a master keyboard controller. But MIDI has rapidly expanded into the realm of effects processors, drum machines, sound consoles, personal computers, and-of-course-lighting consoles, and now the possibilities for creating an integrated system of music, lighting, and computer equipment are virtually endless.

What passes through the MIDI cables is a seemingly endless string of digital commands-binary ones and zeros-that reflect what each MIDI device in the system is doing. Each combination of these ones and zeros is a specific command, telling a device to perform a specific function. Though many of the MIDI commands are geared toward keyboard functions (such as note-on and note-off, pitch bend wheel, etc.), the designers of the MIDI protocol were farsighted enough to make the "language" easily adaptable to a wide range of products. In the case of the LM-850, many keyboard-oriented commands serve completely different functions. For instance, if a synthesizer is connected via MIDI to the LM-850, turning the synth's modulation wheel forward will cause channel 2 of the console to increase in level. Stepping on the keyboard's sustain pedal will effectively "press" the bump button of channel 5. This is because the MIDI command isn't really saying "press the sustain pedal," it is saying, "raise the value of this particular parameter to this particular level." In this instance, that parameter is "continuous controller number 64," which to a keyboard means "sustain pedal" and to the LM-850 means "channel 5 bump button."

Many controls on MIDI devices, such as synthesizer modulation wheels or lighting channel faders, operate over a wide range of values, allowing for smooth transitions from one setting to the next. Because of this, they are called "continuous controllers". The MIDI Specification calls for 128 continuous controllers, with each having a range of 128 possible values (0 to 127). A basic switch function, such as a sustain pedal or bump button, can be a continuous controller as well, by using a value of fully off (0) to be an "Off" setting, and a value of fully on (127) to represent "On". Values in between these two extremes are simply not used. It is these continuous controllers that form the basis of the LM-850's MIDI implementation. Nearly every fader and button on the console's front panel acts like a MIDI continuous controller; moving that control will send out MIDI data, and MIDI data that is received will mimic that control, duplicating its function remotely.

There are 16 MIDI "channels", and like a television set, a unit won't receive a particular message unless it is set to the correct channel. To control a slave device remotely, the master controller must send out data on the same MIDI channel that the slave is set to receive on. If the slave is set to "OMNI mode", then it responds to messages on all MIDI channels (a device can only transmit on one channel, however). While most devices send and receive data on the same channel, some-like the LM-850-offer the added versatility of being able to send and receive on separate channels.

Also prevalent in the MIDI data stream are note-on and note-off messages, usually used to tell a keyboard to play a particular note at a particular velocity. (The velocity of the note, or how hard the key is struck, usually relates to how loudly the note should be played.) There are 128 notes defined by MIDI, with a 128 step range in velocity values. The LM-850 can use either note data or continuous controller data to control dimmers through its MIDI Dimmer Outs; this choice is made in Console mode. In either situation, Leprecon MIDI dimmers will respond to the data as channel fader commands. In note mode, the MIDI note number designates which dimmer channel the data is addressed to, and the velocity data tells the dimmer the correct brightness. For some unusual applications, this data can just as easily be sent to a keyboard or other MIDI device that responds to note data. Since the LM-850 can only address the 108 dimmer channels, it can only send (and receive) MIDI notes 0 through 107.

Program changes are another common type of MIDI data. By sending a program change to a synthesizer, effects unit, or other device, a new program can be accessed. On a synthesizer, this would call up a different sound from memory, making it active on the keyboard. With an effects device, a program change might switch from a chorus program to a reverb setting. On the LM-850, program changes are used to select the Next Scene (any one of the 100 scenes in memory) while in Scene mode, to step through song steps while in Song mode, or to step through chase steps while in Chase mode. There are 128 program numbers (0 through 127) recognized by MIDI.

MIDI is a serial communications protocol, operating at 31.25 kilobaud, and connections are made through 5-pin DIN connectors (only three of the pins are actually used). There are three types of MIDI ports: MIDI In, MIDI Out, and MIDI Thru. Similar to an audio setup, the MIDI Out of one device feed the MIDI In of another. If you are sending data from a keyboard to the LM-850, then, you should plug a MIDI cable from the MIDI Out jack of the keyboard to the MIDI In jack of the LM-850. The MIDI Thru port allows for daisy-chaining devices together; it sends out an exact replica of the data that comes into the In port. Note that this is different from the MIDI Out and often leads to confusion. The MIDI Out of a device sends only the data that that device generates. The MIDI Thru sends out only the data that the device receives from the MIDI In.

The LM-850 is set up to run two completely separate MIDI “networks” -one in the normal fashion (the System Interface), which connects the LM-850 to sequencers, computers, etc., and one specifically for operating special MIDI-controlled dimmers. The two networks are completely independent-MIDI data from one cannot “bleed over” to the other.

MIDI Dimmer Interface

The MIDI Dimmer Interface, with three MIDI Outs, is used for the sending of channel level data from the console to MIDI-controlled dimmers, such as the Leprecon LD-360M. This is provided in addition to the DMX-512 dimmer output, which works at a higher speed, but requires an expensive decoder for use with analog dimmers. The MIDI dimmer outputs are specially equipped so that cable lengths are not limited to the usual fifty feet (as outlined in the MIDI Specifications)-runs of several hundred feet will work fine with quality low-capacitance cables.

The MIDI dimmer outputs are switchable to send either MIDI continuous controller data or MIDI note-on/off data. Leprecon MIDI-controlled dimmers respond to either data type. Continuous controller output should normally be used, because it is more efficient, and doesn’t require as much data transmission. However, the note-on/off output is useful for connecting the LM-850 dimmer output to a synthesizer or other MIDI device that responds only to note data. In note mode, because more data must be sent, a slight lag in dimmer response time may be apparent when controlling a large number of channels simultaneously.

MIDI System Interface

Even disregarding the MIDI System Interface, the LM-850 functions beautifully as a multi-scene memory console, with lots of memory for storing scenes, chases and songs. The MIDI capabilities add much more versatility, however. In conjunction with a computer (with the necessary MIDI interface and software), or with a sequencer, the user can store and recall scenes, chases, songs, and even console setups, and record and edit a performance in either real time, or by typing in a group of specific commands. Such a setup allows a complete lighting show to be recorded and then played back flawlessly each time, synced perfectly to the music. With a SMPTE-to-MIDI interface or a MIDI-tape sync unit, the LM-850 can be even synchronized to tape recorded music, video, or any type of recorded program. It is through the MIDI System Interface - the In, Out, and Thru jacks on the LM-850’s rear panel - that the console can communicate with any other MIDI device.

LD-360M Appendix 2

Learning More About Lighting and MIDI

MIDI information sources:

MIDI is a very versatile and complicated protocol…its orientation toward musical applications make it hard to understand at first for lighting people who do not have a musical background. The musical orientation is very useful for coordinating events related to musical scores, and there is lots of inexpensive and powerful hardware and software devices that are very useful for non-musical applications as well as music related lighting. It's well worth the effort to learn more!

We suggest that you pick up some issues of these MIDI related magazines, and search your area for a music store or a computer store which has a resident MIDI expert and an extensive MIDI department. Search out a MIDI user's group, or computer user's group, which may well have an active MIDI subgroup. There's nothing like sharing ideas!

Electronic Musician
Box 3747
Escondido, CA 92025-9860

International MIDI Association
5316 W 57th St
Los Angeles, CA 90056 (213) 649-6434 FAX: (213) 215-3380
(Good source for technical info and reviews on MIDI.)

Mail order MIDI suppliers with extensive catalogs:
(Look for others in the magazines above).

Digital ARTS and Technologies
21 Glen Ridge Rd
Mahopac, NY 10541 (914) 628-7949 FAX: (914) 628-7941

Micro Music
5269-17 Buford Pkwy
Atlanta, GA 30340 (404) 454-9646

EM Bookshelf
6400 Hollis St #12
Emeryville, CA 94608 (800) 233-9604
(Catalog of books and handy MIDI devices).

Learning more about lighting:

Lighting Dimensions
135 Fifth Ave
New York, NY 10010 (212) 677-5997 FAX: (212) 677-3857

Theatre Crafts
135 5th Ave
New York, NY 10010 (212) 677-5997 FAX: (212) 677-3857

United States Institute of Theatre Technology
10 West 19th St
New York, NY 10011-4206 (212) 924-9088 FAX: (212) 924-9343