LEPRECON®

PRO LIGHTING EQUIPMENT

Leprecon LM-850 MIDI Lighting Console

Sixth Revision

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ROM Version 1.5A

Leprecon/CAE, Inc.
P.O. Box 430, 10087 Industrial Drive, Hamburg, MI 48139-0430 USA
810-231-9373 FAX 810-231-1631, e-mail Lepserv@caeinc.com

LEPRECON LM-850 LIGHTING CONSOLE, ROM Version 1.5A

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FCC Part 15 Potential Radio Frequency Interface Warning

Warning: This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. As temporarily permitted by regulation, it has not been tested for compliance with the limits for Class A computing devices pursuant to Sub-part J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

LM-850 PRODUCT FEATURES

CONTROL CHANNELS: 54 control channels controlled by 3 banks of 18 faders, bump buttons, and proportional LED displays.

CROSSFADER auto-sequences between current and next scenes.

SUBMASTERS (A & B) each control any grouping of channels.

BLACKOUT button, with instantaneous or programmed fade time.

BUMP ALL button, latching or momentary, with instantaneous or programmed fade-in time.

BUMP BUTTONS for channels and chase can be momentary or latching, add or solo, with configuration storable as part of each scene. Submaster and master bump buttons can be momentary or latching.

SCENES: 100 programmable preset scenes, each with its own user-assignable name, fade rate, and chase.

CROSSFADE TIME: Programmable from 0-99.9 seconds, or manual crossfade between scenes.

TITLES: Each scene, song, and chase can be given a nine-character name.

SONG MODE: 50 programmable songs of up to 50 steps each. Songs can be automatically linked one after another. Each song can be named.

CHASES: 50 programmable chases of up to 32 steps each. Each step can be a user-selected group of channels or a selected preset scene. Each chase can be named.

CHASE RATE: Adjustable chase rate from internal clock, manual tempo tap, MIDI clock, or audio sync.

MIDI: Full implementation for synchronization, archiving, and control from sequencers. MIDI In, Out, and Thru jacks.

SOFT PATCH: Any of 54 control channels assignable to any of 108 dimmer channels.

DIMMER OUTPUTS:

Three dedicated MIDI Out jacks for MIDI dimmer control.
DMX-512 digital output.
Analog outputs (0-10 volts) for 48 or 96 channels (optional).

DISPLAY: Easily-readable 2 X 16 character backlit LCD screen for console display and HELP messages.

FOOTSWITCH jack for controlling Go, Black, Bump All, Chase Bump, Chase Start/Stop, or Tempo Tap functions (Leprecon FCP footswitch optional).

GLOSSARY OF TERMS

BLACKOUT – To simultaneously turn all lights completely off, by means of a momentary or latching Blackout button. This allows a complete darkening of the stage without altering any slider settings.
BUMP – To flash a light channel to a certain (usually full) intensity, by pressing a switch known as a Bump Button.
CHASE – A usually rapid automatic flashing of lights in a specific sequence.
CROSSFADE – A smooth transition from one scene into another.
CURRENT SCENE – The scene which is actually controlling the lighting at a given time. Note that this is not necessarily the scene that corresponds to the setting of the channel faders on the LM-850, such as when the console is used in the Manual scene mode.
DMS-512 – A digital control interface to connect a lighting console to dimmers by means of a single 5-pin cable.
EDIT – To change a scene, chase, or other setting which is stored in memory. The edited setting can then either replace the old version, be saved as a completely different version, or not be retained at all.
FADE – A smooth transition, usually done with the Master fader, from the current scene to darkness.
MASTER – A fader that controls the overall level of all channels and submasters, and therefore the overall lighting level.
MIDI – An acronym for Musical Instrument Digital Interface, a serial communications interface that can connect many types of musical, computer, and lighting equipment together into an integrated system.
SCENE – A particular setting of channel levels to achieve the desired brightness' and colors of lights on stage.
SMPTE – An acronym for the Society of Motion Picture and Television Engineers. "SMPTE" commonly refers, however, to the time code used by that group for synchronizing film, video, and audio equipment.
SOFT PATCH – The assignment of console channels to dimmer channels in any desired configuration, done with software in the console rather than with actual hardwiring at the dimmers.
SONG – A predesignated string of numerous scenes, which can be stepped through sequentially during the performance of a song.
SUBMASTER – A fader that controls only those console channels which have been assigned to it, allowing specific groups of lamps to be operated with a single fader. Submasters are under the control of the Master fader.
SYSTEM EXCLUSIVE – A MIDI feature which allows one device to store the memory content of another, or to control the individual parameters of the other.

INTRODUCTION

The LM-850 is a lighting console that is extremely well suited for musical, theatrical, or just about any lighting application. It is very easy to use once a few basic concepts have been learned. The "Getting Started" section of this manual will get the LM-850 up and running, and will allow you to do some hands-on experimenting for a bit. But soon, you will want to read through the rest of the manual and learn the specifics about each of the console's many functions.

In setting up a lighting system, once the stage layout and the available equipment have been surveyed, a plot of lamp layout, focus (aiming), colors, and channel numbers can be made. At this point, the LM-850 can be used to compose scenes by combining different groups of lights, and adjusting their brightness' for a desired effect. A chase may be associated with the scene if desired. Then, each scene can be given an appropriate title and recorded into memory.

Songs can be created in advance, calling any of the 100 scenes in a desired sequence to fit each musical passage or portion of a production, or scenes can be called up "ad lib" – and even composed – during the performance. The LM-850 gives you the power and versatility to create and to use the available lamps to the fullest potential – now the creation is up to you.

The LM-850 is a software-based device, using computer commands to perform many of the functions for which hardware had previously been required. This allows for a tremendous number of features to be combined into a small but extremely versatile system. In addition, future software enhancements could even expand the functions of the console, adding new features with just the replacement of a ROM chip. But because the LM-850 is essentially a computer, it operates differently in some ways from a normal lighting console.

For one thing, the LM-850 has a liquid crystal display (LCD) screen which communicates to the user how the console is set up and what it is doing at any given moment. There are lots of different board functions going on at once, and hence there are lots of different pages of the display screen to tell about them. Be sure and familiarize yourself with these screens so that you can get around easily through the LM-850's operations.

Like most computer-based devices, the LM-850 uses what is known as an "edit buffer" for temporary memory storage. Whenever a scene, song, or chase is altered from the way it is stored in memory, a new edited version is created and stored temporarily in the edit buffer. In this way, **both** versions – edited and original – are available, and if you don't like the changes, the original is still intact. But if you edit a scene, for example, and do want to keep the new edited version, it must then be stored in memory in order to be retained and available for use. It can be stored either in place of or in addition to the original scene. (In the former instance, it would be stored in the same memory location, or scene number, as the original, thus over-writing it. In the latter case, the edited scene would be stored to a new memory location, and would have a different scene number from the original.) The edited scene (or song or chase) is always "live" on the console. For instance, even though an original scene is still intact within the board's memory, any edited version of that scene would actually be controlling the lights.

Another thing to keep in mind about the LM-850 is that it uses **two** completely separate MIDI networks simultaneously. The MIDI System Interface provides the normal MIDI In, Out, and Thru jacks that can tie the LM-850 in with the rest of the MIDI world. At the same time, the MIDI Dimmer Interface provides three MIDI Out jacks only, which are used for driving MIDI-controlled dimmers. Both of these networks use standard MIDI protocol, but they operate completely independently of each other.

Throughout this manual, whenever a specific **parameter** of the LM-850 is mentioned, the word will be Capitalized, and whenever a specific **control** on the LM-850's panel is mentioned, the entire word will be written in UPPER CASE. For example, "To change manually from the Current Scene to the Next Scene, simply move the CROSSFADE slider from its current position to the opposite extreme of its travel." Current Scene and Next Scene exist only as software in the LM-850's memory. The CROSSFADE slider, however, is a physical control – labeled "CROSSFADE" – on the console's front panel.

GETTING STARTED

POWER SUPPLY

The LM-850 receives its power from an external 12-volt AC transformer. This transformer is provided with a screw, which can be inserted in place of the wall-plate screw, to securely fasten the transformer to the electrical outlet, eliminating the possibility of an accidental power interrupt. Other voltage adapters may not work with the LM-850, and could damage its circuitry. Consult your Leprecon dealer before making any substitutions.

BASIC SYSTEM HOOK-UP

Integrating the LM-850 into a standard lighting system is a fairly simple process. (MIDI control of the console from a sequencer or computer is more involved; this is covered in the section, "MIDI Functions and Operation," on page 37.) There are some variables, however, depending on the type of dimmers you will be using. The LM-850 can accommodate three different dimmer types.

MIDI Dimmers. A simple and convenient system can be set up using MIDI-controlled dimmers, such as Leprecon's LD-360M and LD-360M-HD. 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 (see page 34). Each dimmer does need to be assigned a specific "starting address" (see the dimmer's manual for setting this value) 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.

FIGURE 1

Figure 1. A typical setup using the LM-850 and numerous MIDI-controlled dimmers.

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 does not 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" (see page 35), 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.

Digital Dimmers (DMX-512). Dimmers, which receive a DMX-512 digital control signal (via a 5-pin XLR connector), are daisy-chained much in the same way that MIDI dimmers are. A single DMX-512 output on the LM-850's rear panel is used to drive one dimmer, and that dimmer then feeds the next, and so on (see Figure 2). With this setup, as many dimmers can be hooked up as desired.

FIGURE 2

Figure 2. A typical setup using the LM-850 and digitally-controlled dimmers.

You will need to set the LM-850's Dimmer Output to "DMX-512," by pressing first the CONSOLE button to get into Console mode, and then the NEXT button until the Dimmer Output page appears (see page 35). After setting the output mode, press the SCENE button, and you will be ready to plug in lights and begin operations. You will not need to worry about setting MIDI channels at this point.

Analog Dimmers. If your LM-850 is equipped with the optional analog interface, it can be used to control either 48 or 96 channels of analog dimmers. The 25-pin connectors on the console's rear panel output 0-10 volt DC signals, with pins 1-24 the hot connections for the corresponding dimmers and pin 25 the ground (common). Two trim pots and a dip switch for each group of 48 channels are also provided. The "MIN" trim pot adjusts the minimum (pre-heat) level of the lamps, while the "MAX" trim sets the maximum brightness of the lamps. The dip switch is used to set the MIDI channel that the analog interface responds to; this is necessary because the analog interface "reads" the MIDI dimmer output, and converts that data into analog voltages. This switch should be set to the same MIDI channel as the MIDI Dimmer Out, or more simply, set to Omni so that it responds to any MIDI channel, and thus is always active.

It may be necessary to purchase or construct adapters to connect the analog cable to your dimmers; even though most analog dimmers use 0-10 volt control signals, there are many "standard" connectors in use and a simple adapter may be needed to convert one type of connector to another. Figure 3 shows the pin diagram for the LM-850's D-type connector, and how it should be wired to control dimmers, such as the Leprecon LD-360, which use 8-pin Jones connectors. Consult the owner's manual for the pin wiring diagram of your dimmers. In most instances, the pin number corresponds to the channel number, with the highest pin number wired to ground. A typical analog setup is shown in Figure 4.

FIGURE 3

Figure 3. Wiring diagram for the analog D-type connector (optional), and an adapter to control four six-channel dimmers using 8-pin Jones plugs.

Since the analog interface reads the output from the MIDI Dimmer Out, in order for it to function, the LM-850's Dimmer Output must be set to "MIDI." (Your new board should already be set to this; page 35 describes how to change this setting.) Then, once all control connections are made, you should be ready to plug lamps in and begin operating. Set the rear-panel dip switch(es) to Omni, and you will not need to worry about setting any other MIDI parameters at this point.

FIGURE 4

Figure 4. A typical setup using the LM-850 and analog dimmers.

BASIC SCENE FUNCTIONS

Once you have gotten your dimmers connected to the LM-850, and gotten everything powered up, it's easy to start operating the console in a basically "manual" fashion. When the console is first turned on, it will be in "Scene mode," and the LED next to the SCENE button (to the right of the display screen) will be illuminated. While in Scene mode, the channel faders and the MASTER fader will work just as they do on most lighting consoles. You should be able to bring up the individual channels, and as long as the MASTER is up, the channel faders should control their corresponding lamps. If you do not get any illumination from the lamps, make sure that:

a) The LM-850 and your dimmers are turned on.
b) Lamps (in working order!) are plugged in correctly to the dimmers.
c) The control cable (MIDI, DMX-512, or analog) from the LM-850 to the dimmers is not damaged and is hooked up correctly.
d) The Dimmer Output (see page 35) is correctly assigned. When you first use the LM-850, this will be set to "MIDI," the correct setting for MIDI or analog dimmers. For digital dimmers, it will have to be set to "DMX-512."

After first moving any of the channel faders, the screen will flash an "Edited" message repeatedly, but you can ignore the screen for now.

You should have control, at this point, of the channels and the MASTER fader, and of the BUMP, BUMP ALL, and BLACKout buttons. The SUBMASTERS should have no effect, nor should any of the CHASER functions. Note that to access channels 19 through 36, you will have to press the BANK 2 button, to the right of the channel faders, and to access channels 37 through 54, you will have to press BANK 3.

Play around, and get a feel for the console. And do not be afraid to experiment – there is nothing you can erase from memory at this point, and the console can be easily reinitialized to its "factory" state if necessary (see "Hard Reset," page 50). All of the board controls, along with brief descriptions, are diagrammed on page 53. But whenever you are ready to learn more about the specific controls of the LM-850, and how to use them, go on to the next section of the manual.

CONSOLE LAYOUT AND CONTROLS

CONSOLE MODES

At all times, the LM-850 is in one of the following modes:

SCENE for normal scene to scene and manual operation,

SONG for programming or running predesignated sequences of scenes,

CHASE for programming or running chases, and

CONSOLE for setting various console parameters.

The desired mode is accessed by simply pressing the corresponding button to the right of the display screen. LEDs next to these buttons indicate which mode the console is currently in.

PAGES AND PARAMETERS

Each console mode has numerous screens, or “pages” of parameters, which can be stepped through with the NEXT and LAST buttons. (These are diagrammed on page 54.) Each parameter on a page can be altered by first positioning the cursor underneath it with the CURSOR left and right arrow buttons (henceforth referred to simply as LEFT and RIGHT), and then adjusting the parameter with the numeric keypad, the VALUE UP and DOWN buttons (henceforth referred to as just UP and DOWN), or the related control (RATE fader for chase rate, etc.). The UP and DOWN buttons will increment or decrement a value by 1; if a button is held down for longer than one second, it will scroll rapidly through the available values.

FIGURE 5

Figure 5. The LCD display screen of the LM-850, and the buttons used to access its pages and parameters.

Alphabetics and punctuation for writing names of scenes, songs, and chases can be entered by pressing the keypad keys repetitively, or by using the UP and DOWN buttons. The keypad is arranged similar to that of a telephone, with a section of the alphabet grouped with each digit. The first button is labeled "1 ABC"; to enter a "1," simply press the button once, to enter "A," press it twice, etc. When entering numeric values from the keypad, all the digits of a value must be typed in to complete the entry. For example, on the Dimmer control (soft patch) page of the Console mode, the dimmer channel is displayed as a three-digit number. So to access dimmer 49, you must type in "049." If more than 2.5 seconds elapse between digit entries, the originally displayed value will be automatically re-selected.

To simplify programming, the most frequently used parameters are situated in the first page of each mode, and at the first position of the cursor.

Note that on pages which display only one adjustable parameter, it is unnecessary to position the cursor (in fact, the cursor will not move). Simply use the UP and DOWN buttons to make the appropriate selection. In short, a specific parameter or function is accessed and set in four steps:

1) **Select the mode** containing the desired parameter by pressing the Scene, Song, Chase, or Console buttons,

2) **Select the page** displaying the desired parameter by using the NEXT and LAST buttons,

3) **Position the cursor** under the desired parameter (if necessary), by using the LEFT and RIGHT buttons,

4) **Enter the desired value** from the keypad, the UP/DOWN buttons, or the appropriate fader.

HELP BUTTON

For every page of the LM-850's display, pressing the HELP button will display information relevant to the currently selected mode and function. This can be a quick "prompt" for the user if a particular command function is forgotten. (See page 54 for an illustration of these Help messages.)

CONTROL CHANNELS AND BANKS

The LM-850 provides 54 control channels, grouped into three banks of 18 each; Bank 1 consists of channels 1 through 18, Bank 2 consists of channels 19 through 36, and Bank 3 is made up of channels 37 through 54. Each bank is selected with the corresponding BANK switch (1, 2, or 3), and an LED next to each indicates which bank is "active," or controllable by the channel faders at that time. (Banks that are not active can still be controlling lamps; they just cannot be altered from the faders.) Each of the 18 active channels has a level control (a slider potentiometer), a Channel LED, and a BUMP button. The level fader sets the brightness of the light(s) associated with the channel, with a resolution of 128 steps ranging from off to full brightness.

CHANNEL LEDs

The brightness of the Channel LEDs gives a coarse but useful indication of the levels of each channel; these LEDs have a resolution of 8 steps from off to full, so they are not as smooth as the actual lighting levels. The LEDs do not reflect the setting of the MASTER fader; if a channel is up full, the LED will be lit accordingly, even if the Master is down and no stage lamps are actually on. These LEDs indicate channel levels while in the Scene and Song Modes only, and are used for other indications in other modes.

SLIDER OPERATION

Because the setting of a channel's level can also be recalled from memory, and can additionally be controlled by MIDI commands, the position of a fader does not necessarily reflect the value of the actual lamp brightness. A fader will have no effect until it is moved through its preset value (the value stored in memory at the time), at which point the fader smoothly takes control. If a channel's level is stored as 50% in a scene, for instance, that channel's fader will have no effect on the level until the fader is moved through the half-way point of its travel; at that point, an "Edited" message will flash on the screen to indicate that the stored level has been changed.

This situation is identical for the SUBMASTERS, and for the Chase LEVEL and RATE faders.

BUMP BUTTONS

During normal operation, the BUMP buttons allow the user to instantaneously bring the level of any Channel, Master, Submaster, or Chase to the Bump Brightness Level programmed within each scene. While this level is typically used at 100%, note that it can be set to any desired value, all the way down to 0%. If a channel's level is higher than the bump brightness level, that channel will **decrease** in brightness when bumped. With the bump level set at 0%, the BUMP buttons function as blackout buttons for each channel.

The BUMP buttons have four modes of operation, set by the LATCH/MOM and SOLO/ADD switches; both these switches have LED indicators to display which mode they are in.

> ADD: In this mode, a bumped channel will go to its preset bump brightness level; other channels will be unaffected.
>
> SOLO: A bumped channel will go to its preset bump level, as above, but all other non-bumped channels will be blacked out so that only the bumped channel is illuminated. Solo is not just restricted to a single channel; as many channels as is desired can be solo bumped at once.
>
> MOMentary: A channel will go to its bump level for as long as the BUMP button is held down.
>
> LATCH: A channel will go to its bump level when the BUMP button is pressed, and will latch, remaining at that level until the BUMP button is pressed again (to release), or until the CLEAR button is pressed.

Any of the four possible combinations, ADD MOM, ADD LATCH, SOLO MOM, or SOLO LATCH, can be configured by setting the switches accordingly. Whenever a scene is stored, the settings of these switches can be stored as well, if desired (see "Bump Controls," page 32), so that the configurations can be recalled with each scene change. The LATCH/MOM setting also configures the SUBMASTER and MASTER BUMP buttons (these are always in ADD mode).

Whenever any channel (or submaster, master, or chase) is bumped, its LED will flash on and off for as long as the bump is active.

CLEAR BUTTON

The CLEAR button simply unlatches any bumped channel; this allows numerous channels to be cleared simultaneously with a single keystroke. The CLEAR button is used in the Chase mode as well, to clear a chase step (see page 25).

CROSSFADE SLIDER

Just like on a simple two-scene lighting board, the CROSSFADE slider allows the user to manually crossfade from one scene to another. On the LM-850, however, the crossfade does not alternate between "X" and "Y" banks of actual faders, it instead crossfades between any two scenes stored in the console's memory. These scenes are temporarily called the Current Scene and the Next Scene (each scene has its own permanent name and number), and they can be used in any order desired. For instance, scene 39, called "red wash," could be the Current Scene, which could crossfade into scene 73 (the Next Scene), called "sax solo." Because of this, the CROSSFADE slider does not have a "set" position, such as all the way up for the "X" scene, or all the way down for the "Y" scene. Instead, to crossfade to the Next Scene, the slider is simply moved to the opposite extreme of its travel, whether it is currently all the way up or all the way down.

When the CROSSFADE slider reaches this opposite extreme, the Next Scene becomes the Current Scene, and a new Next Scene is displayed on the screen. Note, however, that this does not occur until the slider arrives fully at this destination – the slider can be moved halfway through its travel, for instance, creating a mix of the Current and Next Scenes, and then reversed to its original position. In this instance, the scenes will not have changed, and the Current Scene will still be active.

Whenever an automatic crossfade is in progress, the CROSSFADE slider can be used to override the automatic fade, thus manually making the crossfade quicker or slower. The LED over the slider lights up fully when a fade is begun (either with the slider or automatically), and gradually fades out as the crossfade is completed.

SUBMASTERS

Each SUBMASTER fader (A and B) controls the overall level of the channels assigned to it. Any of the 54 channels can be assigned to either of the submasters, but a single channel cannot be assigned to both A and B simultaneously. A channel can, however, not be assigned to either submaster. This channel assignment is recorded as part of each scene (see Submaster Assignment, page 20), so that each submaster can have a different function in each scene. SUBMASTER A might control a blue stage wash of eight channels in one scene, for instance, and in the next scene it could control a group of six rear-truss vocal specials.

Like the individual channels, the submasters are under the control of the MASTER fader.

Each submaster has its own BUMP button and LED indicator. These work exactly as they do for the individual channels, except that the SUBMASTER BUMP buttons are always in the ADD mode.

MASTER LEVEL CONTROL

The MASTER level fader controls the overall level of all channels and submasters (though it does not affect the brightness of the Channel and Submaster LEDs), and therefore controls the overall level of the lighting. The MASTER doe not control the levels of the chase or the bumps – these each have their own independent settings.

The setting of the MASTER fader is not a programmable function; it cannot be stored as part of a scene. The movements of the MASTER fader can, however, be recorded (and played back) by a MIDI sequencer.

Like the SUBMASTER BUMP buttons, the MASTER BUMP button is always in the ADD mode.

BLACKOUT BUTTON

Pressing the BLACKout button turns off the running chase, and turns off all channels either instantaneously or at the designated Blackout Fade Rate (specified in Console mode). The BLACKout button functions differently depending upon its mode; when in LATCH mode, a short tap of the button starts a timed fade out, while a press and hold of the button causes an instantaneous blackout (after the short time required for the LM-850 to recognize that the button is held down). While a blackout fade is in progress, re-pressing and holding the BLACK out button will produce an instant blackout.

While fading into a blackout, the BLACK out LED flashes; when the scene is completely blacked out, the LED remains on. Pressing the BLACK out button again returns the scene to its previous level, and returns the chase to its former status.

A blackout fade can be cancelled by recalling a scene with the GO button. In this case, the Current Scene will be recalled once again instead of the Next Scene. This allows for going back to a scene from a fading blackout without have to push the BLACKout button twice (once to complete the fade, and again to restore the scene). But be careful – once a blackout has completed its fade (and the LED stays on instead of blinking), a press of the GO button will cancel the blackout and bring up the Next Scene. While a latched blackout is active, any channel edit (motion of a channel slider or a BUMP button) will cancel the blackout as well, and edit the Current Scene to reflect the new fader levels. Master and Submaster edits (done with either the faders or with BUMP buttons) affect the blacked-out Current Scene, and the effects won't be seen until the scene is un-blacked.

When the BLACKout button is in MOMentary mode, a blackout is only active while the button is held down. The fade time is ignored and blackouts are instantaneous.

The function of the BLACKout button can be duplicated by a footswitch set accordingly (see page 32).

BUMP ALL BUTTON

The BUMP ALL button turns off the running chase, and bumps all 54 channels simultaneously. The BUMP ALL button has two modes of operation, which it shares with the BLACKout button. When in LATCH mode, the button will bump all channels instantaneously if held down, or it will initiate an automatic fade-in if tapped. (The fade-in rate is adjusted while in Console mode – see page 33.) The Bump All fade-in can be cancelled, restoring the Current Scene and chase, by pressing the GO button while the fade-in is in progress (while the channel LEDs are still blinking).

When in MOMentary mode, the Bump All is only active while the BUMP ALL button is held down – the fade-in time is ignored and the bump is instantaneous.
Note that the blackout and bump all features are mutually exclusive; only one can be active at any given time (i.e. a blackout cancels a bump all and vice-versa).

The function of the BUMP ALL button can be duplicated by a footswitch set accordingly (see page 32).

GO BUTTON

The green GO button, at the bottom right of the console, is used to step from one scene to another, either in Scene or Song modes. When the button is tapped, the Next Scene will crossfade in at its programmed crossfade rate. The GO button can override this crossfade in two manners. First, if the GO button is held down instead of tapped, any timed crossfade will be negated and the scene change will be instantaneous. Alternatively, once the GO button has been tapped to initiate a timed crossfade, it can be tapped once more while the fade is in progress, and the scene change will then be completed instantaneously.

By plugging in a footswitch to the LM-850 and setting the Pedal Assignment to "GO" (in the Console mode – see page 32), the footswitch can duplicate the function of the GO button, allowing for hands-off scene changes during live performances.

As can any control on the LM-850's panel, the GO button can be mimicked by a specific MIDI command. It is in this manner that the LM-850 is most easily put under MIDI control, as from a sequencer. Scenes, songs, chases, etc. can be programmed normally in the console's memory, then, by simply recording GO commands into the sequencer, the entire light show can be effectively automated.

STORE BUTTON

The STORE button is used for storing to memory any song, scene, or chase that has been edited. By pressing the button once, the Store parameters are displayed on the screen, allowing the user to select the memory location in which the new information will be saved. A second press of the STORE button completes the actual writing of the information into memory. For specific Store functions (storing scenes, storing songs, or storing chases), refer to the appropriate sections of this manual.

MANUAL BUTTON

The MANUAL button is used for selecting a "Manual" scene as the Next Scene (this button functions in Scene mode only). When "Manual" is selected, channel faders, bump buttons, etc. no longer control the Current Scene, instead they are used to set the up-coming Manual scene. For specific applications of this, refer to "Manual Scenes," on page 20.

USING A FOOTSWITCH

A Leprecon FCP footswitch (optional) can be plugged into the FOOTSWITCH jack on the LM-850's rear panel, and with the Pedal Assignment set accordingly (see page 32), it can be used to duplication the function of either the GO button, the BLACKout button, the BUMP ALL button, the Chase BUMP button, the CHASE On/Off switch, or the TEMPO button. The footswitch can thus be used to operate the board in a hands-off manner, for example from the stage while performing. The footswitch is a momentary on (normally open) switch, terminating in a ¼-inch phone plug.

SCENES AND SCENE MODE

SELECTING SCENES

In Scene mode, any of the LM-850's 100 stored scenes can be called up, cleared to zero, "played live" and abandoned or carefully edited and saved. Any scene can be crossfaded into any other. When the SCENE button is first pressed, the LM-850 enters the Scene mode, and a display appears similar to this one:

```
SCN 00 scene 00
 NXT  01 blu wash
```

The upper line of the display show the number of the currently active scene, 00, along with its name, "scene 00." The second line of the display shows the number (scene 01) and name ("blue wash") of the Next Scene to be recalled. The Next scene automatically defaults to the next highest scene number (with 00 following 99), but any scene can be chosen and entered here. The blinking cursor under the Next Scene number prompts the user to enter the number (from 00 to 99) of the desired Next Scene, using the numeric keypad or the UP/DOWN buttons.

The Next Scene can be the same as the Current Scene; this is useful if a scene has been edited and it is desired to return to its original settings.

The Next Scene can be brought up in four different ways:

1) Instantaneously, by pressing the GO button and holding it down for at least ¼ second,

2) At the crossfade rate programmed into the Next Scene, by briefly tapping the GO button (after a crossfade has started, re-tapping the GO button will complete the fade instantaneously),

3) With a foot pedal (optional) set to duplicate the function of the GO button, or

4) Manually, by moving the CROSSFADE slider from its current position to the other extreme of its travel. The GO button can be used after a manual crossfade has been started, to complete the fade either instantaneously or at the Next Scene's programmed crossfade rate.

When a crossfade starts, the LED above the CROSSFADE slider turns on at full intensity. As the crossfade progresses, the LED fades out. This LED is used to verify that a short tap on the GO button or foot pedal effectively started the crossfade even if the crossfade time is very long and difficult to perceive at first. The CROSSFADE slider can always take over an automatic crossfade, allowing the user to speed up or slow down the crossfade with the motion of the fader.

When a crossfade is completed, the Current Scene number and name are replaced by the Next Scene number and name. The following Next Scene number is again defaulted to the new Current Scene plus one.

Whenever a new scene is called up it can bring with it new settings for all 54 channel levels, the scene crossfade time and name, the submaster A & B assignments and levels, the bump mode and brightness level, the blackout mode, and the currently active chase number.

EDITING THE CURRENT SCENE

The Current Scene can be edited in real time with the channel and submaster sliders, and any such changes will be reflected both in the LEDs and in the actual level of the lamp(s) controlled by that fader. When any of the Current Scene's parameters is changed (channel slider, associated chase number, crossfade time, etc.), the word "Edited" will alternate with the Current Scene's name in the display, until either the edited scene is stored, or until another scene is called up.

Current Chase. The second page of the Scene mode shows the following display:

```
CHASE 05
 Verse 2
```

The upper line of this display show the number of the chase associated with the Current Scene, and the second line shows its name; in the above example, Chase number 05 is current, and it is named "verse 2." A new chase number from 00 to 49 can be selected with the numeric keypad, or with the UP/DOWN buttons, and this will cause the current scene to be edited. This newly selected chase will immediately become the active chase, but will not be stored as the new associated chase unless the edited Current Scene is stored. If the chase is started while in Scene mode, the chase will run on top of the Current Scene.

Each chase step can either be a group of individual channels, each turned either fully on or fully off, or it can be an individual scene; a "scene" chase step will **replace** the Current Scene for its step duration, and a "normal" channel-by-channel chase step will **overlay** the Current Scene. So, each chase step can either raise or lower the levels of the channels in a scene, depending on how the chase was programmed.

Crossfade Time and Scene Name. The next page brings up the following display:

```
FADE TIME 01.0 S
NAME:  guit solo
```

Upon entering this page, the cursor is positioned under the crossfade time value. This value can range from 00.0 to 99.9 seconds, and can be entered from the keypad directly, or incremented/decremented with the UP/DOWN buttons. Note that three digits must be entered from the keypad; if the desired crossfade time is 2.0 seconds, you must type in "020" (the decimal is automatically inserted).

Pressing the LEFT and RIGHT buttons moves the cursor to the "NAME:" field; this is where the name of the Current Scene can be specified. The LEFT and RIGHT buttons will position the cursor underneath each space, and then the appropriate letter or number can be entered with the keypad. Each of the ten keypad buttons can enter one digit or one of several letters (or symbols and blank space in the case of the "0" button). Simply press the button repeatedly until the desired character is shown, then go to the next space.

The UP and DOWN buttons can also be used to enter characters, and they control a different character set than that of a keypad. Upper-case letters and many symbols are available here (the keypad only enters lower-case letters). When the complete name has been entered (nine characters maximum), the scene can be saved with the new name.

Submaster Assignment. The next Scene mode page brings up the following display, and you may notice that certain channel LEDs turn on or off when it is accessed:

```
SUB MASTER A
CONTROLS LIT CHL
```

This page tell the user that the channels with illuminated LEDs are controlled by the SUBMASTER A slider. This assignment configuration is easily changed by pressing the Channel BUMP switches to toggle each channel on or off.

Similarly, the following page displays:

```
SUB MASTER B
CONTROLS LIT CHL
```

and the assignments to Submaster B are made in exactly the same way.

A channel cannot be controlled by both submasters at the same time. If the user tries to assign a channel already assigned to the other submaster, that channel's LED will simply not turn on when its BUMP button is pressed, and the display will show an error message while the button is held down. If an attempt is made, for example, to assign an unavailable channel to Submaster B, the screen will display:

```
Channel already
assigned to subA
```

Bump Brightness Level. The final page in Scene mode is used to adjust the brightness level that channels will attain when they are bumped, either with the individual BUMP buttons, or with the BUMP ALL button. The display reads:

```
BUMP BRIGHTNESS
LEVEL: 100%
```

This value can be entered directly from the keypad (three digits must be entered), or it can be incremented/decremented with the UP/DOWN buttons. A setting of 000% will effectively change the BUMP and BUMP ALL buttons to blackout buttons.

MANUAL SCENES

By pressing the MANUAL button while on the first page of Scene mode, a Manual scene is selected as the next scene to be recalled instead of one of the 100 pre-programmed scenes. The screen then displays, for example:

```
SCN 07 lavender
NXT_ Manual
```

where "lavender" is the name of the Current Scene.

Once Manual has been selected as the Next Scene, the channel faders, the SUBMASTERS, and the MASTER fader no longer have any effect on the Current Scene – it can no longer be altered unless the Next Scene is re-selected as another programmed (non-Manual) scene. Instead, the faders and their accompanying LEDs set and indicate levels for the Manual scene coming up. This allows setting and previewing (via the LEDs) all three banks of channels before actually making the Next Scene active.

The Manual scene can then be called up either instantaneously by pressing the GO button (no timed crossfades are possible), or by manually fading into it with the CROSSFADE slider. Once a manual fade is started, any subsequent channel edits will be ignored (though they will be reflected in the following scene). In other words, if a channel fader is moved while a slow manual crossfade is being done, the new Current Scene will only reflect where the channel's fader was at the time the crossfade was started.

When the Current Scene is a Manual scene, the Next Scene also defaults to Manual. This is useful for live applications where specific scenes are not pre-programmed, and scenes are being created "on the fly." Of course, a programmed scene can always be chosen instead for the Next Scene by simply entering the scene number from the keypad.

A current Manual scene can be stored in the same manner as a pre-programmed scene. Press STORE, and the following display appears:

```
STORE CURRENT
SCENE AT _
```

The destination scene number is initially blank; simply key in the destination, and press STORE once again to complete the process. This new scene can then be named, assigned a crossfade rate, etc., similar to any other programmed scene.

Manual scenes are handy because they allow the user to preview, via the channel LEDs, what a new scene is like before it is actually "live." But if a "direct manual" scene which responds immediately to fader motion is desired, it is suggested that Scene 00 be left at its default (all zero levels) setting. Then, when Scene 00 is called as the Current Scene, the faders can be used to adjust levels up from zero. The scene so created can then be stored as another scene number, if desired; just remember not to store anything as Scene 00, so that it will always be available as the "direct manual" scene.

CLEARING SCENES

To clear a scene to all channels off, hold down the BLACKout button, and move any channel fader; this will set all channel levels to zero. Note that this only clears the scene in the edit buffer (the scene that is displayed live); the original scene will still be intact in memory, and the new black scene will not be retained unless it is stored.

STORING A SCENE

Whenever any parameters are changed while in Scene (or Song or Chase) mode, the change will affect the current operation of the console but will not be reflected in that scene when it is recalled unless the edited version is stored. Stored within a scene are many parameters that might not be expected, such as which chase is active, or whether the bump buttons are momentary or latching. This can be confusing at first, as certain settings may suddenly and unexpectedly change whenever a new scene is called up, but this versatility can be used to great advantage.

Bump Controls and Chase Controls can be set to work either globally, or on a scene-by-scene or chase-by-chase basis. In "Global" mode, the parameters always follow the front panel controls; setting Bump Controls to "ScnbyScn" (this is done in the Console mode – see page 32) allows the bump parameters to be recorded as part of each scene, and to be recalled whenever that scene is recalled. Similarly, setting the Chase Controls to "ChsbyChs" allows each scene change to bring with it new chase settings. This allows the user to essentially reconfigure the board parameters automatically with each scene change.

With the STORE button, the level of all 54 channels, the level of the Submasters, the Bump and Blackout modes (if set to ScnbyScn), any associated chase number, the crossfade time, the name, and the current active bank (1, 2, or 3) of a scene can be saved for later recall. After the first press of the STORE switch, the following display appears:

STORE CURRENT SCENE 05 AT 05

Where 05 is the number of the currently selected scene in the example. The cursor underneath the scene destination indicates that the user can select where the Current Scene will be saved; the new scene number can be entered either from the keypad or from the UP/DOWN buttons. The actual storage will take place when the STORE button is pressed a second time. (The Store operation can be aborted before then by simply pressing any button other than the STORE, UP/DOWN, or keypad buttons.) With the second press of the STORE button, the display will briefly read “STORE COMPLETE.” The display then returns to the initial Scene mode page, but with the Current Scene now being the scene just stored, and with “Edited” no longer flashing.

Frequently, the user will want to simply adjust and then re-save a scene to its same memory location. In this case, the only operation necessary, once the editing has been completed, is to push the STORE button twice in a row. The Store function can also be sued even if the Current Scene has not been edited; this allows for copying a scene from one location to another.

SONGS AND SONG MODE

A song is a user-definable list of scene numbers which allows for the scenes (and their associated chases) to be recalled easily and in the correct order during a performance. The successive scenes in a song can be called up manually with the CROSSFADE slider, or can be stepped through with the GO button or foot pedal, allowing either instantaneous or automatic timed crossfades. Up to 50 songs of 50 steps each can be defined.

SETTING UP A SONG

Selecting Scenes for Song Steps, Naming Songs. The song mode is entered by pressing the SONG button, which brings up the following display:

```
SNG 22 let's go
01 SCN 15 NXT 64
```

This initial page of the Song mode allows for selecting which scenes will be recalled in a song, and in what order. This is done by selecting the desired scene for the displayed song Step, then proceeding to the next step, selecting its appropriate scene, and so on. The first line of the display shows which of the 50 song numbers is currently selected (song number 22 in the example) along with its name ("let's go"). The second line shows the Current Step number in the song (01 to 50, always defaulting to Step 01 when the song is first recalled), and the scene numbers for the Current Step and Next Scene (15 and 64 in the example). The LEFT and RIGHT buttons can be used to select any one of the parameters except the Next Scene number. When the Step number is changed, the new Current Scene for that step immediately crossfades in at its pre-selected fade rate. When the last step of a song is reached, the Next Scene number is replaced with the word END.

This page also allows the naming of the song (nine characters maximum) by positioning the cursor under each character space, and selecting the desired letter, number, or symbol from the keypad and the UP/DOWN buttons. The procedure is exactly similar to that for naming scenes (see page 19).

Selecting the End Step and Next Song. The second Song mode page shows the following display:

```
STEP 20 = END
 NEXT SONG 04
```

On the first line of this display, the user can select what is to be the last step of the currently selected song (20 in the example). When step 20 is reached during the song, that scene will still come up, but the Next Scene will be shown as "END." The End Step does not have to directly follow the last scene programmed into the song; it can be assigned to the middle of a song, for instance, in which case the song steps following the End are simply unused – they are not erased. This is useful for changing the end of a song without altering the initial scene list, such as if a band decides to leave out an extended song ending during certain performances.

The second line of this screen page sets the Next Song to be selected when the Current Song has reached its end. A number from 00 to 49 can be used to select any programmed song (even the same Current Song once again), or a number above this range can be entered, in which case the LM-850 will display "NONE" instead of a song number. The Next Song begins immediately after the End step of the current song is reached; simply press the GO button (or use the foot pedal or CROSSFADE slider) as if going to another scene, and the first scene of the Next Song will become active. The transition will be "seamless" – there will not be a pause or a dark scene in between the two songs, unless such a pause is specifically programmed. In this way, several songs can be combined into large, very complex songs of more than 50 steps. (The individual segment songs, for instance, could be called "intro," "verse 1," "chorus," etc. Or for theatrical applications, songs might be named "act 1 sc1," "act 1 sc2," etc.)

Deleting a Song Step. The next Song mode page displays:

```
DELETE STEP 03
CONFIRM WITH GO
```

This page is used to delete a step from a song's scene list. Whenever this page is entered, the current active Step in the song is displayed (Step 03 in the example); a different step can be selected with the keypad or the UP/DOWN buttons. When the GO button is pressed, this step is deleted, and the song's End Step is automatically decreased by one step to retain the same ending scene. The display then returns to the first Song mode page.

Adding a Song Step. The fourth Song mode page shows:

```
ADD SCN 00 AT
STEP 12 GO=OK
```

This page is used to insert a step in the song. When this page is first entered, the defaulted step number to be added (12 in the example) is always one greater than the End Step. In other words, any scene added to the song will be added onto the end by the default. This setting can be changed with the keypad or UP/DOWN buttons, as can the scene number to be added (which defaults to 00). When the GO button is pressed, the new step is added, and the End Step is automatically increased by one to retain the same ending scene. The display then returns to the first Song mode page.

STORING A SONG

When a song has been set up as desired, it must be stored in memory in order to be saved for further use. This is done by pressing the STORE button, at which point the following display appears:

```
STORE CURRENT
SONG 34  AT 34
```

Where 34 is the currently selected song in this example. The destination song number can be changed with the keypad or UP/DOWN buttons; pressing any other button (other than GO) will abort the Store command. Pressing GO a second time will store the song to its new location; the operation is exactly similar to the storing of scenes.

CHASES AND CHASE MODE

The LM-850's memory holds 50 chases, each up to 32 steps long. Each chase step can be either a combination of any of the 54 channels, or any one of the scenes in memory, and these two types of steps can be used together in the same chase. If a channel combination is used as a chase step, each channel is either full on or off, and the overall chase brightness is controlled by the chase LEVEL fader. If a scene is used as a chase step, the individual channels will be at the brightness' at which they were programmed into the scene, and the overall brightness will be independent of the chase LEVEL fader. A Chase Style can be set to provide a gap or an overlap between chase steps to adjust the "softness" or "hardness" of each chase step; a soft style will crossfade each step into the next, while a hard style will snap rapidly between steps. The chase can be running while it is being programmed.

Each scene has one chase associated with it. If the LM-850 is set to Chase Controls=ChsbyChs (in the Console mode – see page 32), then this chase will come up running at the level at which it was stored, and the chase's clock source and rate will be recalled from memory as well. Otherwise, the on/off setting, level, and clock source and rate are reflected by the panel controls. If the same chase is assigned to two different scenes, then that chase will not reset when a scene change occurs between the two – it will keep running in its regular cycle. In Scene mode, a chase can be altered, or another one selected and altered, without affecting the original chase stored within the scene. Note that any changed made to a chase running in Scene mode will not be stored when the scene is stored. The altered chase must be stored independently (in Chase mode).

Any program change command received by the LM-850 while in Chase mode will advance the current chase by one step.

SETTING UP A CHASE

To set up a chase, press the CHASE mode button, and the following display appears:

```
CGS 14 verse chs
STEP 01 SCENE –
```

The upper line of the display shows the number of the currently active chase followed by its name (number 14, called "verse chs" in the example). The chase to be set up can be selected by entering its number (from 00 to 49) from the keypad or the UP/DOWN buttons. The name, up to nine characters long, can be edited in the usual fashion; first move the cursor under the letter you wish to modify, and then enter the new letter, number, or symbol from the keypad or UP/DOWN buttons. When any chase parameter has been changed, the word "Edited" will flash on the screen, alternating with the chase's name.

The second line of the display shows the current Step number (always 01 when first entering the Chase mode), and what scene is programmed as this step, if any. If the step does not use a scene, the scene number is blank (as in the example). Note that the displayed Step number is the chase step which can currently be programmed – it is **not** necessarily the step which is currently up if the chase is running.

Programming a "Normal" Chase Step. While in Chase mode, the Channel BUMP buttons do not operate in their normal fashion, but instead allow for programming individual channels, either on or off, as a chase step. For each step of the chase, press the BUMP button of each channel which should be turned on in that step. Any or all of the 54 channels (3 Banks) can be used for each chase step. The channels will toggle on and off, and the Channel LEDs will indicate the status of each. Pressing the CLEAR button will clear all channels to off. When a step is completed, press the GO button, or position the cursor under the Step number and press the UP button, and the chase will increment to the next step. Note that when the chase is running, the Channel LEDs will light up during each chase step to indicate which channels are on.

Programming a "Scene" Chase Step. To program a scene as one of the steps in a chase, simply enter the desired scene number on the second line of the above display. To remove a scene from a chase step, in order to allow programming individual channels, simply press the CLEAR button, and proceed normally. Note that when the chase is running, the Channel LEDs will light up, indicating the channel levels within each scene programmed as a chase step.

Looping a Chase. The next Chase mode page displays the following:

```
LOOP AT STEP 10
# OF LOOPS: INF
```

The upper line of this page selects the step after which the chase sequence loops back to step 1. In the example shown, the chase will go through its first 10 steps, and then will go back to the first step to repeat the cycle. This loop point can be set to any desired step; moving it earlier in the chase sequence will not erase any steps which then become unused. If a chase step with a higher number than the loop step is edited, the loop step number is automatically reset to that later step.

The second line of this page sets the number of times the chase will loop before it stops. This number can be set from 01 to 98, or if 99 is entered, the display will read "INF" (infinite) and the chase will cycle endlessly.

Chase Style. The next page shows the following display:

```
CHASE STYLE: 50
00=SOFT 99=HARD
```

This page is used to adjust the amount of overlap (softness) or gap (hardness) which occurs between chase steps. This affects the feel, or "snappiness," of the chase. A gap between steps will add snap to a fast chase, while an overlap will essentially crossfade between steps for a softer effect. A value of 50 corresponds to a normal chase setup, with no gap or overlap between steps. A setting of 00 provides the most overlap, while a setting of 99 provides the longest gap between steps. Note that the Chase Style value is not an absolute length of time, but instead is a relative value proportional to the chase rate. In other words, a setting of 20 does not provide an overlap of a fixed 1/8-second, for instance. Instead, the overlap will be longer for slower chases, and shorter for quicker chases.

Chase Clock. The next page of the Chase mode allows the user to select how the chase will be clocked. The first line of the display offers one of three choices: internal clock, MIDI clock, or audio trigger. If the chase is to be run in a normal fashion, select "INT" (for "internal clock"), and the display will read:

```
CHASE CLOCK: INT
 0.77 Seconds
```

The second line of the display show the length of time each chase step will last (0.77 seconds in the example). To speed up or slow down the chase rate, simply adjust the Chase RATE slider; the display will reflect any changes made. Note that this parameter cannot be entered from the keypad or from the UP/DOWN buttons; the cursor always remains on the top line of the screen.

Pressing the UP button changes the clock source to "MID" (for "MIDI clock"), and the display then shows:

```
CHASE CLOCK: MID
      1/6 note
```

In this case, the chase will synchronize to MIDI clock signals from an external sequencer, drum machine, or computer. In order to use this function, therefore, the LM-850 must be connected to one of these devices. For use with a sequencer, for example, a MIDI cable must be connected from the sequencer's MIDI Out jack to the LM-850's MIDI System In jack. Once this is done, the LM-850's chases can synchronize exactly

with what the sequencer is playing. (Note that when the sequencer is stopped, it will stop sending clock signals, so the chase will stop as well.) While the LM-850 offers extensive MIDI capabilities, to synchronize a chase in this manner, no further MIDI settings need to be made, other than setting the LM-850's MIDI System In to any channel that is not otherwise being used (see page 33; this is to avoid receiving spurious commands intended for another device). Simply plug in the MIDI cable, and the LM-850 will be ready to receive any clock signals.

The second line of this page determines how the LM-850's chase will run in relation to the incoming MIDI clock. In the example, the chase will proceed one step every 1/16-note – in other words, there will be 16 chase steps for every measure of the song. This value can be adjusted with the Chase RATE slider from ½-note chase steps up to 1/32-note steps, with triplet values available as well. (Three triplets fit into the space of two normal notes. In other words, three eighth-note triplets fit into the same time span as two eighth-notes; there are thus 12 eighth-note triplets in a measure of music.)

The third clock choice is "AUD" (for "audio trigger"), accessed by pressing the UP button once again, or by pressing the AUDIO button. This page displays the following:

```
CHASE CLOCK: AUD
1 step / 4 trig
```

The AUDIO LED turns on when this is selected. Like the MIDI clock setting, the Audio Trigger allows the synchronization of the chase to music, and also requires an external cable to be plugged into the LM-850. But the Audio Trigger works with audio signals instead of MIDI signals. To use this feature, plug an audio cable (1/4-inch phone plug) into the AUDIO jack on the LM-850's rear panel. By sending a line-level signal into the console, the chase will step each time a signal of a certain level is received. (CAUTION: Do not send the LM-850 a signal form the output of a power amplifier. The high signal level could damage the console's circuitry.) The SENSE fader adjusts the sensitivity of the LM-850; moving the fader up will allow the chase to trigger from weaker signals, and moving it downward will reject all but the strongest audio pulses.

It will probably take a bit of "tweaking" to get the SENSE level at its optimum setting for a given input signal. If the slider is set too low, a weaker pulse may not trigger the chase step. If the slider is set too high, it will trigger too many times from a single pulse. (This can be remedied to an extent with the Audio Trigger Mask, described below, but it's best to get the SENSE slider set correctly first.)

The audio signal can originate from anywhere the user desires, as long as it is a line-level signal, but certain trigger sources are more practical than others. If a drum machine is being used, a line from its kick drum or snare drum output will provide a steady pulse for the chase. Or if live drums are being used, a feed from the kick drum's channel of the mixing board will work nicely. But the chase could just as easily be driven from a guitar solo, for a much different effect.

The audio clock ratio can be adjusted, on the second line of the display, from 1 step per 4 audio triggers to 16 steps per trigger. In order to reduce false triggering, an Audio Trigger Mask Time can be set (in Console mode – see page 43) such that any pulse received within a certain time after a trigger is ignored. If the chase is being triggered from a snare drum, for instance, and the drummer plays a flam (a double-strike of the drum), both strikes would normally trigger the chase, advancing it two steps. But if the Audio Trigger Mask were set at 0.30 seconds, the second drum strike would be ignored if it happened within this time interval.

Deleting a Chase Step. The next Chase mode page reads as follows:

```
DELETE STEP 01
CONFIRM WITH GO
```

This page is used to delete a step in the chase. When the page is accessed, the step to be deleted defaults

to step 01 if no manual stepping has been done, or to the last step the chase was set to otherwise. But if a chase has been edited and not yet stored prior to accessing this page, the step number is automatically set to the step which was last altered. This allows for quickly and easily removing a step if an error was made. Once the correct step number is selected, pressing the GO button deletes that step, and the first page of the Chase mode is once again displayed, with "Edited" flashing on the screen. Deleting a scene only changes the chase in the edit buffer; the new chase must be stored in order to retain it for future use.

Note that deleting a chase step moves any subsequent steps forward by one step.

Adding a Chase Step. The following page shows:

```
ADD A STEP AT
STEP 01   GO=OK
```

This page is used to insert a step in the chase. When the GO button is pressed, the display returns to the first page of the Chase mode, and the page will show:

```
CHS 14 verse chs
STEP 07 SCENE –
```

The step number is the last manually accessed step, or step 01 if no manual stepping has been done. All Channel LEDs will be off, and the scene number is blank. Selected channels or a scene number can then be entered for the new step, just as for any chase step. When a step is added to a chase, subsequent step numbers and the loop point are increased by one (unless the loop point occurs prior to the added step). Once a step is added to a chase, the chase is edited and must be stored for further recall.

STORING A CHASE

When a chase is set up as desired it must be stored in memory by pressing the STORE button. The following display then appears:

```
STORE CURRENT
CHASE 14 AT 14
```

Where 14 is the currently selected chase in our example. The operation is then identical to storing scenes: the destination chase number is entered from the keypad or from the UP/DOWN buttons, and a second press of the GO button completes the storage process. If a chase is stored while it is running, it will automatically start when it is recalled if Chase Controls are set to "ChsbyChs" (see below). A chase can be edited and then stored as a different chase number, leaving the original chase unchanged; this makes the creation of several similar chases quick and easy.

CHASE CONTROLS

On the fifth page of Console mode, if Chase Controls are set to "ChsbyChs," then a chase's on/off status, clock source, rate, and level will be recorded as part of that chase – and the scene(s) that the chase is associated with. Whenever a new chase or scene is called up, the values recorded in memory will be recalled, and the sliders will not necessarily reflect these current values. If set to "Global," however, the chase will always follow the front panel control regardless of scene changes.

Chase LEVEL. The Chase LEVEL slider controls the overall level of the channels that make up a chase. It does not, however, control the level of scenes that are used as chase steps. The Chase LEVEL LED displays the current setting of the chase level; note that the position of the fader does **not** always reflect this. Different chase level settings can be programmed for each chase.

Chase BUMP. The Chase BUMP button allows for instantaneously bringing the chase level to maximum brightness. (This bump level cannot be set to values other than maximum brightness.) The bump mode follows the settings of the LATCH/MOM and SOLO/ADD switches, and is the same as that for channel bumps. A bumped chase can be added to a scene, or soloed over it. The function of the CHASE BUMP button can be duplicated by a footswitch set accordingly (see page 32).

TEMPO Button. The TEMPO button allows for setting the chase speed to whatever tempo is physically tapped on the button. The TEMPO feature simply alters the internal clock to run at the tapped-in rate. The clock switches to this tapped rhythm as soon as two taps (with an interval of less than three seconds) have been made. When a valid tap rate has been established, the console shifts immediately to the internal clock at the new tempo, and any other clock source – MIDI or audio – is overridden. So even if the Chase Clock is set to MIDI, tapping on the TEMPO button will reset the clock source to INTernal. This feature allows the synchronizing of the chase to music without any form of interface whatsoever – other than the user's tapping finger. The tempo may then be altered either by tapping in a new tempo, or by adjusting the RATE slider.

The function of the TEMPO button can be duplicated by a footswitch set accordingly (see page 32).

RATE Slider. The RATE slider adjusts the speed of the chase. If the RATE slider is moved while the internal clock is active (either normally, or with the tap method), the clock rate will be changed. When a chase is running in Scene or Song mode, pressing the CLOCK button down will shift the screen to the Chase Clock page, displaying the current clock rate for as long as the button is held down..

The RATE LED flashes at the chase rate while a chase is running. When a chase is off, the brightness of the LED reflects this rate setting (which may be different from that suggested by the fader position).

CHASE On/Off. The CHASE switch turns the chase function on and off, with the current status indicated by the LED. When a chase is recalled, whether it will be running or not depends on the state in which it was stored (unless Chase Controls are set to "Global"). The CHASE On/Off always starts the chase from step 01, regardless of where it was last stopped. The function of the CHASE On/Off switch can be duplicated by a footswitch set accordingly (see page 32).

SENSE Fader. This slider is only used when the chase clock is set to "AUDio" (see page 27). The slider adjusts the gain, or sensitivity, of the audio input; this is useful for optimizing the synchronization of the chase speed with the audio beat. The SENSE LED lights up whenever an audio pulse is received. The SENSE level is not programmable or controllable by MIDI.

STEPPING THROUGH A CHASE

From the initial page of the Chase mode, it is easy to step through the individual steps of a chase, by simply pressing the GO button, or by setting the cursor under the Step number, and incrementing or decrementing with the UP/DOWN buttons. Both these methods will bypass the loop point, going through all 32 steps if continued, even if these steps are unprogrammed. These new steps will then become part of all chase in the edit buffer, and "Edited" will flash on the screen when the last programmed step is surpassed.

It is also possible to step through a chase in a looping manner, by using the TEMPO and CHASE On/Off buttons, and this can be done whenever a chase is up, regardless of what page is displayed. This can even be done, for example, while in Scene or Song mode. First, press and hold down the TEMPO button; while it is held down, press and hold down the CHASE On/Off button. This freezes the current chase. Now, still holding the CHASE button down, release the TEMPO button. Any subsequent press of the TEMPO button then advances the chase one step. Note that this procedure always starts the chase from the last step it was on and not necessarily from step 01.

CONSOLE MODE

The Console mode of the LM-850 is where the user can set many parameters that affect the general operation of the board. Note that Console mode may be accessed from any other mode without affecting the normal operation of the channel faders and outputs. The Channel LEDs may change to indicate various parameters, but output values will remain at their proper levels and chases will continue running normally until the original mode is returned to, or until another mode is accessed.

Like the other modes, Console mode is entered by pressing the CONSOLE button to the right of the display screen.

CHANNEL-TO-DIMMER ASSIGNMENT – CUSTOM OR DEFAULT

The dimmer assignment can be set to a Default setting where dimmer 1 is controlled by channel 1, dimmer 2 by channel 2, etc. (dimmers 55 through 108 are set to OFF), or to a Custom user-defined dimmer assignment. This choice is made o the first Console page:

```
DIMMER ASSIGNMENT
CUSTOM   default
```

where the current choice is written in upper-case letters. The assignment is switched by pressing any key on the keypad, or by using the UP/DOWN buttons.

CUSTOM CHANNEL-TO-DIMMER ASSIGNMENT

A custom channel-to-dimmer assignment (soft patch) can be set up in the LM-850, which assigns each dimmer to any console control channel. A console channel can control more than one dimmer, but a dimmer cannot be controlled by more than one channel. For example, channel 12 could simultaneously control dimmers 9, 13, and 70, but no other channel could access those particular dimmers. Up to 108 separate dimmers can be assigned in this way. The display for this second Console page is:

```
DIMMER 070
CTRL BY CHAN 12
```

The dimmer number is selected with the keypad or the UP/DOWN buttons, and is assigned to a control channel by pressing the BUMP button of that channel, or by moving the cursor to the bottom line of the display and using the keypad or UP/DOWN buttons to enter the channel number. The LED of the channel controlling the currently selected dimmer will be lit. If another channel is selected to control this dimmer, the LED of the first channel will turn off when the new channel is selected.

To minimize any delay of the MIDI dimmer output by excess data, unused dimmers should not be assigned to a channel. A dimmer can be un-assigned by pressing the currently assigned channel's BUMP button, thus toggling it off, or by keying in "00" as the channel number. When a new dimmer number is selected, the Bank LEDs will switch to the bank containing its assigned channel. The soft-patch assignment is automatically stored in the console's memory, and no separate store routine is necessary.

The custom soft patch can be very useful when transferring a performance from a large lighting rig to a smaller setup (or vice versa). For example, say a band has a lighting show which relies on 54 dimmers, controlled by the default dimmer assignment above (one fader per dimmer channel). If the band performs in a smaller venue, where only minimal lighting can be accommodated, a soft patch can be set up where the exact same lighting cues can control the smaller setup, thus avoiding the necessity of reprogramming any part of the light show. If an amber stage wash is normally controlled by faders 1-6, and a red wash by faders 7-12, yet only two dimmers are available for each wash in the smaller venue, then a soft patch could be set up so that faders 1 and 2 controlled dimmers 1 and 2, faders 3 through 6 controlled no dimmers,

faders 7 and 8 controlled dimmers 3 and 4, and faders 9 through 12 controlled no dimmers. Now, when the same show is executed, the same effects will be achieved, only on a lesser scale. And with the soft patch stored in memory, the same show can be done on either lighting system simply by selecting either Custom or Default for the Dimmer Assignment.

PEDAL ASSIGNMENT

This third Console page assigns the optional FCP foot pedal to duplicate the function of either the GO button, the BLACKout button, the BUMP ALL button, the Chase BUMP button, the CHASE On/Off switch, or the TEMPO button. The UP/DOWN buttons are used to enter the desired choice. Alternatively, pressing any switch on the keypad will step through the choices, but only in a forward manner. The display reads as follows:

```
PEDAL ASSIGNMENT
CHASE START/STOP
```

where the bottom line changes with each press of the UP/DOWN or keypad buttons. When the desired choice is displayed, it will automatically be in effect; there is no storage routine.

BUMP CONTROLS

The control mode of the LATCH/MOM and ADD/SOLO switches can be set with the next page of Console mode. When set to Global, the BUMP buttons will always follow the front panel controls. When set to Scene-by-Scene, the bump modes will be reset with each scene change to the modes recorded within that scene. The display shows:

```
BUMP CONTROLS
 SCNbySCN  global
```

where the current setting is written in upper-case letters. The UP/DOWN buttons or any keypad buttons will toggle between the two choices.

CHASE CONTROLS

The CHASE On/Off, Chase clock source, Chase RATE, and Chase LEVEL can also be controlled either Globally, always following the panel controls, or Chase-by-Chase, with their respective settings recorded as part of each chase (and thereby as part of each scene). The display page for this setting reads:

```
CHASE CONTROLS
CHSbyCHS  global
```

where, once again, the current setting is written in upper-case letters, and the UP/DOWN or keypad buttons toggle between the choices.

BLACKOUT FADE RATE

This page adjusts the rate at which a blackout will commence when the BLACKout button is in LATCH mode, and is tapped briefly. (Holding the button down for over a quarter of a second, or re-pressing it after a tap, completes the blackout instantly; moving the CROSSFADE slider during a fade manually overrides it.) The display page reads:

BLACKOUT FADE RATE:2.0 SECONDS

The fade rate (2.0 seconds in the example) can be selected from the keypad or the UP/DOWN buttons in 0.1-second steps from 0.0 to 9.9 seconds.

BUMP ALL FADE-IN RATE

The next Console page adjusts the rate at which channels will go to the Bump Brightness Level when the BUMP ALL button is in LATCH mode, and is tapped briefly. (Holding it down for over a quarter of a second, or re-pressing it after a tap, will complete the fade-in instantly; moving the CROSSFADE slider during a fad-in manually overrides it.) The display reads:

BUMP ALL FADE RATE:3.2 SECONDS

The fade-in rate (3.2 seconds in the example) can be selected from the keypad or the UP/DOWN buttons in 0.1-second steps from 0.0 to 9.9 seconds.

BUMP ALL AND BLACKOUT MODES

This page selects momentary or latching operation for the BUMP ALL and BLACKout buttons. The display shows:

BUMPALL & BLACK momentary LATCH

The desired choice is made by pressing any key on the keypad, or by using the UP/DOWN buttons. The cursor will be positioned under the current choice, which is written in upper-case letters.

MIDI SYSTEM CHANNELS

The transmit and receive channels of the MIDI System (not the MIDI Dimmer Interface) can be selected on the next Console page. Any defined MIDI channel (1 through 16) is selectable. The MIDI System In can be set to Poly mode (reads messages only on the specified MIDI channel) or Omni mode (reads all MIDI messages, regardless of their channel assignments). The display for this page is:

MIDI CHANNEL IN 12 OUT 13

In the above example, the LM-850 will read incoming MIDI messages on channel 12 only. It will output MIDI data on channel 13. The desired settings are entered from the keypad or the UP/DOWN buttons. Omni mode can be selected for the MIDI In by entering any channel number over 16; “OMNI” is then displayed on the screen. There is no Omni selection for the MIDI Out.

MDI DIMMER CHANNEL

The next page sets the MIDI channel for the three MIDI dimmer outputs. There are not three separate settings; the MIDI dimmer network only requires one MIDI channel for all the dimmers. Once again, any channel, from 1 through 16, is selectable. The display reads:

```
DIMMER MIDI OUT
ON CHANNEL 01
```

and the MIDI channel is set to 01 in this example. As usual, this value is changed from the keypad or the UP/DOWN buttons. Be sure that the dimmers are set to this same channel, or they will not respond.

MIDI DATA DUMPS

The next console page allows the storage of the LM-85's internal memory to another device, such as a computer or a second LM-850, through a MIDI system exclusive (sysex) data dump. The display shows:

```
DUMP Song 32 TO
MIDI   Go=START
```

The first position of the cursor allows the user to select what type of data will be dumped; this can be "All Data" (the entire memory contents) or a single scene, chase, or song. The choices are stepped through by pressing any key on the keypad or the UP/DOWN buttons. When Scene, Chase, or Song is selected, the cursor can then be positioned under the accompanying number, and the desired choice is entered from the keypad or the UP/DOWN buttons.

When a number greater than the maximum valid number is entered here, "All" will be displayed, allowing the transfer of all scenes, all chases, or all songs. (Since 99 is a valid entry for a scene number, to transfer all scenes, simply type in 99 and then increment once with the UP button.) When the GO switch is pressed, the selected data will be sent out through MIDI in the standard system exclusive data dump format (see page 54). In this manner, an unlimited amount of data can be saved from the LM-850, and reloaded into the console at any time.

If a single scene, chase, or song is selected for the dump, the number will increment by one when the dump is completed. In the above example, after the dump takes place, the display will then read "DUMP Song 33 TO MIDI."

While a sysex dump is in progress, the console locks and the display shows:

```
MIDI Data Dump
  In Progress
```

For loading sysex data into the console, the LM-850 simply recognizes when a system exclusive data block is being received, and as long as the Memory Protect is not Locked and the "Receive MIDI Dump" is not disabled, the console updates its memory with the received data. Just as when data is being sent out, the operation of the console is stopped while MIDI sysex data is being received. While this is happening, the display reads:

```
INCOMING MIDI
  DATA DUMP
```

To enable or disable the reception of MIDI sysex data, the next Console page displays:

```
RECEIVE MIDI DMP
DISABLE   enable
```

The choice is made by pressing any button on the keypad, or by using the UP/DOWN buttons. The current selection is written in upper-case letters, with the cursor underneath.

If a data dump is received while the Receive MIDI Dump is disabled, the display will briefly show:

```
INCOMING MIDI
DUMP DISABLED
```

If a dump is received while the Memory Protect is locked, then the display will briefly show:

```
CANNOT STORE !!!
Memory Protected
```

MIDI OR DMX-512 OUTPUT

The next Console page allows choosing which dimmer output port will be active. The display shows:

```
DIMMER OUTPUT
MIDI   dmx512
```

As usual, the choice is made by pressing any key on the keypad, or by using the UP/DOWN buttons; the current choice is written in upper-case letters. If the console has the analog output option, this page must be set to “MIDI” for the analog output to function. If is possible, in a limited way, to use MIDI and DMX-512 dimmers simultaneously; see page 45, “Controlling MIDI Dimmers From the MIDI System Out.”

MIDI DIMMER OUTPUT PROTOCOL

This page allows choosing the method by which the console sends commands to the MIDI dimmers; it does not affect the DMX-512 or the analog outputs. The protocol choices are:

```
MIDI DIMMER OUT
  CONT      note
```

Where the current selection is in upper-case letters, and switching is done either with the keypad or the UP/DOWN buttons. “Cont” refers to continuous controller MIDI data, while “Note” refers to MIDI note-on/off messages. Although Leprecon MIDI dimmers respond to both data types, CONTinuous controller protocol should always be used (since it requires less data transmission to execute a given dimmer command) unless a special device that responds to note data (such as a synthesizer) must be driven by the MIDI Dimmer Outputs of the console. Some output lag may be noticed when using Note protocol if many output channels are being controlled simultaneously.

AUDIO TRIGGER MASK TIME

To reduce false or burst triggering when the chase clock is synced to an audio signal, a minimum time between audio triggers can be specified on the next Console page. The range is 0.00 to 1.00 second, and the display shows:

```
AUDIO TRIGGER
MASK = 0.11 S
```

where 0.11 seconds is the mask time in the example. Changes are made from the keypad, or with the UP/DOWN buttons.

MEMORY PROTECT

The final Console page allows the locking of the LM-850's memory so that edited scenes, chases, and songs cannot be stored. The display reads:

```
MEMORY PROTECT
  OPEN   lock
```

and the current choice is shown in upper-case letters. The keypad buttons or the UP/DOWN buttons toggle between the choices.

PREHEAT

To ease the shock to lamps and dimmers and make lamps respond faster to chases and bumps, preheat can be turned on. The LM-850 will then output a level of a few percent instead of zero or full off when channels are faded out. Dimmers will not go completely off, but will output a small idle current to keep bulb filaments warm. If a slight glow of filaments, noise or power drain are objectionable, turn preheat off.

MIDI FUNCTIONS AND OPERATION

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 a 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 (see page 35). 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; see page 44. Since the LM-850 can only address 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 feeds 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 Specification) - 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 (see page 35). 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.

CONTROLLING THE CHASE RATE THROUGH MIDI

The simplest way to use the LM-850 in a MIDI setup is to control the chase rate from an external MIDI source. In this situation, the console operator would still control all the functions of the LM-850, but chase rates would be controlled by the tempo of the external source, such as a sequencer or a drum machine. The chases would then run in perfect synchronization with the music.

Only one connection needs to be made to operate the console in this manner: the MIDI Out of the sequencer or drum machine needs to be connected to the MIDI In of the LM-850. Once this is done, the console will be able to receive MIDI clock signals from the driving device.

Sequencers and drum machines, by definition, operate in a time domain where MIDI events have to happen at specific instants. A slave keyboard doesn't care at all at what instant it is told to play a particular note. But such timing information is very important to a sequencer - it has to reproduce exactly what was recorded into it, and timing is of the utmost importance. For this reason, its internal clock sends out MIDI clock signals so that any other devices needing timing information can synchronize exactly to it. During every quarter-note interval, 24 clock "ticks" are sent down the MIDI path, and by reading these "ticks," other devices can stay right in time, even if the master's tempo changes.

When the LM-850's Chase Clock is set to MIDI (see page 26), it reads whatever MIDI clock signals are being sent to it, and thus runs at the same speed, synchronizing the chase steps perfectly to the music. The console also allows the user to specify how frequently the chase steps will be made in relation to the clock speed, such as once every quarter note (every 24 clock "ticks"), or once every sixteenth note (every 6 "ticks"). Once these two settings are programmed into a chase, and a MIDI cable is plugged between the console and the sequencer (or drum machine) as specified, the chase is ready to sync to the music.

Press the CHASE On/Off button, and the Chase LED will come on, but there will be no motion yet. Then, when the sequencer is started, it will send a "Start" command through MIDI to any connected devices. The LM-850 will read this command, and will immediately reset to Step 01 (if not there already), and the chase will start running in tempo. Note that when the sequencer is stopped, the chase stops running, but is still on. In other words, the sequencer start/stop does not turn the chase on and off, it merely starts and stops its step motion. After a sequence is stopped, it can either be continued or started over again. If continued, the LM-850's chase will pick up where it left off. If started over the chase will once again reset to Step 01.

Unlike most MIDI commands, MIDI clock signals are not sent on a specific channel - they are sent to all connected devices. Therefore, regardless of what MIDI In channel the LM-850 is set to, it will read the clock signals and synchronize accordingly. But you will probably want to set the MIDI In to a channel that is not being used by the sequencer. If the LM-850 is set to the same channel as a keyboard that the sequencer is driving, then specific MIDI commands intended for the keyboard will be received by the console as well, causing spurious lighting events. (For instance, channel 2 will come up every time the keyboard's modulation wheel is used, etc.)

CONTROLLING THE LM-850 FROM A SEQUENCER

Nearly every control on the LM-850's front panel can be mimicked by a specific MIDI command. Whenever a fader is moved or a button is pressed, the LM-850 will send out a corresponding MIDI message. Likewise, when another device sends such a command to the console, it will produce the same effect as if that control were physically moved. It is this concept that allows the LM-850 to be controlled from a sequencer.

A MIDI sequencer is simply a device that records a stream of MIDI data, and then plays it back exactly as it was recorded. To be more useful, most sequencers have editing functions so that the data can be changed in helpful ways, such as correcting errors, or raising the volume of a specific musical passage. But mainly, the sequencer records MIDI data, and it doesn't care what that data is - it could be a command for a keyboard to play a note, it could be a command to set a digital reverb to a certain program, or it could be a command that mimics the LM-850's GO button. Some keyboards have built-in sequencers, other sequencers are available as stand-alone units from several manufacturers, and there are many sequencers that are just software packages for personal computers equipped with MIDI interfaces. Keyboard-based and stand-alone sequencers are generally the most road-worthy, while software sequencers usually offer the greatest flexibility in editing and the greatest memory capacity.

In many ways, a sequencer operates like a multi-track tape recorder. There are multiple tracks, and each track is used to record a specific instrument, each on its own MIDI channel. To automate the LM-850, it should be recorded as one of these "instruments" on its own track. So data has to be sent first from the console to the sequencer to be recorded, and then from the sequencer to the console for playback. The MIDI System Out of the LM-850, therefore, needs to be connected to the MIDI In of the sequencer, and the sequencer's MIDI Out needs to be connected to the LM-850's MIDI In. The track needs to be set to the same MIDI channel that the LM-850's MIDI Out is set to (see page 33) in order to record data. Similarly, to play back the light cues, the LM-850 must be receiving on the same channel (MIDI In) that the track is set to. At first, it is simplest to set both the LM-850's MIDI System In and Out to the same channel.

Most MIDI devices only have one output, yet a sequencer might be driving six keyboards, a drum machine, some effects processors, and the lighting console. To connect all these devices to the one MIDI Out requires a MIDI Thru box - essentially a box that splits the incoming MIDI signal into numerous signals, all exact copies of the original. So the LM-850 will probably be hooked into this Thru box, which is no different from hooking it directly to the sequencer's MIDI Out. Note that the LM-850's MIDI Thru can be used to feed any other device that the sequencer controls. A typical sequencer setup incorporating the LM-850 is shown in Figure 6.

Recording "GO" Commands Only (Song Mode). At this point, there are two basic ways to go about recording the lighting cues, and the choice depends on your equipment and on your personal preference. If your sequencer has a somewhat limited memory capacity, you may want to record all the scenes and songs into the LM-850 as you normally would, and then, in Song mode, record into the sequencer only the "presses" of the GO button or the motion of the CROSSFADE slider. Then, the show is played back with the LM-850 in Song mode, with the sequencer automatically sending the "GO" cues or crossfading between scene changes. An advantage of this method is that the show is stored in the console's memory, and could be played back live if any problems developed with the sequencer. It uses only minimal amounts of sequencer memory, reserving the memory for the musical instruments. And it is basically a simple recording procedure.

*** Figure 6 ***

Figure 6. A typical sequencer setup using numerous keyboards and effects processors, a drum machine, and the LM-850. The cable connecting the LM-850's MIDI Out to the sequencer's MIDI In is only needed for recording into the sequencer, and may be eliminated for playback-only situations, such as in performance.

On the other hand, if the sequences are changed in any way, say a verse is removed from a song, then those changes will have to be made in the LM-850 as well, with those particular scenes being deleted from the song, etc. And if the sequencer is not started from the beginning every time, then the lighting cues will be off, unless the LM-850 is manually stepped forward to the new starting point.

To avoid having to start a song with the MASTER fader down, and manually bringing it up when the music starts (remember, the LM-850 does not record the motion of the MASTER fader), it is best to program a dark scene as the first song step. When a song is called up on the LM-850, it automatically brings up the first scene if the MASTER fader is up, and with an initial dark scene, the song can be called up with the MASTER on full. A scene change programmed with the downbeat of the song will then bring the lights up (as song Step 02) in perfect timing with the music.

If you are working with a sequencer that will not record undefined continuous controllers (see next section), the scene changes within a song can instead be triggered with a program change command rather than with the GO button or CROSSFADE slider (these are continuous controllers numbers 120 and 54, which are not defined as specific functions by the MIDI Specification). When the LM-850 is in song mode, any program change message received on its MIDI In channel will advance the song one step, regardless of the program number that was sent. A number of sequencers, however, will only allow one program change per sequence (a song is usually made up of a string of sequences); this can be a fairly limiting manner of controlling a show.

Recording All Commands (Scene Mode). Alternatively, rather than just recording "GO" cues into the sequencer for a "Song mode" show, every individual lighting move could be recorded into the sequencer while in Scene mode. Since just about every panel control on the LM-850 operates as a MIDI continuous controller, the movement of each control can be recorded by the sequencer, just as if it were recording a keyboard's modulation wheel. The performance is then played back in Scene mode, and the entire lighting show is basically a single scene subjected to a multitude of automatic "edits" sent from the sequencer.

While the MIDI Specification calls for 128 continuous controllers (numbered 0 through 127), only a small percentage of those are actually "defined" to control a specific function. Continuous controller number 1 is the modulation wheel on a MIDI-equipped keyboard, number 7 is its volume control, and number 64 is its sustain pedal, for instance. Most numbered controllers, though, have no set function, and are not used on most musical instruments. The LM-850, however, utilizes nearly all 128 controllers (see Appendix 1 on page 46). Since the console has no modulation wheel, volume slider, or other typical "keyboard" control, these controllers take on new functions here.

Nearly every available sequencer will record any continuous controller data, whether the controller number is defined or not. A few sequencers, however, will not record the undefined controllers, or will have to be set in a special mode to record them. Check in the sequencer's manual or call the manufacturer to make sure your unit can record these undefined controllers; if it will not, you will not be able to record most light cues on a sequencer track.

Recording the motions of the individual faders and bump buttons is a powerful way to synchronize your lighting show. Since the cues are all recorded in the sequencer, a song could be started in the middle, and the lighting cues would still be synchronized. If any edits are made to a sequence, such as eliminating a verse, then the lighting cues for that verse will automatically be eliminated as well, and there is no need to do separate editing in the console. (Note, however, that if a fader is first brought up momentarily and then pulled back down, and a segment containing the latter cue is edited out, then the fader will be "stuck" on, since it is never told to fade out. So, any cues that overlap the boundaries of a removed segment will have to be fixed in the sequencer.)

But recording the individual fader motions of numerous channels requires a good bit of sequencer memory, so smaller systems may not be able to accommodate such a technique. Also, the recording process will be more tedious, since each event - fader motions, bumps, and so on - will have to be recorded, rather than just a simple string of "GO" commands. Another minor disadvantage is that unless new scenes are called up, only one chase will be active. It is a simple enough matter, however, to call up another scene from the sequencer by using a program change command. When the LM-850 is in Scene mode, any program change received on its MIDI In channel will cause it to call up a new Current Scene with the scene number equivalent to the program number received (00-99), and the Next Scene one number higher. This new Current Scene is accessed regardless of what the prior Next Scene was. Note that MIDI program numbers are "officially" designated 0 through 127, but are also commonly called 1 through 128; the Current Scene accessed by a program change command uses the former nomenclature. Program numbers 0 through 99 call up scenes 0 through 99, and higher program numbers are ignored.

To use this Scene mode technique of recording cues directly into a sequencer, the LM-850 should be hooked into the sequencer exactly as before (as shown in Figure 6). The sequencer track should be set to record on the same MIDI channel as the LM-850's MIDI System Out channel (see page 33). Since there will now be a large number of individual cues to record, it may be easiest to record one track of just a few lighting channels, then record another track of a few more, etc. These can later be merged into a single sequencer track, if necessary. With a large number of cues to record, any "punch in" and editing features of the sequencer could prove very handy. Once again, to play back the recorded cues, the LM-850 must have its MIDI System In channel set to the same channel as the sequencer track(s) driving it.

COMBINING SEQUENCING AND LIVE CONTROL

Probably the best approach to using the LM-850 in a sequencer-based setting is to let the sequencer do what it does best, and let the board operator do what he or she does best. This calls for a combination of recorded cues and live control. The sequencer will be more accurate at executing complex scene changes perfectly every time, so it is best to let it handle this application. However, the sequencer cannot know when a sax player might ad lib a fill, or when a vocalist might step up and talk to the audience between songs, and this type of spur-of-the-moment activity warrants lighting cues as well. An excellent "division of labor" is to let the sequencer handle the scene work, and let the console operator handle the specials. Other effects, such as strobe lights, require on/off switching instead of control through dimmers, and they will therefore require manual control as well. With the sequencer handling the scene chores, the operator is much freer to concentrate on the auxiliary and effect lighting.

If the board is being operated in Song mode, with a sequencer sending Go or Crossfade cues to control scene changes, then any manual cues, such as a channel fader being brought up, will be overridden with the next scene change. When using Song mode, therefore, care must be taken to work in any manual cues within the framework of the song.

With the board in Scene mode, with actual fader motions controlled by a sequencer, manual cues will work more easily into the context of the show, as there will be no overriding scene changes taking place (unless a new scene is called up in order to access a new chase). A sequenced command will still override a manual edit, but it is not likely that this will occur in practice. For example, if a channel is brought up manually, then a sequenced command to fade out that channel will indeed override the manual command. But it is not likely that there will be such a fade-out command without there having been an accompanying fade-in command from the sequencer. In other words, the sequencer won't tell a lamp to turn off if it hadn't told it earlier
to turn on.

STEP-TIME SEQUENCING OF LIGHTING CUES

Rather than manually performing lighting cues in real-time as they are recorded into a sequencer, it is possible - mainly with software sequencers running on personal computers - to enter data from the computer keyboard in "step-time." In other words, without the sequencer actually running, the first lighting cue is typed in to occur in a specific measure of the song. Then, the next cue and its timing are typed in, and so on. With this method, it is possible to program extremely complex events with perfect timing and brightness accuracy.

Exactly how such cues are entered depends on the sequencer itself, but you will, in any case, need to know the MIDI continuous controller numbers that coincide with each of the LM-850's functions. This data is listed in Table 1 on page 46. As an example, if you wanted to program a bump of channel 37, you would need to enter a command for continuous controller number 96 to go to a value of 127 when the bump starts, and to go to a value of 0 when the bump ends.

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 bring up any lights if this becomes necessary (other than by controlling them, say, with a keyboard driving the dimmers).

The gist of this technique is that the show is recorded from the LM-850, only 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 CONTinuous controller or NOTE mode (see page 35); 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.

MIDI SYSTEM EXCLUSIVE DATA DUMP FORMAT

Besides being able to record lighting cues into a sequencer for automatic playback, MIDI provides another great bonus for the LM-850: the ability to store to computer disk the console's memory content. This storage can be done in several formats. Either individual songs, scenes, or chases can be stored, all songs, all scenes, or all chases can be stored, or the entire content of the LM-850's memory (RAM), including Console mode settings, can be stored. The process is accomplished through what is called a MIDI System Exclusive (sysex) data dump.

The LM-850's MIDI System Out must be connected into the computer's MIDI In, and the computer's MIDI Out must be connected to the console's MIDI In. The basic operation of the procedure is that the computer is set up to receive data from the LM-850, and the console then sends its data to the computer when the sysex dump command is entered from the console's panel; see page 34. (The LM-850 does not respond to external dump request messages; all dumps must be initiated from the front panel.) Finally, the computer creates a file that stores the data to disk. The LM-850 can then be completely reprogrammed with a whole new set of scenes, songs, and chases, and these new settings can be stored through sysex as a different disk file. At any time, a file can be re-loaded from disk back into the LM-850 through sysex, and in this way, the console is afforded an unlimited memory.

Like any MIDI message, a system exclusive data dump follows a specific format, outlined below. To designate that the message is a sysex command, the initial message byte is always an F0, while the final byte is always an F7 (all values are in hexadecimal).

FO	Beginning of sysex message
00 00 26	Leprecon/CAE, Inc. Manufacturer's I.D. Number
01	LM-850 Product I.D.Number
0x	Data type (0=all, 1=scene, 2=chase, 3=song.)
nn	Data Select (value=scene, chase, or song number, 7F=all)
0l	Low nibble of data byte*
0h	High nibble of data byte*
..	.....
..	.....
cc	Checksum
F7	End of sysex (EOX) message

*Since a MIDI data byte must begin with a zero in order to be recognized as such, each byte of data must be broken up into two bytes for sysex transmission. For instance, a hex value of 3A is sent as 0A 03 (the low nibble is sent first).

A sysex dump of all the LM-850's chases would thus look like this:

FO 00 00 26 01 02 7F (data) (checksum) F7

where the numbers in parentheses would, of course, depend on the actual data.

To send sysex messages to the LM-850 from a computer, the procedure is simply reversed. The first message byte (F0) tells the console that sysex data follows, of a particular format (such as all chases in the above example), and the console then loads in the new data. To do this, note that the console must not be disabled from receiving dumps (page 35) and its memory protect must be Open (page 36).

TRIGGERING MIDI DEVICES FROM THE LM-850'S DIMMER OUTPUT

An interesting application of the LM-850's MIDI Dimmer Interface is that it can control any MIDI device that responds to the type of data it sends out; it is not just limited to dimmers. By switching the Dimmer Output Protocol to "NOTE" (see page 35), the three dimmer outputs will send note-on/off data that can be read by keyboards and other MIDI devices. Note that the slave device will need to be set to the same MIDI channel as the dimmer output (see page 33).

When the Dimmer Assignment (see page 31) is set to "Default," channel 1 of the console will control MIDI note number 0, channel 2 will control note number 1, and so on. By setting the assignment to "Custom," however, a soft patch can be set up that will trigger any note (up through MIDI note 107) from any channel. And since more than one dimmer (or note, in this instance) can be assigned to each channel, chords can even be triggered, rather than just single notes.

The Channel BUMP buttons will trigger each note at full volume (MIDI velocity = 127), while the faders will trigger the notes at varying volumes. In compliance with the MIDI Specification, a note-off command must accompany every note-on command, so a fader will not give a smooth increase or decrease in a note's volume; instead, it will transmit one value, and then before transmitting the next, it will send a note-off for the first value. The result is that as the fader is moved, the note is rapidly re-triggered, either with an increasing or decreasing volume.

CONTROLLING MIDI DIMMERS FROM THE MIDI SYSTEM OUT

It is also possible on the LM-850 to control MIDI dimmers from the MIDI System Out port, in a somewhat limited way. Since theMIDI dimmers read continuous controller data from the channel faders, it is possible to plug a cable from the MIDI System Out to the MIDI In of a dimmer and control the dimmer with the channel faders. In this case, the dimmer has to be set to the same channel as the MIDI System Out - not to the same channel as the MIDI Dimmer Out. The starting address of the dimmer will determine, as always, which console channels the dimmer channels are assigned to.

The limitation of such an arrangement is that the dimmer responds to the physical position of the channel fader only - it will not respond to the MASTER fader, SUBMASTER faders, BUMP buttons, BLACKout button, or chases. Nor will it come up if that channel is part of a scene. This can be a handy arrangement, however, if a separate set of completely manual channels is needed. Also, it allows the use of MIDI dimmers simultaneously with DMX-512 digital dimmers.

APPENDIX 1: MIDI CONTINUOUS CONTROLLERS AND LM-850 FUNCTIONS

Controller No. (Decimal)	(Hex)	LM-850 Function	Possible Values (Decimal)
0	00	Channel 1 fader	0-127
1	01	Channel 2 fader	0-127
2	02	Channel 3 fader	0-127
3	03	Channel 4 fader	0-127
4	04	Channel 5 fader	0-127
5	05	Channel 6 fader	0-127
6	06	Channel 7 fader	0-127
7	07	Channel 8 fader	0-127
8	08	Channel 9 fader	0-127
9	09	Channel 10 fader	0-127
10	0A	Channel 11 fader	0-127
11	0B	Channel 12 fader	0-127
12	0C	Channel 13 fader	0-127
13	0D	Channel 14 fader	0-127
14	0E	Channel 15 fader	0-127
15	0F	Channel 16 fader	0-127
16	10	Channel 17 fader	0-127
17	11	Channel 18 fader	0-127
18	12	Channel 19 fader	0-127
19	13	Channel 20 fader	0-127
20	14	Channel 21 fader	0-127
21	15	Channel 22 fader	0-127
22	16	Channel 23 fader	0-127
23	17	Channel 24 fader	0-127
24	18	Channel 25 fader	0-127
25	19	Channel 26 fader	0-127
26	1A	Channel 27 fader	0-127
27	1B	Channel 28 fader	0-127
28	1C	Channel 29 fader	0-127
29	1D	Channel 30 fader	0-127
30	1E	Channel 31 fader	0-127
31	1F	Channel 32 fader	0-127
32	20	Channel 33 fader	0-127
33	21	Channel 34 fader	0-127
34	22	Channel 35 fader	0-127
35	23	Channel 36 fader	0-127
36	24	Channel 37 fader	0-127
37	25	Channel 38 fader	0-127
38	26	Channel 39 fader	0-127
39	27	Channel 40 fader	0-127
40	28	Channel 41 fader	0-127
41	29	Channel 42 fader	0-127
42	2A	Channel 43 fader	0-127
43	2B	Channel 44 fader	0-127
44	2C	Channel 45 fader	0-127
45	2D	Channel 46 fader	0-127
46	2E	Channel 47 fader	0-127
47	2F	Channel 48 fader	0-127

Controller No. (Decimal)	(Hex)	LM-850 Function	Possible Values (Decimal)
48	30	Channel 49 fader	0-127
49	31	Channel 50 fader	0-127
50	32	Channel 51 fader	0-127
51	33	Channel 52 fader	0-127
52	34	Channel 53 fader	0-127
53	35	Channel 54 fader	0-127
54	36	CROSSFADE slider	0-127 (1)
55	37	MASTER fader	0-127
56	38	SUBMASTER A fader	0-127
57	39	SUBMASTER B fader	0-127
58	3A	Chase LEVEL fader	0-127
59	3B	Chase RATE fader	0-127
60	3C	Channel 1 BUMP button	0=Off, 127=On
61	3D	Channel 2 BUMP button	0=Off, 127=On
62	3E	Channel 3 BUMP button	0=Off, 127=On
63	3F	Channel 4 BUMP button	0=Off, 127=On
64	40	Channel 5 BUMP button	0=Off, 127=On
65	41	Channel 6 BUMP button	0=Off, 127=On
66	42	Channel 7 BUMP button	0=Off, 127=On
67	43	Channel 8 BUMP button	0=Off, 127=On
68	44	Channel 9 BUMP button	0=Off, 127=On
69	45	Channel 10 BUMP button	0=Off, 127=On
70	46	Channel 11 BUMP button	0=Off, 127=On
71	47	Channel 12 BUMP button	0=Off, 127=On
72	48	Channel 13 BUMP button	0=Off, 127=On
73	49	Channel 14 BUMP button	0=Off, 127=On
74	4A	Channel 15 BUMP button	0=Off, 127=On
75	4B	Channel 16 BUMP button	0=Off, 127=On
76	4C	Channel 17 BUMP button	0=Off, 127=On
77	4D	Channel 18 BUMP button	0=Off, 127=On
78	4E	Channel 19 BUMP button	0=Off, 127=On
79	4F	Channel 20 BUMP button	0=Off, 127=On
80	50	Channel 21 BUMP button	0=Off, 127=On
81	51	Channel 22 BUMP button	0=Off, 127=On
82	52	Channel 23 BUMP button	0=Off, 127=On
83	53	Channel 24 BUMP button	0=Off, 127=On
84	54	Channel 25 BUMP button	0=Off, 127=On
85	55	Channel 26 BUMP button	0=Off, 127=On
86	56	Channel 27 BUMP button	0=Off, 127=On
87	57	Channel 28 BUMP button	0=Off, 127=On
88	58	Channel 29 BUMP button	0=Off, 127=On
89	59	Channel 30 BUMP button	0=Off, 127=On
90	5A	Channel 31 BUMP button	0=Off, 127=On
91	5B	Channel 32 BUMP button	0=Off, 127=On
92	5C	Channel 33 BUMP button	0=Off, 127=On
93	5D	Channel 34 BUMP button	0=Off, 127=On
94	5E	Channel 35 BUMP button	0=Off, 127=On
95	5F	Channel 36 BUMP button	0=Off, 127=On
96	60	Channel 37 BUMP button	0=Off, 127=On

Controller No. (Decimal)	(Hex)	LM-850 Function	Possible Values (Decimal)
97	61	Channel 38 BUMP button	0=Off, 127=On
98	62	Channel 39 BUMP button	0=Off, 127=On
99	63	Channel 40 BUMP button	0=Off, 127=On
100	64	Channel 41 BUMP button	0=Off, 127=On
101	65	Channel 42 BUMP button	0=Off, 127=On
102	66	Channel 43 BUMP button	0=Off, 127=On
103	67	Channel 44 BUMP button	0=Off, 127=On
104	68	Channel 45 BUMP button	0=Off, 127=On
105	69	Channel 46 BUMP button	0=Off, 127=On
106	6A	Channel 47 BUMP button	0=Off, 127=On
107	6B	Channel 48 BUMP button	0=Off, 127=On
108	6C	Channel 49 BUMP button	0=Off, 127=On
109	6D	Channel 50 BUMP button	0=Off, 127=On
110	6E	Channel 51 BUMP button	0=Off, 127=On
111	6F	Channel 52 BUMP button	0=Off, 127=On
112	70	Channel 53 BUMP button	0=Off, 127=On
113	71	Channel 54 BUMP button	0=Off, 127=On
		CHASE On/Off	17=pressed
114	72	CLOCK button	34=pressed
		AUDIO button	68=pressed
		Master BUMP button	17=pressed, 16=released
115	73	Submaster A BUMP	34=pressed, 32=released
		Submaster B BUMP	68=pressed, 64=released
116	74	Chase BUMP button	0=Off, 127=On
117	75	BLACKout button	127=pressed, 0=released (2)
118	76	BUMP ALL button	127=pressed, 0=released (2)
119	77	CLEAR button	127=pressed
120	78	GO button	127=pressed (3)
121	79	Scene/Song mode buttons	0=Song mode (4), 127=Scene mode

NOTES:

(1) When in Scene mode, the CROSSFADE slider sends a program change number following the initial controller message.

(2) Release message is only sent for MOMentary mode. If button is held down while in LATCH mode, a second "pressed" message is sent after 1/4 second to override timed fades.

(3) Controller message sent in Song mode only. In Scene mode, GO button sends program changes which designate scene number.

(4) Song mode command is followed by a program change byte.

The following panel controls have no associated MIDI function:

BANK switches	UP/DOWN and NEXT/LAST	STORE	TEMPO
LATCH/MOM	CONSOLE & CHASE mode	MANUAL	SENSE
SOLO/ADD	Cursor LEFT/RIGHT	Keypad	HELP

APPENDIX 2: BUILT-IN TESTS

POWER-UP COMMUNICATIONS TEST

Whenever the LM-850 is powered up, a test of the communications between the main microprocessor (type 8031) and the output microprocessor (type 8052) is automatically performed. If the test is successful, the screen will briefly display:

```
LEPRECON LM-850
  Version 1.4B
```

and then the console will automatically enter the Scene mode. If the test fails, the following message is displayed:

```
Dimmer Output
Not functional
```

Press any switch or button to continue. Note that the controls will function properly, but all of the dimmer outputs will be disabled. If this occurs, the console should be returned to an authorized service center.

SERVICE TESTS

There are other tests which are for use by service technicians for troubleshooting and repair. These tests are built into the software, and are accessed by holding down the GO button while the power is switched on. The display will then show:

```
Test Selection
1)LEDS    G0=Ok
```

The desired test can be selected by entering its number (from 1 through 5) on the numeric keypad. The choices are:

1: LEDS. The console sequences through all the front panel LEDs.

2: MIDI INT. Connect the MIDI System Out to the MIDI System In with a MIDI cable, and this test verifies that these ports are working correctly.

3: MIDI DIM. Connect a MIDI Dimmer Out to the MIDI System In with a MIDI cable, and this test verifies that the MIDI Dimmer Out is working correctly.

4: RAM. This tests the console's battery-backed RAM (Random Access Memory).

5: ROM. This tests the console's ROM (Read Only Memory).

All tests are initiated by pressing the GO button.

BATTERY
The LM-850 uses a lithium battery to maintain its RAM memory. This battery should last several years. Removing the battery will cause a memory loss, and will require a hard reset (see below) after a new battery is installed.

HARD RESET
A hard reset is performed by holding the STORE and LAST buttons down while the power is switched on. This causes all program memory to be initialized to its original factory state, and **all user programmed scenes, songs, chases, and console settings will be lost.**

DEFAULT SETTINGS:
A new console, or one that has just been reinitialized (hard reset) will be set to the following default values:
- All scenes: black
- All chases: empty
- All songs: Steps 1-50 = Scenes 1-50
- All fade rates: 0.00 sec.
- Output mode: MIDI
- Bump and chase controls: Global
- Dimmer assignment: Default (channels 1-54 to dimmers 1-54; dimmers 55 and higher = OFF)
- Custom dimmer assignment: same as above.
- All scene names: "scene 1," "scene 2," etc.
- All song names: "song 1," "song 2," etc.
- All chase names: "chase 1," "chase 2," etc.

APPENDIX 3: LEPRECON LM-850 MIDI IMPLEMENTATION CHART

Function	Default	Transmit	Recognized	Remarks
CHANNEL VOICE				
Channel #	1	1-16	1-16, Omni	
Mode 1	X	O	O	Omni on/Poly
Mode 2	X	X	X	
Mode 3	O	O	O	Omni off/Poly
Mode 4	X	X	X	
*Note Numbers	X	0-107	X	*via MIDI Dimmer OUT only
*Velocity: Note on	X	0-127	X	*via MIDI Dimmer OUT only
* Note off	X	X	X	*via MIDI Dimmer OUT only
Program Change	0	0-99	0-99	See Note (1)
Aftertouch: Keys	X	X	X	
Channels	X	X	X	
Pitch Bend	X	X	X	
SYSTEM COMMON				
Song Pos.	X	X	X	
Song Select	X	X	X	
Tune	X	X	X	
EOX Flag	X	X	X	
SYSTEM REAL-TIME				
Timing Clock	X	X	O	Controls chase rate
Start	X	X	O	
Stop	X	X	X	Resets chase to Step 01
Continue	X	X	X	
Active Sensing	X	X	X	
System Reset	X	X	X	

Function	Default	Transmit	Recognized	Remarks
Control Change - MIDI Dimmer Output. *(Outputs either note-on/off or continuous controller data to dimmers.)*				
	X	0-127	X	MIDI Dimmer Out (Dimmer level values, 0-127)
Control Change - MIDI System Out:				
	X	0-53	0-53	MIDI System Out (Channel level sliders, 0-127)
	X	54	54	CROSSFADE, 0-127; also sends program change (0-99) in Scene mode
	X	55	55	MASTER, 0-127
	X	56	56	SUBMASTER A, 0-127
	X	57	57	SUBMASTER B, 0-127
	X	58	58	Chase LEVEL, 0-127
	X	59	59	Chase RATE, 0-127, slow-fast
	X	60-113	60-113	Channel 1-54 BUMP, 127= bump on, 0=bump off
	X	114	114	CHASE On/Off, CLOCK, AUDIO; see Note (2)
	X	115	115	Master, Subm A, Subm B BUMPs; see Note (3)
	X	116	116	Chase BUMP, 0=On, 127=Off
	X	117	117	BLACKout, 127=pressed,0=released
	X	118	118	BUMP ALL,127=pressed,0=released
	X	119	119	CLEAR, 127=pressed
	X	120	120	GO, 127=pressed
	X	121	121	SCENE and SONG mode, 127=Scene, 0=Song
SYSTEM EXCLUSIVE	X	O	O	Data Dumps
CHANNEL MODE				
Local Control	X	X	X	
All Notes Off	X	X	X	
Omni on/off	X	X	X	
Mono/Poly	X	X	X	

0 = YES
X = NO

NOTES:

(1) In Scene mode, program changes are received as GO commands, with program change numbers 00-99 corresponding to the selected Current Scene number. In Song mode, any program number will advance the current song one step. In Chase mode, any program number will advance the current chase one step.

(2) The value of the third controller byte designates which switch is accessed (values are in hex):

- 11 = CHASE On/Off
- 22 = CLOCK
- 44 = AUDIO

(3) The value of the third controller byte designates which switch is accessed (values are in hex):

- 11 = Master BUMP pressed, 10 = released
- 22 = Submaster A BUMP pressed, 20 = released
- 44 = Submaster B BUMP pressed, 40 = released

LM-850 PARTS LIST

PART #	DESCRIPTION	SUG LIST
03-0002	DIODE, IN 4002	0.25
03-0004	DIODE, IN 4148	0.25
03-3014	OPTO-ISOLATOR FAST BUFFERED, PC 900	3.00
04-0004	XSISTOR, 2N4401 NPN GP, TO-92	0.25
04-0012	XSISTOR, 2N3906	0.25
04-0024	TRANSISTOR, TIP-115 PNP DAR. TO-220, 60V	1.25
05-0002	OSC, 12 MHZ CRYSTAL	2.00
05-0003	OSC, 8MHZ CRYSTAL	1.75
06-0001	IC, LM324N, QUAD OP AMP	1.00
06-0143	IC, TLC274C	3.25
06-0144	IC, LM2940 CT 5.0, LO-DROP OUT 5V REG	3.50
06-2003	IC, 75174 QUAD DIFF. RS 422 LINE DRIVER	3.75
06-2004	IC, 74HC244 OCTAL TRI-STATE BUFFER	1.25
06-2008	IC, 27C256-20 EPROM 256K 200NS	8.75
06-2009	IC, 80C31 CPU W/128*8 RAM I/O, CMOS	8.50
06-2015	IC, 27C64-25 EPROM 64K 150NS CMOS	10.00
06-2016	IC, 8032AH CPU 8-BIT 256 BYTES RAM	11.00
06-2026	IC, 74F244 OCTAL BUFFER/DRIVER (64MA)	1.50
07-1019	XLR, 5 PIN FEMALE CHASSIS	25.25
07-1114	DIN, 5 PIN FEMALE PCB	2.25
07-1115	CON, PHONE JACK PCB RA	3.25
07-1116	CON, PCB POWER TYPE, 2.1 MM PIN	2.00
07-1138	XLR, 3 PIN FEMALE PANEL MOUNT	2.75
07-4136	PLUG, 2.1 MM COAXIAL POWER	0.50
08-0013	POT, 100K LIN.45 MM SLIDE, LM850	4.00
08-1011	POT, 5K ¼ W ROTARY LINEAR	0.75
08-2038	SHAFT, TRIMPOT LM850, 6MM X ¾", PT10	0.25
09-0035	SWITCH, MOMENTARY PUSH-BUTTON SQUARE TOP	1.25
09-0060	CAP, BLACK FOR .3" SQ. SWITCH, D-6	0.50
09-0062	CAP, GRAY DARK FOR .3" SQ SWITCH, D-6	0.50
09-0063	CAP, GREEN FOR .3" SQ SWITCH, D-6	0.50
09-0064	CAP, YELLOW FOR .3" SQ SWITCH, D-6	0.75
09-0065	CAP, RED FOR .3" SQ SWITCH, D-6	0.50
09-0066	CAP, BLUE FOR .3" SQ SWITCH, D-6	0.50
09-0070	SWITCH, ROCKER SPDT ON/OFF MIDI	6.75
09-0071	SWITCH, MOMENTARY ROUND .35" BLACK	1.25
09-0072	SWITCH, MOMENTARY ROUND .35" DARK GRAY	1.25
15-3045	KNOB, LOW PROFILE SLIDER, DRK GRY	2.00
15-9068	ELEC HDWR, NYLON PUSH FAST 1/8"	0.25
15-9103	BATTERY, 3 VOLT LITHIUM 24 MM	3.75
15-9104	HOLDER, COIN CELL LITHIUM 24 MM	1.75
18-3003	RUBBER BUMPER 5/16*3/4	0.50
20-3001	LM-850, FRONT PANEL, REV H	143.00
20-3002	LM-850, BOTTOM PANEL	83.50
21-2083	MANUAL, LM-850	9.50
60-01-0053	WALL-XF, 12VAC/2A,2.1 MM PWR PLUG	30.75
60-30-3001	LCD ASSEMBLY FOR LM-850	93.25
60-30-3002	PROM KIT FOR LM-850	18.75
72-30-3001	LM MIDI CONTROLLER PCA, REV F	669.50

effective 10/96

Prices are subject to change without notice. Please contact the factory for parts not included on this list.

Leprecon/CAE, Inc PO Box 430 10087 Industrial Dr Hamburg MI 48139-0430 Tel: (810) 231-9373 Fax: (810) 231-1631