color pro

User Manual

2209 WEST BRAKER LN.
AUSTIN, TX. 78758

LIGHTWAVE
RESEARCH

COLOR PRO

USER MANUAL

TABLE OF CONTENTS

1)   **KEY SWITCH** applies power to controller and enables fixtures.

2)   **STANDBY** disables controller output to all fixtures regardless of status.

3)   **REGION** control performs the following functions: allows for viewing of
     luminare's **RGB** percentages, shows status of 16 outputs, and editing.

4)   **IMP** DISPLAY - <u>indicated by decimal points at the TOP of each</u>
     <u>display</u>, and consists of Intensity, Memory, and Page
     information.

     INTENSITY - master dimmer assigned to all regions.

     MEMORY - 9 sections, each containing 99 pages.

     PAGE - a "scene" which is visualized in the **Region** display. A Page contains
         information about programmed regions.

5) RGB DISPLAY - with the display in the **RGB** mode, **indicated by decimal points at the BOTTOM of each display**, percentages of **Red**, **Green**, and **Blue** available in each **Region** are shown.

6) ↑/↓ - these controls are used for changing Intensity, Memory and Page (IMP), and **RGB** values.

7) SELECT - used to choose a **Region** for Programming. Also toggles controller between **Master** and **Slave**.

8) RECORD - used to store Programming in Memory and to download Memory to a personal computer. Holding **Record** down for ten seconds causes the Intensity display to read **SA**, prompting "save to computer" or download Memory.

9) ERASE - removes Programming from Memory and is used to upload Memory from a personal computer. Holding **ERASE** down for 10 seconds causes the Intensity display to read **PL**, prompting "play from computer" or upload Memory.

10) ADVANCE - Pages are advanced by this section with the following controls:

    AUTO - **Automatic Advance** of the Pages as set by the **Rate** control.

    AUDIO - **Advances** Pages with **Audio** synchronization.

    RANDOM - Pages are **Advanced** randomly in all **Advance** modes.

11) CONTROL - This section allows the user 3 types of control over active **Regions** on a Page.

    PROGRAM - active **Regions** are controlled by user preset colors and intensities.

    MODULATE - special effect creates colors and Intensities derived from the amplitude and frequency of the musical information supplied to the controller input. **Audio** trim is set by the **Audio** level control.

	CYCLE -	active **Regions** cycle through the Color Pro spectrum of colors with the **Rate** of change controlled by **Rate** level control.
12)	**CROSSFADE** -	This feature is used to provide **Page-to-Page** crossfading with the controller under **Program** control. **Crossfade** times are set by the **rate** control below it.
13)	**AUDIO** -	Adjusts **Audio** input level.
14)	**LEVEL** -	Indicates **Audio** input.
15)	**RATE** -	Adjusts **Crossfade** and **Cycle** times.
16)	**RATE** -	Adjusts **Automatic** Page **Advance** time.
17)	**DATA LINK OUTPUT** -	Serial data link providing pulse modulated digital signals to the fixtures.
18)	**SERIAL PORT RS-232** -	For connection to a personal computer operating at 9600 BAUD for external Memory storage, special communication and **Master/Slave** configuration.
19)	**REMOTE PAGE SELECT** -	(2) 8-pin locking DIN connectors for direct access of 99 Pages.
20)	**REMOTE ENABLE JACK** -	3.5mm mini-plug allows remote standby of controller.
21)	**STEREO AUDIO INPUT** -	RCA type connection of line level **Audio** signal @ 1.4V.
22)	**240/120** Voltage Selector -	for 240V operation a new Eprom must be installed for optimum performance.
23)	**LINE CORD** -	Mains supply for controller.

CONTROLLER SPECIFICATIONS

- 9 Memories - 99 Pages each

- Remote Page interface

- Page crossfade

- Music color synthesis

- 16 channels

- Master dimmer

- Remote enable

- Editing functions

- Master/Slave function

- Region lockout

- Positive feel switches

- RS-232 computer backup

- Stereo Audio input

- Security keylock

- 19" rack mount - 3 units

- Voltage -   120V / 240V

- Fuse -   1A 5mm x 20mm Slow Blow @ 120V - 1/2A @ 240V

- Current -   1/2 Amp @ 120V - 1/4 Amp @ 240V

- Weight -   5.9kg (6.9kg packed)

- Dimensions -   133mm H x 482mm W x 203mm D
                     330mm H x 558mm W x 330mm D (Packed)

specifications subject to change without prior notice

LUMINAIRE ILLUSTRATION
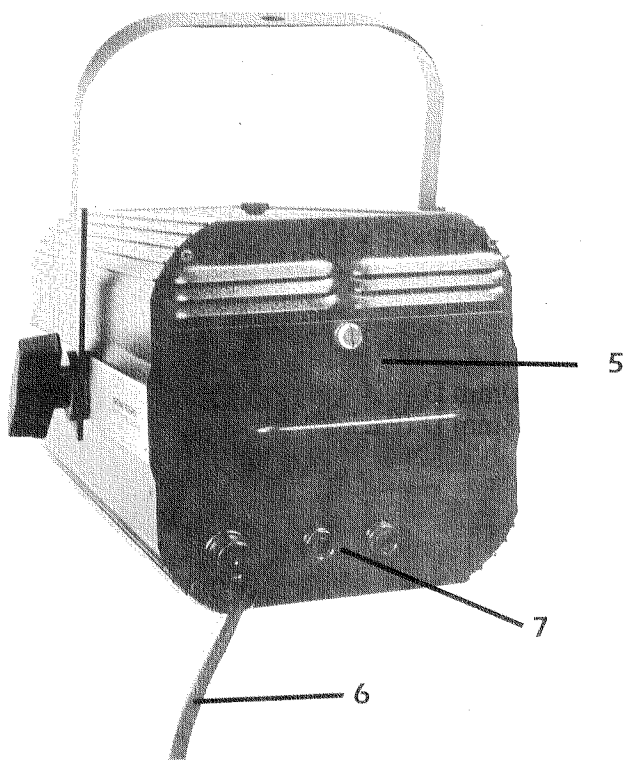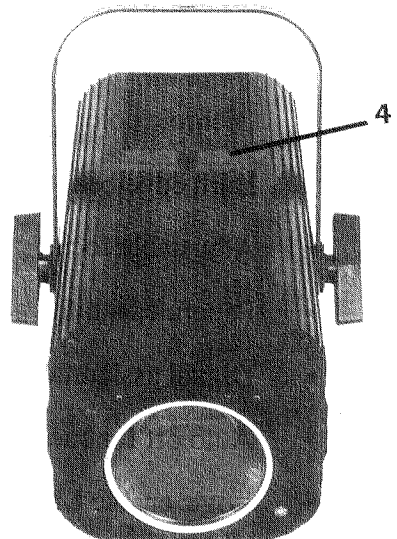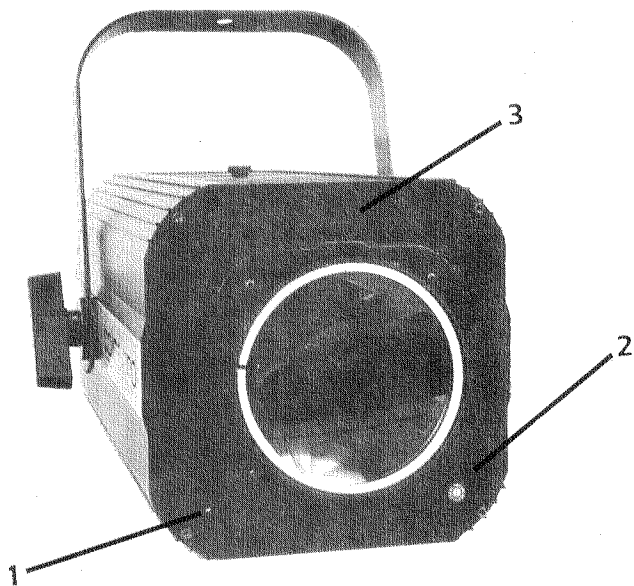
LUMINAIRE DESCRIPTION

1) **LED** - Logic and fan enable indicator

2) **DIGITAL REGION SELECTOR**

3) **LENS CLAMPING SCREW**

4) **GOBO SLOT**

5) **LAMP SERVICE DRAWER**

6) **MAINS CORD**

7) **1/4" (3 WAY) INPUT/OUTPUT CONNECTOR**

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LUMINAIRE SPECIFICATIONS

- Dichroic color change system

- Hard edge beam -   Fresnel lens available

- Adjustable focus

- Pattern capability

- Digital assignment selector

- Auto off function

- Logic enable LED

- Electronic over temperature protector

- MRI6 lamp technology

- Easy lamp replacement

- Lightweight aluminum construction

- Voltage -   120V / 240V (selected at factory)

- Fuse -   10A 5mm x 20mm Fast Blow @ 120V / 7A @ 240V

- Wattage -   750w total (3) 250w ENH lamps
                       900w total (3) 300w ELH lamps

- Current -   6 Amps @ 120V (ENH) - 4.5 Amps @ 240V
                       7.5 Amps @ 120V (ELH) - 5.5 Amps @ 240V

- Weight -   5.5kg (6.5kg Packed)

- Dimensions -   180mm H x 190mm W x 450mm D
                       330mm H x 330mm W x 558mm D (Packed)

specifications subject to change without prior notice

INSTALLATION

Each box containing a Color Pro fixture should also include:
(1) #10 Phillips screw to replace lens clamping screw in vertical installation of fixture

Plug no more than 2 fixtures into a single 120V 20A (USA), 240V (European) grounded non-switched, non-dimmable circuit. Simple hookup of low voltage controller output requires **shielded** Low Capacitance 2-conductor wire. The correct hookup is shield to sleeve, black to ring, and red to tip. Be certain to observe polarity throughout hookup or the system will not function properly.

Run the cable from the controller to the first fixture and then turn the controller on. Check to be sure the first fixture functions properly and then continue connecting the remaining fixtures, being aware of any changes to the light output as you hook up each additional fixture. This method will allow you to spot bad cables as they are installed.

Cable may also be paralleled up to 5 times to allow for individual runs to different locations. Maximum number of fixtures per **Region** is 8 (128 per controller), though you may have an uneven number of fixtures on each of the 16 **Regions,** i.e.:

Region 1 = 8 fixtures
Region 2 = 6 fixtures
Region 3 = 5 fixtures

COLOR PRO SIGNAL CONNECTIONS

Signal	XLR	1/4" phone jack
Ground	PIN 1	Sleeve
Strobe	PIN 2	Ring
Data	PIN 3	Tip

Color Pro fixtures with 1/4" phone jacks automatically terminate the data link line wherever there is an unused jack (the last fixture in the line).

XLR equipped fixtures need a terminating connector for the last fixture in the line.

Take a blank male XLR cable connector and solder a 4.7K 1/4 watt resistor from PIN 2 to PIN 1 and PIN 3 to PIN 1, as shown below.
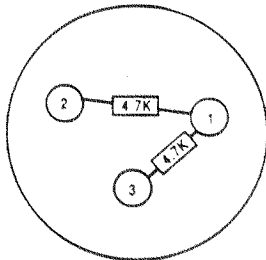
CONNECTION SIDE
OF MALE XLR

Install this plug in the unused female XLR connector on the last Color Pro fixture in the line.

PROGRAMMING

There are 9 Memories available, each containing 99 Pages or "scenes" for a total of 891 Pages or "scenes." A Page contains 16 output **Regions** that contain **RGB** percentage information. The primary keys for Programming are the yellow **Select, Record,** and **Erase.** The Red, Green, Blue, and **Region** keys will also be used.

Turn the controller power switch on. A Memory test will be performed and the Memory display will count 1-9 twice and then the display will read **F.L** , **0.1** , **0.1** , F L indicating full intensity. The **Standby** and **Program** LEDs will both light and the controller will be in manual mode.

Programming may be done with the controller in **Standby** and no visible output from the fixtures. Begin by choosing the Memory number with the Green keys and the Page number with Blue keys. **Master** Intensity does not have to be set during **Recording** as it is an adjustable playback feature and has no **Memory,** though it may be helpful during early Programming to see the Intensities of a **Program** as it is being assembled.

USING
SELECT/RECORD/ERASE

Depress the **Select** button once and the **Select** LED will flash. Momentarily depress the **Region** you want to adjust, its LED will flash in unison with the **Select** LED, and the display will change to **RGB**, indicated by the decimal points being at the BOTTOM of the displays.

During Programming, the **RGB** up/down keys have a built in Wrap Around function. That is, instead of having to go from **0.0** to **9.9** sequentially, you may go "backwards" the other way. Depress the down key once and the display will go to **9.9**. If depressed and held, these keys will accelerate the display to either limit and then stop. If depressed once again they will go to the next value in that direction.

Set the color output you desire from that **Region** by using the Red, Green, and/or Blue up/down keys. When the **RGB** levels of the **Region** are set, depress **Record** and the display will return to **IMP**, indicated by the decimal points at the TOP of the displays. The LED of the **Region** adjusted will remain lit and **Select** will go off. Other **Regions** on this Page may be activated or edited in the same manner. If a **Region** is mistakenly adjusted and it is noticed before depressing **Record**, depress **Select** again and the **Region** will be restored to its previous setting.

Blank **Regions** may be **Recorded.** Depress **Select** and then the **Region** you wish to adjust. Using the **RGB** controls adjust the **RGB** to **0.0** , **0.0** , **0.0** and then depress **Record.** This will **Record** no output for that **Region** on that Page.

To Clear an entire Page, depress **Select** then **Erase.** To **Record** entire blank Pages, depress **Select,** then **Erase,** followed by **Record.** A blank Page will have been **Recorded.**

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Copying Regions - A **Region's RGB** values may be copied to another **Region** easily. Depress **Select** and then the **Regions** to be adjusted (they will flash in unison) before depressing **Record.**

For example, depress **Select** and then the **Regions** to be Programmed - all keys that were depressed will flash their LEDs simultaneously. Adjust the values of **RGB** and depress the **Record** key. To restore previous settings, do not depress **Record** but depress **Select** again and **Select's** LED will go out, with all adjustments ignored, and the **Regions** restored to their previous (if any) setting.

After the **Page** has been recorded, merely depress the **Blue** up/down key to go to the next **Page** you wish to Program.

Copying Pages - Complete Pages may also be copied to other Pages in the same or other Memories. These Pages may be Copied forwards or backwards. To perform Page Copying, select the Page you wish to Copy, then depress **Select** and the display will go blank with decimal points at the bottom. Depress either of the Green and Blue up/down keys to bring back the display which will read **P.C** , _._ , _._ indicating Page Copy and the previously Programmed Memory and Page information. The information contained on this Page can be copied to any other Page in any Memory. This is accomplished by depressing the Blue or Green keys again to direct the Copied information to another location and then the **Record** key. The Page Copy function may be repeated over and over again by following these instructions.

INITIALIZED / NONINITIALIZED PAGES

INITIALIZED PAGE   -   is one that has **RGB** values of **0.0** , **0.0** , **0.0** or greater. This can be a blank or dark **Page** with no output.

NONINITIALIZED PAGE -   is one that has been "removed" by the **Select Erase Erase** method (where by depressing the keys in that order, a page is "removed"). The display will read ___ , ___ , ___ any time a **Noninitialized** **P**age is viewed with a **Region** key.

If you want to make a **Sequence** after recording a number of **P**ages totalling less than 99, a **Noninitialized P**age must be created. This is done by **Advancing** to the next **P**age and depressing **Select Erase Erase.** This tells the controller how many steps have been Programmed, so it can run them in a loop. Several different loops may be **Recorded** in a Memory.

Example: Program Pages 1-40. **Advance** to **P**age 41 and depress **Select Erase Erase** (Installing a **Noninitialized P**age). The display will return to **IMP**. Next, go to **P**age 42 and Program to **P**age 60. Then go to 61 and repeat the above procedure. This allows for "multiple sequences" in each **Memory.**

If the controller is **Advanced** manually to a **Noninitialized P**age and then placed in an **Auto** mode, it will revert to the lowest value **Initialized P**age.

Example: As in the above, manually go to **P**age 61 and press **Auto**; the controller will then begin running through **P**ages 42 to 60 in a loop until instructed otherwise.

In **Random**, Pages from 1-40 or 42-61 would be accessed. Pages 41 & 61 or any other **Noninitialized P**age would not be accessed, as they would have values of less than **0.0** , **0.0** , **0.0**.

CONTROLLER OPERATIONS

The following sections of the Color Pro controller are the **"operational"** areas which manipulate the **Active** Programmed **Regions**. These are **Advance (Manual, Random, Audio,** and **Auto)** and **Control (Program, X-fade, Modulate,** and **Cycle)**

THE ADVANCE SECTION

Advance provides 4 basic ways, plus combinations to step through the **Initialized Pages** of a Memory:

1. **Manual** only -   if no **Advance** mode is chosen and no LED's are lit in the **Advance** section. Depressing the Blue keys beneath the Page/Blue display causes the controller to **Advance** up or down through the Pages.

2. **Random** only -   instructs the controller to **Randomly Advance** through the **Initialized** Pages in a Memory. For example: (15,8,29,89,60,72 etc.) when one of the Blue keys is depressed or if advancing by **Audio** or **Auto**. To disable, depress the **Random** key again.

3. **Audio** only -   allows the controller to **Sequence** through the Pages to the bass step of the music information. The **Audio** level may be fine tuned with the aid of the **Audio** Level pot and LED in the bottom right corner. To disable, depress **Audio** again.

4. **Auto** only -   allows the controller to **Sequence** through the Pages in order at a speed set by the **Rate** pot below it. To disable, depress **Auto** again.

5. **Combination** -   **Audio** or **Auto** may be depressed at any time to provide **Random** or sequential Page changes either to the bass step or **Automatically**. Depressing either **Audio** or **Auto** turns the other off.

MEMORY SEQUENCING

You may **Automatically Sequence** through the different Memories. This is achieved by depressing and holding the Green "up or down" key until the Memory display reads **A.1** and the Page display reads **1.0**. (Intensity will remain where it is set until adjusted). Release the key and Memory 1's Initialized **Pages** will be **Sequenced** through according to the **Advance** mode. On the completion of Memory 1's highest Initialized Page the controller will advance to Memory 2; then Memory 2's will and so on through Memory 9, with an "A" preceeding each Memory. The controller will continue to run through Memories 1-9 until instructed to perform another function. To disable Memory **Sequencing**, depress and hold the Green "up or down" key until "A" is no longer in the display.

THE CONTROL SECTION

Determines the type of **Control** of Active **Regions** on a Page. One of the LEDs in this section will be lit at all times. There are three basic types of **Control** afforded here plus various combinations.

1. **PROGRAM** -	when this LED is on, the Active **Regions** on a Page are controlled by user-Programmed information of **RGB** values. Changing **Pages** results in sharp cuts from one Page's Programmed settings to the next. **X-fade** can be used with **Program** only and is controlled by the **Rate** pot below its key. **X-fade** allows for smooth changes between Pages.
2. **MODULATE** -	depress the **Modulate** key to activate this effect; **Modulate's** LED will flash and **Program's** will remain lit. To turn off **Program**, depress the **Program** key again and **Program's** LED will go out. Now the controller overlooks the Programmed **RGB** values and all Active **Regions** on a Page are randomly assigned a color value corresponding to the bass and treble frequencies. Bass becomes one color and treble another for random lengths of time, and then reassigned different colors. The level of **Modulate Audio** is fine tuned by the **Audio** pot.
3. **CYCLE** -	depress the **Cycle** key, **Cycle's** LED will flash, and **Modulate's** LED will remain lit. To turn off **Modulate**, depress **Modulate** key again. **Cycle** accesses the Active **Regions** on a Page but not their **RGB** values. It will **Cycle** through the ColorPro spectrum of colors from Page to Page. Speed of **Cycling** is controlled by the **Rate** pot below the key.

4. **COMBINATIONS -** **Program, Modulate, and Cycle** may also be used in various combinations, though at least one must always be engaged. To toggle between any two **Effects**, follow the above examples but do not turn off the previous **Effect**. The LED that is flashing indicates the **Effect** in **Control**. After a **Random** length of time the other **Effect** will flash indicating that it is in **Control**. All three **Effects** can be toggled through by depressing the third key after the other two have been **Selected**. A function may only be turned off if it is not the last function remaining on. (**Program** will be the default function if the others are turned off).

REGION LOCKOUT

Region Lockout provides the ability to take a **Region** out of a Programmed **Sequence** without reprogramming. This would be necessary if for some reason a **Region** were acting erratically or a lamp fails and you wish to remove the fixture from Programming. To remove a **Region**, depress and hold that **Region's** key down for 15 seconds. The decimal points will begin to flash and then the display will show **L.O** , ___ , ___ , indicating a **Locked Out Region**. The **Locked Out Region** will display **L.O** anytime its key is depressed on any **Page** and any **Memory**. To restore a **Region**, turn the controller Key Switch to off and then back on, and all **Regions** will function normally.

TOUCH PANEL / REMOTE PAGE SELECT INTERFACE

Two locking 8-pin DIN connectors located at the rear of the controller provide direct access to the Pages of a selected Memory. Any control device with the ability to provide at least 12 channels of **0VDC** to **+5VDC** through **+16VDC** output may be used. A touch panel providing 12 outputs is discussed here although many other types of Programmable lighting controllers may be used. Any function (Chase, Auto, Audio) available on the touch panel or controller may be used to **Advance** through Color Pro's Pages.

The pinouts for hookup are as follows:

REMOTE PAGE CONNECTOR 1 - 6

KEY NUMBER	PIN NUMBER
1	3
2	4
3	5
4	6
5	7
6	8
common negative	2
not used	1

REMOTE PAGE CONNECTOR 7 - 12

7	3
8	4
9	5
10	6
11	7
12	8
common negative	2
not used	1

With a touch panel connected to a Color Pro controller, it will have priority on Page selection. If a key is pressed and latched you may not change Pages on the controller until you change the touch panel setting.

There are two modes of Control afforded by the touch panel hook up:

First, if Color Pro is in **Standby** the touch panel will override it and act as a momentary. For example, touch a key and the controller will go to that **Page**. If the key is touched for a moment and then released, the controller will return to **Standby** with no output, however, the last page accessed will be displayed. During the time the touch panel keys are being used, the **Standby** LED will flash. When the keys are released, the controller will return to the normal **Standby** mode.

Second, if not in **Standby** and touch panel outputs are activated, then the controller will go to that **Page** and stay there (disabling **Advance** method) until instructed otherwise. Touch panel still has priority and the interface acts as a latching controller, latching to a particular **Page**. The **Standby** LED will also flash in this mode whenever there is input to the controller from the touch panel.

Keys 1-12	Access pages 1-12
Keys 10,11,& 12	are also **special** function keys.
Key #10 -	Functions as the **"tens"** key. Any other key (1 - 9) touched in conjunction with the #10 key allows access to Pages 10, 20, 30, 40, 50, 60, 70, 80 & 90.
Key #11 -	Functions as the **"doubler"** key. Any other key (1 - 9) touched in conjunction with the #11 key allows access to Pages 11, 22, 33, 44, 55, 66, 77, 88 & 99.
Key #12 -	Functions as the **"reverse"** key. The two lowest numbered keys pressed with this key will **"reverse."** 2, 3, & 12 is 32, not 23 as it would be normally without the #12 key pressed.

If more than 2 keys are pressed with the **#10, 11** or **12** key, only the lowest value integer will be selected. **Crossfade, Cycle, Modulate** and/or Program will remain on while the touch panel is in use unless turned off directly. Only the Remote Enable plug will override the touch panel.

REMOTE ENABLE OF SYSTEM

On the back panel of the controller there is a 3.5mm mini jack that accepts a 3.5mm mini jack plug. This is a normally closed jack so that the controller functions normally when nothing is in it. Inserting the plug causes the controller to go into Standby until voltage (+5VDC through +16VDC) is applied and then the controller is restored to the mode of operation it was in prior to Remote disable.

MASTER / SLAVE CONFIGURATION

Color Pro offers practically infinite expandability. Via its RS-232 port, up to 9 additional controllers may be connected allowing for **160 channels** capable of handling **1280 fixtures.** Hookup of the **Master/Slave** configuration requires the use of cable # 2 shown on p. 21 to interconnect two or more controllers together. Individual serial data outputs must be run for each 16 **Regions** of control as shown on p. 18.

Example: For a 32-channel system, Programming for each **Region** of 16 must be carried out on its own controller, though the **Master** will dictate the mode of playback for all connected **Slaves**. Each controller will function normally until it is put in the **Slave** mode. This is accomplished by depressing and holding the **Select** button on the **Slave** controller until SL is displayed in the first window. Then release **Select** and the displays will revert to normal, in this case a Copy of the **Master** controller's display. All **Standby**, **Advance**, and **Control** LEDs will also be copied on the **Slave's** front panel.

The only usable functions on the **Slave** controller(s) are **Power**, the **Region RGB** levels, **Select, Record,** and **Erase.** All others when depressed will cause SL to be displayed in the first display window.

When **Select** is depressed on the **Master** and held, the first window of the display will read **CL** for **Control**; if it is continually held down, the display will toggle between CL and SL and **Select** will flash.

Note: Even though Programming a 32-**Region** or greater combination is done with the additional controllers in **Slave** mode, Memory downloading or uploading must be done with the controller in **Master** mode. Please refer to page 17 for more information.

EXTERNAL MEMORY STORAGE / RETRIEVAL
AND COPYING BETWEEN CONTROLLERS

Your Color Pro controller contains an internal battery for secure memory backup. External Memory storage capability is provided to increase the amount of programming and storage available for special events, performances or simply as extra protection.

The Color Pro Backup disk provided with this manual (inside front cover) requires an IBM (Trademark) compatible computer with a disk drive and RS-232 serial port. A standard RS-232 cable is also required (like cable #3). The controller must be set to Full Intensity (**F.L.**), and be in Master mode, displaying **C.L.** when Select is depressed, in order to begin the procedure.

Insert the backup disk after booting up the computer and type **CPB**. Color Pro Backup, version 1.02 will appear on the top of your screen and then a menu. To make a selection, type the letter or move the light bar with the arrow keys and press enter. Instructions will appear to direct the upload or download procedure and simplified directions follow below.

To **Upload** (**Play** or load) memory from the computer to the controller:
Depress and hold **Erase** until the display reads **P L , 0 1 , 0 1** (**Note:** the decimal points will be at the top indicating **IMP** as the **Play** process is activated). Release the key and **Select** will be lit. When the file begins to **Upload** to the controller reads **Memory 9, Page 99**, depress **Select** once to return controller to the normal mode with the new Memory replacing what was there.
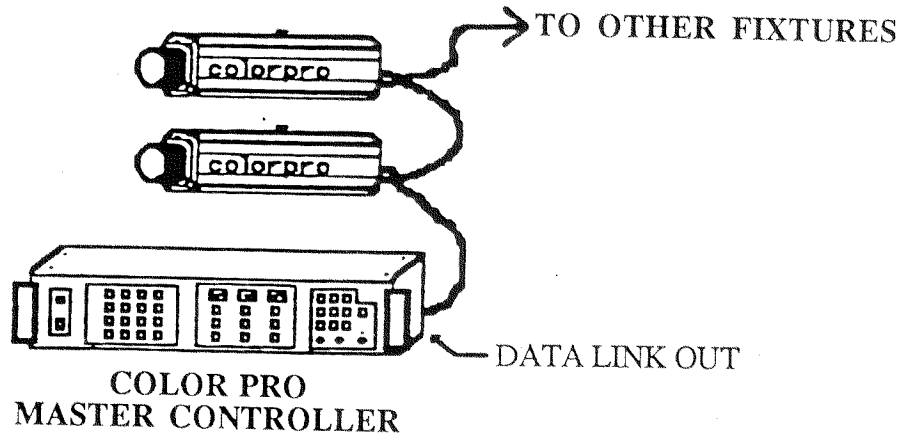
To **Download** (**Save** to computer) the controller's memory:
Depress **Record** until the display reads **S A , 0 1 , 0 1** (Note: no decimal points in this display, though they do return to the top as the **Memory** and **Page** begin counting after **Record** is depressed again). When the computer is ready to receive data from the controller, depress **Record** again to begin controller transmission to the computer. Controller will display **Memory** and **Page** number as it is being saved to disk. When all **9 Memories** and **99 Pages** have been copied, turn off the computer 'receive.' Now return the controller to normal operation by depressing the **Select** key. All **Memories** have been **Downloaded** to disk and **Saved** but still reside in the controller until written over.
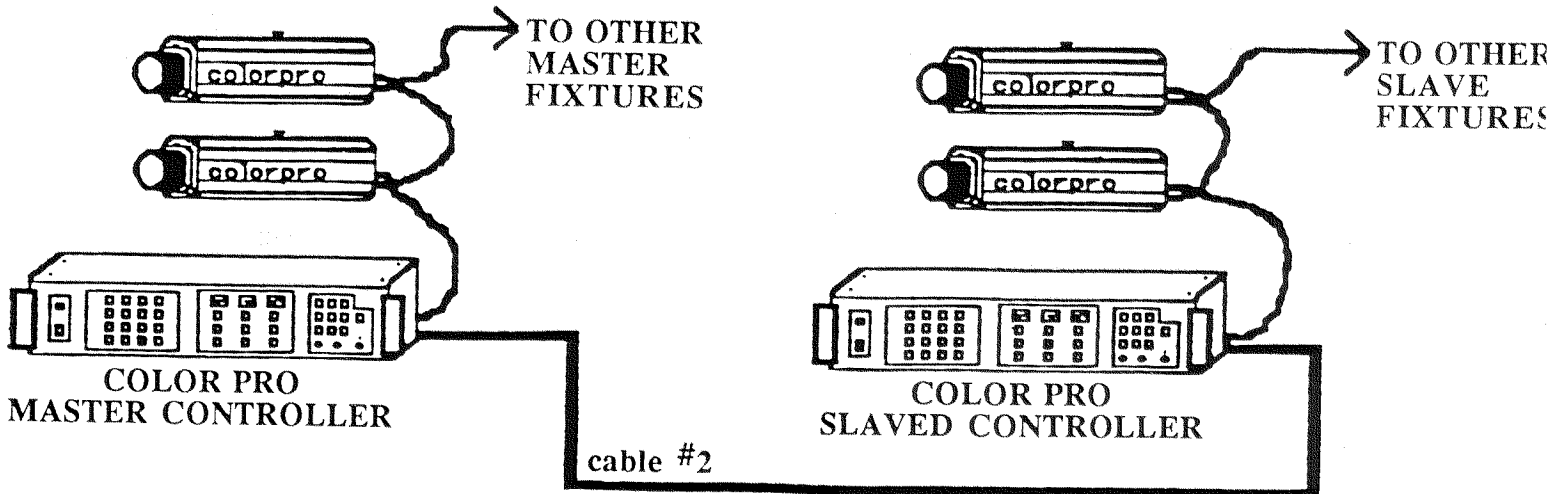
To **Copy** Memories from one controller to another:
Requires RS232 cable with PIN 2&3 reversed on one end as in cable #2. The procedure is essentially the same, but does not require the disk or computer. Both controllers must be in the Master mode with one set to Save (S.A) and the other to Play (P.L). Depress **Record** on the controller in S.A mode to begin transfer of its Memory to the other controller. When the process is complete, depress the Select key once on each controller to return to regular operation.

BASIC COLOR PRO HOOKUP

TO OTHER FIXTURES

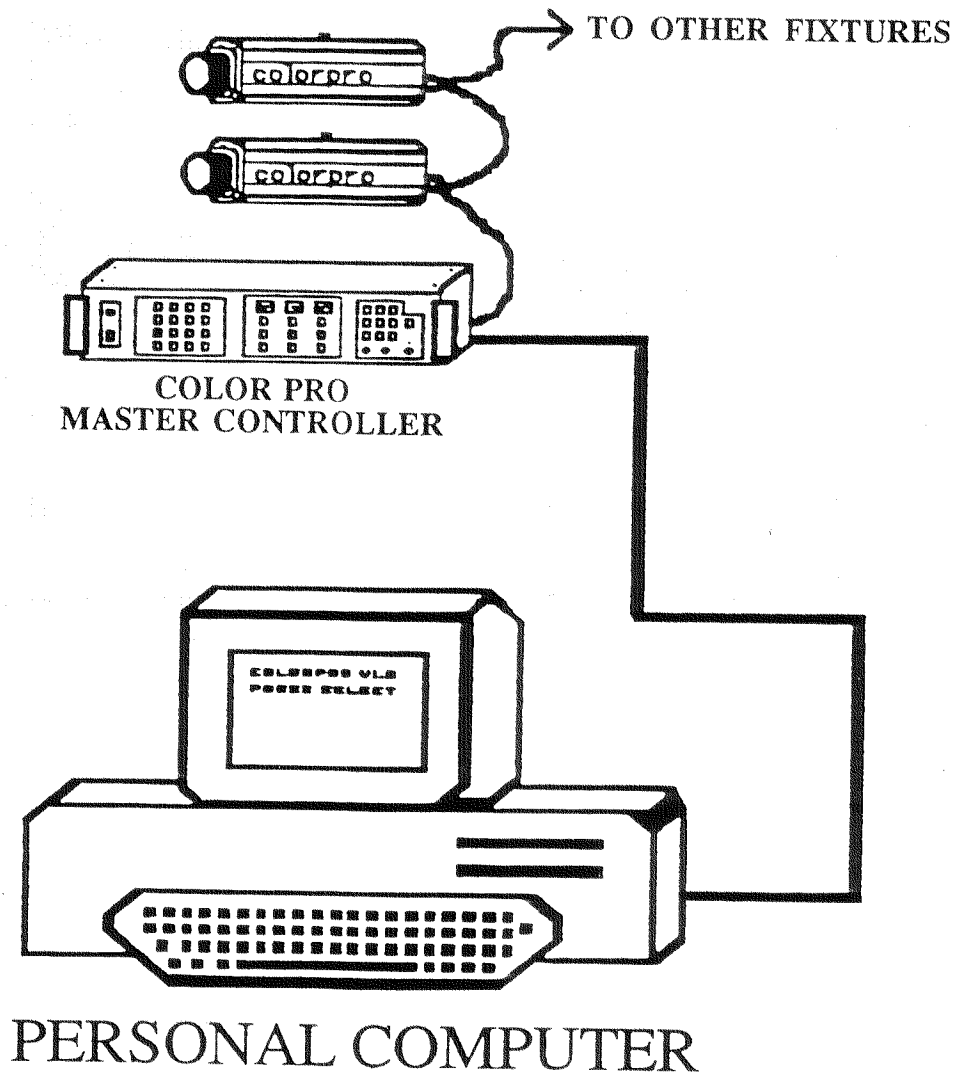DATA LINK OUT

COLOR PRO
MASTER CONTROLLER

COLOR PRO MASTER / SLAVE HOOKUP

TO OTHER
MASTER
FIXTURES

TO OTHER
SLAVE
FIXTURES

COLOR PRO
MASTER CONTROLLER

COLOR PRO
SLAVED CONTROLLER

cable #2

For description of cable pinouts refer to page 21.

TO OTHER FIXTURES

COLOR PRO
MASTER CONTROLLER

PERSONAL COMPUTER

The cable for connecting one Color Pro controller in the **Master** mode to your personal computer is a straight, one-to-one, 25-conductor ribbon cable with a male RS-232D connector at one end (for the controller) and a female connector at the other end (for connecting to the RS-232 port on your **personal computer**).

MASTER / SLAVE WITH COMPUTER BACKUP CAPABILITY

TO OTHER
MASTER
FIXTURES

TO OTHER
SLAVE
FIXTURES

COLOR PRO
MASTER CONTROLLER

cable #3

COLOR PRO
SLAVED CONTROLLER

cable #4

IN/OUT

IN/OUT

STANDARD RS-232 SWITCHBOXES

TO "A"
ON NEXT
SWITCH-
BOX

cable #1

B

A   B

A

A   B

box - 1

cable
#2

box - 2

PERSONAL COMPUTER

B

TO "B" ON
NEXT
SWITCHBOX
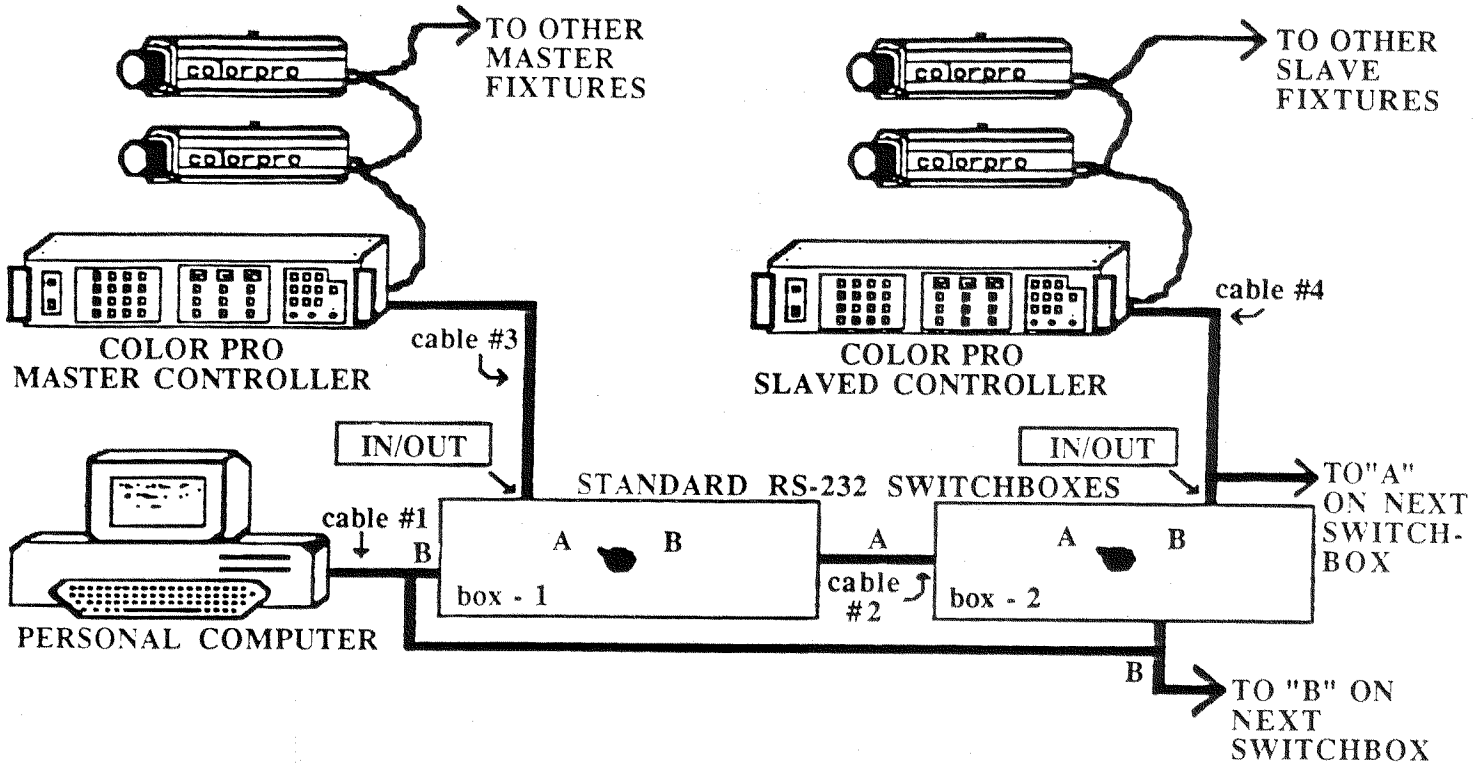
DESCRIPTION OF OPERATION

Setting all RS-232 switchboxes on their "A" setting allows normal **Master/Slave**
operation. In the example above, setting box-1 on "B" allows saving or playing (uploading
or downloading) of **Programming** between computer and **Master**. Setting box-2 on "B"
allows saving or playing of **Programming** between computer and **Slave**, operation of
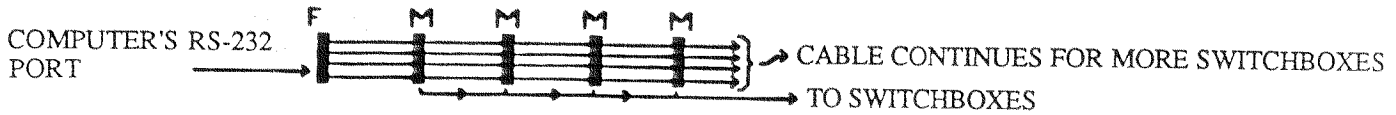linked switchboxes for more **Slaved** controllers is identical.

> ## Caution!!
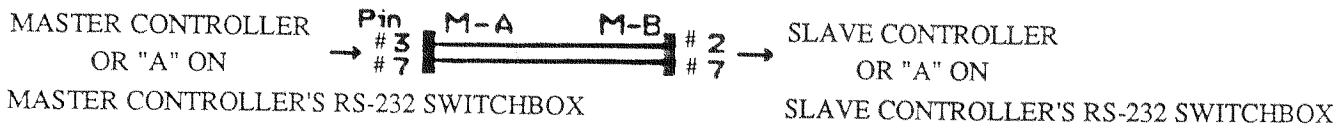> Never allow more than one switchbox at a time to be set on "B"!

For description of cable pinouts and signals refer to page 21.
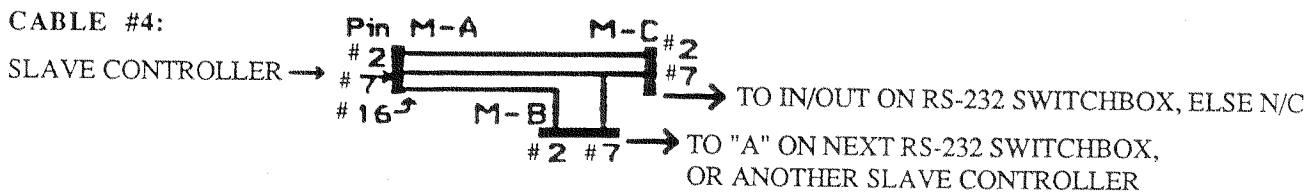
DESCRIPTION OF CABLE PINOUTS

CABLE #1: This is a one ribbon cable with the first connector going to the computer and following connectors going to linked switchboxes.

COMPUTER'S RS-232 PORT → [F M M M M] → CABLE CONTINUES FOR MORE SWITCHBOXES
→ TO SWITCHBOXES

CABLE #2:

MASTER CONTROLLER
OR "A" ON
MASTER CONTROLLER'S RS-232 SWITCHBOX
→ Pin #3 #7 [M-A ———— M-B] #2 #7 →
SLAVE CONTROLLER
OR "A" ON
SLAVE CONTROLLER'S RS-232 SWITCHBOX

CABLE #3: This is a one to one ribbon cable with one male RS-232 connector at each end.

CABLE #4:

SLAVE CONTROLLER →
Pin M-A   M-C
#2   #2
#7   #7 → TO IN/OUT ON RS-232 SWITCHBOX, ELSE N/C
#16   M-B
#2 #7 → TO "A" ON NEXT RS-232 SWITCHBOX,
         OR ANOTHER SLAVE CONTROLLER

LEGEND

▌ = Standard 25-pin RS-232D connector, labeled M-(letter) for male and F-(letter) for female -- letter after hyphen is used to differentiate one end of a finished cable from another.

≣ = Twenty five conductor ribbon cable.

═ = Standard wire cable, number of lines denotes number of conductors needed.

Signals used: Pin #2 - Transmitted data, #3 - Received Data, #7 - Signal Ground, #16 - Secondary Received Data.

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RS-232 PROTOCOL

The correct protocol information sent via the RS-232 port (see Page 1, #18.) allows a computer or other external device to operate a Color Pro controller in **Slave** mode. A Color Pro controller used in this manner is as capable as any theatre board. The computer could then be Programmed with exact time between Page changes, the manner of change, and the ability to link Pages together. This linking can be from one Page to any other Page of any Memory with variable user-programmed **Crossfade** times. Programming of colors and Intensities must be done on the controller itself with all playback modes controlled by the external device.

The following information along with the pinout diagrams on Pages 19 and 21 provide the necessary information to allow external devices access to the controller. All front panel functions with the exception of **Select**, **Record**, **Erase**, **Audio Level**, **RGB**, and **Region** controls, are available and variable with the use of the RS-232 port.

Color Pro master-slave communications are done at 9600bps, 8 data, no parity, 1 stop bit. Master controllers need only transmit data, not receive. Therefore, master control of a Color Pro network requires just two wires: data and ground. For best results, a 70-100 microsecond pause is recommended between transmitted bytes to provide better start-bit detection.

There are five packets types used for remote control of Color Pro systems. These packet types are called:

        I.   System State packets.
        II.   Memory/Page packets.
        III.   Modulate packets.
        IV.   Crossfade packets.
        V.   Cycle packets.

All control packets begin with a CONTROL SYNC byte. For all five CONTROL packet-types, the CONTROL SYNC character (first byte of packet) has value '16' hexadecimal.

All packets' second byte are PACKET IDENTIFICATION bytes. Their values can be found in the packet descriptions which follow.

The next portion of all packets is the DATA field. This field can be anywhere from two to four bytes in length. Each packet type has its own specfic length which is as short as possible to reduce traffic on the 9600bps serial line, yet convey all necessary information.

The last portion of all packets is a CHECKSUM field. The checksum field length also varies with the packet type, in an effort to reduce transmission time.

To encode data efficiently and to avoid confusion between SYNC bytes and packet data, some fields are encoded in a manner to be called (for brevity) 'ASCII-SHIFTED.' Data encoded this way still requires just one byte but its hexadecimal value (NOT ASCII equivalent) resides in the normal 'text' area of the ASCII character set. Perform this encoding by adding 20 hex to a single-byte number. This cheme will not work for binary numbers above 0DF hex but they are not needed for proper Color Pro remote control. See a reference on the ASCII character-code set for more information.

For Example:
  1) intensity setting 4 is a single-byte number 04hex.
  2) add 20h to 04h to yield 24hex. This is an ASCII-SHIFTED '4.'
  3) To recover '4' at the reciever, Color Pro simply subtracts 20 hex.

In cases where ALL binary values are needed, some fields are encoded in a manner called (for brevity) 'ASCII-ENCODED' representation. A binary 8-bit or 16-bit number is converted to its human-readable ASCII equivalent. This scheme requires two ASCII bytes to represent one binary byte.

For Example:
  1) Binary 16-bit number 'C5C5' hex has a four-byte ASCII-ENCODED
     representation: '43' hex, '35' hex, '43' hex, '35' hex.
     ('43' hex is the printable ASCII character 'C' and
     '35' hex is the printable ASCII character '5.')
     Again, refer to an ASCII chart for more information.

PACKET DESCRIPTIONS

Each control packet type is listed below in chronological byte order. Contents will vary according to system settings, but packets will not vary from their descriptions.

I. Packet: System State

Field	Packet-byte	
1	1	Control Sync. '16'hex.
2	2	System-State ID. '22'hex.
3	3	Master Intensity Setting, integer. ASCII-Shifted.
4	4,5	MSB, LSB bytes, system options. ASCII-encoded.
5	6	Program/Modulate/Cycle select integer value. ASCII-shifted.
6	7,8,9,10	Checksum. ASCII-encoded.
		Sum of fields 3,4,5 (bytes 3-6) BEFORE shifting/encoding.

Description:
This packet type alters the Color Pro system status to match the master controller's dinner, option settings, and current special-effect setting as it cycles around.

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Field 3. - 'Master Intensity' 8-bit value is 0 to 30 decimal. Subject to change, depending on optional resolution of the master dimmer. ASCII-Shift before transmission.

Field 4. - 'System options' bit positions:

7 (MSB)	-	Standby
6 (MSB)	-	Random
5 (MSB)	-	Audio
4 (MSB)	-	Program
3 (MSB)	-	Modulate
2 (LSB)	-	Cycle
1 (LSB)	-	Crossfade

For Example:
Desired state is Standby off, Random on, Audio on, Auto off, Program on. Modulate off, Cycle off, Crossfade off. System options' binary value should be '01101000' binary or '68'hex. The ASCII-ENCODED equivalent for the Options byte should be the two 8-bit characters '36' hex, '38' hex. Therefore, the 8-bit system options value requires 16 bits for ASCII-encoding. ASCII-Encode before transmission.

Field 5. -   'Prog/Mod/Cycle' 8-bit value is 0 to 2. PROGRAM = 0, MODULATE = 1, CYCLE = 2. ASCII-Shift before transmission.

Field 6. -   'Checksum' is the sum of values in fields 3,4,5 BEFORE they are encoded. Then ASCII-ENCODE this 16-bit sum into four bytes for transmission. Color Pro will decode back to 16 bits and compare against the received packet values. Garbled packets will be ignored. ASCII-Encode before transmission.

II. Packet: Memory/Page

Field	Packet-byte	
1	1	Control Sync. '16' hex.
2	2	Memory/Page ID. '23' hex.
3	3	System Memory number. ASCII-Shifted.
4	4	System Page number. ASCII-Shifted.
5	5,6	Checksum. ASCII-Encoded, Least significant two bytes. Sum of fields 3 and 4 BEFORE ASCII-shifting.

Description:
This packet type alters the Color Pro memory and page setting to match the master controller's settings.

Field 3. - 'System memory' number is an 8-bit integer from 1 to 9 decimal. ASCII-Shift before transmission.

Field 4. - 'System Page' number is an 8-bit integer from 1 to 99 decimal. ASCII-Shift before transmission.

Field 5. - 'Checksum' is the 8-bit sum of fields 3 and 4. 8-bit sum should be ASCII-ENCODED into 16 bits for transmission.

III. Packet: Modulate

Field	Packet-byte	
1	1	Control Sync. '16' hex.
2	2	Modulate ID. '25' hex.
3	3	Red value. ASCII-Shifted
4	4	Green value. ASCII-Shifted
5	5	Blue value. ASCII-Shifted
6	6	Checksum. Optional. ASCII-Encoded, Least significant byte. Sum of fields 3,4,5 BEFORE ASCII-shifting.

Description:
This packet type alters the Color Pro RGB values when in MODULATE mode. Modulate is only activated when Option 'modulate' is selected and the system 'Prog/Mod/Cycle' 8-bit value is set to MODUALTE. See System-state packet description.

Fields 3, 4, & 5. -   'Red,' 'Green,' 'Blue,' values are 8-bit integers from 0 to 99 decimal. ASCII-Shift before transmission.

Field 6. -   'Checksum' is the sum of red, green and blue values BEFORE ASCII-Shifting. 8-bit sum should be ASCII-ENCODED before transmission. Checksum for this packet type is optional.

IV. Packet: Crossfade

Field	Packet-byte	
1	1	Control Sync. '16' hex.
2	2	Crossfade ID. '26' hex.
3	3	Fade-rate Period. ASCII-Shifted
4	4	Fade-step Count. ASCII-Shifted.
5	5, 6	Checksum. ASCII-Encoded. Sum of fields 3,4 BEFORE ASCII-shifting.

Decription:
This packet type alters the Color Pro RGB values when in CROSSFADE mode. Crossfade is only activated when Option 'crossfade' is selected and the system has recently changed scenes.

Field 3. -   'Fade-rate' is an 8-bit integer from 0 to 30 hex. Smaller numbers cause fastest crossfade speed. Allows crossfade action to be smoothed out between crossfade steps (see fade-step below) for slower fades, yet provide fast-cut capability. ASCII-SHIFT before transmission.

Field 4. -   'Fade-step' is an 8-bit integer from 1 to 99 decimal. Allows crossfade
synchronization at all speeds. Crossfade begins when Color Pro's
MEMORY or PAGE number is changed, and continues for a maximum of
99 decimal PARTIAL crossfade steps. Multiple controllers can crossfade at
the same rate by sending all controllers the same fade-step number. This
step number can be sent as quickly or as slowly as necessary; crossfade
times from sub-second to hours long can be accomodated with this scheme.
In case of garbled data, Color Pro will attempt to catch up to the last-sent
master step value while crossfading. ASCII-SHIFT before transmission.

Field 5. -   'Checksum' is the sum of fields 3 and 4 BEFORE ASCII-Shifting.
8-bit sum should be ASCII-ENCODED before transmission.

V.Packet: Cycle

Field	Packet-byte	
1	1	Control Sync. '16' hex.
2	2	Cycle ID. '27' hex.
3	3,4,5,6	Cycle phase value. ASCII-Encoded.
4	7,8	Checksum. ASCII-Encoded.
		8-bit sum of field 3 BEFORE ASCII-encoding.

Description:
This packet type alters the Color Pro RGB values when in CYCLE mode. Cycle is only
activated when Option 'cycle' is selected and the system 'Prog/Mod/Cycle' 8-bit value is
set to CYCLE. See System-state packet description.

Field 3. -   'Cycle phase' allows synchronized color fading from shade to shade around
the color spectrum. This 16-bit integer (0-599 decimal) specifies a unique
color about the wheel; 0=reds, midway=greens, and max=magenta.
ASCII-ENCODE before transmission.

Field 4. -   'Checksum' is the 8-bit sum of field 3 BEFORE encoding.
ASCII-ENCODE before transmission.

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DEFINITIONS

ACTIVE REGION- indicated by a lit LED shown in the **Region** display indicating an **RGB** value for that **Region** greater than **0.0** , **0.0** , **0.0**.

NONINITIALIZED PAGE - one that has had all value removed by the **Select Erase Erase** process, therefore no LEDs will light in the **Region** display when this **Page** is accessed. A **Noninitialized Page** will be indicated in the display; by __ , __ , __ when a **Region** key is depressed.

INITIALIZED PAGE - one that has had an **RGB** value Programmed into it of **0.0** , **0.0** , **0.0** or greater. When an **Initialized** Page is accessed, the Active **Regions** may not be shown in the **Region** display as only **Active Regions** (indicated by an **RGB** value greater than **0.0** , **0.0** , **0.0**) will display lit LEDs. Initialized **Regions** with **RGB** values of **0.0** , **0.0** , **0.0** will not cause LEDs to light.

SERIAL DATA LINK- pulse modulated digital signals are sent via this to control fixtures' output, Intensity level, and activity.

MAINTENANCE

Your Color Pro system has been designed for longevity with minimum maintenance, and cleanliness will enhance its life. Controllers should be cleaned regularly with a soft cloth. Luminaires will need to have their lenses cleaned with a soft tissue and a glass cleaning solution.

Important: The cooling fan and insides of fixture will need to be periodically blown clear of any dust which could cause overheating. This is best done with a can of compressed air or an air compressor set for low pressure.

The dichroic filters will also need periodic cleaning. To gain access, loosen the drawer access screw and pull and drawer out to its stops. The six dichroics will then be exposed, though you must remove the lamps to access both sides of some filters. A soft tissue and glass cleaner should be used but do not attempt to clean them while warm or hot.

Controller and power should be off when any cleaning or maintenance is done.

WARRANTY

Your Color Pro system is covered by a limited, 6 month parts and labor warranty. It is the owner's responsibility to furnish receipts or invoices for verification of purchase, date, and dealer or distributor. **It is necessary to obtain a return authorization number BEFORE** any units are sent in for repair to the manufacturer. The manufacturer will make the final determination as to whether or not the unit is covered by warranty. This warranty does not cover lamps of fuses.

Warranty is void if the product has been opened, misused, altered, or modified in any way.

Shipping will be paid by the purchaser and warrantied items shall have return shipping paid by the manufacturer in the continental United States. Under no circumstances will freight collect shipments be accepted! Prepaid shipping does not include rush expediting such as air freight. Air freight can be sent customer collect in the continental United States.

PRECAUTIONS

Please note on the fixture and the controller the various precautions. Keep both units away from rain or moisture to reduce the risk of fire or electrical shock. These units are not for residential use and contain no user-serviceable parts inside. Servicing must be conducted by the manufacturer or other qualified service personnel. For continued protection against fire, fuses must be replaced only by those with the specified voltage and current ratings. Use lamp type ENH, ENG, or ELH only.

TROUBLE SHOOTING

Your Color Pro luminaire is equipped with an LED indicator on the front lower left of the fixture. This LED will light and the cooling fan will run when the fixture is first plugged in and then both will turn off after approximately 60 second. With the serial data lines plugged in and the controller turned on, the LED and the fan will be on continuously until the controller is turned off or ther serial data line is unplugged, at which time the fan will continue to operate for 60 seconds to cool the lamps. The LED will extinguish as the fan turns off. Should this LED fail to light when the controller is turned on, check for voltage at the fixture and that all serial data cables are plugged in.

OTHER PROBLEMS

| SYMPTOM(S)	CAUSE
UNITS FLASHING UNCONTROLLABLY AND/OR FAILING TO GO DARK WHEN STANDBY IS DEPRESSED	SHORTED CONNECTION IN DATA LINE OR PLUG NOT INSERTED COMPLETELY IN JACK.
COLOR OUTPUT OF FIXTURE(S) NOT THE SAME AS OTHERS OR THEIR **RGB** SETTINGS	ONE OR MORE LAMPS OUT OR INCORRECT REGION ASSIGNMENT
S.L. DISPLAYED IN FIRST WINDOW WHEN ANY ADVANCE OR CONTROL KEY IS DEPRESSED	CONTROLLER IN SLAVE MODE - DEPRESS AND HOLD SELECT KEY UNTIL C.L. IS DISPLAYED
ADVANCE NOT RESPONDING TO AUDIO INFORMATION	AUDIO LEVEL POT SET TOO LOW OR HIGH -- SET WHERE LED JUST FLASHES WITH BEAT
CROSSFADE NOT WORKING - LIGHTS SEEM TO BE STUCK ONE COLOR	CROSSFADE RATE TOO LOW FOR ADVANCE RATE - MUST BE THE SAME OR FASTER
REGION NOT RESPONDING TO CONTROLLER - **L.O.** DISPLAYED WHEN REGION IS DEPRESSED	REGION LOCKED OUT - TURN CONTROLLER OFF AND THEN BACK ON TO RESET
UNABLE TO RECORD PROGRAMMING IN A MEMORY - **L.C.** DISPLAYED WHEN RECORD IS DEPRESSED	MEMORY HAS BEEN LOCKED TO PROTECT A MEMORY, PREVENTING ADJUSTMENT - CONTACT INSTALLER

ATTENTION:
ABOUT LAMP LIFE

DETRIMENTAL EFFECTS OF OVER-VOLTAGE

BECAUSE OF DRASTIC LAMP LIFE REDUCTION AT OVER-VOLTAGE, LIGHTWAVE RESEARCH RECOMMENDS THAT ANY OVER-VOLTAGE CONDITION BE CORRECTED BEFORE OPERATION OF THE COLORPRO SYSTEM.

A lamp that is stressed by over-voltage, even if just for a day or two, may be very near failure. For example, a lamp operated just 5% above rated voltage (126 volts rather than 120 volts) will last half of its rated life! (See figure 1.)

Figure 1.
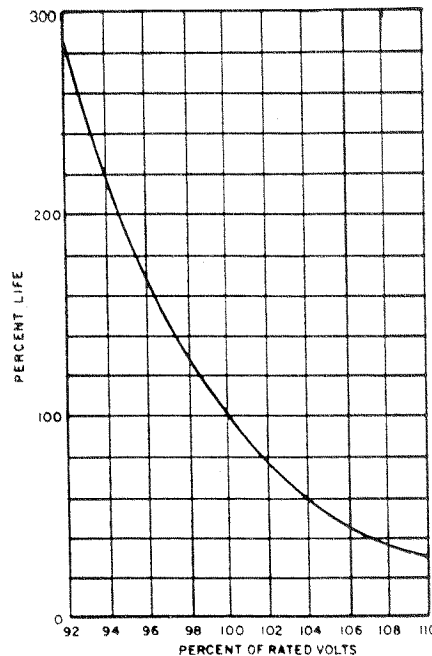
If your lamps have been stressed, Lightwave Research recommends that all lamps be changed immediately after rectifying the over-voltage problem. Continued use of stressed lamps will result in constant lamp maintenance problems. Lightwave Research does not warranty lamps that have been stressed by over-voltage.

DETERMINING LINE VOLTAGE

Measuring line voltage with a Volt-OHM-Meter does not give an accurate indication of lamp operating voltage. Assuming the meter is properly calibrated (most are not!), the reading it gives is only an instant in time.

A power line monitor, connected to the line for one week, will chart on paper line voltage fluctuations versus time. Monitoring for one full week allows all power consuming businesses to shut down (line voltage goes up), and gives a realistic "picture" of line voltage during those times your Colorpro system is operated. Most local utilities will provide this service at no charge.

If over-voltage conditions exist, the power company can often correct this at the service transformer. If not, Lightwave Research offers 95% and 90% power options, easily retrofitted to the Colorpro controller.

AVERAGE LAMP LIFE

Colorpro luminaires are shipped with ENH-MR-16 LAMPS, a Tungsten Halogen lamp rated for 175 hours. This lamp life, given by the lamp manufacturer, is the average life of a large group of lamps tested at their rated voltage.

Normally, some lamps will fall short of their rated life, even when operated under laboratory conditions, and others may last half again longer than their rated life. At 175 hours, approximately 50% of ENH lamps in a large group will have burned out and 50% will remain burning as indicated in figure 2.
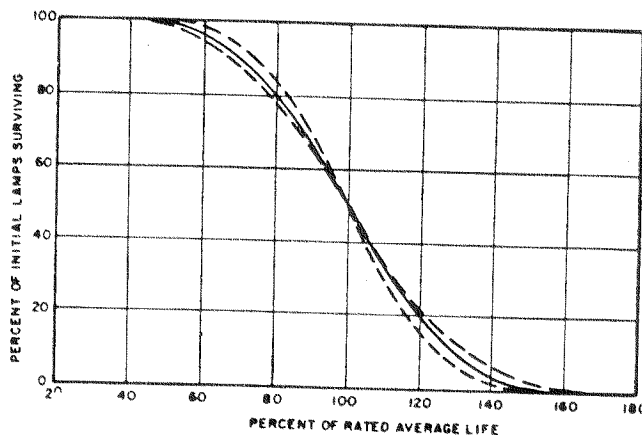
Figure 2.

Table 1 provides a summary of voltages, average lamp life, and power options. Notice that, given normal line voltage of 120 volts, lamp life can be extended with the 95% or 90% power option, with only a slight reduction of light output.

240 VOLT/50 CYCLE USERS

The Colorpro luminaires are set at the factory so that when connected to a 240 volt/50 cycle line, there will be 120 volts RMS at the lamps. Expected lamp life in 240 volt/50 cycle areas are also shown in table 1. For example, if line voltage in your area is 5% high, the numbers in the middle row will apply.

POWER OPTION:		100%		95%		90%	
LINE VOLTAGE		LAMP VOLTAGE	AVERAGE LAMP LIFE	LAMP VOLTAGE	AVERAGE LAMP LIFE	LAMP VOLTAGE	AVERAGE LAMP LIFE
NORMAL 120V/60Hz (240V/50Hz)		120V	175HR	114V	332HR	108V	500HR+
+ 5% 126V/60Hz (252V/50Hz)		126V	88HR	120V	175HR	114V	332HR
+10% 132V/60Hz (264V/50Hz)		132V	53HR	126V	88HR	120V	175HR

Table 1.