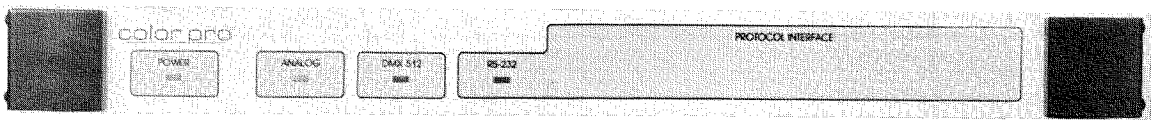
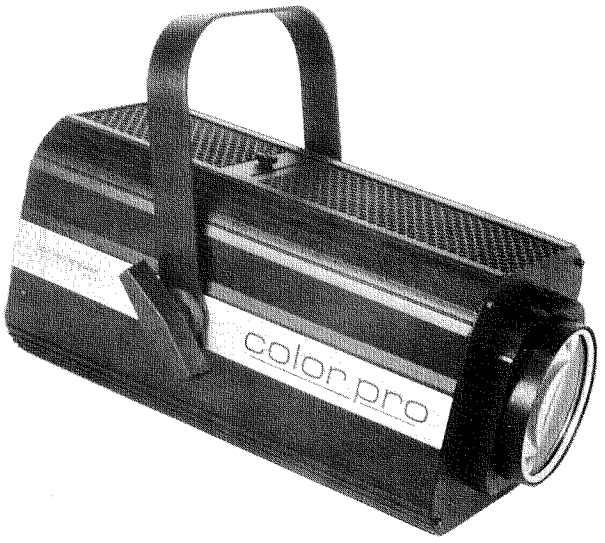


color pro

and Protocol Interface

User Manual



LIGHTWAVE RESEARCH

2209 WEST BRAKER LN.

AUSTIN, TX. 78758

Part No. 60600018

color pro

and Protocol Interface

U.S. Patent # 4,962,687

User Manual / Schematic Drawings

LIGHTWAVE RESEARCH
2209 WEST BRAKER LANE
AUSTIN, TEXAS USA 78758

REV. 4 / FEBRUARY '92

Part No. 60600018

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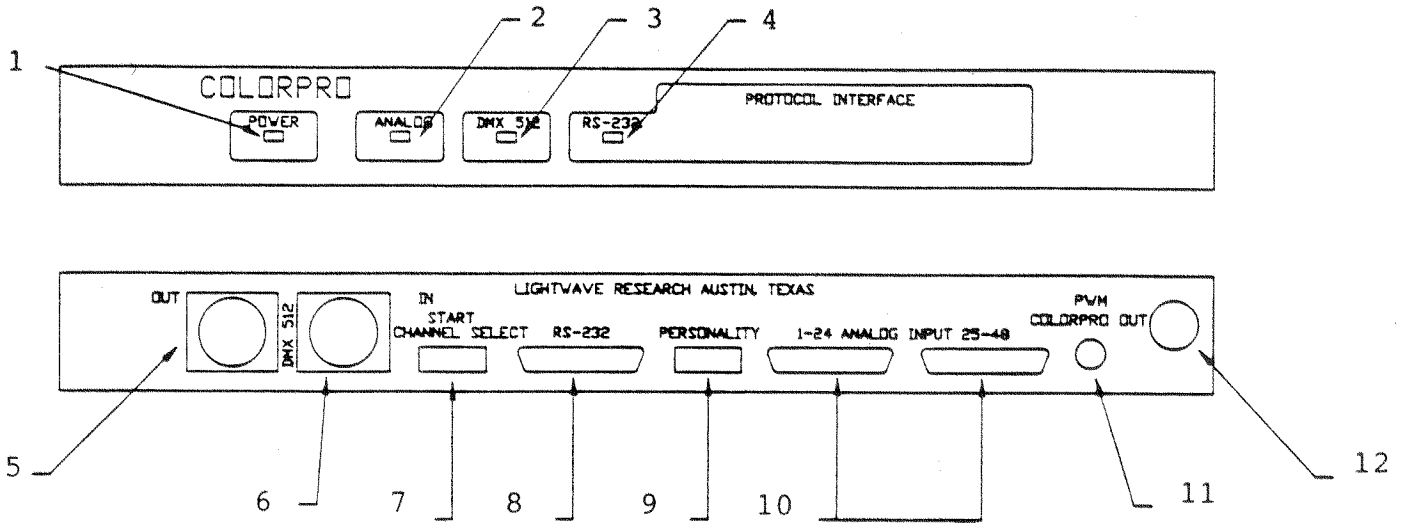
LUMINAIRE SPECIFICATIONS

- 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

PROTOCOL INTERFACE ILLUSTRATION



PROTOCOL INTERFACE DESCRIPTION

1.	POWER LED	Indicates unit is receiving power
2.	ANALOG LED	Indicates input is set for ANALOG
3.	DMX512 LED	Indicates input is set for DMX512
4.	RS-232 LED	Indicates input is set for RS-232
5.	DMX512 OUT	Five pin locking female 'XLR' jack. Allows connection to additional Interfaces or other RS-422 equipment
6.	DMX512 IN	Five pin locking male 'XLR' jack. For input of RS-422 signals
7.	START CHANNEL SELECT	Sets the beginning number of the 48 channels required to operate 16 Color Pro luminaires
8.	RS-232 JACK	For communication with personal computers and other external control devices using the PULSAR (copyright) RS-232 standard

9. PERSONALITY	8 position switch for setting various operating modes
10. ANALOG INPUT	Two 25 pin jacks for input of 48 analog signals needed to control 16 Color Pro fixtures
11. PWM COLOR PRO OUT	Pulse width modulated serial data for Color Pro fixtures
12. POWER CORD	Mains supply

PROTOCOL INTERFACE SPECIFICATIONS

INPUTS	Analog 0 - 10 Volts DC DMX512 RS-232
COLOR PRO PWM SERIAL DATA OUT (16 X 3 channels)	
LOCKING INPUT CONNECTORS	
19" RACK MOUNT - 1 UNIT	
VOLTAGE	120V/60Hz - 240V/50Hz
CURRENT	.175A/120V .088A/240V
FUSE	.25A/120V .125A/240V
DIMENSIONS BOXED	44mm H x 482mm W x 203mm D 330mm H x 558mm W x 330 mm D
WEIGHT BOXED	2.8kg 3.8kg

INSTALLATION

COLOR PRO LUMINAIRES

Each box containing a Color Pro fixture should also include:

(1) #10 Phillips screw to replace lens clamping screw in vertical installation of fixture.

Mount the fixture in the desired location setting the Region Selector on the front of the fixture (1-16). Maximum number of fixtures per Region is 8 (128 per Interface), 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

All fixtures assigned to Region 2, for example, will be controlled by 3 channels of the lighting board.

Plug no more than 2 fixtures into a single 120V (USA), grounded non-switched, non-dimmable circuit. Simple hookup of the low voltage Interface output requires shielded low capacitance 2-conductor wire. The correct hookup is shown below. Be certain to connect the shield or drain wire to pin 1 or sleeve, and to observe polarity throughout hookup, or the system will not function properly.

Run the cable from the Interface to the nearest fixture and check for proper operation. 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.

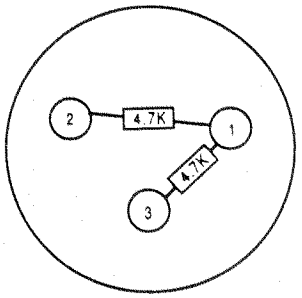
COLOR PRO SIGNAL CONNECTIONS

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.

PROTOCOL INTERFACE

The Protocol Interface can operate with the three standard inputs mentioned in the introduction. Proper connection to your lighting board is outlined below. Connection for only one type of input, or all three at once, is possible. For more detail about each input connection, please see the OPERATION section.

ANALOG IN

Analog Channel	Pin Number	Connector Needed
1 - 24	1 - 24	Female 25 Pin 'D'
Ground	25	
25 - 48	1 - 24	Female 25 Pin 'D'
Ground	25	

With 25 conductor ribbon cable and crimp on connectors, these cable assemblies are easy to make. Keep the lengths as short as possible. In electrically noisy environments, shielded ribbon cable is recommended.

DMX512 IN

Pin Number	Signal	Connector Needed
1	Shield	Female 5 Pin 'XLR'
2	Data Complement (-)	(Neutrik # NC5FC
3	Data True (+)	or equivalent)

DMX512 out is same as above except a male 5 pin 'XLR' connector is used (Neutrik # NC5MC or equivalent).

Shielded low capacitance 2-conductor wire should be used (such as Color Pro fixture hook-up wire.)

RS-232 IN

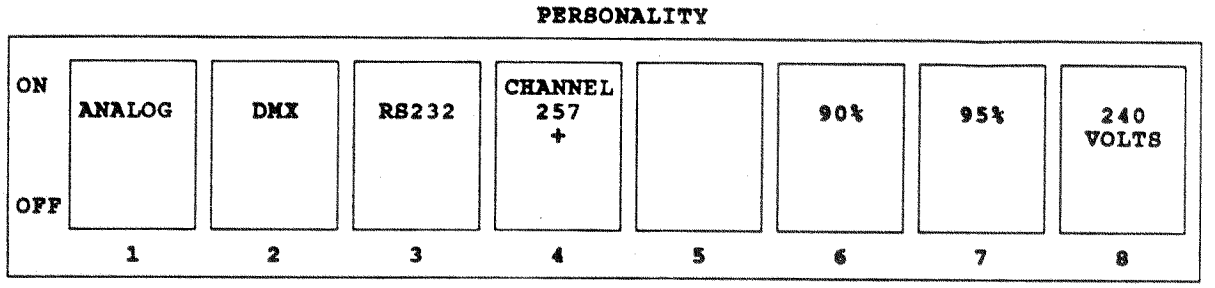
Pin Number	Signal	Connector Needed
2	Receive	Male 25 Pin 'D'
3	Transmit	
7	Ground	

Shielded low capacitance 2-conductor wire should be used.

OPERATION

PERSONALITY SWITCH

The PERSONALITY switch on the rear panel selects all operating modes (up is the on position).



It is first necessary to select which input the Interface is to respond to:

SWITCH ON
- 1 ANALOG 0 to 10 volts
- 2 DMX512
- 3 RS-232

A front panel LED will light to indicate which input has been selected.

This switch also allows setting the power option for 95% or 90% operation to improve lamp life. (See ABOUT LAMP LIFE, page 19.) For instance, with the 90% option selected, Color Pro lamp voltage will be reduced 10% at all settings of the lighting board.

Also included on this switch is a 240 Volt setting for proper operation of Color Pro fixtures at 240 Volt/50 Hz.
CAUTION! An internal voltage select jumper must be set for 240 volt/50 Hz operation of the Protocol Interface.

SWITCH ON
- 6 90% power (Switch 6 and 7 off for 100% power)
- 7 95% power
- 8 240 volt/50 HZ fixture operation

Finally, switch 4, labeled 'CHANNEL 257+' is for use with DMX512 input and will be discussed in the 'START CHANNEL SELECT' section.

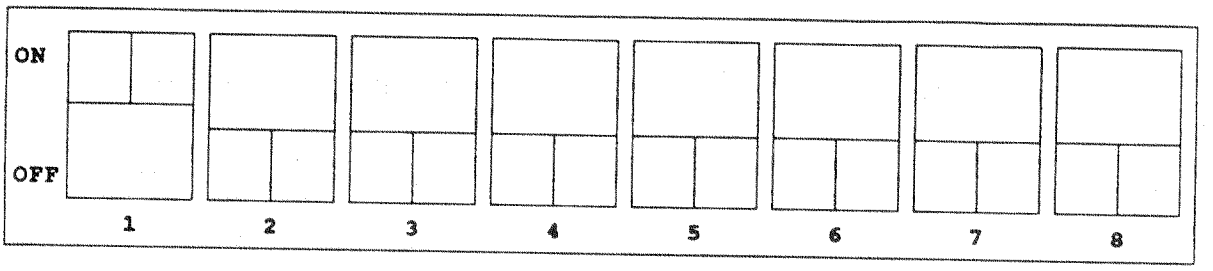
START CHANNEL SELECT SWITCH

When running DMX512 or RS-232 input, this switch selects a block of 48 consecutive channels to control 16 Color Pro fixtures.

For convention's sake, Red is Color Pro's channel 1, Green channel 2, and Blue channel 3. Now an example. Assume there are 16 Color Pro fixtures, all set to different regions. Also assume we have set the Interface so that the first 48 channels of the lighting board are controlling them. Fader one will control the red level of the fixture assigned to region 1, fader 2 controls green, and fader 3 controls blue. Fader 4, then, will control the red level of region 2, fader 5 controls green, and 6 controls blue, and so on up to channel 48.

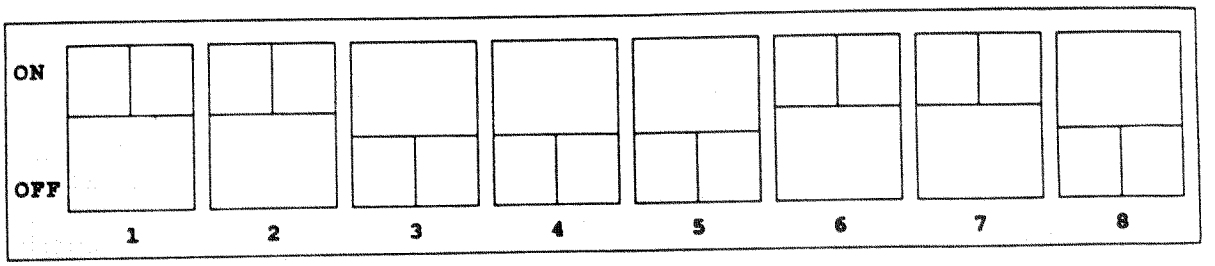
Of course, it may not be practical for the Color Pro fixtures to occupy the first 48 channels of the desk. The Protocol Interface is designed so any consecutive 48 channels can be used. Refer to the examples below and to Table 1 on pages 14 -16 for proper START CHANNEL SELECT settings.

START CHANNEL SELECT



This example shows switch one on, all others off. Table 1 shows that with switch 1 on, the start channel will be channel 2.

Suppose we want 16 Color Pro fixtures to begin on channel 100 and end on channel 147. Look up Start Channel #100 from Table 1. Switch 1,2,6, and 7 should be on. Set the switch as shown below.



USING CHANNELS ABOVE 256

Table 1 shows that if all switches (1-8) are on, channel 256 will be the Start Channel. But the DMX512 standard allows for up to 512 channels. This is where switch #4 (CHANNEL 257+) on the Personality Select Switch is used. If channel 257 is the Start Channel, switch #4 on the Personality Select Switch should be on, and all Start Channel Select switches off. If channel 258 is the start channel, switch #4 on the Personality Select Switch and switch #1 on the Start Channel Select switch should be on. Start Channels above 256 are indicated in parenthesis in Table 1.

Suppose we want 16 Color Pro fixtures to begin on channel 300 and end on channel 347. Look up Start Channel #(300) from Table 1. Switches 1, 2, 4, and 6 of the START CHANNEL SELECT switch should be on **AND** switch #4 of the PERSONALITY switch should be on.

To run another 16 Color Pro separate from the first, daisy-chain to another Protocol Interface by plugging from DMX512 OUT on unit 1 to DMX512 IN on unit 2, and so on. Then set the START CHANNEL SELECT on each Interface to respond to the desired channels. This flexible arrangement allows the next group of 16 Color Pro to begin with the channel immediately following the previous group; or there could be any number of channels separating the groups. It is even possible to overlap channels for different groups. See figure 1.

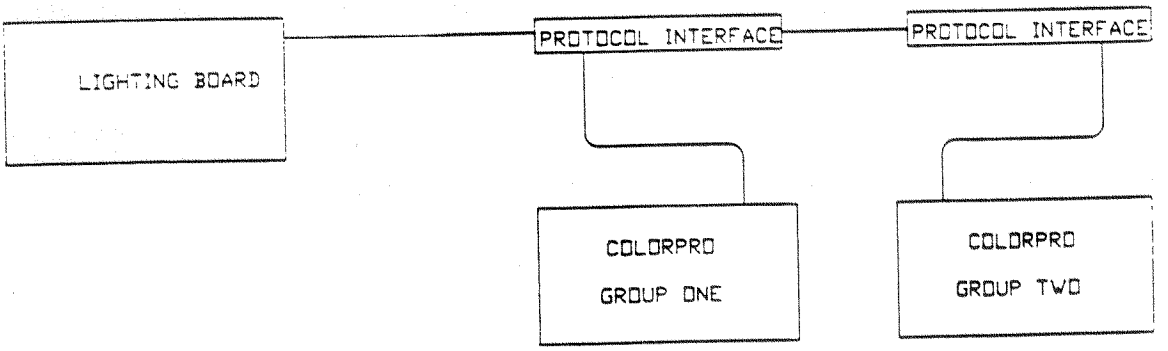


Figure 1.

ANALOG 0-10 VOLTS

There are 2 male 25 pin 'D' connectors for hook-up of analog 0-10 volt signals. Since this is an unmultiplexed analog signal, there are no START CHANNEL SELECT settings necessary. Connect directly to the desired faders on the lighting board.

The connector labeled 1-24 controls channels 1-24 (Color Pro Regions 1-8), and connector 25-48 controls channels 25-48 (Color Pro Regions 9-16). On both connectors pin 25 is analog signal ground. As before, channel 1 controls Red, 2 Green, and 3 Blue on Color Pro Region 1, and so on to channel 48 (Region 16).

RS-232

A female 25 pin 'D' connector is provided for standard RS-232 serial data. Pin 2 is receive, pin 3 is transmit, and pin 7 is ground.

The Protocol Interface is designed to operate with the Pulsar (copyright) RS-232 data transmission protocol. See page 17 for software details.

The Pulsar standard calls for a slightly different Start Channel Select switch setting than the DMX512. Channel 1 is the start channel with no switches on OR with switch #1 on. Because of this initial difference, when using Table 1 to find a start channel switch setting, you must drop to the setting for the next higher start channel. For instance, if channel 32 is to be the start channel, drop to channel 33 on Table 1, which calls for switch 6 to be on.

The transmit connection is made when using more than one Interface. Connect pin 3 of the first Interface to pin 2 of the next Interface, and so on. The ground connection (pin 7) is continued throughout. See figure 2.

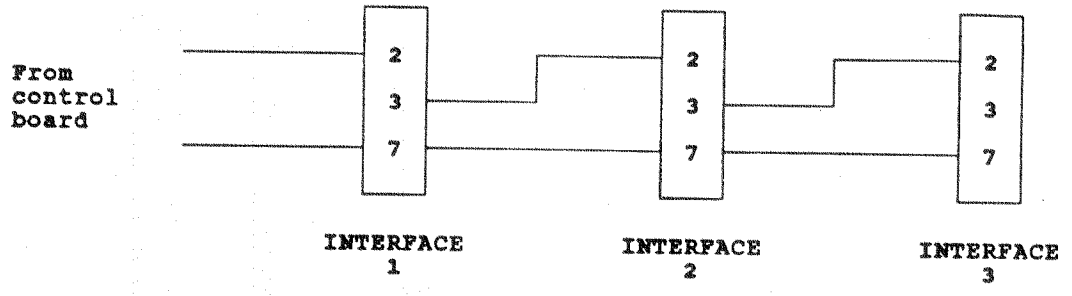


Figure 2.

TABLE 1. 512-CHANNEL DIP SWITCH SETTING CHART

START CHANNEL #	START CHANNEL SWITCHES ON	START CHANNEL #	START CHANNEL SWITCHES ON
001 (257)	NONE	046 (302)	1,3,4,6
002 (258)	1	047 (303)	2,3,4,6
003 (259)	2	048 (304)	1,2,3,4,6
004 (260)	1,2	049 (305)	5,6
005 (261)	3	050 (306)	1,5,6
006 (262)	1,3	051 (307)	2,5,6
007 (263)	2,3	052 (308)	1,2,5,6
008 (264)	1,2,3	053 (309)	3,5,6
009 (265)	4	054 (310)	1,3,5,6
010 (266)	1,4	055 (311)	2,3,5,6
011 (267)	2,4	056 (312)	1,2,3,5,6
012 (268)	1,2,4	057 (313)	4,5,6
013 (269)	3,4	058 (314)	1,4,5,6
014 (270)	1,3,4	059 (315)	2,4,5,6
015 (271)	2,3,4	060 (316)	1,2,4,5,6
016 (272)	1,2,3,4	061 (317)	3,4,5,6
017 (273)	5	062 (318)	1,3,4,5,6
018 (274)	1,5	063 (319)	2,3,4,5,6
019 (275)	2,5	064 (320)	1,2,3,4,5,6
020 (276)	1,2,5	065 (321)	7
021 (277)	3,5	066 (322)	1,7
022 (278)	1,3,5	067 (323)	2,7
023 (279)	2,3,5	068 (324)	1,2,7
024 (280)	1,2,3,5	069 (325)	3,7
025 (281)	4,5	070 (326)	1,3,7
026 (282)	1,4,5	071 (327)	2,3,7
027 (283)	2,4,5	072 (328)	1,2,3,7
028 (284)	1,2,4,5	073 (329)	4,7
029 (285)	3,4,5	074 (330)	1,4,7
030 (286)	1,3,4,5	075 (331)	2,4,7
031 (287)	2,3,4,5	076 (332)	1,2,4,7
032 (288)	1,2,3,4,5	077 (333)	3,4,7
033 (289)	6	078 (334)	1,3,4,7
034 (290)	1,6	079 (335)	2,3,4,7
035 (291)	2,6	080 (336)	1,2,3,4,7
036 (292)	1,2,6	081 (337)	5,7
037 (293)	3,6	082 (338)	1,5,7
038 (294)	1,3,6	083 (339)	2,5,7
039 (295)	2,3,6	084 (340)	1,2,5,7
040 (296)	1,2,3,6	085 (341)	3,5,7
041 (297)	4,6	086 (342)	1,3,5,7
042 (298)	1,4,6	087 (343)	2,3,5,7
043 (299)	2,4,6	088 (344)	1,2,3,5,7
044 (300)	1,2,4,6	089 (345)	4,5,7
045 (301) *	3,4,6	090 (346) *	1,4,5,7

* FOR CHANNELS ABOVE 256, SET SWITCHES AS INDICATED ON START CHANNEL SWITCH AND SWITCH #4 ON PERSONALITY SELECT SWITCH TO ON.

TABLE 1. 512-CHANNEL DIP SWITCH SETTING CHART

START CHANNEL #	START CHANNEL SWITCHES ON	START CHANNEL #	START CHANNEL SWITCHES ON
091 (347)	2,4,5,7	136 (392)	1,2,3,8
092 (348)	1,2,4,5,7	137 (393)	4,8
093 (349)	3,4,5,7	138 (394)	1,4,8
094 (350)	1,3,4,5,7	139 (395)	2,4,8
095 (351)	2,3,4,5,7	140 (396)	1,2,4,8
096 (352)	1,2,3,4,5,7	141 (397)	3,4,8
097 (353)	6,7	142 (398)	1,3,4,8
098 (354)	1,6,7	143 (399)	2,3,4,8
099 (355)	2,6,7	144 (400)	1,2,3,4,8
100 (356)	1,2,6,7	145 (401)	5,8
101 (357)	3,6,7	146 (402)	1,5,8
102 (358)	1,3,6,7	147 (403)	2,5,8
103 (359)	2,3,6,7	148 (404)	1,2,5,8
104 (360)	1,2,3,6,7	149 (405)	3,5,8
105 (361)	4,6,7	150 (406)	1,3,5,8,
106 (362)	1,4,6,7	151 (407)	2,3,5,8
107 (363)	2,4,6,7	152 (408)	1,2,3,5,8
108 (364)	1,2,4,6,7	153 (409)	4,5,8
109 (365)	3,4,6,7	154 (410)	1,4,5,8
110 (366)	1,3,4,6,7	155 (411)	2,4,5,8
111 (367)	2,3,4,6,7	156 (412)	1,2,4,5,8
112 (368)	1,2,3,4,6,7	157 (413)	3,4,5,8
113 (369)	5,6,7	158 (414)	1,3,4,5,8
114 (370)	1,5,6,7	159 (415)	2,3,4,5,8
115 (371)	2,5,6,7	160 (416)	1,2,3,4,5,8
116 (372)	1,2,5,6,7	161 (417)	6,8
117 (373)	3,5,6,7	162 (418)	1,6,8
118 (374)	1,3,5,6,7	163 (419)	2,6,8
119 (375)	2,3,5,6,7	164 (420)	1,2,6,8
120 (376)	1,2,3,5,6,7	165 (421)	3,6,8
121 (377)	4,5,6,7	166 (422)	1,3,6,8
122 (378)	1,4,5,6,7	167 (423)	2,3,6,8
123 (379)	2,4,5,6,7	168 (424)	1,2,3,6,8
124 (380)	1,2,4,5,6,7	169 (425)	4,6,8
125 (381)	3,4,5,6,7	170 (426)	1,4,6,8
126 (382)	1,3,4,5,6,7	171 (427)	2,4,6,8
127 (383)	2,3,4,5,6,7	172 (428)	1,2,4,6,8
128 (384)	1,2,3,4,5,6,7	173 (429)	3,4,6,8
129 (385)	8	174 (430)	1,3,4,6,8
130 (386)	1,8	175 (431)	2,3,4,6,8
131 (387)	2,8	176 (432)	1,2,3,4,6,8
132 (388)	1,2,8	177 (433)	5,6,8
133 (389)	3,8	178 (434)	1,5,6,8
134 (390)	1,3,8	179 (435)	2,5,6,8
135 (391) *	2,3,8	180 (436) *	1,2,5,6,8

* FOR CHANNELS ABOVE 256, SET SWITCHES AS INDICATED ON START CHANNEL SWITCH AND SWITCH #4 ON PERSONALITY SELECT SWITCH TO ON.

TABLE 1. 512-CHANNEL DIP SWITCH SETTING CHART

START CHANNEL #	START CHANNEL SWITCHES ON	START CHANNEL #	START CHANNEL SWITCHES ON
181 (437)	3,5,6,8	226 (482)	1,6,7,8
182 (438)	1,3,5,6,8	227 (483)	2,6,7,8
183 (439)	2,3,5,6,8	228 (484)	1,2,6,7,8
184 (440)	1,2,3,5,6,8	229 (485)	3,6,7,8
185 (441)	4,5,6,8	230 (486)	1,3,6,7,8
186 (442)	1,4,5,6,8	231 (487)	2,3,6,7,8
187 (443)	2,4,5,6,8	232 (488)	1,2,3,6,7,8
188 (444)	1,2,4,5,6,8	233 (489)	4,6,7,8
189 (445)	3,4,5,6,8	234 (490)	1,4,6,7,8
190 (446)	1,3,4,5,6,8	235 (491)	2,4,6,7,8
191 (447)	2,3,4,5,6,8	236 (492)	1,2,4,6,7,8
192 (448)	1,2,3,4,5,6,8	237 (493)	3,4,6,7,8
193 (449)	7,8	238 (494)	1,3,4,6,7,8
194 (450)	1,7,8	239 (495)	2,3,4,6,7,8
195 (451)	2,7,8	240 (496)	1,2,3,4,6,7,8
196 (452)	1,2,7,8	241 (497)	5,6,7,8,
197 (453)	3,7,8	242 (498)	1,5,6,7,8
198 (454)	1,3,7,8	243 (499)	2,5,6,7,8
199 (455)	2,3,7,8	244 (500)	1,2,5,6,7,8
200 (456)	1,2,3,7,8	245 (501)	3,5,6,7,8
201 (457)	4,7,8	246 (502)	1,3,5,6,7,8
202 (458)	1,4,7,8	247 (503)	2,3,5,6,7,8
203 (459)	2,4,7,8	248 (504)	1,2,3,5,6,7,8
204 (460)	1,2,4,7,8	249 (505)	4,5,6,7,8
205 (461)	3,4,7,8	250 (506)	1,4,5,6,7,8
206 (462)	1,3,4,7,8	251 (507)	2,4,5,6,7,8
207 (463)	2,3,4,7,8	252 (508)	1,2,4,5,6,7,8
208 (464)	1,2,3,4,7,8	253 (509)	3,4,5,6,7,8
209 (465)	5,7,8	254 (510)	1,3,4,5,6,7,8
210 (466)	1,5,7,8	255 (511)	2,3,4,5,6,7,8
211 (467)	2,5,7,8	256 (512) *	ALL ON
212 (468)	1,2,5,7,8		
213 (469)	3,5,7,8		
214 (470)	1,3,5,7,8		
215 (471)	2,3,5,7,8		
216 (472)	1,2,3,5,7,8		
217 (473)	4,5,7,8		
218 (474)	1,4,5,7,8		
219 (475)	2,4,5,7,8		
220 (476)	1,2,4,5,7,8		
221 (477)	3,4,5,7,8		
222 (478)	1,3,4,5,7,8		
223 (479)	2,3,4,5,7,8		
224 (480)	1,2,3,4,5,7,8		
225 (481) *	6,7,8,		

* FOR CHANNELS ABOVE 256, SET SWITCHES AS INDICATED ON START CHANNEL SWITCH AND SWITCH #4 ON PERSONALITY SELECT SWITCH TO ON.

PULSAR Data Transmission Protocol

Copyright
PULSAR LIGHT OF CAMBRIDGE LIMITED
Henley Road, Cambridge CBI 3EA, England

SERIAL DATA IN - 9600 Baud, RS-232/RS423

DATA FORMAT - 1 start bit, 8 data bits, 1 stop bit, no parity

HANDSHAKING - none - only two wires required, transmit and ground

RESOLUTION - 128 levels (7 bits)

TRANSMISSION PROTOCOL - channel address followed by channel level. Bit 7 signifies address, bit 7 clear signifies level. Addresses in range 1 - 120 are sent as 128 to 247, levels as 0 - 127. Thus to set channel 10 to half brightness 137 is transmitted followed by 64.

BYTES 248 TO 255 ARE RESERVED FOR SPECIAL CODES - 248 sets all channels to the level which follows e.g. 0 for blackout. 249 changes page number to the page number which follows. Each page allows you to address 120 channels. The unit defaults to page 0 (channels 1 - 120) which is sufficient for the BBC software. To address channel 150 for example the following sequence is sent: 249 followed by 1 for page 1 (this means that addresses 128 - 247 will now be interpreted as channels 121 - 240) followed by the address 157 and the required level. The page number remains in the new page until another 249 sequence is sent. 250 - 255 are reserved for future expansion.

REFRESH - not required - only level changes need to be transmitted. However it is good practice to send all unchanged levels and the code 249 followed by the current page number occasionally, to correct any data corruptions.

MAINTENANCE

Your Color Pro system has been designed for longevity and ease of use. Cleanliness will prolong its life. Interfaces should be cleaned occasionally with a soft cloth. Luminaires will need to have lenses cleaned with a soft tissue and a glass cleaning solution. The dichroic filters will also need periodic cleaning. To gain access, loosen drawer access screw and pull drawer out to its stops. The dichroics will then be exposed, though you may wish to remove the lamps to access both sides of some filters. Dust should be cleaned from the fan and ventilation holes.

Power should be off when any cleaning or maintenance is done.

WARRANTY

Your Color Pro system is covered by a limited, 1 year 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 or 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 Interface 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-servicable parts inside. Servicing must be conducted by the manufacturer or other qualified service personnel. For continued protection against fire, fuses must be replaced with the specified voltage and current ratings only. Use lamp type ENH, ENG, or ELH only. Refer to user manual for safe operation.

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 first receives power, and then both will turn off after approximately 60 seconds. With the fixture's serial data lines, and your lighting board, properly connected to the Protocol Interface, the fixtures will be 'enabled' (LED and fan on) under the following conditions:

DMX512 and RS-232	Any channel enabled within the 48 consecutive channels the Interface is set to work with, regardless of fader settings
ANALOG	Any channel output above 0.07 volts

If these conditions are met and the fixtures do not enable, check for voltage at the fixture, and that all data cables are plugged in.

OTHER PROBLEMS

SYMPTOMS	CAUSE/remedy
UNITS FLASHING SPORADICALLY AND/OR FAILING TO GO DARK WHEN ALL FADERS ARE OFF	SHORTED CONNECTION IN DATA LINE OR PLUG NOT INSERTED COMPLETELY IN JACK. Repair or replace cable; re-seat all data plugs.
COLOR OUTPUT OF FIXTURE(S) NOT THE SAME AS OTHERS OR NOT FOLLOWING FADER SETTINGS	ONE OR MORE LAMPS OUT OR INCORRECT REGION ASSIGNMENT. Replace bad lamps; reset region
FIXTURE ENABLE LED & FAN DO NOT COME ON; NO RESPONSE TO LIGHTING BOARD COMMANDS	PROTOCOL INTERFACE INPUT NOT SET PROPERLY FOR LIGHTING BOARD OUTPUT. Check PERSONALITY switch # 1-3
FIXTURES NOT CONTROLLED BY DESIRED FADERS	DMX512 and RS-232: INCORRECT START CHANNEL SELECT SWITCH SETTING. ANALOG: CONNECTIONS REVERSED AT INTERFACE OR NOT CONNECTED TO PROPER BOARD OUTPUTS. INCORRECT REGION ASSIGNMENT(S)
FIXTURE LIGHT OUTPUT DOES NOT FOLLOW FADERS SMOOTHLY	INCORRECT VOLTAGE SELECTION. Check PERSONALITY switch # 8
FIXTURE LIGHT OUTPUT SEEMS REDUCED	90% OR 95% POWER OPTION SELECTED. Check PERSONALITY switch # 6,7

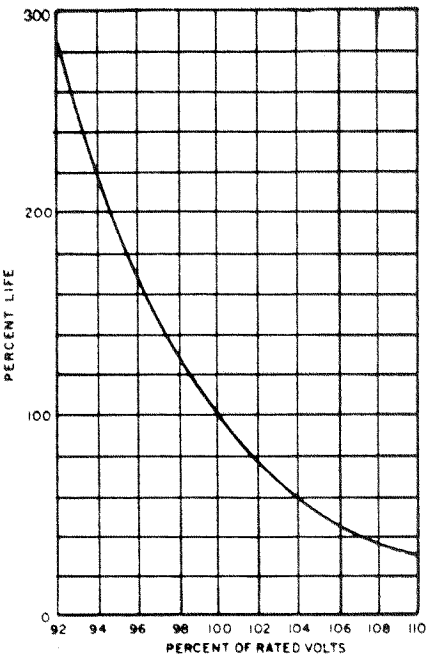
ATTENTION:
About Lamp Life

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.

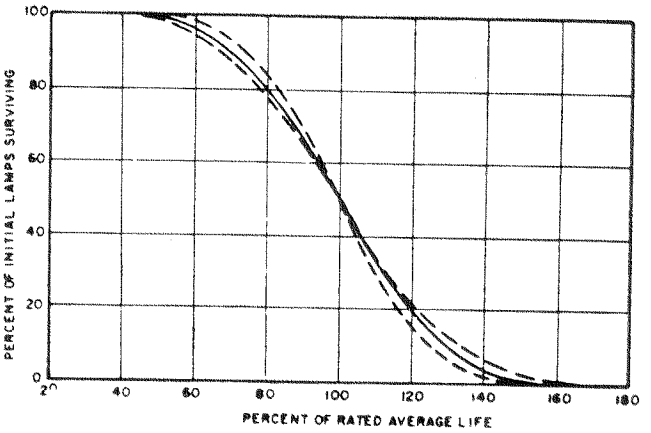


Figure 2.

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.

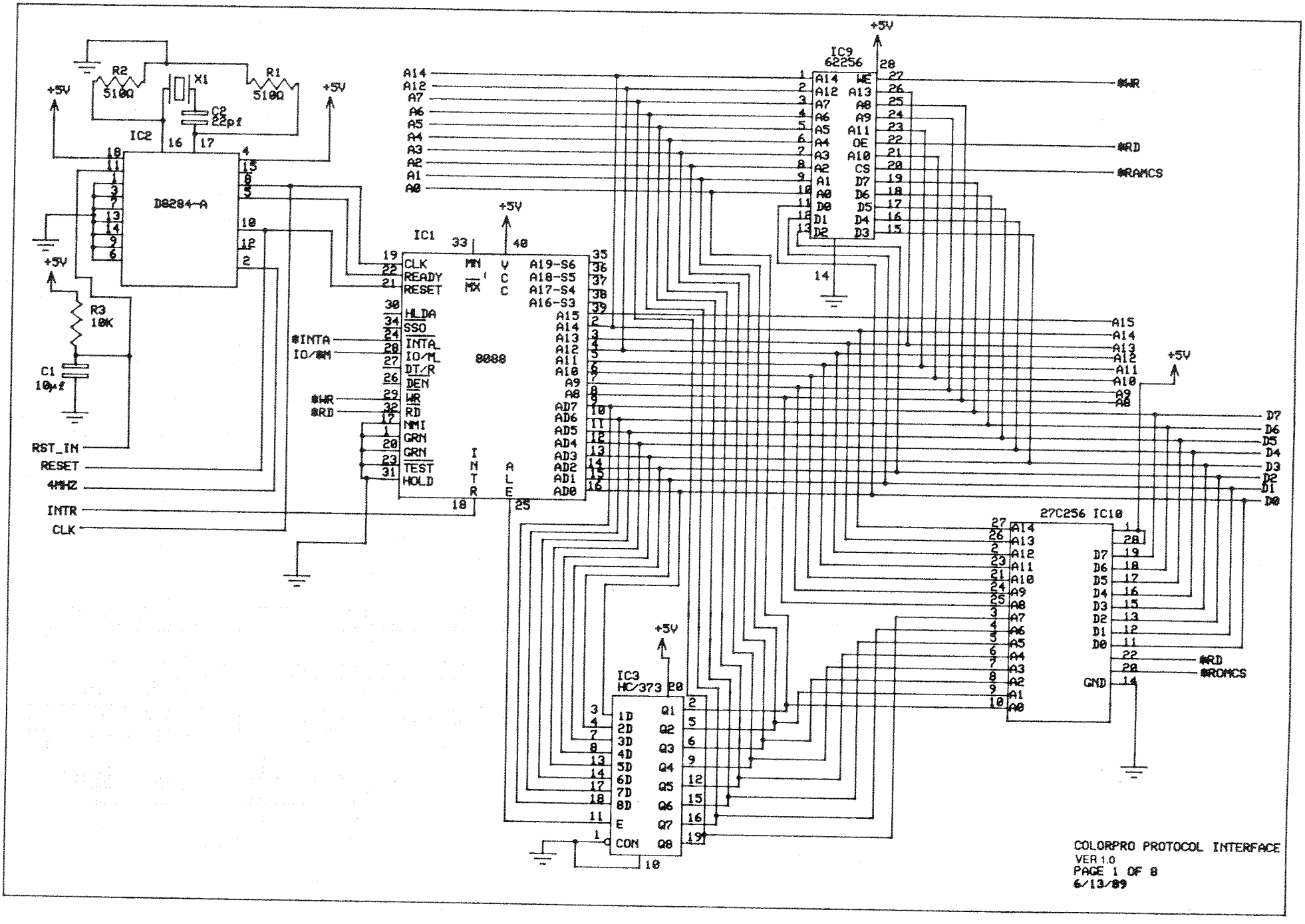
POWER OPTION:		100%		95%		90%	
LINE VOLTAGE		LAMP VOLTAGE	AVERAGE LAMP LIFE	LAMP VOLTAGE	AVERAGE LAMP LIFE	LAMP VOLTAGE	AVERAGE LAMP LIFE
NORMAL	120V/60Hz (240V/50Hz)	120V	175HR	114V	332HR	108V	500HR+
+ 5%	126V/60Hz (252V/50Hz)	126V	88HR	120V	175HR	114V	332HR
+10%	132V/60Hz (264V/50Hz)	132V	53HR	126V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

Table 1.

SCHEMATIC KEY

RPACK	Dual inline resistor package - 2%
DIP	"
SIP	Single inline resistor package - 2%
J	Jack (Female connector)
P	Plug (Male connector)

All resistors 1/4W 5% unless noted otherwise
T1 on fixture board is rated 115/230VAC primary, 8/16VAC secondary at 1.1VA
TF1 on Interface board is rated 115/230VAC primary, 8/16VAC secondary at 6VA


R2
510Ω
X1
R1
510Ω
C2
22pf
IC2
8284-A
+5V
R3
10K
C1
10µf
RST_IN
RESET
4MHZ
INTR
CLK
IC1
8088
CLK
READY
RESET
HLDA
SSO
INTA
IO/M
DT/R
DEN
WR
RD
NMI
GRN
GRN
TEST
HOLD
MN/MX
A19-S6
A18-S5
A17-S4
A16-S3
AD7
AD6
AD5
AD4
AD3
AD2
AD1
AD0
#INTA
IO/#M
#WR
#RD
A14
A12
A7
A6
A5
A4
A3
A2
A1
A0
IC9
62256
WE
CS
OE
D7
D6
D5
D4
D3
#WR
#RD
#RAMCS
A15
A13
A11
A10
A9
A8
IC3
HC373
1D
2D
3D
4D
5D
6D
7D
8D
E
CON
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
27C256 IC10
GND
#ROMCS
COLORPRO PROTOCOL INTERFACE
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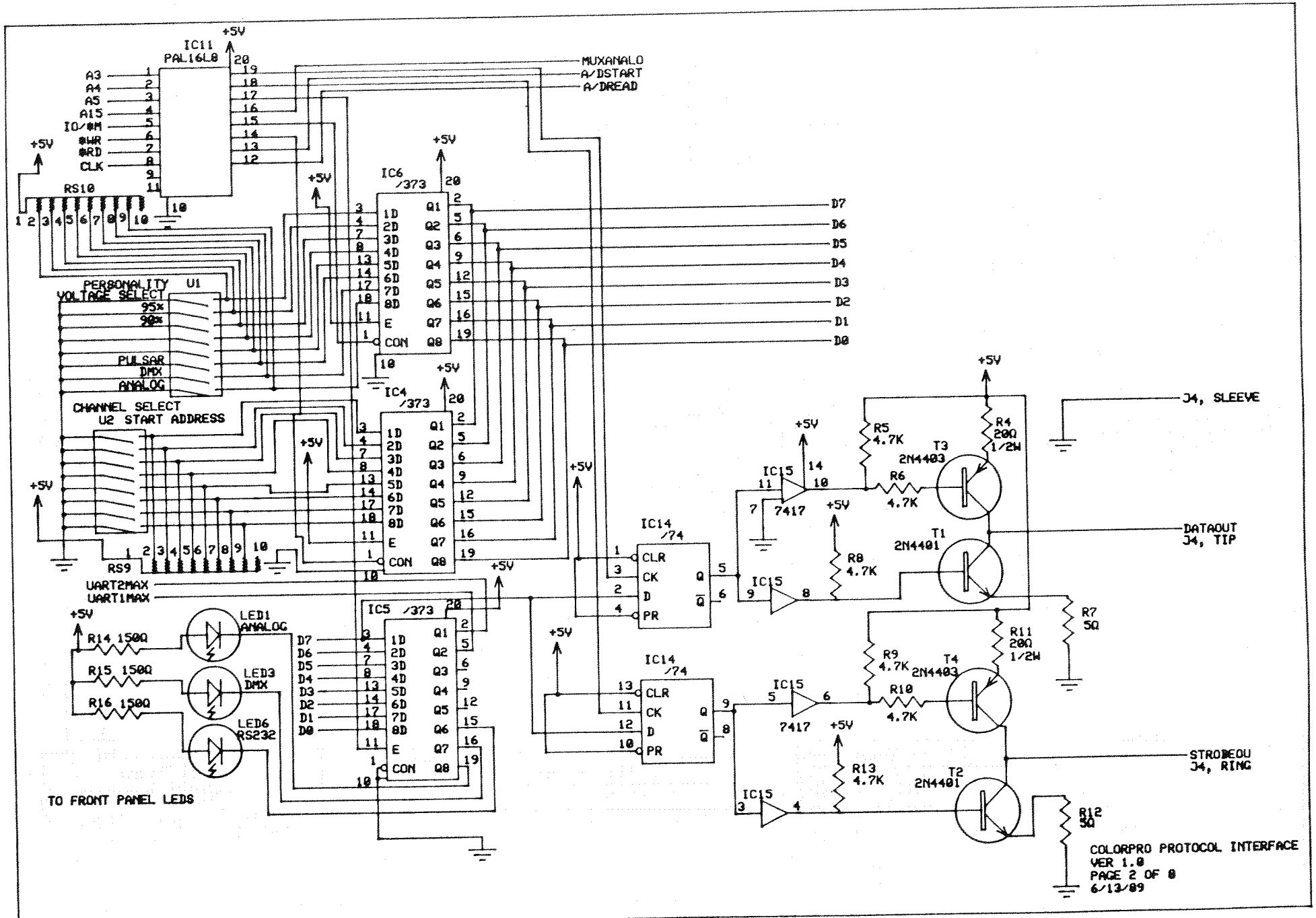
IC11
PAL16L8
A3
A4
A5
A15
IO/*M
*WR
*RD
CLK
+5V
MUXANALO
A/DSTART
A/DREAD
RS10
PERSONALITY U1
VOLTAGE SELECT
95%
90%
PULSAR
DMX
ANALOG
CHANNEL SELECT
U2 START ADDRESS
RS9
IC6 /373
IC4 /373
IC5 /373
1D
2D
3D
4D
5D
6D
7D
8D
E
CON
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
D7
D6
D5
D4
D3
D2
D1
D0
UART2MAX
UART1MAX
LED1
ANALOG
LED3
DMX
LED6
RS232
R14 150Ω
R15 150Ω
R16 150Ω
TO FRONT PANEL LEDS
IC14 /74
CLR
CK
D
PR
Q
IC15
7417
R5
4.7K
R6
4.7K
R8
4.7K
R9
4.7K
R10
4.7K
R13
4.7K
R4
20Ω
1/2W
R11
20Ω
1/2W
R7
5Ω
R12
5Ω
T3
2N4403
T1
2N4401
T4
2N4403
T2
2N4401
J4, SLEEVE
DATAOUT
J4, TIP
STROBEOU
J4, RING
COLORPRO PROTOCOL INTERFACE
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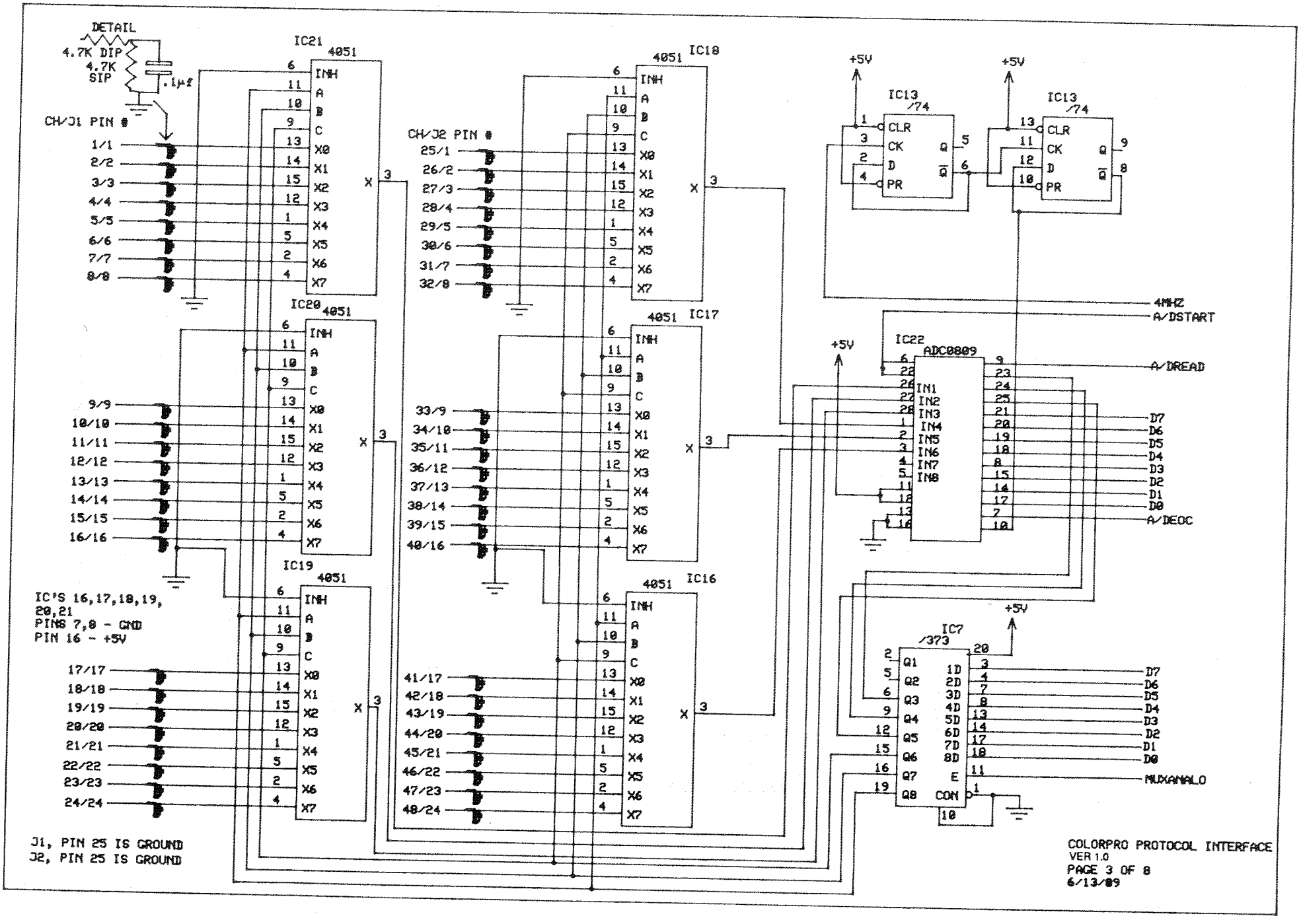
DETAIL
4.7K DIP
4.7K SIP
.1µf
CH/J1 PIN #
1/1
2/2
3/3
4/4
5/5
6/6
7/7
8/8
IC21
4051
INH
A
B
C
X0
X1
X2
X3
X4
X5
X6
X7
X
3
IC20
9/9
10/10
11/11
12/12
13/13
14/14
15/15
16/16
IC19
17/17
18/18
19/19
20/20
21/21
22/22
23/23
24/24
IC'S 16,17,18,19, 20,21
PINS 7,8 - GND
PIN 16 - +5V
J1, PIN 25 IS GROUND
J2, PIN 25 IS GROUND
CH/J2 PIN #
25/1
26/2
27/3
28/4
29/5
30/6
31/7
32/8
IC18
IC17
33/9
34/10
35/11
36/12
37/13
38/14
39/15
40/16
IC16
41/17
42/18
43/19
44/20
45/21
46/22
47/23
48/24
+5V
IC13
/74
CLR
CK
D
PR
Q
IC22
ADC0809
IN1
IN2
IN3
IN4
IN5
IN6
IN7
IN8
4MHZ
A/DSTART
A/DREAD
D7
D6
D5
D4
D3
D2
D1
D0
A/DEOC
IC7
/373
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
1D
2D
3D
4D
5D
6D
7D
8D
E
CON
MUXANALO
COLORPRO PROTOCOL INTERFACE
VER 1.0
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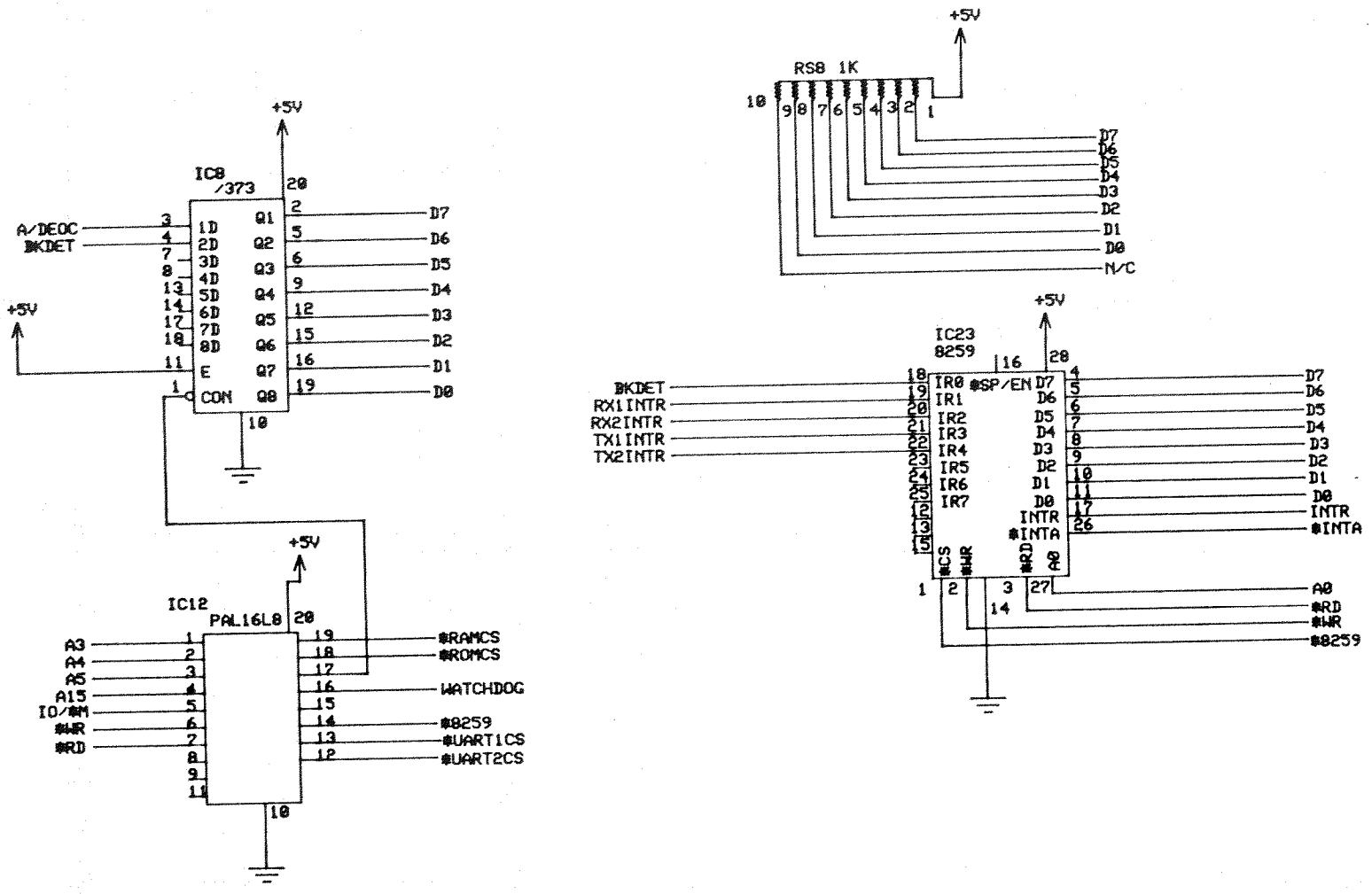

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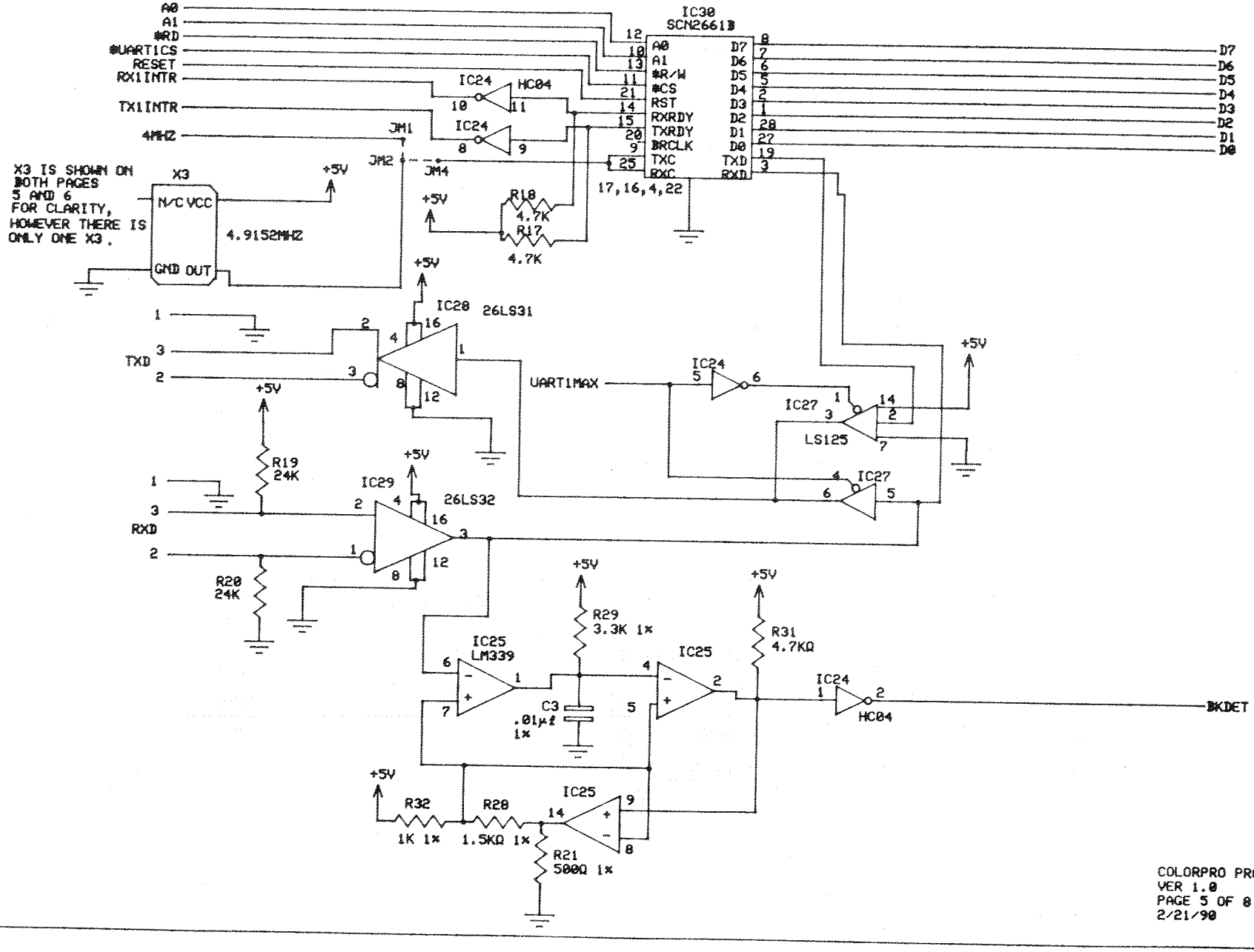
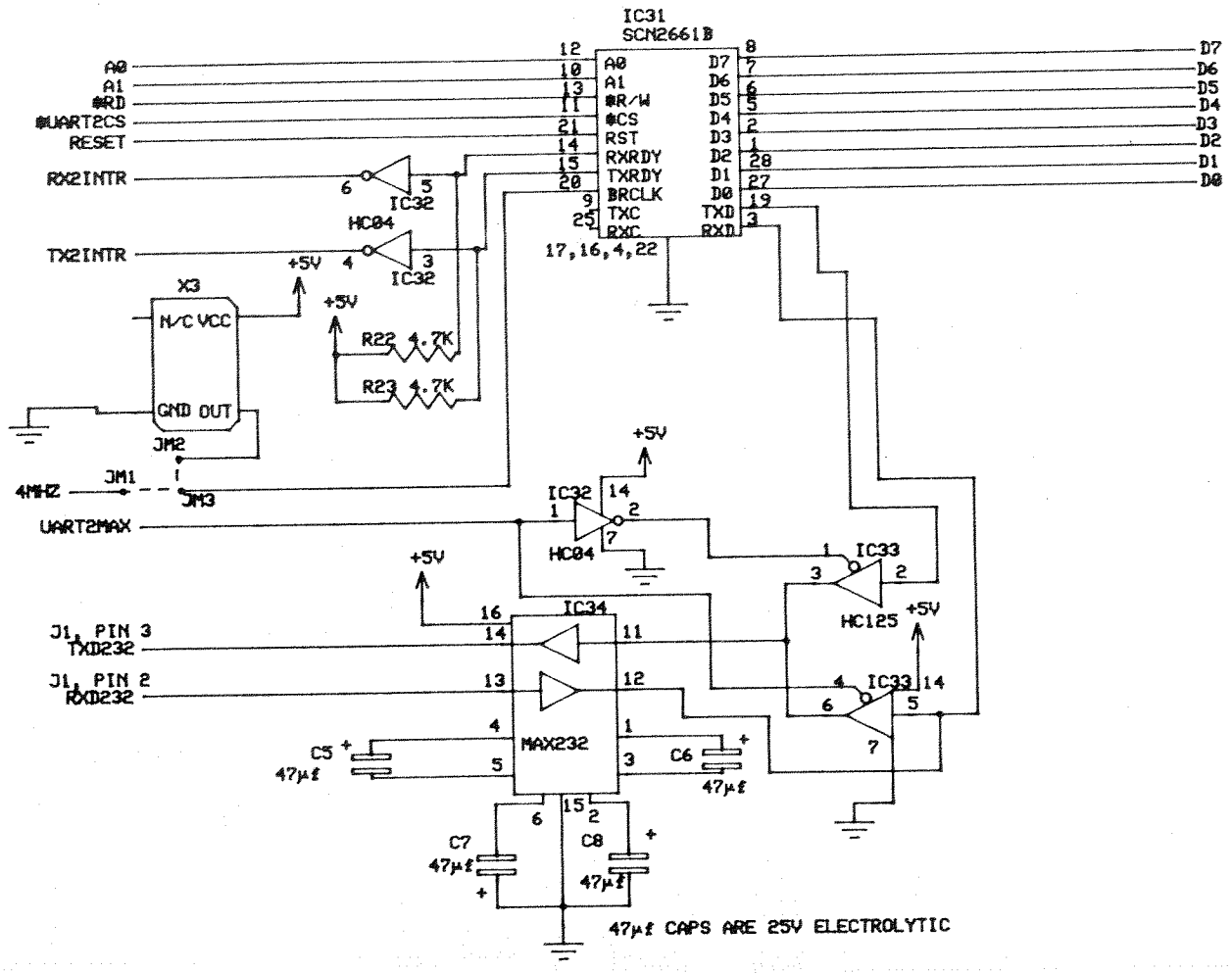

A0
A1
#RD
#UARTICS
RESET
RX1INTR
TX1INTR
4MHZ
IC30
SCN2661B
IC24
HC04
JM1
JM2
JM4
X3
X3 IS SHOWN ON BOTH PAGES 5 AND 6 FOR CLARITY, HOWEVER THERE IS ONLY ONE X3.
N/C VCC
GND OUT
4.9152MHZ
+5V
R18
4.7K
R17
4.7K
17,16,4,22
D7
D6
D5
D4
D3
D2
D1
D0
TXD
RXD
IC28 26LS31
UART1MAX
IC27
LS125
R19
24K
IC29
26LS32
R20
24K
R29
3.3K 1%
R31
4.7KΩ
IC25
LM339
C3
.01µf
1%
BKDET
R32
1K 1%
R28
1.5KΩ 1%
R21
500Ω 1%
COLORPRO PROTOCOL INTERFACE
VER 1.0
PAGE 5 OF 8
2/21/90



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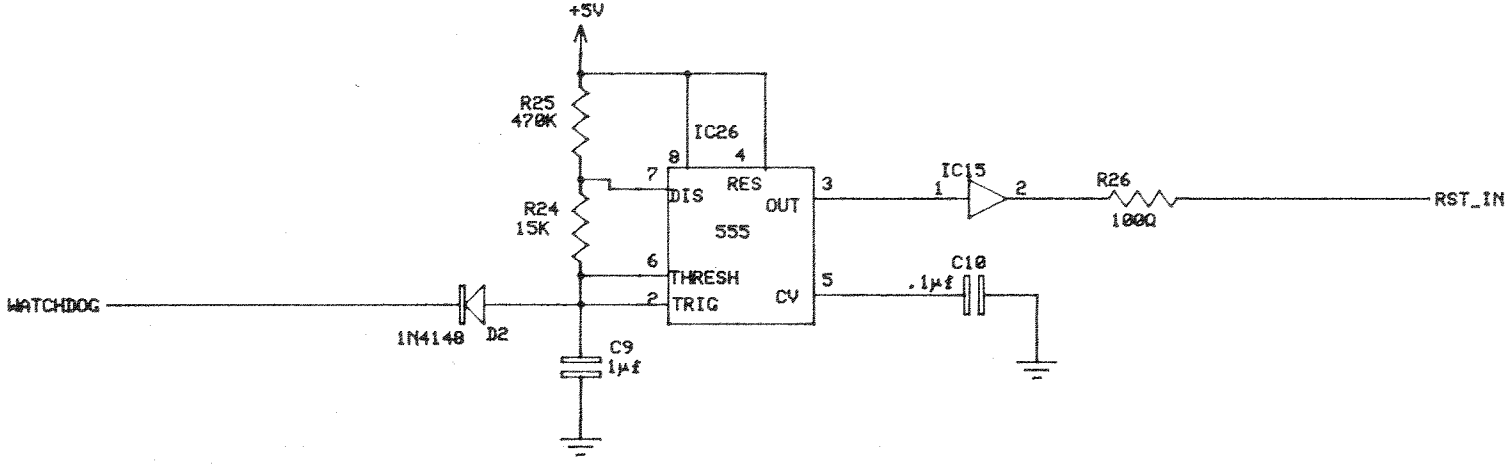

COLORPRO PROTOCOL INTERFACE
VER 1.0
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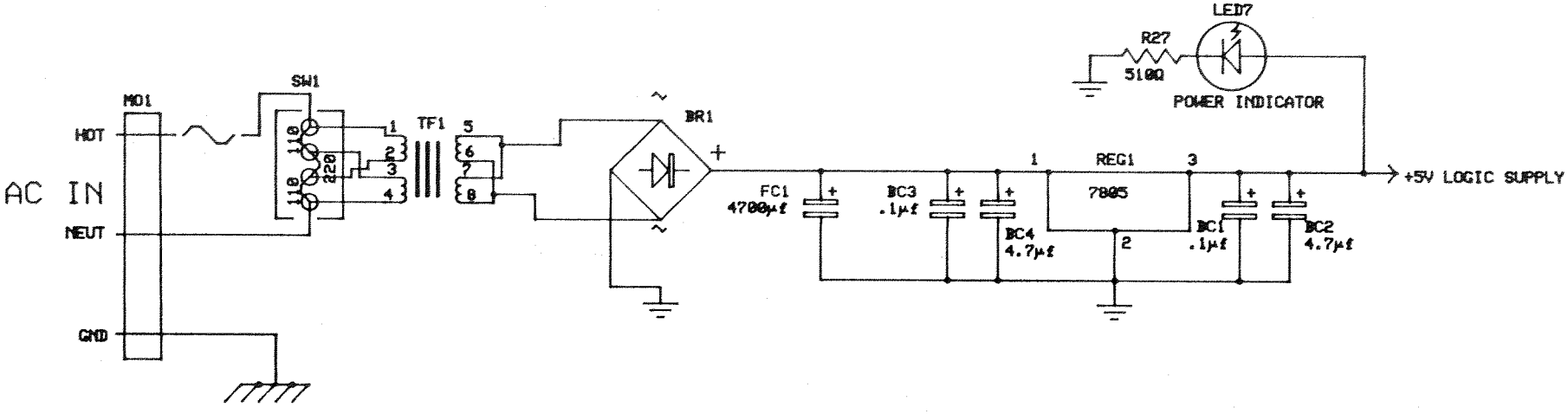

COLOPRO PROTOCOL INTERFACE
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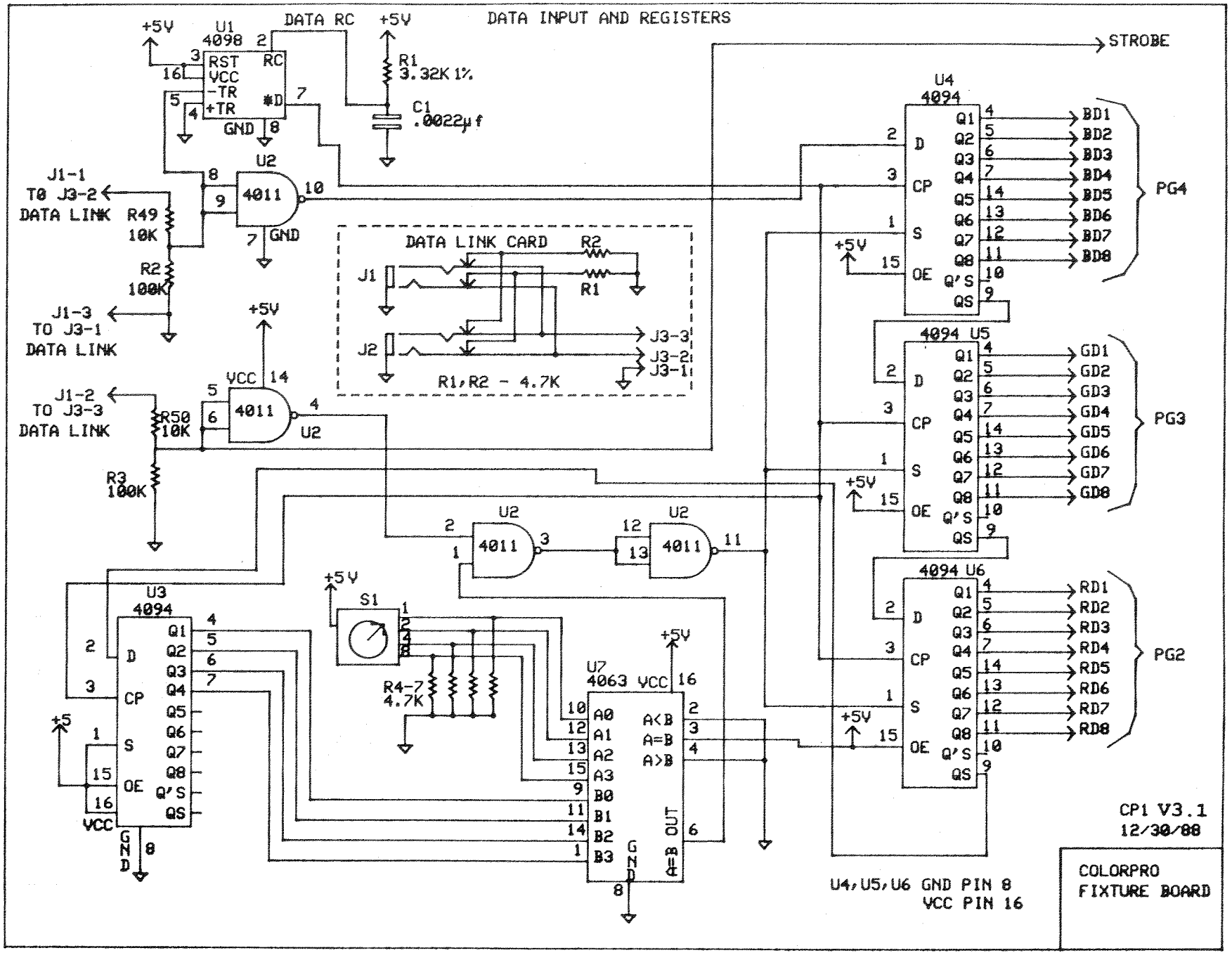
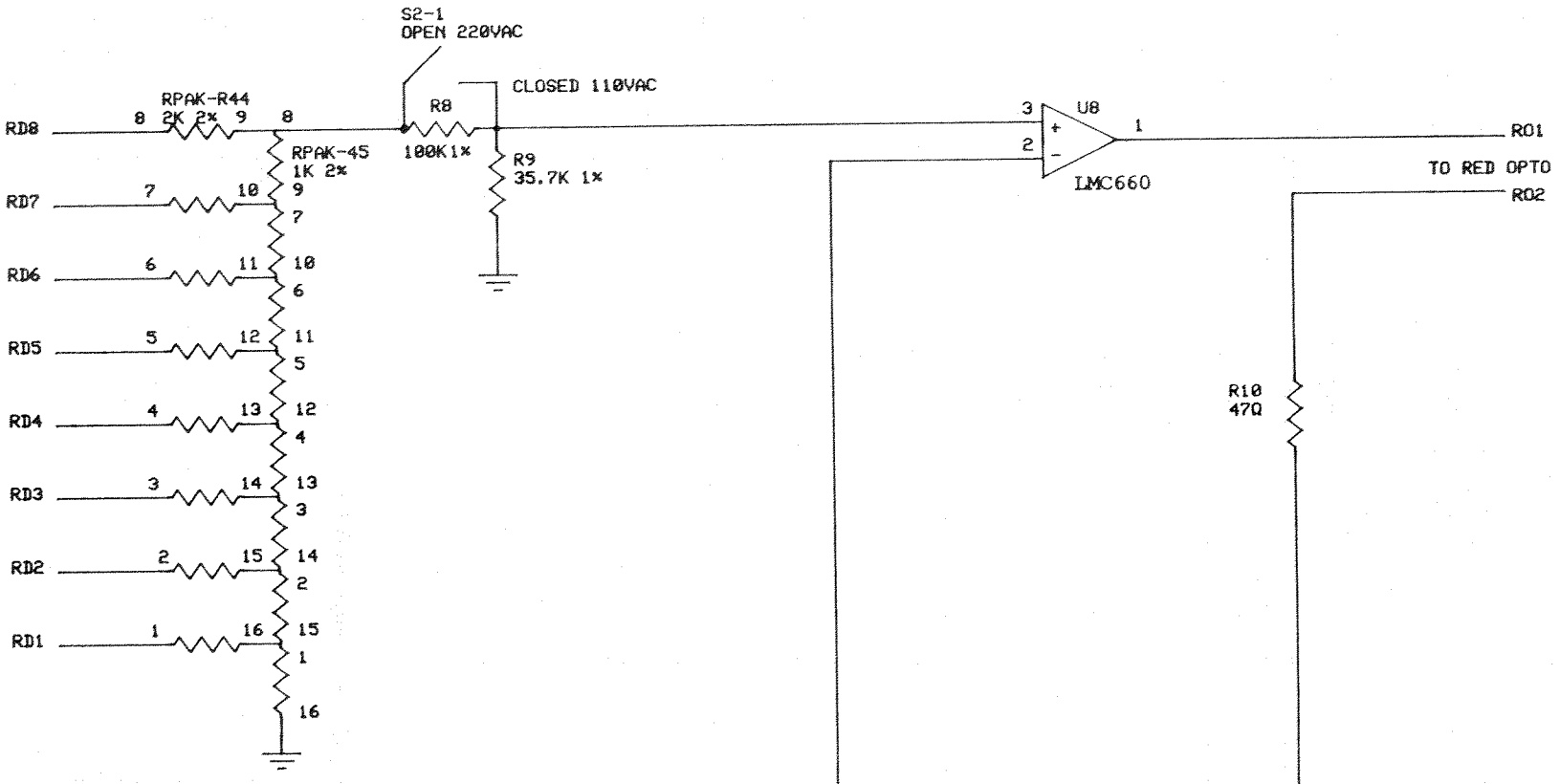
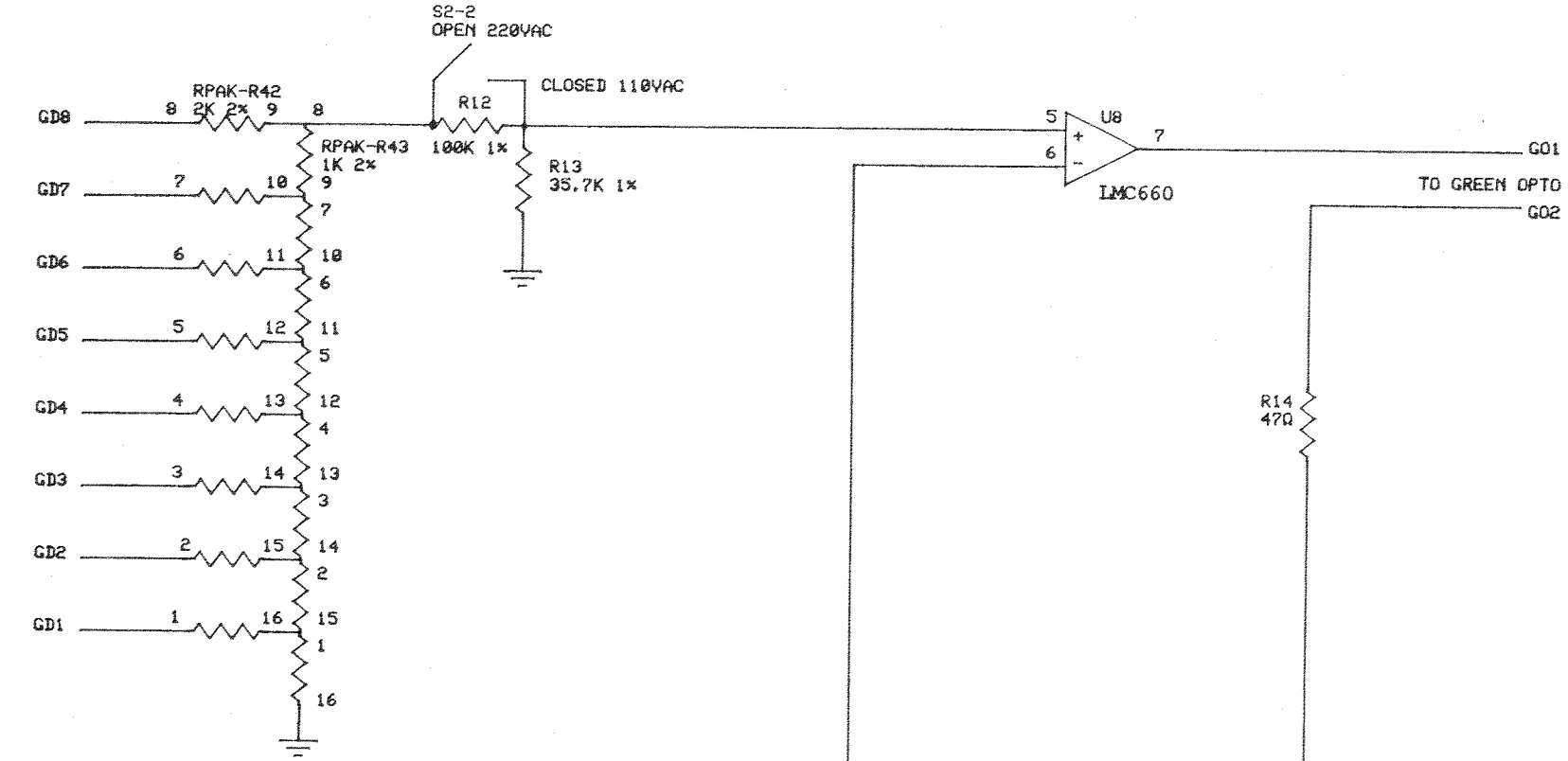

DATA INPUT AND REGISTERS
DATA RC
+5V
U1
4098
RST
VCC
-TR
+TR
RC
#D
GND
R1
3.32K 1%
C1
.0022µf
STROBE
U4
4094
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q'S
QS
D
CP
S
OE
BD1
BD2
BD3
BD4
BD5
BD6
BD7
BD8
PG4
4094 U5
GD1
GD2
GD3
GD4
GD5
GD6
GD7
GD8
PG3
4094 U6
RD1
RD2
RD3
RD4
RD5
RD6
RD7
RD8
PG2
U2
4011
J1-1
TO J3-2
DATA LINK
R49
10K
R2
100K
J1-3
TO J3-1
DATA LINK
J1-2
TO J3-3
DATA LINK
R50
10K
R3
100K
DATA LINK CARD
R2
R1
J1
J2
J3-3
J3-2
J3-1
R1, R2 - 4.7K
U3
4094
S1
R4-7
4.7K
U7
4063
VCC
A0
A1
A2
A3
B0
B1
B2
B3
A<B
A=B
A>B
A=B OUT
GND
U4, U5, U6 GND PIN 8
VCC PIN 16
CP1 V3.1
12/30/88
COLORPRO
FIXTURE BOARD

D/A CONVERSION FOR RED

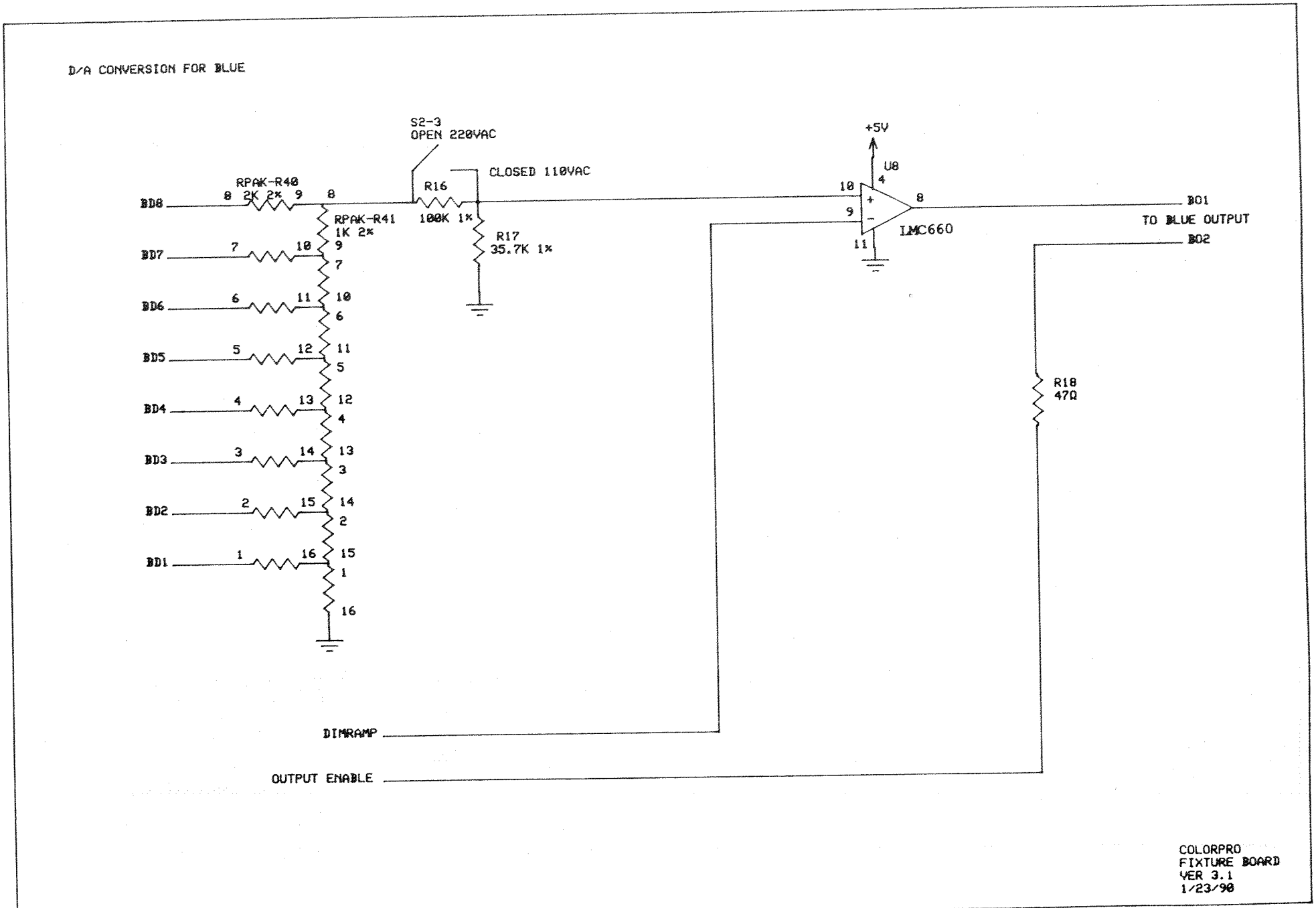


COLORPRO
FIXTURE BOARD
VER 3.1
1/23/90

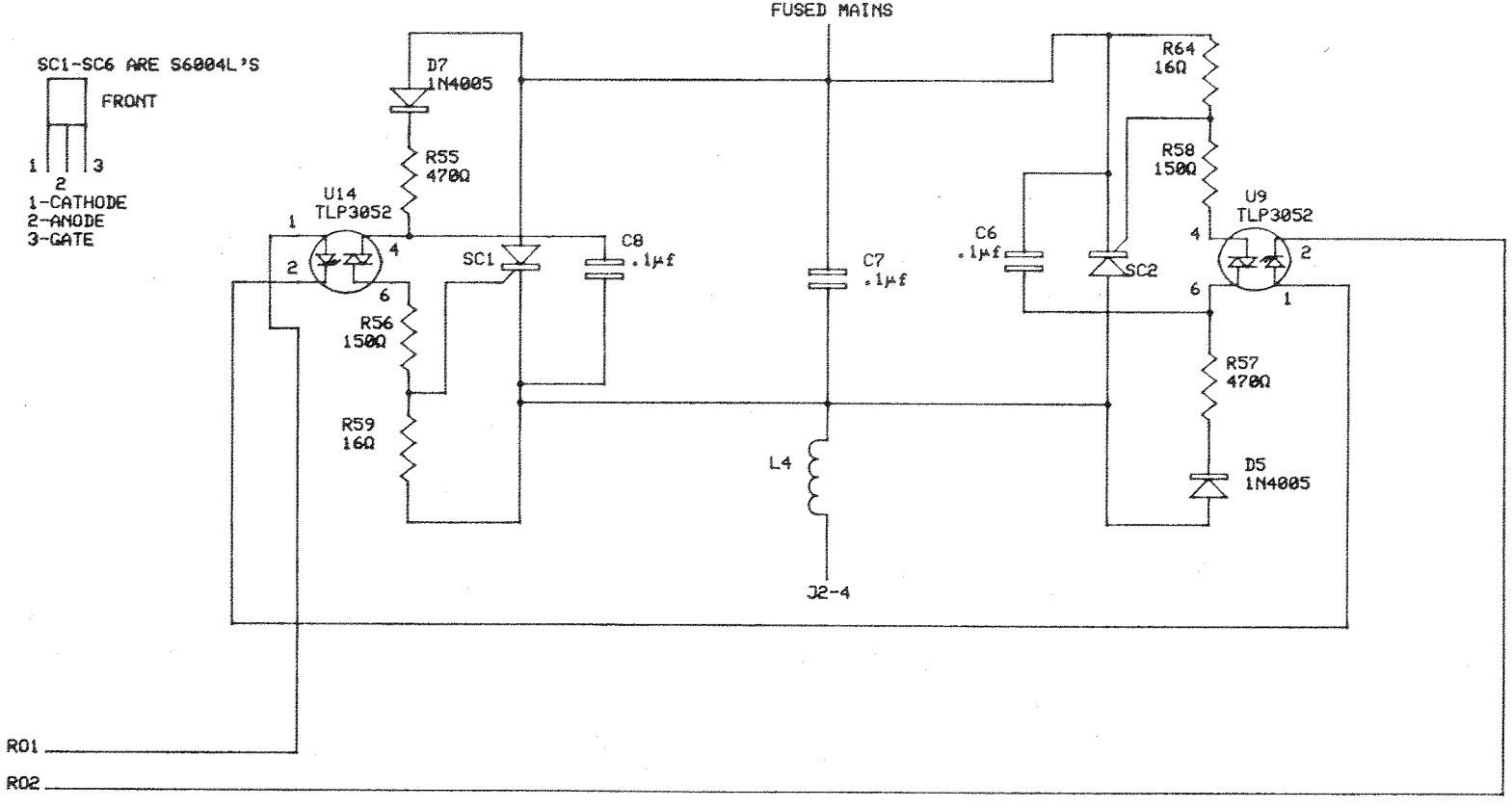
D/A CONVERSION FOR GREEN



COLORPRO
FIXTURE BOARD
VER 3.1
1/23/90

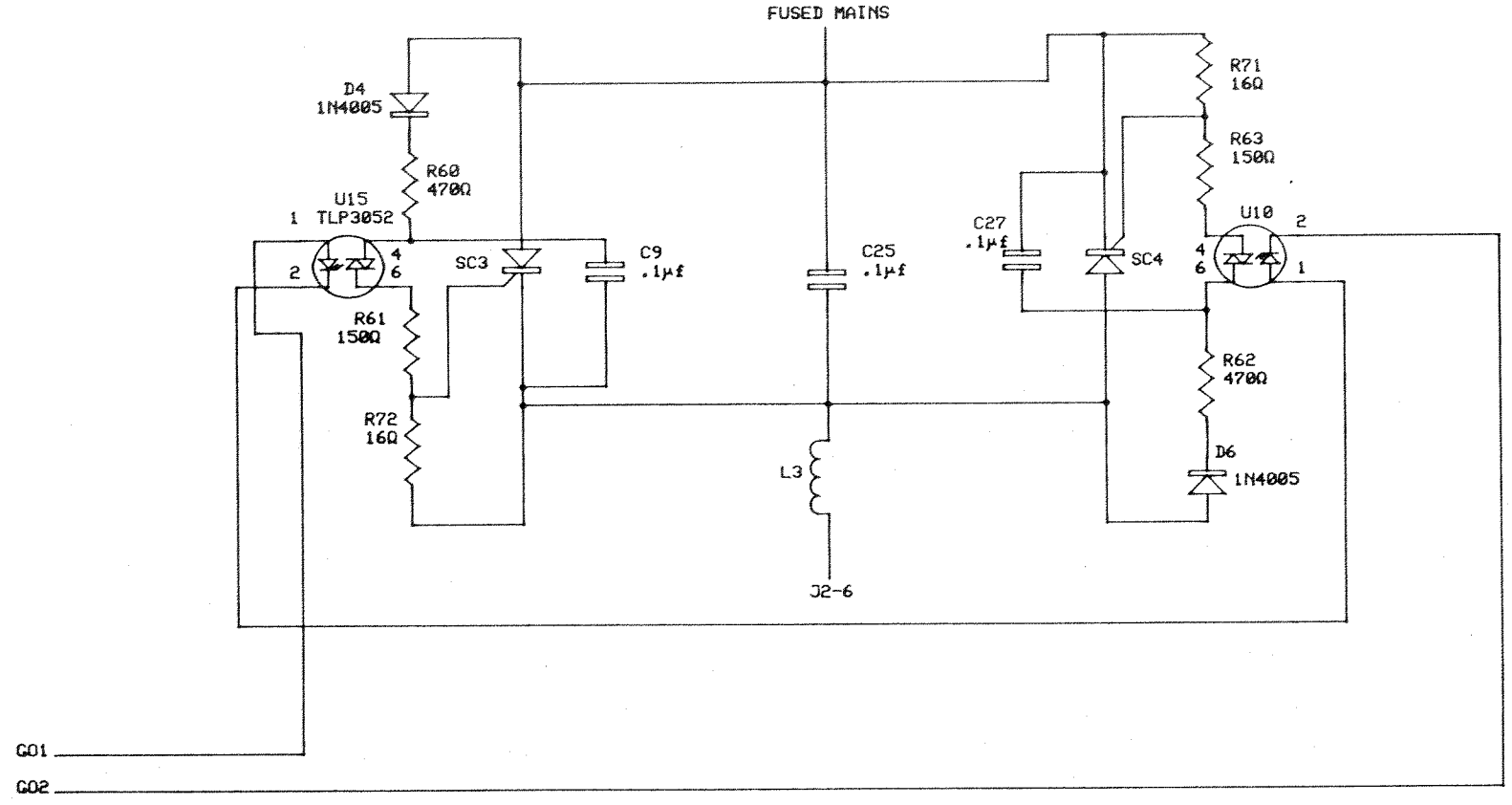

D/A CONVERSION FOR BLUE
S2-3
OPEN 220VAC
CLOSED 110VAC
+5V
U8
RPAK-R40
8 2K 2% 9
8
R16
100K 1%
RPAK-R41
1K 2%
R17
35.7K 1%
BD8
BD7
BD6
BD5
BD4
BD3
BD2
BD1
IMC660
BO1
TO BLUE OUTPUT
BO2
R18
47Ω
DIMRAMP
OUTPUT ENABLE
COLORPRO
FIXTURE BOARD
VER 3.1
1/23/90

RED OUTPUT



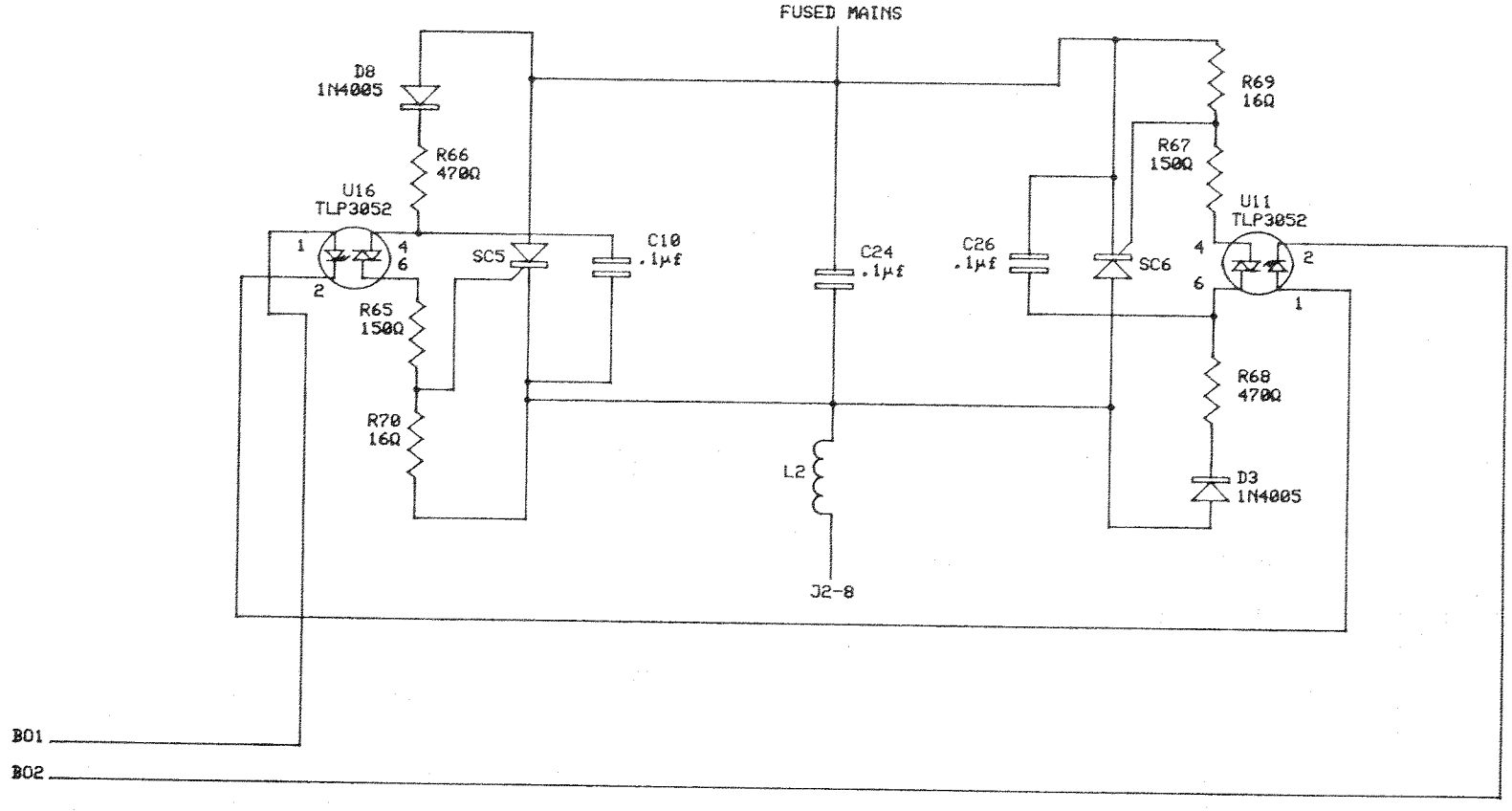
COLORPRO
FIXTURE BOARD
VER 3.1
1/23/90

GREEN OUTPUT



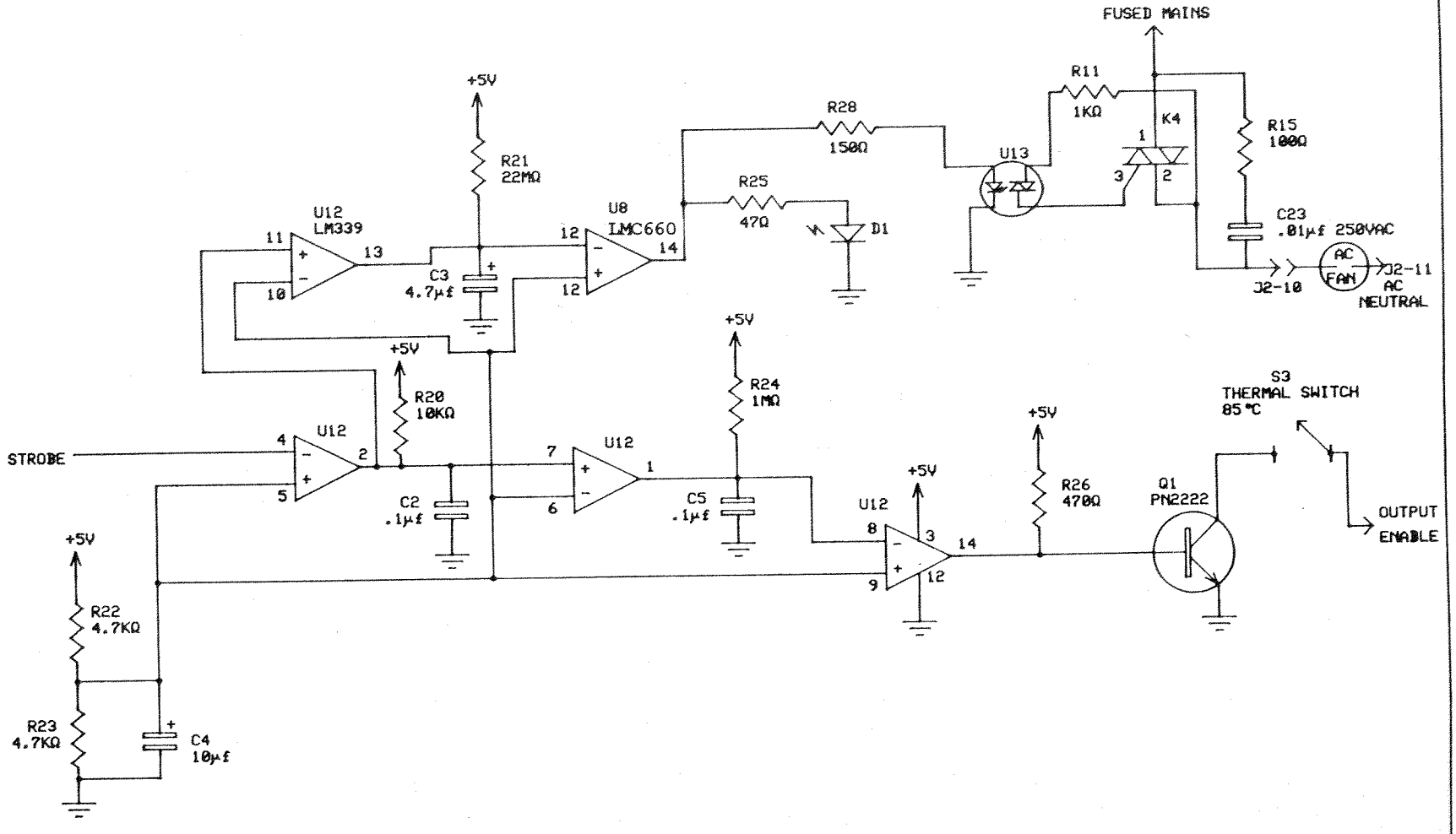
COLORPRO
FIXTURE BOARD
VER 3.1
1/23/90

BLUE OUTPUT

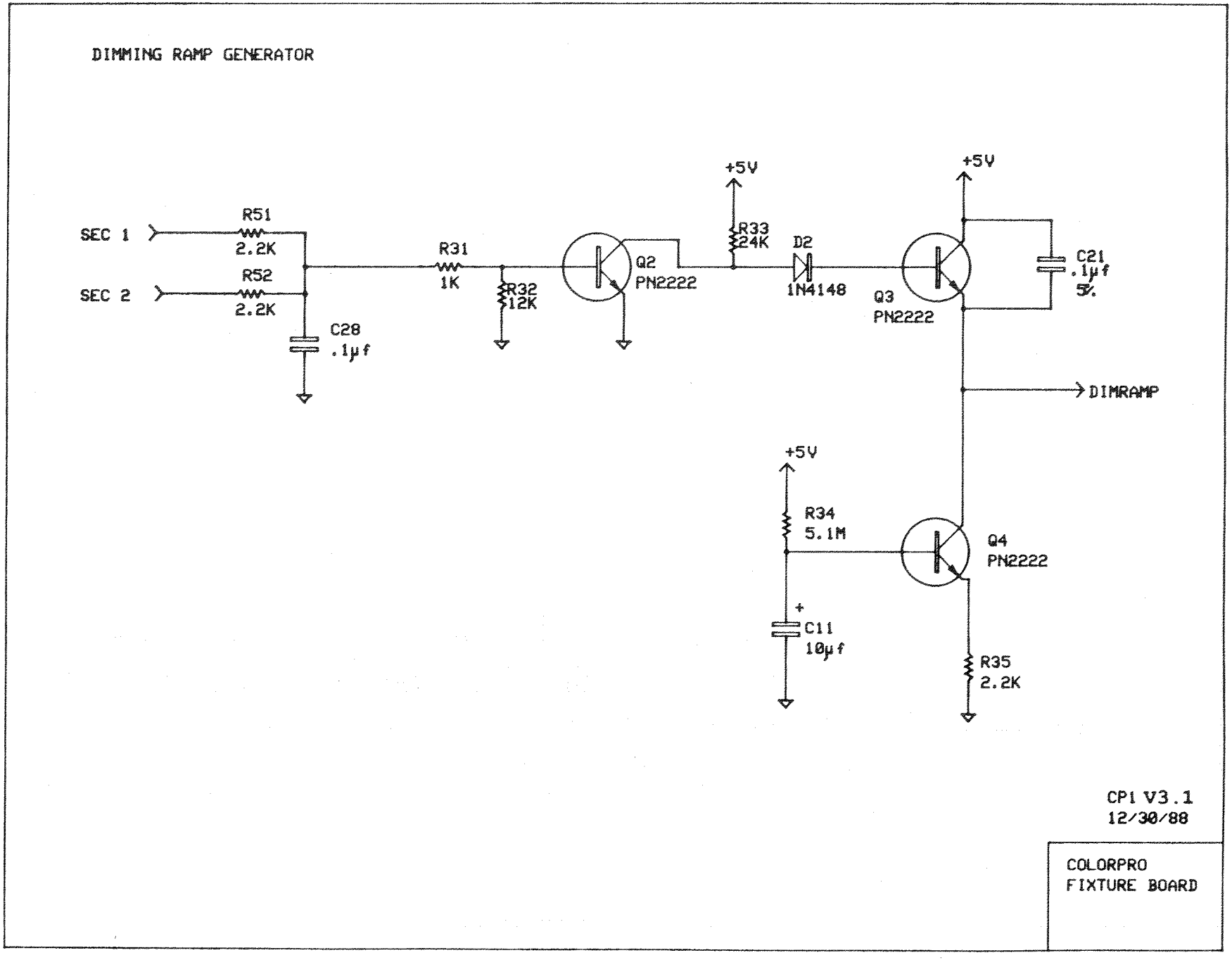


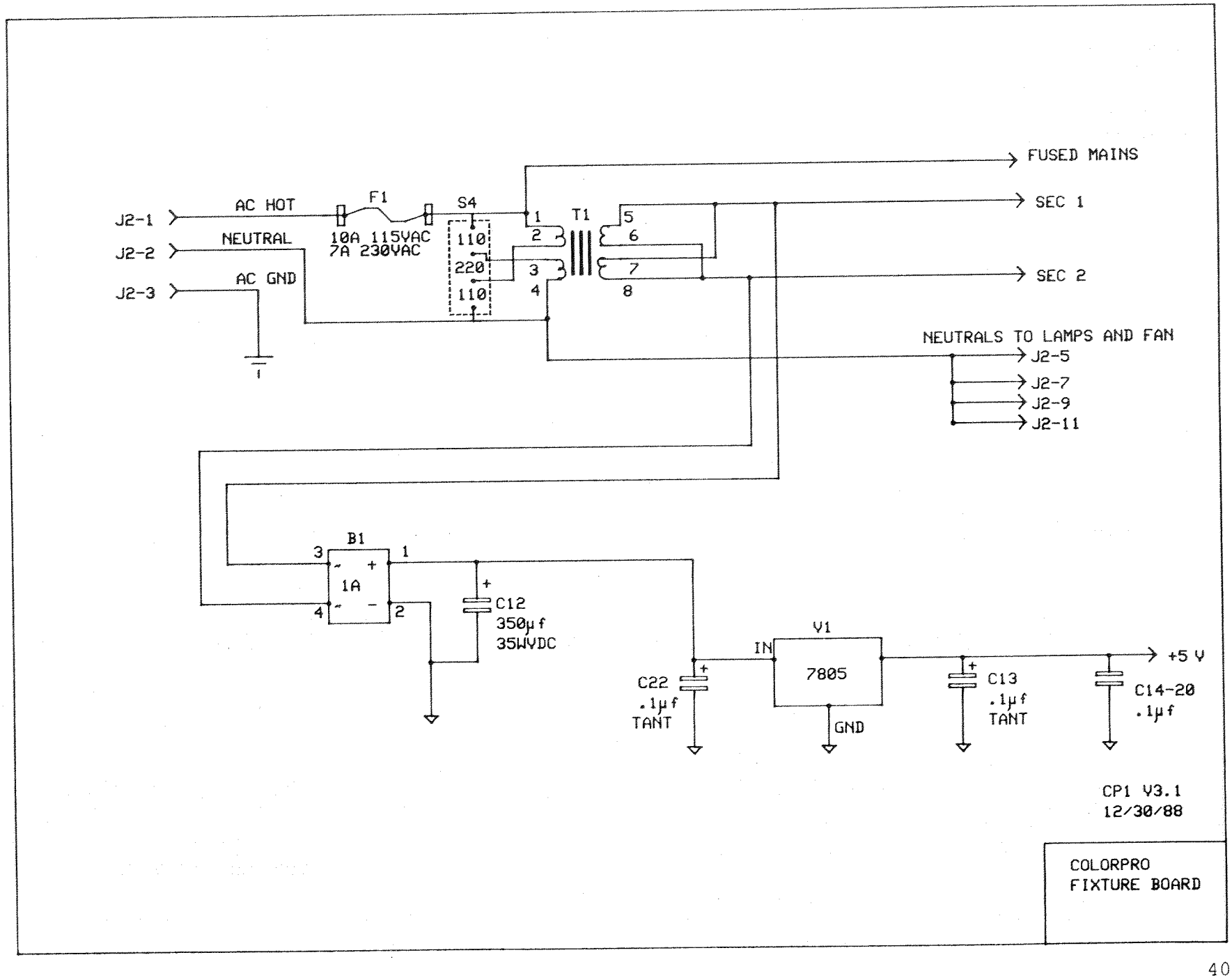
COLORPRO
FIXTURE BOARD
VER 3.1
1/23/90

LAMP ENABLE AND FAN TIMER



COLORPRO
FIXTURE BOARD
VER 3.1
2/21/90


DIMMING RAMP GENERATOR
SEC 1
SEC 2
R51
2.2K
R52
2.2K
C28
.1µf
R31
1K
R32
12K
Q2
PN2222
+5V
R33
24K
D2
1N4148
+5V
Q3
PN2222
C21
.1µf
5%
DIMRAMP
+5V
R34
5.1M
Q4
PN2222
+
C11
10µf
R35
2.2K
CP1 V3.1
12/30/88
COLORPRO
FIXTURE BOARD


FUSED MAINS
SEC 1
SEC 2
NEUTRALS TO LAMPS AND FAN
J2-5
J2-7
J2-9
J2-11
J2-1
J2-2
J2-3
AC HOT
NEUTRAL
AC GND
F1
10A 115VAC
7A 230VAC
S4
110
220
110
T1
B1
1A
C12
350µf
35WVDC
C22
.1µf
TANT
V1
IN
7805
GND
C13
.1µf
TANT
C14-20
.1µf
+5 V
CP1 V3.1
12/30/88
COLORPRO
FIXTURE BOARD