

PRICE: \$20.00

# CD80 RACK

---

## *OPERATOR'S REFERENCE*



Strand Lighting

Part #: 2-450061-010  
Document Revision: E1  
Date: 01/14/91  
Author: D. Lammers

Information contained in this document is disclosed in confidence and may not be duplicated in full or in part by any person without prior written approval of Strand Lighting. It's sole purpose is to provide the user with adequately detailed documentation so as to efficiently install, operate, maintain, and order spare parts for the system supplied. The use of this document for all other purposes is specifically prohibited.

The material in this manual is for information purposes and is subject to change without notice. Strand Lighting assumes no responsibility for any errors or omissions which may appear in this manual.

Comments and suggestions for corrections and/or updates to this manual are appreciated and will be considered for the next printing if forwarded in writing (red-lined photocopy preferred) to the Documentation Manager or Applications Engineering Manager at the West Coast facility of Strand Lighting North America.

Copyright Strand Lighting 1985, 1991. All rights reserved.

**West Coast Office (All Services):**

18111 South Santa Fe Ave. Rancho Dominguez, CA 90221	(213) 637-7500
---	----------------

**East Coast Office (Field Service, Sales):**

20 Bushes Lane Elmwood Park, NJ 07407	(201) 791-7000
--	----------------

**Canadian Office (All Services):**

6490 Viscount Road Mississauga, Ontario L4V 1H3 Canada	(416) 677-7130
--	----------------

# TABLE OF CONTENTS

---

*CD80 Rack Operator's Reference*

## INTRODUCTION

---

This section provides information on manual organization. It also details procedures for getting your suggestions to Strand Lighting, and receiving help if necessary.

1. ABOUT THIS MANUAL .....	3
2. TECHNICAL ASSISTANCE .....	5
2.1 In Case Of Problems .....	5
2.2 Technical Questions .....	5
2.3 Parts Purchases .....	5
2.4 Comments and Suggestions .....	5

## SYSTEM INFORMATION

---

This section provides specifications and component layout information for the CD80 Rack.

3. MECHANICAL SPECIFICATION .....	9
4. ELECTRONIC SPECIFICATION .....	13
4.1 Fan Housing .....	13
4.2 Support Electronics .....	14
5. DIMMER MODULE SPECIFICATION .....	21

# **OPERATION**

---

This section provides information on installation and operation, including external accessories available for CD80 Dimmer Racks.

<b>6. INSTALLATION .....</b>	<b>27</b>
6.1 Plan Conduit Layout .....	27
6.2 Install Dimmer Racks .....	28
6.3 Connect Power Wiring .....	28
6.4 Connect Control Wiring .....	28
6.5 Install Fan Housing .....	29
6.6 Install Dimmers .....	29
 <b>7. SYSTEM CALIBRATION .....</b>	 <b>35</b>
7.1 Ramp Card Calibration .....	35
7.2 Power Supply Card Calibration .....	35
 <b>8. CD80 CHANNEL TEST CHASSIS .....</b>	 <b>39</b>
8.1 Description .....	39
8.2 Operation .....	40
 <b>9. EMERGENCY BACKUP CONTROLLER .....</b>	 <b>41</b>
9.1 Description .....	41
9.2 Operation .....	42



# **MAINTENANCE**

This section provides basic trouble-shooting procedures to follow if you should have any problems with the equipment. It also provides a list of steps and equipment for periodic maintenance.

<b>10. BASIC TROUBLE-SHOOTING .....</b>	<b>45</b>
10.1 Problems Affecting Entire Rack Or Major Portion .....	46
10.2 Dimmer Problems Common To A Single Ramp Card .....	49
10.3 Dimmer Problems Not Related by Phase Or A Common Ramp Card .....	50
 <b>11. PERIODIC MAINTENANCE .....</b>	 <b>53</b>

# **APPENDICES**

<b>A. SPARE PARTS .....</b>	<b>55</b>
-----------------------------	-----------

# REFERENCES

---

## LIST OF FIGURES

1.	Typical CD80 Dimmer Bank .....	11
2.	Basic Support Electronics .....	17
3.	Multiplex Transfer Module .....	18
4.	CD80 Houselight Module .....	19
5.	Dimmer Module - 20A .....	23
6.	Dimmer Module - 50A & 100A .....	24
7.	XLR To mini-SwitchCraft Adapter .....	29
8.	CD80 Rack Assembly - Single Rack Version .....	30
9.	CD80 Rack Assembly - Multiple Rack Version .....	31
10.	Multiplex Control Signal .....	32
11.	Fan Housing Installation .....	33
12.	Final Rack Assembly .....	34
11a.	CD80 Dimmer Output Curves .....	37
13.	Channel Test Chassis .....	39
14.	Emergency Backup Controller .....	41
15.	CD80 Rack Parts Pictorial .....	58
16.	CD80 Rack Rear Panel Parts .....	59
17.	Solid State Relay Replacement Guide .....	61

INDEX .....	63
-------------	----

# **INTRODUCTION**

---

*CD80 Rack Operator's Reference*

This section provides information on manual organization. It also details procedures for getting your suggestions to Strand Lighting, and receiving help if necessary.



## ***1. ABOUT THIS MANUAL***

---

This manual provides information on the operating and basic maintenance procedures for CD80 Dimmer Racks. Test and repair information is included in the CD80 Rack REpair Procedures Manual

This manual contains 5 major sections as shown below.

### **INTRODUCTION**

Manual organization (chapter 1)  
How to get help (chapter 2)

### **SYSTEM INFORMATION**

Mechanical Specifications (chapter 3)  
Electronic Specifications (chapter 4)  
Dimmer Specifications (chapter 5)

### **OPERATION**

Installation (chapter 6)  
Field Adjustments (chapter 7)  
Channel Test Chassis (chapter 8)  
Hand Held Emergency Backup (chapter 9)

### **MAINTENANCE**

Basic trouble-shooting procedures (chapter 10)  
Periodic maintenance procedures (chapter 11)

### **APPENDICES**

Appendix A



## **2. *TECHNICAL ASSISTANCE***

---

CD80 Dimmer Racks, Fan Housings, and Dimmer Modules are designed to require a minimum of maintenance and servicing. Circuit descriptions are included in this manual for those who have a Test Fixture and wish to do their own repair and maintenance work on printed circuit boards. Repair of Dimmer Modules can be accomplished without special tools. Use the CD80 Maintenance Print Set (Part #8-700006-000) with this manual for best results. Other documentation may be purchased through Strand Lighting Customer Service.

### **2.1 *In Case Of Problems***

If equipment fails to operate properly upon installation, or under normal load and temperature conditions, and basic trouble-shooting procedures are not effective, please contact Strand Lighting Field Service at the office serving your area. Strand Lighting will issue an RGA (Return Goods Authorization) before the return of any defective materials. This allows tracking of returned equipment, and speeds its return to you.

### **2.2 *Technical Questions***

For technical questions regarding setup, operation, or maintenance of this equipment, please contact the Strand Lighting Field Service office serving your area (see reverse side of manual title sheet for addresses and phone numbers).

### **2.3 *Parts Purchases***

For purchase of spare parts or documentation, Please contact Strand Lighting Customer Service in the Rancho Dominguez office.

### **2.4 *Comments and Suggestions***

For comments regarding equipment functions and/or suggested enhancements, please call or write to the Control and Dimming Product Manager at the Rancho Dominguez office.

For comments on this manual, please write to the Documentation Manager at the Rancho Dominguez office.





# **SYSTEM INFORMATION**

---

## *CD80 Rack Operator's Reference*

This section provides specifications and component layout information for the CD80 Rack.



### 3. *MECHANICAL SPECIFICATION*

---

The CD80 Dimmer Bank is a free standing factory assembly of dimmer rack(s) (see drawing) constructed of 3/16" (5mm) steel angle top and bottom frames, 14 gauge roll formed posts and a 0.125" (3mm) aluminum back panel. It may also contain one or more power cubicles for auxiliary wiring (not shown).

Each dimmer rack includes removable dimmer trays, fan module, top and bottom vent grills, and a hinged latching front door. Rack components are designed for easy removal and installation so that the dimmer bank is completely open and empty during contractor's wiring.

Each dimmer rack has provisions for up to 48 plug-in Dimmer Modules, each containing two 20A dimmers, one 50A dimmer, or one 100A dimmer. Dimmer racks containing 100A dimmers are limited to 24 100A dimmers (due to cooling constraints), which are usually placed in the bottom half of the rack. CD80 "Half-racks" are the same dimensions as full racks but with only one half of the dimmer receptacles and wiring. Half racks are available as either a "top half" rack, or a "bottom half" rack. This allows two CD80 Racks side by side to provide the equivalent of a full rack of 100A dimmers.

Guides in the dimmer trays allow easy insertion and withdrawal of Dimmer Modules. A tapered housing on the rack and Dimmer Module connectors assures positive alignment of the module and protects the connector pins from insertion damage. All power and signal connections are factory wired. All contractor load connections are made directly to the appropriate dimmer receptacles. Adequate space is provided for contractor wiring alongside factory installed wiring. A tubular screw termination point (maximum wire size - #6) is provided for each contractor load and neutral wire. An adapter lug for #4 through #1/0 AWG is provided when required. Terminals are also provided for the multiplexed signal wires, overtemp wires and auxiliary wires as defined by the contracted installation requirements.

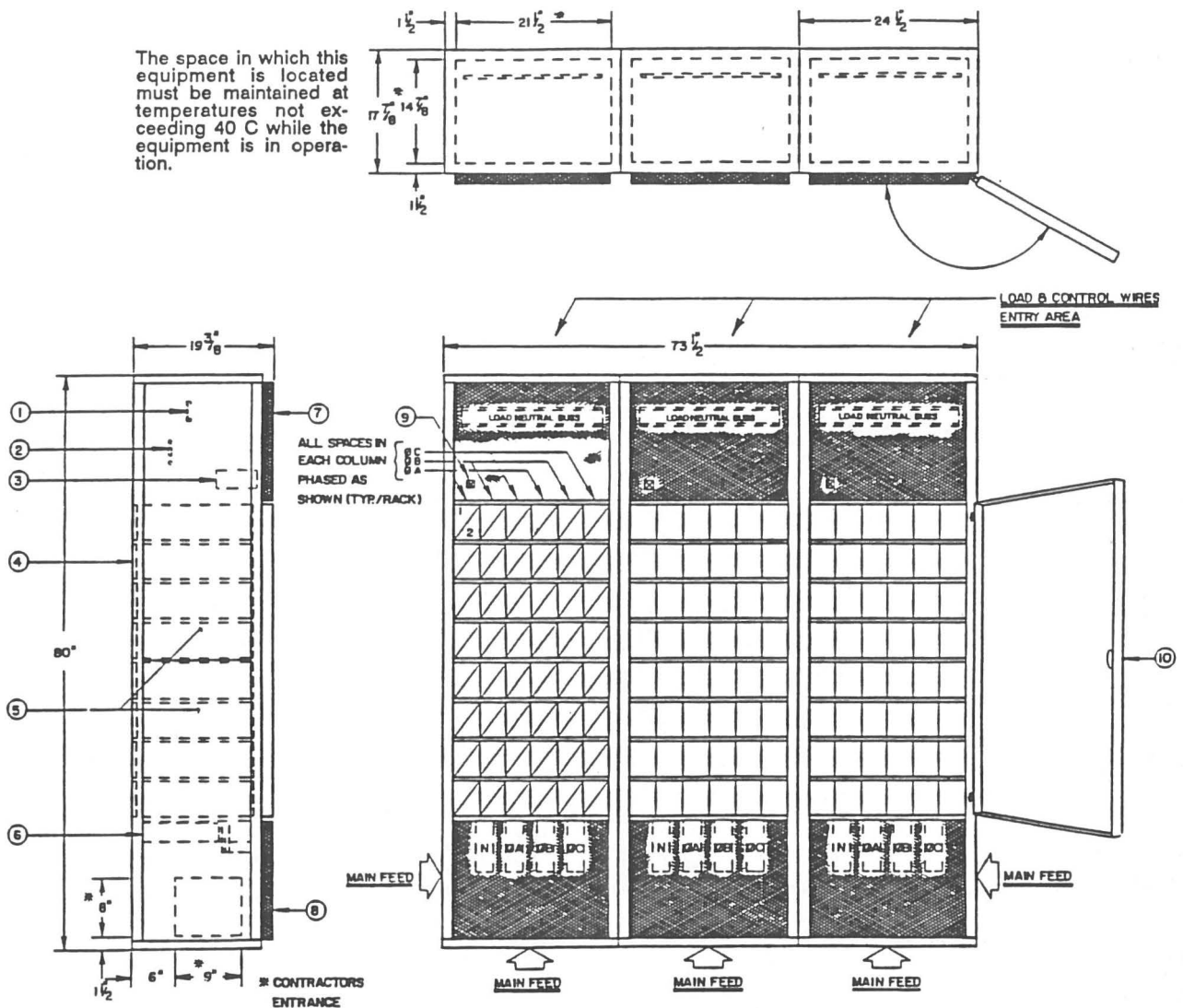
Two 10" fans (545CFM or greater) in the base of the rack maintain the temperature of all components at proper operating levels with all dimmers under full load as long as ambient room temperature does not exceed 40°C. An automatic fan shut off, activated when the control console is turned off, is provided to extend fan life.

Each rack has an overtemperature thermostat and indicator which shows when rack temperature exceeds 131°F (55°C). A separate shutdown circuit turns the rack OFF if rack temperature exceeds 149°F (65°C).

All terminals are clearly marked and all connectors and wiring are accessible from the front of the rack.



The space in which this equipment is located must be maintained at temperatures not exceeding 40 C while the equipment is in operation.



#### ITEMS:

- |  |  |                         |
|--|--|-------------------------|
| 1 Load neutral bus                                 | 7 Removable air outlet vent (typ/rack)                                   | 6.0Kw wired space       |
| 2 Control terminals and thermal sensors (typ/rack) | 8 Removable air inlet vent (typ/rack)                                    | 2.4Kw wired space       |
| 3 OverTemp assembly (typ/rack)                     | 9 OverTemp pilot light (typ/rack)  | Blank module over space |
| 4 (96) dimmer load terminals (typ/rack)            | 10 Removable/lockable hinged doors w/ circuit schedule holder (typ/rack) |                         |
| 5 Removable side panels                            |  |                         |
| 6 Fan Housing (typ/rack)                           |  |                         |

Figure 1. Typical CD80 Dimmer Bank



## **4. *ELECTRONIC SPECIFICATION***

---

### **4.1 *Fan Housing***

A removable Fan Housing at the bottom of the CD80 Rack contains 6-12 Ramp/Demultiplexing cards (usually called "Ramp Cards") and 3 Power Supply Cards. This circuitry converts the incoming control signal to appropriate signals for Dimmer Module power control.

A "full rack" Fan Housing contains 12 Ramp Cards. A "top half rack" Fan Housing contains 6 Ramp Cards (#1 - #6). A "bottom half rack" Fan Housing contains 8 Ramp Cards (#1 & #2 for signal sensing and fan turn-on, and #7 - #12 for dimmer control). Fan housings with "split" control (different portions of the rack are controlled by different control consoles) are also available. These are custom units and are not discussed in this manual.

#### **A. *Ramp Card***

Ramp Cards provide control signal demultiplexing and analog to pulse width conversion.

Up to 192 dimmer levels are time multiplexed on the ANA (analog) line of the control cable (control terminal 4). Levels vary from 0-5VDC, representing dimmer output levels of 0-100%. A differential clock on the CLK- (minus clock) and CLK+ (plus clock) lines (control terminals 1 and 3) synchronizes the dimmer rack with the control console. The multiplexing scheme conforms to the USITT AMX192 Dimmer Signal Specification. 6KW and 12KW dimmers require 2 clock cycles or dimmer positions.

Each Ramp Card contains the following circuitry:

- 1) clock receiver and reset detector
- 2) counter/decoder circuit
- 3) analog buffer
- 4) analog demultiplexer
- 5) A.C. zero crossover detector
- 6) square law curve generator
- 7) output solid state relay driver
- 8) power supply

**B. Power Supply Card**

Power Supply Cards condition AC power from the three power phases, and supply AC line reference sources for the Ramp Cards.

Each Power Supply Card also has an SSR for fan power (used only in the phase A and phase B cards), which is energized from the Ramp Card when system clock signals are present. A fuse on the Power Supply Card provides overload and short circuit protection for this SSR.

## **4.2 Support Electronics**

Rack Support Electronics consists of basic support provided in all racks, plus an optional Multiplex Transfer Module and CD80 Houselight Control Module.

**A. Basic Support Electronics**

Basic Support Electronics(see page 17 ) is 3 fuses for protection of the Fan Housing and other electrical components, a 24 volt transformer to provide overtemperature indicator and relay coil voltage, an overtemperature indicator light, a thermal shutdown relay, and two thermostats. One thermostat (right hand unit looking into the dimmer rack) provides overtemperature warning to consoles so equipped, and lights the overtemperature indicator in the rack. The other thermostat (left hand unit looking into the dimmer rack) operates the overtemperature relay and turns power to the Fan Housing OFF.

**B. Multiplex Transfer Module (optional)**

A Multiplex Transfer Module (see page 18 ) allows take control between two separate multiplex control signals feeding into the CD80 Dimmer Rack. Without take control, all but the active console must be unplugged, so that the dimmer rack "sees" only one multiplex control signal.

**C. CD80 Houselight Module (optional)**

A Houselight Control Module (see page 19 ) may be mounted in the upper right side of the rack, opposite the Overtemp/Shutdown Bracket. This unit controls either 6 channels into 6 dimmer slots (for 6KW or 12KW dimmers) or 6 channels into 3 dimmer slots (for 2.4KW dimmers). 12 2.4KW dimmers may be run (in the "6 channels into 6 dimmer slots" mode) from the Houselight Module as long as each 2.4KW dimmer pair is on the same control channel.



Selection of the dimmer row to be controlled is via jumper on the board, and is preset at the factory. Row #1 cannot be selected due to timing constraints. If the "3 dimmer slot" configuration is selected, the last 3 dimmer slots in the selected row are controlled. The first three slots in a row can only be addressed using the "6 dimmer slot" mode of control. Two Houselight Modules can be linked, providing control over two rows of dimmers or two sets of 3 slots each (last 3 slots of each selected row).

Control is via analog potentiometer, and take control for 3 separate stations is provided. When all stations are OFF, control of the selected dimmers reverts to the stage lighting control console. If 2.4KW dimmers are being used in the 6 dimmer slot mode of this module (i.e., each pair is a single channel), special patching may be required in the stage lighting control console, depending on which Strand Lighting console is used, and which version of software is installed. 2 of the 3 houselight control stations may be locked out via an optional switch.

**D. Status Quo Memory (optional)**

Status Quo Memory maintains dimmer output if the control signal to the dimmer rack is either turned OFF or lost in some other manner. Dimmer output is maintained at the last levels before signal was removed, and is maintained for a specified period of time.



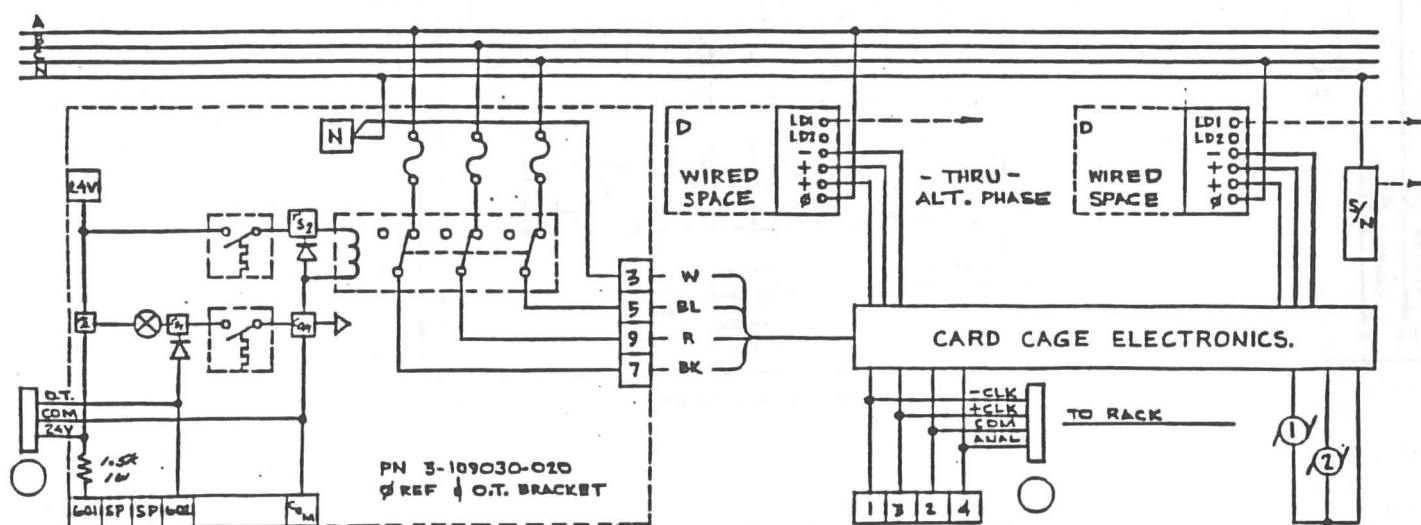
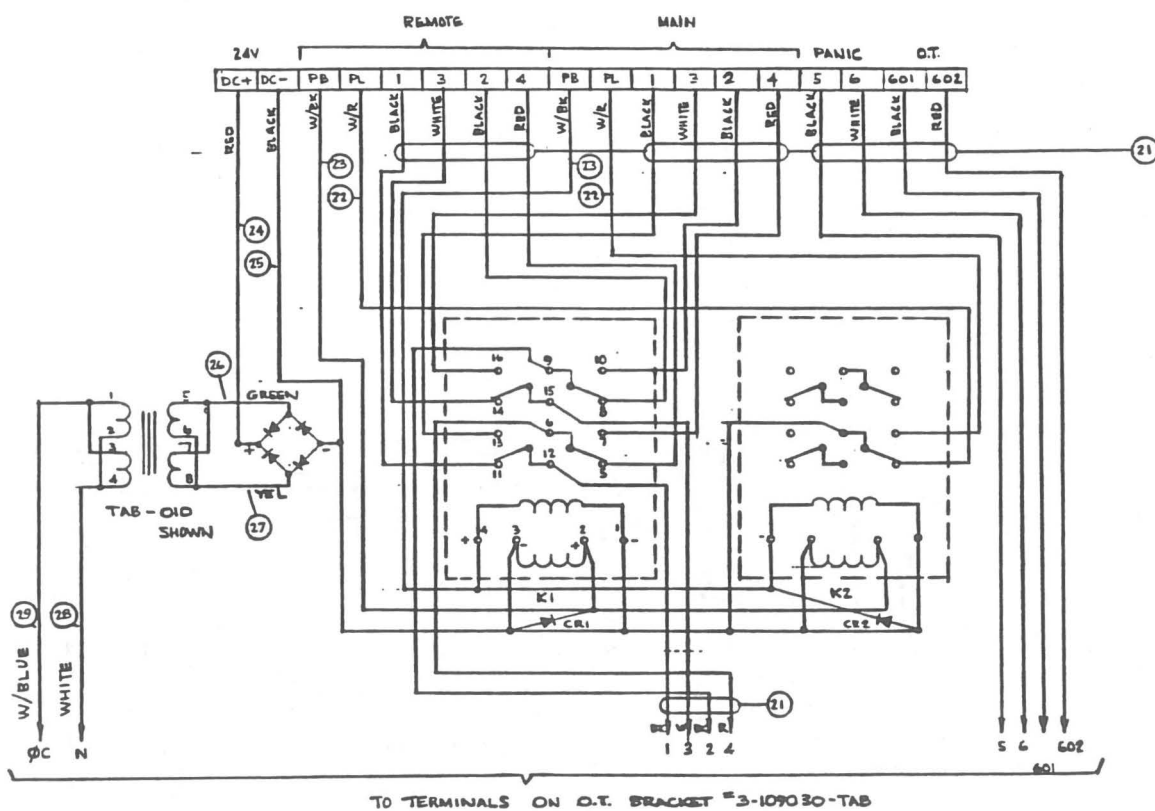


Figure 2. Basic Support Electronics



TAB	VOLTAGE	TRANSFORMER
- OIO	100/120V	AS SHOWN (PINS 1TD3, 2TO4)
- O20	220/240V	JUMPER PINE 2 TD3

Figure 3. Multiplex Transfer Module

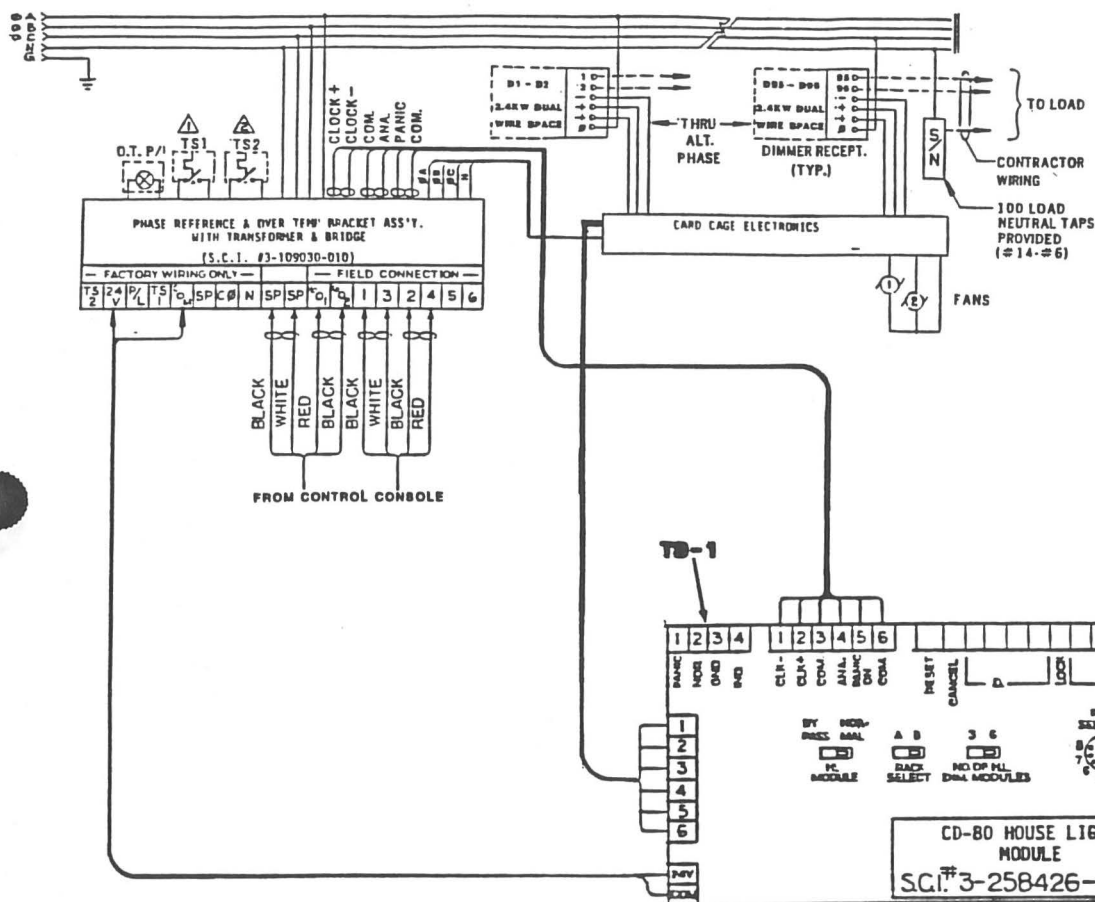


Figure 4. CD80 Houselight Module



## **5. *DIMMER MODULE SPECIFICATION***

---

Dimmer Modules are the high power switching section of the CD80 dimming system. The Solid State Relay (SSR) in this module is the interface between high power A.C. and low power control signal (card cage/fan housing), since it is driven by low level signals (10mA, 3-24V) and switches high level signals (up to 100A, 120/220VAC).

Dimmer Modules are factory wired plug-in units which slide into the dimmer rack. Components are enclosed by a 0.125" (3mm) formed aluminum chassis. Power and signal pins are oversized and recessed in a self-aligning plastic housing to avoid damage. A contoured handle allows easy insertion and withdrawal.

Dimmer Modules of the same capacity are interchangeable. Connectors and receptacles of different capacity modules are polarized so that they cannot be interchanged. 20A Dimmer Modules, however, can be plugged into 50A or 100A slots, since all wiring is still properly protected. Only the left-hand 20A dimmer in the module will function.

Each dimmer, with circuitry in the Fan Housing (card cage), regulates output voltage with changes in the AC line from 108 to 130 volts RMS (120VAC Dimmer Modules - 100VAC and 220VAC models are also available).

Dimmers will maintain output RMS voltage within  $\pm 2\%$  with changes in load from 10 watts to full rated load at any point on the dimming curve.

The output RMS voltage versus Control Console setting follows the "square law dimming curve."

The power efficiency of the dimmer is a minimum of 95% at full load.

The major components of the power switching section are the SSR or SCR block, inductor, load, circuit breaker, and interconnection wiring. In 100A dimmers, 50A dimmers with SCR blocks (instead of SSRs), and nondims, an additional circuit board is attached to the SSR or SCR block.

For locations where noise levels are critical, CD80/8 Dimmer Modules (2.4Kw and 6.0Kw only) provide reduced dimmer noise through the use of high performance chokes. Nominal rise time for 2.4Kw dimmers using these chokes is greater than 800 microseconds.

Dimmer modules are available in the following configurations for 120VAC. Consult Strand Lighting for 100VAC and 220VAC applications.

**CD80 & CD80/8**

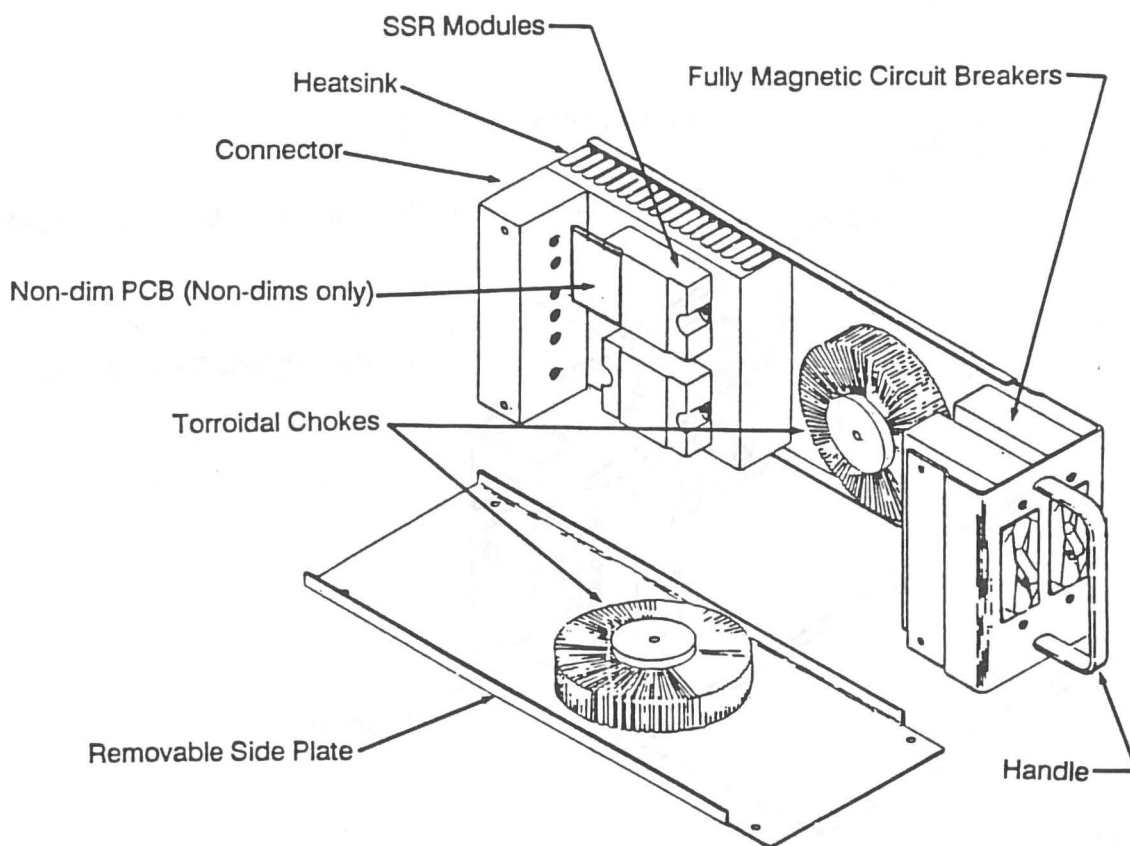
Dual 2.4Kw	Dimmer/Dimmer
	Dimmer/Non-Dim
	Non-Dim/Dimmer
	Non-Dim/Non-Dim
	Selectable/Selectable *
Single 6.0Kw	Dimmer
	Non-Dim
	Selectable *

**CD80 only**

Single 12.0Kw	Dimmer
	Non-Dim
	Selectable *

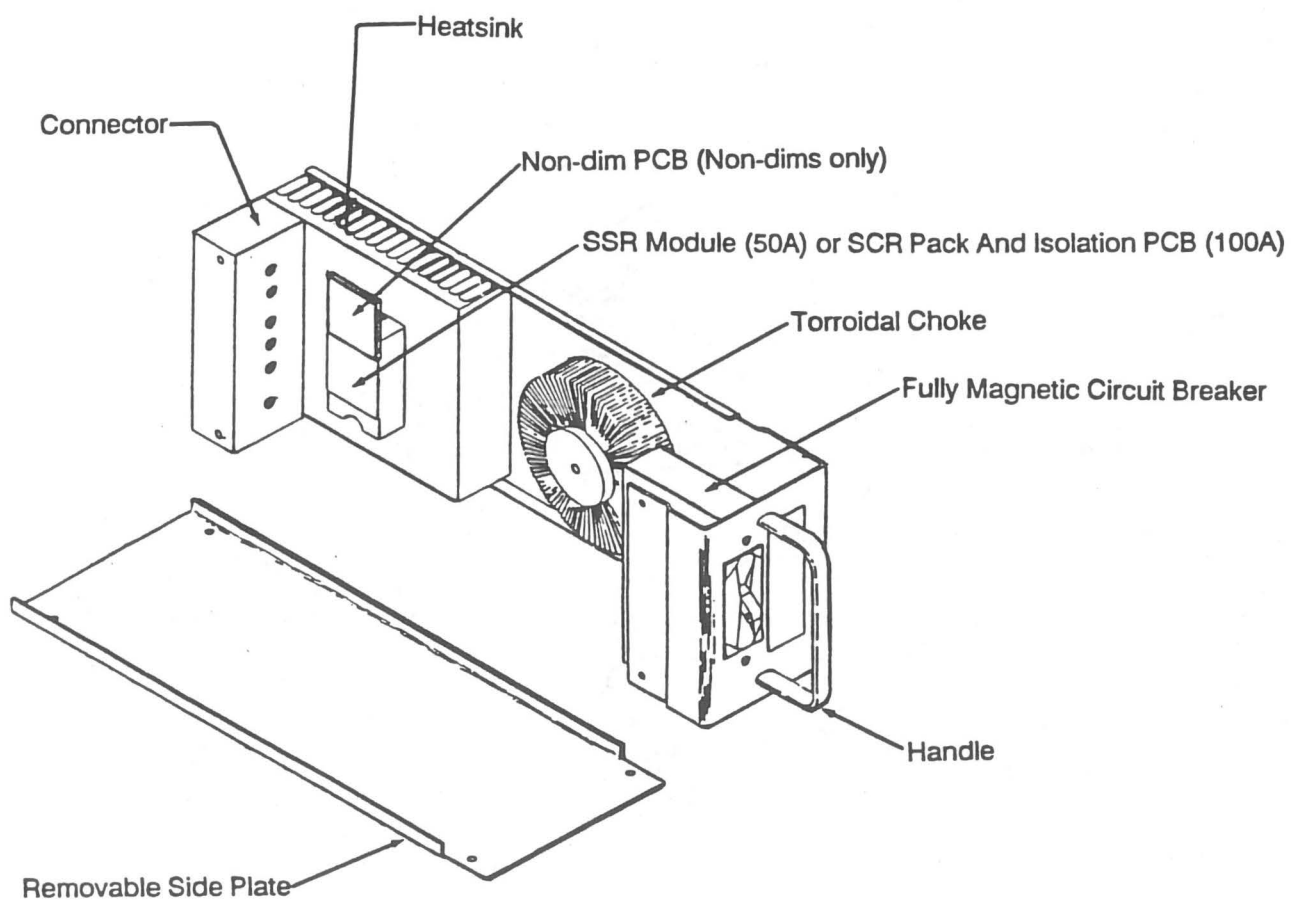
- \* Selectable units are switched at the dimmer module. On dual selectable units, each dimmer can be separately selected.





Consult Strand Lighting for available models and part numbers of Dimmer Modules, and for UL/CSA status of required models.

**Figure 5. Dimmer Module - 20A**



Consult Strand Lighting for available models and part numbers of Dimmer Modules, and for UL/CSA status of required models.

**Figure 6. Dimmer Module - 50A & 100A**

# **OPERATION**

---

## *CD80 Rack Operator's Reference*

This section provides information on installation and operation, including external accessories available for CD80 Dimmer Racks.



## **6. *INSTALLATION***

---

Installation of the CD80 Rack involves the following main steps:

- 1) Plan conduit layout.
- 2) Install Dimmer Racks
- 3) Connect power wiring.
- 4) Connect control wiring.
- 5) Install Fan Housing.
- 6) Install Dimmer Modules.

### **6.1 *Plan Conduit Layout***

The location of conduit runs and their entrance to the dimmer cabinet is important and should be carefully planned before cutting holes or attaching conduit.

**DO NOT run power feed or load wires in same conduit or wireway as control wiring.**

**DO NOT run wiring from other manufacturers equipment, or from unrelated Strand Lighting equipment in same conduit with CD80 wiring.**

**DO NOT enter control wires from dimmer rack locations marked for load or power wires, and vice versa.** These locations are chosen to minimize electrical interference between various sections of the system.

**DO NOT run wiring in ways other than shown on system riser diagram.** Electronic and computer controlled systems (including CD80) are designed to be installed in a specific manner.

**DO NOT substitute plastic conduit for metal** where conduit is called for. Metal conduit acts as a ground and shield.

**DO NOT substitute shielded wiring for any unshielded wiring specified, or for conduit.** Electronic characteristics of the wiring are affected and may cause problems with the control signals.

## 6.2 *Install Dimmer Racks*

- A. Unpack dimmer racks and remove all dimmer trays.
- B. Make sure that any conduit work which will be covered up is completed.
- C. Set racks in place as shown in system drawings.
- D. If racks were shipped in more than one piece, bolt rack sections together and connect control wiring between racks.
- E. Cut required conduit holes and install conduit.
- F. Vacuum out any metal chips resulting from making conduit holes.

## 6.3 *Connect Power Wiring*

- A. Connect system ground to ground lug provided.
- B. Connect power neutral and feed wires as shown in system drawings.
- C. Connect load neutrals to load neutral bus(es) at top(s) of dimmer rack(s), and load wires directly to the appropriate dimmer receptacle at the back of the dimmer rack(s).

## 6.4 *Connect Control Wiring*

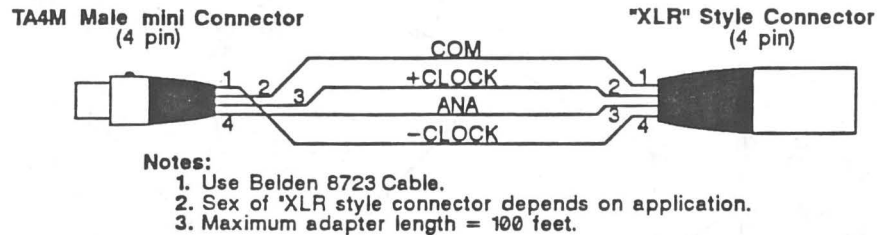
CD80 Dimmer Racks accept control signals conforming to the USITT AMX192 Dimmer Signal Specification.

Short extensions of the multiplex signal, where TA4/TY4 connectors are used, are made with Belden cable #8723 (2 pairs of shielded 24 gauge wire). All other runs (in or out of conduit) are made with Belden #9156 (2 pairs of unshielded 18 gauge wire). Maximum allowable distance from control console to last dimmer cabinet is 1000 feet.

The three types of connections provided in Strand Lighting equipment for the AMX192 signal are the XLR style connector, the TA4/TY4 Series Mini-SwitchCraft connector, and terminal blocks. Unless otherwise specified, CD80 Racks use terminal block connections. Pin assignments are shown below.

Function	XLR Pin #	TA4/TY4 Pin #	CD80 Term. Block Pin #
- CLOCK	4	1	1
+ CLOCK	2	3	3
COMMON	1	2	2
ANALOG	3	4	4

Interconnection between equipment with different plug types requires an adapter cable. **The plugs on this adapter are not connected pin to pin.** See figure below for proper adapter wiring.



**Figure 7. XLR To mini-SwitchCraft Adapter**

### **6.5 *Install Fan Housing***

Install Fan Housing as shown on page 33 and 34. If a field turn-on by Strand Lighting personnel is scheduled, do not power up system at this time. Otherwise, do the following.

- A. Remove 3 fuses and 1 relay from bracket in upper right of CD80 Rack.
- B. At the incoming power feed busses, check between all 3 power phases and neutral, and between each phase combination, for short circuits. If there is a short circuit, find it and clear it before proceeding. Short circuits in the load wiring will not be caught at this point.
- C. Replace fuses and relay taken out at step A.
- D. Make sure that control console is OFF.
- E. Apply system power. Fans in Fan Housing should turn ON for a few seconds and then back OFF. If not, call Strand Lighting Field Service.

### **6.6 *Install Dimmers***

- A. Make sure that system power is OFF.
- B. Install dimmer support trays in rack.
- C. Install Dimmer Modules as shown in system drawings.
- D. Install blank modules provided in all blank spaces.

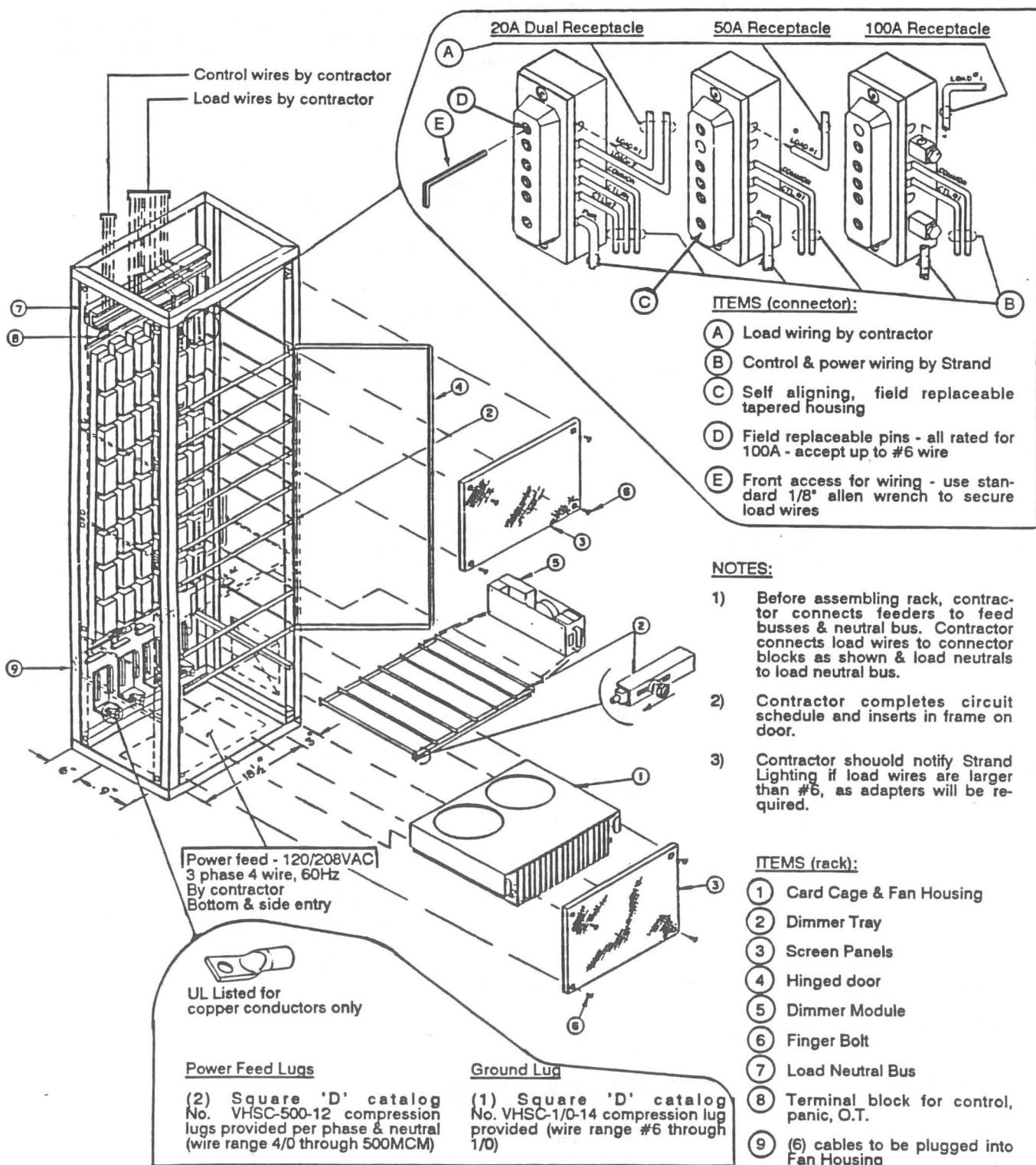
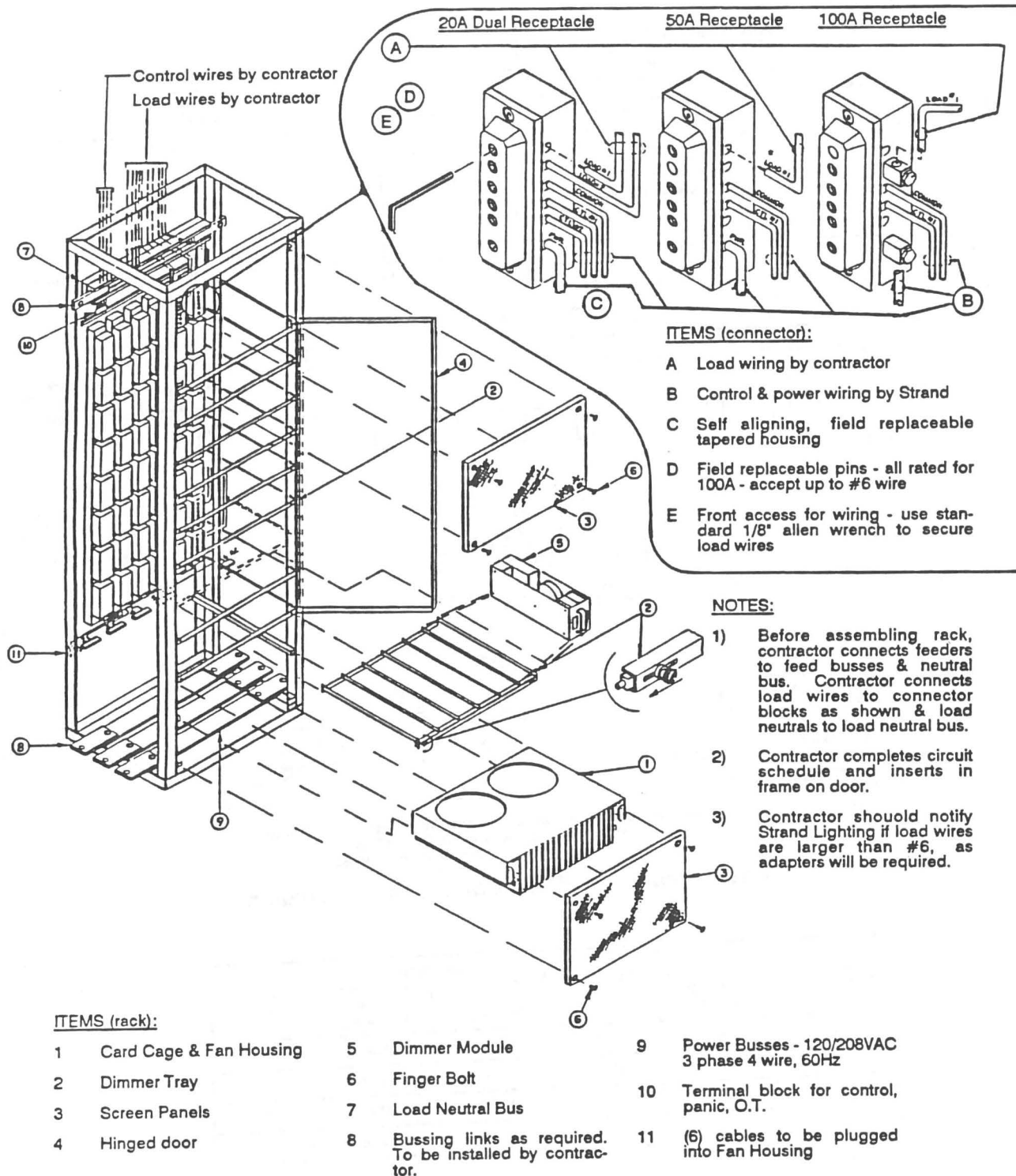


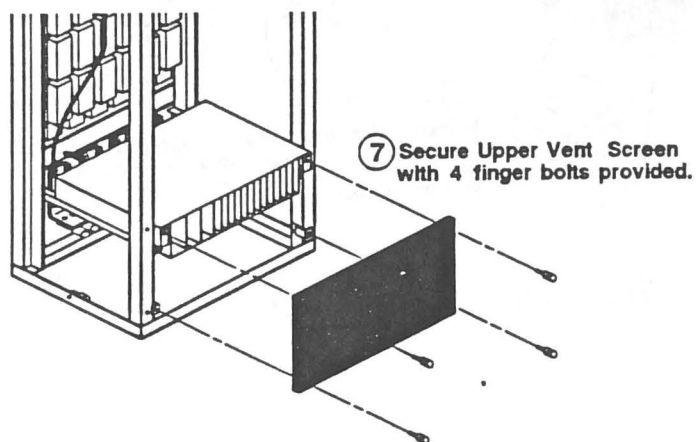
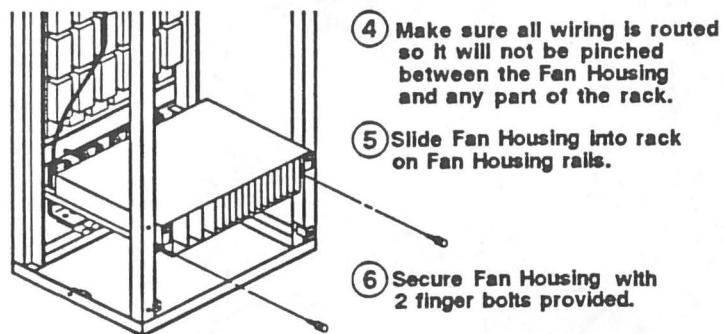
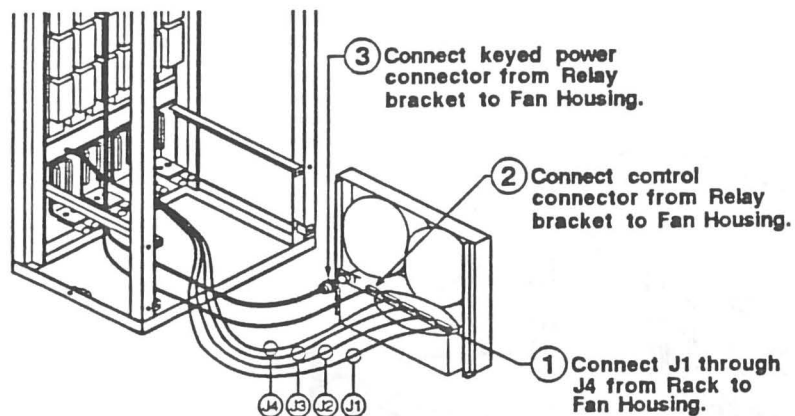
Figure 8. CD80 Rack Assembly - Single Rack Version



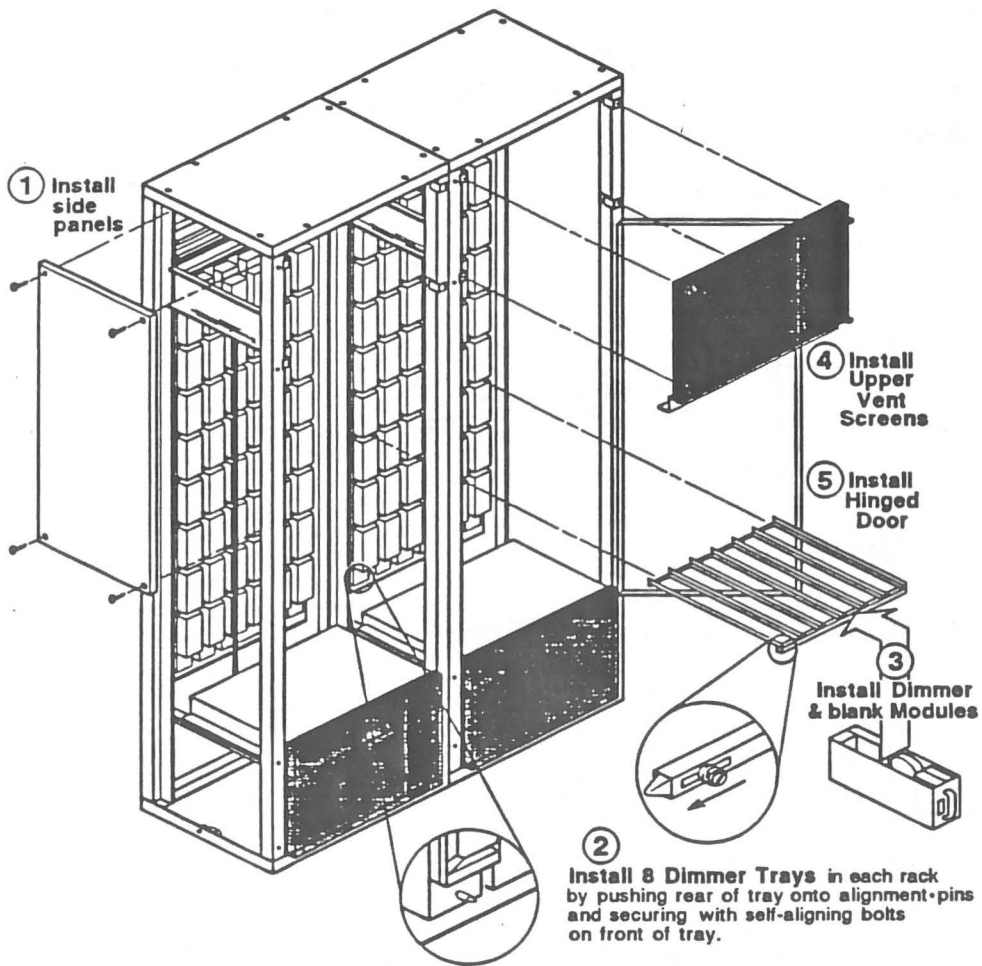


**Figure 9. CD80 Rack Assembly - Multiple Rack Version**





**Figure 11. Fan Housing Installation**



**Figure 11a. Final Rack Assembly**

## **7. SYSTEM CALIBRATION**

---

### **7.1 Ramp Card Calibration**

Calibration of the CD80 Rack Ramp Cards should be done with the CD80 Rack Test Fixture, and is discussed in the "CD80 Rack Ramp Card" chapter of this manual. Calibration is done in the factory prior to shipment of the CD80 Fan Housing, and should not be necessary in the field. All field adjustments relating to curve or to maximum output level should be accomplished with the Power Supply adjustment.

### **7.2 Power Supply Card Calibration**

CD80 Rack Ramp Cards require a specific reference voltage from the CD80 Rack Power Supply Card (measured between J3 and J2 on the Power Supply Card) to generate their 5 Volt reference ramp (5V "S" curve). The Power Supply is then used to make any required adjustments in dimmer output curve using a true RMS (AC+DC) meter. Adjustment is made with the Power Supply Card installed in a Test Fixture, or in a Fan Housing with all Ramp Cards installed.

60Hz systems require a 10.96VAC RMS reference and 50Hz systems require a 9.13VAC RMS reference from the Power Supply Card (VJ3-J2). Compensation for different line voltages, different number of Ramp Cards in the card cage, and different line frequencies is by adjusting the Power Supply, not the Ramp Card.

CD80 electronics virtually eliminates the need for on-site calibration. The "CD80 Dimmer Output" drawing (see page 37 ) shows typical output curves of CD80 dimmers when Power Supplies are calibrated to actual incoming line voltage, and the effects of line voltage shifts in a system calibrated for 120VAC. Once calibrated, the output is held to the ideal output curve for the calibrated voltage until it reaches incoming line voltage level, at which time it flattens out. Systems with greater than calibrated voltage as power line voltage will maintain a square law curve to the calibrated voltage. Systems with lower than calibrated voltage as incoming line voltage should be recalibrated in the field. Recalibration for this purpose is on the Power Supply Cards, not on the Ramp Cards.

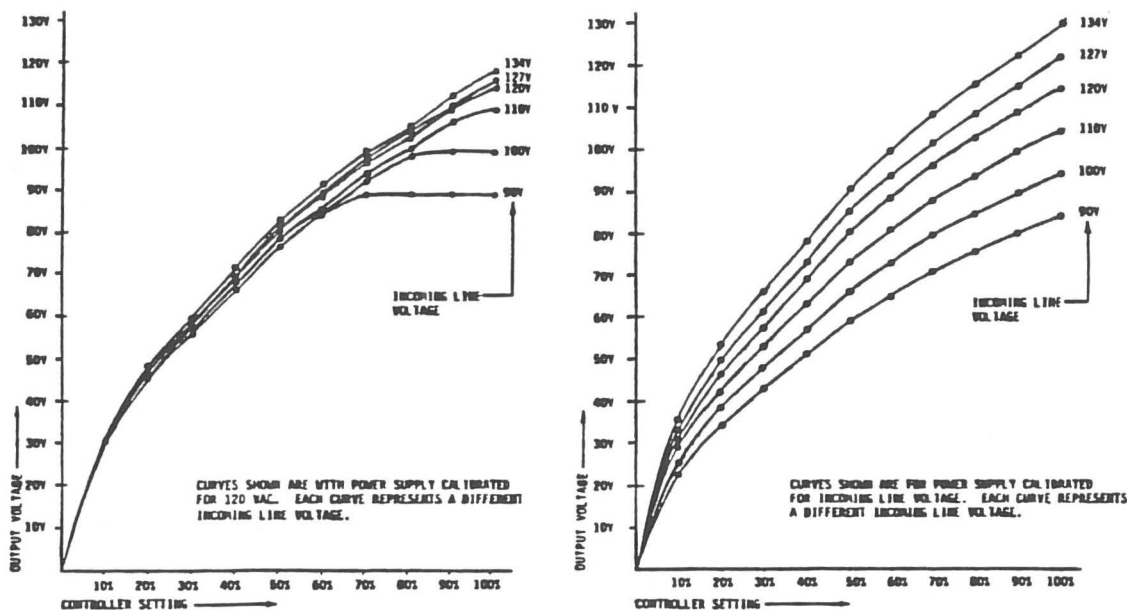
Where line voltages vary significantly from calibration voltage, a standard square law output can be obtained by adjusting the Power Supply reference voltage (VJ3-J2) to 10.96VAC RMS (for 60Hz systems) or 9.13VAC RMS (for 50Hz systems) on-site. This results in a square law output curve with a maximum output voltage about 3-5VAC below incoming line voltage. Though adjustment to boost output voltage slightly (or limit output to a specific level) is possible, it is not recommended, as it will change the output curve.



Control Setting	Linear Volts	Square Law Volts	Square Law Percent * Light Output
0	0	0.0	0.0
1	12	32.2	1.0
2	24	47.8	4.0
3	36	60.3	9.0
4	48	71.0	16.0
5	60	80.8	25.0
6	72	89.6	36.0
7	84	97.9	49.0
8	96	105.6	64.0
9	108	113.0	81.0
10	120	120.0	100.0

\*Ideal Incandescent Lamp

### Ideal Square Law Output



### CD80 Dimmer Output

Figure 12. CD80 Dimmer Output Curves





## 8. CD80 CHANNEL TEST CHASSIS

### 8.1 Description

This test module is provided with CD80 Rack dimming systems. It replaces a 20A, 50A, or 100A dimmer or non-dim chassis and verifies that the dimmer space is properly controlled by the control console. Indicating lights on the test module respond to signals from the control console.

The actual lighting load connected to the dimmer wiring space will not respond to console commands when the test chassis is in use.

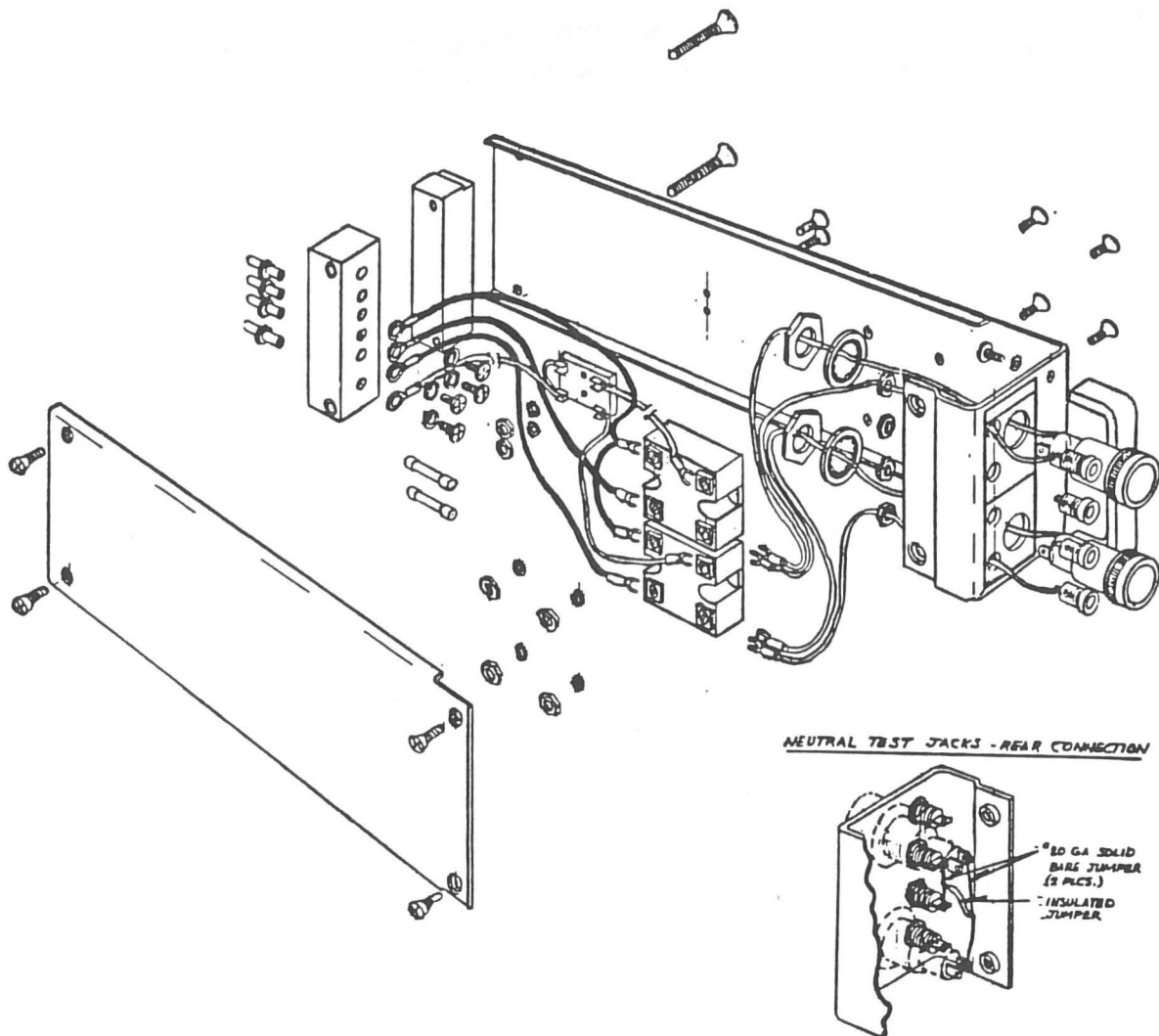


Figure 13. Channel Test Chassis

## 8.2 *Operation*

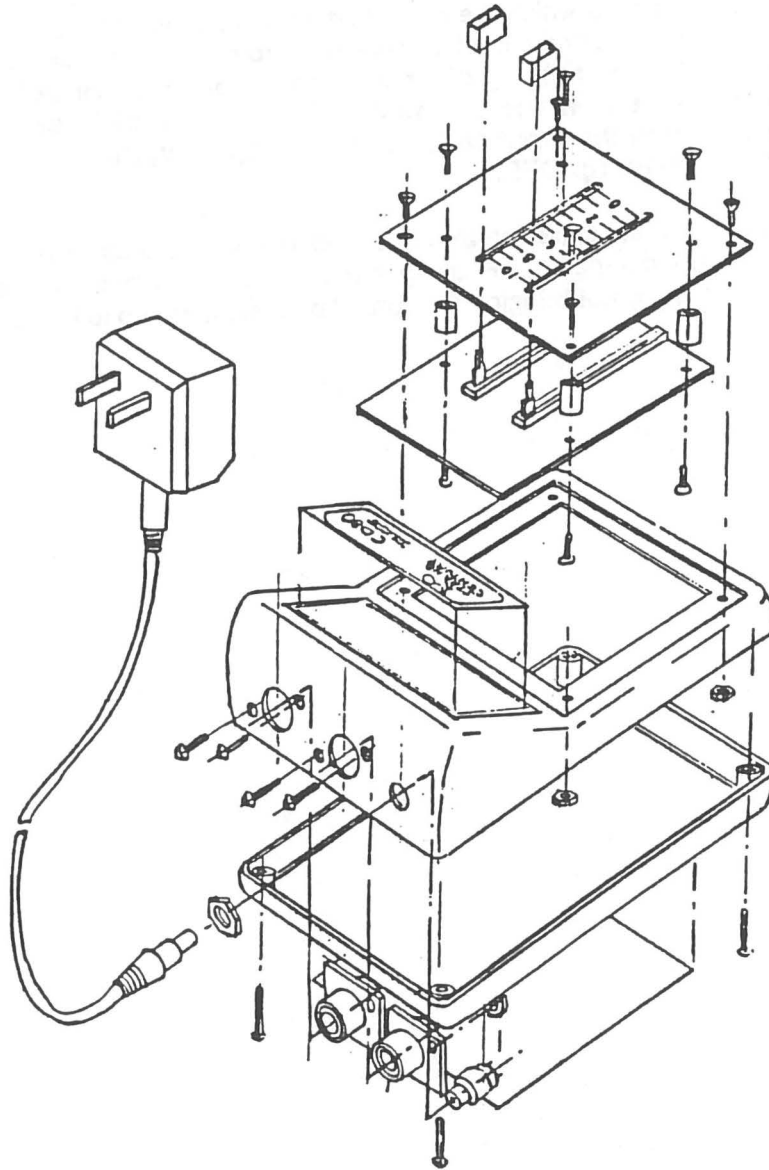
- A. Set control for channel under test to ZERO.
- B. Remove CD80 dimmer from slot in dimmer rack.
- C. Place tester in vacated slot and push all the way in.
- D. Connect test lead between white neutral jack on tester face plate and rack frame (ground).
- E. Operate console controls in normal manner and observe tester pilot lights. These should track console operations.
- F. An RMS iron vane volt meter or true RMS reading digital voltmeter may be connected to test jacks to monitor output voltages.

## 9. *EMERGENCY BACKUP CONTROLLER*

---

### 9.1 *Description*

The Hand Held Emergency Backup Controller (SL part #3-258425-010) provides emergency backup of CD80 Rack and CD80 Pack systems if the control console fails. It provides an analog signal and clock for two (2) multiplexed control lines, regardless of the number of dimmers on each line. This unit activates all dimmers on the selected multiplexed line(s) to a single level. The dimmer circuit breaker must be used to turn individual dimmers ON or OFF.



**Figure 14. Emergency Backup Controller**

## 9.2 *Operation*

- A. Plug power supply unit into controller and into 120VAC wall outlet. This wall outlet may be either 50 or 60 Hz.
- B. Unplug multiplex control cables from rear of control console, and plug them into the appropriate outlet on the Emergency Backup Controller. If only one output port on the control console is non-functional, the Emergency Backup Controller may be used to activate only dimmers from that output port, while the control console is used for all other dimmers.
- C. Activate dimmers which are controlled from each multiplexed output by setting the appropriate level potentiometer to the required dimmer level. **CAUTION: this sets all dimmers on the selected control line to the set level. If the connected load of the dimmer rack is greater than the input circuit breaker capacity, the input circuit breaker may trip OFF.**
- D. To prevent main circuit breaker overload, decrease the total system load by turning dimmers OFF using dimmer primary circuit breakers as switches, or by not bringing the control potentiometer up to FULL.

# **MAINTENANCE**

---

## *CD80 Rack Operator's Reference*

This section provides basic trouble-shooting procedures to follow if you should have any problems with the equipment. It also provides a list of steps and equipment for periodic maintenance. Circuit descriptions and detailed repair procedures are included in the CD80 Rack Repair Procedures Manual.



## 10. BASIC TROUBLE-SHOOTING

---

This chapter provides the user with basic trouble-shooting procedures for the CD80 Rack. It does not provide comprehensive maintenance data, but rather helps the user to solve simple problems and provide Strand Lighting with initial data when these procedures do not work.

For best operation, do a routine check and cleaning about once each year unless the operating environment is unusually harsh or dirty. Service and maintenance other than this cleaning are seldom required. In case of problems, and in order to save time and aggravation, follow the procedures outlined here before calling Strand Lighting. Observe what happens at each step. These steps represent the questions you will first be asked by Strand Lighting Service Representatives. The person actually doing the tests should contact Strand Lighting to minimize errors in translation and other misunderstandings.

In case of failures in the system, fault isolation is expedited by considering the system subject to the following categories of possible malfunctions:

- A. Major system malfunctions common either to all dimmers or to a single phase.
- B. Dimmer problems common to a single Ramp Card.
- C. Dimmer problems not related by phase or Ramp Card.

Establish fault location by interchanging Ramp Cards, Power Supply Cards, or Dimmer Modules as required. Correct the problem by card or module replacement. Always turn dimmer rack power OFF when removing or replacing a PCB from the Fan Housing. This is not necessary when removing and replacing Dimmer Modules.

Repair defective dimmers or non-dims (inability to produce maximum output, or instability) by field replacement of the solid state relay (SSR). To maximize SSR service life, use a heat transfer compound between the SSR and heat sink when replacing SSRs.

This chapter contains several sections describing possible failure modes and solutions. If all actions fail, please contact Strand Lighting Field Service.

The Ramp Card (P/N 3-722776-010) is not field repairable. If a Ramp Card fails, replace the unit with a spare (provided with system) and return it to the Strand Lighting. Use static electricity safeguards when handling Ramp Cards. **The dimmer rack must be powered down before removing or inserting Ramp Cards.** This can be done by turning off the mains power, or by using alligator clip leads to activate the thermal shutdown relay. The latter is accomplished by shorting out the 2 leads of the left hand button thermostat on the back wall of the CD80 Rack just above the top row of dimmers. **WARNING: Do not proceed beyond this point if fans do not shut off. Do not try to remove power from the Fan Housing by removing the power feed plug from under the Fan Housing. This plug is too close to power bussing to be safely unplugged while power is applied to the rack.**

A Ramp Card locator chart is provided inside the door of all CD80 Racks. Use this chart to locate the Ramp Card related to the faulty dimmer.

Other than simple replacement of fuses, the Power Supply Card (P/N 3-722777-010) is not a field repairable unit. In the event of a failure to produce the required AC and DC outputs, the card should be returned to factory for repair. One spare Power Supply Card is provided with each system sold.

The Ramp Card locator chart inside the door of the CD80 Rack can also be used to locate the Power Supply Card related to the faulty dimmer phase. The phasing for the Power Supply Cards are:

PS1 - Phase A  
PS2 - Phase B  
PS3 - Phase C

### ***10.1 Problems Affecting Entire Rack Or Major Portion***

Total or major part of system does not power up load circuits correctly. Failures will be by entire columns (phases) of dimmers. 2 columns fail per failed phase.

#### **A) ALL POWER SUPPLY INDICATORS OFF.**

##### POSSIBLE CAUSE

- 1) Main power feed off.

##### SOLUTION

Check main power feed.

##### POSSIBLE CAUSE

- 1) Dimmer rack has overheated and shut down.

##### SOLUTION

If overtemp light is on in addition to unit being shut down, let system cool down before attempting to use it again. Make certain that there are no obstructions which impede airflow, and that the dimmer rack fans are functional.

##### POSSIBLE CAUSE

- 2) Thermal shutdown circuit faulty. Thermal shutdown relay in rack is energized.

##### SOLUTION

Pull one lead off of thermal shutdown thermostat (left hand bottom thermostat). If relay does not de-energize, replace relay. Otherwise, replace thermostat.



**B) POWER SUPPLY INDICATORS ON, FANS OFF.**

POSSIBLE CAUSE

- 1) Control cable disconnected, or broken.

SOLUTION

Repair, connect, or replace control cable.

POSSIBLE CAUSE

- 2) Incorrect patch in console.

SOLUTION

Check console patch to make certain it is correct.

POSSIBLE CAUSE

- 3) Clock leads reversed.

SOLUTION

Reverse clock leads to CD80 Rack at control signal input terminal block (TB1).

**C) INDICATORS ON, FANS ON. ALL LIGHTS FLOAT TO FULL.**

POSSIBLE CAUSE

- 1) Analog line broken or no analog output from console.

SOLUTION

Try control cable for defective rack in a different console output. Remember that this changes the dimmer numbers, and repatching may be necessary, as well as resetting the number of dimmers. If problem persists, check analog line for breaks. Otherwise, problem is probably in console.

**D) INDICATORS ON. FANS ON. ALL LIGHTS OFF.**

POSSIBLE CAUSE

- 1) Analog line shorted or reversed.

SOLUTION

Repair or clear shorts on analog line, or replace defective control cable.

**E) ONE FAN ON. ONE OR MORE LEDS IN POWER SUPPLY OFF (32 OR MORE LOAD CIRCUITS OFF).**

POSSIBLE CAUSE

- 1) Problem in one or more incoming phase.

SOLUTION

Check incoming feed to assure all 3 phases are intact.

POSSIBLE CAUSE

- 2) Power supply(s) failure.

SOLUTION

Check and replace power supply fuses. Determine cause of fuse failure.

Swap suspect power supply(s) with known good units. If problem moves, replace bad power supply.

POSSIBLE CAUSE

- 3) Problem on motherboard.

SOLUTION

Check motherboard for open leads from connector 6 to terminal board.

**F) ALL INDICATORS ON, ALL FANS ON. ONE WHOLE RACK CANNOT BE CONTROLLED.**

POSSIBLE CAUSE

- 1) Blanking switch set incorrectly in card cage, or dimmer control wiring set up incorrectly.

SOLUTION

See figure 10 in this document for proper wiring and blanking switch setting, and set system up correctly.

**G) ALL INDICATORS ON, ALL FANS ON, CONSOLE NOT ADDRESSING DIMMER BANK CORRECTLY (I.E. DIMMER NUMBERS ARE CONSISTENTLY OFF BY A CERTAIN NUMBER OF SLOTS).**

POSSIBLE CAUSE

- 1) Patch problem in console.

SOLUTION

Check 6kW/12kW assignments in patch.

**H) ALL DIMMERS IN ONE RACK WILL ONLY GO TO 90%.**

POSSIBLE CAUSE

- 1) Control wiring error.

SOLUTION

+ Clock and common probably reversed in control wiring.

**I) ALL DIMMERS IN ONE RACK WILL NOT GO TO ZERO.**

POSSIBLE CAUSE

- 1) Control wiring error.

SOLUTION

- Clock and common probably reversed in control wiring.

**10.2 Dimmer Problems Common To A Single Ramp Card**

The dimmer rack must be powered down before removing or inserting Ramp Cards (see page 45).

**A) A PATTERN OF EIGHT DIMMERS DO NOT RESPOND TO COMMANDS. (DIMMERS FAIL IN CONSECUTIVELY NUMBERED PAIRS, FOUR APART, IN SEQUENCE.)**

POSSIBLE CAUSE

- 1) Ramp Card failure.

SOLUTION

Replace Ramp Card and return faulty card to factory for repair.

**B) A SINGLE PAIR OF CONSECUTIVELY NUMBER DIMMERS DO NOT RESPOND TO CONTROLS.**

POSSIBLE CAUSE

- 1) Ramp Card driver output failure.

SOLUTION

Replace Ramp Card and return faulty card to factory for repair.

**C) A PATTERN OF EIGHT DIMMERS IN CONSECUTIVELY NUMBERED PAIRS, FOUR APART, IN SEQUENCE DO NOT COME UP TO FULL BRIGHTNESS OR DO NOT TRACK SYSTEM.**

POSSIBLE CAUSE

- 1) Ramp Card improperly calibrated.

SOLUTION

Replace Ramp Card and return faulty card to factory for recalibration.

- D) **ONE FAN DOES NOT OPERATE. EIGHT DIMMERS PER PATTERN ABOVE DO NOT FOLLOW COMMANDS.**

POSSIBLE CAUSE

- 1) Clock conditioning circuitry in one Ramp Card not functioning.

SOLUTION

Replace Ramp Card and return faulty card to factory for repair.

- E) **ONE OR MORE LIGHTS COME ON WHEN CONSOLE IS TURNED OFF OVERNIGHT.**

POSSIBLE CAUSE

- 1) Output driver or sample and hold malfunction.

SOLUTION

Replace Ramp Card and return faulty card to factory for repair.

- F) **ONE OR MORE LIGHTS FLASH ON FOR A FEW SECONDS ON INITIAL POWER UP OF RACK, THEN WORK CORRECTLY.**

POSSIBLE CAUSE

- 1) Old style Ramp Card without clamping circuit.

SOLUTION

Replace Ramp Card and return faulty card to factory for update.

### ***10.3 Dimmer Problems Not Related by Phase Or A Common Ramp Card***

The dimmer rack must be powered down before removing or inserting Ramp Cards (see page 45).

- A) **DIMMER FLICKERS AS SYSTEM IS BROUGHT UP.**

POSSIBLE CAUSE

- 1) Defective Dimmer Module or Ramp Card.

SOLUTION

Swap dimmer with a known good unit. If problem moves, dimmer is defective. Replace SSR (and driver card, if applicable) and replace dimmer.

Swap Ramp Card with a known good unit. If problem moves, Ramp Card is defective. Replace Ramp Card and return defective unit to factory for repair.

**B) DIMMER DOES NOT FOLLOW COMMANDS.**

POSSIBLE CAUSE

- 1) Defective Dimmer Module or Ramp Card.

SOLUTION

Swap dimmer with a known good unit. If problem moves, dimmer is defective. Replace SSR (and driver card, if applicable) and replace dimmer.

Swap Ramp Card with a known good unit. If problem moves, Ramp Card is defective. Replace Ramp Card and return defective unit to factory for repair.

POSSIBLE CAUSE

- 2) Control circuitry open.

SOLUTION

Check and repair control circuitry, motherboard connectors.



## ***11. PERIODIC MAINTENANCE***

---

Periodic Maintenance should be performed every six (6) to twelve (12) months, depending on the environmental conditions.

- A. Turn power to the dimmer rack OFF.
- B. Remove Ramp Cards and Power Supply Cards from the Fan Housing, dust them off with a soft natural bristle brush, and clean their edge connectors with a mixture of 70% denatured alcohol and 30% distilled water (or other cleaning compound intended for gold edge connectors).
- C. Inspect the dimmer bank for loose connections, build-up of dust, and placement of obstructions around it which may impede air flow. Tighten any loose connections found at this time.
- D. Vacuum out any excessive dust build-up in the dimmer rack while power to the rack is shut down.
- E. Exercise all circuit breakers by turning them ON and OFF several times.
- F. Replace Power Supply Cards and Ramp Cards.
- G. Turn power to the system ON and verify Power Supply reference voltages and adjust as required.





*Appendix A*

# **SPARE PARTS**

---

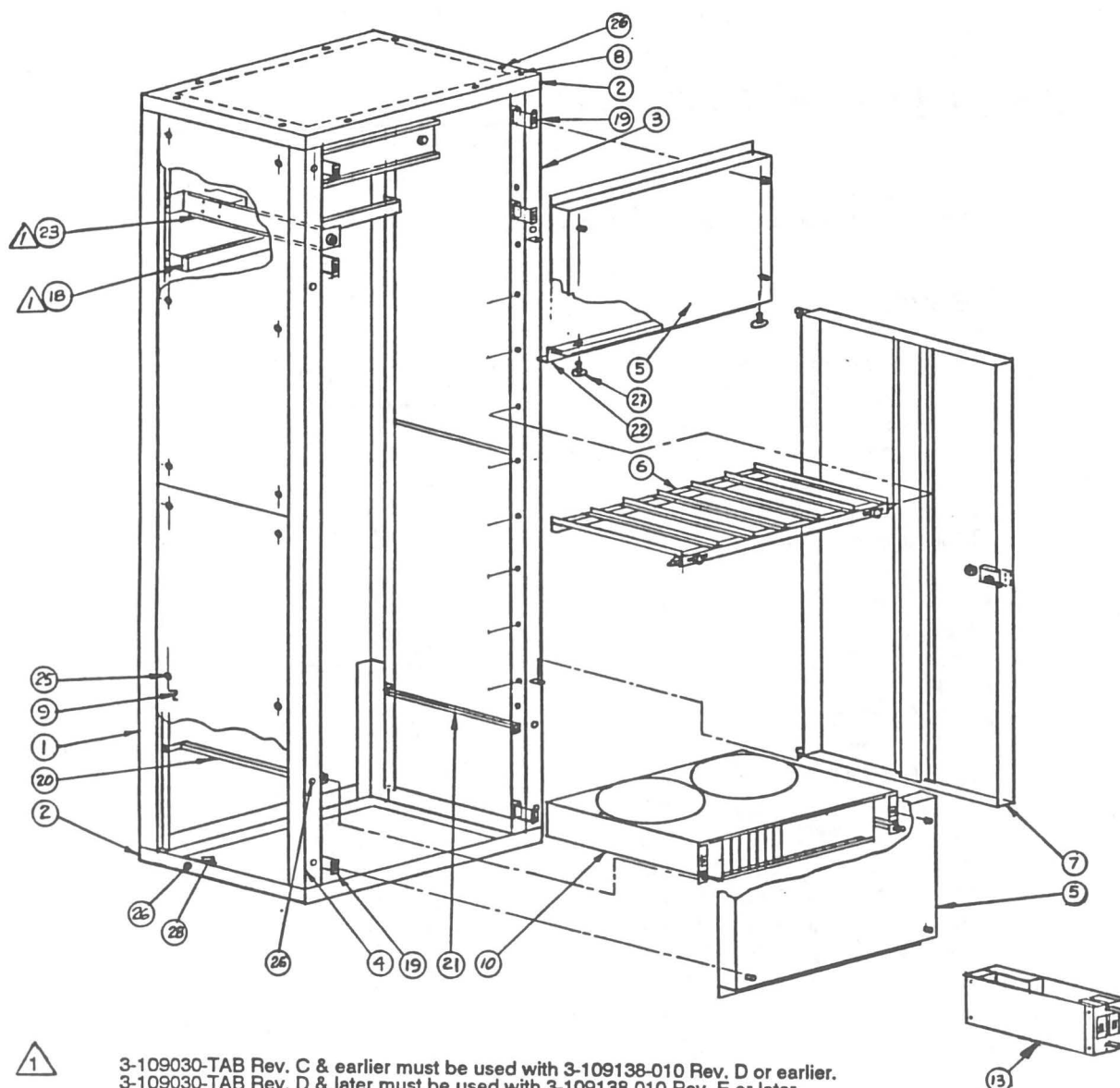
*CD80 Rack Operator's Reference*



## **CD80 RACK BASIC PARTS LIST**

See following pages for additional parts listings.

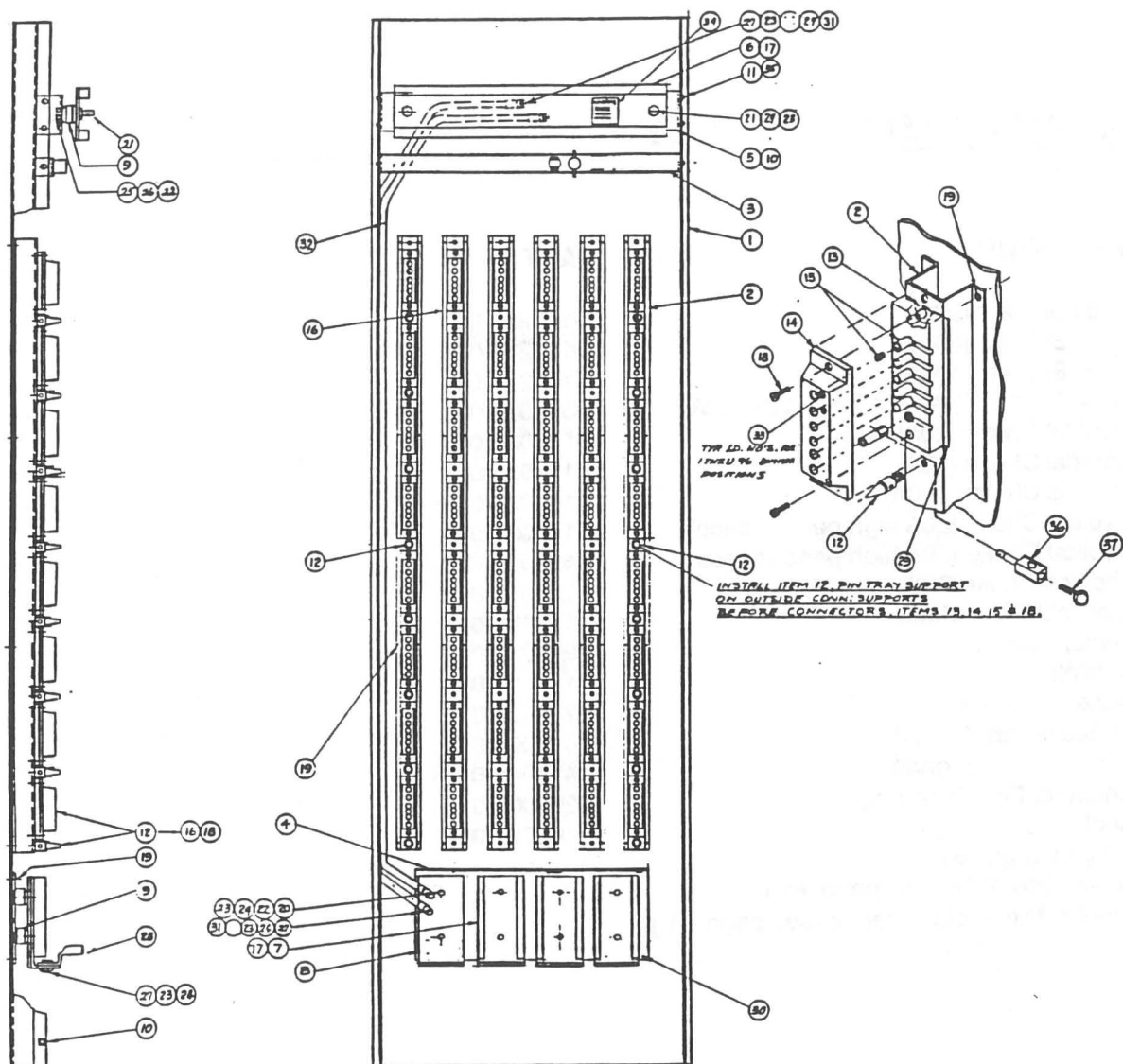
<b>DESCRIPTION</b>	<b>PART #</b>
Fan Housing Assy, Full Rack	3-191618-010
Fan Housing Assy, Half Rack (top half)	3-191618-020
Fan Housing Assy, Half Rack (bottom half)	3-191618-030
Fan Housing Assy, Half Rack (no electronics)	3-191618-040
CD80 Ramp Card	3-722776-010
CD80 Power Supply Card	3-722777-010
CD80 Motherboard	3-722778-010
10" Howard Fan (550CFM)	1-260008-010
CD80 Rack Dimmer Tray	3-170007-010
CD80 Hardware Spares Kit	3-199013-010
2.4KW Test Dimmer	3-081071-010
Blank, 6 Space	3-091620-010
Blank, Single Space	3-091621-010
24V Transformer (STANCOR 8615)	1-414038-000
Relay, O.T. Shutdown (P&B KUP14-D15-24V)	1-377136-000
Thermostat (131°F)O.T. Shutdown	1-290018-000
Thermostat (149°F)O.T. Warning	1-290121-000
Dimmer Receptacle, Back Half	2-229023-010
Dimmer Receptacle, Front Half	2-229022-010
Dimmer Receptacle, Contacts	3-411002-010
12KW Power Lug Adapter for receptacle	3-007001-010



3-109030-TAB Rev. C & earlier must be used with 3-109138-010 Rev. D or earlier.  
 3-109030-TAB Rev. D & later must be used with 3-109138-010 Rev. E or later.  
 3-109154-TAB was previously used in place of 3-109030-TAB, but was replaced to add 220VAC and 240VAC capacity.

Item #	Part #	No. Req.	Description	Item #	Part #	No. Req.	Description
1	3-283335-TAB	1	Rear Panel	13	Various	AR	Dimmer Module
2	3-170312-010	2	Frame End	18	3-109138-010	1	Terminal Support Bracket
3	3-109147-010	1	Right Rail Bracket	19	3-109145-010	6	Screen Support Bracket
4	2-109147-010	1	Left Rail Bracket	20	3-109137-010	1	Left Fan Support Bracket
5	3-293103-010	2	Screen Plate	21	3-109137-020	1	Rt. Fan Support Bracket
6	3-170007-010	8	Dimmer Tray	22	3-109125-010	1	Spacer Bracket
7	3-283338-010	1	Door	23	3-109030-TAB	1	OverTemp/P.L. Bracket
8	2-293170-010	1	Top Cover Plate	25	0-140046	24	Screw 1/4-20 X 1"
9	2-283337-010	4	Side Cover Plate	26	0-140043	40	Screw 1/4-20 X 1/2"
10	3-191618-TAB	1	Fan Housing	27	0-080033	2	Screw 8-32 X 1/2"
11	3-722776-010	AR	Ramp Card	28	1-411215	1	IlSCO Lug SLU.125
12	3-722777-010	3	Power Supply PCB				

**Figure 15. CD80 Rack Parts Pictorial**



Item #	Part #	Description
1	2-283335-010	Rear Panel
2	3-109129-010	Connector Support Bracket
3	3-109138-010	Terminal Support Bracket
4	3-293014-010	Power Bus Support
5	3-109136-010	Neutral Bus Support
6	3-006001-010	Neutral Bus Ass'y
7	3-006002-010	Power Bus Ass'y
8	2-006002-010	Neutral Bus
9	1-193003-000	Standoff Insulator
10	1-390052-000	1/4-20 CP Floating Nut
11	0-140043	Screw 1/4-20 X 1/2"
12	2-291006-010	Tray Support Pin
13	2-229023-010	Female Connector (Back)
14	2-229022-010	Female Connector (Front)
15	3-411002-010	Female connector Pin
16	3-109129-020	Connector Support Bracket
17	0-140016	Allen Set Screw 1/4-28 X 7/16
18	0-100052	Screw 10-32 X 1
19	1-379013-000	Pop Rivet 3/16 dia X 3/8"

Item #	Part #	Description
20	1-380005	Bolt 3/8-16 X 3/4"
21	1-290128-000	Brass Studs 3/8"-16 X 2"
22	0-380003	Split Washer 3/8"
23	1-380015	Hex Nut 3/8"-16
24	0-380009	Split Lock Washer 3/8"
25	0-380013	Bolt 3/8"-16 X 1"
26	0-380012	Flat Washer 3/8"
27	0-380006	Bolt 3/8"-16 X 1"
28	1-411279-000	Lug VHSC 500-12
29	2-193013-010	Connector Insulator
30	1-379046-000	Pop Rivet
31	1-411245-000	Crimp Lug T&B 54213
32	1-434102-000	250MCM Wire
33	2-325048-010	Marker Strip Label
34	2-325035-010	Warning Label
35	0-140031	Split Lock Washer 1/4"
36	2-191004-010	Adapter Lug, 6Kw Dimmer
37	1-560009	Bolt 5/16"-18 X 5/8"

Figure 16. CD80 Rack Rear Panel Parts

## ***CD80 DIMMER BASIC PARTS LIST***

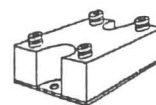
---

<b>DESCRIPTION</b>	<b>PART #</b>
Circuit Breaker (20A)	1-132234-000
Circuit Breaker (50A)	1-132239-000
Circuit Breaker (100A)	1-132241-000
Choke Clamp (Spacer, Choke, 20A, 50A)	2-340036-010
Torroidal Choke (20A)	2-169025-010
Torroidal Choke (50A)	2-169026-010
Torroidal Choke (100A)	2-169027-010
Torroidal Choke (20A high performance)	2-169036-010
Torroidal Choke (50A high performance)	2-169037-010
Asbestos Choke Pad	2-193011-010
Removable Side Plate	2-109126-010
Dimmer Chassis	3-293017-010
Heatsink	2-189015-030
Connector Block	3-229021-010
Connector Pin (Power)	2-411001-010
Connector Pin (Signal)	2-411001-010
Connector Pin (Polarizing)	2-291007-010
Handle	1-187017-000
SSR (see page 61 )	
Opto-isolator PCB (See page 61 )	
Non-dim Threshold Detector (see page 61 )	

---

### 2.4Kw Dimmer

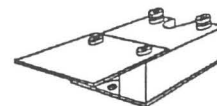
2-377001-010 or 1-377127-000 (120VAC only)  
replaced by  
2-377003-010 or 2-377006-010 (120VAC or 220VAC)



---

### 2.4Kw Non-dim

3-722793-010 attached to 1-377126-000 (120VAC only)  
replaced by  
3-722852-010 attached to 1-377137-000 (120VAC and 220VAC)  
replaced by  
3-722852-010 attached to 2-377003-010 or 2-377006-010 (120VAC and 220VAC)

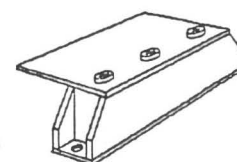


---

### 6.0Kw Dimmer

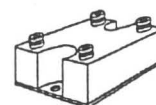
3-722779-010 attached to 1-377128-000

This assembly is replaced by an SSR block (below). On older dimmers which are not drilled for the SSR to be centered on the heat sink, use the lower holes drilled for 2.4Kw SSRs.



replaced by

2-377002-010 or 2-377007-010 (120VAC or 220VAC)

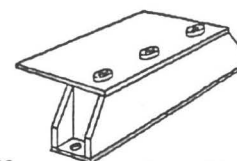


---

### 6.0Kw Non-dim

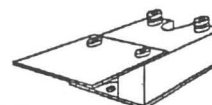
3-722779-020 attached to 1-377128-000

This assembly is replaced by an SSR block & non-dim driver (below). On older dimmers which are not drilled for the SSR to be centered on the heat sink, use the lower holes drilled for 2.4Kw SSRs.



replaced by

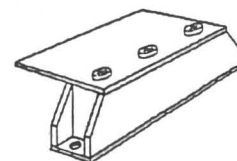
3-722852-010 attached to 1-377140-000  
replaced by  
3-722852-010 attached to 2-377002-010 or 2-377007-010 (120VAC or 220VAC)



---

### 12.0Kw Dimmer

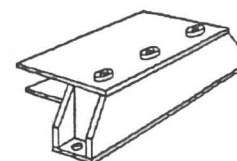
3-722779-010 attached to 2-377005-010 or 1-377141-000  
replaced by  
3-722877-010 attached to 2-377005-010 or 1-377141-000  
(may require addition of 2 pin molex plug to control wires in dimmer)



---

### 12.0Kw Non-dim

3-722877-010 and 3-722852-010  
attached to  
2-377005-010 or 1-377141-000



---

Figure 17. Solid State Relay Replacement Guide





# INDEX

## *CD80 Rack Operator's Reference*

### **A**

About This Manual, 3

### **C**

Calibration  
    Ramp Card, 35  
Calibration  
    Power Supply Card, 35  
Channel Test Chassis, 39  
Comments, 5  
Conduit  
    Planning, 27  
    Type, 27  
    Wire Routing, 27  
Control Signal, 32  
Control Wires  
    Installation, 28  
    Routing, 27

### **D**

Dimmer Cabinet  
    Wire Routing, 27  
Dimmer Module, 21  
Dimmer Rack  
    Install, 28  
    Trouble-Shooting, 46  
Dimmers  
    Installation, 29  
    Output Curve, 37  
    Specification, 21  
Documentation, 5

### **E**

Electronics  
    Fan Housing, 13  
    Specification, 13  
Emergency Backup Controller, 41  
Equipment Ground, 28

### **F**

Fan Housing  
    Installation, 29, 33  
    Specification, 13

### **G**

Ground, 28

### **H**

Hand Held Emergency Backup, 41  
Houselight Module  
    Block Diagram, 19  
    Specification, 14

### **I**

In Case Of Problems, 5  
Installation, 27  
    Control Cable Adapter, 28  
    Control Cable Type, 28  
    Control Wires, 28  
    Dimmer Racks, 28  
    Dimmers, 29  
    Equipment Ground, 28  
    Fan Housing, 29, 33  
    Final Assembly, 34  
    Ground, 28  
    Load Neutrals, 28  
    Load Wires, 28  
    Neutral Feed, 28  
    Plan Conduit, 27  
    Power Feed, 28

### **L**

Load Neutrals  
    Installation, 28  
Load Wires  
    Installation, 28  
    Routing, 27

### **M**

Manual Organization, 3  
Mechanical Specification, 9  
Multiplex Control Signal, 32  
Multiplex Transfer Module  
    Block Diagram, 18  
    Specification, 14

## **N**

Neutral Feed  
Installation, 28

## **P**

Parts Purchase, 5  
Periodic maintenance, 53  
Power Feed  
Installation, 28  
Routing, 27  
Power Supply Card  
Calibration, 35  
Specification, 14  
Trouble-Shooting, 45  
Purchase  
Documentation, 5  
Parts, 5

## **R**

Rack Final Assembly, 34  
Ramp Card  
Calibration, 35  
Specification, 13  
Trouble-Shooting, 45  
Routing  
Control Wires, 27  
Load Wires, 27  
Power Feed, 27

## **S**

Specification  
Channel Test Chassis, 39  
Dimmers, 21  
Electronic, 13  
Emergency Backup Controller, 41  
Houselight Module, 14  
Mechanical, 9  
Multiplex Transfer Module, 14  
Power Supply Card, 14  
Ramp Card, 13  
Status Quo Memory, 15  
Support Electronics, 14  
Status Quo Memory  
Specification, 15  
Suggestions, 5  
Support Electronics  
Block Diagram, 17  
Specification, 14

## **T**

Technical Questions, 5  
Trouble-shooting, 45  
Dimmer Rack, 46  
Periodic Maintenance, 53  
Power Supply Card, 45  
Ramp Card, 45

## **W**

Wiring  
Ground Connection, 28  
Routing, 27



