

CD80 Digital Pack

User's Manual

Strand Lighting

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Introduction and Assistance

This manual provides information on the operating procedures for the CD80 Digital Dimmer Pack.

Manual Organization

This manual contains the chapters shown below, plus an Index.

Introduction and Assistance (chapter 1) - tells you about the organization of this manual, plus definitions and conventions used. Also tells you how to get technical help if necessary

Operational Features (chapter 2) - gives an overview of the operational features of CD80 Digital Packs.

Hardware Description (chapter 3) - gives an overview of the hardware and how it works together.

Installation (chapter 4) - tells you about the installation requirements for CD80 Digital Packs and peripherals. This chapter shows pinouts for externally accessible connectors, cable types and lengths, and (where applicable) setup information.

Basic Trouble-shooting (chapter 5) - tells you how to begin trouble-shooting if you have problems with a pack. Since actual internal repair of the pack electronics is beyond the scope of this manual, this chapter shows only the basic steps you can take without having to replace individual circuit parts, and before you call for help from Strand Lighting.

Periodic Maintenance (chapter 6) - lists the steps which should be taken to keep your Digital Packs running at their best.

Definitions

This manual uses the following definitions throughout:

- Circuit** Connection device and wiring for powering a lighting fixture from a dimmer.
- Dimmer** Device controlling power to a lighting fixture. Two lights on the same dimmer cannot be separately controlled.
- Channel** Device controlling a dimmer or group of dimmers. Historically, there is a physical controller (such as a slider) for each channel. On most current control systems, channels are numbers accessed by a numeric keypad. Each channel can control multiple dimmers.
- Patch** Historically, the process of physically connecting circuits to dimmers. Now usually refers to electronic assignment of dimmers to channels. "Patch" does not refer to assignment of channels to cues or submasters.
- Preset** A pre-defined setup of intensities for a set of channels, stored in memory for later replay.
- Memory** Storage location for preset information.
- Cue** The process of recalling a preset from its memory location and putting the result on stage.
- Preset, Memory, and Cue are often used interchangeably.*
- Submaster** A controller (usually a linear slider controller) which allows manual control of groups, effects, cues, or channels.
- Fade** A gradual change in stage levels from one set of intensities ("look") to another.
- Up-fade** The portion of a fade which involves only channels which are increasing in level.
- Down-fade** The portion of a fade which involves only channels which are decreasing in level.
- Crossfade** A fade which contains both an up-fade and a down-fade. Also may refer to any fade where the levels of one cue are replaced by the levels of another cue.
- Bump** An instantaneous change in stage levels from one set of intensities ("look") to another.

Conventions

The following conventions are used in this manual:

- ON** (all capital text) shows the status of a function or switch, as in "Turn the switch ON."
- Live** (text with first letter capitalized) shows the name of a function or mode of operation, as in Live mode, Group function, or Preview display.

Technical Assistance

CD80 Digital Dimmer Packs require a minimum of maintenance and servicing.

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 a Return Goods Authorization before the return of any defective materials. This allows tracking of returned equipment, and speeds its return to you.

Technical Questions For technical questions regarding setup, operation, or maintenance of this equipment, please contact the Strand Lighting Field Service office serving your area.

Parts Purchases For purchase of spare parts or documentation, please contact the Strand Lighting office serving your area.

Comments and Suggestions For comments regarding equipment functions and/or possible improvements, or for comments on this manual, please call or write to the Marketing Manager at the Strand Lighting office serving your area.

Addresses Addresses for all of the Strand Lighting offices are shown on the reverse side of the manual title sheet.

Operational Features

This chapter presents the basic operational features of the CD80 Digital Pack.

Protocol

The CD80 Digital Pack Controller will accept and decode AMX192 multiplexed analog signals or DMX512 digital dimmer protocols.

- Protocol type is sensed automatically by the Controller
- Separate analog and digital protocol input connectors allow you to hook analog and digital control to each pack simultaneously if required.

Caution



If the controller senses more than one protocol hooked up and active it will lock onto the first protocol it sees, and stick with that protocol until the protocol disappears. When a Digital Pack Controller is first powered up it will scan the AMX192 port first, and then the digital port. If signals are present on both, the AMX192 signal will take priority.

Configuration

One CD80 Digital Pack contains 24 1.2Kw dimmers, twelve 2.4Kw dimmers, or six 6Kw or 12Kw dimmers.

- The controller can be set to start "reading" dimmer levels at any dimmer number required (1-192 for AMX192 and 1-512 for DMX512 signals). This provides maximum flexibility in using CD80 Digital Dimmer Packs with multiple consoles and/or other types of packs or dimmers.
- The 12 channel controller can be set to read 12 consecutive control signals and control either 12 or 6 consecutive dimmers, or to read every other signal of 12 to control 6 consecutive dimmers. The second option is used for systems where the 6Kw/12Kw assignments will be handled by the console patch.

Analog Input

The CD80 Digital Pack Controller can input 12 (Cat. #8216) or 24 (Cat. #8215) discreet analog signals in addition to the signal from the main console. This is an easy way to set up manual house lights, or set up a minimum dimmer level for some of the dimmers.

- The controller can read 0-10VDC or 0-15VDC analog signals.
- Analog input processing can be set for standard pile-on operation or so that the dimmer level is the discreet analog input level plus the protocol input level (up to a maximum of 100%).
- 12 (Cat. #8216) or 24 (Cat. #8215) ON/NORMAL (override) push-button switches let you turn any dimmer ON without a console or discreet analog signal, or override the console and discreet analog inputs.

Dimming Characteristics

Regulation Each 120VAC dimmer module, with circuitry in the Digital Controller module, regulates output voltage with changes in the AC line from 108 to 130 volts RMS.

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 (30 watts to full rated load for 12Kw Packs).

Output

- Output RMS voltage versus setting follows a modified square law dimming curve.
- Output waveform is a variable conduction angle 120VAC sine wave.
- Output waveform risetime is greater than 500 microseconds.
- Output response time (from control signal change) is less than 0.1 seconds.
- Output connections can be Grounded Twist Lock, Pin Plug, U-Ground (2.4Kw Packs only), or terminal strip outputs.

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

Protection

- Front panel overtemperature indication. The OverTemp thermostat will turn OFF all dimmers in the pack when the temperature on the pack heat sink is greater than 85°C.
- Solid State Relay Peak Surge Rating:
 - 2.4Kw Pack - 600 Amps.
 - 6Kw Pack - 1000 Amps.
 - 12Kw Pack - 1000 Amps.
- Short Circuit Protection:
 - 2.4Kw - Fully Magnetic breakers protect against shorts across 40 feet of #14 AWG cable. Short circuit proof version withstands shorts at output plug (lifetime 100 surges).
 - 6Kw Pack - Fully magnetic breakers protect against shorts across 125 feet of #8 AWG cable (lifetime 100 surges).
 - 12Kw Pack - Fully magnetic breakers protect against shorts across 125 feet of #8 AWG cable (lifetime 100 surges).

Dimmer Level Retention

The microprocessor will maintain current dimmer levels ("Status Quo" memory) for 30 minutes if there is a loss of control signal (i.e., when you turn the console OFF). This feature can be turned OFF if required.

Servicing

The CD80 Digital Pack is designed to be easily serviced in the field. It incorporates:

- Rapidly replaceable Controller module.
- Rapidly replaceable SSR modules.

Hardware Description

The CD80 Pack is a lightweight portable performance dimming pack containing twelve (2.4Kw pack) or six (6Kw or 12Kw Pack) dimmers.

- Size - 23.25" x 20.00" x 7.75"
- Weight - 65 pounds
- 12S" aluminum alloy housing.
- Black semi-gloss power coat finish with off-white silkscreened graphics.
- Integral carrying handles for transporting.
- Optional wall mounting.

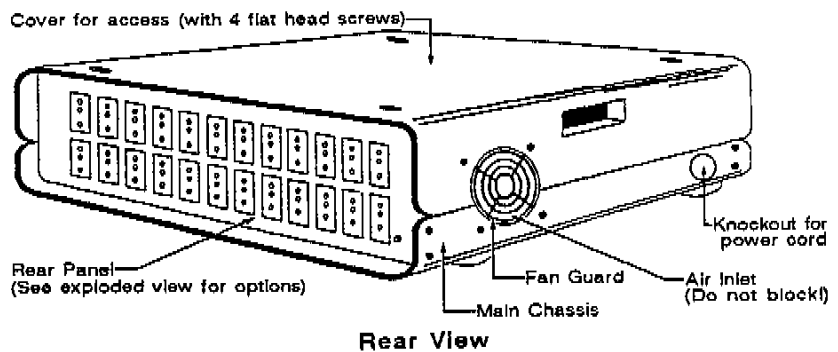
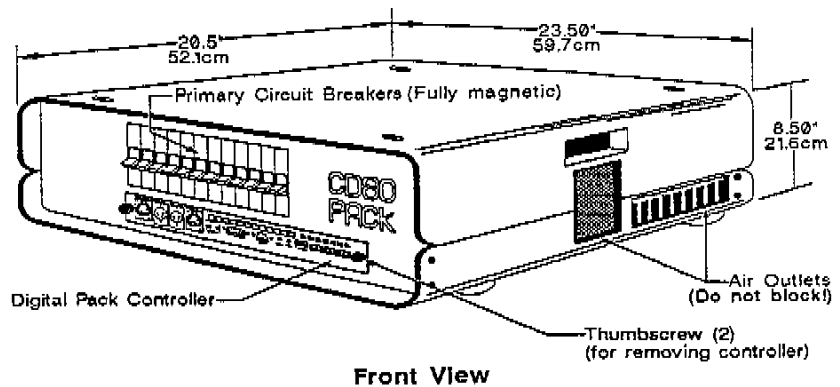


Figure 1. CD80 Digital Pack

Chassis

The CD80 Pack chassis consists of a main structural chassis (bottom housing and front panel), a removable top, and an interchangeable rear connector panel. The heavy gauge structural panels create a rugged container even though assembled with only four pieces.

The main structural chassis consists of the bottom housing and front panel fastened rigidly together. The front panel is recessed to protect the breakers and PCB face panel components.

The front panel, constructed of .090 thick aluminum alloy, contains U.L. listed circuit breakers and a slot for the plug-in printed circuit board module.

The bottom housing, constructed of .125 thick aluminum alloy, supports a heat sink subassembly (mounting the solid state relays and an overheat thermostat), a fan, a fan guard, a torroidal choke subassembly (with chokes solidly mounted in a "clamshell" Lexan retaining channel), and a power-in knock-out, provided for customer removal for terminal wiring. The rear panel is attached to the main structural chassis and recessed to protect the connector faces. Four large diameter feet, approximately 3/4" high, are attached to the underside of the bottom housing and existing feet mount holes are accessible for easy wall mounting.

The rear connector panel, constructed of .090 thick aluminum alloy, is manufactured in four customer options:

- Pin connectors
- Twist lock GTL connectors (2.4 and 6Kw units only).
- Straight blade (Duplex) connectors (on 2.4Kw only)
- A terminal block for hard wiring of outputs plus control.

The top cover, constructed of .125 aluminum alloy, fastens to the main chassis by four screws, and allows easy access for servicing. Recessed handles are integrated into the top housing for easy one man carry capability. Instruction labels are affixed to the underside of the top cover and a warning label..., "Disconnect power before removing top"...attached to the top of the cover.

Digital Controller

The plug-in controller, accessible on the front panel of the CD80 Pack, is made of a face plate and control card. The Control Module contains all necessary indicators and control electronics, allowing rapid interchange of active components in the field without the need for calibration or adjustment.

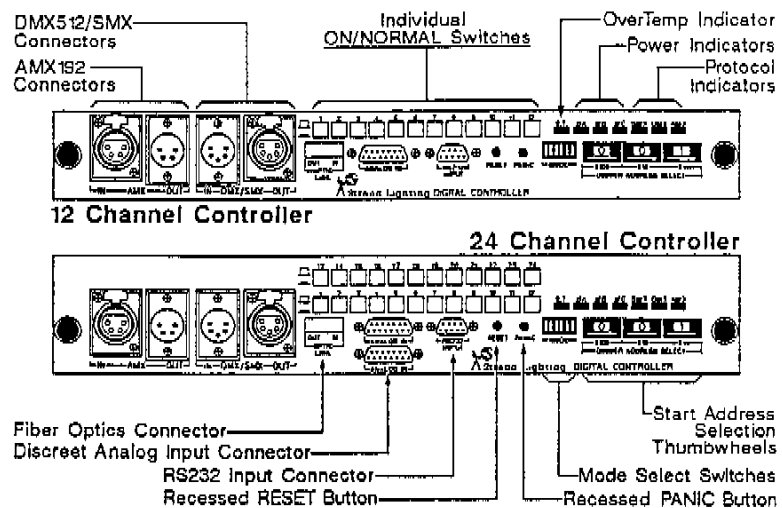


Figure 2. CD80 Digital Pack Controller

Control Module Front Panel

The following functions and indicators are on the Control Module face plate:

- Three Power Indicators (green) - show when each power phase is present.
- Three Protocol Indicators (yellow) - show which input protocol is currently being decoded.
- A 6 position Mode Select DIP switch for selecting various parameters.
- OverTemp Indicator (red) - On when heat sink temperatures exceed +85°C. The pack will shut down when this function is activated.
- Input and output connectors for analog (AMX192) and digital (DMX512) multiplexed inputs.
- Input and output connectors for optical connection of the digital input signal.
- Input connector(s) for up to 12 or 24 discreet analog control signals.
- An RS232 connector for connection with a computer.
- A set of three thumbwheel switches for selecting the start dimmer number for the pack.
- An alternate action "Panic" switch - to turn all dimmers ON full. Push this switch again to return all dimmers to normal operation.
- A "Reset" switch - to restart the processor if required.
- 12 or 24 alternate action ON/NORMAL (override) push-button switches let you turn any dimmer ON without a console or discreet analog signal, or override the console and discreet analog inputs. These switches are backlit to show the approximate level of the associated dimmer.

Controller Electronics The CD80 Digital Pack Controller will accept and decode AMX192 multiplexed analog signals or DMX512 digital dimmer protocols. An additional connector (2 connectors on 24 channel units) allows inputting discreet analog signals if requires.

The Controller electronics contains all of the electronics required to detect input signal type, decode the incoming signal, and produce 24 phase synchronized pulse width modulated control signals to drive the SSRs.

The electronics are powered from a power supply connected to the phase A power source. The phase B and phase C power sources are used for phase reference only.

Power Control and Cooling Assemblies

The following circuit and thermal elements in the bottom housing and front panel serve to control and dissipate power in the CD80 Pack:

- One SSR for each dimmer, rated appropriately for the dimmer power rating, are mounted on a common 18" long heat sink anchored to the bottom housing. Each SSR is field replaceable and identical to SSRs in Strand Lighting CD80 Dimmer Racks. 12Kw packs use a dual SSR block, which is different from the single SSR block used in CD80 dimmer racks.
- One torroidal choke for each dimmer is mounted in a common assembly adjacent to the heat sink.
- One primary, fully magnetic circuit breaker for each dimmer is mounted to the front panel and provides for protection of individual dimmers.
- A fan mounted on the positive pressure side of the heat sink provides approximately 70 CFM (derated) of cooling air through the enclosure.
- A phase changing/terminal block assembly on the bottom housing (except 12Kw packs) provides termination of either 3 phase 4-wire plus ground 120/208VAC 80 AMPS, or single phase 3-wire plug ground 120/240VAC 120 AMPS.

Dimmer Types

Dimmer modules are available in the following 120VAC configurations. These dimmers are intended for use with incandescent and inductive loads only.

UL And CSA Approval The following CD80 Digital Packs are UL listed and CSA approved:

- 8324 - 24 1.2Kw dimmers (15A primary breaker) with 24 20A Twist Lock outputs.
- 8325 - 24 1.2Kw dimmers (15A primary breaker) with 24 20A Pin Connector outputs.
- 8326 - 24 1.2Kw dimmers (15A primary breaker) with 24 20A U-Ground outputs.
- 8327 - 24 1.2Kw dimmers (15A primary breaker) with terminal strip connections.
- 8328 - 24 1.2Kw dimmers (15A primary breaker) with 24 15A U-Ground outputs.
- 8524 - Twelve 2.4Kw dimmers (20A primary breaker) with 24 20A Twist Lock outputs.
- 8525 - Twelve 2.4Kw dimmers (20A primary breakers) with 24 20A Pin Connector outputs.
- 8527 - Twelve 2.4Kw dimmers (20A primary breakers) with terminal strip outputs (intended for wall mounting).
- 8566 - Six 6Kw dimmers (50A primary breakers) with 12 Twist Lock outputs.
- 8567 - Six 6Kw dimmers (50A primary breakers) with 12 Pin Connector outputs.
- 8568 - Six 6Kw dimmers (50A primary breakers) with terminal strip outputs (intended for wall mounting).
- 8564 - Six 12Kw dimmers (50A primary breakers) with terminal strip outputs (intended for wall mounting).

The following CD80 Packs are UL listed but not CSA approved:

- 8526 - Twelve 2.4Kw dimmers (20A primary breakers) with 24 20A U-Ground outputs.

The following CD80 Packs are CSA approved but not UL listed:

- 8526C - Twelve 1.8Kw dimmers (15A primary breakers) with 24 15A Parallel Blade outputs.

Caution



These dimmer packs are designed and rated for use with incandescent or inductive loads only. Dimmer packs may be damaged if used with any other type of loads.

The following controllers are available for retrofitting and spares:

- 8215 - 24 channel Digital Pack Controller (for 1.2Kw packs)
- 8216 - 12 channel Digital Pack Controller and retrofit kit (for 2.4Kw, 6Kw, and 12Kw packs).

The 24 channel Digital Pack Controller cannot be retrofitted into any existing CD80 packs. Cat. #8215 contains only a 24 channel Digital Pack Controller. The 12 channel Digital Pack Controller is a direct replacement for the Multiplexed Analog Pack Controller (part #3-258358-010) and the Discreet Analog Pack Controller (part #3-258362-010). Cat. #8216 contains a 12 channel Digital Pack Controller and the necessary items for retrofitting older CD80 packs.

Input Power Connectors

A variety of input power connectors can be custom mounted in the CD80 pack if required. Packs using special input connectors may not carry CSA approval or UL listing. Please contact your sales representative for details.

Installation

Preparation

Before installing your CD80 Packs, you should carefully consider the environment in which the equipment is to be installed, the power feeding the equipment, and the required conduit and/or cable runs.

Environmental Considerations

To maximize equipment life, and minimize the chance of failures, the following environmental requirements should be met:

- Temperature -- 40°C (104°F).
- Humidity -- 5%-80% relative humidity maximum, no condensation.

Caution



Dimmer pack efficiency is at least 95%. Since the remainder of the energy is dissipated as heat, they should be installed in a room with adequate ventilation to dissipate a heat load equivalent to 5% of the maximum load the dimmer racks will handle.

Power Requirements

2.4Kw and 6Kw CD80 Digital Dimmer Packs can be powered by three phase or single phase power. 12Kw Digital Dimmer packs must be powered by three phase power.

Three Phase Power Requirements

- 1.2Kw or 2.4Kw Pack - 120/208VAC, 80 Amps, 4-wire plus ground
- 6Kw Pack - 120/208VAC, 100 Amps 4-wire plus ground
- 12Kw Packs - 120/208VAC, 200 Amps, 4-wire plus ground

Single Phase Power Requirements

- 1.2Kw or 2.4Kw Pack - 120VAC, 120 Amps, 3-wire plus ground
- 6Kw Pack - 120VAC, 150 Amps 3-wire plus ground
- 12Kw - Single phase operation is not allowed.


Warning 

Do not install this equipment with power applied. Make sure that your incoming power is disconnected before proceeding.

Do not provide 220VAC power to a 120VAC pack, as damage may result.

Plan Pack Positioning

CD80 Packs may be placed on any flat surface for normal operation. You may stack up to 8 units vertically. Do not place more than 2 units side to side unless there is at least 24 inches between packs. Otherwise, the hot air exhaust from each unit will simply feed into the next. In permanent or semi-permanent installations, you can build shelves to hold packs or mount them on a wall separated by at least 24 inches horizontally. Vertical shelf spacing should allow removal of the CD80 Pack top covers for access to SSR modules if required. Figure 1 shows dimensions and existing mounting holes.

Warning 

This equipment is intended for indoor use only.
Utilizer dans endroit a l'abri.

For CSA approval when mounting over a combustible surface, a floor plate of at least 1.44mm galvanized or 1.6mm uncoated steel extended at least 150mm beyond the equipment on all sides must be installed.
Lorsque L'appareil est installe sur ou au-dessus d'une surface combustible, on doit prévoir une plaque d'acier galvanise d'au moins 1.44mm ou une plaque d'acier sans revetement de 1.6mm se prolongeant sur au moins 150mm tout autour de l'appareil.

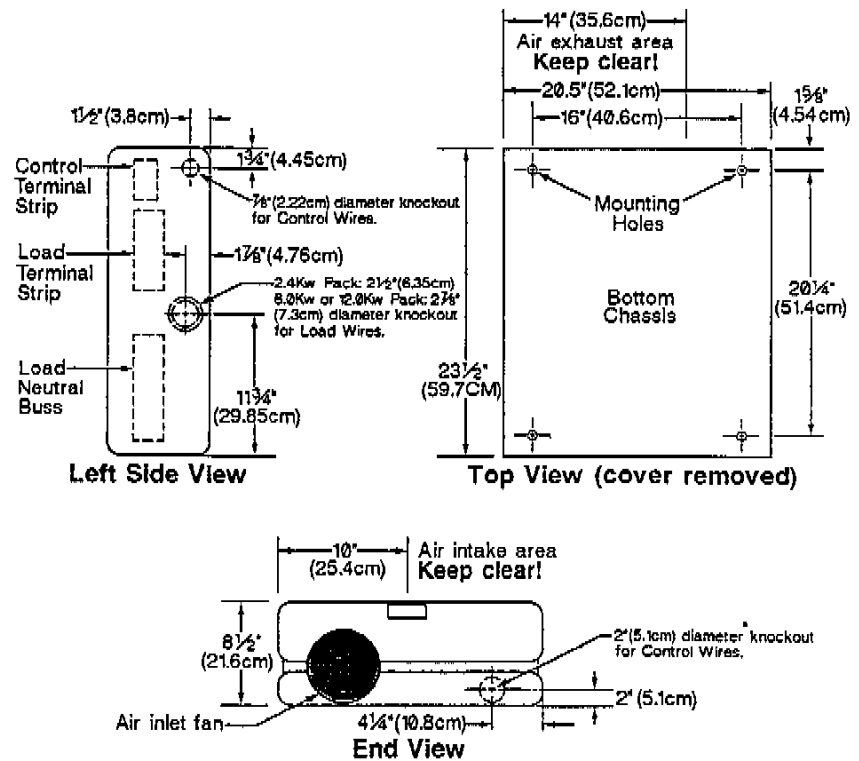


Figure 1. CD80 Pack Wall Mounting

Plan Wiring Layout When installing packs with terminal strip wiring, the location of conduit runs and their entrance to the pack is important and should be carefully planned before cutting holes or attaching conduit. Figure 1 shows the allowed entry areas for the various types of wiring. When installing portable packs, all connections are external.

When you are planning a hookup for a portable system you should avoid running control and load wires parallel to each other. The radio frequency noise produced by the load wiring may cause disruption to the control signal.

Caution



Do not run power feed or load wires in the same conduit or wireway as control wiring.

Do not run wiring from other unrelated equipment in the same conduit with CD80 wiring.

Do not run wiring in ways other than shown on system riser diagram. CD80 systems 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 unshielded wiring or conduit. Changes in transmission line capacitance can cause problems with the control signals.

Installation

Once you have determined that all required conditions for the installation will be met, you can install the packs.

Install Packs Install the dimmer packs and run conduit as required.

1. Unpack the packs.
2. Make sure that any conduit work which will be covered up is completed.
3. Set or fasten packs in place as planned. If you are mounting packs on the wall, make sure that the fan is at the bottom of the unit as mounted.
5. Cut required conduit holes and install conduit.
6. Vacuum out any metal chips resulting from making conduit holes.

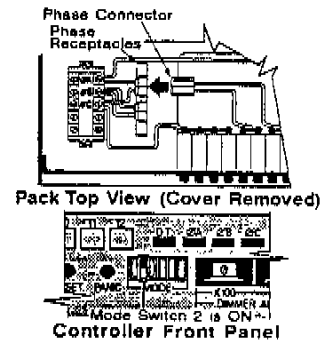
Set Correct Phasing

Mode Switch 2 sets the type of power the Control Module will be expecting. You must set this switch and the phase selector plug inside the pack to the same phase type. The factory default setting for Mode Switch 2 and the phase selector plug is 3-phase.

The phase changing terminal assembly (consisting of a terminal block and a connector pair assembly) provides termination for a 3-phase 4-wire 240/208VAC 80 AMP power source or a single phase 3-wire 120/240VAC 120 AMP power source in 2.4Kw and 6Kw CD80 Packs.

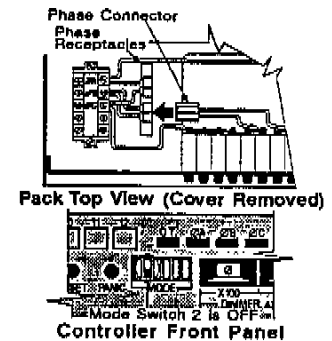
Set for Single Phase Operation

1. Make sure power to the pack is OFF and take the top cover OFF.
2. Plug the phase connector into the single phase side of the phase receptacle.
3. Set Mode Switch 2 to ON.
4. Replace the top cover unless you still need to connect power.



Set for Three Phase Operation

1. Make sure power to the pack is OFF and take the top cover OFF.
2. Plug the phase connector into the three phase side of the phase receptacle.
3. Set Mode Switch 2 to OFF.
4. Replace the top cover unless you still need to connect power.



12Kw Packs are always operated with three phase power. Make sure that the Mode Switch 2 is set to OFF for any 12Kw packs. There is no phase change plug inside a 12Kw Pack.

Connect Power Connect power to the pack by attaching your power leads to the power terminal block inside the pack. For portable packs, close the pack up after connecting power. For terminal strip packs, leave the top open to connect load wires.

The only components that do not come installed in the pack are the neutral bus bar set screws. They are in a plastic bag attached to the neutral bus bar.

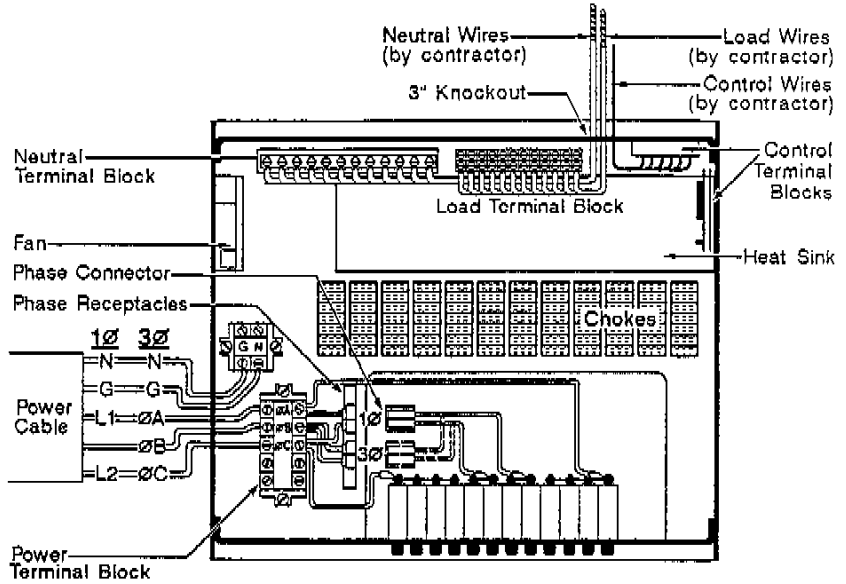


Figure 2. 1.2Kw Pack Power Connection

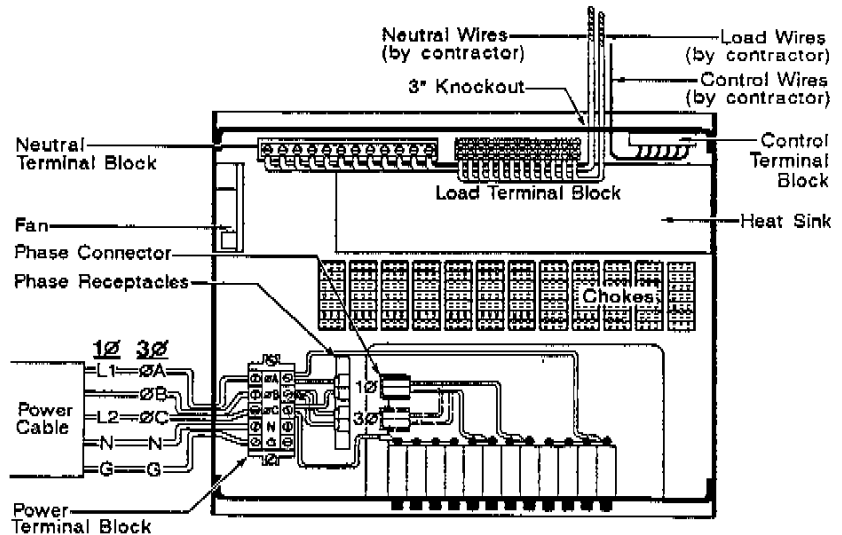


Figure 3. 2.4Kw & 6Kw Pack Power Connection

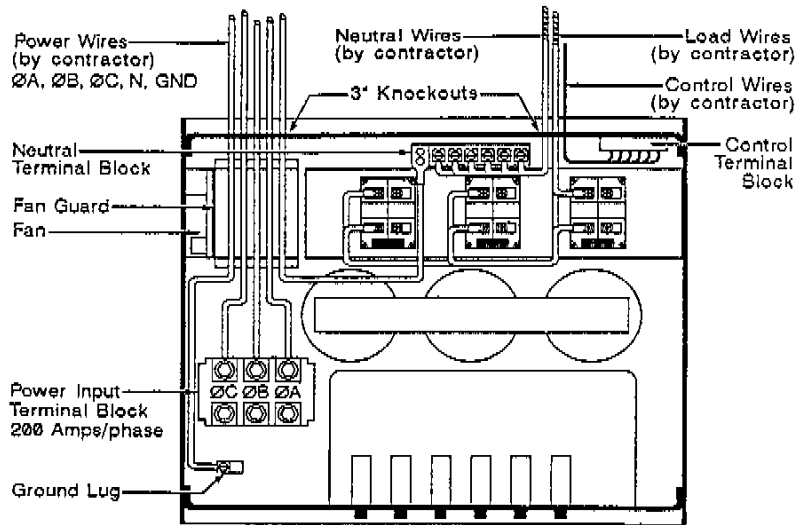


Figure 4. 12Kw Pack Power Connection

Connect Load Wires Connect the load wires by plugging them into the rear panel connectors (portable units) or connecting them to the internal terminal blocks (terminal block packs). On 12Kw packs the load wires are connected directly to the solid state relays.

Caution



These dimmer packs are designed and rated for use with incandescent or inductive loads only. Dimmer packs may be damaged if used with any other type of loads

Connect Control Wires CD80 Digital Dimmer Packs accept control signals conforming to the USITT AMX192 or DMX512 Dimmer Signal Specifications.

AMX192 Control Wiring

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, dimmer cabinets use terminal block connections and consoles use XLR style connectors (see table 1 for pin assignments).

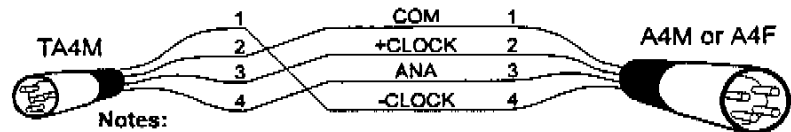
Table 1. AMX192 Control Inputs

Cable:		Belden 9156 or equal. May use Belden 8723 for adapters under 100 feet (30m) long.				
Max Length:		1000 feet (300m). must be Daisy chained - no branching runs.				
Connector:		Terminal block in dimmer rack. "XLR" style connector, or SwitchCraft TA4/TY4 series connector in control equipment.				
XLR Pin #	TA4/TY4 Pin #	Terminal Pin #	Signal	Comments	Belden 8723	Belden 9156
4	1	AMX CLK-	CLOCK -	Clock Complement	Green	Black
2	3	AMX CLK+	CLOCK +	Clock True	White	White
1	2	AMX COM	COMMON	Analog Common	Black	Black
3	4	AMX AMUX	ANALOG	Multiplexed Analog	Red	Red

CLOCK+ and CLOCK- are one twisted pair. Analog and Common are one twisted pair.

There are two AMX192 inputs, labelled "A" and "B." Use only "A" terminals in systems with 192 AMX192 dimmers or less. Use both "A" and "B" terminals for AMX192 systems with more than 192 dimmers.

Interconnection between equipment with different plug types requires an adapter cable in which the plugs are not connected pin to pin (see figure 3).

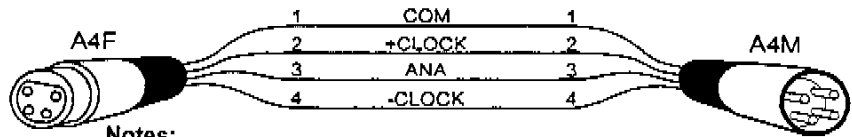


Notes:

1. Use Belden 8763 cable
2. Maximum adapter length = 100 ft. (30m)
3. Sex of "XLR" style connector varies with application

Figure 5. XLR to TA4 Series Adapter

AMX192 adapters (under 100 ft) using TA4/TY4 connectors are made with Belden #8723 cable (2 pairs of shielded 24 AWG wire). All other runs are made with Belden #9156 (2 pairs of unshielded 18 gauge wire).



Notes:

1. Use Belden 9156 cable
2. Maximum extension length = 1000 ft. (300m) including all adapters

Figure 6. AMX192 Extension Cable

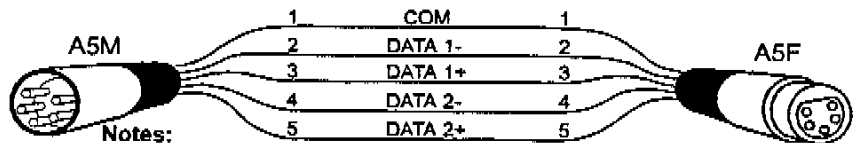
DMX512 Dimmer Control Wiring

The two types of connections provided in Strand Lighting equipment for DMX512 dimmer control signals are the XLR style connector and terminal blocks. Unless otherwise specified, dimmer cabinets use terminal block connections and consoles use XLR style connectors (see table 2).

Table 2. DMX512 Control Inputs

Cable:		Belden 9829 or equal.			
Max Length:		Standard RS485 electrical characteristics apply, including line driver and receiver characteristics, line loading, and multi-drop configurations.			
Connector:		Terminal Block in Premiere cabinet. Terminal block in dimmer rack.			
XLR Pin #	Terminal Label	DMX Signal	Comments	Pairs	Wire Color
1	D-GND	COMMON	Dimmer Common (shield)		shield
2	DATA-	DATA 1-	Dimmer Drive Complement	pair 1	black
3	DATA+	DATA 1+	Dimmer Drive True		red
4	Not used	DATA 2-	Optional #2 Data Link Complement	pair 2	black
5	Not used	DATA 2+	Optional #2 Data Link True		white

DATA 1- and DATA 1+ are one twisted pair. Common is tied to the cable shield.



Notes:

1. Use a cable approved for RS485
2. For electrical characteristics, including driver and receiver selection, line loading, and multi-drop configurations, see RS485 specification.

Figure 7. DMX512 Dimmer Control Extension Cable

Setup

Once you have installed the packs they must be set up to correctly read the control signal from the console.

Dimmer Signal Number The first dimmer signal to which a Digital Pack Controller will respond is set by the thumbwheel switches. When you are using AMX192 control signals and 6Kw dimmers, the Mode Switch 6 on the front panel of the controller can also effect the numbering.

Set the starting dimmer signal number for each pack by setting the thumbwheel switches on the front of the control module to the appropriate dimmer number. The CD80 Digital Pack Controller will start looking at dimmer signals starting with the dimmer signal number set on the thumbwheel switches.

Each pack is completely independent of all other packs. You can set two packs to the same start number if you require more than one physical dimmer for each dimmer number.

You do not have to set the start dimmer number to a boundary divisible by 6 or 12. You can have a 2.4Kw pack set to dimmer 1 (the pack is dimmers 1-12), with the next pack set to dimmer 9 (the pack is dimmers 9-20). This will give you two each of dimmers 9 through 12.

Combining Pack Types You may use combinations of 1.2Kw, 2.4Kw, 6Kw, and 12Kw packs in the same installation. Make sure that you set the thumbwheel switches to the correct dimmer numbers. Remember that a 6Kw or 12Kw dimmer pack may use either 6 or 12 dimmer signals if you are using AMX192 control, depending on the setting of Mode Switch 6. 1.2Kw packs use 24 dimmer signals.

You can mix packs with analog multiplexed controllers, discreet multiplexed controllers, and old style 1.2Kw packs with CD80 Rack electronics if you take a few precautions:

- Disable the curve jumper on the digital packs used in the system so that dimming curves match (see page 26).
- Be careful about setting pack addressing for different pack types.
- 6Kw analog multiplexed packs always use 12 dimmer signals.
- The input connector on 6Kw and 12Kw units as supplied by the factory uses every other dimmer signal. If you wish them to be on consecutive channels you must use the console to declare 6Kw/12Kw assignments or have appropriately wired splitter boxes.

Dimmer Number Offset For purposes of pack dimmer numbering, each control cable from the console is treated as a separate system. The first pack on the second control cable must be set to "001" even though the actual console dimmer number will be the number of dimmers on the first cable plus one.

In DMX512 systems dimmer #1 on control cable #2 is actually console dimmer number 513, since the first cable controls 512 dimmers. For DMX512 systems, this numbering is not affected by any 6Kw dimmers on the first cable.

In AMX192 systems with only 2.4Kw dimmers, numbers on cable 2 are offset by 96 or 192 (depending on the console) and each subsequent cable is offset by an additional 192. This means that dimmer #1 (by the thumbwheel switch) on cable #2 is actually console dimmer 97 or 193 in a system with all 2.4Kw dimmers.

The following Strand Lighting control consoles output only 96 dimmer signals from dimmer output #1, and 192 dimmer signals from all other outputs. Each dimmer declared as 6Kw/12Kw in the console patch takes up two dimmer signals.

- All versions of Mantrix
- Mantrix Memory
- miniPalette consoles set for 288 dimmer signals or less. When set for more than 288 dimmer signals, these consoles output 192 dimmer signals from dimmer output #1.
- Lightboard M with AMX192 select jumper installed. Without this jumper the console outputs 192 dimmer signals from dimmer output #1.
- mini Lightpalette series consoles set for 288 dimmer signals or less. When set for more than 288 dimmer signals, these consoles output 192 dimmer signals from dimmer output #1.
- Lightpalette, Lightpalette II, and Lightpalette III consoles with software versions V6E and higher set for 288 dimmer signals or less. When set for more than 288 dimmer signals these consoles output 192 dimmer signals from dimmer output #1.

Strand Lighting Light Palette Series consoles with software revisions V5A, V5B, V6A and V6B output 96 dimmer signals from all console outputs when set for 384 dimmer signals or less. When set for more than 384 dimmer signals, these consoles output 192 dimmer signals from each output.

Very early Mantrix production consoles may not be compatible for 6Kw/12Kw Pack operation. If not, consult Strand Lighting.

Caution



When you are using AMX192 control signals, a 6Kw or 12Kw Pack uses 12 dimmer signals when Mode Switch 6 is OFF. This simulates the analog multiplexed pack control module for easy retrofitting. You must have 6Kw/12Kw dimmers declared in your console patch for this setup to work correctly. This also skews the dimmer offset for the next control cable. For each 6Kw or 12Kw pack set up in this manner, the dimmer offset is decreased by 6 dimmers, since 6 dimmer signals are wasted per pack.

*If Mode Switch 6 is ON, the 6Kw or 12Kw Pack only uses 6 dimmer signals. You should **not** have 6Kw/12Kw dimmers declared in your console patch if you are using this setting. This method does not skew the dimmer offset for the next cable, since all dimmer signals are being used.*

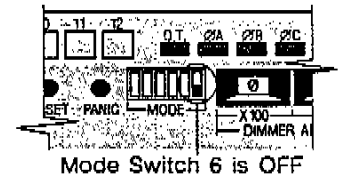
You can set some 6Kw or 12Kw packs for 6 signals and some for 12 signals as long as you adjust appropriately in your console patch. However, it is generally less confusing if all 6Kw/12Kw adjustments are in patch or all are in the pack controllers. If you have some Analog Multiplexed Pack Controllers and some Digital Pack Controllers it is generally less confusing if you set all of the digital controllers to mimic the analog controllers (Mode Switch 6 is OFF).

Set 6Kw/12Kw Control Mode

In order to maintain compatibility with older Strand Lighting equipment and procedures, you can set the CD80 Digital Pack Controller to use consecutive incoming signals or use only every other signal. The factory default setting for this switch is ON.

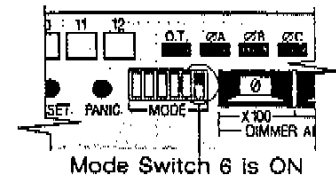
Use Every Other Control Signal

To use every other control signal for dimmer levels, set the Mode Switch 6 to OFF. This setting is for Strand Lighting systems where the 6Kw assignment is being made in the console. Since 2 consecutive signals are output for each 6Kw dimmer assigned in the console, the CD80 Digital Pack Controller will use every other signal starting with the thumbwheel dimmer number. This setting is for retrofit situations where you already have 6Kw dimmers set in the console and do not wish to reset the patch. **You should not use this setting in 2.4Kw Packs.**



Use Every Control Signal

To use every control signal for dimmer levels, set the Mode Switch 6 to ON. In this mode, the controller will use the first 6 signals starting from the thumbwheel dimmer number for 6Kw packs, and the first 12 signals for 2.4Kw packs. You should always use this setting for 2.4Kw Packs.



Set Dimmer Curve

The CD80 Digital Pack Controller can be set so that its output curve matches CD80 Multiplexed Analog and Discreet Analog Controllers, or can be set with a modified square law curve which allows smoother control at the lower end of the dimming curve. The setting is made with a jumper. The factory default for this jumper is INSTALLED (modified square law curve).

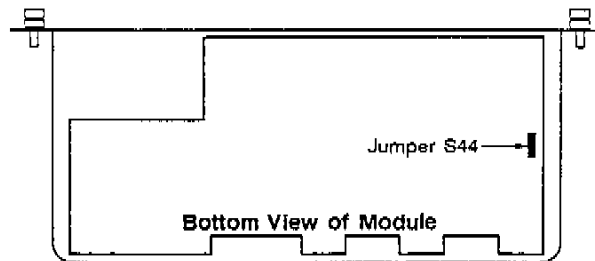


Figure 8. Dimmer Curve Jumper Location

Modified Square Law Curve

1. Make sure power to the pack is OFF.
2. Remove the Digital Pack Controller from the pack and locate jumper S44 (see figure 7 on page 26).
3. Install jumper S44 as shown.
4. Install the Digital Pack controller back in the pack.
5. Turn power to the pack back ON.



Analog Pack Matching Curve

1. Make sure power to the pack is OFF.
2. Remove the Digital Pack Controller from the pack and locate jumper S44 (see figure 7 on page 26).
3. Move jumper S44 as shown so that it is inactive.
4. Install the Digital Pack controller back in the pack.
5. Turn power to the pack back ON.



**Using AMX192
Dimmer Control**

Figure 9 shows a typical system hookup using AMX192 control signals. Note that the 6Kw pack on output #1 (pack #3) is configured for skipping every other control signal. This skews the numbering, so that dimmer 31 (pack #4) is actual controlled by control signal #37. The 6Kw pack on output #2 (pack #10) is set to use every signal. This keeps the thumbwheel numbering consistent with the actual dimmer signal used in each pack.

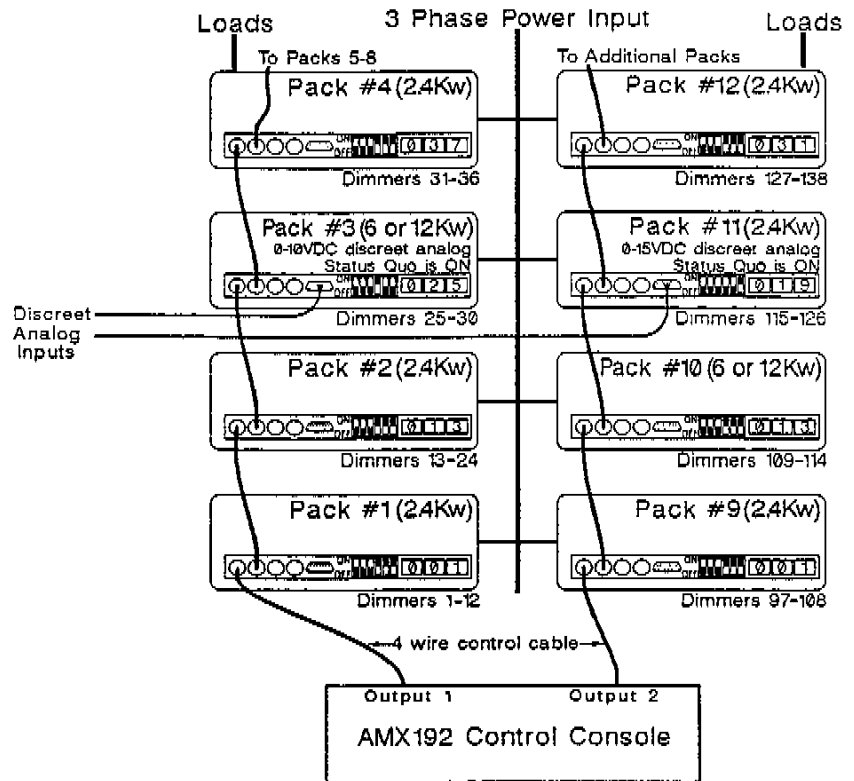


Figure 9. Connect Packs for AMX192

**Using DMX512
Dimmer Control**

Figure 10 shows a typical system hookup using DMX512 control signals. Since each DMX512 control cable transmits signals for 512 dimmers, there will seldom be a need for more than one control cable in a typical pack application. If you need a second cable, the first pack on the second cable should be set to "001" just as it is with AMX192 systems.

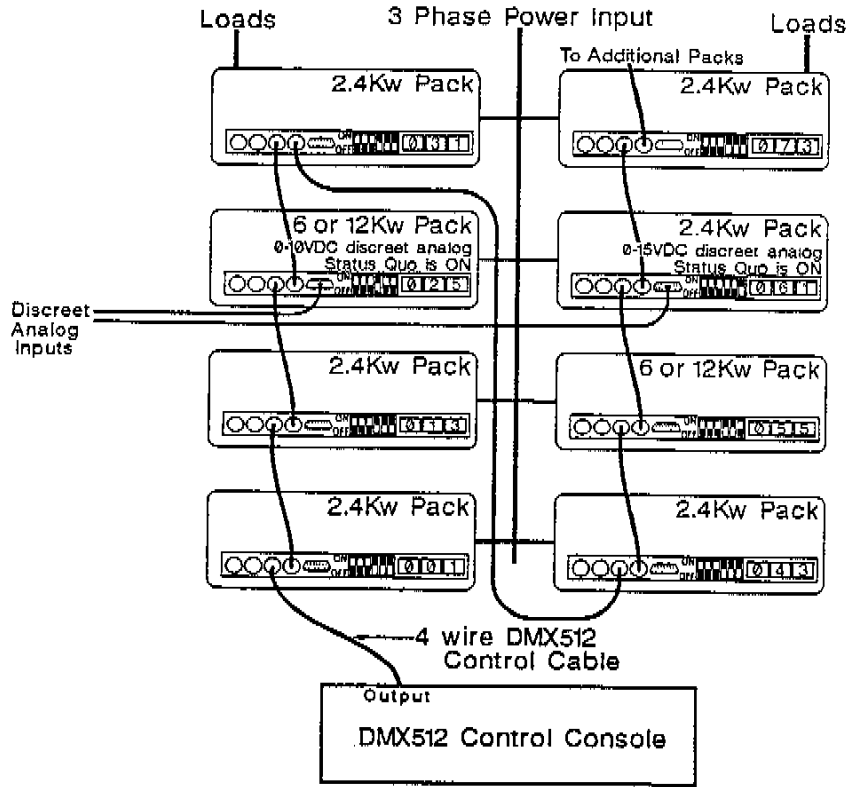


Figure 10. Connect Packs for DMX512

Discreet Analog Control Hookup

The CD80 Digital Pack has 12 discreet analog inputs which can be piled on to the dimmer levels from the selected incoming protocol. These signals are input through a standard DB15 connector on the front of the Digital Pack Controller. Table 3 shows the pinouts of this connector.

These signals also appear at the rear of the pack on hard wired 1.2Kw packs. They do not appear at the rear of 2.4Kw or 6Kw packs.

Table 3. Discreet Analog Input Connections

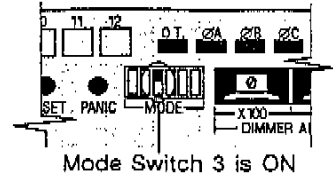
Connector: Male DB15 connector (there are 2 connectors on 24 channel controller, shown as pins 2-1 through 2-15 in this table)		
Pin #	Signal Name	Description
1-1	Analog 1	Analog control for dimmer 1
1-2	Analog 2	Analog control for dimmer 2
1-3	Analog 3	Analog control for dimmer 3
1-4	Analog 4	Analog control for dimmer 4
1-5	Analog 5	Analog control for dimmer 5
1-6	Analog 6	Analog control for dimmer 6
1-7	Analog 7	Analog control for dimmer 7
1-8	Analog 8	Analog control for dimmer 8
1-9	Analog 9	Analog control for dimmer 9
1-10	Analog 10	Analog control for dimmer 10
1-11	Analog 11	Analog control for dimmer 11
1-12	Analog 12	Analog control for dimmer 12
1-13	GND	Ground
1-14	GND	Ground
1-15	+12V	+12V feed for analog
2-1	Analog 13	Analog control for dimmer 13
2-2	Analog 14	Analog control for dimmer 14
2-3	Analog 15	Analog control for dimmer 15
2-4	Analog 16	Analog control for dimmer 16
2-5	Analog 17	Analog control for dimmer 17
2-6	Analog 18	Analog control for dimmer 18
2-7	Analog 19	Analog control for dimmer 19
2-8	Analog 20	Analog control for dimmer 20
2-9	Analog 21	Analog control for dimmer 21
2-10	Analog 22	Analog control for dimmer 22
2-11	Analog 23	Analog control for dimmer 23
2-12	Analog 24	Analog control for dimmer 24
2-13	GND	Ground
2-14	GND	Ground
2-15	+12V	+12V feed for analog

Set Analog Pile-on Mode

The 12 analog signals can be piled on in the standard "highest takes precedence" manner or in such a way that the dimmer output level is the analog signal level plus the protocol level. The factory default setting for this switch is OFF.

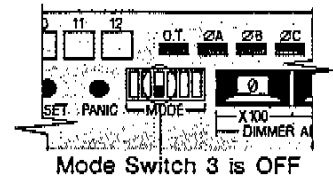
Analog Plus Protocol

To set the pile-on mode to "Analog Plus Protocol," set the Mode Switch 3 to ON. In this mode, the controller adds the level from the discreet analog input and the multiplexed protocol input and passes the sum to the dimmer.



Highest Takes Precedence

To set the pile-on mode to "Highest Takes Precedence," set the Mode Switch 3 to OFF. In this mode, the controller looks at the incoming discreet analog level, and the incoming multiplexed level, and passes the higher of the two levels to the dimmer.

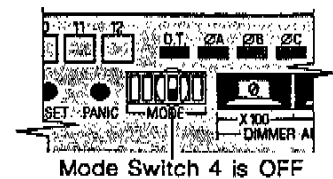


Set Analog Input Level

In order to function with a wide variety of analog controllers, the Digital Pack Controller can process either zero to +10VDC or zero to +15VDC signals from the discreet analog inputs. The factory default setting for this switch is ON.

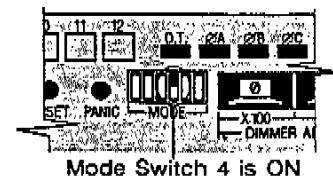
Zero to +15VDC

To set the controller for an analog input signal level of zero to +15VDC, set the Mode Switch 4 to OFF. This will allow it to recognize the analog signals from Strand Electro Controls consoles.



Zero to +10VDC

To set the controller for an analog input signal level of zero to +10VDC, set the Mode Switch 4 to ON. This will allow it to recognize the analog signals from Strand Lighting and many other manufacturers' consoles.

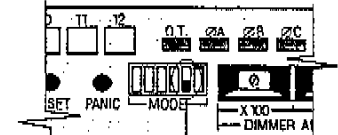


Set "Status Quo"

The CD80 Digital Pack Controller can "remember" the stage levels for 30 minutes after the control signal is lost or turned OFF. The factory default setting for this switch is ON.

"Status Quo" ON

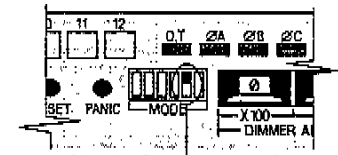
To turn on the "Status Quo" function, set the Mode Switch 5 to OFF. When this switch is OFF the controller will retain the last known dimmer levels for 30 minutes after loss of control signal. This function is particularly handy for house lights, and will allow you to turn OFF the console and leave, knowing that the lights will turn themselves OFF after 30 minutes. This function will also maintain stage lighting for long enough to bring in another console in case of an equipment failure.



Mode Switch 5 is OFF

"Status Quo" OFF

To turn off the "Status Quo" function set the Mode Switch 5 to ON. When this switch is ON the dimmers will all go OFF immediately after loss of control signal.



Mode Switch 5 is ON

Fault Protection

If the SSR heat sink overheats, the OverTemp indicator will turn ON and the pack will shut down. This shows that air flow has been blocked or the fan has failed.

Electromagnetic circuit breakers protect the SSRs if there is a dead short, (defined as .02 ohms or less) across 40 feet of #14 AWG load wires. A short on any dimmer in the pack will trip the circuit breaker for the dimmer OFF. Restore circuit operation by clearing the short and turning the circuit breaker back ON.

Hot Pocket

On 2.4Kw, 6Kw, and 12Kw packs you can check your load wiring for shorts by using the "hot Pocket" on the back of the pack. This receptacle is wired directly to the last circuit breaker (#6 on 6Kw or 12Kw dimmers and #12 on 2.4Kw dimmer) and connected in parallel to the "test outlet" pilot light.

On 2.4Kw dimmers this "hot pocket" is the 24th receptacle (the second receptacle for dimmer #12). You can convert the "hot pocket" to normal dimmer output by moving the power lead for receptacle 24 from the AC input terminal of SSR #12 to its output terminal.

On 6Kw and 12Kw packs, there is a seventh receptacle wired directly to circuit breaker #6.

There is no "hot pocket" on 1.2Kw packs, but you can turn dimmers full ON for testing by using the ON/NORMAL push-buttons on the front of the controller.

This feature also aids in trouble shooting by isolating faults to either the user load or the CD80 Pack.

Local Dimmer Control

Dimmers attached to a CD80 Digital Pack can be turned ON and OFF locally by using either the PANIC switch or the individual ON/NORMAL push-buttons.

Dimmer Panic The alternate action PANIC switch lets you turn all dimmers in the pack ON if required.

Use a bent paper clip or other thin probe to press the PANIC switch ON. Press the switch again to return to normal dimmer control.

ON/NORMAL Push-buttons Each dimmer output can be switched ON using the ON/NORMAL push-button associated with the dimmer.

Press the required push-button to turn the associated dimmer ON. Press the push-button again to return the dimmer to normal dimmer control.

Mode Switch Settings

The 6 position Mode Switch allow various control parameters to be changed as required. Individual switch settings are discussed earlier in this chapter.

Table 4. Mode Switch Settings

Position/ Condition	Effect
Position 1 OFF	reserved
Position 1 ON	reserved
Position 2 OFF	three phase operation
Position 2 ON	single phase operation
Position 3 OFF	dimmer level is the higher of analog and protocol (pile-on)
Position 3 ON	dimmer level is analog + protocol
Position 4 OFF	0-15VDC analog input level
Position 4 ON	0-10VDC analog input level
Position 5 OFF	30 minute output "Status Quo" when signal is lost
Position 5 ON	immediate blackout if signal is lost
Position 6 OFF	uses every other control signal starting with the thumbwheel number
Position 6 ON	uses the first 12 control signals starting with the thumbwheel number

Factory default settings are shown in bold in this table.

Retrofitting an Analog Pack

The 12 channel CD80 Digital Pack Controller (Cat. #8216) is a direct replacement for the CD80 Multiplexed Analog Pack Controller (part #3-258358-010) and the CD80 Discreet Analog Pack Controller (part #3-358362-010). It is very easy to retrofit a 12 channel Digital Pack Controller into an older CD80 pack to provide compatibility with a larger variety of control signals.

1. Make sure that power to the pack is OFF
2. Remove the old controller from the pack.
3. Set the curve jumper as required on the new controller (see 26).
4. If you are going to set the controller to use every other channel for 6Kw or 12Kw packs, attach the switch label provided with the retrofit kit. If the pack controller will be used in multiple applications it is probably better not to attach this label.
5. Set the Mode switches as required.
6. Install the new controller in the pack.
7. Turn power to the pack back ON.

2.

Basic Trouble-shooting

This chapter provides basic trouble-shooting procedures for the CD80 Digital Pack Controller. It does not provide comprehensive maintenance data, but allows you to solve simple problems which may occur, and helps to provide Strand Lighting with initial data when these procedures are not effective.

For best system operation, do a routine check and cleaning once each year unless the operating environment is unusually harsh or dirty. Please consult Strand Lighting field Service if you are in doubt about the frequency of maintenance required for your system. Service and maintenance operations 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 answer the first questions a Strand Lighting Service Representative will ask. The person actually doing the tests should call Strand Lighting in order to avoid confusion and misunderstanding.

Each section of this chapter describes a possible failure mode and actions to be taken. If all actions fail, please call the appropriate Strand Lighting office.

Component Removal

The CD80 Digital Pack has been designed to be serviced easily and quickly by the customer.

Controller Replacement

The Digital Pack Controller can be removed and installed without disconnecting any wiring.

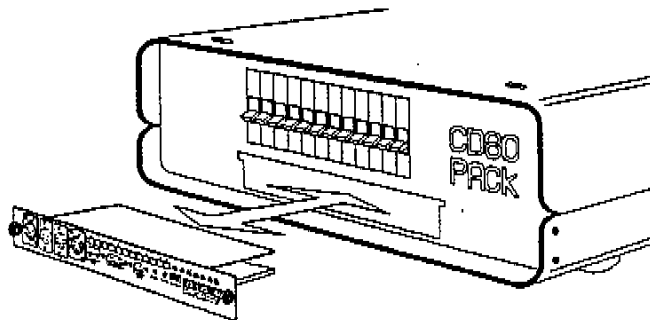


Figure 1. Digital Dimmer Controller Removal

Removing the Controller

1. Turn power to the dimmer pack OFF.
2. Loosen two thumbscrews (on opposite ends of the controller).
3. Pull on the thumbscrews to remove the controller.

Installing the Controller

1. Turn power to the dimmer pack OFF.
2. Line the controller up with guides on each side of the slot.
3. Slide the module in carefully until it touches the connector in the pack.
4. Firmly seat the controller by pressing on both ends of the module.

SSR Replacement Single dimmer failures are usually caused by Solid State Relay (SSR) failure. Replacement of SSRs requires removal of the pack cover.

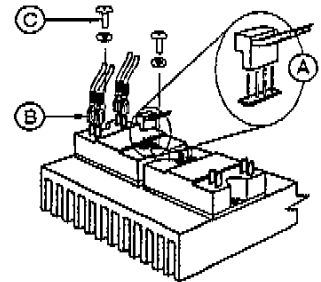
Caution



Clean and coat the SSR mounting surface with thermal compound (Wakefield 120-8 or equivalent) before replacing it on the heat sink.

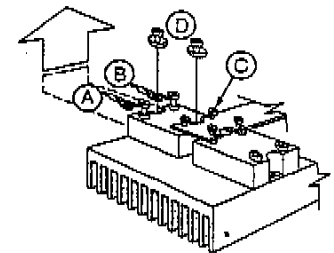
Replacing a 1.2Kw SSR

1. Turn power to the dimmer pack OFF.
2. Remove the pack cover.
3. Unplug the control connector (A) from the SSR.
4. Remove the choke and load lugs (B) from the SSR. Make sure you write down where each of the wires was terminated.
5. Remove the relay mounting screws and lock washers (D).
6. Lift the SSR away from the heat sink.
7. To replace the SSR, reverse the above.



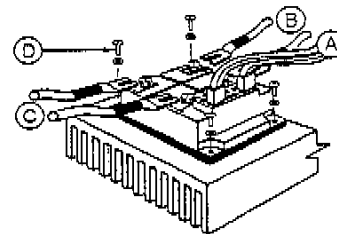
Replacing a 2.4Kw or 6Kw SSR

1. Turn power to the dimmer pack OFF.
2. Remove the pack cover.
3. Loosen (do not remove) the control screws (A) and the choke and load terminal screws (B & C).
4. Remove the relay mounting screws and lock washers (D).
5. Slide the SSR away from the control PCB and lift it out.
6. To replace the SSR, reverse the above.



Replacing a 12Kw SSR

1. Turn power to the dimmer pack OFF.
2. Remove the pack cover.
3. Disconnect the control wires (A) from their terminals.
4. Loosen (do not remove) the choke and load terminal screws (B & C)
5. Remove the relay mounting screws and lock washers (D).
6. Lift the SSR away from the heat sink.
7. To replace the SSR, reverse the above.



Changing other components

The electrical and mechanical components, relays, chokes, breakers, connectors, fan and phase changer are accessible by simply removing the top cover. The relays are fastened from above into the heat sink by two screws and are easily replaced by the customer by removing the two screws and loosening four screw terminal wire connectors.

Problems Affecting the Entire Pack

Problems which affect the entire pack are usually related to incorrect power or control hookup, open fuses, or overheating of the pack.

No phase LED lit

- Controller may not be seated correctly. Remove and reinstall the controller.
- Fuse F1 (phase A) may be open. Replace with a .250A fast blow fuse if required.
- If the fuses are all OK and you can turn the dimmers on with their individual push-buttons, the module is defective. Replace it with a spare and return the defective unit to Strand Lighting for repair.

Phase B or C LED not lit

- Fuse F2 and/or Fuse F3 is probably open. Replace with equivalent fuse.

All phase LED lit but no Protocol indication

- Incoming control wiring may be miswired or one or more conductors broken.

No control of dimmers (dimmers are always OFF)

- If the OverTemp light is ON, the pack has shut down from overheating. Make sure that the air intake and exhaust are not blocked and wait for the thermostat resets.
- The thumbwheel switches may be set to an incorrect address. Check the settings and correct as required.

No control of dimmers (dimmers are always ON)

- The PANIC switch may be ON or one or more individual push-buttons may be ON.

Problems Confined to a Single Phase

Problems which are confined to a single phase are usually related to Controller problems or to the dimmer pack being incorrectly set up for the type of power in use.

Four consecutively numbered dimmers will not go ON

- The power feed for the phase may be OFF or not connected.
- The control module may be incorrectly inserted. Remove it and carefully re-insert it into the dimmer pack.
- One or more output control circuits may have failed. Swap the Controller with a known good spare. If the problem goes away, return the defective Controller to Strand Lighting for repair.

One or more dimmers on the same phase do not come up to full or do not track correctly

- The phase change switch or Mode Switch 2 may be incorrectly set. Make sure that the pack is set up for the type of AC power you are using.
- The phase fuse may be open (F2 for phase B and F3 for phase C). Check the fuses and replace if necessary. Since the phase A fuse (F1) powers the electronics as well as providing a phase reference, an open phase A fuse will completely disable the pack.
- One or more output control circuits may be defective. Replace the defective Controller with a spare and return the defective unit to Strand Lighting for repair.

Individual Dimmer Problems

Problems relating to individual dimmers are due to one of the following:

- Dimmer circuit breaker is OFF
- Defective load wiring or burned out lamp in fixture
- Defective Controller module
- Defective discreet analog control wiring
- Defective SSR, circuit breaker, or choke (probably the SSR)

Check for a load wiring problem or burned out lamp by turning the ON/NORMAL switch for the dimmer ON or by moving the suspect load to a known good dimmer. If the problem remains, repair the problem in the load circuit or lamp.

Check for a defective Controller module by swapping it with a known good unit from another pack. Make sure that the Mode switches are set the same way before replacing the Controller module. If the problem goes away with the new module, replace the defective Controller module with a spare and return the defective unit to Strand Lighting for repair.

Check for a defective SSR, choke, or circuit breaker by checking the voltage at the circuit breaker output, choke output, and SSR output with the dimmer ON. The component with an input but no output is defective. Replace the defective component.

If the dimmer works from the console (protocol input) but not from the discreet analog input, there is a problem in the discreet analog circuitry, probably external to the pack.

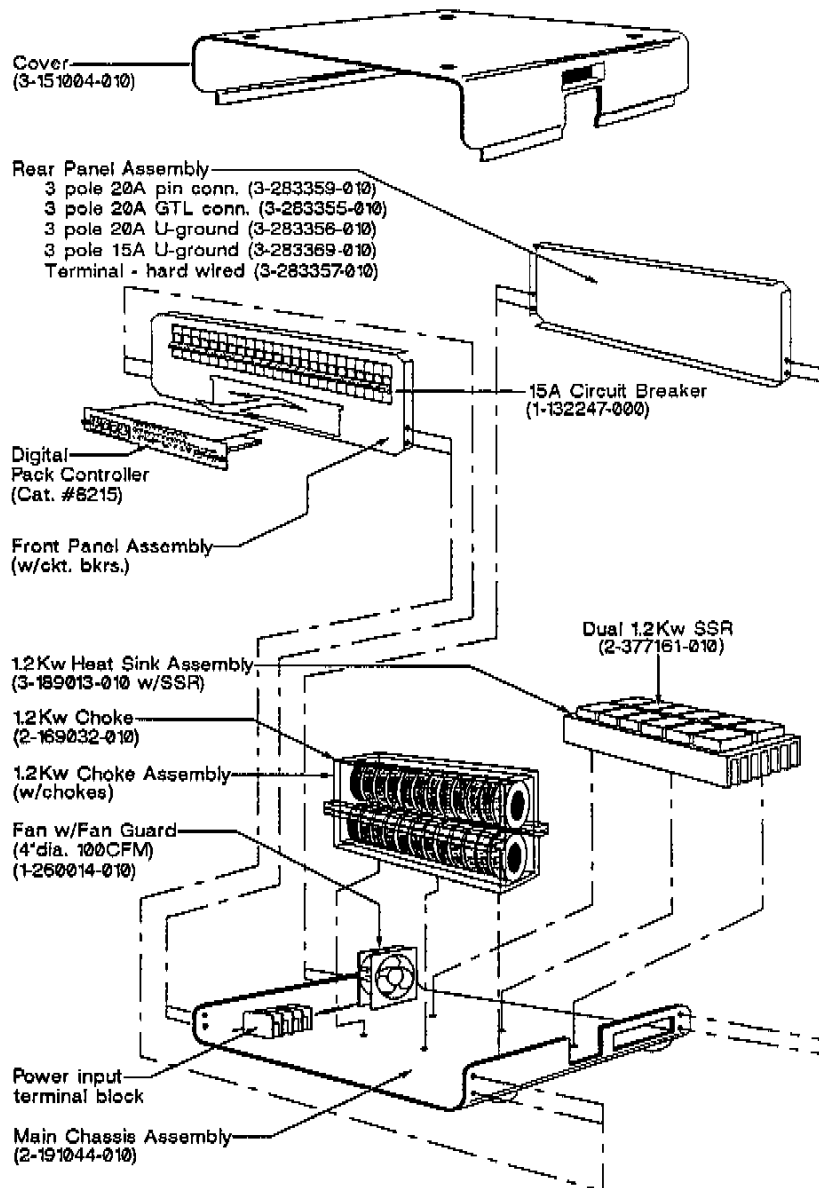


Figure 2. 1.2Kw Digital Pack Parts

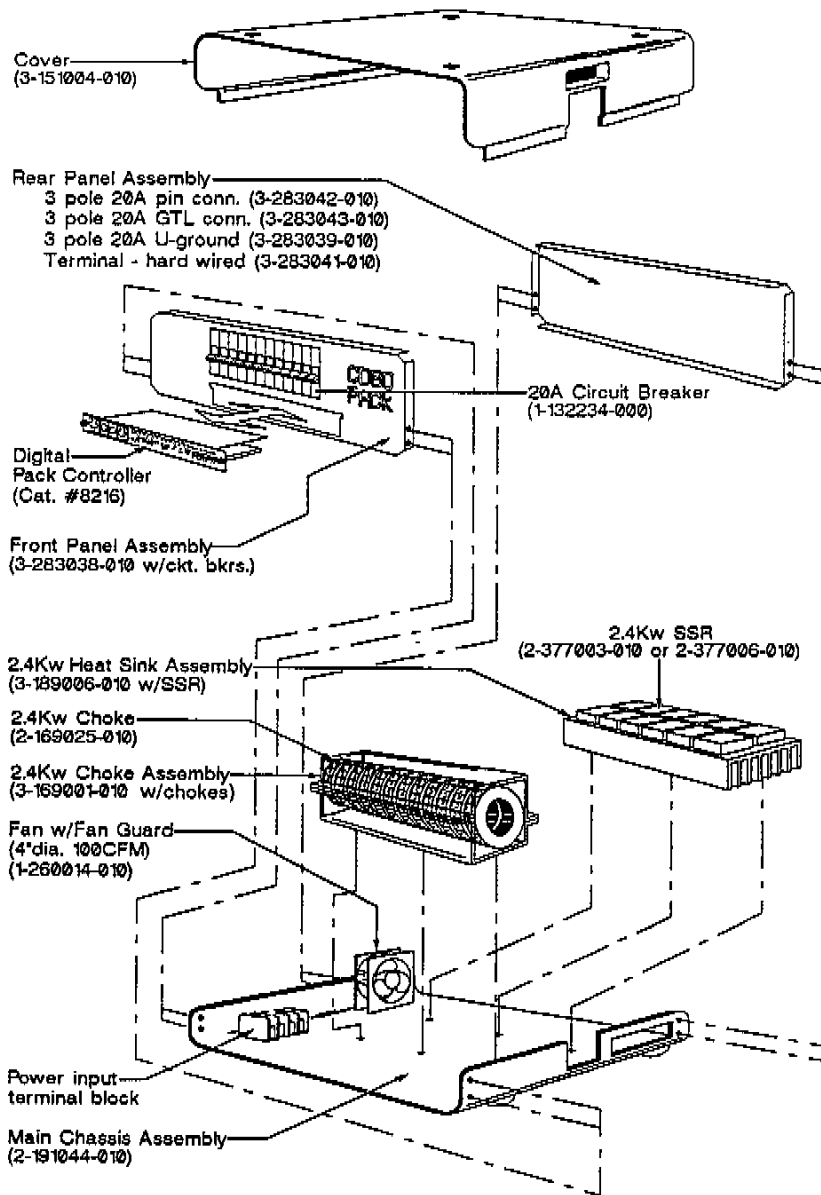


Figure 3. 2.4Kw Digital Pack Parts

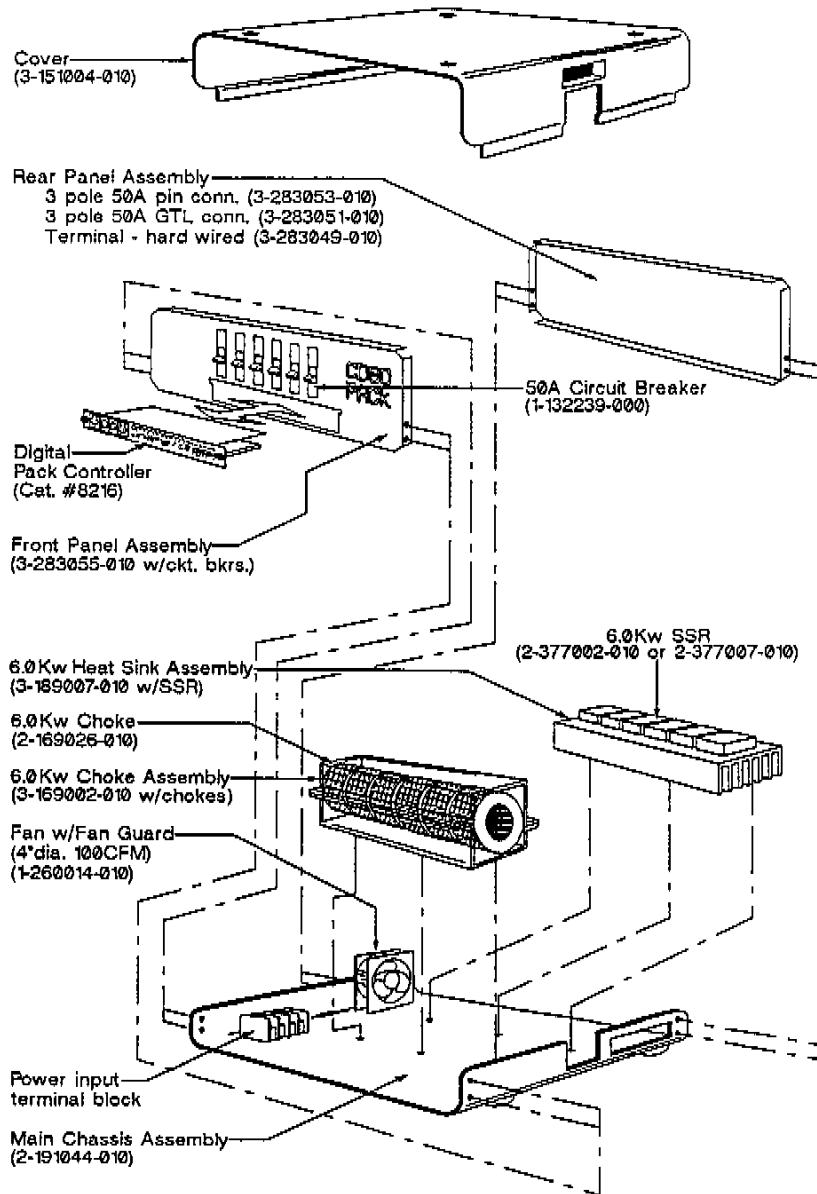


Figure 4. 6Kw Digital Pack Parts

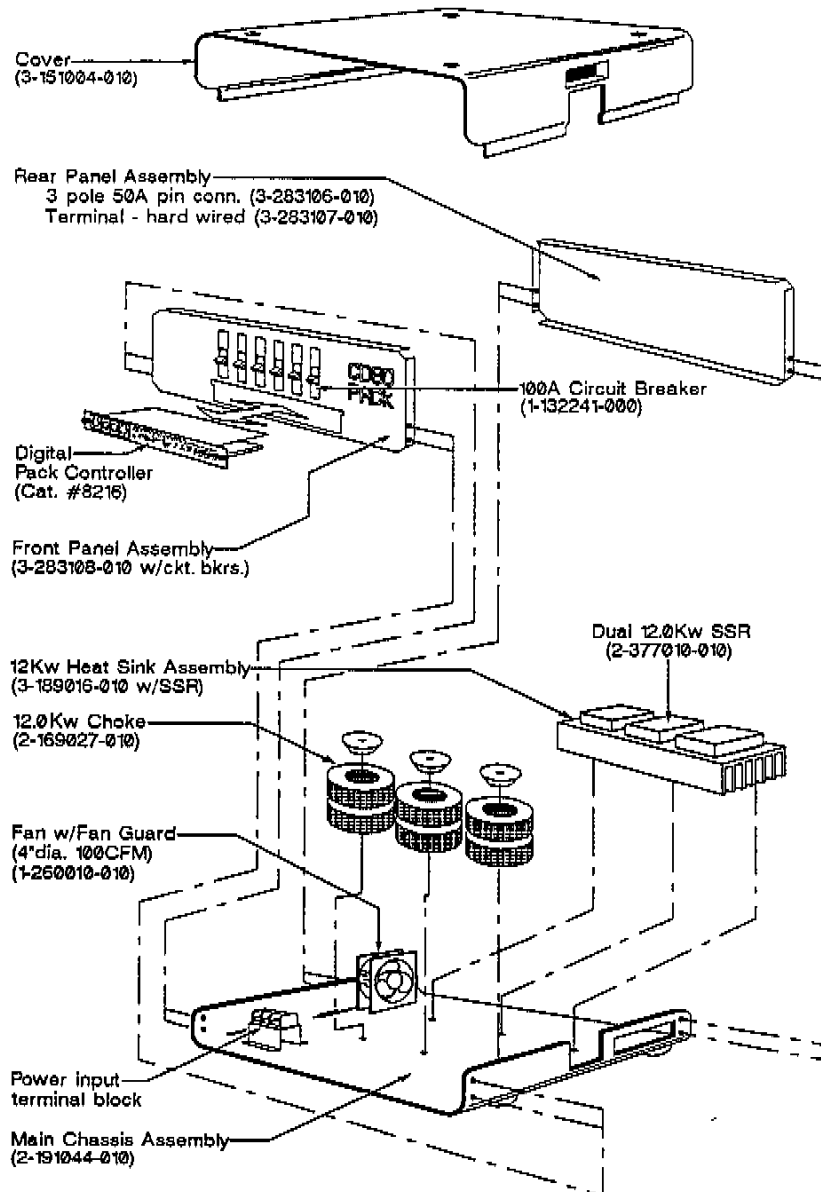


Figure 5. 12Kw Digital Pack Parts

Periodic Maintenance

Periodic Maintenance should be done every six (6) to twelve (12) months, depending on the environmental conditions. Although a detailed discussion of this procedure is beyond the scope of this manual, basic checklists are provided to show what is involved. Users wishing to do these procedures on their own should consult Strand Lighting Field Service.

1. Turn power to the dimmer pack OFF.
2. Inspect the dimmer pack for loose connections, build-up of dust, and (for permanent or semi-permanent installations) placement of obstructions around it which may impede air flow. Tighten any loose connections found at this time.
3. Vacuum out any excessive dust build-up in the dimmer pack while power to the pack is shut down.
4. Remove the Control Module from the pack, dust it off with a soft natural bristle brush, and clean its edge connectors with a mixture of 70% denatured alcohol and 30% distilled water (or other cleaning compound intended for gold edge connectors).
5. Exercise all circuit breakers by turning them ON and OFF several times. The arc produced when the circuit breakers engage and disengage will clean corrosion and dust off of the contacts.

For best effect the lights for the dimmers should be ON when you do this.

6. Replace Control Module.
7. Turn power to the system ON and verify proper functioning.

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