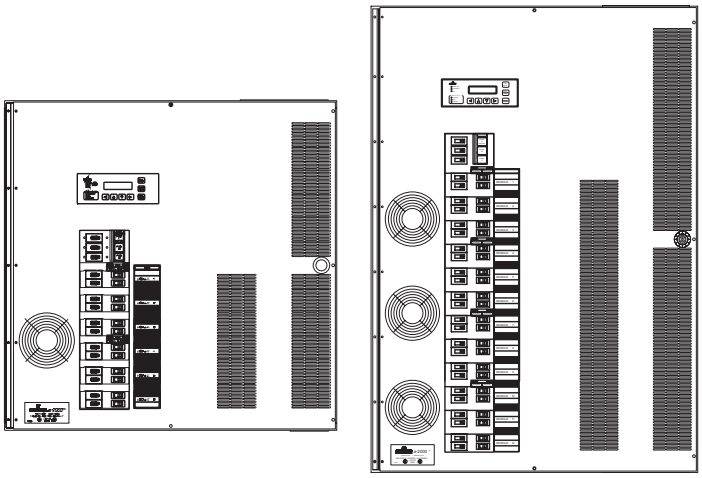
User Guide

a-2000™ Dimmer Cabinet with Digital Controls

12 & 24 Circuit Versions

Software revision 2.40 and above



Notes:

Overview

Inspection

Carefully unpack the dimmer system, and inspect to make sure there has been no hidden shipping damage. Report all damage to the freight carrier who delivered the system. Claims for damages are filed with the freight carrier as all freight is shipped FOB Tualatin, Oregon. The a-2000 can be serviced in the field with replacement factory components in case of damaged parts.

Updates

For updates to this manual, latest bulletins, announcements, and other helpful documentation, please reference the support and product sections of Leviton's webbiest which can be found at http://lms.leviton.com.

Description

The compact physical design of the a-2000 dimmer cabinet takes up a minimum of wall space and allows it to be recess-mounted in a 4-in. deep wall. When surface mounted it also complies with ADA requirements. There are three sizes of cabinets:

Max. Circuits	# of Dual Module Slots	Weight - Fully Loaded	Dimensions - in. (CM)*
12	6	145 lbs. (66Kg)	30 $^{1}/_{8}$" W x 29$^{7}/_{8}$" H x 4 $^{1}/_{8}$" D (76.5 x 75.9 x 10.5)*
24	12	155 lbs. (70.3 Kg)	30$^{1}/_{8}$" W x 43" H x 4 $^{1}/_{8}$" D (76.5 x 109 x 10.5)*
Relay Section	12 Relays	60 lbs. (27.2 Kg)	14$^{1}/_{4}$" W x 43 "H x 4$^{1}/_{8}$" D (36.2 x 109 x 10.5)*

Table 1 - Cabinet Properties

* Flush trims add 2" (5.08 cm) to overall length and width.

Some of the dimmer features are:

- Plug-in design
- Fan cooling
- Ability to dim virtually any lighting load
- UL Listed for use in USA and Canada
- Compliant with NEMA requirements
- Easy to install
- Generous wiring space
- Main circuit breaker capability

The control portion of the dimmer cabinet employs all digital circuitry for accuracy and for minimum wiring requirements between the dimmer cabinet and its control systems.

Surface-mount and flush-mount units both include necessary mounting hardware.

Control Overview

The Leviton a-2000D Dimmer Cabinet uses an intelligent central control card (Digital Main Control Module), enabling the dimmers in this system to dim and control virtually any incandescent or fluorescent lighting load. The software can tell a dimmer module whether it is to be a dimmer or a non-dim, tell it what type of fluorescent dimmer ballast it will operate, and set up the required parameters to properly drive virtually any type of fluorescent dimmer ballast. You can use three different types of control input signals, Luma-Net III, DMX512 and 0-10VDC (with optional Analog Card) to control the dimmers. The LCD display provides an easy user interface.

Mounting - Surface or Flush Mounted?

The 12 and 24 circuit dimming cabinets comes standard for surface mounting. In order to flush mount the unit, you must use the appropriate flush mount hardware kit. Consult the factory for the appropriate kit.

Cabinet Size/Type	Flush Trim Kit Part Number
12	A2K12-T10
24	A2000-T10
12+24	A2K12-T30
24+24	A2000-T20

Table 2 - Flush Trim Kits

Stacked Mounting

The following cabinets can be joined together vertically and wired with a single feed:

- 12+24 - Factory only.
- 24+24 - Field or factory. Field kit part number A2K24-Kit

This can be accomplished in the factory or the field using a UL listed bussing kit.

Cooling Fans

Both surface and flush-mounted units contain fans for cooling. They are relatively quiet, but this unit should not be mounted where minor fan noise is objectionable. The fans are rated at 41 dBa each. The fan(s) are normally off when the system is off, and comes on when any dimmer comes on.

NOTE

Cooling Fan dust covers should be removed and cleaned with compressed air or non abrasive cleaning agent every 6 months for optimum fan operation.

Feed and Load Wiring

The entire right side of the dimmer cabinet is reserved for power wiring. The cabinet includes:

- Knockouts for feeding in and out through the top, bottom, or right side of the cabinet.
- Main lugs for phases A, B, and C (or A and B in the case of a single-phase cabinet)
- A load terminal block.
- A multi-terminal neutral block.
- A single ground terminal

An optional multiple-terminal ground bus is available, part number OPT-A2GND-KIT.

Unless limited by an optional main breaker, the main lugs are sized for every dimmer to be loaded to maximum capacity. You may elect to size the feed to the actual connected load on the cabinet.

Control Input Wiring

The upper left portion of the dimmer cabinet is reserved for control wiring.

Fluorescent Wiring

There are several types of fluorescent dimming ballasts. Check carefully for the type of ballasts you are installing on this system.

NOTE

Incorrect wiring of these ballasts to dimmers can damage the ballasts.

Turn On

Prior to turn on, verify the following is installed correctly:

- Main feed wiring
- Load wiring
- Control wiring
- Configuration of each module with the type of load connected and any ballast control wiring

Bypass Switch - Non Universal 120V Units Only

The Bypass switch has two modes: Normal and Bypass. When the switches are set to Bypass, all the dimmer electronics are removed from the circuit and line is connected directly to load. Leviton normally ships the cabinet with all these switches in the Bypass position and all circuit breakers in the Off position.

Bypass Shunts - Non Universal 277V Units Only

On 277V units, the bypass is accomplished via an optional constant module.

Bypass Switch-Universal Units Only

The bypass switch has two modes: Normal and Bypass. When the switch is set to Bypass (red LED illuminated) the SCR's and relays are forced to turn on independent of the control module.

Modules

The dimmer modules simply slide and plug in. No tools are required, except for a shipping screw when dimmers are pre-installed at the factory.

NOTE To avoid misapplication of product, 277V cabinets are mechanically keyed to reject 120V modules and the previous style of 277V dimmer modules without integral breakers.

Checklist

- ☐ Unpack the system
- ☐ Report any damages to the freight carrier
- ☐ Attach the flush or surface mounting hardware
- ☐ Attach the cabinet to the wall
- ☐ Terminate the main feed wiring
- ☐ Terminate the load wiring
- ☐ Terminate control wiring
- ☐ Verify the dimmer ballasts are correctly wired
- ☐ Verify the main feed wiring
- ☐ Verify the load wiring
- ☐ Verify the remote control wiring
- ☐ Verify the configuration of each module

Warnings

1. To be installed and/or used in accordance with appropriate electrical codes and regulations.
2. To be installed by a qualified Electrician.
3. DO NOT CONNECT line voltage wires to low voltage terminals.
4. When a magnetic low voltage circuit is operated at a dim level, with all lamps inoperative, excess current may flow through the transformer. To avoid possible transformer failure, due to over current, use a transformer that incorporates thermal protection or a fuse in the primary winding.
5. For best lamp life, lamp manufacturers recommend their fluorescent lamps should be operated at full brightness for a minimum or 100 hours before dimming is permitted. For best results, lamp brands and types should not be intermixed on a circuit

   5a) Hook up flourescent control wiring, if required
6. When using with fluorescent ballasts, both lighting fixture and ballast must be grounded.
7. Use this dimmer cabinet only with 90^{o} C copper wire at 75^{o} ampacity.
8. Do not mix load types on a single zone (i.e. 120 V tungsten and magnetic low voltage).
9. Disconnect power when servicing the dimmer, fixture or when changing lamps.
10. Indoor use only.
11. TO AVOID FIRE, SHOCK OR DEATH: TURN OFF POWER AT MAIN CIRCUIT BREAKER OR FUSE AND TEST THAT THE POWER IS OFF BEFORE WIRING, OPENING THE PANEL, OR REPLACING A DIMMER MODULE!

Installation

Installation Checklist - Non Universal 120V Units

Install the cabinets by following these simple steps:

Step 1 Mount the cabinets to the wall
Step 2 Hook up the feed/line wiring
Step 3 Hook up the load wiring
Step 4 Wire the Relay Cabinet (OPTIONAL)
Step 5 Hook up the control input wiring
Step 6 Hook up the fluorescent control wiring, if required
Step 7 Install the dimmer modules
Step 8 Verify the dimmers are in bypass mode
Step 9 Double check the wiring
Step 10 Power up the system
Step 11 Clear any faults that have caused any breakers to trip
Step 12 Set the bypass switch to normal
Step 13 Set up and Configure the control module

Installation Checklist - Non Universal 277V and Universal Units

Install the cabinets by following these simple steps:

Step 1 Mount the cabinets to the wall
Step 2 Hook up the feed/line wiring
Step 3 Hook up the load wiring
Step 4 Wire the relay cabinet (optional)
Step 5 Hook up the control input wiring
Step 6 Hook up the fluorescent contorl wiring if required
Step 7 Install constant modules (optional) or dimmer modules
Step 8 If using universal modules verify the switches are in bypass mode
Step 9 Double check the wiring
Step 10 Power up the system
Step 11 Clear any faults that have caused any breakers to trip
Step 12 Disconnect power to cabinet if constant modules were installed
Step 13 Install the dimmer modules if constant modules were installed
Step 14 Set Bypass switches to normal if they were used
Step 15 Set up and Configure the control module

Step 1: Mounting

The cabinets can be mounted either Surface or Flush (recessed into wall). Verify that the correct hardware was ordered and proceed to the appropriate step! 120 and 277 volt cabinets mount in the same fashion.

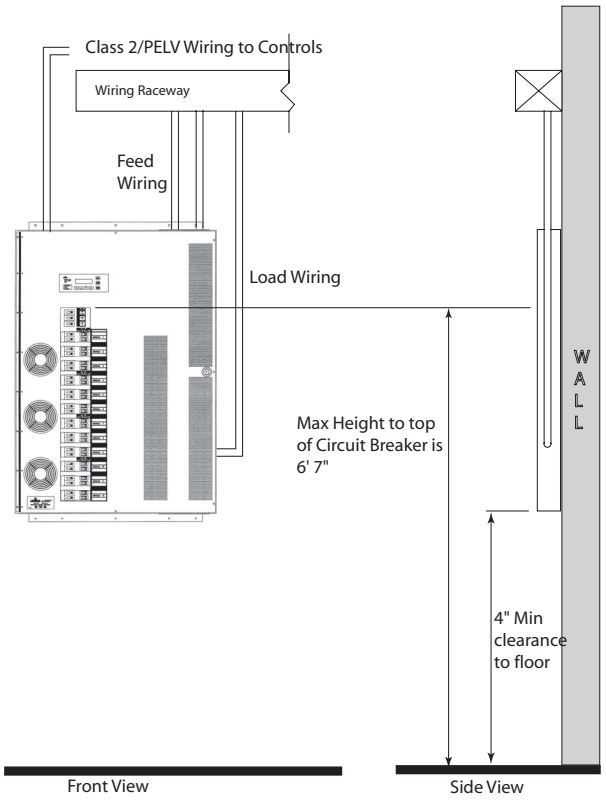


Figure 1 - Suggested Mounting - Single Cabinet ONLY

NOTE

For mounting two cabinets one above the other see instructions provided with the bussing kit.

Step 1A -Surface Mount

1. Locate the Surface Mount Hardware and place them on the back of the top and bottom of the cabinet as shown in Figure 2.
2. Screw them in place with the provided 10-32 x $^1/_4$" self tapping screws
3. Attach the unit to the wall. There is a center hole and holes on 16-in. and 24-in. centers. These 5/16-in. holes allow #10 or $^1/_4$" hardware to be used to anchor the cabinet.
4. Remove the shipping screws holding the front door closed; these are located along the top, bottom and right edge
5. Using the keys provided, open the hinged front door and proceed to Step 2: Feed and Load Wiring.

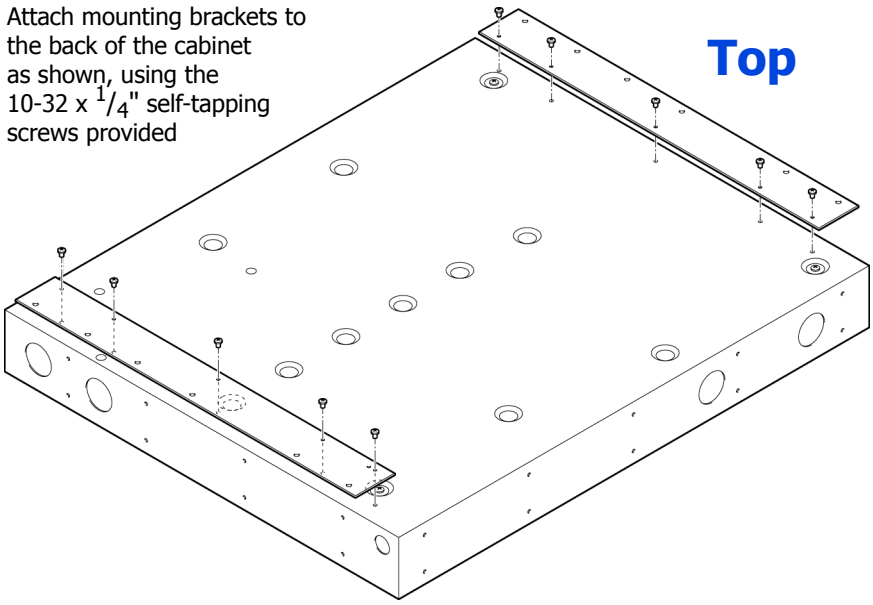


Figure 2 - Surface Mount Hardware

NOTE

Leviton recommends that cabinet mounting hardware reaches through the drywall and attaches to the wall studs. However, properly sized struts and suitable hardware can also be used. They must distribute the load to the anchors without exceeding the recommended anchor limit. Using drywall screws directly through drywall without a stud is not recommended.

Flush Mount

Step 1B - Flush Mount Frames

NOTE

All Cabinets are designed to accept a Flush Mount kit (See Table 2) which is designed like a picture frame. To install, simply remove door, screw the four pieces to the front frame of the cabinet using the provided hardware and replace the door.

Install Steps - All Cabinets

1. Remove the screws holding the front door closed; these are located along the top, bottom and right edges.
2. Locate the Flush Mount Hardware and place on the side of the cabinet as shown in Figure 3.
3. Screw them in place with the provided 10-32 x 1/4" self tapping screws. The bottom left edge is not accessible for attaching a fourth mount.
4. Attach the unit to the wall using #10 or larger screws or 16-penny or larger nails, through the 1/4" diameter holes in the mounting bracket and on the top, right, and bottom sides of the cabinet.

5 Once the cabinet is mounted, proceed to Step 2: Feed and Load Wiring.

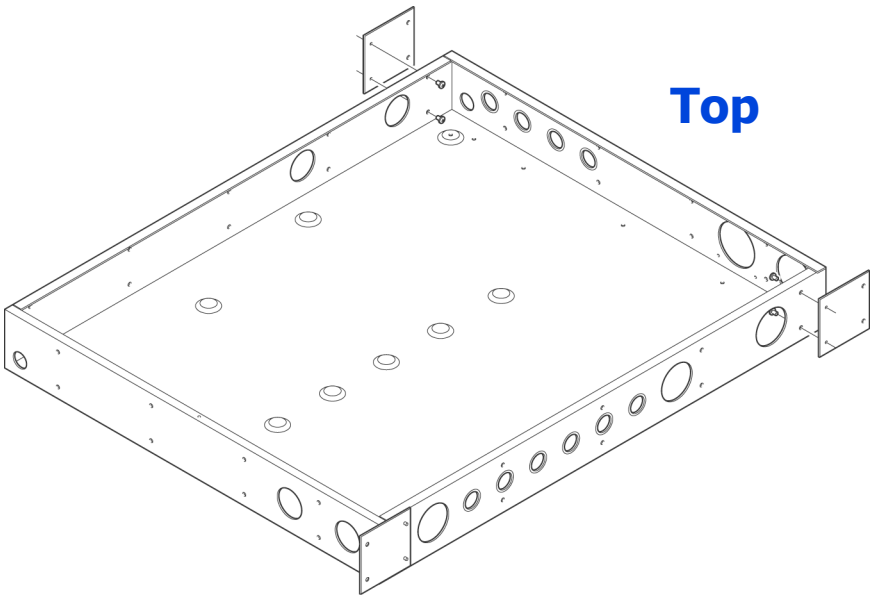


Figure 3 - Flush Mounting Hardware

Main Feed and Load Wiring

Step 2: Power Wiring - Feed\Line Wiring

The entire right side of the dimmer cabinet is reserved for power wiring. Refer to Figure 4 and the cabinet labels for all appropriate wiring notes. The cabinet includes:

- Knockouts for feeding in and out through the top, bottom, or right side of the cabinet.
- Main lugs for phases A, B, and C (or A and B in the case of a single-phase cabinet (feed terminates to optional main breaker if provided).
- A load terminal block to land all the dimmer output load wiring.
- A multi-terminal neutral block.
- A single ground terminal.

Consult the factory if a multiple terminal ground bus is needed for your particular installation.

NOTE

Unless limited by an optional main breaker, the main lugs are sized for every dimmer to be loaded to maximum capacity, however you may elect to size the feed to the actual connected load on the cabinet.

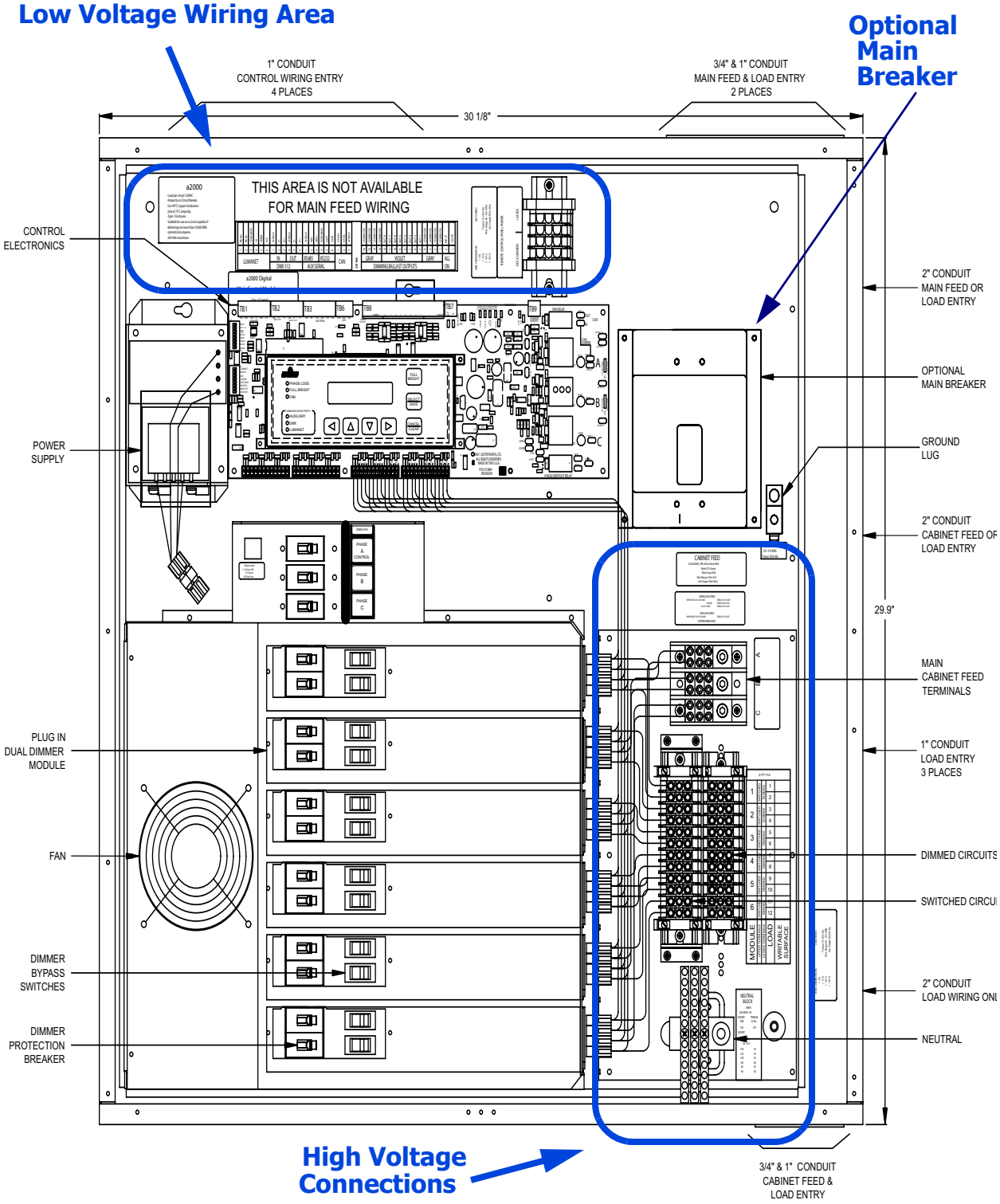


Figure 4 - Typical Low Voltage and High Voltage Wire Connections

Note: Non Universal Cabinet pictured above

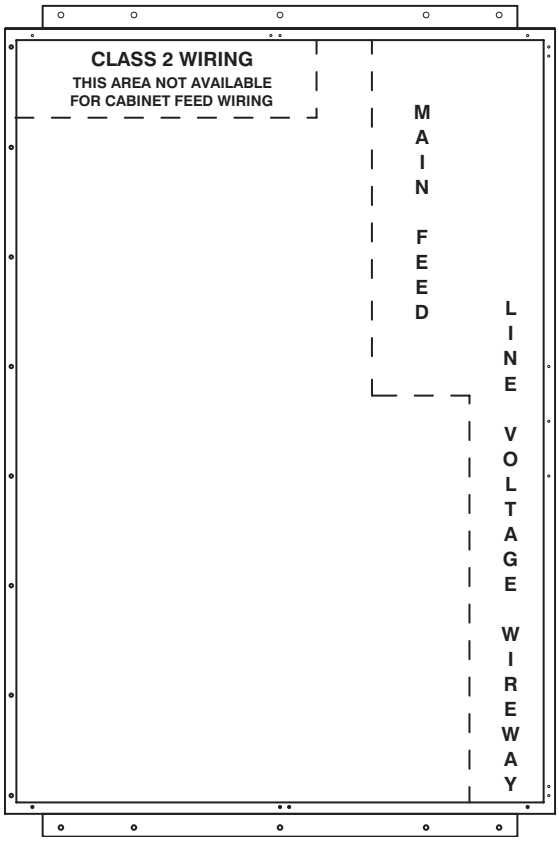


Figure 5 - Appropriate Wireways for High and Low Voltage Wires

Depending on the cabinet that was ordered, it will have either main lugs or a main breaker. See Table 4-5 for feeder information. Information shown is for feeder lugs only. If optional main breaker is installed, feeder information may be reduced. Preferred entry is from the top or the top right hand side of the cabinet, but may be run from the bottom as well.

Cabinets with Main Breakers (factory installed)		
Main Breaker Size (A)	**Cabinet Sizes**	**Wire Size**
30, 50, 60	12, 24	#14-#2 AWG
40	24	#14-#2 AWG
70, 80, 100	12, 24	#12-2/0 AWG
90	24	#12-2/0 AWG
110, 125	24	#4-250kcmil
125 (1 phase only)	12	#4-250kcmil
150	24, 36	#4-250kcmil
175, 200	24, 36	#4-250kcmil
225	36	#4-250kcmil
Main Breaker not available	48	N/A

Table 4 - Max Feeder and Wire Size, Cabinets with Main Breakers

Cabinets with Main Lugs			
Cabinet Size	Phase	Max Feed Size	Wire Size
12	1	125A	#14-#2 AWG
	3	80A	#14-#2 AWG
24	1	250A	#6-250kcmil
	3	250A	#6-250kcmil
36	1	250A	#4 - 250kcmil
	3	175A	#4 - 250kcmil
48	1	500A	(2) #6-250kcmil
	3	350A	(2) #6-250kcmil

Table 5 - Max Feeder and Wire Size, Cabinets with Main Lugs

Step 3: Load Circuit Wiring - 120 Volt Units

Load and neutral terminal blocks accept the following wire sizes:

Load Terminal (AWG)		Neutral Block (AWG)	
Quantity	Size	Quantity	Size
1	#8	1	#4
1	#10	1	#6
1-3	#12	1	#8
1-4	#14	1	#10
		1	#12
		1	#14

Table 6- Wire Combinations for Load and Neutral Block

Preferred wire entry is from the right hand side of the cabinet.

For all loads except Lutron's Hi-Lume ®, Eco-10, Fluorescent dimming ballasts and the Leviton High Rise Dimmer Module:

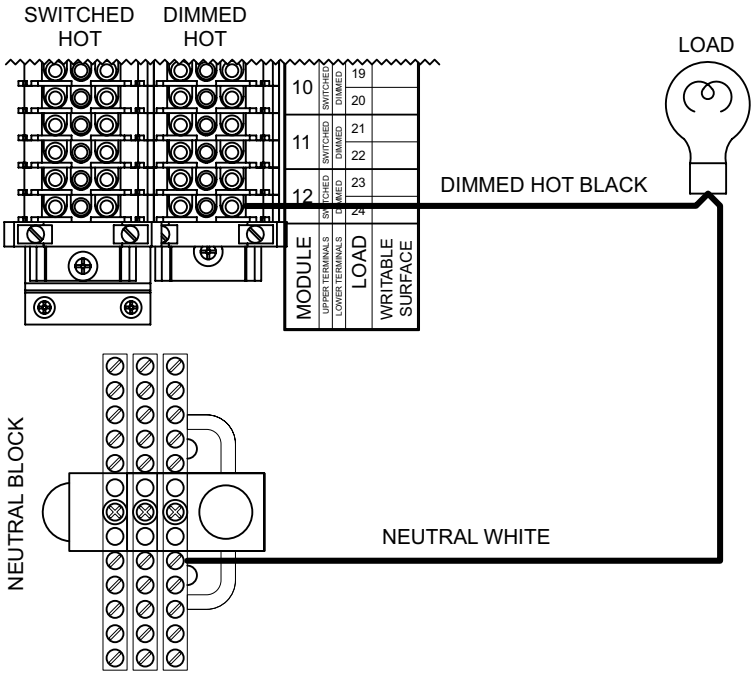


Figure 6 - Incandescent, Non-Dim and Constant Loads

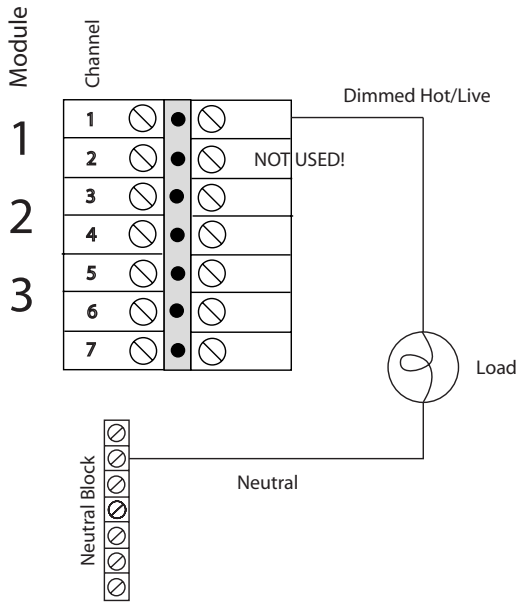


Figure 7 - Load Terminal Wiring for Leviton High Rise Time Dimmer

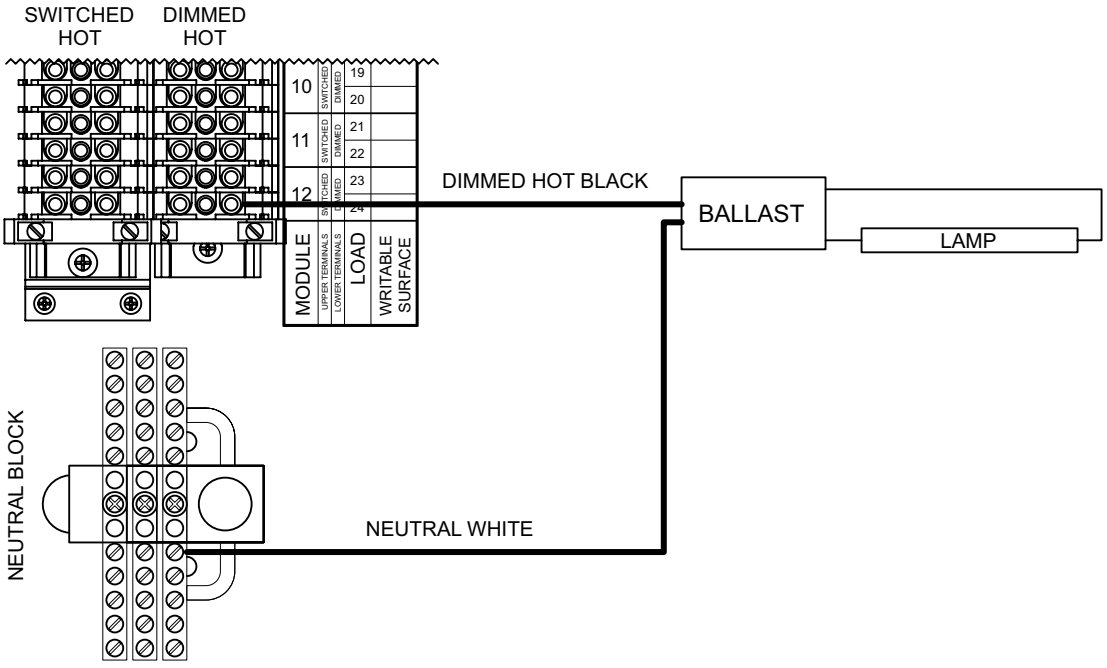


Figure 8 - Load Terminal Wiring for Advance Mark X™ or Lutron Tu-Wire™

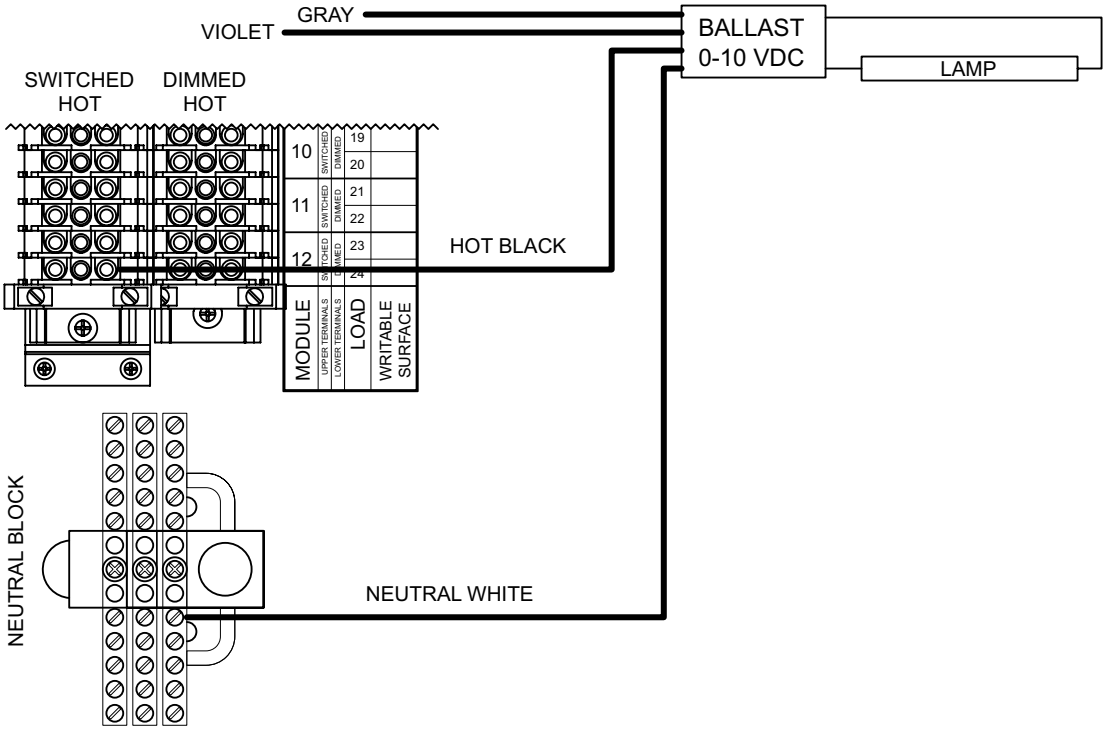


Figure 9 - Load Terminal Wiring for 0-10 VDC Control Dimming Ballasts

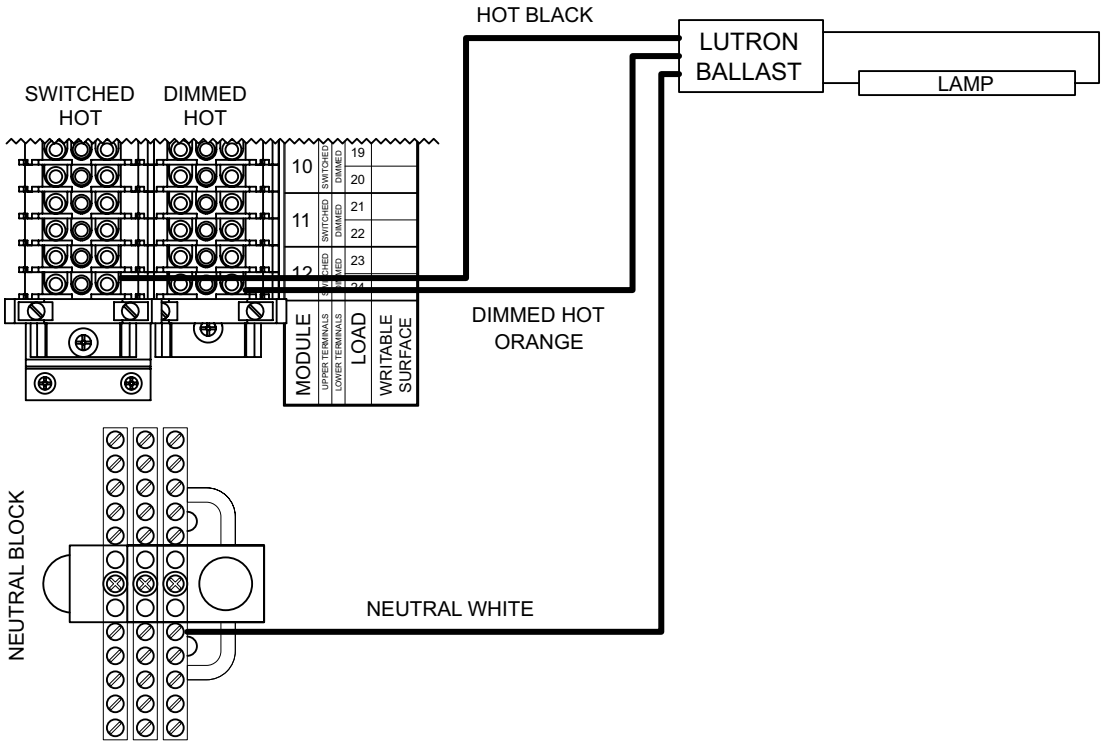


Figure 10 - Load Terminal Wiring for Lutron Hi-Lume or Eco 10

Step 4 - Relay Cabinet (OPTIONAL)

The optional relay cabinet is primarily intended for 277 Volt fluorescent dimming ballast with a 0-10 VDC control signal. However the cabinet can accommodate 120V and 347V applications and may be used for any non dim load. They come completely pre-wired and attached to the main a-2000 cabinet. The relay cabinet can be configured with branch circuit breakers as shown in Figure 12. The relay cabinet must be ordered attached to a either a 12 or 24 channel cabinet only at the factory.

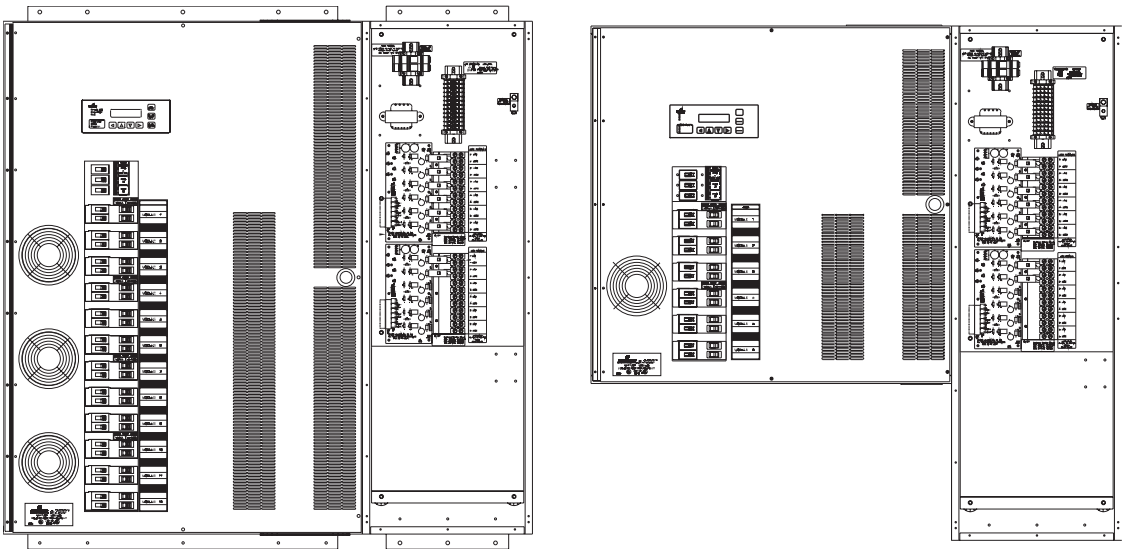


Figure 11 - Relay Cabinets Attached to a 24 Circuit a-2000 Cabinet (on left) and a 12 Circuit cabinet (on the right)

Branch Breakers in the Relay Cabinet - See Figure 12:

To wire the relay cabinet, follow these simple steps:

1. Remove or open the door.
2. Run and land the power/feed wires to the relay Cabinet Feed Terminals
3. Run and land the load wires to the Load side of the relay terminal block
4. Run and land the neutral wires to the Neutral Terminal Block
5. Run and land the ground wire to the Ground Lug

No Branch Breakers in the Relay Cabinet -See Figure 13:

To wire the relay cabinet, follow these simple steps:

1. Remove or open the door.
2. From the external branch circuit breaker, run and land the power wires to the Line side of the relay terminal block
3. Run and land the load wires to the Load side of the relay terminal block
4. Run and land the neutral wires to the individual Neutral Terminals
5. Run and land the ground wire to the Ground Lug

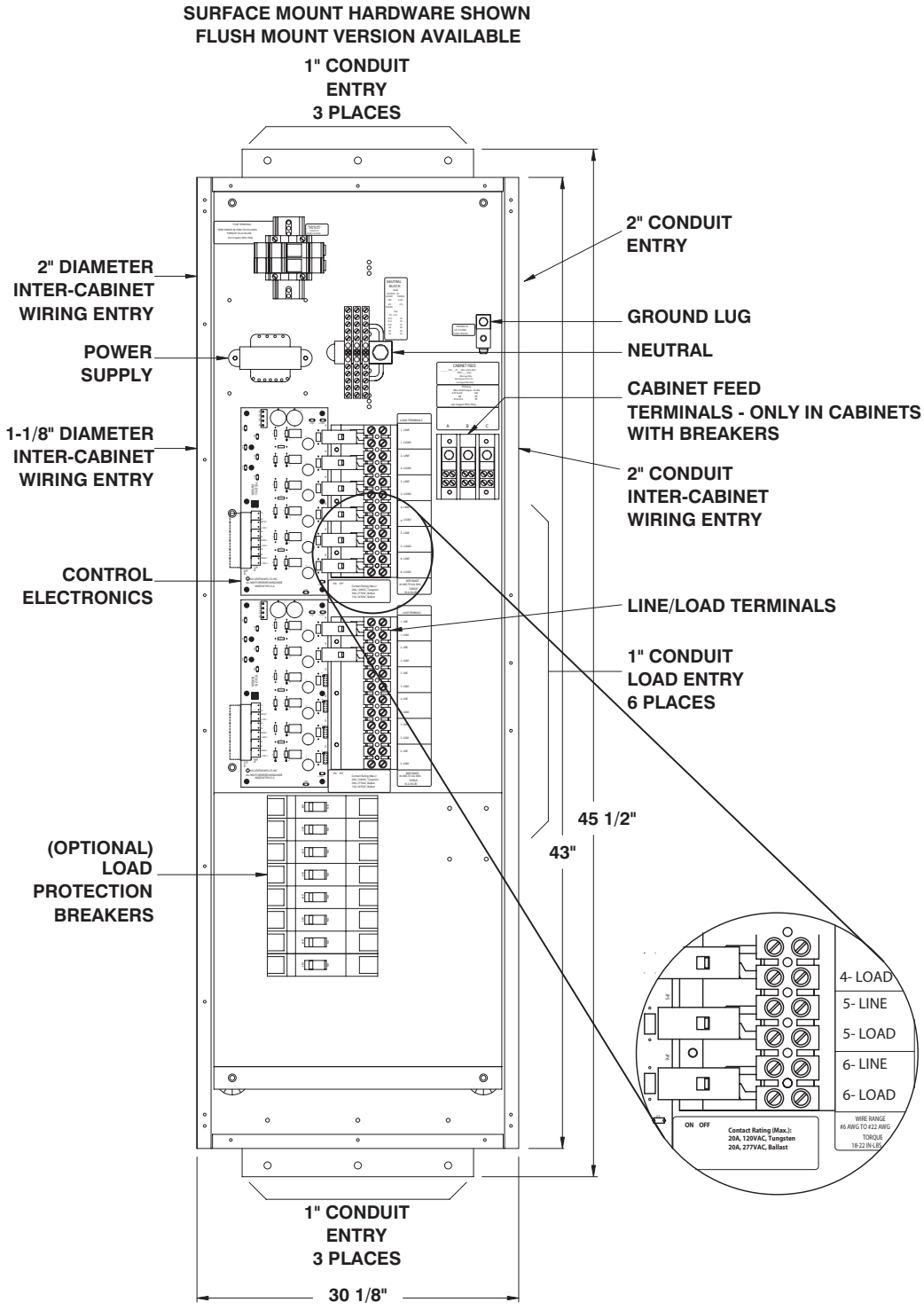


Figure 12 - Detail of Relay Cabinet (Optional Breakers shown - other similar)

Low Voltage Control Wiring

Step 5: Control Input Wiring

Once the power wiring has been completed, control wiring can be addressed. The upper left side of the dimmer cabinet is reserved for control wiring. Refer to Figure 4 and 28 for the location of the control module and the low voltage wire way. Terminate all control wiring directly to the terminal blocks on the printed circuit card found in the upper left location. Use a small 1/8-in. flat screwdriver on these terminals.

Wire Range:

- 24-12 AWG, Stranded, Torque to 9 in-lbs.
- 16-8 AWG, Stranded, Torque to 18-20 in-lbs. for 24 Channel power supply terminals

The digital control panel can accept the following control signals:

- Luma-Net® III
- DMX512
- Analog 0-10VDC Inputs - Available as an Option

NOTE

See the Appendix for a full description of the various control inputs

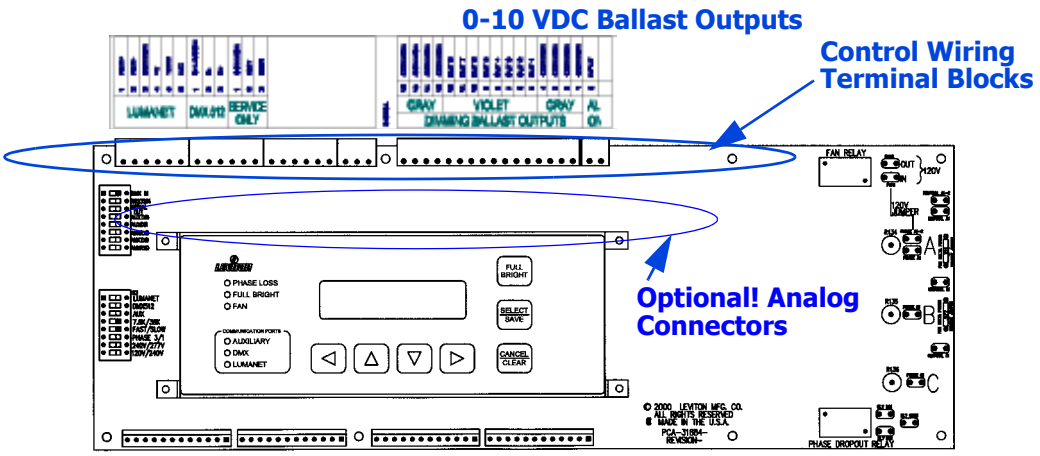


Figure 13 - Digital Control Module

Luma-Net® III

Power Considerations for Control Systems

The control system should be carefully planned out to take into consideration these important issues:

- Power Supply for Control Stations
- Wire Size for Power Runs

On most systems, our applications engineering department has already managed these calculations for you so this information should be irrelevant. However, if this is not the case, like an ASAP (Quick Ship) program, when adding on to a system or planning for a remodel, you will want to take this information into consideration.

Power Requirements & Maximum Run Length

Each device on a Luma-Net network has a different load (draw) and each source of power can support a different total load (supply.) To determine the total capacity of your network, first determine the maximum supply current of your power source, convert that to Unit Loads, then determine the total load it can handle by summing the load of each device.

NOTE

One Unit Load = 25mA

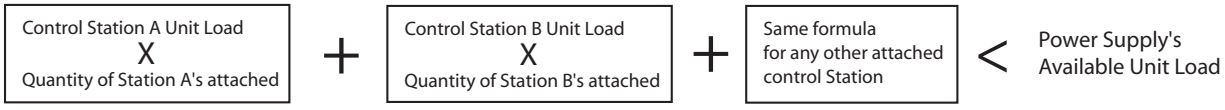


Figure 14 - Load Rating Verification Formula

The a-2000 cabinets are designed to be able to power either D4200 or D8000 stations from the internal power supply. See Table 7 for the available power from each cabinet.

Supply	Maximum # of Unit Loads
a-2000D, 12 Circuit, Standard Power Supply	40
a-2000D, 24 Circuit Standard Power Supply	24
NPC – XP	49
NPC – DHV	0 (no Luma-Net)
NPC – DLR	49

***Table 7 -* Power Supply Maximum Unit Loads**

Station Type	Unit Load (per station)	Station Type	Unit Load (per station)
D4200 LCD	2	D8000 Entry (Button)	1
D4200 Entry (Button)	1	D8000 Slider	1
D4200 Room Combine Station	1	D8000 Key switch	1
D4200 Remote I/R	1	D8000 Port (LumaEdit, A/V, etc.)	1
Luma-Net Hub	3	D8000 Combine/Closure (Advanced)	10
D8000 LCD	2		

Table 8- Control Station Loads

Example:

Suppose we had a network with the following equipment:

- D4200 LCD Stations
- D4200 Entry Stations
- Remote IR Station
- Powered from an a-2000 24 Cabinet with a Standard Power Supply

Use these quantities along with the Load Rating verification formula (Figure 15) to do the math and verify that the combined unit input load does not exceed the maximum input Unit Load Available.

	Quantity		Unit Loads		
D4200 LCD Stations	4	x	2	=	8
					+
D4200 Entry Stations	6	x	1	=	6
					+
Remote IR Station	1	x	1	=	1
				Total	15

15 is less than the 40 available so all the components CAN BE wired on a single run from the a-2000 24 Channel cabinet without an additional external power supply.

Power Wire - Run Length

The maximum total run length of each segment is a function of the total number of unit loads. A run becomes to long when the voltage drop, due to wire size and run length, increase to a point where the station does not have sufficient voltage to operate. The maximum run length, in feet, based on the total number of unit loads is shown below:

	14 AWG (Feet)	12 AWG (Feet)	10 AWG Feet)
10 Unit Loads	1905	3000	4800
20 Unit Loads	950	1500	2400
30 Unit Loads	630	1000	1600
40 Unit Loads	475	750	1200
50 Unit Loads	380	600	960
60 Unit Loads	315	500	800
70 Unit Loads	270	425	685
80 Unit Loads	235	375	600
90 Unit Loads	210	330	530
100 Unit Loads	190	300	480
110 Unit Loads	170	270	435
120 Unit Loads	155	250	400

Table 9 - Wire Size vs. Length of Runs - Power Wiring

Terminating the wiring

Control Stations can be located up to 2,000 ft. from the dimming cabinet.

NOTE

The 2,000 ft. limitation is a RS485 digital communications specification. The power supply pair must be sized correctly for the control stations that are connected to them.

Luma-Net is wired Daisy Chained, station to station. For applications where runs become too long a Luma-Net Hub can be used. See Figure 15 for the correct ways to wire this system.

NOTE

The cable should not pass near any source of electrical noise such as fluorescent circuits or motor wiring. Avoid close proximity to any AC wiring. All control/power wiring must be in conduit.

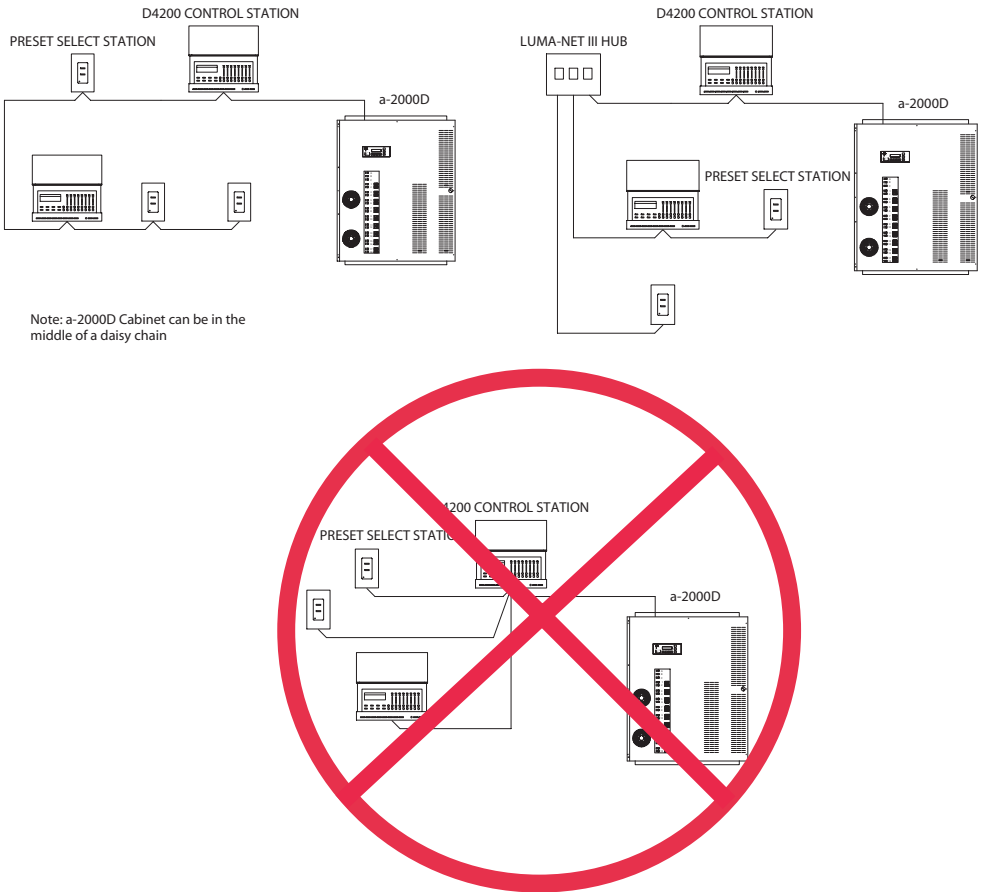


Figure 15 - The Right and Wrong Way to Run Luma-Net

- See Table 10 for recommended Wire Types
- Use RS485 compatible cable for the communications. It is recommended that a cable with 2 Twisted Pair, 24 AWG, stranded conductors be used. The spare pair is for future uses.
- Capacitance of wire shall be 12pF/ft. or less
- Nominal Impedance of wire shall be between 100-120 ohms
- A second pair (#14 AWG stranded or larger) is required for the power.
- Drain/Shields to be tied together, insulated and grounded (on **one point** only)!
- **We strongly recommend the use of either Belden 9829 or Belden 9729 for the Luma-Net wire runs.**

NOTE

The most effective way to insulate the drain/shield wire is to use a piece of heat shrink tubing!

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Manufacturer	Catalog Number	# of Pairs
Belden	9729, 9829	2
Belden	9841	1
Belden	88102	2 (Plenum Rated)
Alpha	6222C	1
Alpha	6412	1

Table 10- Luma-Net Recommended Wire

Wire/Color	No. Pair	Pin/Terminal	Pin/Function
Belden 9729			
Red Black	1	1 2	REM+ REM-
Red White	2	N/C - Not Connected N/C - Not Connected	N/C - Not Connected N/C - Not Connected
Drains/Shields		N/C - Not Connected	See figure 17
Belden 9829			
Blue with white stripe White with blue stripe	1	1 2	REM+ REM-
Orange with white stripe White with orange stripe	2	N/C - Not Connected N/C - Not Connected	N/C - Not Connected N/C - Not Connected
Drain/Shield		N/C - Not Connected	See figure 17

Table 11 - Color Coding for Belden Wire

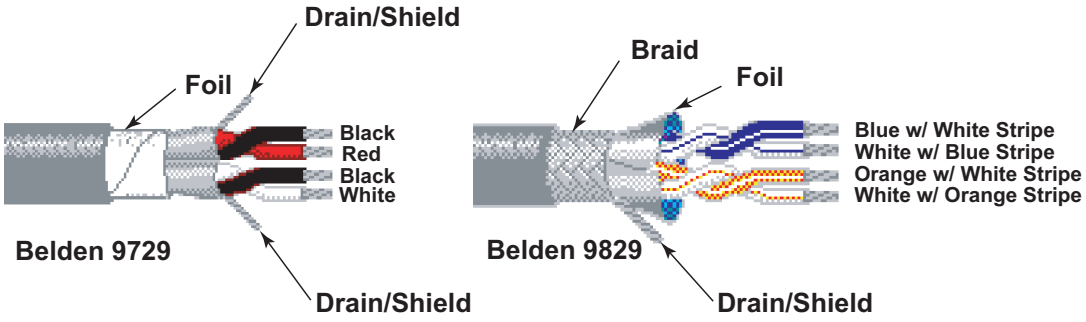


Figure 16 - Belden Wire Callouts

NOTE

If a remote DC power supply is used and you have multiple Luma-Net runs, all DC common wires must be joined at the power supply.

Wiring the Phoenix Connector

Step 1: Connect leads per wiring diagram as illustrated in Figure 18.

Step 2: Twist strands of each lead tightly (making sure that there are no stray strands) and push firmly into appropriate plug connector location.

Step 3: Tighten the screws on the plug connector—making sure that no bare conductor is showing.

Step 4: Tie the Drain/Shield wires together and insulate using a small piece of heat shrink tubing.

Step 5: Install termination jumpers as required. Termination jumpers are required at the two ends of the Luma-Net run.

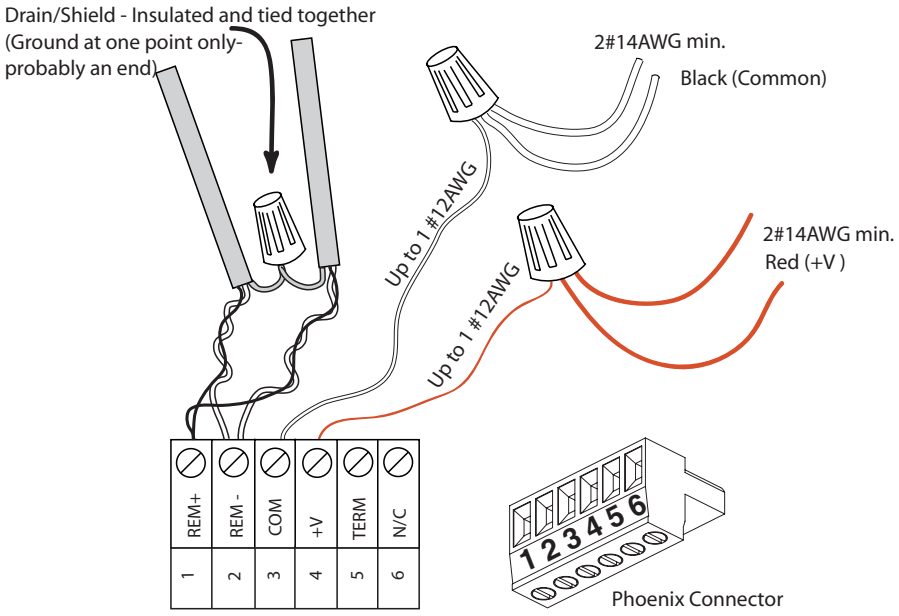


Figure 17 - Luma-Net Wiring Connections

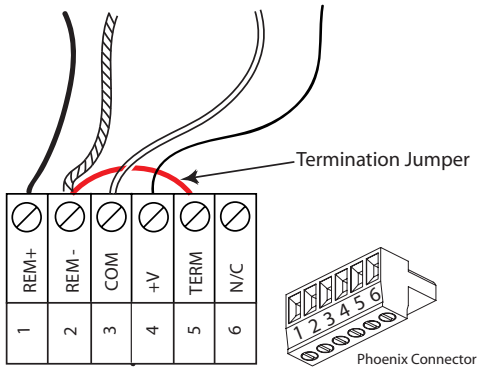


Figure 18- Luma-Net Termination Jumper

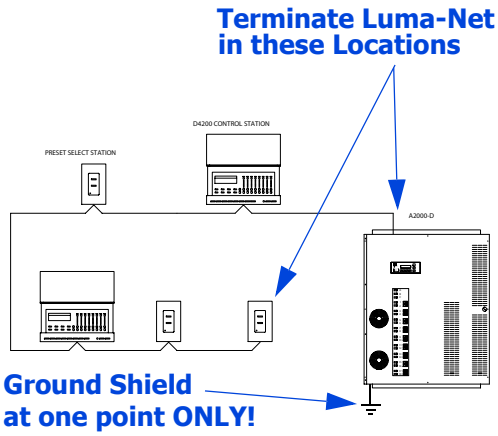


Figure 19- Luma-Net Termination Jumper Locations

NOTE

The common (DCC) must be connected to earth ground at only one point in the run. The dimmer cabinet or a Luma-Net Hub (if used) are the most likely places.

Special Feature for Low Voltage Power Terminations

The 12 and 24 circuit dimming cabinets have a separate +24 VDC and Common terminal strip. Since the Luma-Net connector will only accept 1 #12 wire, it may be necessary to pig tail the connections to a single wire coming into the connector. To simplify this process, all power supply type

wiring for control stations should go to these terminals in the these cabinets. These terminals are fed directly by the power supply and accommodate larger wires and multiple wires per terminal section solving power distribution problems for remote power controls.

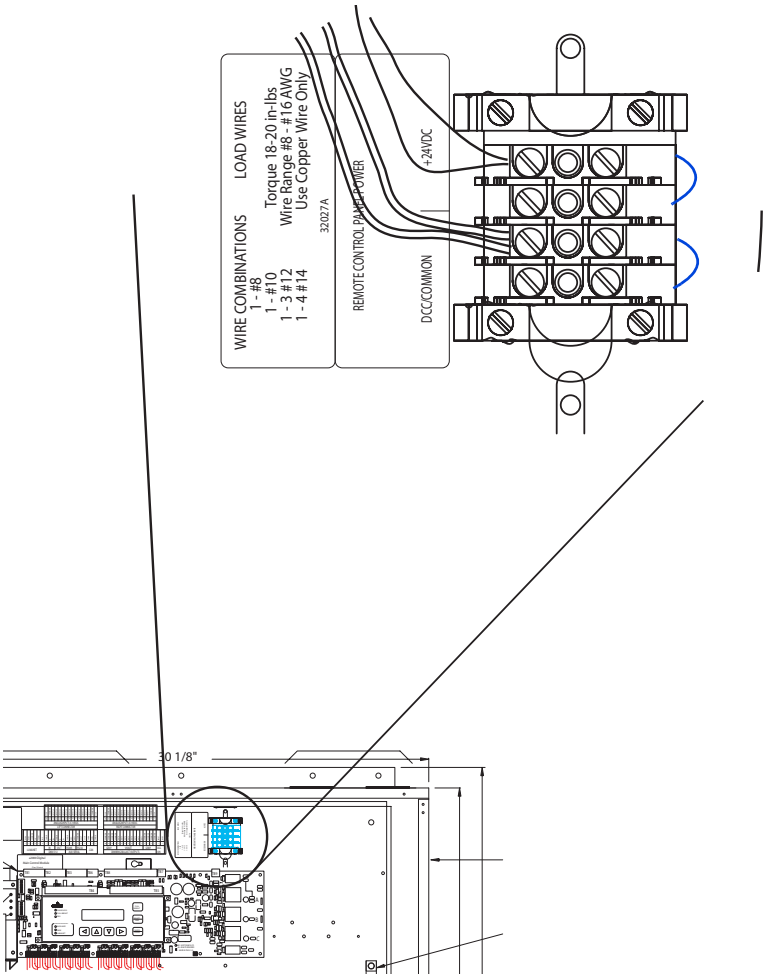


Figure 20 - Control Station Power Wiring - Preferred Wiring Method

Testing the Wiring

To assure problem-free startup, it is important to check the system wiring for proper connections, shorts and opens.

The following procedure is recommended:

Step 1: Test the following wire pairs for shorts at each station location, using an ohmmeter or other continuity tester.

1-2 Open
2-3 Open
3-4 Open

Step 2: Repair any short circuits before continuing.

Step 3: Install wire jumpers to the Phoenix connector (not supplied) on either end of the cable run between pins 1-2, and a separate jumper between pins 3-4.

Step 4: Retest each the following wire pairs at each connector:

1-2 Short
2-3 Open
3-4 Short

Step 5: Make any necessary repairs and remove wire jumpers before continuing.

DMX-512

The digital control panel accepts DMX-512 signals (In and Out), an industry standard signal widely used in the theater industry. This offers the opportunity to use theatrical consoles to control some or all of the dimmers in the a-2000D Dimmer Cabinet.

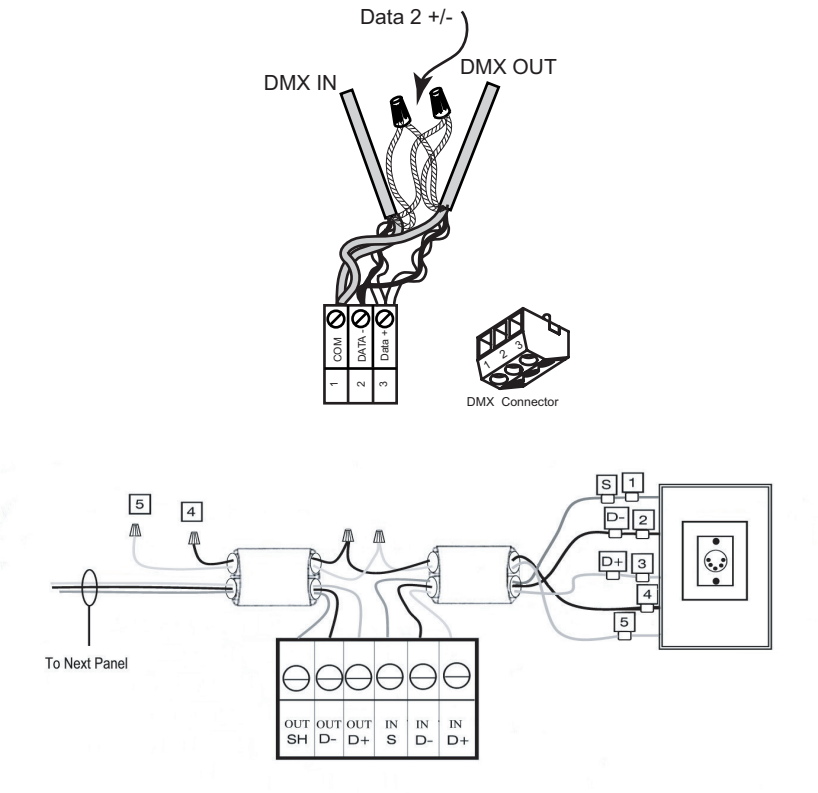


Figure 21 - DMX Wiring Schematics

DMX Wire Recommendation:

- Use RS485 compatible wire with 2 Twisted Pair, 24 AWG, stranded conductors.
- Shields to be tied together, insulated and grounded (on **one** end only)!.

Manufacturer	Catalog Number	# of Pairs
Belden	9729, 9829	2
Belden	88102	2 (Plenum Rated)

Table 12 - DMX512 Recommended Wire

Analog Input, 0-10 VDC (Optional)

A third type of control input signal, 0-10 Volt DC, can be used if equipped with the optional Analog DC Control Card. This signal varies between 0-+10 VDC and can be used to control the dimmer outputs or for photo cell/daylight harvesting application.

NOTE

This section relates only to use of the analog input for direct 0-+10V control. For Protocol/Daylight harvesting applications see page 71.

Control Input	Output to Dimmers
0 VDC	Lights off
+10 VDC	Lights at full

Table 13 - Analog Control Input Signal

Varying this signal from 0 VDC to +10 VDC varies the AC output voltage from zero to virtually full line voltage.

Analog connections can be hooked up in two ways:

1. Analog devices powered by external source
2. Analog devices powered by a-2000 cabinets

NOTE

If +12 VDC is supplied from the analog card to power analog controls, the common **MUST BE** connected to the **TB9 terminal** on the main control module board - See Figures 22.

Photocell Input

See page 71 for details on photocell operation. This section relates to the connection of the photocell device to the a-2000 dimmer cabinet.

NOTE

In order to use photocells in daylight harvesting applications, the analog input card must be installed.

To connect the photocell to the a-2000, perform the following steps (reference figures 24-25):

1. Connect the +0-10VDC output from the photocell to one of the a-2000 analog input terminals, labeled "Input 1, Input 2,... etc.
2. Connect the photocell common to the a-2000 input card
3. If the a-2000 +12VDC supply is powering the photocell, connect the photocell +V and common supply leads to the +12V and common terminals of the a-2000 analog input card.

NOTE

The photocell manufacturer's instructions must be followed explicitly to ensure accurate results. Some photocells require a +24VDC supply. In this case the photocell must be supplied from the +24 VDC remote control panel power terminal.

When the above connections have been made correctly, and the programming complete per page 71, the photocell will inversely control the output of the dimmer level to reach the desired target level.

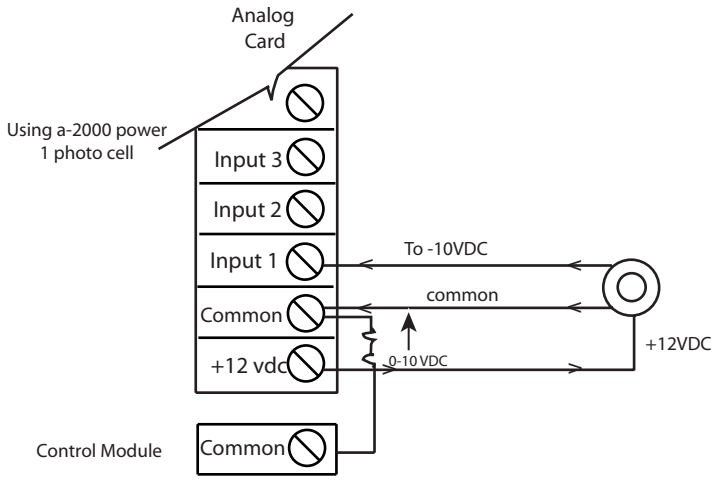


Figure 22 - Wiring Diagrams for One Photocell

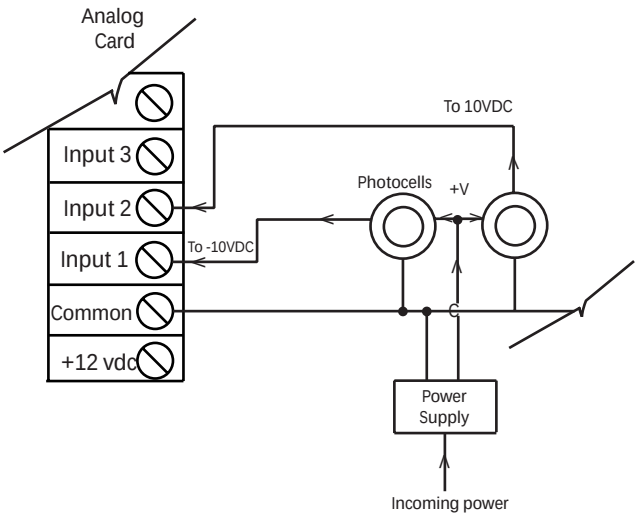


Figure 23 - Multiple Photocells with External Power Supply

Multiple Signal Types

Under certain circumstances the digital control panel can receive two or more types of input signals.

The output for each dimmer is determined as follows:

1. DMX and Analog- by the highest input signal it is receiving from the different sources.
2. DMX/Analog and Luma-Net - by the last action input signal it receives from different sources. e.g. If DMX signal is on and a Luma-Net signal appears, control is faded from the DMX level to the Luma-Net level. If DMX level is then changed, control will fade back to and track the DMX level.

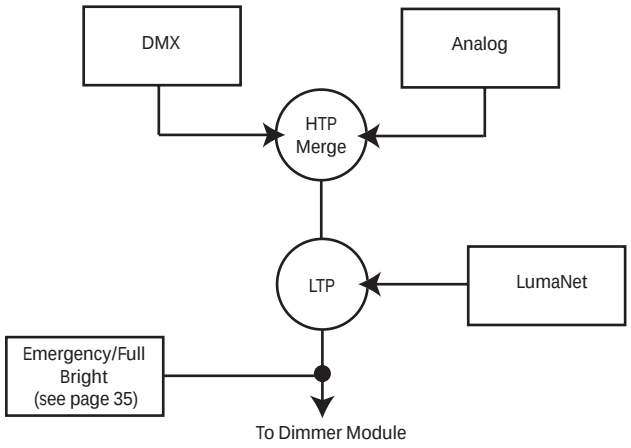


Figure 24: Control Signal Precedence and Merging

External Full On/Emergency (Full Bright)

The a-2000 cabinet has an external trigger which can be used to force selected dimmers to *full bright*.

The external full bright input is enabled with a contact closure between terminals on TB7.

NOTE

The software feature is called External Full Bright, however the label of TB7 is called "Emergency" (formerly "All On").

- If the closure is open, the system operates normally.
- If the closure is closed, the system overrides all channels, that have been programmed to respond to External Full Bright, to 100% and overrides the remainder of the channels to 0%.
- When the closure is re-opened, the channels return to their previous levels

NOTE

Factory default programming has all channels to respond to an external full bright command

One application of this feature is shown in Figure 23. If any one of the phases is low in the "Normal" cabinet, the phase dropout relay relaxes, closing the "All On" contact closure.

For Example: If circuits 1, 2 and 3 are on at 50% (and are programmed to respond to the external full bright command), they will go to 100%. If channels 4, 5 and 6 are at 50% (and not programmed to respond to external full bright), they will go to 0% to unload the emergency generator.

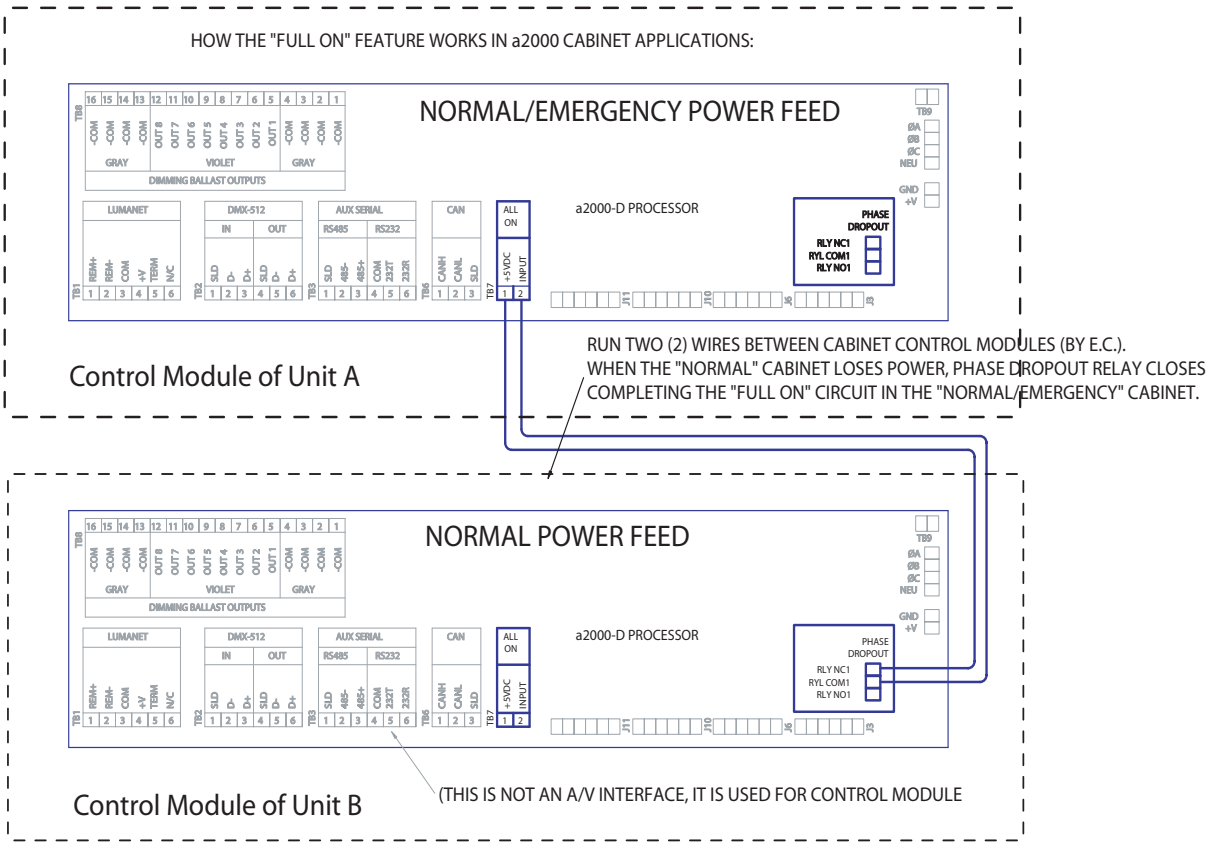


Figure 25 - External Full On Wiring Diagram

Step 6: Fluorescent Dimming and Control Output Wiring

Many installations incorporate fluorescent dimming ballasts into some or all of the fluorescent fixtures. Refer to the Appendix section for general information about dimming ballasts, their use and their control methods.

NOTE

For best lamp life, lamp manufacturers recommend their fluorescent lamps should be operated at full brightness for a minimum or 100 hours before dimming is permitted. For best results, lamp brands and types should not be intermixed on a circuit.

Types of Dimming Ballasts

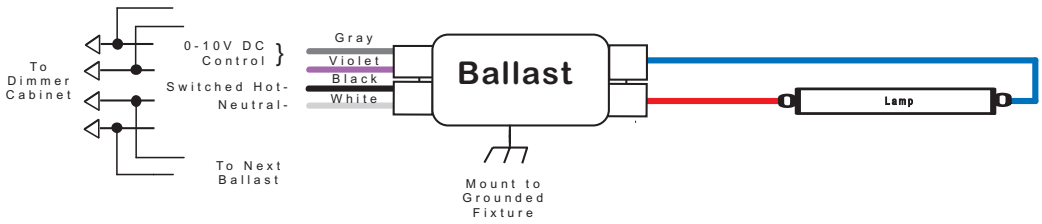
- 0-10 volt DC control
- Two Wire Ballasts
- Three Wire ballasts

0-10 volt DC control:

These ballasts require that the low voltage wires (typically Violet and Grey) are landed on the Dimming Ballast Output terminals located on the Control Modules main circuit board.

NOTE

The control output channels are auto assigned. The control wire for the first M7 dimmer will be the first control terminal, and the second M7 dimmer will be the second terminal, even though there are other dimmers of different types in between.



0-10 Volt DC Wire Schematic

Note: drawing shows one lamp, but can be applied to 2,3, and 4 lamp ballast versions.

Figure 26 - 0-10 VDC Ballast Control Wiring

NOTE

The maximum number of 0-10 VDC dimming ballasts that can be controlled on any one circuit is 100. (THIS IS A NEW FEATUE)

NOTE

Double check the wiring to the dimmer output terminals that feed the dimmer ballasts before turning on any power; these ballasts can be adversely affected if the line voltage control wire and the switched line connections are reversed. Make sure the dimmer ballasts are correctly wired prior to turn on.

Other Ballast Types

For other ballast wiring options, see the following page on Dimmer Module Wiring.

Dimmer Module Installation

Step 7: Dimmer Module Installation and/or Replacement

Blanking Plates

In some instances the dimmer modules are shipped separately from the cabinet. When this occurs, the blanking plates (two per module slot) must be removed prior to installing the dimmer modules. These plates are installed to maintain proper airflow. See Figure 27 for the locations of the blanking plates.

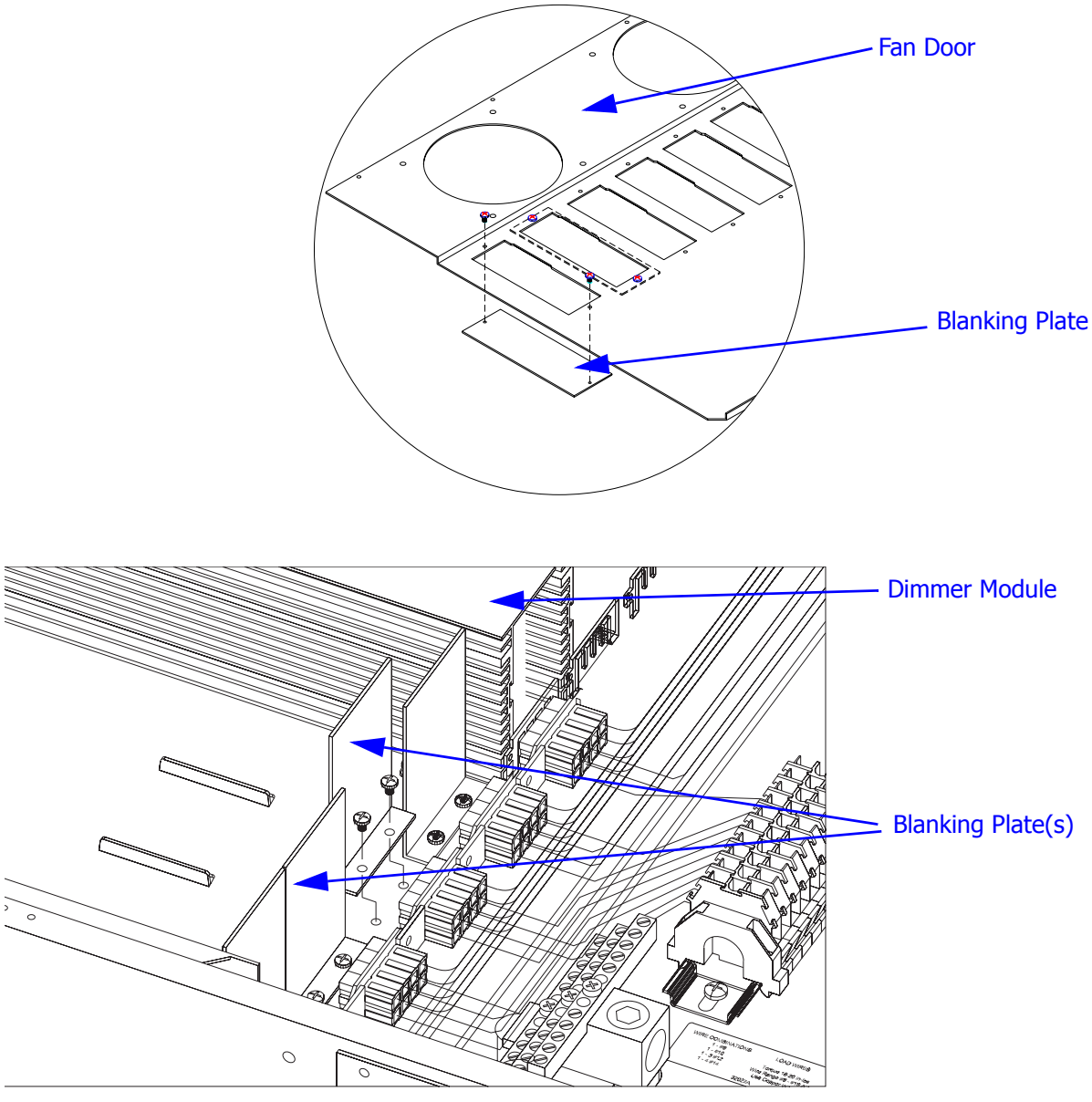


Figure 27 - Blanking Plate Locations

Removal or Installation of Dimmer Module:

When the cabinets are shipped with the modules pre-installed, they are held in place by a single sheet metal screw (#10-32). This screw is located on the left side of the dimmer and securely holds each module to the cabinet for transportation from the factory.

The dimmer modules simply plug in. No tools are required (except for shipping screw when dimmer modules are pre-installed at factory) and there is no risk of crossed wires when hooking up a new module.

NOTE

If project drawings have been supplied by the factory and if the dimmers are shipped separately, make sure that any special dimmers are inserted into the proper module position within the dimmer cabinet. These positions are marked in the cabinet and shown on the installation diagrams provided with the system and should also have a label inside the cabinet instructing where these modules should be placed.

To remove a dimmer module:

1. Remove the shipping screw located on the left side of the module (if installed).
2. Slide the module to the left to clear the power and control plugs until it bumps the stop.
3. Lift it straight out of the cabinet.

To install a dimmer module into one of the positions

1. Remove the appropriate blanking plate(s) from the cabinet. There are two plates per module location. One is located on the fan door. The second is screwed down to the back pan. Start from the top and work your way down (see Figure 27)
2. Place the heat sink notches over the two tabs while aligning the dimmer module against the dimmer stop. Place the dimmer against the cabinet pan. If the dimmer is not against the dimmer stop, the two notches will not catch the two tabs on the pan.

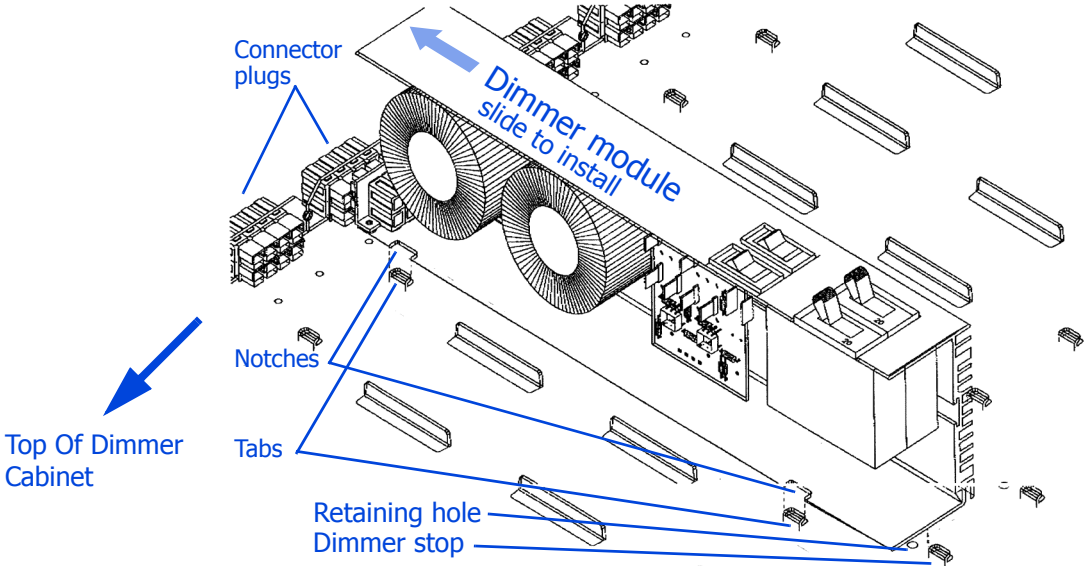


Figure 28 - Dimmer Module Installation and Removal

3 Slide the dimmer until the back of it slides underneath the tabs.

4 The dimmer should slide into the mating connector plugs with a small amount of pressure.

The dimmer may need to be moved up and down or forward and backward until the connectors mate. DO NOT FORCE.

5 Insert a #10-32 1/4-in. screw into the dimmer retaining hole to hold the dimmer module in place. (Optional)

NOTE

If the cabinet has been configured at the factory and there are special dimmer modules, there will be a label indicating where these modules should be placed. Verify that each module is wired to the load as shown on these drawings. If the dimmer modules are driving the wrong load circuits, damage can occur to certain types of dimmer ballasts. Some ballasts are adversely affected if the dimmed and switched connections are reversed.

Step 8: Bypass Mode

Set 120 V Non Universal Dimmers to Bypass Mode:

Each 120 V dual dimmer is equipped with two 20-amp circuit breakers; one for each circuit to be fed from that dimmer module. It is also equipped with two dimmer bypass switches, adjacent to the breakers, see Figure 29.

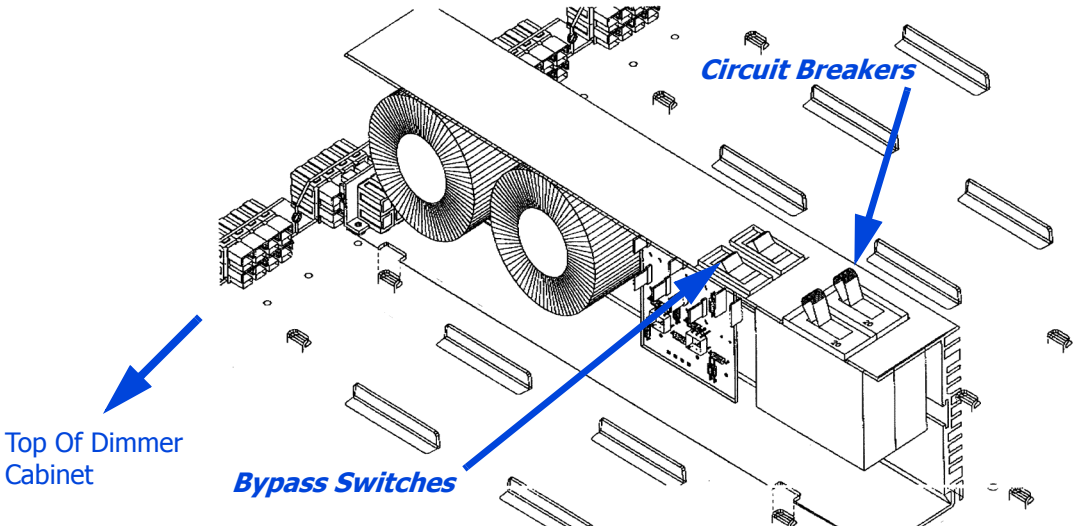


Figure 29 - Bypass Switch - 120V Modules

The Bypass switch has two modes:

- Normal and
- Bypass.

When the switch is set to Bypass, all the dimmer electronics are removed from the dimming circuit and the line is connected directly to load. Leviton normally ships the dimmer cabinet with all these switches in Bypass mode.

1. After checking that all circuits come on and contain no short circuits,
2. Turn these switches to the Normal position. Once these switches are turned to Normal, the dimmers and non-dims all operate in their programmed condition.

If a dimmer fails to come on, the bypass switch associated with that dimmer channel can be used to achieve full bright light output until repairs can be made to the appropriate system components.

NOTE

0-10 VDC controlled ballasts require an additional step to ensure that the lights come to full brightness when the switch is in the Bypass position. The purple control wire from the control terminals must be removed and capped to allow the ballast to "float high." Once this control wire is removed and capped, the bypass switch can be used to force the lights to the full bright condition.

You can use the **FULL BRIGHT** button on the control panel in addition to the bypass switches to set the lights to full brightness.

NOTE

Be sure to turn Full Bright switch off when you turn off the bypass switches and go to normal operation. This switch overrides all controls and forces all lights to full brightness.

277V Non Universal Bypass

The 277V dimmer modules have no bypass switch. To achieve similar functionary for testing or electronics bypass, a constant module can be inserted in place of the dimmer module.

Universal Bypass

The universal dimmer is provided with bypass switches but they do not bypass the dimmer electronics. For load testing purposes we recommend inserting a constant module in place of dimmer modules.

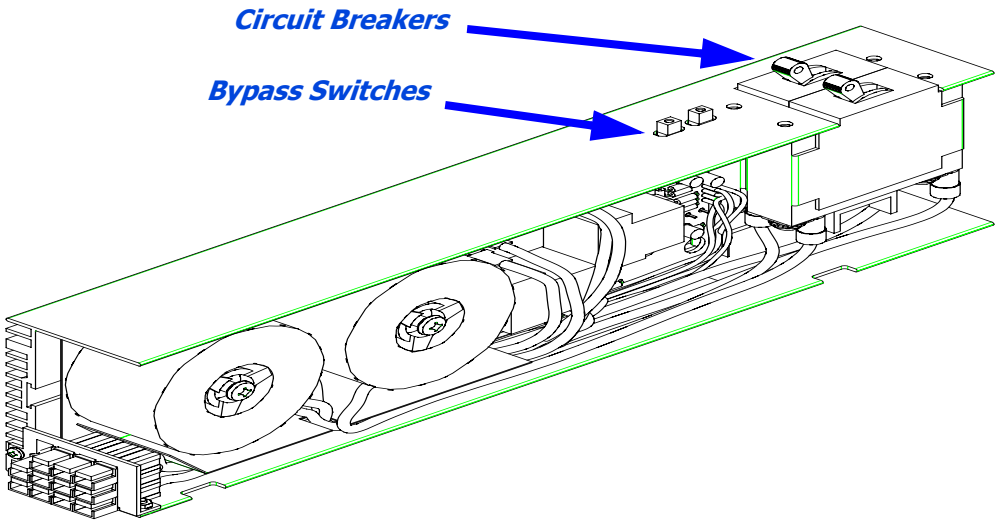


Figure 30 - Bypass Switch - Universal Modules

NOTE

DO NOT install 120V dimmers into a 277 Volt cabinet. DO NOT install the obsolete bypass shunts or 277V dimmers without integral breakers in either 120V or 277V cabinets. This will void the Warranty and cause damage to the cabinet!

Step 9: Double Check the Wiring

Prior to turn on, verify that the following has been done correctly:

- Main feed wiring
- Load wiring
- Remote control wiring
- Correct wiring to any fluorescent dimmer ballasts
- Dimmers are set in the Bypass Mode

With all power and control wiring in place, and all dimmer modules or constant modules installed, breakers off and bypass on, the system is ready for turn-on.

Step 10: Turn On The Power

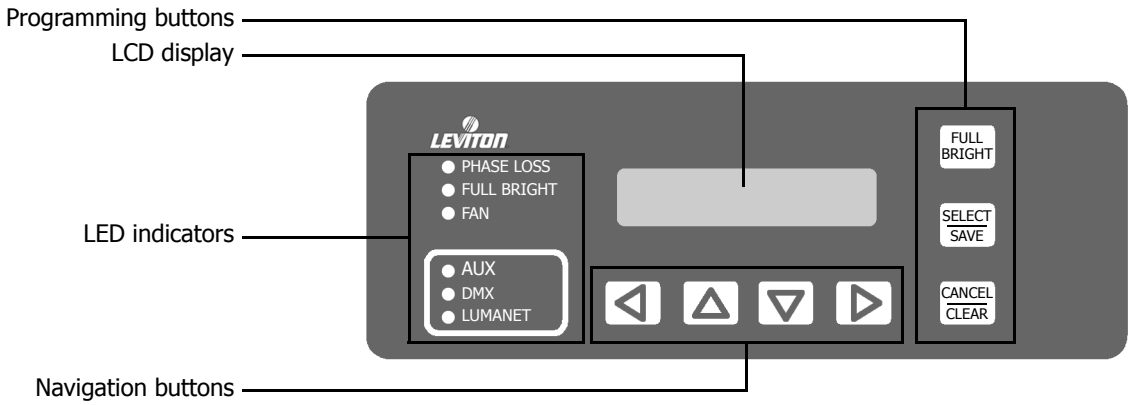
Step 11: Clear Faults that have Caused any Breakers to Trip

Step 12: 120 V Systems - Set Bypass Switches to Normal

Note: If your system uses constant modules for testing in lieu of bypass switches, replace the constant modules with the appropriate dimmer module.

Digital Control Panel

Readouts and Indicators



LCD Display

The LCD display helps you determine that the system is operating properly: it helps locate certain types of malfunctions or errors in connections to the system, and enables certain setup instructions to be programmed, such as combining more than one dimmer to a single channel of control.

When the system is operating normally the top line of the LCD display shows the name of the system and the version of software running in the microprocessor (`a2000 Ver 2.40 (or above)`). The second line flashes continuously and displays `STATUS=OK 3PHASE` or `STATUS=OK 1PHASE`.

Programming/Function Buttons

The three programming buttons are located to the right of the LCD display:

- **FULL BRIGHT.** Turns all lights assigned to react to the Full Bright button. Pushing it twice turns off this function and returns the lights to their previous state.
- **SELECT/SAVE.** Causes a new readout on the LCD display. It shows the actual input voltage on each of the incoming three phases. It reads out directly in volts as well as showing the frequency as 60 Hz or 50 Hz.
- **CANCEL/CLEAR.** Returns the LCD display to the normal readout.

NOTE

Many parameters can be modified using the LCD screen and a password (setup code), however these modifications should be made by a qualified factory technician. Some of these options are covered in *Step 13: Configuration and Programming*.

LED Indicators

The digital control panel has several LED indicators:

- **PHASE LOSS.** Lights if one or more of the three phases feeding the dimmer cabinet are lost or are low. On a single-phase system it indicates the loss of one or more of the two legs.

- **FULL BRIGHT.** Indicates that someone has selected full bright using the manual switch on the front panel or any external full bright switch, and no outside signals will override and allow dimming to occur.
- **FAN.** Shows that power is being fed to the fan(s).
- **AUX**, **DMX**, **LUMANET.** Shows digital signals being received. A blinking indicator light indicates that a digital signal is actively being received through the channel with the blinking LED. If more than one is lighted, more than one digital signal is being received.

Navigation Buttons

The lower four buttons, used for navigation of menu items, are **LEFT** ◁, **UP** △, **DOWN** ▽, and **RIGHT** ▷.

Step 13: Configuration and Programming

LCD Display Menu Structures

See Figure 40-44 for the Flow Chart of LCD Display Menu's.

The next few pages will give you a pictorial overview for reference of menu structures used for programming your a-2000 cabinet. Following the menu structures is a text based description of the setup, configuration and programming procedure.

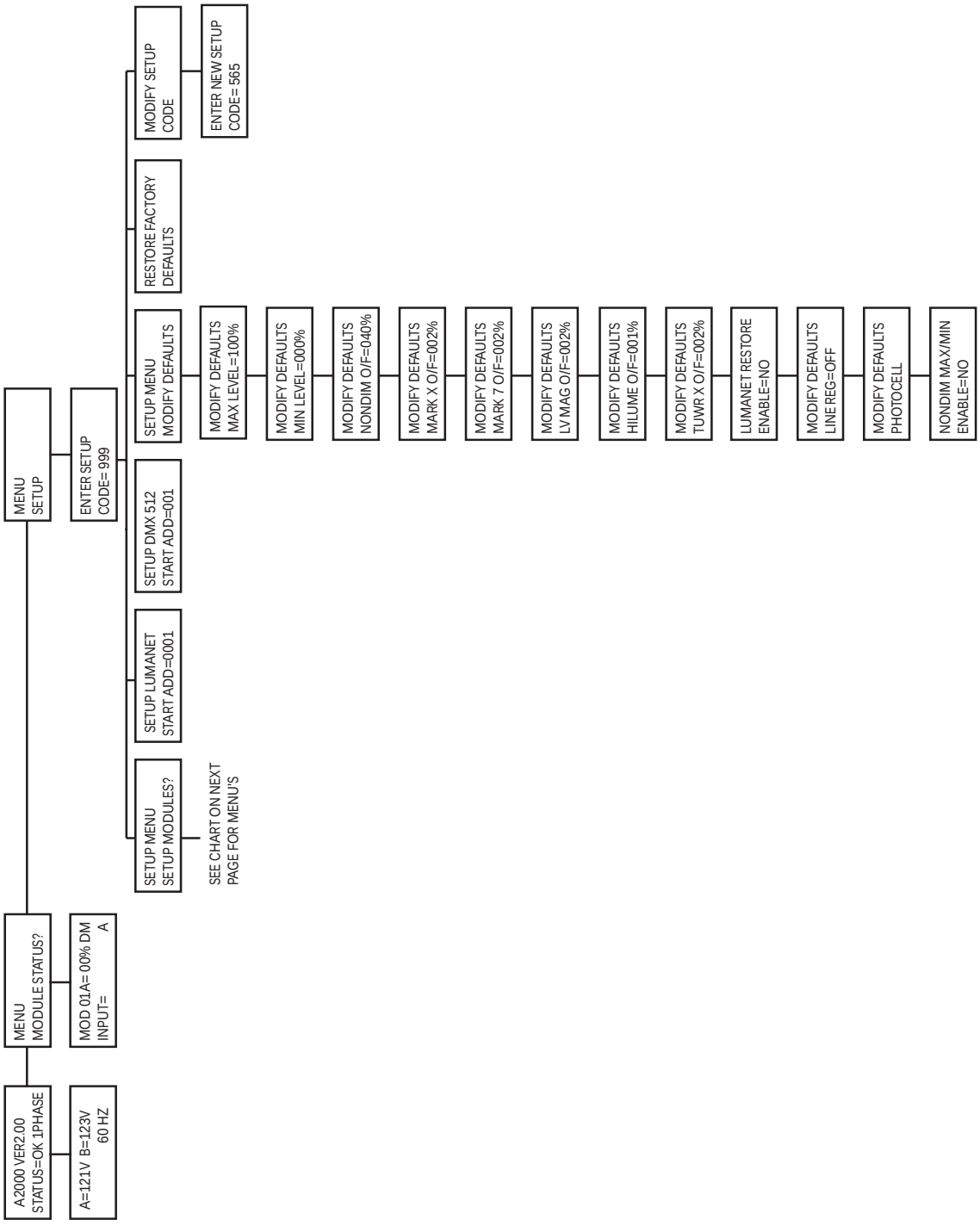


Figure 30 - 42 Main Menu Screens

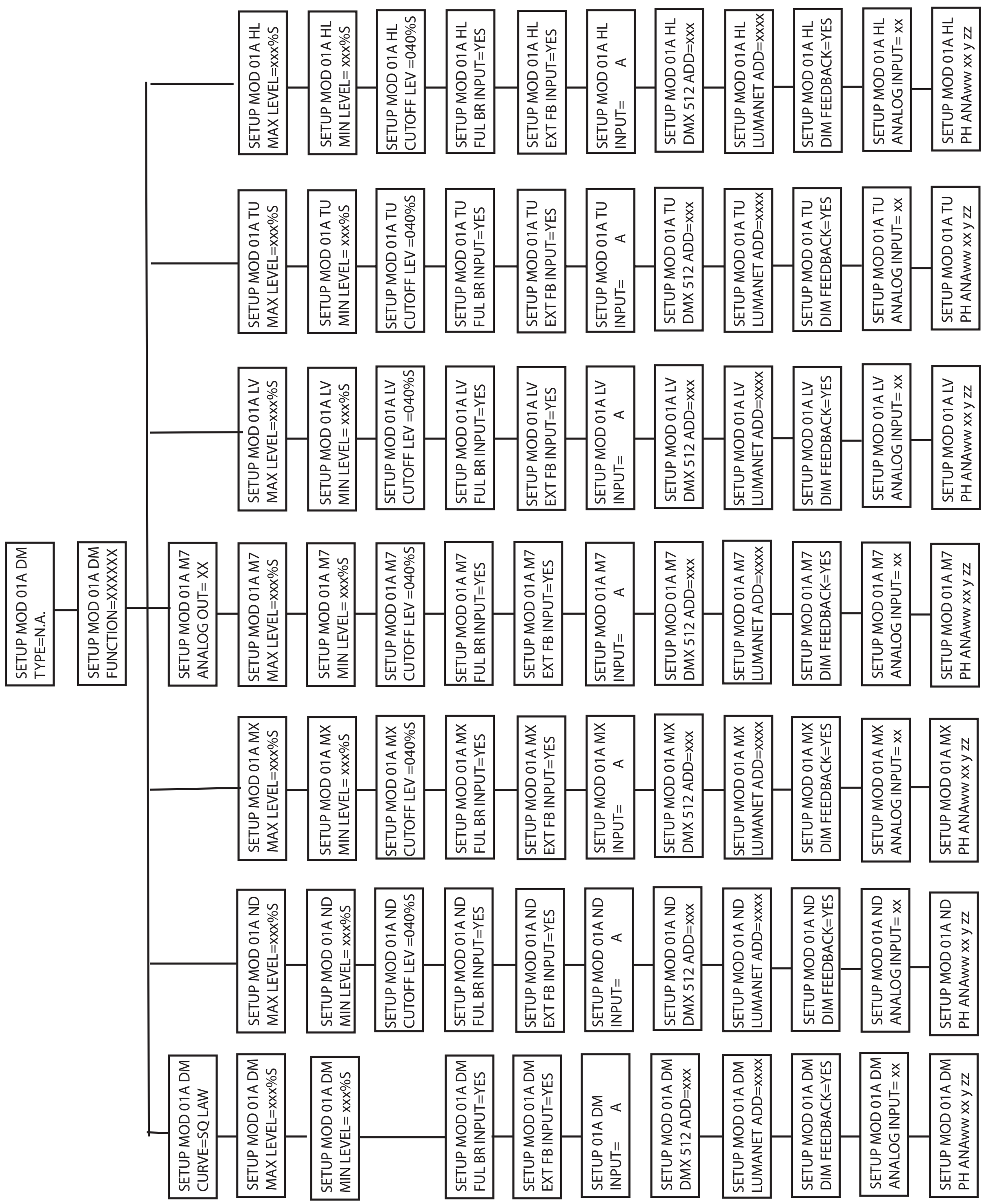
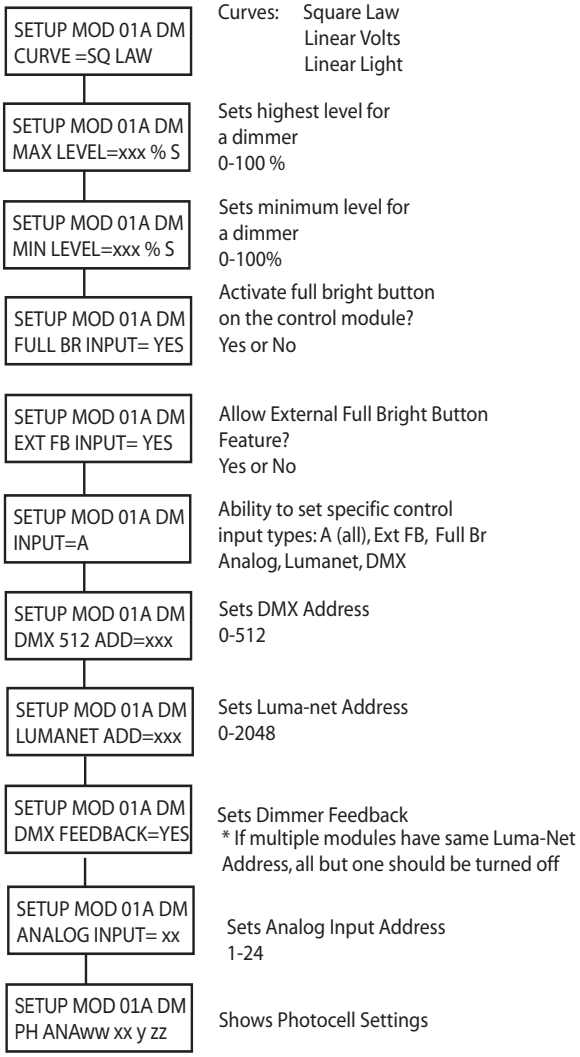


Figure 31 - Module Set Up Screens

LCD Menus for Dimmer Setup



LCD Menus for Non Dim Setup

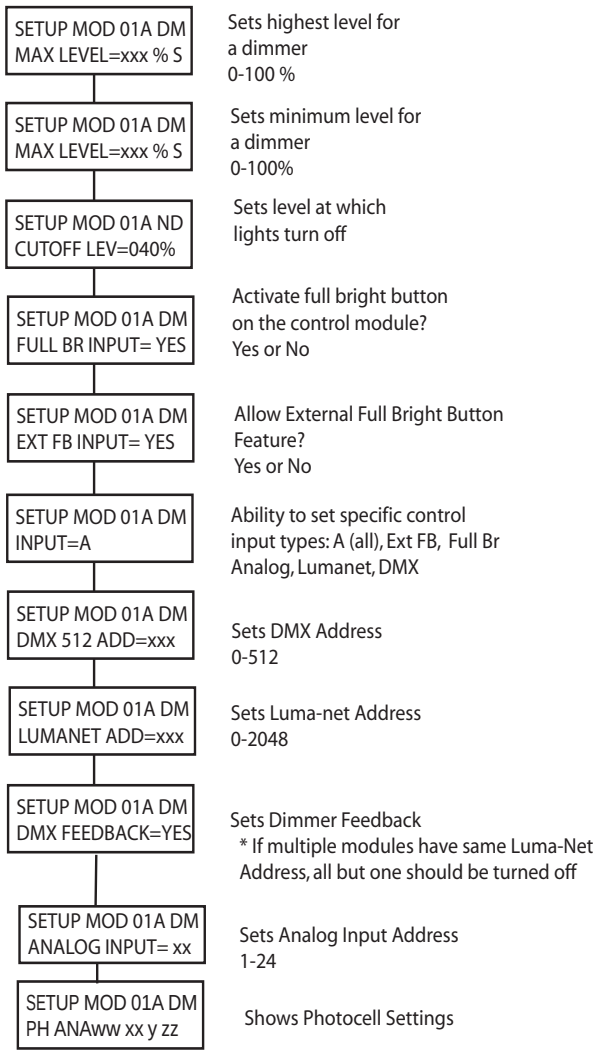
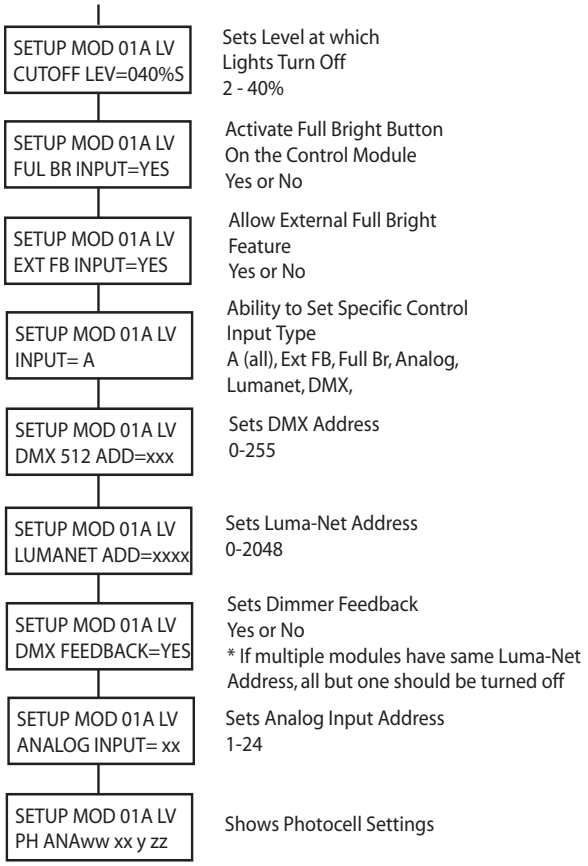


Figure 32 - Module Set Up Screen Shots and Sub-Menu Options

LCD Menus for Low Voltage Setup



LCD Menus for Lutron Tu Wire Setup

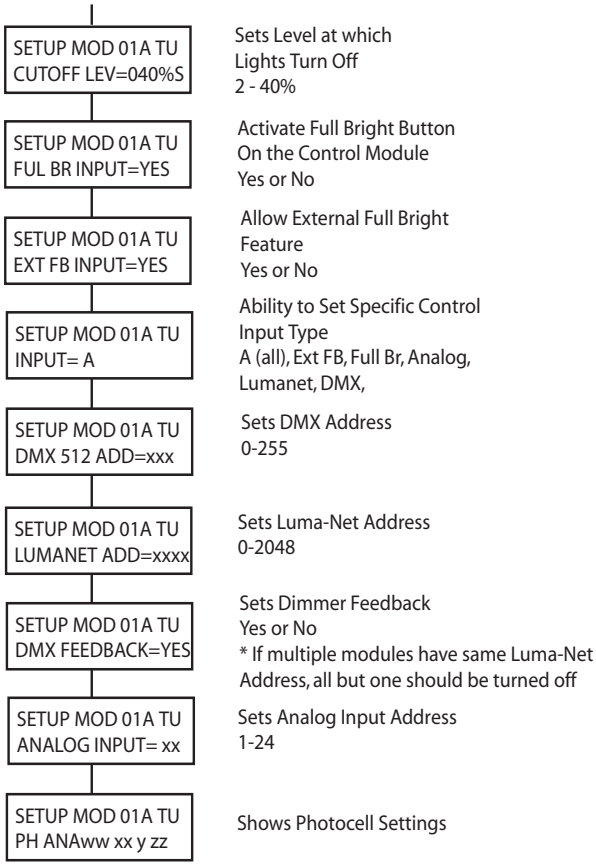


Figure 33- Module Set Up Screen Shots and Sub-Menu Options

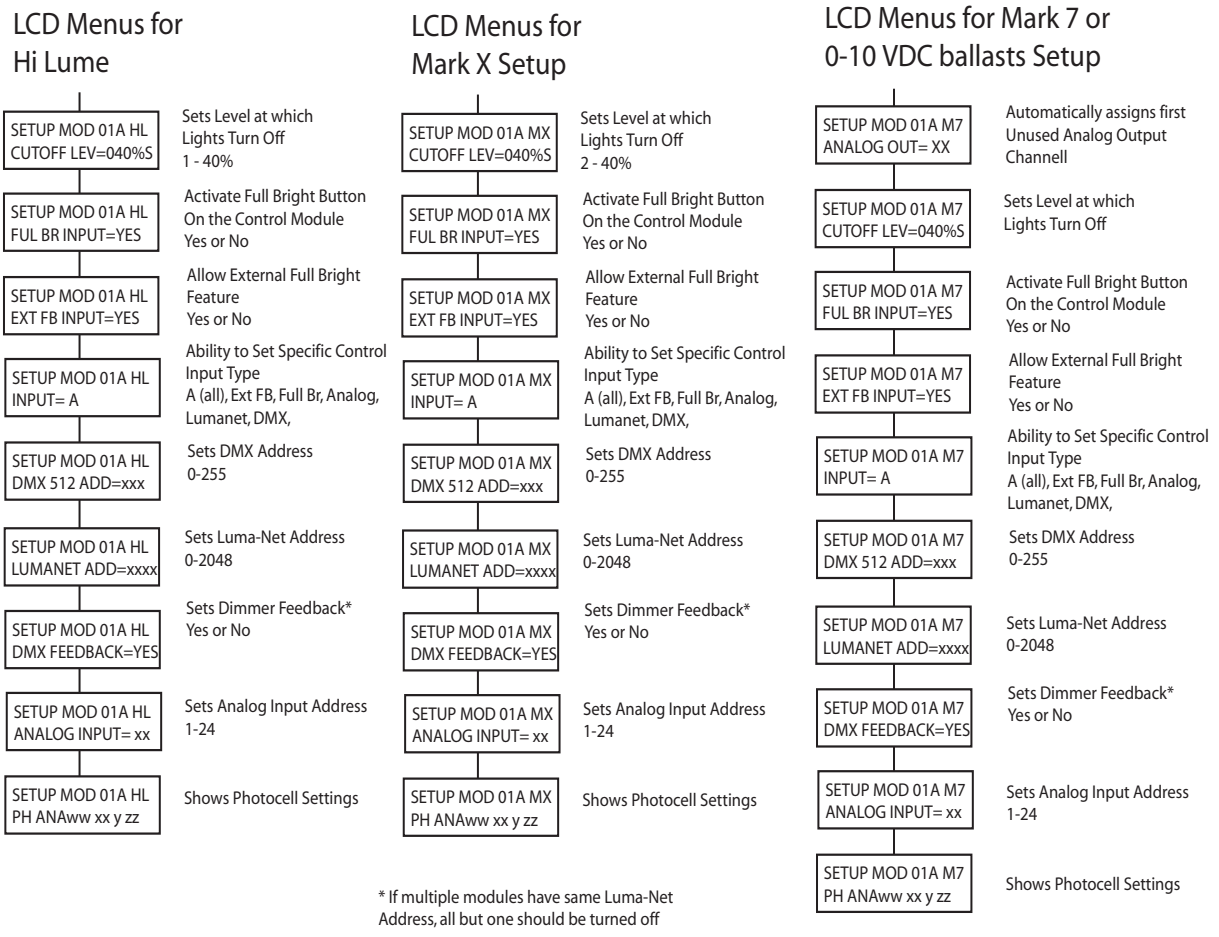


Figure 34- Module Set Up Screen Shots and Sub-Menu Options

Basic Concepts

The a2000D system automatically senses dimmer module types. These are physical differences in the modules themselves. There are four types: Dual Dimmer, (Dual) Constant Circuit, High Rise Time Dimmer (Single), and Dual Universal Dimmer. (See Appendix A for details on these module types.) When power to a system is turned on the system senses the modules in each location. If the module types match those stored in its memory "STATUS=OK" is displayed on the LCD Display. If the module types don't match "MODULE ERROR" is displayed. This error condition will occur if the system has not been programmed, if the modules haven't been installed, if the modules have been installed in the incorrect locations, or if the module types have been changed. To re-program the system for this feature and remove the "MODULE ERROR" see Section 13A

In addition some dimmer module types have several dimmer function types. These are software-based differences that are not automatically sensed and must be selected manually. Examples of dimmer function types are: dimmer, non-dim. Mark VII (fluorescent). Mark X (fluorescent). For programming these password-protected function types see Section 13C

Step 13A: Display at Startup

The main menu should appear like the menu below. It indicates the version of

```
a2000 Ver 2.00
STATUS=OK 1PHASE
```

software and if the voltage is single or three phase power.

NOTE

If **"Fault Condition"** appears in lieu of **"Status=OK"**, call Leviton's Technical Service Department at 1-800-959-6004.

Potential Error Screens in the Main Menu:

Module Error

```
a2000 Ver 2.00
MODULE ERROR
```

If the system does not find the modules that were previously assigned, it will flash "Module Error". To clear this message you must:

1. enter the set-up mode (or install the pre-assigned dimmers).
2. When you enter the set-up mode "Auto Assigning Module Types" will appear.
3. Follow the procedure below

To Auto Assign Module Types:

1. When auto assign module type appears, push **SELCT/SAVE** to auto assign the current module.
2. Once assigned press **CANCEL/CLEAR** to move on to the next module.
3. If the "auto assign module" appears again, repeat steps 1 and 2 for all subsequent modules.

Step 13B: Verifying Phase Voltages

To check the phase voltages:

1. From the main menu Press the **Select/Save** button.

```
A=123V      B=121V
            60 HZ
```

Step 13C: Assigning Module Types

The control module and dimmer modules have auto sensing technology. Regardless of where you insert a dimmer module the unit will set itself to the

appropriate dimmer module type (see Appendix). In addition, some dimmer types must be set up for specific dimmer types (functions) manually.

Module Catalog Number	Description	Automatically assigns Dimmer Type-function to:
120 Volt Modules		
000-A15DC-012	15 amp dual constant module	N.A.
000-A15DD-012	15 amp dual dimmer module	Dual-Dimmer (DM)
000-A15HD-012	15 amp high rise time (700 micro second) single channel module	Single-Dimmer (DM)
000-A20DC-012	20 amp dual constant module	N.A.
000-A20DD-012	20 amp dual dimmer module	Dual-Dimmer (DM)
000-A20HD-012	20 amp high rise time (700 micro second) single channel module	Single-Dimmer (DM)
000-A20UN-012	20 amp universal dual dimmer module	Univers-Dimmer (DM)
120/277 Volt Modules		
000-A20DD-A27	120/277 Volt dual dimmer module	Dual-Dimmer (DM)
000-A20UN-027	120/277 universal dual dimmer module	Univers-Dimmer (DM)
000-A20DC-A27	20A dual 120/277V constant module	N.A.

Table 15 - Available Dimmer Modules

NOTE

Since the Dual Dimmer , Universal Dimmer, and High Rise Time Modules can be used for load types other than an incandescent dimmer, you must assign the particular module the functionality you wish it to use.

Below are the different type of dimmer functions:

- **DM.** A basic dimmer meant to drive incandescent lamps, quartz halogen lamps, stepdown transformers for low voltage incandescent lamps, and neon or cold cathode low power factor type transformers.

NOTE

If a “High Rise Time” dimmer” is used for an incandescent circuit, it occupies one whole module space. The software sees it is as a single dimmer, and does not assign or try to use the B position of that module.

- **M7.** The module is set up to drive a dimming ballast requiring that the 120 V power to the ballast be turned on and off, and the control for the ballast is a signal voltage varying from 0 VDC to +10 VDC. The control output channels are auto assigned. The control wire for the first M7 dimmer will be the first control terminal, and the second M7 dimmer will be the second terminal, even though there are other dimmers of different types in between. There is a maximum number of 8 of these control output channels.

NOTE

Inserting a new M7 dimmer at a later time may require renumbering dimmers, or the control wires will fall out of order.

- **TU.** The output is set up to drive the Lutron TuWire™ dimming ballast. It wires the same as the Advance Mark X ballast, but requires a different low light limit setting which is automatically provided whenever the TU setting is chosen.
- **MX.** The dimmer is set up to drive an Advance Mark X dimmer ballast, and the software automatically provides the proper low light limit as required for that ballast type. The ballast requires only two power wires for control; a dimmed line and a neutral.
- **ND.** The module is set up for On/Off operation only. As the input signal approaches 40% the module switches full On. When the input falls below about 38% it switches Off. The slight difference in level is called hysteresis and is used to prevent "chattering" at the switching point.
- **LV.** A normal dimmer but with a low-end cutoff. This can be useful for certain load types such as driving a stepdown transformer for low voltage lights where a complete turnoff is needed at some low light level.
- **HL.** This module is set up to drive the Lutron HiLume™ and EcoDim™ dimmer ballasts. Each of the two channels include two sub-channels; dimming and switching. When the control channel is off both sub-channels are off. When the channel is on to 1% the switching channel turns on and the dimming channel goes to its minimum level.
-

NOTE

By pressing the **UP** △ button, from the main menu, you can step through each of the modules to determine how they are programmed, if they are receiving an input, and the source of that input. If a dimmer is being driven from two inputs (for example Luma-Net and DMX512), whichever input is higher has control, and that control type appears.

Assign the Module/Load Type

Assigning the module type involves the use of a password (setup code) to prevent unauthorized changes of vital data within the digital module. The factory default password is **000**.

NOTE

If the Setup Code is lost or forgotten you will have to contact the factory to regain access to your system setup menus. If your system normally resides in a locked electrical room it may be best to keep the default Setup Code.

To access the module you want to change:

1. Press the **UP** ⍓ button until **Menu Setup** appears on the LCD display.
2. Press the **Select/Save** button.
   Enter Setup Code 000 appears on the LCD display.
3. Press the **UP** ⍓ or **DOWN** ⍗ buttons to change the **000** to the actual password (setup code).
   Note: If it has not been changed use **000**.
4. Press the **Select/Save** button.
   The LCD display shows **SETUP MENU SETUP MODULES?**.
5. Press the **Select/Save** button to access the first module.
   The setup module display for module 01A appears flashing; the number is the module number, the letter (A or B) is the channel within the module.

   SETUP MOD 01A DM
   TYPE DUAL

6. Press the **Select/Save** button to access that channel of the module, or press the **UP** ⍓ button to move to another channel of another module.

Once you have reached the module you wish to change:

1. Press the **Select/Save** button.
   The number stops flashing, and the module type starts flashing.
2. With the type flashing, press the **DOWN** ⍗ button until the LCD display shows **Function = Dimmer**.
3. Press the **Select/Save** button.
   Dimmer *flashes.*
4. Press the **UP** ⍓ or **DOWN** ⍗ buttons to scan through the functions.
5. Press the **Select/Save** button to select the desired function.
   The flashing moves from **Function** *to several choices of dimmer types.*
6. Press the **UP** ⍓ or **DOWN** ⍗ buttons to select a dimmer type
7. Press the **Select/Save** button.
8. Press the **UP** ⍓ button to move on to another channel, or press the **Cancel/Clear** button three times slowly to return to the to-level menu.
9. Continue to change the rest of the modules to the desired dimmer type.

Step 13D: Modify the Dimmer Type Features:

Once you have assigned the module type, you can alter the default settings for each dimmer type.

Features applicable to all dimmer types:

- **Full Bright Input:** Toggles On/Off override to Full Bright from the front control panel
- **External Full Bright:** Toggles On/Off override to Full Bright from an external contact.
- **Input:** Determines the control input source. Choices are:
    - **Scan All (A)**
    - **EXT Full Bright**
    - **Full Bright**
    - **Analog**
    - **Luma-Net**
    - **DMX512**
- **DMX 512 Address:** Sets the DMX address for that particular circuit (1-512)
- **Luma-Net Address:** Sets the Luma-Net address for that particular circuit (1-2048)
- **Dimmer Feedback:** Toggles the Dimmer Feedback for Luma-Net on or off.

NOTE

If multiple dimmer circuits have the same Luma-Net address, all but one should have its Dimmer Feedback turned off.

- **Max Level:** Sets the max level a dimmer will reach (%). An "S" next to this number indicates that it is using the default setting.

- **Min Level:** Sets the min. level a dimmer will reach (%). An "S" next to this number indicates that it is using the default setting.

- **Analog Input:** Sets the Analog input number if applicable.

- **Ph (Photocell):** See step 13G
-

Features Specific to dimmer types:

Dimmer:

- **Curve:** Sets the dimmer curve. Choices are:
    - **Square Law**
    - **Linear Volts**
    - **Linear Lights**

Non Dim:

- **Cutoff Level:** Sets the level (%) at which the dimmer will switch off. Default is 40%.

Mark X (10):

- **Cutoff Level:** Sets the level (%) at which the dimmer will turn off. Default is 2%

Mark VII (7):

- **Analog Output:** System automatically assigns the first available analog output. This is not user adjustable.
- **Cutoff level:** Sets the level (%) at which the dimmer will turn off. default is 2%.

Low Voltage Magnetic:

- **Cutoff Level:** Sets the level (%) at which the dimmer will turn off. Default is 2%

Lutron Tu-Wire:

- **Cutoff Level:** Sets the level (%) at which the dimmer will turn off. Default is 2%

Hi Lume:

- **Cutoff Level:** Sets the level (%) at which the dimmer will turn off. Default is 1%

Example: To change the max level for a dimmed circuit:

1. Press the **UP** ⍓ button until **`Menu Setup`** appears on the LCD display.
2. Press the **Select/Save** button.
   `Enter Setup Code 999` *appears on the LCD display.*
3. Press the **UP** ⍓ or **DOWN** ⍗ buttons to change the **`999`** to the actual password (setup code).
   Note: If it has not been changed use **`000`***.*
4. Press the **Select/Save** button.
   The LCD display shows **`SETUP MENU SETUP MODULES?`***.*
5. Press the **Select/Save** button to access the first module.
   The setup module display for module 01A appears flashing; the number is the module number, the letter (A or B) is the circuit within the module.

   SETUP MOD 01A DM
   TYPE DUAL

6. Press the **Select/Save** button to access that circuit of the module, or press the **UP** ⍓ button to move to another circuit of another module.

Once you have reached the module you wish to change:

1. Press the **Select/Save** button.
   The number stops flashing, and the module type starts flashing.

2 With the type flashing, press the **DOWN** ▽ button until the LCD display shows **`Function = Dimmer`**.

3 Press the **Select/Save** button.
`Dimmer` *flashes.*

4 Press the **UP** △ or **DOWN** ▽ buttons until the LCD display shows **`MAX LEVEL= 100%`**.

5 Press the **Select/Save** button to select the desired function.

6 Press the **UP** △ or **DOWN** ▽buttons to select the desired maximum level.

7 Press the **Select/Save** button.

8 Press the **RIGHT** ▷ or **LEFT** ◁ button to move on to another circuit or press the **Cancel/Clear** button several times slowly to return to the main menu.

Step 13E: Verifying Module Programming in a Dimmer Cabinet

To determine how the modules are programmed in the dimmer cabinet, check the module programming:

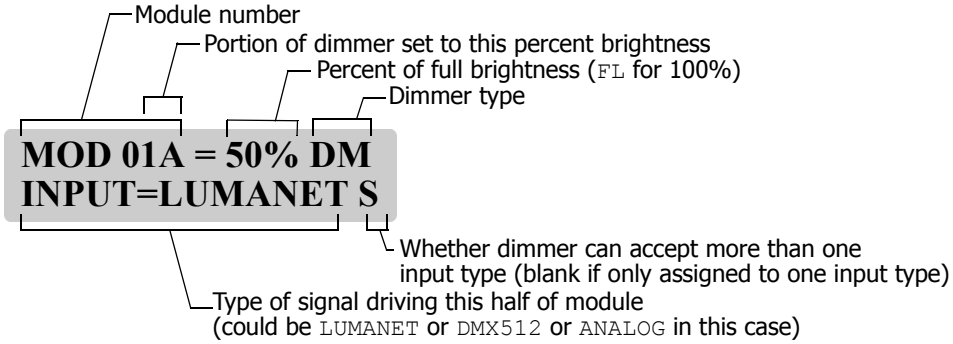
1 Make sure the powered on and in operating normally.

2 Press the **UP** △ button.
The LCD display shows **`MENU SETUP`***, with* **`MENU`** *flashing.*

3 Press the **UP** △ button again.
The LCD display shows **`MENU MODULE STATUS`***.*

4 Press the **SELECT** button.
The LCD display shows how the first circuit of the first dual dimmer is programmed.

Module programming information is displayed in a two-line format, as in the following example:



The above example indicates Module 01A, which is normally a dual dimmer, and the A circuit of that dimmer is set to 50% of full brightness. DM indicates that it is set up as a standard dimmer.

Step 13F: Assigning Luma-Net and/or DMX512 Channels

The a-2000D can assign dimming channels to various Luma-Net and/or DMX512 control channels within the software; no wiring changes are necessary.

Assigning Numbers Automatically

For a simple configuration, the first control channel number is defined as a system-wide address (the factory default is **0001**), and the system automatically assigns the control channel numbers in numerical order to the dimming zones (dimmers) within the dimmer cabinet. If a second dimmer cabinet is connected, its system-wide address can be set (to **0025**, for example), and the dimmer circuits are assigned beginning with that number.

To change the system-wide addresses:

1. Press the **UP** ⍓ button until the LCD display shows **Menu Setup**.
2. Press the **Select/Save** button.
   The LCD display shows **Enter Setup Code = 999**.
3. Press the **UP** ⍓ and **DOWN** ⍗ buttons to change the **999** to the actual setup code.
   The unit is now unlocked so changes can be made.
4. Press the **Select/Save** button.
   The LCD display shows **Setup Menu Setup Modules?**.
5. Press the **DOWN** ⍗ button once to set up the Luma-Net start address,

   SETUP LUMANET
   START ADD = 0001

   or press the **DOWN** ⍗ button twice to set up the DMX 512 start address.

   SETUP DMX 512
   START ADD = 001

6. Press the **Select/Save** button.
   The flashing moves from the description to the number.
7. Press the **UP** ⍓ and **DOWN** ⍗ buttons to change the flashing number to the desired new address.
8. Press the **Select/Save** button to store the new address.
   The flashing returns to the description.
9. Press the **Cancel/Clear** button twice.
   Returns to the top level menu.

Assigning Individual Control Channels

You might need to assign control channels in a sequence other than the automatic assignment described above. This can happen when single rather than dual dimmers are installed, and you do not want to lose the continuity of the numbering system due to the loss of the second module circuit.

After completing most of the assignments using the system-wide method described above, the individual dimming channels can be further modified.

To select a dimming circuit to modify:

1. Press the **UP** ⍓ button until the LCD display shows **`Menu Setup`**.
2. Press the **Select/Save** button.
   The LCD display shows **`Enter Setup Code = 999`**.
3. Press the **UP** ⍓ and **DOWN** ⍗ buttons to change the **`999`** to the actual setup code.
4. Press the **Select/Save** button.
   The LCD display shows **`Setup Menu Setup Modules?`**.
5. Press the **Select/Save** button.
   The LCD display shows **`Setup Mod 01A`**.
6. Press the **UP** ⍓ and **DOWN** ⍗ buttons to change the dimming circuit to be modified (**`01A`**, **`01B`**, **`02A`**, etc.).
7. Press the **Select/Save** button to select the dimming circuit.
   The flashing moves from the upper number to the lower description.

To modify the channel:

1. Press the **UP** ⍓ button twice to display the Luma-Net address,

   LUMANET ADD=0001

   or press the **UP** ⍓ button three times to display the DMX 512 address.

   DMX 512 ADD=001

2. Press the **Select/Save** button.
   The flashing in the lower part of the display moves from the description to the number.
3. Press the **UP** ⍓ and **DOWN** ⍗ buttons to change the flashing number to the desired new address.
4. Press the **Select/Save** button to store the new address.
   The flashing returns to the description.
5. Push the **Cancel/Clear** button five times to return to the top level menu.

Verifying Assignment of Mark VII Analog Output Signal

1. Enter Set-up
2. Enter Set-up Modules
3. Select Modules and Circuits
4. Page once to Analog Out = X

Where X (1 - 8) is the analog out (auto) assigned. It can now be changed if desired.

Step 13G: Daylight Harvesting/Photocells

Background-Daylighting:

In a daylight harvesting application, the goal is to maintain a consistent lighting level within the space, regardless of the source of light which could be either

daylight or dimmable artificial light. If this lighting level can be maintained completely with daylight, no artificial light is necessary. However, if the lighting is not sufficient to meet the desired level, it can be boosted by the artificial light connected to the a-2000 dimming cabinet to whatever level is necessary to reach the desired lighting level. That is the theory behind daylight harvesting. The desired lighting level is called the "target."

Background-Photocells:

Photocells are devices which sense the incident light levels, and output a voltage proportional to the dynamic range which the photocell has been pre-configured to support. For example, Leviton's ODC0P-00W calibrated photocell senses 0-70fc. When the photocell receives 0fc of incident light, the output voltage will be 0V. Likewise, when the photocell receives 70fc of incident light, the output voltage will be +10Vdc. When received by the a-2000, this is converted to a scale of 0-255.

Configuring your a-2000 cabinet to use a photocell:

1. Connect the photocell(s) to one of the a-2000 analog inputs on the optional analog input card.
2. Configure the system defaults for photocell operations:
   a. From the Setup Menu, select modify defaults, and set the following settings:

RESPONSE determines how quickly the dimmers fade from point A to point B in order to achieve the desired threshold. Valid values are 1-7, 1=fast response, 7=slow response. A fast response is about 3.33% change per second and a slow response it about 0.83% change per second.

DEAD BAND determines the deviation from the target which must occur before the dimmer level will be adjusted to again match the target. For example, if the dead band is 5, the target is 128, and the current lighting level is 130, the dimmer level will not lower to meet the target. If however the current lighting level exceeds target+dead band, or 133, the dimmer levels will lower until either their value is 0, or the current lighting level is 128.

NOTE

If your lights are oscillating between levels and do not seem to settle upon one current level, try increasing the dead band and/or slowing down the response.

3. Assign dimmer modules to the photocell and set the settings for that module:
   a. From the dimmer modules setup menu, page until the PH ANA setting is reached. From this point, your LCD screen should read similar to the following:

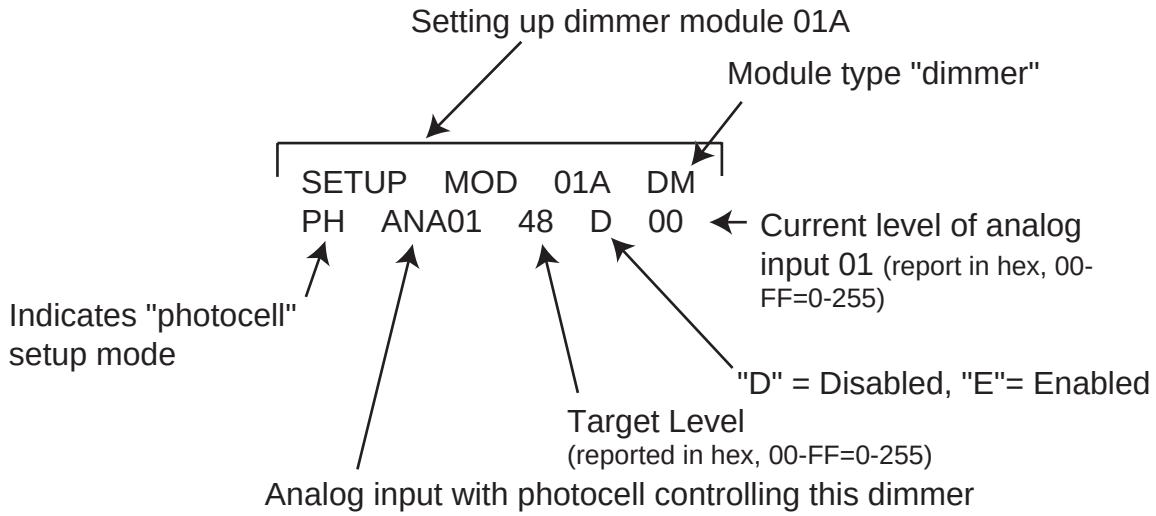


Figure 35- Setting up Dimmer Module 01A

Module type - is set elsewhere in the module setup screens and the information is provided here for reference only.

ANA01 - is used to set which analog input the photocell is connected to which this dimmer is listening to. Depending on your application, many dimmers may be reacting to the same photocell.

48 - the Target Level represents the level which you want the photocell to achieve indicating that the lighting level is at it's desired setting. This level is represented in hexadecimal format, valid values in the range of 00 to FF. 00 is equivalent to 0 in decimal notation and FF is equivalent to 255 in decimal notation.

D - indicates disabled. The valid settings are E for Enabled or D for Disabled. When enabled, it indicates that the dimmer is "enabled" in photocell mode and that it will reach to the analog input in attempt to reach the target.

NOTE

When a dimmer is "Enabled", any control change required of the dimmer and requested by any source other than the photocell will automatically disable the photocell function.

If analog input channel = photomatic channel, then analog input is ignored.

00 - shows the current level being reported by the analog input.

NOTE

` All of these settings can be set through the a-2000 menu structure as shown. However, in some installations which also have connected either Dimension 4200 or Dimension 8000 control stations, other methods can be used to set these settings.

Threshold can be "captured" from the current live setting by issuing a fade time of 253, Photocell Rec if using D4200 or D8000, on the Luma-Net channels patched to the dimmers assigned to the analog input.

For example, to use this feature given the following installation:

Photocell connected to Analog input 1

Analog Input 1 assigned to dimmers 7, 8, 9, & 10

Luma-Net channels 7, 8, 9 & 10 assigned to dimmers 7, 8, 9 & 10

1. Program a button/preset on either a D4200 or D8000 station with channels 7, 8, 9, & 10 at any levels with a fade time of 253s, Photocell Rec if using D4200 or D8000.
2. Create the desired lighting level in the space
3. Execute the button/reset

The current level reported by the photocell will now be stored as the target in dimmers 7,8,9 & 10.

Enabling dimmers to be controlled by their assigned photocell can also be triggered from a button/preset on a D4200 or D8000 control device.

To Enable the dimmer for photocell control

1. Program a button/preset on either the D4200 or D8000 station with the Luma-Net channel patched to the dimmer which you want to enable and a fade time of 254, Photocell On if using D4200 or D8000.
2. Execute the button/preset.

The assigned dimmer will now be enabled for photocell control.

Step: 13H: Modifying Factory Defaults

The majority are self explanatory, however a few deserve a little explanation.

Luma-Net Restore:

If this feature is turned "ON", the control module will take snapshots of the Luma-Net values periodically and in the event of a power failure, will restore the lighting to the levels they were at prior to the power failure. When the feature is turned "OFF", the control system will be responsible for restoring the lighting levels or the levels will go to zero.

Line Regulation:

Regulation is designed to maintain basic long term levels and will not correct for momentary instantaneous changes in excess of 10% of Line Voltage. When turned "ON", the dimmer cabinet will maintain consistent lighting levels as the incoming voltage varies. When turned "OFF" the cabinet will not compensate for the varying voltage levels.

NOTE

Speed of response controlled by a DIP switch. Contact factory for more information.

Parts Replacement

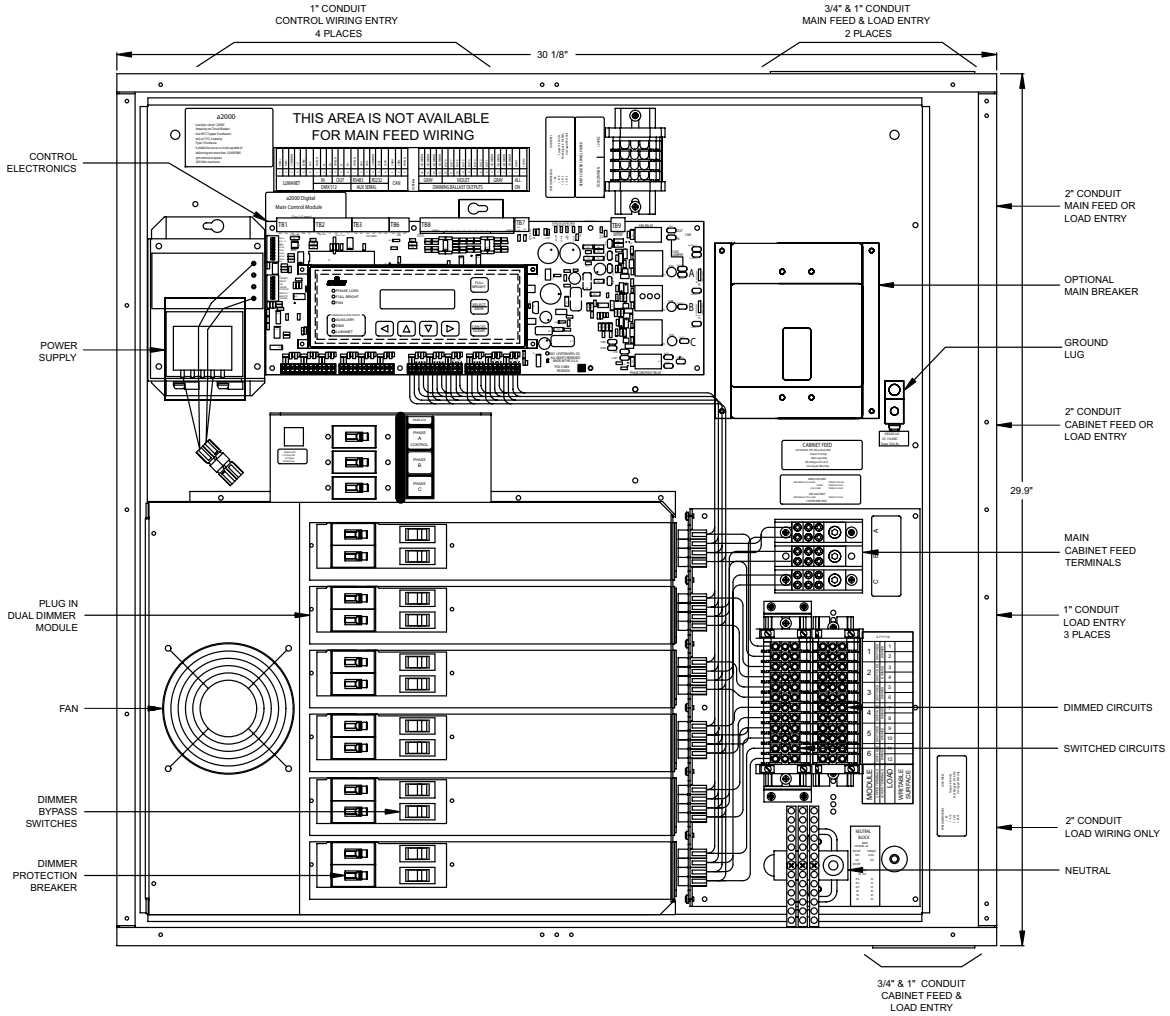


Figure 37 - 12 Circuit Cabinet

Specifications

Dimmer cabinet capacity	12 circuits, 15 or 20-amp each	24 circuits, 15 or 20-amp each
Dimensions with surface-mount hardware	30.125" wide x 29.88" high x 4.125" deep	30.125" wide x 43" high x 4.125" deep
Weight, fully loaded	125lb.	155 lb.
Conduit entry	See Figure 4	See Figure 4
Maximum fan noise rating	41 dBA each	41 dBA each
Ambient operating temperature	32° F to 104° F	32° F to 104° F
Maximum operating humidity	90% non-condensing	90% non-condensing
Input Feeder Configurations 120V 3ϕ Cabinets	120/208V 3ϕ, 80A Max 4 wire+Ground, 60Hz	120/208V 3ϕ, 175A Max 4 wire+Ground, 60Hz
Input Feeder Configurations 120V 1ϕ Cabinets	120/240V 1ϕ, 125A Max 3 wire+Ground, 60Hz	120/240V 1ϕ, 250A Max 3 wire+Ground, 60Hz
Input Feeder Configurations 277V 3ϕ Cabinets	277/480V 3ϕ, 80A Max 4 wire + Ground, 60Hz	277/480V 3ϕ, 175A Max 4 wire + Ground, 60Hz
Nominal 240 V circuits	Not available	
Phase to neutral operating voltage 120V Cabinets	110 to 130 V +/- 10%	
Phase to neutral operating voltage, 277V Cabinets	277V +/- 10%	
Operating frequency	47 - 63 Hz	
Cabinet type	NEMA type 1 for indoor use only; available for surface or flush mounting	
Control inputs	Luma-Net, DMX-512, 0 to +10 VDC (Optional Analog card)	
Square law curve control	Yes	
Top, bottom, right side feed	Yes	
Fully plug-in dimmer modules	Yes	
Dimmers available for	Incandescent, LV stepdown transformers, neon, cold cathode, high-rise time, fluorescent dimmer ballasts, 0-10 VDC controlled ballasts, Mark X, Hi-Lume, quartz, and constant circuits. Electronic Low Voltage is supported with factory qualification of transformer.	
Bypass switch for every dimmer	120V Dimmers Yes Universal Dimmers: Yes 277V Dimmers optional, requires 277V constant module	
Operating efficiency	Minimum 97%	
UL and cUL Listed	Yes	
Default SETUP Code (Password)	000	

Appendix A

Control Inputs

Luma-Net® III

The most common input is Luma-Net III, a Leviton protocol, that sends serial digital data over a twisted pair of communication (data) wires. With this system, controls can be located up to 2000 ft. from the dimming cabinet. The two data wires terminate on REM+ and REM- of the Luma-Net Terminal Block. Any shield if present is not connected.

Along with this pair of communications (data) wires are a second pair of wires for providing current limited 24 VDC power to operate displays and electronics in the remote control stations. These wires terminate on COM and +V. The communications signals require very little power, and number 24 AWG wire is adequate for the twisted pair. Belden number 9729 or equivalent is recommended. However the 24 VDC power wires handle more current and should be a #14 AWG minimum wire to insure that only a very small amount of voltage drop takes place over long distances. If a remote DC power supply is used, all DC common wires must be joined.

Where more than one remote control panel or dimmer cabinet using Luma-Net III communications is used in a system, the data wires and the DC power wires are run together from the dimmer cabinet to the nearest control station, then on to the next station, and the next, and so on. At the last control station or dimmer cabinet on both ends of the run, a small jumper wire must be run from the terminal labeled "Rem-" to the terminal marked "Term" on that last station. This jumper wire properly terminates the digital communications lines at the end of the line. Shield to ground at one point only.

DMX512

The digital control panel accepts DMX-512 signals, an industry standard signal widely used in the theater industry. This offers the opportunity to use theatrical consoles to control some or all of the dimmers in the a-2000D Dimmer Cabinet.

Analog

The digital control panel accepts a third type of control signal often used with analog control systems, if equipped with the optional analog control card. This signal varies between 0 VDC and +10 VDC to control the dimmer outputs. An input of 0 V results in no output power from the dimmer; an input of +10 VDC gives full voltage output from the dimmer. Varying this signal from 0 VDC to +10 VDC varies the AC output voltage from zero to virtually full line voltage. If this system uses analog inputs, an optional analog control card will have been added during fabrication.

Multiple Signal Types

Under certain circumstances the digital control panel can receive two or more types of input signals.

See page 34.

Types of Dimmer Modules

Dual Dimmer Module 000-A20DD-012(120V), -A27 (120/277V)

The 000-A20DD-012 & -A27 dimmer is capable of driving:

- Regular incandescent, quartz, quartz halogen, tungsten argon and similar lamp loads
- Magnetic stepdown transformers to operate low voltage incandescent lamp types
- Certain electronic stepdown transformers (Check exact types for compatibility)
- Neon and cold cathode transformers, of the low power factor type
- Fluorescent dimmer ballasts requiring 0 VDC to +10 V DC control signals (up to 8)
- Fluorescent dimmer ballasts using two wires for both power and control using the Advance Mark X dimming ballasts
- Fluorescent dimmer ballasts using two wires for both power and control using the Lutron TuWire™ ballasts
- Non-dim loads that need to be only turned on and off by the module, not dimmed
- Dimmed loads that require complete turn off at some point (done by correctly programming each dimmer slot for the load that is to be connected)

There are many different types and brands of fluorescent dimming ballasts and electronic low voltage transformers; many of these require different types of dimmers, modules, and control configurations. If the dimmer ballasts found on a job site are different than the system was designed to drive, it is necessary to check with the factory for ballast compatibility. We can assist you in verifying whether the existing dimmer will drive this different ballast, or whether we suggest changes to accommodate the different ballast type.

Constant Module 000-A20DC-012 (120V), -A27 (120/277V)

Occasionally there is a requirement to provide a circuit from the dimmer cabinet to a load that is never switched or dimmed. There is a module that fits into one of the dimmer slots that contains only two 20-amp circuit breakers and no other components, providing two “constant” circuits.

High Rise Time Module 000-A20HD-012

Incandescent lamps can make a buzzing sound under some dimmed conditions due to the rapid heating and cooling of the filament at certain brightness settings. if a circuit of incandescent lamps are being dimmed, and some of the lamps are near people, this buzzing noise can be objectionable. The 000-A20HD-012 dimmer module has a special "high rise time" filter chokes to further minimize this noise. The components take up more space than those used in a regular dimmer, so this dimmer takes up one module space, but contains only a single dimmer.

Dual Universal Module 000-A20UN-012(120V), -027 (120/277V)

The 000-A20UN-012 & -027 dimmer is capable of driving on its dimming channels (lower load terminals):

- Regular incandescent, quartz, quartz halogen, tungsten argon and similar lamp loads
- Magnetic stepdown transformers to operate low voltage incandescent lamp types
- Certain electronic stepdown transformers (Check exact types for compatibility)
- Neon and cold cathode transformers, of the low power factor type
- Fluorescent dimmer ballasts requiring 0 VDC to +10 V DC control signals (up to 8)
- Fluorescent dimmer ballasts using two wires for both power and control using the Advance Mark X dimming ballasts
- Fluorescent dimmer ballasts using two wires for both power and control using the Lutron TuWire™ ballasts
- Non-dim loads that need to be only turned on and off by the module, not dimmed
- Dimmed loads that require complete turn off at some point (done by correctly programming each dimmer slot for the load that is to be connected)

There are many different types and brands of fluorescent dimming ballasts and electronic low voltage transformers; many of these require different types of dimmers, modules, and control configurations. If the dimmer ballasts found on a job site are different than the system was designed to drive, it is necessary to check with the factory for ballast compatibility. We can assist you in verifying whether the existing dimmer will drive this different ballast, or whether we suggest changes to accommodate the different ballast type.

The Lutron company makes a series of dimmer ballasts called HiLume™ and Eco-10™ that control differently than other dimmer ballasts on the market. The 000-A20HL-027 dimmer module can drive these ballasts. It has two output terminals. One provides the 120V (-027, 277V)line voltage and is switched On or Off. The other output terminal provides a symmetrical phase-controlled dimmer output with a low end limit as required to drive these ballasts to different light outputs. The dimmed circuit is connected to the lower load terminal. The switched circuit is connected to associated upper load terminal. The upper terminals are for ballast loads only.

Fluorescent Dimming Ballast Types

0-10 VDC Controlled Ballasts

This method of ballast control is used by Sylvania, MagneTek, Advance (for the Mark VII ballasts) and others. It requires that the line voltage feed to the ballasts be switched On for operation, and Off to achieve zero light level, because these ballasts do not dim all the way to blackout.

One half of a dual dimmer module is used as an On/Off switch as described above, and feeds the line voltage to the dimmer ballast. A row of screw compression terminals located along the top of the PC board provides the 0 VDC

to +10 VDC control voltage drain for the ballast. There are sufficient terminals for the purple (+V) control wire for up to eight circuits using these ballasts. Therefore the maximum number of circuits with this type ballasts that can be fed from one a-2000D dimmer cabinet is eight. The system automatically assigns outputs in order of these dimmer types. Refer to the Configuring and Programming Section to determine that assignment. There is also a group of terminals for the (common) gray ballast control wires.

Since these are dual dimmers, one half of the dimmer provides the On/Off line voltage to the ballast, and for that same position the 0 VDC to +10 VDC signal is available to tell the ballast what brightness is required.

Two-Wire Fluorescent Ballasts **(Additional Control Wiring is not required)**

A second method of control, used by the Advance Mark X ™ fluorescent dimmer ballast and certain Lutron dimmer ballasts called TU Wire™, uses the power feed wires to the dimmer for both power and control. Only half of a dual dimmer is required to drive the ballast since it serves to dim both the ballast and as an On/Off switch to turn the lights fully off when necessary. In this configuration, the dimmer output that controls the light intensity is not allowed to go below some value of true RMS voltage in order to allow the ballast to generate the correct amount of filament voltage for the fluorescent lamps. By selecting the correct ballast type in setup, the digital circuitry of the a-2000D control board automatically sets the correct minimum voltage for the ballast type selected.

Other Ballasts - Three-Wire- (**Refer to the load wiring schematic.**)

A third method of control used by Lutron Hi Lume™ or Eco 10™ ballasts and older core and coil type magnetic dimming ballasts uses Universal Dimmer Module (000-A20UN-012, -027). There are three power wires to the ballast, which differs from other dimming ballasts on the market.

The first power wire supplies line voltage whose output is varied by the dimmer & is connected to the lower dimmer load terminal.

The second power wire supplies line voltage that must be switched on and off is connected to the corresponding upper switching load terminal.

The third power wire is the neutral return.

This dimmer module uses only one input breaker to feed the dimming load & the switching load.

NOTE

A minimum light level must be set for the Lutron ballasts, depending on the particular ballast being used. Operating the ballasts below that minimum level can result in damage to the ballast and lamps.

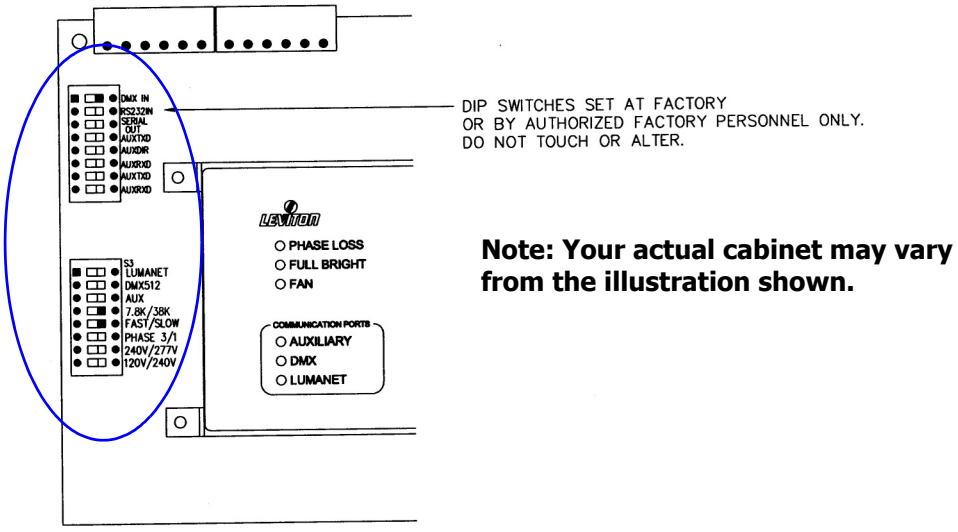


Figure 38 - Factory Set Dip Switches

The above figure shows the dip switches on the Control Module. These are factory set and should not be altered unless instructed to do so by an authorized Leviton Factory Person.

Warranty Information

Limited Warranty

LEVITON LIGHTING CONTROL DIVISION of Leviton Manufacturing Co Inc. warrants its Lighting Control Systems products to be free of material and workmanship defects for a period of two years after system acceptance or 26 months after shipment, whichever comes first. The Z-MAX Relay cards are covered for a period of Ten (10) years. Lighting fixtures manufactured by Leviton are covered for a period of one year.

This Warranty is limited to repair or replacement of defective equipment returned Freight Pre-Paid to Leviton Lighting Control Division at 20497 SW Teton Ave., Tualatin, Oregon 97062, USA. User shall call 1-800-959-6004 and request a return authorization number to mark on the outside of the returning carton, to assure that the returned material will be properly received at Leviton.

All equipment shipped back to Leviton must be carefully and properly packed to avoid shipping damage. Replacements or repaired equipment will be returned to sender freight prepaid, F.O.B. factory. Leviton is not responsible for removing or replacing equipment on the job site, and will not honor charges for such work. Leviton will not be responsible for any loss of use time or subsequent damages should any of the equipment fail during the warranty period, but agrees only to repair or replace defective equipment returned to its plant in Tualatin, Oregon.

This Warranty is void on any product that has been improperly installed, overloaded, short circuited, abused, or altered in any manner. Neither the seller nor Leviton shall be liable for any injury, loss or damage, direct or consequential arising out of the use of or inability to use the equipment. This Warranty does not cover lamps, ballasts, and other equipment which is supplied or warranted directly to the user by their manufacturer. Leviton makes no warranty as to the Fitness for Purpose or other implied Warranties.

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Power Considerations for Control Systems

The control system should be carefully planned to take these important issues into consideration:

- Power Supply for connected devices
- Wire Size for Power Runs

On systems where full factory drawings have been provided, our Applications Engineering department has already managed these calculations for you so you need only follow the instructions on the system drawings. However, on any installation where factory drawings were not provided, the information contained within this guide must be followed to ensure that all of your devices operate properly and without failures or complete in-operability.

NOTE This chapter contains information which applies to many Leviton products and is not necessarily limited to the product which is primarily included in this manual. There may be information in this chapter which is not relevant to your particular installation. If you have questions about ANY information contained herein, please immediately contact our Technical Services Department prior to proceeding with installation.

Terminology

Please review these definitions which are used throughout this chapter:

- *Power Supply* or *Supply* - references a device which supplies power to other devices
- *Power Control Device (PCD)* - refers to a device which controls power. Examples of Devices in the Leviton product line which control power are dimming racks, relay panels, A-2000, i-series e, Z-MAX, etc. Generally PCD's also supply a certain amount of power to connected low voltage control devices
- *Control Devices* or *Low Voltage Control Devices* or *Device* - these terms all refer to control devices which connect to a Power Control Device (PCD). These devices could be simple low voltage switches, Occupancy Sensors, or D8000 control stations
- *Luma-Net* - is one of our network lighting control protocols. Luma-Net is an RS-485- based control protocol used by D8000 & D4200 control devices. Many of our PCD (Power Control Device) products have a direct data connection for a Luma-Net device. All Luma-Net Control Devices require power in one form or another. This power generally accompanies the data wires
- *Unit Load* - (1) Unit load is defined as 25mA, or 0.025A. It is an arbitrary definition by Leviton and was created to simplify power calculations

Power Requirements & Maximum Run Length

Each Control Device used in your system has a different load (draw) and each PCD can support a different total load (supply.) The steps for determining the total load of your network and verifying that the supply is sufficient are simple--or at least logical:

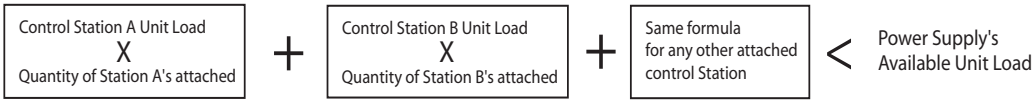
Step 3: Determine the maximum available current of your supply, be it a PCD or other Power Supply. Convert this to the maximum number of Unit Loads if necessary.

Step 4: Sum the required load of each Control Device, expressed in unit loads

Step 5: Verify that the Sum from Step 2 <= the maximum available power from your supply in Step 1.

- If this verification fails, the Sum of required loads is > than the available supply, either use an external power supply or reduce the number of control devices. Or, contact our Technical Services department for help.

NOTE One Unit Load = 25mA =.025A



Load Rating Verification Formula

Power Control Devices - Available Supply Current

The Z-MAX cabinets are designed to be able to power external control loads from the internal power supply. See the table below for the available power from each cabinet.

Power Control Device (PCD)	Maximum # of Unit Loads	Supply (VDC)	Power Control Device (PCD)	Maximum # of Unit Loads	Supply (VDC)
a-2000D, 12 Circuit, Standard Power Supply	40	24VDC	Z-MAX 8 Cabinet	20	24 VDC
a-2000D, 24 Circuit Standard Power Supply	46	12VDC	Z-MAX 48 Cabinet (Master or Slave)	20	24 VDC
a-2000D, 12 Circuit, Large Power Supply	120	12VDC	Z-MAX Switch Input Board (accessory to Z-MAX 24 & 48 size Cabinets)	20	24 VDC
a-2000D, 24 Circuit Large Power Supply	114	12VDC	RRP - Z-MAX Remote Relay Panel	6	24 VDC
NPC – XP	49	12-24 VDC	i Series e (all Racks)		
NPC – DHV	N/A	N/A			
NPC – DLR	49	12-24 VDC			

Power Supply Maximum Unit Loads

NOTE The sum of all devices connected to all power output terminals can not exceed the Maximum number of Unit Loads available in the PCD or supply.

Control Devices	Unit Load @12VDC	Unit Load @24VDC	Station Type	Unit Load @ 12VDC	Unit Load @ 24VDC
D4200 LCD	5	2	Z-MAX Digital Switch, 1 Button	N/A	0.6
D4200 Entry (Button),	2	1	Z-MAX Digital Switch, 2 Buttons	N/A	0.8
D4200 Room Combine Station	3	1	Z-AX Digital Switch, 3 Buttons	N/A	1.0
D4200 Remote I/R	2	1	Z-MAX Digital Sw., 4 Buttons	N/A	1.1
Luma-Net Hub	6	3	Z-MAX Digital Switch, 5 Button	N/A	1.3
D8000 LCD	3	2	Z-MAX Digital Switch, 6 Button	N/A	1.0
D8000 Entry (Button)	2	1	Z-MAX Digital Switch, 8 Button	N/A	1.1
D8000 Slider	2	1	Z-MAX Digital Sw., 10 Button	N/A	1.3
D8000 Key switch	1	1	1 Button Low Voltage Switch	N/A	0.6
D8000 I.O Port	2	1	2 Button Low Voltage Switch	N/A	0.9
D8000 Combine/ Closure (Advanced)	11	10	3 Button Low Voltage Switch	N/A	1.2
Infrared Only Occ Sensor	N/A	1.2	4 Button Low Voltage Switch	N/A	1.5
Ultrasonic Only Occ. Sensor	N/A	1.2	5 Button Low Voltage Switch	N/A	1.8
Multi-tech Occ Sensor	N/A	1.2	6 Button Low Voltage Switch	N/A	2.1
Ultrasonic 2-Way Occ. Sensor	N/A	1.4	8 Button Low Voltage Switch	N/A	2.7
Multi-tech 2-Way Occ, Sensor	N/A	1.4	10 Button Low Voltage Switch	N/A	3.3
Photocell, odc0p-00w			Photocell, pcatr-000		
Photocell, pcind-000			-		

Control Devices	Unit Load @12VDC	Unit Load @24VDC	Station Type	Unit Load @ 12VDC	Unit Load @ 24VDC
Photocell, pcout-000			-		
Photocell, pcsky-000			-		

Control Device Loads

Power Wire - Run Length

The maximum total run length of each segment is a function of the total number of unit loads. A run becomes too long when the voltage drop, due to wire size and run length, increases to a point where the station does not have sufficient voltage to operate. The maximum run length, in feet, based on the total number of unit loads is shown below:

NOTE (2) Tables are provided, (1) @ 12VDC and (1) at 24VDC. Make sure that you use the correct table!

Voltage Drop Table

Current		18AWG		16AWG		14AWG		12AWG		10AWG	
(Ams)	Unit Loads	12V	24V	12V	24V	12V	24V	12V	24V	12V	24V
0.25	10	756	3,528	1,200	5,600	1,904	8,885	3,000	14,000	4,800	22,400
0.50	20	378	1,764	600	2,800	952	4,443	1,500	7,000	2,400	11,200
0.75	30	252	1,176	400	1,867	635	2,962	1,000	4,667	1,600	7,467
1.00	40	189	882	300	1,400	476	2,221	750	3,500	1,200	5,600
1.25	50	151	706	240	1,120	381	1,777	600	2,800	960	4,480
1.50	60	126	588	200	933	317	1,481	500	2,333	800	3,733
1.75	70	108	504	171	800	272	1,269	429	2,000	686	3,200
2.00	80			150	700	238	1,111	375	1,750	600	2,800
2.25	90			133	622	212	987	333	1,556	533	2,489
2.50	100			120	560	190	889	300	1,400	480	2,240
2.75	110			109	509	173	808	273	1,273	436	2,036
3.00	120			100	467	159	740	250	1,167	400	1,867
3.25	130					146	683	231	1,077	369	1,723
3.50	140					136	635	214	1,000	343	1,600
3.75	150					127	592	200	933	320	1,493
4.00	160					119	555	188	875	300	1,400
4.25	170					112	523	176	824	282	1,318
4.50	180					106	494	167	778	267	1,244
4.75	190					100	468	158	737	253	1,179
5.00	200							150	700	240	1,120

Wire Size vs. Length of Runs - Power Wiring @24 VDC

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LIT-32400-00