

# The Light Source DMX 1 Rev F Installation Guide

## DMX CONTROL

## Installation Manual



### DMX CONNECTOR WIRING INSTRUCTIONS

It is essential to take the time to ensure that all DMX connections are done properly the first time. It is difficult and time consuming to find DMX wiring errors after the installation is complete.

The DMX-512 cable terminations must have the jacket carefully removed without damaging or nicking the insulation of the individual conductors inside the cable. Only the three wires that are to be connected should extend one inch past the cable jacket. Any other conductors and the shield in the cable should be trimmed flush with the jacket and completely encased with heat shrink or tightly wrapped electrical tape. This will keep the non-data conductors and shield from possibly shorting the DMX signal or shorting something on the dimmer board.

### ESSENTIAL DMX PROCEDURES

All DMX wiring must be daisy chained--run from the controller to the first fixture, from the first fixture to the second fixture, from the second fixture to the third fixture, etc.

No DMX wiring may use twofers or wiring configurations made in a star, tee, or Y. The DMX cable should be a continuous run between DMX devices with no splicing and should be grounded only at the console, never further in the daisy chain.

Data plus and data minus cannot be interchanged anywhere in the DMX system.

A practical maximum DMX daisy chain length with 24 gauge DMX cable is 1000 feet (one 1000' spool).

Use one DMX Opto-Splitter with as many DMX outputs required to provide additional DMX daisy chains.

The last DMX device on each DMX daisy chain must be terminated. The Light Source fixtures use dip switch 4 in the "ON" position to terminate the DMX data plus and data minus signals. Only the last fixture on the DMX daisy chain should be terminated.

DMX cable must meet the RS485 standards, (or the Cat 5 standards if double shielded CAT 5 cable is installed in metallic conduit).

**Bizarre system operation will result from failing to observe these rules!**

### SYSTEM DMX WIRING CABLE REQUIREMENTS

Proper DMX wiring is critical to a satisfactorily working lighting system. Do not

cut corners on the DMX wiring. The system can only perform as well as the onsite DMX wiring installation will allow. The DMX-512 digital control signal turns on and off up to a quarter of a million times a second. Because of these rapid electrical current changes, exacting methods must be followed and special cable types are required for the DMX system to work properly. The longer the total distance the DMX control signal runs, the more critical it is that the proper cable is used. DMX512 uses the RS485 standards for data communication cable. All DMX512 cable used for the installation must meet these standards.

Only one twisted pair of data conductors is required to run the fixture. Some DMX cables have more than one twisted pair, which makes more work to complete the installation. The Light Source can provide an excellent DMX cable with a double shield, drain wire, and a single 120 Ohm impedance low capacitance twisted wire pair. This cable will save installation time. A partial list of other manufacturer's cable types that meet the DMX requirements are: Belden 9729, 9829, and TMB Proplex.

CAT 5 cables have four 100 Ohm impedance low capacitance twisted data pairs and have been proven by a leading industry group to properly distribute DMX when correctly installed in permanent installations using metallic conduit as a protective shield. CAT 5 STP (shielded twisted pair) with double shielding cable may be used if installed inside metal conduit. CAT 5 cable is best connected with IDC style connectors.

### IMPORTANT NOTES

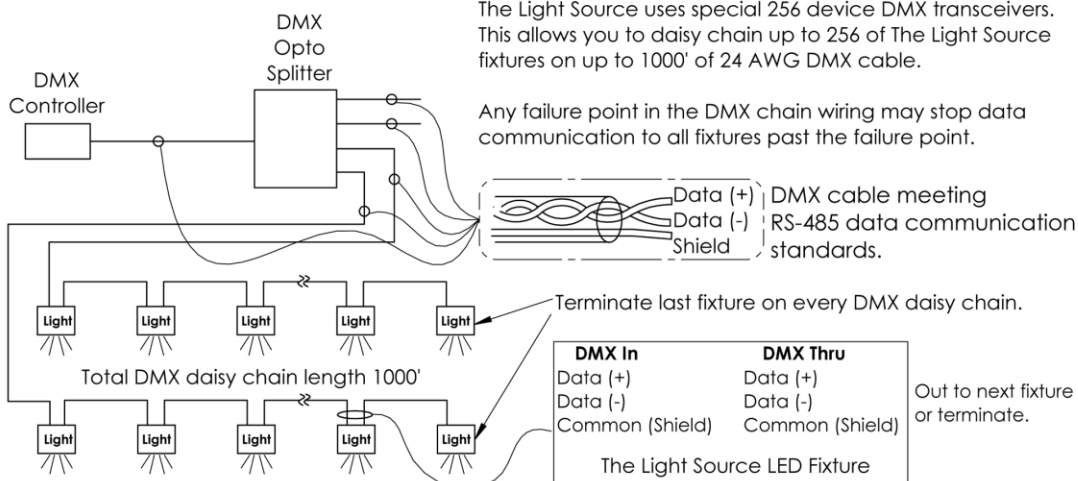
The 120 Ohm termination resistor at the end of the daisy chain stops the electronic control signal from bouncing back down the DMX line and mixing with the incoming DMX signal, confusing the DMX receivers and causing havoc with proper control of DMX system.

DMX receiving devices have male XLR plugs. DMX transmitters have female XLR connectors. RJ45 connectors may be used for permanent DMX wiring cable terminations only.

### WARNING

Accidental connection of RJ45 connectors to non-DMX512 equipment may result in serious damage to the Light Source equipment. Both Power over Ethernet (POE), and Telecom (phone ringing), have voltages that are above the DMX-512 limits on pins 4 and 5. Some lighting manufacturers also have proprietary DMX distribution systems that have voltages that are above the DMX-512 limits on RJ45 pins 4 and 7. Because of these various uses, connecting unlike systems could cause serious damage. For example, do not run The Light Source fixtures on a Color Kinetics control daisy chain.

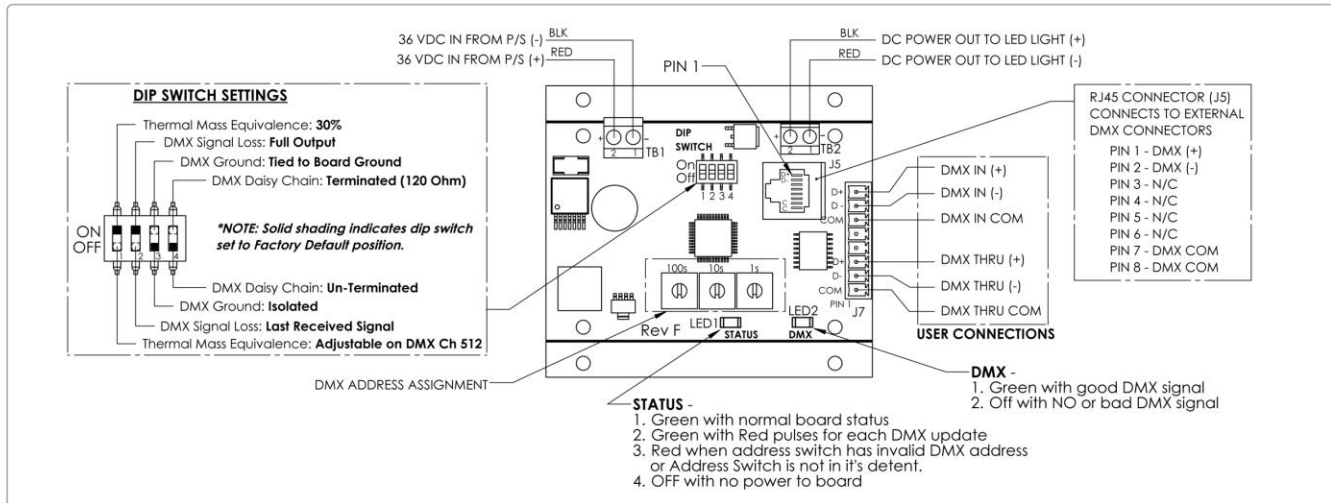
## SYSTEM DMX RISER



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THE LIGHT  
SOURCE INC.



### FIXTURE ADDRESS SETTING

The Light Source recommends that each fixture be given an individual DMX address to maximize the system flexibility. However, if you have channel limitations you may group lights on the same DMX address without any harm to the system.

To set the fixture DMX address, use the 3 rotary switches labeled 100's, 10's, and 1's. Use your fingers or a small screw driver to rotate the selector switch to the desired address. The arrow should point to the DMX address number desired. It is important that each rotary switch is fully clicked into the number detent. There is a definite detent for each number that can be felt as the numbers are set. If any of the DMX address rotary switches are in between detents, then the board will indicate a DMX error by changing the Status LED indicator from its normal green to red. The Status LED is labeled LED 1.

The 100's switch sets the 100's digit, the 10's switch sets the 10's digit, and the 1's switch sets the 1's digit. For example: DMX address 358 has the 100's switch set to 3; the 10's switch set to 5 and the 1's switch set to 8.

### DIP SWITCH SETTINGS

"ON" is the up position, away from the address selectors. Use only a small screwdriver to move the switch horizontally. Do NOT press down on the switch or press at an angle.

### DIP SWITCH SETTINGS

### Factory Default Setting

Switch 1	ON	Sets Thermal Mass Equivalence at factory default of 30%	ON
Switch 1	OFF	Allows Thermal Mass Equivalence to be adjustable on Channel 512	ON
Switch 2	ON	Sets Fixture to default to full output with DMX signal loss	ON
Switch 2	OFF	Sets fixture to maintain last received signal with DMX loss	
Switch 3	ON	Ties Board ground to DMX common through a 10K Ohm resistor	
Switch 3	OFF	Isolates board ground from DMX common	OFF
Switch 4	ON	Terminates the DMX daisy chain with a 120 Ohm resistor	
Switch 4	OFF	Leaves the DMX data unterminated	OFF

The last fixture on each DMX 512 daisy chain must be terminated by turning switch 4 ON

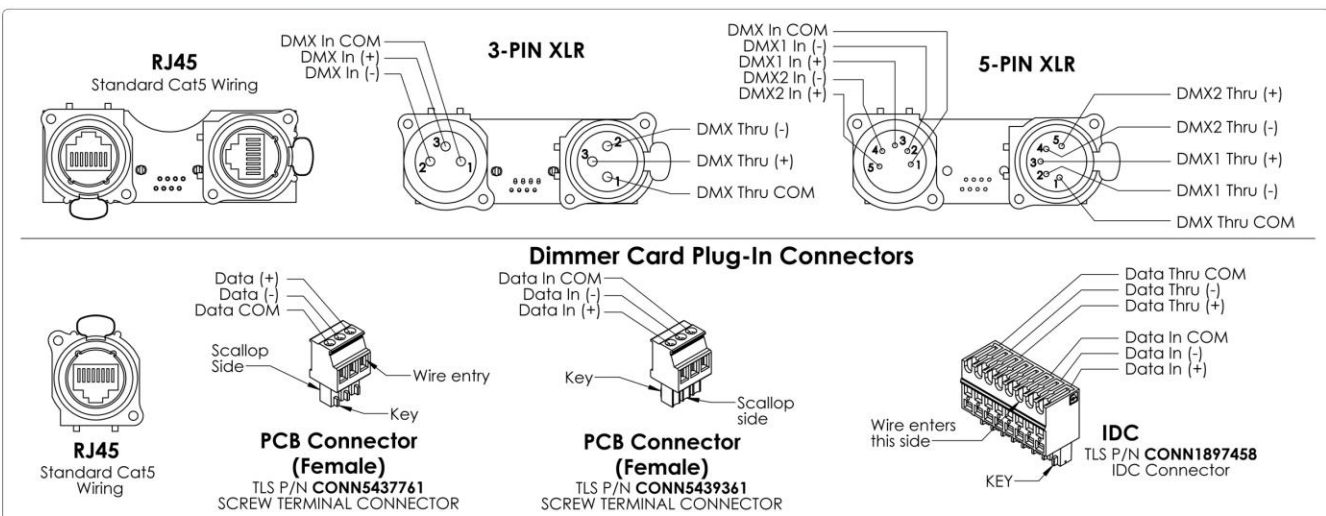
### DMX WIRING ON FIXTURE DIMMER BOARD FOR SCREW TERMINAL OR IDC CONNECTORS

Pin #	DMX Function	Cat 5 Wire Color
1	Data In +	Orange/White
2	Data In -	Orange
3	Data Common	Brown
4	Not Used	
5	Not Used	
6	Data Through +	Orange/White
7	Data Through -	Orange
8	Data Through Common	Brown

### XLR WIRING

5 PIN XLR	3 PIN XLR
Pin #	Pin #
1 Common	1 Common
2 DMX 1 Data -	2 Data -
3 DMX 1 Data +	3 Data +
4 DMX 2 Data -	
5 DMX 2 Data +	

## DMX CONNECTOR WIRING



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**How to test your DMX wiring before powering up the system:**

**Measure the unplugged DMX line that would plug into the console or Opto-Splitter with power off to all light fixtures:**

**Measure between the DMX Data+ and DMX Data- conductors or pins, the reading should be about 120 Ohms for a properly terminated DMX chain.**

**If the reading is between 2.5K and 100K Ohms this DMX chain is not terminated, terminate the last fixture on this DMX Chain.**

If this reading is 60 Ohms or less, there are likely multiple terminators on this DMX chain.

If this reading is close to zero Ohms, there are shorts between the DMX Data+ and DMX Data- conductors or between the data connections on this DMX chain.

**Measure between the common/drain wire to either the DMX Data+ or DMX Data- conductors or pins, they should both read at least 250K Ohm.** If the reading is significantly less than this, there is a short between the common/drain wire and the DMX Data leg. Any higher reading is good.

## **Finding and Fixing Multiple Terminations:**

You can divide the DMX chain in half and measure both directions; Measuring between Data + and Data -, a reading with 2.5K Ohms to 100K Ohms would show no terminator, while the multi terminator side of the chain would read less than 120 Ohms. Keep dividing the DMX Chain on the side with less than 120 Ohms until you see 120 Ohms reading on both sides of the DMX chain. Remove the extra termination on fixture on the console side of the divided DMX chain. Measure both sides of the DMX chain again, after removing the extra termination, to see if there are other terminations to remove. When you have found and removed all the extra DMX terminations, be sure that the entire DMX chain is reconnected and only the last fixture in the DMX chain is terminated.

**Finding and Fixing Data+ to Data- Shorts: You can divide the DMX chain in half and measure Data + to Data - in both directions, a reading with 2.5K Ohms to 4.6K Ohms would be normal on the console side of things,** and the other side of the chain should have a normal reading of about 120 Ohms, the short will read close to zero Ohms. Keep dividing the DMX Chain on the abnormal side until you isolate the short. You may need to fix the shorting wires at a connection, or run a new DMX cable to fix the problem between two fixtures. When you have found and removed all the shorts, be sure that the entire DMX chain is reconnected and that only the last fixture in the DMX chain is terminated.

**Finding and Fixing Common to Data+ or Data- Shorts:** You can divide the DMX chain in half and measure both directions, a reading with at least 250K Ohms would be normal on both sides of things, and a reading of close to zero Ohms would indicate a fault. Keep dividing the DMX chain on the abnormal side until you isolate the short showing close to zero Ohms between Common and either Data + or Data -. You may need to run a new DMX cable to fix the problem between two fixtures, or fix the shorting wires at a connection. When you have found and removed all the shorts, be sure that the entire DMX chain is reconnected and only the last fixture in the DMX chain is terminated.

**The above measurements find all DMX wiring errors except for reversing the DMX Data+ and DMX Data- connections.** The fixtures will work properly up to the point on the DMX chain where the Data+ and Data- wires are reversed, and after this point the fixtures will behave erratically when dimming. This reversal could happen more than once on a DMX chain. The second reversal point would fix the problem for the rest of the DMX chain, (until the first reversal is repaired.) The problem will be on either the DMX through wiring from the last working fixture, or on the DMX in wiring on the first non-working fixture.

## **Pre-DMX Wiring Trouble Shooting**

**Only five things can fail in a DMX controlled lighting system; the controller, the cable, the terminations, the power, and the fixture.**

Is the Console turned on?

Is the Grand Master on?

Are the light fixtures patched correctly in the console or controller?

Is the DMX control cable plugged into the correct output on the console?

Is the Opto-Splitter on? Are the Opto-Splitter outputs working correctly?

Does the house light controller have control authority for the house lights?

Are the breakers powering the light fixtures on?

## **Troubleshooting the system:**

**The Fixture stays on when it is powered up, but will not dim, and the other Fixtures are working on both sides of the DMX daisy chain from this fixture.** If Switch 2 is set to on, and the Fixture Dimmer Board does not receive a valid DMX signal, the fixture is programmed to turn on to full. See if the DMX LED indicator is indicating Red, if so, the problem is probably a DMX addressing issue. Check to see that the Dimmer Board is set to a valid DMX address from 1 to 512. Check to see that the rotary selector switches are pointed at the number desired and are in their detent. The DMX LED indicator will turn green as soon as a DMX address is properly entered, (with valid DMX), and the fixture will go to its assigned level.



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**The Fixture stays on when it is powered up, but will not dim, and the Fixtures are dimming correctly only on the console side of the DMX daisy chain from this fixture.** If Switch 2 is set to on, and the Dimmer Board does not receive a DMX signal, the fixture is programmed to turn on to full. See if the DMX LED indicator is indicating Red, and if all the fixtures on the far side of the DMX daisy chain from this fixture are on, but not dimming. This would indicate that the DMX signal is not reaching the Fixture's Dimmer Board. Be sure the DMX connector is seated all the way into the receptacle on the Dimmer board. It may be the DMX wiring at this Fixture is not proper. Look for a wire that was put in the terminal without stripping the insulation, or a reversed Data + and Data- wiring, or look for a loose wire connection at the DMX wiring terminal. Be sure to check the common/drain wire for a good connection, if all of these things check out properly, then check the wiring leaving the previous fixture for the same things. If that wiring is good, replace the DMX cable between the fixtures. The DMX LED indicator will turn green as soon as a good DMX signal is being received, and the fixtures will respond to the console again.

**The Fixture does not come on with the controller commands.**

There may not be a control signal, check to see that the DMX LED indicator is green, indicating good DMX. If the DMX LED indicator is red, the fixture may not have a valid DMX address, be sure the address is a number between 1 and 512. Check all three address selectors to see that they are clicked into their address number. They must be "Clicked in" or they will not work. The DMX LED will turn Green as soon as it sees valid DMX and a valid DMX address. Check the controller patch and output to be sure the fixture is being commanded to be on. Check that the fixture has power - check the circuit breaker and/or the fixture power connections.

**DMX Trouble Shooting:**

Basically, **it is almost always a DMX cable or the termination of a DMX cable that is the problem.**

Any loose wire termination in a DMX daisy chain will wreak havoc with the lighting system. DMX control cables that have been broken from being pulled too hard around corners, DMX cables having objects dropped on them, and other DMX cable abuse may have created broken conductors in the DMX cable that are intermittent, that is, sometimes they work, and sometimes they don't. The wire continuity through the daisy chain is very important to a properly working DMX system. The longer the total DMX daisy chain length is, the more important that terminating the data at the last fixture becomes.

**IF the entire system is behaving strangely.**

Set the control console to run a continuous loop of a 10 second fade from 20% to full and back to 20%.

This will let you see the lights that are behaving properly and the ones that are not. Make a list of the misbehavers, what their misbehavior is, find which DMX daisy chains the misbehavers are on, as well as where on the DMX daisy chain the misbehaviors are. This drawing or chart gives you a starting place to work out a solution. If parts of the system work correctly, determine where in the DMX daisy chain the working lights are as well. Go to just the first Fixture and unplug or unwire the rest of the DMX chain. Does the first fixture now work properly? If not, try a new control cable from the console to only the first fixture. Does this fix the problem? If so, plug in the rest of the DMX daisy chain and if they all work properly, remove the bad cable and permanently replace it with the new one. If the new cable does not work, try another control console with the new DMX cable. If the fixture works now, add the rest of the fixtures back to the daisy chain, if they all work, get a new console or repair the broken one.

The DMX standard does not allow for 3 pin XLR connectors to be used in DMX applications. They are often used in spite of this. Some low end controllers have changed the normal DMX Data wiring connections used for DMX by reversing Data+ and Data-. The console will work with their own fixtures that also have Data+ and Data- reversed, but this will cause normal DMX fixtures to behave bizarrely.

**Fixture or system is intermittent or flashing.**

Check to see that the end of the DMX chain is terminated. Switch 4 should be set to OFF on all fixtures, except for the last fixture. It is important that only the last fixture on the DMX chain have the Data terminator Switch 4 set to ON. Check for a faulty cable. Check for a faulty channel on control console or the control console itself. Check to see if the data conductors are connected properly at both ends of the cable. Data plus or data minus cannot be shorted together or reversed. DMX 512 has a tendency to work intermittently even if one of the data wires is missing. Check to see if one of the data signals is missing. (Data plus or Data minus wire disconnected.) This may cause random flickering intermittently during otherwise apparently normal operation. Check to see if adding an opto-isolator into the network clears up or reduces the problem. If so, there is probably a ground-loop effect taking place. You may be able to reroute the power cabling to minimize this. Otherwise, you may have to add an Opto-isolator in the middle of some branches of the DMX daisy chain. Alternately, you may have to split a longer daisy chain and add an additional homerun.

**Random flashing of fixtures & lamps when powering up from a dimmer.**

Do not power the fixture on a dimmed electrical circuit. Power circuits to the Fixtures must be from a constant voltage source, that is, from an electrical panel through a circuit breaker. The Fixtures are not designed to function when powered by a dimmed mains voltage. **Powering the fixture through a dimmer may cause erratic behavior of fixtures, and will void the warranty.**