

IRIDEON[®]

AR500[®] Exterior Wash Luminaire

Remote Ballast Version Installation Manual

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AR500^ä Exterior Wash Luminaire

Remote Ballast Version Installation Manual

Reporting Errors and Recommending Improvements

You can improve this manual. If you find any mistakes, or if you know of a way to improve procedures, please let us know. Send your letter to:

Electronic Theatre Controls, Inc.

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attn: Service Manager

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U.S. Patents No. 5,728,994; 5,367,444; 5,186,536; 5,073,847; 4,779,176;
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994; 0 060 068;

France Designs Reg. No. 370297 - 3703003;

German Patents No (DBP) 96314122.0; 69208615.3; 69121029; 3768727;
3279888; 3274291;

German Design Reg. No. M9402951.2;

Hong Kong Patents No. 965/1990; 285/1987;

Japan Patents No. 2,059,669; 2,055,324; 1,889,481; 1,770,241; 1,723,825;
1,683,007; 1,533,011;

Japan Design Reg. No. 1,002,123; 985,985;

Korea Patent No. 76,310; 42,639

Korea Designs Reg. No. 209,896; 209,895;

Mexico Patent No. 180,148;

Singapore Patents No. 663/90; 134/87;

Spain Patents No. 2.031.748; 2.020.960; 548.328;

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AR500[™] Exterior Wash Luminaire

Remote Ballast Version Installation

Each AR500 exterior wash luminaire is shipped in two cartons, with the stanchion in one carton and the head assembly in another carton. Ensure one stanchion and one head assembly is available for each luminaire to be installed. Lamps, manuals, and accessories are packed in a third carton.

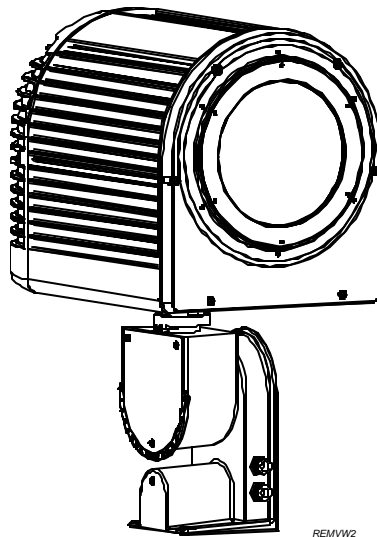
Included in each shipment is an installation tool kit. Check the tool kit for the following items:

- 1-15/16 inch open-ended wrench
- 3/16 inch T-handle Allen wrench
- 100 Ω termination resistor
- Depinning tool

Some additional tools will also be necessary in order to complete the installation. Obtain the following items:

- #2 Phillips screwdriver
- #2 Straight slot screwdriver
- 3/4" (or 19mm) socket
- 9/16 inch (or 15mm) Socket

The installation site must provide an adequate mounting platform, sufficient clearance for focus adjustment of the head assembly and stanchion, sufficient access for relamping and other servicing, and provisions for power and data cabling.



AR500 Exterior Wash Luminaire, Remote Version

Chapter 1: Site Preparations

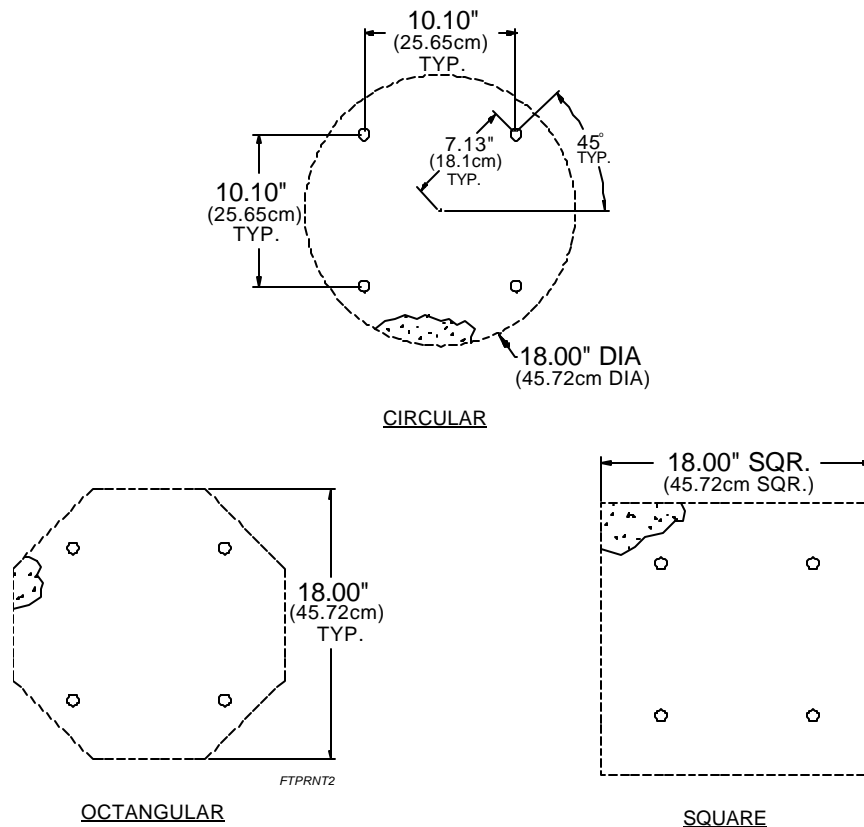
Note: The installation contractor is responsible for compliance with local electrical codes.

The luminaire stanchion is provided with 10 feet (3 m) data cable and 10 feet (3 m) power cable for external termination. To ensure proper operation, the installation site should be equipped with waterproof junction boxes for data and power cable termination. Data and AC power for each luminaire should be terminated in separate junction boxes, unless a single barriered junction box is installed. Terminal strips, not wire nuts, must be used to terminate wiring.

1.1 Mounting Platform for Stanchion Assembly

The stanchion mounting platform must have a diameter (or distance across flat sides) of at least 18 inches (45.00cm). The luminaire's mounting plate includes mounting holes sized to provide clearance for four sets of 3/8-18 (M10) (preferably stainless steel). The hole pattern for the mounting plate is a square that is 10.10 inch (25.65cm) on a side [or 10-7/64 inches (5.65cm)square].

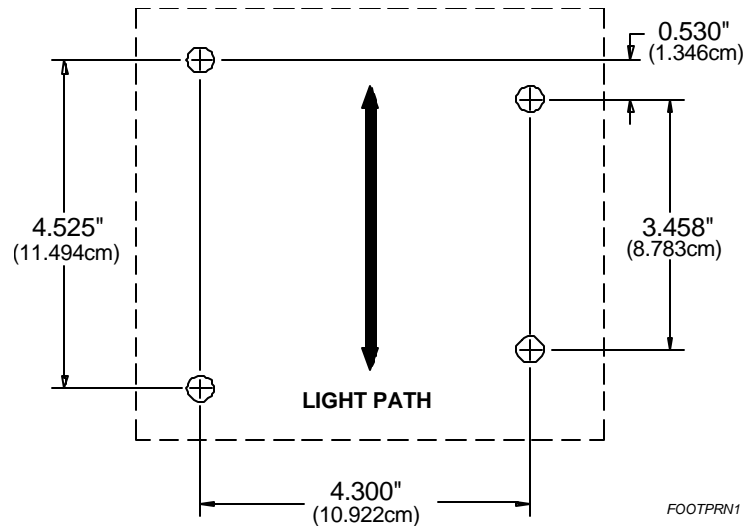
Note: Be sure to use four sets of 3/8 inch (M10) hardware when installing unit.



1.2 Mounting Platform for Remote Head Assembly

The remote head mounting assembly requires a flat surface about 6-1/2 inches (16.51cm) square. The mounting plate includes holes sized to provide clearance for four sets of 3/8-18 (M10) studs (preferably stainless steel). The hole pattern is shown below.

Note: Be sure to use four sets of 3/8 inch (M10) hardware when installing unit.



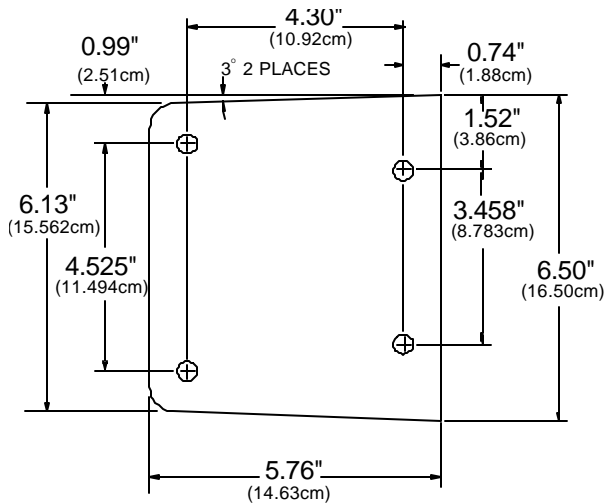
As shown, the head assembly can be installed so that the light is generally directed either forward or rearward of the bolt pattern.

The head assembly can either be installed on a flat horizontal surface or a flat vertical surface as long as the requirements detailed above can be met.

1.3 Clearance and Access

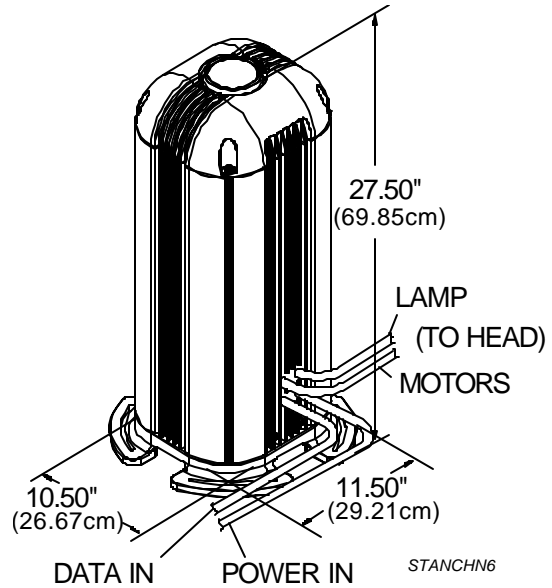
As shown, the bolt pattern for the remote mounting foot is not square and the stanchion requires an 8 inch (20.32cm) radius clearance all around, with access to cable entrance/exit.

WARNING: This appliance must be earthed. Flammable objects must be kept a minimum of 13'-2" (4.0 m) from lens.



AR500 REMOTE MOUNTING FOOTPRINT

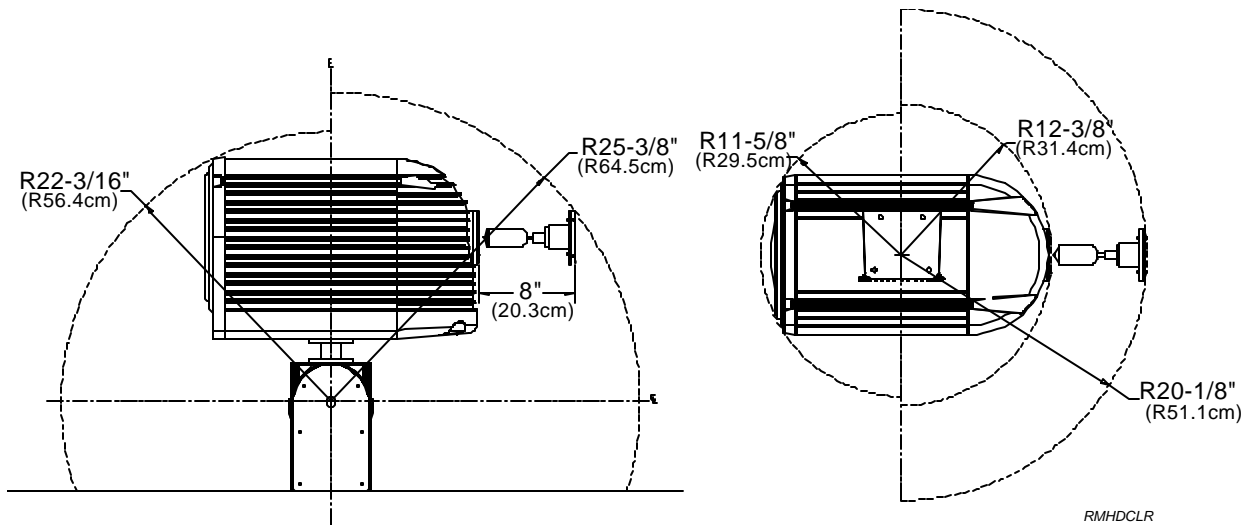
FOOTPRINT



DATA IN

POWER IN

STANCHION6



R22-3/16"
(R56.4cm)

R25-3/8"
(R64.5cm)

R11-5/8"
(R29.5cm)

R12-3/8"
(R31.4cm)

8"
(20.3cm)

R20-1/8"
(R51.1cm)

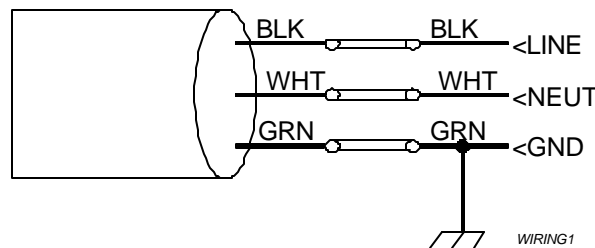
RMHDCLR

1.4 Input Power and Control Cabling

Each **AR500** luminaire requires 1000 watts of power at the specified voltage and frequency. The luminaire is provided with 10 feet (3 m) of unterminated power cable type SJOW-A 16-3 (1.5mm²). Power wiring is to be connected as follows:

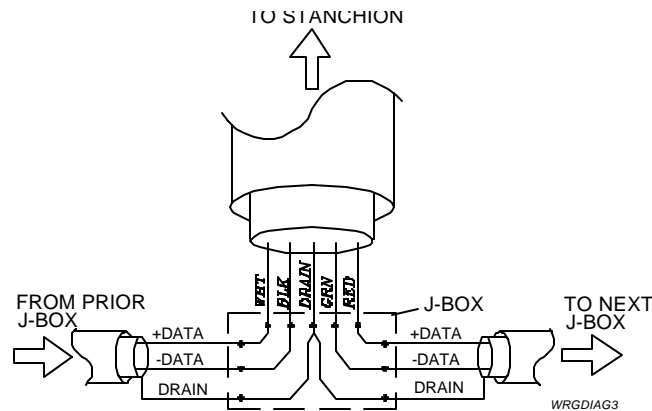
Wire	Connection
Black *(Brown)	AC Line
White *(Blue)	AC Neutral
Green *(Green/Yellow)	Ground

* - European Model



The **AR500** luminaire is controlled by DMX-512 data connected to the two shielded twisted-pairs provided in the data cable. For DMX In and Thru configuration, connect data wiring as follows:

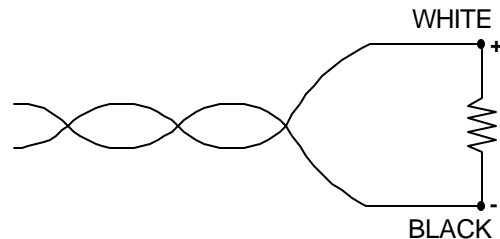
Wire	Connection
White/Red	Positive Data
Black/Green	Negative Data
Drain	Ground



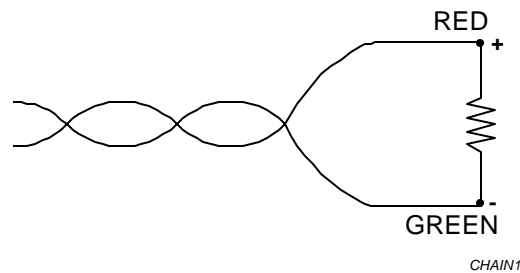
ETC, Inc recommends Belden 9729 cable for control signal distribution to the luminaire.

1.5 Data Wire Termination

If data cable is installed in a daisy-chain (feed-thru) configuration, install 100Ω termination resistor (provided) at end-of-line between positive(white or red) data line and negative(black or green) data line. If data splitter is installed, the last luminaire on each data run, as well as the transmitter to splitter data run, must be terminated. (See diagram in 1.8 Multiple Data Run.)Cable Specifications



-OR-



CHAIN1

AC POWER INPUT (to stanchion)

Wire Gauge: 16 AWG 3-conductor *(1.5mm²×3-conductor)

Rating: 300V / 13 Amps

O.D.: 0.345 inches(8.77cm) *[0.433inches(11mm)]

* European model.

DATA INPUT (to stanchion)

Wire Gauge: 22 AWG 2-shielded-pair w/ drain wire

Shield (inner): Aluminum/mylar

Shield (outer): Tinned copper braid

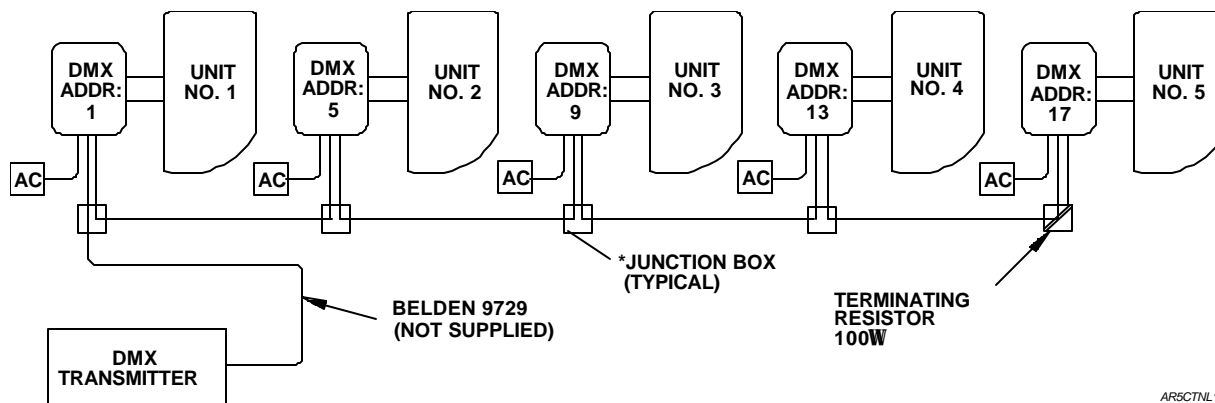
Rating: 300V

O.D.: 0.280 inches *(7.11cm)

* European model.

1.6 Single Data Run

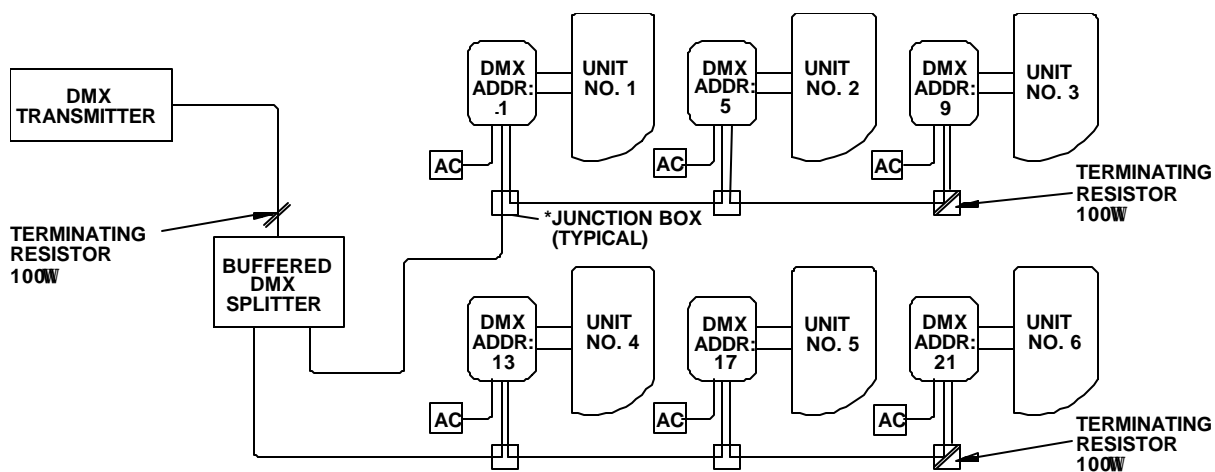
The following illustration displays a five units layout with a single data run. Notice the 100Ω resistor at the end of the data line.



AR5CTNL1

1.7 Multiple Data Run

The following illustration displays a six unit layout with a buffered DMX splitter. Notice the three 100Ω termination resistors.



AR5CTNL2

Chapter 2: Luminaire Installation Procedure

The following chapter describes unpacking shipping cartons, installing, preparing, and wiring the stanchion and head unit for the AR500 remote luminaires. This section also covers lamp installation and focus procedures.

2.1 Unpack Shipping Cartons

Note: Stanchion weighs 82 pounds (37.19Kg) or less, depending on voltage configuration; head enclosure weighs 62 pounds (28.12Kg) for a total weight of 144 pounds (65.31Kg). The luminaire requires two people for installation.

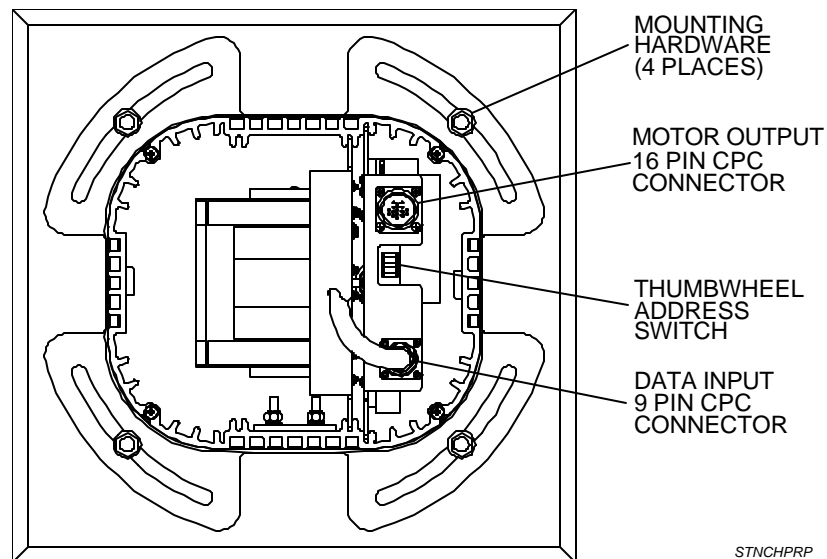
1. Remove stanchion and head assembly from cartons.
2. Locate tool kit (provided).

2.2 Install Stanchion

3. Set stanchion on mounting pad in required orientation. Loosely secure stanchion to pad using 3/8 inch (M10) hardware (not provided). Typically, this requires four flat washers, four lock washers, and four hex nuts.

2.3 Prepare Stanchion

4. Remove stanchion cap.
5. Set thumbwheel to address desired on switch board located at top of electronics plate (detailed in [3 Fixture Address](#)).



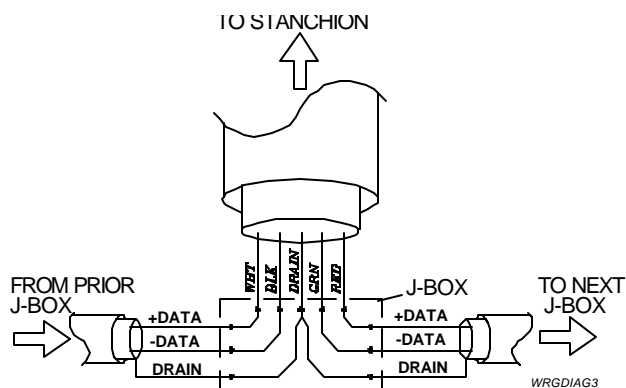
6. Reinstall stanchion cap. Tighten screws in a diagonal cross pattern only until snug. Then tighten screws in same pattern until tight. Be sure gasket forms proper seal when replacing cap.

2.4 Wiring to Stanchion

7. Strip both data cable and power cable in order to expose conductors. Connect as follows:

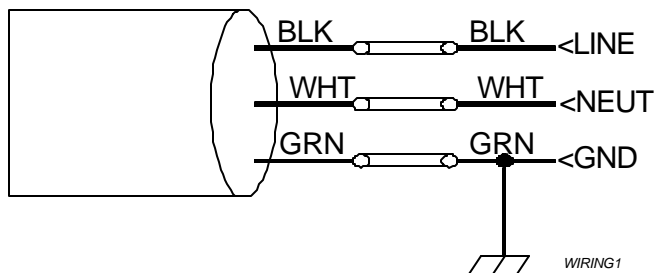
a. DATA Wires:

Wire	Connection
White/Red	Positive Data
Black/Green	Negative Data
Drain	Ground



b. POWER wires:

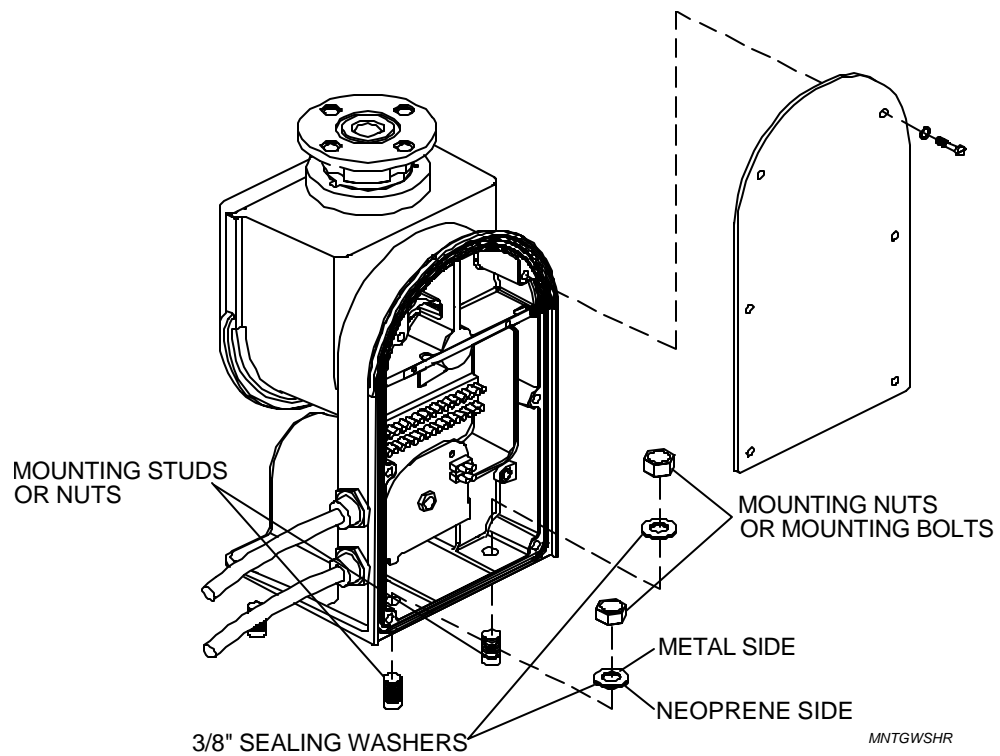
Wire	Connection
Black *(Brown)	AC Line
White *(Blue)	AC Neutral
Green *(Green/Yellow)	Ground



8. Install 100Ω termination resistor (provided) at end-of-line between positive (white or red) data line and negative (black or green) data line. If data splitter is installed, the last luminaire on each data run, as well as the transmitter to splitter data run, must be terminated. (See diagram in [1.4 Input Power and Control Cabling](#)).
9. Route output wiring to location of head enclosure, according to local code requirements.

2.5 Install Head Enclosure

10. Using screwdriver, remove large cover (six screws) from remote mounting assembly.
11. Set head on mounting pad in required orientation.
12. Secure head to pad using 3/8 inch hardware (not provided) and two 3/8 inch sealing washers (provided on interior holes only). Tighten hardware securely.



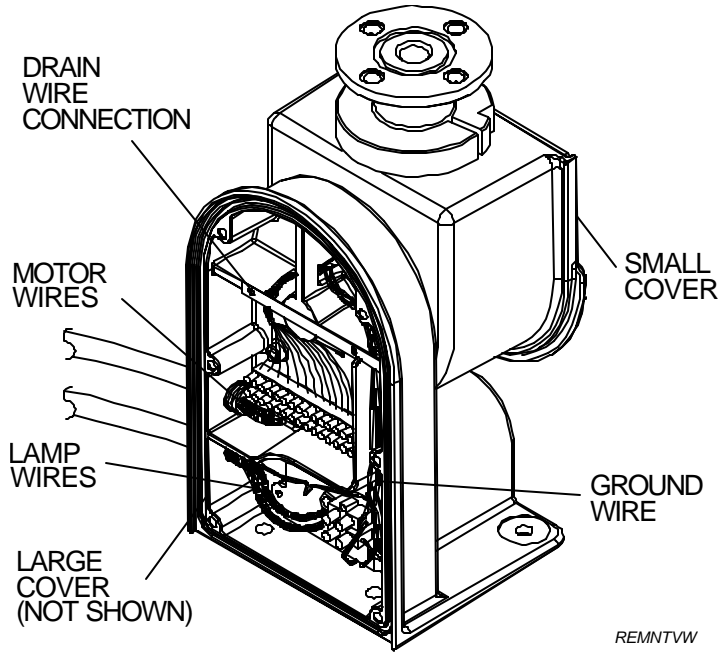
2.6 Input Wiring to Head

Note: If necessary, loosen terminal strip to install wiring and replace when all wires are terminated.

13. Connect wiring as shown:

- a. Feed lamp cable (14 AWG, 3-conductor cable) through the lower cable entrance, strip insulation 1/4 inch(6.35mm), and connect to the two-position terminal strip (connect black wires to black wires and white wires to white wires).
- b. Secure ground wire under brass washer using green ground screw and secure inside mounting foot.
- c. Feed motor cable (22 AWG, 16-conductor) through the upper cable entrance. Strip shield back four inches, and strip each wire 1/4 inch(6.35mm). Connect wires to a 16-position terminal strip in the mounting foot. Observe color code (printed sticker inside remote head mounting foot).
- d. Tighten cable entrance clamps securely.

14. Reinstall large cover on remote mounting assembly



**MOTOR WIRES
COLOR CODE**

- BLACK1**
- WHITE2**
- RED3**
- GREEN4**
- ORANGE5**
- BLUE6**
- WHT/BLK7**
- RED/BLK8**
- GRN/BLK9**
- ORG/BLK10**
- BLU/BLK11**
- BLK/WHT12**
- RED/WHT13**
- GRN/WHT14**
- BLU/WHT15**
- BLK/RED16**

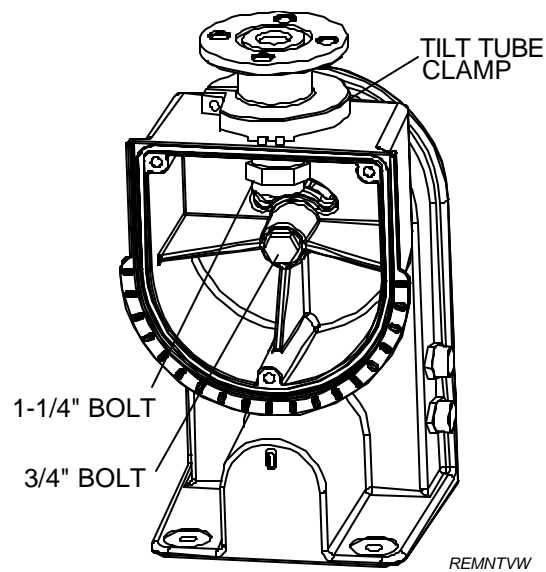
**COLOR KEY:
BASE COLOR/STRIPE COLOR**

2.7 Preliminary Focus Adjustment

15. Adjust focus:

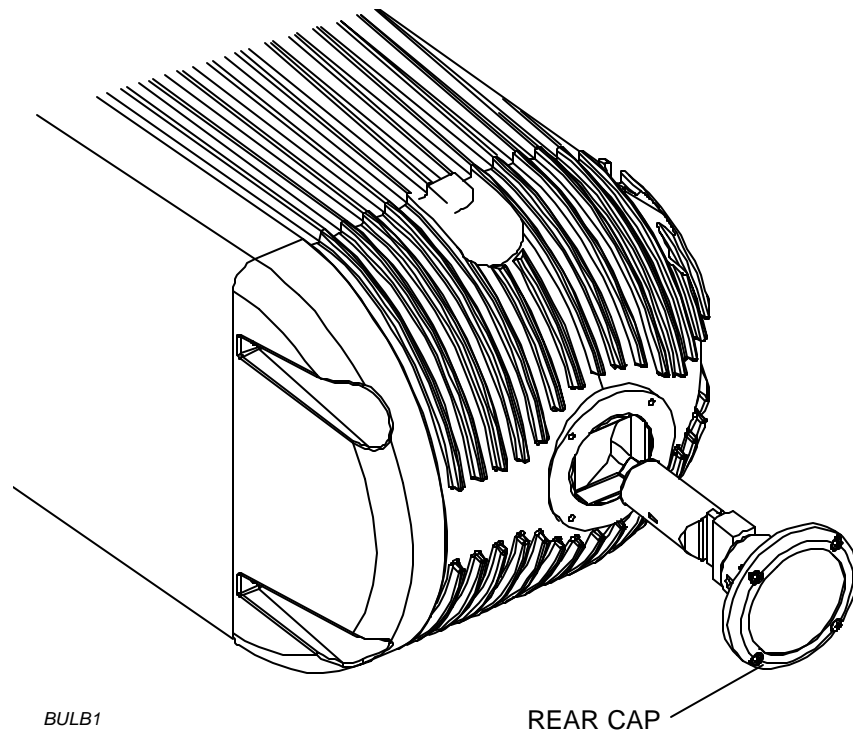
CAUTION: Be careful when loosening 3/16 inch Allen screw, 1-1/4 inch nut and 3/4 inch bolt (Steps 15.a. and 15.c.). This unit is heavy and could rotate quickly once it is loosened.

- a. Using 3/16 inch T-handle Allen wrench (provided), loosen Allen head screw on tilt tube clamp slightly if needed.
- b. Using screwdriver, remove three screws and small cover plate.
- c. Using 3/4 inch (or 19mm) socket, loosen bolt securing top remote head mounting assembly to bottom remote head mounting assembly.
- d. Rotate head assembly to desired angle and pivot remote mount assembly to desired angle.
- e. Tighten bolt and Allen head screw securely.



2.8 Install Lamp

16. Remove rear cap. Be sure O-ring remains in groove of rear cap.
17. Install lamp in lamp socket. Do not touch the quartz bulb with bare fingers. If touched, clean quartz bulb with alcohol.
18. Reinstall rear cap on head enclosure, assuring O-ring is still in-place.



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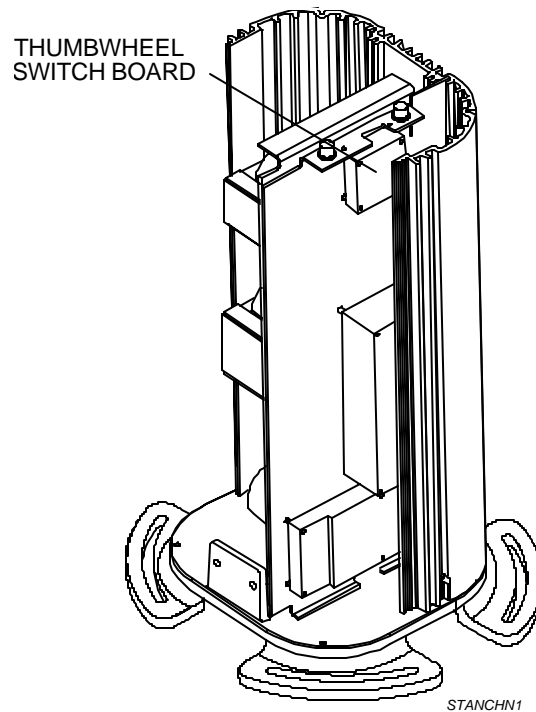
Chapter 3: Fixture Address

Each AR500 luminaire requires four channels of DMX data to control the position of the color filters and diffuser/douser. The control sequence is as follows:

Channel	Filters & Diffuser/Douser
1	Blue Filters
2	Amber Filters
3	Magenta Filters
4	Diffuser/Douser Panels

3.1 Setting the DMX Starting Address

The luminaire DMX starting address is set by a thumbwheel switch on the electronics plate in the stanchion. The next three channels will also be received. Each luminaire in a system must be set to the appropriate address in order to receive the four channels of data to control each luminaire.



IRIDEON^a AR500^ä EXTERIOR WASH LUMINAIRE-REMOTE VERSION

In a simple case, only **AR500** luminaires are on a DMX-512 distribution network and the first luminaire is set for DMX channel 1. Thumbwheel addresses for **AR500** luminaires in such a case are given below:

Luminaire	Thumbwheel Address	Luminaire	Thumbwheel Address	Luminaire	Thumbwheel Address
1	1	11	41	21	81
2	5	12	45	22	85
3	9	13	49	23	89
4	13	14	53	24	93
5	17	15	57	25	97
6	21	16	61	26	101
7	25	17	65	27	105
8	29	18	69	28	109
9	33	19	73	29	113
10	37	20	77	30	117

Chapter 4: Power-Up and Final Focus

1. Apply power to start lamp. The automatic calibration process will drive all filters to an open position. The luminaire will then remain on a solid white beam (unless DMX signal is present). Allow seven minutes for lamp to warm-up to full output.

CAUTION: Be careful when loosening 3/16 inch Allen screw, 1 1/4 inch nut and 3/4 inch bolt. This unit is heavy and could rotate quickly once it is loosened.

2. Focus luminaire as follows:
 - a. Loosen locking bolt and tilt tube clamp as required. (Detailed previously in Preliminary Focus Adjustment.)
 - b. Turn head assembly to adjust for vertical and horizontal aim.
 - c. Tighten 3/4 inch bolt and tilt tube clamp screw securely.
 - d. Power unit off.
 - e. Tighten 1-1/4 inch locking nut securely using wrench. Tilt tube clamp should hold head in place while tightening.
 - f. Reinstall small cover and secure with captive screws.
 - g. Power unit on.
3. Adjust front lens as follows:
 - a. Loosen screws securing the lens clamping ring. Loosen in diagonal cross pattern until you can rotate lens and rotate to desired position.
 - b. Tighten screws in diagonal cross pattern.
 - c. Clean lens.
4. Turn on DMX control unit. Test each channel to see if DMX and luminaire are working properly.

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Chapter 5: Test Routines

The AR500™ fixture has embedded test routines which allow you to control the unit using the thumbwheel switch. Use this feature to test and troubleshoot the unit without DMX control present. The settings are given below.

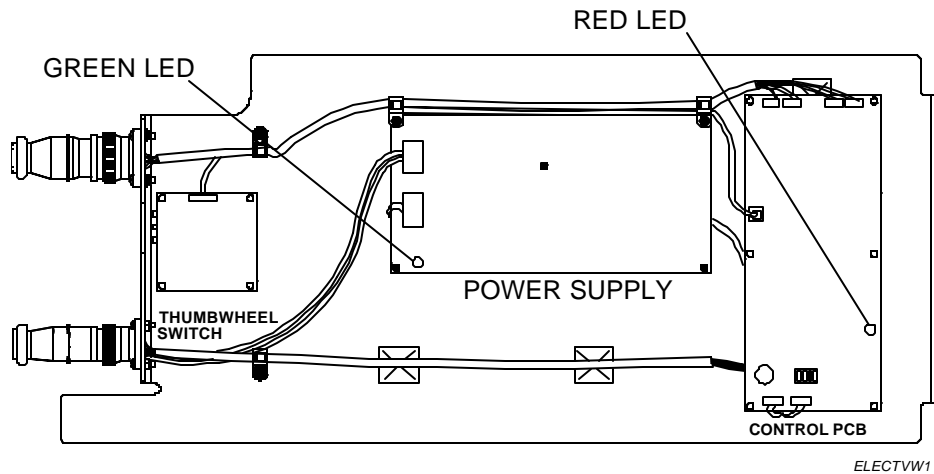
To start the tests, change thumbwheel address as required. Abort tests by moving address out of 900 range.

Test	Thumbwheel Address	Description of Routine
All Open	900	All panels open, static.
Blue Closed	910	Blue panels only closed, static.
Amber Closed	920	Amber panels only closed, static.
Magenta Closed	930	Magenta panels only closed, static.
Diffuser/Douser Closed	940	Diffuser/Douser panels only closed, static.
Blue Cycle	950	Blue panels only cycling. All other panels open.
Amber Cycle	960	Amber panels only cycling. All other panels open.
Magenta Cycle	970	Magenta panels only cycling. All other panels open.
Diffuser/Douser Cycle	980	Diffuser/Douser panels only cycling. All other panels open.
All Cycle	990	Sequential cycling of individual panels with an open state before the next panel closes.

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Chapter 6: LED Functions

The stanchion electronics plate contains two boards with LED functions: a power supply and a control card. Both contain a single LED which indicates the activity of the unit.



The POWER SUPPLY has a green LED. When lit, the LED indicates that 24 Vdc power is present in the output and the supply is working properly.

The CONTROL CARD has a red LED which indicates one-of-three states of activity:

Control Card LED state	Description
Slow Flashing	Control card operating normally but DMX signal is missing or invalid.
Fast Flashing	Control card operating normally and has valid DMX signal.
Solid On or Off	The control card has stopped running for some reason. Possible blown fuse, control card failure, loose connection, etc.

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Chapter 7: Troubleshooting

If the fixture has been installed and exhibits the following problems, try the suggested remedies and/or see the referenced section of the manual for possible solutions. **If the problem cannot be solved, please call your local ETC distributor or call ETC**

Technical Support in Middleton, WI U.S.A. at
608-831-4116 or toll-free at 800-688-4116.

Refer to Figures 1 and 2 at end of troubleshooting section as needed.

7.1 GENERAL TROUBLESHOOTING

WARNING: Hazardous voltages are present. Tests to be performed by qualified personnel only.

If bulb does not light...

Is the bulb installed?	Power off unit. Make sure good lamp is installed. See <u>2.8 Install Lamp</u> .
Is ballast power connector plugged-in?	Power off unit. Remove stanchion cap. Check brown 2-pin connector at top of ballast for good connection. (See Figure 1: <u>Ballast Layout</u> for location).
Is there AC power to ballast?	Power off unit. Remove stanchion cap. Unplug brown 2-pin connector at top of ballast card. Power on unit and check for proper input AC across pins on female connector. See Figure 1: <u>Ballast Layout</u> . (Proper input AC dependent on configuration) Power off unit. Plug connector back in and reinstall stanchion cap.
Is the AC correctly terminated?	Power off unit. See <u>2.4 Wiring to Stanchion</u> .
Is bulb wire connected in stanchion?	Power off unit. Bulb wires are on white connector at top of stanchion. Check for good connection.
Are there any loose connections on ballast?	Power off unit. Check other wire connections. Note: <i>The transformer and inductor each have unterminated wires for use in installations with alternate AC power. These should be "tied off" and are not considered loose connections.</i>
Does the unit have a douser mechanism?	If so, make sure douser mechanism is open. To open douser, remove DMX signal, then cycle power to fixture. The douser and all filters should go to open. If filters do not move, go to <u>7.3 Electronics Troubleshooting</u> .

In order to troubleshoot the color mechanism, the bulb may be disabled by disconnecting the input power connector from the ballast card. This will allow repeated power-up of the fixture without the necessary cool down period (for the bulb).

Disable lamp and ballast as follows:

1. Remove power from **AR500** fixture.
2. Remove stanchion cap.
3. Unplug brown 2-pin power connector from ballast input connector.
4. Replace stanchion cap.
5. At conclusion of test, power off unit and reconnect brown 2-pin connector.

If the fixture does not change color...

Do the color panels open when the fixture is powered-up?	If so, go to <u>7.2 DMX Troubleshooting</u>.
Are the color panels already open?	If so, listen for 'whirr' of motors as they attempt to drive panels for first 3 seconds after power-up. If panels do not open and motors do not 'whirr', go to <u>7.3 Electronics Troubleshooting</u>.
Do some panels open, while others remain closed?	If so, go to <u>7.4 Mechanical Troubleshooting</u>.

7.2 DMX TROUBLESHOOTING

Is there DMX to the fixture?	See description of LED operation in <u>6 LED Functions</u> to check for DMX activity.
Are the 1/16A fuses on the control card good?	See <u>Figure 2: Electronics Plate Layout</u> for location. Check for continuity across each green fuse (4 total). If there are blown fuses, remove fuse block, rotate 180 degrees, then reinsert. This will provide two new fuses since only two fuses are in use at one time.
Is the DMX address set properly?	See <u>3 Fixture Address</u>
Is the DMX line properly terminated?	See <u>1.4 Input Power and Control Cabling</u>.
Does fixture respond properly to diagnostic tests given in <u>7. TEST ROUTINES</u>?	If so, problem may be with the incoming DMX data. See <u>1.4 Input Power and Control Cabling</u>.

7.3 ELECTRONICS TROUBLESHOOTING

<p>Is there AC power to the electronics?</p>	<p>Remove power from unit. Remove stanchion cap. Disconnect two CPC connectors from electronics card. Remove electronics card and reconnect connectors. Turn on power to unit. Measure the incoming AC voltage on the orange 6-pin plug connected to the DC power supply (see Figure 2: Electronics Plate Layout). There should be input AC across the black and white wires.</p>
<p>Is there 24V DC power to the lamp control board?</p>	<p>Check to see if green LED on power supply is lit. See 6 LED Functions.</p>
<p>Is the 5A fuse on control card good?</p>	<p>Power off unit. See Figure 2: Electronics Plate Layout for location. Remove fuse to check continuity. If no continuity, replace fuse.</p>
<p>Are there any loose connections on electronics plate?</p>	<p>Power off unit. See Figure 2: Electronics Plate Layout for locations. Plug-in any loose connections. Make sure none are plugged-in backwards.</p>

7.4 MECHANICAL TROUBLESHOOTING

<p>Are all drive linkages properly connected?</p>	<p>Power off unit. Remove front of head enclosure. Make sure each filter ring is connected to its drive motor shaft by small brass link. (The drive arm on disconnected linkages will spin during power-up). If disconnected, reconnect by spreading tabs on drive arm link around corresponding brass link.</p>
<p>Are all motor wires connected?</p>	<p>Check connections at control card (4 total, match wire number to PCB Step number), at remote mounting foot, and 16-pin CPC connector. See Figure 2: Electronics Plate Layout, 2.6 Input Wiring to Head, and 2.3 Prepare Stanchion.</p>

Note: At conclusion of these tests replace all components, making sure all connections are secure and clean.

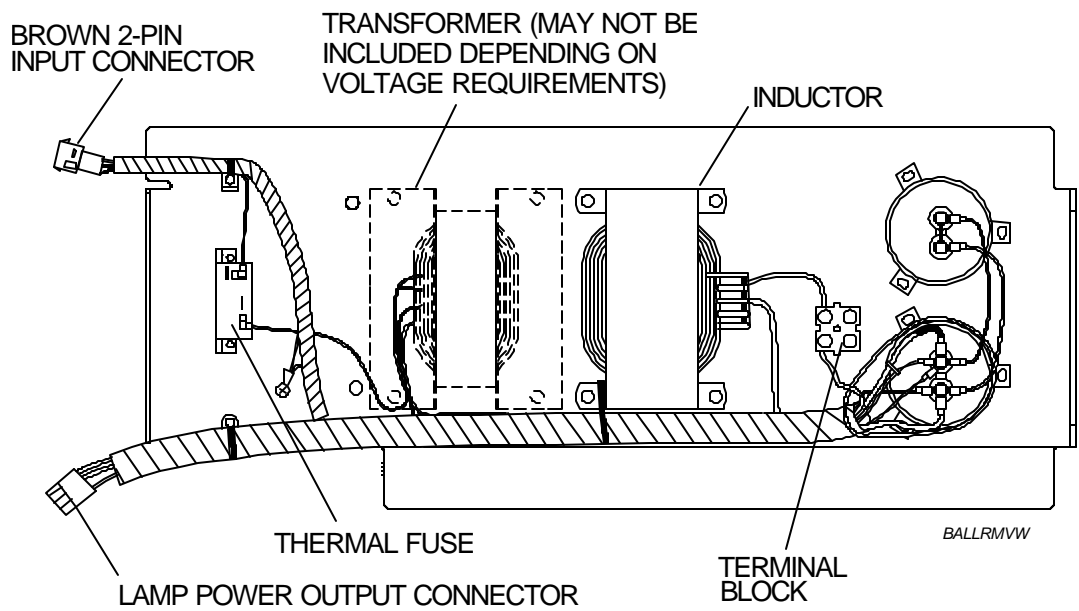


Figure 1 - Ballast Layout

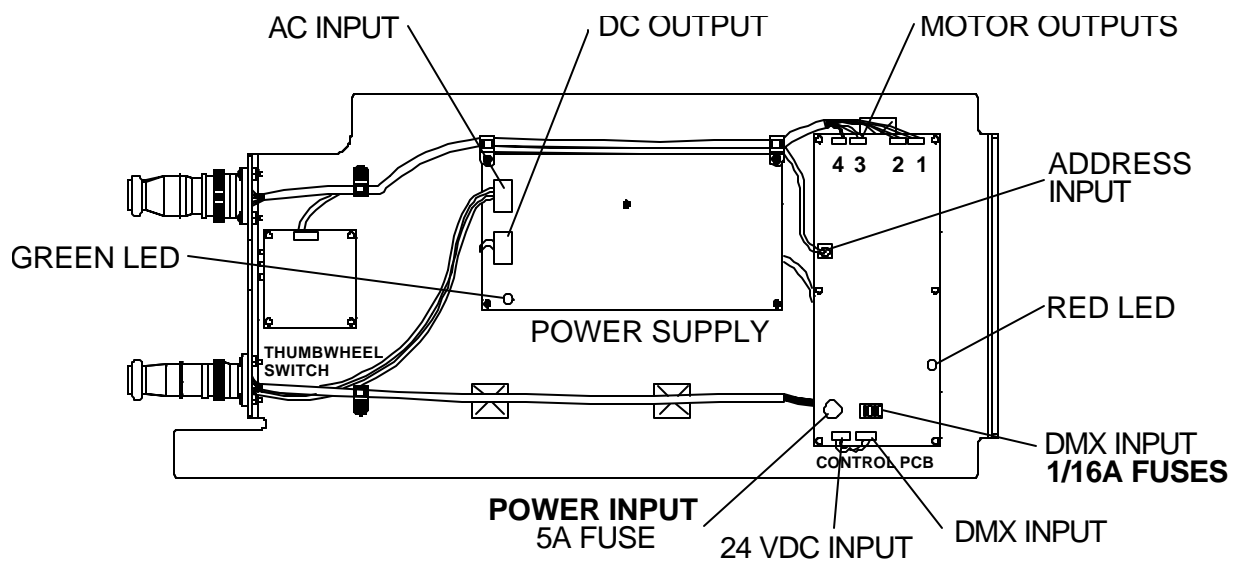


Figure 2 - Electronics Plate Layout

Chapter 8: Limited Warranty / Terms and Conditions

This chapter describes the Electronic Theatre Controls, Inc. limited warranty and Terms and Conditions.

WARRANTY

Electronic Theatre Controls, Inc. (ETC) warrants to the original owner or retail customer (Customer) that during the warranty period ETC will repair or replace its products that are defective in materials or workmanship under normal use and service, subject to the terms of this limited warranty. The warranty period shall begin on the date of delivery of a portable system or on the date of energization of a permanently installed system, and shall continue for the following periods: (a) one year, for all Irideon products, and (b) two years, for all other ETC products. Warranty is limited to (60) days from shipment for purchase of demo or loaner products. Warranty does not cover any product or part of a product subject to accident, negligence, alteration, abuse or misuse, or any accessories or parts not supplied by ETC. Warranty does not cover "consumable" parts such as fuses, lamps, color media or components warranted directly to the owner by the original manufacturer. ETC's warranty does not extend to items not manufactured by us. Freight terms on warranty repairs are FOB ETC factory or designated repair facility. Collect shipments or freight allowances will not be accepted. ETC's sole responsibility under this warranty shall be to repair or replace at ETC's option such parts as shall be determined to be defective on ETC's inspection. ETC will not assume any responsibility for any labor expended or materials used to repair any equipment without ETC's prior written authorization. ETC SHALL NOT BE RESPONSIBLE FOR ANY INCIDENTAL, GENERAL OR CONSEQUENTIAL DAMAGES, DAMAGES TO PROPERTY, DAMAGES FOR LOSS OF USE, TIME, PROFITS OR INCOME, OR ANY OTHER DAMAGES. The customer's obligations during the warranty period under this warranty are to notify ETC at ETC's address within one week of any suspected defect, and to return the goods prepaid to ETC at their factory or authorized service center. THIS WARRANTY IS CONTINGENT ON THE CUSTOMER'S FULL AND TIMELY COMPLIANCE WITH THE TERMS OF PAYMENT SET FORTH IN THE "TERMS AND CONDITIONS." THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND OF OTHER OBLIGATIONS AND LIABILITIES ON OUR PART. THE CUSTOMER ACKNOWLEDGES THAT NO OTHER REPRESENTATIONS WERE MADE TO HIM OR RELIED UPON BY HIM WITH RESPECT TO THE QUALITY AND FUNCTION OF THE GOODS SOLD. This written warranty is intended as a complete and exclusive statement of the terms thereof. Prior dealings or trade usage shall not be relevant to modify, explain or vary this warranty. Acceptance of, or acquiescing in, a course of performance under this warranty shall not modify the meaning of this agreement even though either party has knowledge of the performance and a chance to object.

TERMS AND CONDITIONS

The following terms and conditions, and those on the face here of, shall control as to any order accepted by Electronic Theatre Controls, Inc. (ETC), notwithstanding any terms and conditions that may be contained in any purchase order or other document of Customer, and ETC's acceptance of any order is expressly made conditional on Customer's assent to such terms and conditions. Such terms and conditions will constitute the entire agreement between the parties as to any order and will supersede any prior understandings, agreements, representations, or warranties. Such terms and conditions will not be modified, added to, superseded or otherwise altered except by written document signed by an authorized representative of ETC, notwithstanding any terms and conditions contained in the purchase order or other document of Customer. ETC's commencement of performance and/or delivery shall not constitute a waiver of these terms and conditions or any acceptance of any terms and conditions contained in the Customer's order or other documents. Acceptance of any product or service by the Customer will be construed as acceptance of ETC's terms and conditions. Any dispute or questions of construction with respect to any order placed with ETC shall be governed by the laws of the State of Wisconsin. All prices are in US Dollars, FOB ETC's factory or warehouse. Prices, models and specifications are subject to change without notice. Orders must be in writing. Phone orders will be accepted from established accounts when followed by written confirmation. The acceptance of any order does not imply conformance with plans and specifications unless the plans and specifications accompany the order and are accepted as binding by ETC. Equipment ordered which differs in any way from our standard catalog items will require drawings approved in writing by the Customer. When drawings are approved, they shall take precedence over all other written or verbal instructions. Orders are effective only when accepted and acknowledged by the factory. Minimum order is \$25.00 net, exclusive of freight. Price protection will be given on orders entered for immediate shipment and for project orders entered before the effective date of a price increase. All other orders will be billed at the current price at time of shipment. Quotations for custom products are valid for thirty (30) days. ETC will attempt to ship goods for delivery on or about the times stated on the reverse side here of, although time shall not be the essence in this contract. ETC will attempt to follow customer's written instructions as to mode and routing of shipments. In absence of such instructions, ETC shall have absolute discretion as to mode and routing of shipments, including express or parcel post for small shipments. Where the customer has requested expedited freight, the customer will be responsible for the incurred additional charges. ETC shall not be liable for late delivery and/or inability to perform due to unforeseen circumstances or conditions, including our ability to obtain supplies and raw materials, government regulations, labor stoppages, casualties, fire, and other causes beyond our control. When such circumstances or conditions have been remedied, ETC will make and Customer will accept delivery/performance. Equipment is shipped at the Customer's risk and our obligation to deliver equipment is discharged upon their delivery in good condition to the carrier. Shipments are FOB ETC factory or warehouse. ETC will prepay and bill freight on UPS shipments. Freight and air are sent collect unless specifically quoted otherwise. Unless specifically prohibited, partial shipments will be made. Federal, state and/or local taxes, duties and other charges are the responsibility of the purchaser. Any changes in engineering drawings, specifications, or in other terms of manufacture, assembly or shipment, requested by customer, must be in writing and approved by ETC. If

any such change by Customer causes an increase in the cost of, or in the time required for performance of, any part of the contract, then ETC shall make a reasonable adjustment to the price of the goods. If purchaser cancels any portion of a Purchase Order prior to shipment, Purchaser shall be liable to ETC for a cancellation charge equal to ETC's actual costs incurred in connection with that portion of the Purchase Order that is cancelled, including, without limitation, labor and materials. Customer represents that it is solvent. ETC retains a security interest in the goods to secure payment of the purchase price and all other indebtedness now or hereafter owed by the customer to ETC. At ETC's request, customer will execute a financing statement or statements evidencing such security interest and will take any other action necessary to perfect the same. Payment terms are net 30 days after date of invoice. If ETC in good faith doubts customer's ability or willingness to pay, ETC may in its discretion complete its performance of this contract upon a cash in advance basis or make deliveries only upon a C.O.D. basis or file a UCC filing or suspend all or part of its performance here under. All payments are applied to the oldest outstanding invoice. Accounts over thirty (30) days are subject to a 1 1/2% (one and one-half percent) per month late payment penalty. ETC will have the option of withholding performance under any and all orders from the Customer if an invoice remains unpaid after 30 days. All disputes otherwise unresolved between ETC and Customer shall be resolved in a court of competent jurisdiction in the location of ETC's offices, Dane County, Wisconsin. If suit or action is instituted by ETC to enforce payment or performance by the Customer, the Customer agrees to pay all costs and attorney's fees incurred. Claims for shortage or damaged goods must be made within ten (10) days. Equipment is carefully packed and delivered in good condition to the carrier. All claims for loss or damage in transit must be made by the consignee directly to the carrier. ETC will render every aid and assistance in the presentation and enforcement of such claims without waiver of our rights to have compliance with the terms of payment of our invoices. Equipment returned without ETC's written permission will not be accepted. Equipment returned for credit must be in accordance with established RMA procedures. Equipment must be unused, in original cartons and in saleable condition, subject to ETC's quality control and test inspection. Restocking charges of \$25.00 or 25% of invoice (whichever is greater) plus any repacking or reconditioning costs will be deducted from the credit. Returns for warranty work will be via warranty procedures. In no case will permission be granted to return specially-modified or custom equipment, or merchandise invoiced more than six (6) months prior to date of Customer's return request. No failure of ETC to insist upon or compel compliance by the customer with any of these terms and conditions shall be construed as a waiver by ETC of its right to insist upon compliance. No waiver by ETC of any breach by customer shall be effective unless in writing signed by ETC, and no waiver by ETC of any breach by customer shall be deemed a waiver of any other breach. If ETC shall fail to repair or replace defective goods within a reasonable time after they are returned to ETC, or if ETC shall wrongfully fail to make delivery or shall wrongfully repudiate this contract, then customer shall be entitled to recover from ETC such part of the purchase price as has been paid by customer to ETC. The remedy stated in the preceding sentence shall be customer's exclusive remedy for any breach, non delivery, or repudiation by ETC or for any other liability of ETC to customer. This exclusive remedy shall not be deemed to have failed if its essential purpose so long as ETC is willing and able to repair or replace defective parts in the prescribed manner.

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