IMPORTANT!!!

PLEASE TAKE THE TIME TO FILL OUT THIS FORM COMPLETELY. FILE IT IN A SAFE PLACE. IN THE EVENT YOU EXPERIENCE PROBLEMS WITH OR HAVE QUESTIONS CONCERNING YOUR CONTROLLER, THE FOLLOWING INFORMATION IS NECESSARY TO OBTAIN PROPER SERVICE AND PARTS.

MODEL # .................................................. E-2/3DB

SERIAL # ..................................................

PURCHASE DATE ........................................

PURCHASED FROM ....................................
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1.0 INTRODUCTION

TWR Lighting, Inc.'s Model E-2/3DB Type L-864/L-865 Controller has been designed and built to the Federal Aviation Advisory Circular 150/5345-43E with safety and reliability in mind. TWR is committed to providing our customers with some of the best products and services available. TWR welcomes you to our family of fine products and we look forward to servicing your needs now and in the future.

NOTE: Structures exceeding 500’ will require to be painted, in addition to this lighting, for added visual hazard marking.

1.1 APPLICATION

The E-2/3DB Controller is for use on lighting structures or towers 351’ to 700’ AGL (above ground level) that are approved to be lighted with Dual White/Red Flashing Medium Intensity Strobes in accordance with the FAA Advisory Circular 70/7460-1K.

1.2 SPECIFICATIONS OF EQUIPMENT

Dimensions:
- Controller (H x W x D)/Weight: 33.00” x 36.75” x 9.0”/210.0 lbs.
- Mounting Dim (H x W): 37.375” x 24.0”
- Beacon Height/Weight: 28.0” /36 lbs.
- Cable Diameter/Weight per 100 ft: 625” +/- 10% 24 lbs.

Electrical Voltage:
- 120V AC +/- 10% 60 Hz (Standard)
- 240V AC +/- 10% 60 Hz (Available)

Intensity:
- White Daymode: 20,000 +/- 25% Effective Candelas
- Red Nightmode: 2,000 +/- 25% Effective Candelas
- White Nightmode (Back-up mode): 2,000 +/- 25% Effective Candelas

Beam Spread:
- Horizontal: 360°
- Vertical: 3° Minimum

Flash Rate:
- White Daymode: 40 fpm +/- 2 fpm
- Red Nightmode: 22 fpm +/- 2 fpm
- White Nightmode (Back-up mode): 40 fpm +/- 2 fpm

Wattage:
- Daymode: 285 Watts
- Red Nightmode: 930 Watts
- White Nightmode: 105 Watts

Temperature: +55°C / -55°C

Beacon Wind Load: 2.1 ft²
2.0 INSTALLATION

WARNING - DANGER!!

THIS SYSTEM OPERATES AT HIGH VOLTAGE LEVELS THAT COULD BE LETHAL TO SERVICE PERSONNEL. ALL INSTALLATION AND MAINTENANCE WORK SHOULD BE DONE BY QUALIFIED SERVICE PERSONNEL ONLY. WHEN PERSONNEL IS INSTALLING SYSTEM OR PERFORMING MAINTENANCE ON THIS SYSTEM, MAKE SURE THE POWER IS TURNED OFF AT THE SERVICE BREAKER PANEL!!

READ AND UNDERSTAND THE THEORY OF OPERATION AND ITS SAFETY MESSAGES BEFORE ATTEMPTING INSTALLATION/MAINTENANCE OF THIS SYSTEM. DO NOT ATTEMPT TO DEFEAT THE INTERNAL SAFETY SWITCHES IN THE CONTROLLER AND BEACONS!!

2.1 POWER SUPPLY CONTROL CABINET MOUNTING

The power supply control cabinet can be located at the base of the structure or in an equipment building. Mounting Dimensions can be found in Section 1.2 on page 5. Pay particular attention when choosing your controller mounting location to ensure proper door opening and room for service personnel. Refer to installation Drawings INS-279 and HDO-279 for ease of install.

2.2 PHOTOCELL HOUSING

The standard photocell housing is supplied with a 20’ pigtail of 16 AWG TYPE TFFN wire. On occasion, in mounting of the photocell, an additional amount of wire may be required. Refer to Drawing 100239 for proper assistance on determining gauge of wire for your specific needs.

2.3 PHOTOCELL WIRING
(Refer to Drawings HDO-279 and H40-279)

If the control cabinet is mounted inside an equipment building, the photocell should be mounted vertically on ½” conduit outside the building above the eaves facing north. Wiring from the photocell housing socket to the control cabinet should consist of one (1) each; red, black, and white wires. The white wire is connected to the socket terminal marked "N," the black wire is connected to the socket terminal marked "L," and the red wire is connected to the socket terminal marked "LO." The photocell should be positioned so
that it does not "see" ambient light, which would prevent it from switching to the nightmode.

If the control cabinet is mounted outside an equipment building, the photocell should be mounted vertically on ½" conduit so the photocell is above the control cabinet. Care must be taken to assure that the photocell does not "see" any ambient light that would prevent it from switching into the nightmode. The photocell housing socket wiring is the same as above.

2.3.1 Connect the BLACK wire from the photocell to terminal block TB2-5.

2.3.2 Connect the RED wire from the photocell to terminal block TB2-6.

2.3.3 Connect the WHITE wire from the photocell to terminal block TB2-7.

2.3.4 Install the photocell into the receptacle and twist to the right while depressing to lock into place.

2.4 POWER WIRING
(Refer to Drawing H40-279)

Power wiring to the control cabinet should be in accordance with local methods and the National Electric Code (NEC).

2.4.1 A 30 amp circuit breaker is recommended at service panel

2.4.2 Connect the "HOT" side of the 120V AC line to TB1-16.

2.4.3 Connect the "NEUTRAL" side of the 120V AC line to TB1-17.

2.4.4 Connect the AC ground to the ground lug to the lower right of the terminal block TB1.

2.4.5 Controller panel should be connected to the tower and/or building grounding system with the exception of installations on AM RF

Applications where controller grounding to earth ground is prohibited. Ground the controller only to the tower itself using a suitable RF ground.

2.5 TOWER LIGHTING KIT

When installing this system, the customer will need to use strobe cable
method to wire the strobe beacons. Refer to Lighting Kit Drawings 601-01 for conduit cable, and 601 for cable installations.

**WARNING**  **DANGER!!!**

THIS SYSTEM OPERATES AT HIGH VOLTAGE LEVELS THAT COULD BE LETHAL TO SERVICE PERSONNEL. ALL INSTALLATION AND MAINTENANCE WORK SHOULD BE DONE BY QUALIFIED SERVICE PERSONNEL ONLY.

WHEN PERSONNEL IS INSTALLING SYSTEM OR PERFORMING MAINTENANCE ON THIS SYSTEM, MAKE SURE THE POWER IS TURNED OFF AT THE SERVICE BREAKER PANEL!!

READ AND UNDERSTAND THE THEORY OF OPERATION AND ITS SAFETY MESSAGES BEFORE ATTEMPTING INSTALLATION/MAINTENANCE OF THIS SYSTEM. DO NOT ATTEMPT TO DEFEAT THE INTERNAL SAFETY SWITCHES IN THE CONTROLLER AND BEACONS!!

2.5.1 Beacon Mounting and Wiring
(Refer to Drawings HDO-279 and INS-279)

2.5.1.1 Bolt the beacon to the mounting plate using four 5/8” x 1-1/4” galvanized bolts that are supplied. Installer should make sure to check for full thread engagement on Anco locknut. Allow 16” clearance in back of the hinge (25” from the center of the base) to tilt lens back without hitting an obstruction.

2.5.1.2 Level the beacon using the spirit level at the base of the lens. Shims may be used under beacon base or triple nutting each bolt with palnuts on all four (4) nuts.
2.5.1.3 Slip the electrical cable for the dual beacon through the watertight connector (cable gland bushing) and tighten the gland nut to make a watertight seal. Attach the wires to the terminal strip as follows:

<table>
<thead>
<tr>
<th>Wire color</th>
<th>to match</th>
<th>Lamp platform wire color</th>
<th>Terminal Block No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Gauge Black</td>
<td>20 Gauge Black</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>10 Gauge</td>
<td>12 Gauge Red/Black</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>10 Gauge Red</td>
<td>12 Gauge Red/Black</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>14 Gauge White</td>
<td>20 Gauge White</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>14 Gauge</td>
<td>20 Gauge</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>14 Gauge Green</td>
<td>20 Gauge Green</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>16 Gauge Blue</td>
<td>20 Gauge Blue</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>16 Gauge Brown</td>
<td>20 Gauge Brown</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>16 Gauge Bare</td>
<td>Beacon Base</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.5.2 LIGHTING KIT WIRING

Install wiring between the controller and the beacon utilizing strobe cable method. Refer to Drawings HDO-279, 601 and 601-01 for installation of light kits. Following these minimum guidelines as well as any local or end user addition requirements, installing light kits will require lifting of the cable by the supplied cable grip or conduit to affix to the tower. Always work safely and adhere to all OSHA Safety Guidelines when lifting wiring or working on the structure or tower itself. It is the installer’s responsibility to install the lighting kit in a safe manner. Installers can request from OSHA their requirements 29CFT 1926.21, and 29CFR 1926.105 to ensure compliance to regulations.

**NOTE:** On occasion, a set of custom lighting kit drawings may be specifically requested by a customer and installed in this manual. In cases such as this, the drawings will proceed the manual if a conflict occurs.

All the necessary information for wiring the dual beacons and sidelights is contained on the tower kit Drawings 601 and 601-01. The connections for the dual beacons and sidelights in the controller are as follows:

2.5.2.1 Connect the 10 gauge Red/Black wire from Beacon #1 wiring to TB1-1.

2.5.2.2 Connect the 10 gauge Red wire from Beacon #1 wiring to
TB1-2.

2.5.2.3 Connect the 10 gauge **Black** wire from Beacon #1 wiring to TB1-3.

2.5.2.4 Connect the 14 gauge **White** wire from Beacon #1 wiring to TB1-4.

2.5.2.5 Connect the 14 gauge **White/Green** wire from Beacon #1 wiring to TB1-5.

2.5.2.6 Connect the 10 gauge **Red/Black** wire from Beacon #2 wiring to TB1-6.

2.5.2.7 Connect the 10 gauge **Red** wire from Beacon #2 wiring to TB1-7.

2.5.2.8 Connect the 10 gauge **Black** wire from Beacon #2 wiring to TB1-8.

2.5.2.9 Connect the 14 gauge **White** wire from Beacon #2 wiring to TB1-9.

2.5.2.10 Connect the 14 gauge **White/Green** wire from Beacon #2 wiring to TB1-10.

2.5.2.11 Connect the 10 gauge **Red/Black** wire from Beacon #3 wiring to TB1-11.

2.5.2.12 Connect the 10 gauge **Red** wire from Beacon #3 wiring to TB1-12.

2.5.2.13 Connect the 10 gauge **Black** wire from Beacon #3 wiring to TB1-13.

2.5.2.14 Connect the 14 gauge **White** wire from Beacon #3 wiring to TB1-14.

2.5.2.15 Connect the 14 gauge **White/Green** wire from Beacon #3 wiring to TB1-15.

2.5.2.16 Connect the 14 gauge **Green** wire from Beacon #1 to the first ground lug located to the left of TB1.

2.5.2.17 Connect the 14 gauge **Green** wire from Beacon #3 to the
first lug located to the left of TB1.

2.5.2.18 Connect the 16 gauge Bare Drain wire (if strobe cable install) from Beacon #1 to second ground lug located to the left of TB1.

2.5.2.19 Connect the 16 gauge Bare Drain wire (if strobe cable install) from Beacon #2 to second ground lug located to the left of TB1.

2.5.2.20 Connect the 16 gauge Bare Drain wire (if strobe cable install) from Beacon #3 to second ground lug located to the left of TB1.

2.5.2.21 Connect the 16 gauge Brown wire from Beacon #1 wiring to TB2-1.

2.5.2.22 Connect the 16 gauge Blue wire from Beacon #1 to TB2-2.

2.5.2.23 Connect the 16 gauge Blue wire from Beacon #2 to TB2-2.

2.5.2.24 Connect the 16 gauge Brown wire from Beacon #2 to TB2-3.

2.5.2.25 Connect the 16 gauge Brown wire from Beacon #3 to TB2-3.

2.5.2.26 Connect the 16 gauge Blue wire from Beacon #3 to TB2-4.

2.5.2.27 Connect the Red wire from the Sidelight #1 to fuse block marked SL1.

2.5.2.28 Connect the Yellow wire from the Sidelight #2 to fuse block marked SL2.

2.5.2.29 Connect the White Neutral wire from Sidelights #1 and #2 to TB1-17.

2.5.2.30 Connect the Green ground wire (if cable is used) from Sidelights #1 and #2, wiring the ground lug to the lower right of TB1.
2.6 ALARM WIRING

Alarm contacts (Form C) are provided for strobe failures, power failure and photocell on. It is left up to the customer or installer on how they choose to utilize these contacts with their monitoring equipment. External monitoring equipment is available. Please inquire within the sales staff at the factory for models available and pricing. Alarm configurations are shown on Drawings H40-279 and M01-279.

2.6.1 White Strobe #1 Failure (ST1)

Connect the customer's alarm common to plug J3, terminal #2. Connect the customer's alarm wire to plug J3, terminal #3, for normally open (or) terminal #1, for normally closed monitoring.

2.6.2 White Strobe #2 Failure (ST2)

Connect the customer's alarm common to plug J3, terminal #5. Connect the customer's alarm wire to plug J3, terminal #6, for normally open (or) terminal #4, for normally closed monitoring.

2.6.3 White Strobe #3 Failure (ST3)

Connect the customer's alarm common to plug J3, terminal #8. Connect the customer's alarm wire to plug J3, terminal #9, for normally open (or) terminal #7, for normally closed monitoring.

2.6.4 Red Strobe Failure (RF)

Connect the customer's alarm common to plug J3, terminal #14. Connect the customer's alarm wire to plug J3, terminal #15, for normally open (or) terminal #13, for normally closed monitoring. **NOTE:** All three (3) red strobe alarms are grouped due to the fail-safe operation.
2.6.5 Power Failure (PF)

Connect the customer's alarm common to plug J3, to terminal #11. Connect the customer's alarm wire to plug J3, terminal #12, for normally open (or) terminal #10, for normally closed monitoring.

2.6.6 Photocell (PC)

Connect the customer's alarm common to plug J3, terminal #17. Connect the customer's alarm wire to plug J3, terminal #18, for "off" operation (or) terminal #16, for "on" operation monitoring.

2.6.7 Sidelight #1 Alarm (SA1)

Connect the customer's alarm common to Module M1, terminal T4. Connect the customer's alarm wire to Module M1, terminal T5, for normally open (or) terminal T6, for normally closed monitoring.

2.6.8 Sidelight #2 Alarm (SA2)

Connect the customer's alarm common to Module M2, terminal T4. Connect the customer's alarm wire to Module M2, terminal T5, for normally open (or) terminal T6, for normally closed monitoring.

2.7 ALARM TESTING

To test alarms, follow these procedures using an "ohm" meter between alarm common and alarm points.

2.7.1 White Strobe Failure (ST1, ST2, and ST3)

White strobe failure testing can be performed in the day mode operation. Check for status of strobe beacons. Turn "off" switch S1 on PCB #1 and status should change after a four (4) second delay. After test, turn S1 to the normal operating position.
2.7.2 Red Strobe Failure (RF)

Red strobe failure testing can be performed in the night mode operation. Check for status of strobe beacons. Turn "on" switch SW2 on controller panel and status should change after an eight (8) second delay. This testing will cause the unit to go into the back-up white strobe operation. To clear this situation, turn off SW2 and reset the breaker.

2.7.3 Power Failure (PF)

While the controller is in normal operation, shut off power to the controller at the breaker panel. Alarm should be prompt. Reset the breaker to resume normal operation.

2.7.4 Photocell (PC)

Controller should be in the daymode of operation when performing this test. Check status of operation. Turn SW1 on (or) cover the photocell and operation status should change state. After test, turn SW1 to normal operating position.

2.7.5 Sidelight #1 Alarm (SA1)

Controller should be in the nightmode of operation. Check status of operation. Pull fuse switch SL1 open. Alarm should occur within five (5) seconds. After test, re-engage fuse switch SL1.

2.7.6 Sidelight #2 Alarm (SA2)

Controller should be in the nightmode of operation. Check status of operation. Pull fuse switch SL2 open. Alarm should occur within five (5) seconds. After test, re-engage fuse switch SL2.

2.8 CONTROLLER CONFIGURATION
(Refer to Drawing H01-279)
This unit is factory setup to be a master controller. If this unit is to be used in conjunction with an additional unit, change dip switch settings as drawing indicates. The following connections will need to be interfaced between systems.

2.8.1 Connect at least an 18/20 gauge wire from PCB #1, connector P1-15, from unit set-up to be the master unit to PCB #1, connector P1-15, of unit set-up to be the slave unit.

2.8.2 Connect at least an 18/20 gauge wire from TB1-9 of master unit to slave unit TB2-6.

2.8.3 Connect at least an 18/20 gauge wire (ground) from one (1) chassis to the other chassis.

2.8.4 Use a single breaker for supply power to all controllers.

2.8.5 Follow standard instructions provided in the manuals supplied with the controllers.
3.0 THEORY OF OPERATION

3.1 THE POWER SUPPLY

The AC line is sent to transformers T2, and T2A through fuses F2, F3, MOVMOD, and relay K1. In order for K1 to energize and complete the circuit to T2 and T2A, the safety interlock switch CSS, BSS, must be closed. The BSS switch is located in the base of the beacon. In order for the system to operate, the beacons and the power supply must be closed and secured.

Transformers T2, and T2A secondary outputs are around 1,000V AC. These outputs are sent to the high voltage rectifier PCB (PCB #2) and converts the 1,000V AC of each transformer to around +550V DC and -550V DC in daymode and +700V DC and –550V DC in nightmode. This high voltage is then used to charge the energy storage capacitors C102, C112, and C122 through current limiting resistors R31A, R31B, and R31C, and steering diodes D5, D6, and D8, for nightmode operation. Resistors R31A, R31B, and R31C are bypassed through K5A, K5, and K5C for daymode operation.

Energy storage capacitors bank C103-131 is used for the daymode operation and are connected to the high voltage through the normally closed contacts of relays K5A, K5B, and K5C. When the light level drops below 3 foot candles, the photocell supplies 120V AC to relays K5A, K5B, and K5C, which removes C103-131 from the discharge path leaving capacitors C102, C112, and C122 in the circuit for nightmode operation. The energy storage capacitor banks are connected to the flashtube through the interconnecting tower wiring.

3.2 THE FLASHTUBE

The flashtubes FTW1, FTW2, and FTW3 (daymode) and FTR1, FTR2, and FTR3 (nightmode) are quartz tubes containing two (2) electrodes each. The electrode at the positive (+) end is called the anode and is connected to the positive side of the storage capacitors through inductors L1, L11, L2, L22, L3, and L33. The electrode at the negative (-) end of the tube is called the Cathode and is connected to the negative side of the energy storage capacitors banks.

The flashtube contains a gas called Xenon. When the high voltage energy in the storage capacitors is connected to the flashtube, nothing will happen since Xenon in its natural state is not a conductor of electricity. However,
when a very short duration high voltage pulse is impressed on the trigger element of the tube (via the power supply and trigger transformers T4, T5, T6, T7, T8, and T9) the Xenon gas is ionized and thereby becomes a good conductor of electricity. This allows the electrical energy in the storage capacitors to discharge rapidly through the flashtube, which converts this energy to light energy and heat energy. When the voltage stored in the capacitors discharges to a low level, the Xenon gas can no longer sustain conduction and since the short trigger pulse is gone by this time, it de-ionizes returning to its non-conducting state until another trigger pulse arrives to repeat the process. Meanwhile, the storage capacitor is being re-charged by the transformer and the high voltage rectifiers.

3.3 TIMING CIRCUIT

The timing circuit is contained entirely on printed circuit board #1. The timing circuit has its own power supply. This circuit converts the AC voltage to approximately 12V DC, which is used to supply all of the components in this circuit. It uses this low voltage DC to generate pulses that control the flash rate of the flashtube. It actually generates two (2) groups of pulses. The first is a pulse approximately once every 1.2 seconds to operate the flashtube during daylight hours. The second is a burst at 100Hz to elongate the apparent flash during the night time hours at reduced flash energy.

3.4 TRIGGER CIRCUIT

The trigger circuit is supplied by transformer T1 secondary windings. The 250V AC is converted to DC, which is stored in a storage capacitor much like the action of the high voltage circuit. The main difference is that the storage capacitor is much smaller. The trigger circuit receives the pulses generated by the timing circuit. It releases its stored energy with each pulse and delivers it to the flashtube's trigger element to initiate each flash.
3.5 ALARM CIRCUITS

3.5.1 White Strobe Failure (ST1, ST2, and ST3)
White Strobe Failure alarm circuit monitors each flash of the day mode flashtube within the beacon. If the flashtube fails to flash (for any reason) the alarm circuit operates relays K7A, K7B, and K7C (on PCB #3) that the customer can connect to their alarm transmitting devices. The alarm point can be accessed on J3 of PCB #3.

3.5.2 Red Strobe Failure (RF)
Red Strobe Failure alarm circuit monitors each flash of the night mode flashtube within each beacon. If any Red Strobe flashtube fails to flash (for any reason) the alarm circuit would operate relay K8 (on PCB #3) that the customer can connect to their alarm transmitting devices. The alarm point can be accessed on J3 of PCB #3.

3.5.3 Power Failure (PF)
The power failure alarm relay is energized during normal operation. Should the power be removed for any reason, then relay K1A would drop, creating an alarm for the customer alarm transmitting device.

3.5.4 Photocell (PC)
The photocell alarm relay K4 is energized whenever the photocell or SW3 is on. This relay will allow the customer to monitor the modes of operation to determine if switch from day to night mode has occurred.

3.5.5 Sidelight Alarm (SA1, and SA2)
Modules M1, and M2 monitor the current flowing to the sidelights. These modules can monitor from (1-4) 116W lamps. Factory setting is generally for three (3) lamps. When the current falls below two (2) amps (one [1] lamp less than the factory setting), then the onboard relay will engage, creating an alarm.
3.6 BELLEADER CIRCUIT

The bleeder circuit is the most important safety item in this system. It consists of resistors R32A, R32B, and R32C connected to the high voltage storage capacitor through relays K2, and K2A. When the AC line voltage is turned off, the relay will close allowing the resistors to discharge the high voltage stored in the capacitor banks below 50V in 30 seconds.

**CAUTION**

NEVER RELY ON THIS CIRCUIT TO RENDER THIS SYSTEM HARMLESS. ANY DEFECT IN THIS CIRCUIT COULD ALLOW A HAZARDOUS HIGH VOLTAGE CHARGE TO REMAIN ON THE STORAGE CAPACITORS. ALWAYS WAIT AT LEAST 30 SECONDS AFTER POWER HAS BEEN TURNED OFF BEFORE STARTING ANY WORK ON THIS SYSTEM. ALWAYS MEASURE THE VOLTAGE ON THE STORAGE CAPACITORS WITH A VOLTMETER BEFORE STARTING ANY OTHER WORK ON THIS SYSTEM. NEVER ATTEMPT TO DEFEAT THE SAFETY INTERLOCKS.

3.7 STROBE DIAGNOSTIC CIRCUITS

The diagnostic circuit is provided as a means of making system checks and maintenance more convenient. This circuit is entirely contained on the printed circuit boards PCB #1, and PCB #2. The circuits that are contained on PCB #1, and PCB #2 are as follows:

3.7.1 Control Power On

Line from the 120V AC input is sent through safety switches CSS, BSS, isolation transformer T1, and fuse F11 on PCB #1. Once this low voltage is at PCB #1, it is rectified, and then sent to LED4 (D5). If for any reason power is interrupted, (beacons opened, controller door open, blown F1 fuse, failed relay, etc.) LED4 would be extinguished.

3.7.2 High Voltage

The Cathode side of the high voltage HV1, HV2, and HV3, are routed through current limiting resistors (R201, R202, and R203). When the unit is in daymode, D14, D15, and D16 will be at full brightness when the capacitors are at full charge but, dims with the discharging of the storage capacitors. A constant intensity indicates that high voltage is present but capacitors are not discharging (check other indicators for fault). When the red LEDs fail to glow, then the high voltage is no longer present.
3.7.3 Trigger Voltage

The trigger voltage from fuse F41 (PCB #4) is sent to current limiting resistor R1, and LED6 (D11). Under normal circumstances, the red LED should be at full intensity, indicating voltage to be normal. An absence of this indication means that the voltage is no longer present.

3.7.4 Nightmode

Output voltage from the photocell (SSR) is connected to the coil of relay K4 on PCB #3. Whenever the photocell senses the darkness, or switch SW1 is on, relay K4 will energize, thereby sending 120V to relay U2. Relay U2 will supply 12V DC to the timing circuit as well as LED7 (D7). LED7 will glow a constant red when in the nightmode.

3.7.5 Primary Timing

The primary timing pulses are received at LED8 (D12). LED8 will flash according to the pulses received from the timing circuit. If LED8 fails to flash, then the primary timing circuit has failed. Check LED9 (D28) for secondary timing operation. The strobe unit should produce 40 (+/- 2) pulses per minute in daymode or nightmode back-up operation. The strobe unit in nightmode operation should produce 22 (+/- 2) pulses per minute.

3.7.6 Timing Signal Verify

Timing pulses (either primary or secondary) are received at LED9 (D28). The LED will flash according to the pulses received from the timing circuit. In the unlikely event that this LED is out, then total timing failure has occurred.

3.7.7 Flash Verified

Current from the Cathode side of the flashtube (FTC1, FTC2, and FTC3) are sent through the current sensing transformers T1, T2, T3, T4, T5, and T6 on PCB #1. T1, T2, T3, T4, T5, and T6 will send a pulse to the gate of the SCR's Q6, Q8, Q10, Q13, Q14, and Q17, and turns it on. Capacitors C12, C13, C14, C15, C16, and C17, via Q6, Q8, Q10, Q13, Q13, Q14, and Q17, will send voltage to LED1 (D20), LED3 (D21), and LED5 (D22). After each confirmed flash, LED1 and LED3 will blink. Absence of a blinking LED signifies that strobe beacon has ceased to flash.

3.7.8 Strobe Fail Test
Switch S1, when turned on, cuts off timing signal to the trigger circuit and extinguishes LED8 (D12). At this time the strobe alarm should be received at J3. The normal position of S1 is off (switch downward).
4.0 TROUBLE SHOOTING

Much of the trouble shooting of this system will consist of correcting a "beacon out" situation. There may also be a failure mode where flashtube is still flashing, but at the wrong rate or the wrong intensity.

You must study and understand the safety messages and the theory of operation before attempting any service on this system. Servicing this system must be done by qualified personnel only.

4.1 TOOL REQUIREMENTS

In order to be prepared to trouble shoot or repair this system, a minimum amount of tools and equipment will be required. A recommendation list includes:

1) 5/16 Flat Electrician's Screwdriver
1) #2 Phillips Screwdriver
1) Nut Driver or Socket Set
1) Multi meter - Analog or Digital 600V AC / 600V DC Minimum

4.2 DIAGNOSTIC EVALUATION

The first step in trouble shooting of this system or performing annual maintenance will require the technician to open the controller door. With the power off to the controller, the technician should look over the controller circuit and repair or replace any apparent problems such as loose wire connections or corroded terminations. After the initial visual checks have been completed, restore power to the controller and pull out on the plunger of the cabinet safety switch (CSS) located at the lower right edge of the enclosure. Observe at this time the LEDs located on PCB #1 and PCB #2. Determine, by observation of these LED indicators, if the controller is performing to normal operation.

LEDs on PCB #1 are numbered from top to bottom, 1-9. LEDs on PCB #2 are numbered from top to bottom D14 - D16. (See drawings H40-279, and H01-279.)
4.3 TROUBLE SHOOTING ASSISTANCE

4.3.1 Flash Verify LED - Out

4.3.1.1 Observe high voltage LED (D14, D15, and D16) on the same beacon circuit to determine if it is available. If the LED is dim or out completely, then check the high voltage capacitor bank (C103 - C131 day, C102, C112, and C122 night) for a short. If no capacitor is found to be shorted, check the resonant capacitor (C101, and C101A) for a short. If the resonant capacitor is okay, replace PCB#2. If the LED is at full illumination, go to the next step.

4.3.1.2 Check the status of trigger LED6. If LED is dim or off, check fuse F41. If blown, replace with exact type of fuse. If the fuse blows again, check transformer T1. Replace as necessary. If LED is okay, go to the next step.

4.3.1.3 If steps 4.3.1.1 and 4.3.1.2 check out okay, re-lamp the beacon.

4.3.2 Control Power on LED - Out

Check interlock circuits for an open circuit. If open, make the necessary repairs. If okay, check fuses F2, and F3. Replace if bad.

4.3.3 Primary Timing LED - Out

Observe the status of the timing LED8. If the LED is dim or out completely, check LED9, if dim or out, replace PCB#1. If one or both are lit, you should have timing.

4.3.4 False or Nonexistent Beacon Alarms (ST1, ST2, and ST3)

4.3.4.1 If alarm trips when the system appears to be working normally or fails to show an alarm when there is an obvious failure, check PCB #1 P1-4, and P1-10 for 120V AC output. If voltage is okay, go to the next step.

4.3.4.2 Check relays K7A, K7B, and K7C coils for an open condition. Normal resistance should be around 2K ohm. If one (1) or more coils are open, replace relay.

4.3.4.3 The time delay between an actual failure and the point
where the relay trips is pre-set at the factory or about eight (8) seconds. This delay period can be tested by throwing "on" (upward) switch number S1 (on the circuit board #1). After testing return switch S1 to its normal (downward) position.

4.3.5 False or Nonexistent Beacon Alarm (RF)

If alarm trips when the system appears to be working normally or fails to show an alarm when there is an obvious failure, check relay K8 coil for an open condition. Normal resistance should be around 2K ohm. If coil is open, replace K8.

4.3.6 No Red Strobe Operation

4.3.6.1 Check if switch SW2 is on. If switch is off, turn switch to the on position (upward). Reset the circuit breaker at the service panel. If okay, go to the next step.

4.3.6.2 Turn switch SW1 to the upward position. On the breaker at the service panel to the lights, turn off, then back on. If the beacons comes on, then the unit fail-safes back to the white back-up mode of operation, then replace the failed red mode flashtube.

Note: Once the unit fail-safes, you will need to reset the breaker at the panel in order to release the latched relay in this circuit anytime a failure has been detected. This is an important fact to remember when trouble shooting this system.
5.0 MAINTENANCE GUIDE

**WARNING - HIGH - VOLTAGE**

THIS SYSTEM OPERATES AT HIGH VOLTAGE LEVELS THAT COULD BE LETHAL TO SERVICE PERSONNEL. ALL INSTALLATION AND MAINTENANCE WORK SHOULD BE DONE BY QUALIFIED SERVICE PERSONNEL. READ AND UNDERSTAND THE THEORY OF OPERATION AND ITS SAFETY MESSAGES BEFORE ATTEMPTING; INSTALLATION OF THIS SYSTEM. DO NOT ATTEMPT TO DEFEAT THE INTERNAL SAFETY DEVICES.

Tools Required: #2 Phillips Screwdriver
3/16 Flat Blade Screwdriver

5.1 FLASHTUBE REPLACEMENT

The only required maintenance needed to be performed is the replacement of the flashtubes every four (4) years. By following these instructions, maximum safety and performance can be achieved.

5.1.1 Loosen the single quick open bolt located on upper hinge assembly.

5.1.2 Open the lens and tilt it back.

ALWAYS WAIT AT LEAST 30 SECONDS AFTER OPENING THE BEACON BEFORE STARTING ANY WORK ON THE BEACON.

5.1.3 Loosen the three (3) socket screws with a #2 Phillips screwdriver to remove lamp.

5.1.4 Install the new nightmode flashtube making sure that the pins are aligned with the socket. Make sure tube is flush on the socket.

5.1.5 Tighten the socket screws snug, then 1/4 turn more.

5.1.6 Open the internal hatch plate latch and let it recline open.

5.1.7 Disconnect the cable running through the tube from the 10 position terminal block located at the base of the fixture.

5.1.8 Loosen the three (3) socket screws with a #2 Phillips screwdriver.

5.1.9 To remove the flashtube, slide the lamp down to the cable.

5.1.10 To install a flashtube, slide the lamp over the connector on to the
cable with the lamp in the base up position.

5.1.11 Insert the flashtube with the pins aligned with the socket.

5.1.12 Tighten the socket screws snug, then 1/4 turn more.

5.1.13 Reconnect cable connection. Make sure to follow the color codes on the cable to the terminal block.

5.1.14 Close the hatch and latch securely.

5.1.15 Close the upper hinge assembly and latch securely.

5.2 RED OBSTRUCTION LIGHTING

The only required maintenance needed to be performed is replacement of the lamps in the L-810 fixture. Lamps should be replaced after being operated for not more than 75% of the rated life or immediately upon failure as per FAA Advisory Circular 70/7460-1K. By following these instructions, maximum safety and performance can be achieved.

Tools Required: None

5.2.1 LAMP REPLACEMENT

5.2.1.1 Unclasp the two (2) latches and let the bail recline back.

5.2.1.2 Lift the lens up and over the lamp letting the lens hang from the safety cable.

5.2.1.3 Unscrew the lamp counter-clockwise and remove.

5.2.1.4 Install the new lamp by screwing the lamp clockwise.

5.2.1.5 Re-install the lens making sure it is seated properly on the base.

5.2.1.6 Re-clasp the two (2) latches.

5.3 POWER SUPPLY

The only required maintenance to be performed is periodic
inspection/cleaning of the vent filter. Monthly inspections should be made at first to familiarize yourself with power supply’s particular maintenance requirements. Maintenance intervals can vary due to location, seasonal weather conditions, and general housekeeping of site.

The filter is located on the inside of the enclosure on the lower right hand side.

**Tools Required:** None.

5.3.1 Turn off power at breaker panel.

5.3.2 Open the controller door.

5.3.3 Disconnect P1 and P2 connectors from PCB #1.

5.3.4 Remove PCB #1 from track.

5.3.5 Slide filter up and remove from bracket.

5.3.6 Wash filter with water and squeeze until all excess water is removed. If no water is available, then knock out dust from filter before reinstalling.

5.3.7 Reinstall filter into bracket.

5.3.8 Reinstall PCB #1.

5.3.9 Reconnect P1 and P2 connectors to PCB #1.

5.3.10 Close the controller door.

5.3.11 Turn on power at breaker panel.

5.4 PHOTOCELL

The photocell is a sealed unit. No maintenance is needed or required other than replacement as necessary.
## 6.0 MAJOR COMPONENTS LIST

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<th>DESCRIPTION</th>
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<td>BEACON SAFETY SWITCH</td>
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### 7.0 SUGGESTED SPARE PARTS LIST

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<td>2</td>
<td>10 amp FUSE</td>
<td>FNQ10</td>
</tr>
<tr>
<td>2</td>
<td>20 amp FUSE</td>
<td>KTK20</td>
</tr>
<tr>
<td>2</td>
<td>1/2 amp FUSE</td>
<td>FUSE.5</td>
</tr>
<tr>
<td>2</td>
<td>1/8 amp FUSE</td>
<td>FUSE.125</td>
</tr>
<tr>
<td>1</td>
<td>E2/3DB PCB #1</td>
<td>STH01279</td>
</tr>
<tr>
<td>1</td>
<td>120V AC PHOTOCCELL</td>
<td>P2455L</td>
</tr>
</tbody>
</table>
TWR Lighting, Inc. (“TWR”) warrants its products (other than replacement parts) against defects in design, material (excluding incandescent bulbs) and workmanship for a period ending on the earlier of two (2) years from the date of shipment or one (1) year from the date of installation.

**Replacement parts are warranted for 90-days from the date of shipment.**

Conditions not covered by this Warranty or which might **void** this Warranty are as follows:

- Improper Installation or Operation
- Misuse
- Abuse
- Unauthorized or Improper Repair or Alteration
- Accident or Negligence in Use, Storage, Transportation, or Handling
- Any Acts of God or Nature

**Field Service – Repairs are warranted for 90 days from the date of service,** except where TWR has made recommendations that were not adhered to that may cause premature failure on previous repairs. Labor, Travel, and Tower Climb are not covered under warranty. Customer shall be obligated to pay for all incurred charges not related to warranty. All warranty repairs are performed by trained TWR personnel, or dispatched through an extensive network of certified and insured subcontractors.

**Return Policy**

**Return Terms** - You must first contact our Product Support Administrative Assistant at (713-973-6905) to acquire a Return Goods Authorization (RGA) number in order to return the product(s). Please have the following information available when requesting an RGA number:

- The contact name and phone number of the tower owner
- The contact name and phone number of the contractor
- The site name and number
- The part number
- The serial number (if any)
- A description of the problem
- The billing information
- The Ship To address

**This RGA number must be clearly visible on the outside of the box.** If the RGA number is not clearly labeled on the outside of the box, your shipment will be refused. Please ensure the material you are returning is packaged carefully. **The warranty is null and void if the product(s) are damaged in the return shipment.**

All RGAs must be received by TWR 4300 Windfern Rd., Suite 100, Houston TX 77041-8943, within **30 days of issuance.**

Upon full compliance with the Return Terms, TWR will replace, repair and return, or credit products returned by the customer. It is TWR’s sole discretion to determine the disposition of the returned item(s).
Replacements - Replacement part(s) will be shipped and billed to the customer for product(s) considered as Warranty, pending return of defective product(s). When available, a certified reconditioned part is shipped as warranty replacement with a Return Goods Authorization (RGA) number attached. Upon receipt of returned product(s), inspection, testing and evaluation will be performed to determine the cause of defect. The customer is then notified of the determination of the testing.

- Product(s) that is deemed defective and/or un-repairable and covered under warranty, a credit will be issued to the customer's account.
- Product(s) that are found to have no defect will be subject to a **$60.00 per hour testing charge (1 hour minimum), which will be invoiced to the customer**. At this time the customer may decide to have the tested part(s) returned and is responsible for the return charges.
- Product(s) under warranty, which the customer does not wish returned, the customer will be issued a credit against the replacement invoice.

Repair & Return - A Return Goods Authorization (RGA) will be issued for all part(s) returned to TWR for repair. Upon receipt of returned product(s), inspection, testing and evaluation will be performed to determine the cause of defect. The customer is then notified of the determination of the testing. If the returned part(s) is deemed un-repairable or the returned part(s) is found to have no defect, the customer will be subject to a **$60.00 per hour testing charge (1 hour minimum), which will be invoiced to the customer**. Should the returned parts be determined to be repairable, a written estimated cost of repair will be sent to the customer for their written approval prior to any work being performed. In order to have the tested part(s) repaired and/or returned, the customer must issue a purchase order and is responsible for the return shipping charges.

Return to Stock - Any order that is returned to TWR for part(s) ordered incorrectly by the customer or unneeded upon receipt, the customer is required to pay a **20% restocking fee**. A credit will be issued once it is determined that the Return Terms are met.

Credits - Credits are issued once it is determined that all of the Warranty and Return Terms are met. All credits are processed on Fridays. In the event a Friday falls on a Holiday, the credit will be issued on the following Friday.

Freight - All warranty replacement part(s) will be shipped via ground delivery and paid for by TWR. Delivery other than ground is the responsibility of the customer.

REMEDIES UNDER THIS WARRANTY ARE LIMITED TO PROVISIONS OF REPLACEMENT PARTS AND REPAIRS AS SPECIFICALLY PROVIDED. IN NO EVENT SHALL TWR BE LIABLE FOR ANY OTHER LOSSES, DAMAGES, COSTS OR EXPENSES INCURRED BY THE CUSTOMER, INCLUDING BUT NOT LIMITED TO, LOSS FROM FAILURE OF THE PRODUCTS TO OPERATE FOR ANY TIME, AND ALL OTHER DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING ALL PERSONAL INJURY PROPERTY DAMAGE DUE TO ALLEGED NEGLIGENCE, STRICTLY LIABLE, OR ANY OTHER LEGAL THEORY WHATSOEVER. THIS WARRANTY IS MADE BY TWR EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, TWR MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS OF THE PRODUCTS FOR ANY PARTICULAR PURPOSE. TWR EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES.
RETURN GOODS AUTHORIZATION FORM (RGA)

RGA#: __________________________ DATE: __________________________

CUSTOMER: ______________________________________________________

CONTACT: _______________________ PHONE NO.: ______________________

ITEM DESCRIPTION (PART NO.): ______________________________________

MODEL NO.: __________________ SERIAL NO.: _________________________

ORIGINAL TWR INVOICE NO.: __________ DATED: ______________________

DESCRIPTION OF PROBLEM: _________________________________________

SIGNED____________________ DATE NEEDED _________________________

RETURN ADDRESS: _________________________________________________

RETURN PRODUCT TO: 4300 WINDFERN RD. #100 HOUSTON TX 77041-8943
RETURN GOODS AUTHORIZATION FORM (RGA)

RGA#: ___________________________ DATE: ___________________________

CUSTOMER: _________________________________________________________
______________________________________________________

CONTACT: ______________________ PHONE NO.: ______________________

ITEM DESCRIPTION (PART NO.): _______________________________________
 ______________________________________________________

MODEL NO.: ______________ SERIAL NO.: ____________________________

ORIGINAL TWR INVOICE NO.: ___________________ DATED: __________

DESCRIPTION OF PROBLEM: _________________________________________
 ______________________________________________________
 ______________________________________________________

SIGNED ___________________________ DATE NEEDED __________

RETURN ADDRESS: ________________________________________________

RETURN PRODUCT TO: 4300 WINDFERN RD. #100 HOUSTON TX 77041-8943
ITEM # | DESCRIPTION
--- | ---
1 | BEACON L-864/L865 DUAL RED/WHT STROBE
2 | POWER SUPPLY E-2/3DB
3 | WATER TIGHT CABLE CONNECTOR WITH SEALING GLAND.
4 | ENTRANCE HUB 3/4”
5 | ENTRANCE HUB 1”
6 | RIGID GALVANIZED CONDUIT OR STROBE CABLE.
7 | #P2455L PHOTOCELL
8 | VENT & FILTER COVER

NOTES:

A. POWER SUPPLY IS NORMALY MOUNTED AT GROUND LEVEL ON TOWER. IT CAN ALSO BE MOUNTED INDOORS. RECOMMENDED MOUNTING HEIGHT IS 48” TO BOTTOM OF THE ENCLOSURE FOR EASE OF MAINTENANCE.

B. MOUNT BEACON HINGES SO LENS WILL OPEN UNOBSRTED BY STRUCTURE.
TOWER HT.
500'/122M (MAX.)
351'/107M (MIN.)

DUAL BEACON

SIDELIGHTS

DUAL BEACON
1/2 TOWER HT.

DUAL BEACON

SIDELIGHTS

1/4 TOWER HT.

TO DUAL BEACON(B1)
TO DUAL BEACON(B2)
TO DUAL BEACON(B3)
TO SIDELIGHTS
TO BREAKER PANEL
ALARMS

NOTES:

1. THIS CONTROLLER CAN BE MOUNTED INDOOR OR OUTDOOR.
2. IT IS HIGHLY RECOMMENDED TO MOUNT A LIGHTING ROD AT THE TOP LEVEL.
3. FOR MORE DETAILS REFER TO DRAWINGS HD9-279 (CONTROLLER INSTALLATION), 601 (LIGHT KIT CABLE RUN), 601-01 (LIGHT KIT CONDUIT & CABLE RUN) AND 601-02 (LIGHT KIT ONLY CONDUIT RUN).

TYPICAL SITE LAYOUT
<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>PHOTOCELL</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>6-32 x 1/2&quot; SCREW</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>RECEPTACLE SOCKET</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>RECEPTACLE GASKET</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>RECEPTACLE HOUSING</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>1/2&quot; CONDUIT LOCKNUT</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>3/4&quot; TO 1/2&quot; REDUCER</td>
</tr>
</tbody>
</table>

NOTES:

1. ITEM #7 CAN BE USED TO REDUCE 3/4" CONDUIT TO 1/2" CONDUIT AT THE HOUSING OR AT THE CONTROLLER ITSELF.

2. IF ADDITIONAL WIRE IS REQUIRED OVER THE FACTORY 20', USE THE FOLLOWING CHART.
   - 21' TO 300' = 16 AWG TFFN
   - 301' TO 500' = 14 AWG TFFN

ASSEMBLY

EXPLODED VIEW

BLACK
RED
WHITE
BILL OF MATERIALS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>TWR PART NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>OLT/LED</td>
<td>3/4&quot; OBSTRUCTION LIGHT</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>T27CG</td>
<td>3/4&quot; CONDUIT W/COVER AND GASKET</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>EL3430</td>
<td>3/4&quot; 30° ELBOW</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>N34T3</td>
<td>3/4&quot; x 3/4&quot; NIPPLE</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>HC402</td>
<td>3/4&quot; NO THREAD CONNECTOR</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>A314</td>
<td>3/4&quot; CONDUIT LOCKNUTS</td>
</tr>
<tr>
<td>7</td>
<td>3D</td>
<td>CONDUT134</td>
<td>3/4&quot; CONDUIT</td>
</tr>
</tbody>
</table>

* = ITEMS NOT SHOWN

NOTES:

1. THIS DRAWING IS A TYPICAL INSTALLATION DETAIL FOR 3 OL=1 PER LEVEL SYSTEM.
2. IN VIEW C ITEM NUMBER 3 MAY BE OMITTED WHEN ARRANGING FOUR LEG TOWERS.
3. ITEMS #7 CUT TO LENGTH FOR PROPER EXTENSION OF OL1 FROM STRUCTURE (6"-12"). ATTACH ITEM #5 TO UN-THREADED CONDUIT TO COMPLETE ASSEMBLY.
4. USE COUPLING THAT IS PROVIDED BY ITEM #7.
5. GREEN WIRE USED ONLY ON LED SIDELIGHTS.

SLASSM
SIDELIGHT MOUNT ASSEMBLY
(10" FACE WIDTH MAX)

TWR Lighting, Inc.
Enlightened Technology

DATE: 04/05/07(A) UPDATED TO LED
DATE: TR. REVISION

DRAWN BY F. DELACRUY
DATE 09/30/07 SHEET 1 OF 1
REV. 00481
For use as an obstruction light on towers, building, bridges, cooling towers. Meets or exceeds all FAA specs as found in AC 150/5345-43 Type L-810.

Our most popular light. The side hub allows for a straight run of conduit from the junction box for hook up.

High temperature, ultra pure FAA approved Aviation red, blue, yellow, or clear glass fresnel lens.

Can be used steady burning or flashing.

Neoprene gasket for weatherproofing.

Copper free aluminum casting and all stainless steel latches and hardware for corrosion protection.

High quality porcelain receptacle.

Stainless steel safety cable.

Specify conduit size 3/4", 1", 1-1/4" NPT (19.055mm), (25.407mm), (31.756mm)

No special tools required for maintenance.

General Specifications
Height 7.5 inches (19.055 cm)
Weight 3 lbs (13605.442g)
Power 120, 230, or 240 volts AC
Uses 116W, 120V or 240V bulbs
Bulbs sold separately
NOTE:
1. FAA APPROVED LIGHT USES THE 116A21TS LAMP. OTHER LAMPS ARE AVAILABLE TO MEET YOUR APPLICATION.
**NOTES:**

1) DRAWING ILLUSTRATES METHOD OF STRAIN RELIEVING WIRE. USE THIS METHOD ON ALL JUNCTION BOXES.

2) THE NATIONAL ELECTRICAL CODE—ARTICLE 300-19-83 REQUIRES CONDUCTORS IN A VERTICAL CONDUIT BE SUPPORTED TO RELIEVE STRAIN ON TERMINAL BLOCK CONNECTIONS.

3) SKETCH ILLUSTRATES METHOD OF STRAIN RELIEVING A SINGLE CONDUCTOR. SEVERAL CONDUCTORS MAY BE GROUPED TOGETHER.

4) CONDUCTORS MAY BE MIXED BUT SHOULD NOT TAKE UP MORE THAN 40% OF CONDUIT'S INSIDE AREA.

<table>
<thead>
<tr>
<th>AWG</th>
<th>MAX. NUMBER WIRES IN 3/4&quot; CONDUIT</th>
<th>MAX. NUMBER WIRES IN 1&quot; CONDUIT</th>
<th>WIRE AREA SQ. INCHES</th>
<th>WEIGHT PER 100 FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 THHN</td>
<td>16</td>
<td>26</td>
<td>0.0117</td>
<td>2.50</td>
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<td>17</td>
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<td>9</td>
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<td>4</td>
<td>7</td>
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<td>10.30</td>
</tr>
<tr>
<td>4 THHN</td>
<td>2</td>
<td>4</td>
<td>0.0845</td>
<td>16.20</td>
</tr>
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</table>

**JUNCTION AND STRAIN RELIEF BOXES**

**TWR Lighting, Inc.**

**Enlightened Technology**

**DATE:** 9/29/00 **REVISION:** L7