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FTB 311-3/3A/3AE

Medium Intensity Obstruction Lighting System

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Front Matter

Abstract

This manual contains information and instructions for installing, operating, and maintaining the FTB 311-3, FTB 311-3A, and FTB 311-3AE Obstruction Lighting Systems.

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Trademark Acknowledgments

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Applicable Specification

This equipment meets or exceeds requirements for an FAA Type L-865 medium intensity obstruction light in Advisory Circular 150/5345-43.

Disclaimer

While every effort has been made to ensure that the information in this manual is complete, accurate and up-to-date, Flash Technology Corporation of America assumes no liability for damages resulting from any errors or omissions in this manual, or from the use of the information contained herein. Flash Technology Corporation of America reserves the right to revise this manual without obligation to notify any person or organization of the revision.

In no event will Flash Technology Corporation of America be liable for direct, indirect, special, incidental, or consequential damages arising out of the use of or the inability to use this manual.

Replacement Parts

The use of parts not manufactured or supplied by FTCA or unauthorized modification of this equipment voids the warranty and could invalidate the assurance of complying with FAA requirements for Type L-865 medium intensity lights as published in Advisory Circular 150/5345-43.

Warranty

All components are fully warranted, under normal operating conditions, for two years.

Pub. No. 0594-311-3/3A/3AE_7

PERSONNEL HAZARD WARNING

Dangerous Voltages

Dangerous line voltages reside in certain locations in this equipment. Also, this equipment may generate dangerous voltages. Although FTCA has incorporated every practical safety precaution, exercise extreme caution at all times when you expose circuits and components, and when you operate, maintain, or service this equipment.

Avoid Touching Live Circuits

Avoid touching any component or any part of the circuitry while the equipment is operating. Do not change components or make adjustments inside the equipment with power on.

Dangerous Voltages Can Persist with Power Disconnected

Under certain conditions, dangerous voltages can be present because capacitors can retain charges even after the power has been disconnected.

Protect yourself — always turn off the input (primary) power and wait for one minute for storage capacitors to drain their charge. Then check between the red and blue wires on the TB2 terminal block with a voltmeter for any residual charge before touching any circuit element or component.

Do Not Depend on Interlocks

Never depend on interlocks alone to remove unsafe voltages. Always check circuits with a voltmeter. Under no circumstances remove or alter any safety interlock switch.

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Section 1 — FTB 311-3/3A Introduction and Operation

System

Each single FTB 311-3, FTB 311-3A, or FTB 311-3AE System consists of a FH 308 Flashhead, a PC 311-3, PC 311-3A, or PC 311-3AE Power Converter, a PEC 510 Photocell, and a connecting cable from the power converter to the flashhead.

The power converter supplies the controlling circuitry to convert main AC power to the required voltages for internal operation and the discharge energy for the flashhead. It also controls the flash rate.

The photocell senses changes in lighting conditions from day to night and from night to day thus signalling the power converter to change its operation appropriately. Also, a manual intensity switch can override the photocell if required.

Specifications

Physical

Power Converter:

(H x W x Depth, Wgt):	12 x 16 x 10 in, 33 lbs
	306 x 408 x 255 mm, 14.85 kg

Flashhead:

(H x Diam, Wgt):	17 x 18.25 in, 14 lbs
	430 x 463 mm, 6.3 kg

Performance Characteristics

Application:	L-865/L-864
Flash Intensity (nominal):	
Day Intensity	20,000 ± 25% ECD
Night Intensity (back-up operation)	2,000 ± 25% ECD
Beam Spread:	
Horizontal	360° (omnidirectional)
Vertical	5°
Flash Rate:	
Day (White)	40 flashes per minute
Night (Red)	20 flashes per minute
Default Night (White)	40 flashes per minute

Electrical

Voltage	120/240V ± 10%, 60 Hz
	230V, 50 Hz, single phase
Volt-Amperes	250 VA peak; 175 VA avg.
Watts	Day: 130; Night: up to 850

Effective Wind Area

.93 sq. ft. (.0864 sq. m.)

Environmental

Complies with AC 150/5345-43.

Operation

FTB 311-3/3A/3AE Obstruction Lights are white, flashing medium intensity lights. The lights are omnidirectional, operate at 40 flashes per minute and have two intensity steps.

The lights begin to operate as soon as electrical power is applied. The nominal flash intensity for daytime and twilight is 20,000 effective candelas. At night the nominal flash intensity is 2,000 effective candelas. Power converters operate in day mode by default.

Three interconnected PC 311-3, PC 311-3A, or PC 311-3AE Power Converters operate the corresponding number of flashheads on a structure. In multiple-light systems, the power converters must be wired together at the master/slave interconnect terminals on TB1 at the front panel. A master/slave control line (two-wire) at terminals TB1-4 and -5 at the front panel interconnects the units. A sync pulse on the line flashes all the lights in unison and at the same rate. The photocell can be wired to only one unit, typically the master unit, which controls the top-most light on a tower structure.

The FTB 311-3, FTB 311-3A, or FTB 311-3AE System has a *dual* system interface. It can be set up to: flash during daytime and shut down at night; and turn on a system of red incandescent lights at night.

For *backup*, if the red light system fails, the white light takes over and flashes at the proper night intensity. A failure of the top light in night mode causes the master power converter that drives that failing light to signal backup mode to all power converters. Thus, all flashheads on the structure flash in backup mode (correct night intensity white light operation).

Each FTB 311-3 or FTB 311-3A power converter has a Timing and Trigger Board (PCB1) #24740xx that has cutable jumpers and switches. The functions of the jumpers and switches on PCB1 are shown in *Figure 1-1 Timing and Trigger Board (PCB1) (24740xx)*.

Each FTB 311-3AE power converter is supplied with a surge suppressor board in a separate housing, which connects to a phone line, and a Timing and Trigger Board (PCB1) #24747xx that has cutable jumpers. PCB1 for “E” systems connects to a telephone line for remote monitoring by computer.The functions of the jumpers on PCB1 are shown in *Figure 1-2 Timing and Trigger Board (PCB1) (24747xx)*.

Photocell

The photocell changes resistance as ambient light changes from day to night or from night to day. Connected to the first (master) power converter, the photocell signals the change for all units. The Timing and Trigger Board (PCB1) in the master power converter changes the operation to flash the lights at the appropriate intensity for day or night operation.

Options

Call FTCA Customer Service at 1-800-821-5825 for more information about options.

Monitoring Alarms

Electrically isolated relay contacts, either normally open or normally closed, change state upon equipment failure. Alarm relay contacts are rated at 120 V, 1 A.

White light alarm relay contacts may be connected to an external monitoring circuit. The contacts change state if the equipment fails to flash, unless the no-flash condition results from set-up programming (as in *dual* system operation).

Similarly, red light alarm and marker alarm relay contacts may be connected to an external monitoring circuit. These contacts change state if a red beacon fails to flash or the markers fail.

Alarm Summary

The extended monitoring alarms 4 to 7 are available at the front panel (at TB1-14 to TB1-18) on the PC 311-3A:

1. White Alarm — indicates white light failure (standard).
2. Red Alarm — indicates failure of the top red incandescent beacon.
3. Marker alarm:

    - Indicates red marker light failure. A predetermined number of marker lamps are out or not functioning.
    - The marker lamp current is too low or not present.

    The number of marker lamps installed on a power converter must be set in the jumper settings and internal programming on PCB1 of that power converter. See *Section PCB1 Jumper and Switch Settings* for the correct setting of these jumpers.

4. Day Intensity Error — indicates that the light is flashing at an intensity that does not agree with the signal from the photocell:

    - A light fails during day operation.
    - A light operates at the incorrect intensity for day lighting conditions.

5. Night Intensity Error — indicates that the light is flashing at an intensity that does not agree with the signal from the photocell:

    - A light fails during night operation.
    - A light operates at the incorrect intensity for night lighting conditions.

6. Photocell Error — indicates that the photocell has failed to switch state during a 24-hour period (or a period set by the factory).
7. Day Mode — indicates that the power converter is operating in day mode.
8. Nite Mode — indicates that the power converter is operating in night mode.

Programming

The factory sets up the equipment to operate according to your application. Its operation is altered (customized) by internal programming and jumpers on PCB1. *Figure 1-1* and *Figure 1-2* show the locations and functions of programming jumpers and switches. PCB1 also has indicator lights that are useful for monitoring the operation.

Section Setting Up PCB1 explains how to use the controls, programming jumpers and indicator lights.

Section Operational Checkout explains how to perform an operational checkout.

PCB1 governs all automatic functions. It has twelve red light emitting diode (LED) indicators and one clear neon indicator that you can use to monitor equipment operations during checkout and troubleshooting. The LEDs are mounted at the connector edge of PCB1. The essential features on PCB1 for troubleshooting are shown in *Figure 1-1* and *Figure 1-2*. PCB1 is located on the side of the power converter. Refer to *Figure 4-1*.

The following, *Section Setting Up PCB1*, describes the jumper programming options of PCB1 and the operation of the LEDs.

Setting Up PCB1

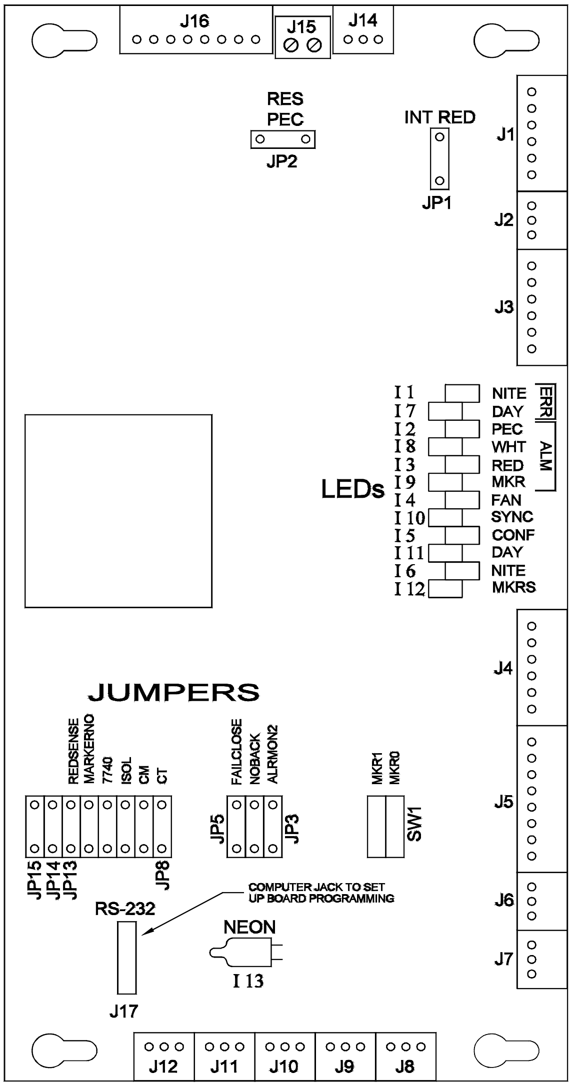
Factory settings must be changed by factory service personnel. Call Customer Service for changing settings not described in this manual.

LED Function Indicators

The 12 red LED function indicators and one clear neon bulb are located on PCB1 as shown in *Figure 1-1* and *Figure 1-2*. The functions associated with these LEDs are described in *Figure 1-1* and *Figure 1-2*.

PCB1 Jumper and Switch Settings

Figure 1-1 and *Figure 1-2* describe the jumpers available on PCB1. *Do not change these jumpers without consulting Flash Technology Customer Service.*



<table>
<tr><th>JUMPER†</th><th>FUNCTION</th></tr>
<tr><td>JP1</td><td>INT RED -- Cut in the 311-3. This jumper is for power converters with internal controllers for external red beacon lamps.</td></tr>
<tr><td>JP2</td><td>RES PEC -- Cut to allow the power converter to use a resistive photocell. Cut in the PC 311-3.</td></tr>
<tr><td>JP3</td><td>ALRMON2 -- Applies to beacon lamps. Cut in the PC 311-3.</td></tr>
<tr><td>JP4</td><td>NOBACK -- Cut to disable white light backup upon the failure of the red night flashhead operation.</td></tr>
<tr><td>JP5</td><td>FAILCLOSE -- Applies to power converters that use external red light controllers. Not cut in the PC 311-3.</td></tr>
<tr><td>SW1-1</td><td>Selects the marker lamp fail threshold. Chart etched on 24740 board shows "ALARM AT" thresholds.
MARKER Parameter in Board Softwere = 4ORLESS
<table>
<tr><th>Bulbs Installed</th><th>SW1-2/MRK1</th><th>SW1-1/MRK0</th><th>Alarm At:</th></tr>
<tr><td>0</td><td>Off</td><td>Off</td><td>No alarms</td></tr>
<tr><td>2</td><td>Off</td><td>On</td><td>One bulb lit</td></tr>
<tr><td>3</td><td>On</td><td>Off</td><td>Two bulbs lit</td></tr>
<tr><td>4</td><td>On</td><td>On</td><td>Three bulbs lit</td></tr>
</table>
MARKER Parameter in Board Software = 5ORMORE
<table>
<tr><th>Bulbs Installed</th><th>SW1-2/MRK1</th><th>SW1-1/MRK0</th><th>Alarm At:</th></tr>
<tr><td>0</td><td>Off</td><td>Off</td><td>No alarms</td></tr>
<tr><td>5</td><td>Off</td><td>On</td><td>Four bulbs lit</td></tr>
<tr><td>6</td><td>On</td><td>Off</td><td>Five bulbs lit</td></tr>
<tr><td>7</td><td>On</td><td>On</td><td>Six bulbs lit</td></tr>
</table></td></tr>
<tr><td>SW1-2</td><td>MRK1 - Selects the marker lamp fail threshold. See the chart above for SW1-1 (MRK0).</td></tr>
<tr><td>JP8</td><td>CT -- Cut to indicate top tier operation for this power converter in a catenary system. If both JP8 and JP9 are cut or both uncut, operation is for the bottom tier. Internal programming must be set to CATENARY or RED CAT for this jumper to be operative.</td></tr>
<tr><td>JP9</td><td>CM -- Cut to indicate middle tier operation for this power converter in a catenary system. If both JP8 and JP9 are cut or both uncut, operation is for the bottom tier. Internal programming must be set to CATENARY or RED CAT for this jumper to be operative.</td></tr>
<tr><td>JP10</td><td>ISOL -- Cut to allow an alarm for only local alarm conditions on this power converter. Not cut to allow an alarm for local alarms and alarms signaled to this power converter through a communications bus wire.</td></tr>
<tr><td>JP11</td><td>RETROFIT -- Cut to allow the 4740 board to emulate other boards on a tower of mixed circuit boards. The parameter RETROFIT TYPE in internal programming on the 4740 must also be set to the board type that the 4740 is to emulate: 7413, 7740-CMOS, or 7740-PLD.</td></tr>
<tr><td>JP12</td><td>MARKERNO -- Uncut to energize the power converter marker relay during the day and de-energize it at night. Cut to de-energize the power converter marker relay in day mode and energize it at night. Uncut to operate markers at night.</td></tr>
<tr><td>JP13</td><td>REDSENSE -- Cut to enable the 4740 board to be used with sense boards. Uncut to allow use with laminated transformers (#8111). This refers to internal design changes. Factory use only.</td></tr>
<tr><td>JP14</td><td>**Unused --** Factory use only.</td></tr>
<tr><td>JP15</td><td>**Unused --** Factory use only.</td></tr>
</table>

† JUMPERS -- OFF=CUT=OPEN

LED Indicator	Function
I 1	NITE ERR -- On for a night intensity error.
I 7	DAY ERR -- On when a day intensity error occurred (the light flashed at an incorrect intensity).
I 2	PEC ALM -- On for photocell alarm (photocell failed to switch state within 19 hours).
I 8	WHT ALM -- On when a white alarm occurs (white light failed).
I 3	RED ALM -- On for a red alarm (a red light failure occurred).
I 9	MRK ALM -- On when a marker alarm occurs (a marker or markers are out).
I 4	FAN -- Not used.
I 10	SYNC -- Flashes when flash control is present on the master/slave interconnect line.
I 5	CONF -- (Confirm) Flashes after the timing and trigger board detects a valid flash.
I 11	DAY -- On when the power converter is in day mode.
I 6	NITE -- On when the power converter is in night mode.
I 12	MKRS -- On when PCB1 is commanding markers to be on.
I 13	TRIGGER POWER NEON -- On when the 120VDC trigger power circuit for the flashhead is active.

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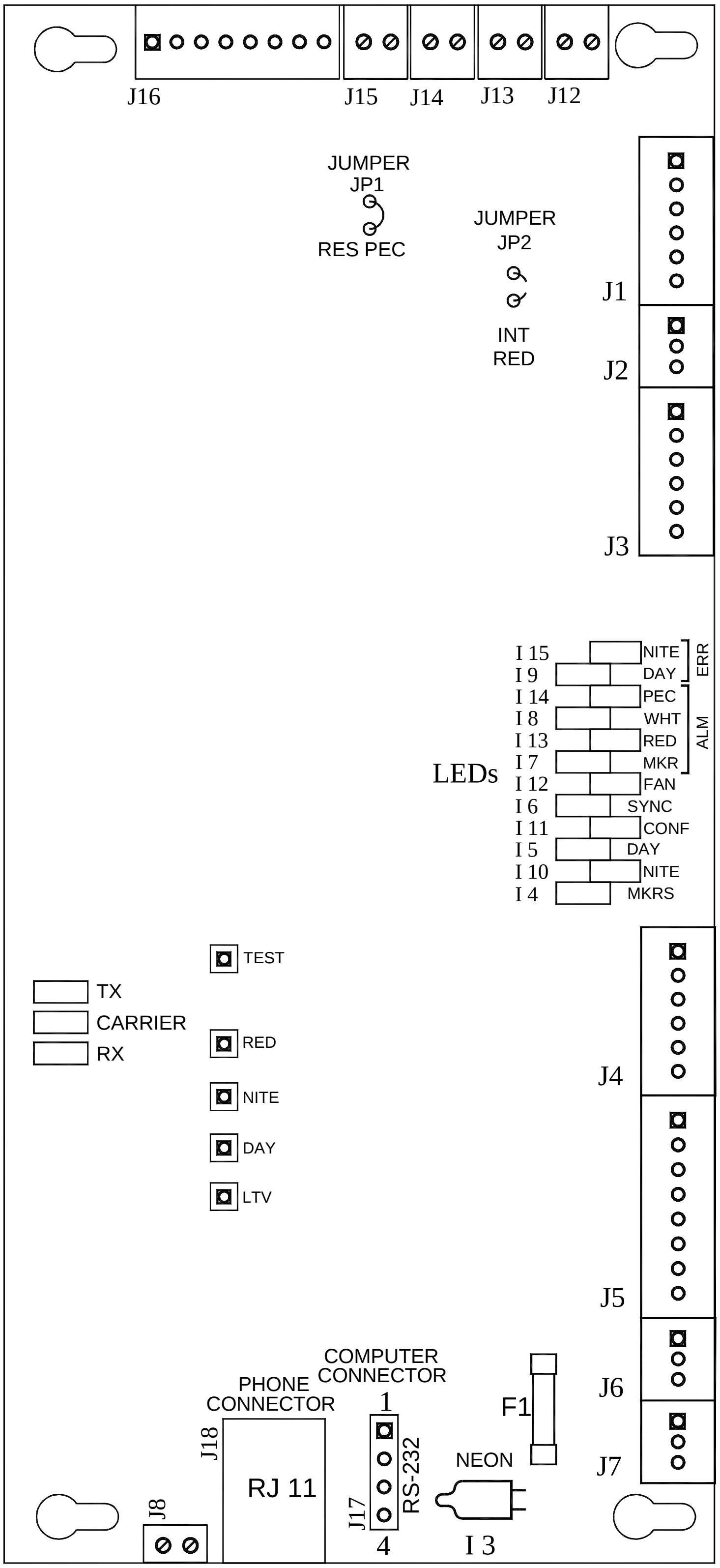
Figure 1-1 Timing and Trigger Board (PCB1) (24740xx)



CONNECTOR	FUNCTION
RS-232	Computer cable connector used to program the circuit board at the factory.
RJ11	Telephone line connector.

JUMPER	FUNCTION
JP1	Cut to use the power converter with a resistive photocell. Cut on the PC 311-3AE.
JP2	INT RED -- Cut to use the internal red controller of the power converter. Cut in the PC 311-3/3A/3AE.

LED/LAMP	FUNCTION
I 15	NITE ERR -- On for night intensity error.
I 9	DAY ERR -- On for day intensity error.
I 14	PEC ALM -- On for PEC alarm.
I 8	WHT ALM -- On for white alarm.
I 13	RED ALM -- On for red alarm.
I 7	MKR ALM -- On for marker alarm.
I 12	FAN -- Not used.
I 6	SYNC -- Flashes when flash control output is on.
I 11	CONF -- (Confirm) Flashes after the PCB1 board detects a valid flash.
I 5	DAY -- On when in day mode.
I 10	NITE -- On when in night mode.
I 4	MKRS -- On when the board is commanding markers to be on.
I 3	NEON -- On when 120VDC from the power transformer is applied to PCB1.
I 2	RD -- Modem is receiving a signal.
I 1	TD -- Modem is transmitting a signal.

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Figure 1-2 Timing and Trigger Board (PCB1) (24747xx)

Fixed Intensities

You may override photocell intensity control. You can do this either for temporary purposes (checkout or testing) or for permanent operations at a fixed flash intensity.

1. Remove any wire from the *master/slave interconnect* terminals.
2. Daytime — Switch the manual intensity override switch on the power converter to day mode.
3. Night — Switch the manual intensity override switch on the power converter to night mode.

If you are merely checking out the operation with the switch, be sure to reconnect the *master/slave interconnect wires* and place all manual intensity override switches back to AUTO. AUTO allows the photocell to control the operating mode.

Operational Checkout

If the system contains more than one light, and the lights are interconnected for master/slave control, perform the actual checkout steps described below only at the master unit. However, observe all lights for responses. These procedures assume that the following conditions are present:

1. Normal outdoor daylight strikes the photocell.
2. All installation steps in *Section 2* have been completed.
3. The PCB1 Timing and Trigger Board is correctly programmed.

Dual System (White Light in Daylight, Red Light at Night)

Check Daytime Operation

1. Apply primary power with the photocell *uncovered* and verify the following responses:
   - a. NITE ERR LED I 1 is off.
   - b. DAY ERR LED I 7 is off.
   - c. PEC ALARM LED I 2 is off.
   - d. WHT ALM I 8 is off.
   - e. RED ALM LED I 3 is off.
   - f. MRK ALM I 9 is off.
   - g. FAN LED I 4 is off.
   - h. SYNC LED I 10 blinks for each sync pulse. This LED may be difficult to see in bright daylight.
   - i. CONF LED I 5 blinks once for each flash. This LED may be difficult to see in bright daylight.
   - j. DAY LED I 11 is on.
   - k. NITE LED I 6 is off.
   - l. MRKS LED I 12 is off.
   - m. TRIG NEON I 13 is on indicating the presence of trigger voltage for the flash tube. This bulb may flicker.
   - n. The associated red incandescent markers are off.
   - o. The white light flashes at daytime intensity (observe flashes directly).

Check Nighttime Operation

2. Cover the photocell so that it is completely dark (it may take several seconds to change state) and verify the following responses:
   - a. NITE ERR LED I 1 is off.
   - b. DAY ERR LED I 7 is off.
   - c. PEC ALARM LED I 2 is off.
   - d. WHT ALM I 8 is off.
   - e. RED ALM LED I 3 is off.
   - f. MRK ALM I 9 is off.
   - g. FAN LED I 4 is off.
   - h. SYNC LED I 10 blinks for each sync pulse. This LED may be difficult to see in bright daylight.
   - i. CONF LED I 5 blinks for each flash. This LED may be difficult to see in bright daylight.
   - j. DAY LED I 11 is off.
   - k. NITE LED I 6 is on.
   - l. MRKS LED I 12 is on.
   - m. TRIG NEON I 13 is on indicating the presence of trigger voltage for the flash tube. This bulb may flicker.
   - n. The associated red markers are on.
   - o. The red beacons flash at night intensity.

Check Back-Up Mode by Simulating a Failure of the Red Light System

3. In this step, you *simulate a failure of the red light system*. You can do this by using the following procedure:
   a. Remove fuse F5 in the power converter for the top light.
   b. Cover the photocell so that it is completely dark (it may take several seconds to change state).
   c. After several seconds in red light night mode, the PC 311-3/3A resumes flashing the white lights (at night intensity).

4. Verify the following:
   a. NITE ERR LED I 1 is lit.
   b. DAY ERR LED I 7 is not lit.
   c. PEC ALARM LED I 2 is not lit.
   d. WHT ALM I 8 is not lit.
   e. RED ALM LED I 3 is lit.
   f. MRK ALM I 9 is not lit.
   g. FAN LED I 4 is not lit. The fan is not used in the PC 311-3/3A.
   h. SYNC LED I 10 blinks for each sync pulse.
   i. CONFIRM LED I 5 blinks for each flash.
   j. DAY LED I 11 is not lit.
   k. NITE LED I 6 is lit.
   l. MARKERS LED I 12 is not lit.
   m. TRIGGER POWER NEON I 13 is on.
   n. The white light flashes at the correct night intensity.

Replace fuse F5.

Check Alarm Sensing

5. Remove primary power and temporarily disconnect the black wire on TB2-4. Apply primary power and verify the following after a few flash cycles:
   a. Select day mode with the manual intensity override switch.
   b. The white light does not flash.
   c. The DAY ERR LED I 7 is lit.
   d. WHT ALM I 8 is lit.

Restore the Equipment After Checking

6. Replace all disconnected wires. Remove the cover that you placed on the photocell. Finally, select **AUTO** on the manual intensity override switch.

If Any Responses are Not Normal

7. If any of the responses above are not *exactly* as described, proceed to *Section Troubleshooting* on Page *3-3*.

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Section 2 — Outline, Mounting, and Installation

Unpacking

Inspect shipping cartons for signs of damage before opening. Check package contents against the packing list and inspect each item for visible damage. Damage claims should be reported promptly to the freight handler.

Tools

The following tools and equipment are recommended for maintenance and service:

- Medium (number 2), flat-blade screwdriver
- Medium (number 2), Phillips screwdriver
- Medium, slip joint pliers
- 8-in. adjustable wrench
- #2 Phillips, 9-inch shank screwdriver
- 5/16-inch flat blade screwdriver
- 7/16-inch combination wrench
- Triplett™ Model 630-NA VOM, or equivalent analog volt-ohm meter, or a digital meter with an averaging function.

Access

WARNING

STOP: Before proceeding, read the warning on Page iii.

Power Converter

Latches secure the cover. When you release these, you can remove the cover for internal access.

Flashhead

Pivot the lens open by disengaging the quick-release latches. Be careful that the rim of the lens clears nearby objects during opening and closing.

Mounting

Power Converter

Mounting and outline dimensions for the power converter are shown in *Figure 2-2*. FTCA does not furnish mounting hardware unless ordered as part of an installation kit. Use the following guidelines for mounting the power converter:

- Ensure that adequate space exists around the equipment for access during installation, maintenance and servicing.
- Allow space for air flow around the power converter.
- You must use a bonding strap on a bolt through the power converter case leg. Connect the strap to the site grounding system.

Flashhead

Mounting and outline dimensions for the flashhead are shown in *Figure 2-3*. The flashhead must be protected from lightning strikes. The flashhead may be mounted to painted or unpainted surfaces. One of the mounting holes in the base of the flashhead contains a built-in electrical ground connection. Use the following guidelines for mounting the flashhead:

- Use a lightning rod extended above the flashhead to protect it when it is mounted at the uppermost part of the structure.
- Avoid locating a lightning rod where it would prevent tilting the lens open or interfere with access by maintenance or service personnel.
- You must use a bonding strap with a flashhead mounting bolt when mounting the flashhead to the structure, using the mounting bolt to fasten the strap to the leg that contains the ground connection.

Flashhead Leveling

The flashheads must be level for correct vertical beam alignment. Two leveling vials—aligned with the mounting feet—are permanently attached to the flashhead assembly. Typically, the mounting surface for the flashhead is level and no adjustments are required. When the flashhead is level, bubbles in both leveling vials are centered. For leveling, use the following guidelines:

- If adjustment is necessary, raise the appropriate mounting foot with shims or washers. Raising one foot by 1/16 inch (1.6 mm) tilts the beam about 1/2 degree.
- Take extreme care to ensure that all four feet rest snugly against a firm mounting surface before tightening the mounting bolts. Failure to do so could result in serious damage to the base when you tighten the bolts.

Photocell

Mounting and outline dimensions for the photocell are shown in *Figure 2-4*. The photocell uses a male 1/2" NPT for mounting. Use the following guidelines to mount the photocell:

- Locate the photocell where it is level and has an unobstructed view of the polar sky.
- Position it so that it does not view direct or reflected artificial light.
- Allow it to be supported directly by conduit if needed.
- *Ensure that the installation is watertight.*

Installation

This manual may not contain all the information about installation wiring required for your installation.

NOTE

If installation drawings prepared specifically for your site disagree with information provided in this manual, the installation drawings should take precedence. *Consult any installation drawings prepared especially for your site or supplied with the equipment.*

Note: FTCA wiring diagrams define only minimum requirements recommended for satisfactory equipment operation. ***It is the responsibility of the installer to comply with all applicable electrical codes.***

You can find conduit and other distribution wiring details on electrical installation diagrams provided by FTCA or others. Installation instructions concerning red light marker fixtures are not part of this manual.

All installation wiring should have an insulation rating of 600 volts. Size power service wiring to satisfy the load demand of the red light system (if present) and the power converters. Read the notes on the installation wiring diagrams supplied both in this manual and with the equipment. See *Figure 2-10* for information about wiring alarm connections to the main panel of the power converter.

FAA Advisory Circular 70/7460-1H gives lighting requirements for various types of structures.

Wiring

Power Converter

Consult the installation drawings. For service wiring of the power converters and flashheads only, consider the voltage, length of the wire run, and the total load (number of lights). Assume a load of 175 volt-amperes per power converter, and do not permit the line voltage to drop by more than 5% due to wire resistance. Also assume a load of 175 volt-amperes per light to determine the appropriate *slow-acting* fuse ratings at the power distribution panel. Use a value of 250 volt-amperes per light to determine *fast-acting* fuse ratings at the power distribution panel and to select a system feeder transformer (if used).

In multiple-unit systems, the master unit and slave units communicate over the “master/slave” interconnect wiring. Twist the wires together at the rate of 12 twists per foot. The recommended minimum size for control and signal conductors is #16 AWG.

You must also consider the additional power requirements for the red lights, which are as follows:

- Each beacon draws approximately 10 amperes
- Each marker draws approximately 1 ampere

Flashhead

The power converter and flashhead are interconnected by the flashhead cable. When FTCA Part Number 6340, or equivalent cable, is used the two may be separated by a distance of up to 600 feet. Consult the factory when a greater separation is necessary.

The cable between the power converter and flashhead requires five conductors with 600 volts (minimum) insulation. Two of the conductors must be #10 AWG. The other three may be #16 AWG (minimum; for mechanical strength) if you are cabling together individual wires.

To ensure long-term equipment reliability, we recommend continuous wiring between the power converter and flashhead without intervening junctions or splices.

Securing the Flashhead Cable

FTCA recommends the following procedure for securing the flashhead cable to a skeletal structure:

1. Run the cable along one of the tower legs and wrap one full turn of two-inch Scotchwrap™ #50 tape, or the equivalent, around the cable and tower leg at regular intervals of about 5 feet (1.5 meters).
2. Wrap three full turns of one-inch Scotchwrap Filament #890 tape, or the equivalent, over the Scotchwrap #50 tape.
3. Wrap four full turns of two-inch Scotchwrap #50 tape, or the equivalent, over the Scotchwrap Filament #890 tape.
4. Perform steps 1 through 4 also directly above and below any tower leg flanges that the cable may cross.

Photocell

The photocell is supplied with pigtails for connection to wires that connect to the power converter. It is connected to the main panel of the power converter at TB1-1 and TB1-2. It may be located any practical distance from the power converter. The recommended minimum wire gauge is #16 AWG.

A jumper should be installed between terminals TB1-1 and TB1-2 on the *slave* power converters.

Installation Checklist

Complete the following steps before applying power:

1. Equipment Damage:
   Inspect all equipment for damage.
2. Required Equipment:
   Verify the received equipment against the packing list to ensure completeness.
3. Power Converter Mounting:
   Position and mount each unit allowing adequate clearance for opening the covers. Use the following checks:
   - Ensure that the case is mounted upright, watertight, and grounded with a bonding strap from the case leg to the site grounding system.
   - Check hardware to ensure that all mounting hardware is tight.
   - Ensure that only the bottom of the case has drain holes and that they are clear.
   - Ensure that no holes are punched or drilled on the top surface of the case.
   - Ensure that air can flow around the case.
   - Mount the power converter away from radio frequency interference (RFI).

4. Power Converter Wiring:
   Examine the installation drawings and use the following checks:
   - Check for proper incoming service voltage.
   - Wire each unit according to the instructions.
   - Ensure that all three power converters are on the same main line breaker.
   - Check all electrical connections for tightness.
   - Check all terminal strip connections for tightness.
   - Ground the power converter using a bonding strap from the case leg to the site grounding system.
5. Flashhead Mounting:
   - Ensure that the flashhead lens can be opened without striking other objects.
   - Level and aim the flashhead.
6. Flashhead Wiring:
   - Protect the top flashhead against lightning strikes.
   - Ground the flashhead leg with the ground connection by using a bonding strap to the tower.
   - Check the wiring of the flashhead cable to the flashhead.
   - Secure the flashhead cable to the tower. Support and tape the cable to prevent its movement by the wind.
7. Alarm Wiring:
   - If external alarm detection circuit responds to *closed* contacts, ensure that they are wired to the contacts on TB1-1 that *close* on alarm.
   - If external alarm detection circuit responds to *open* contacts, ensure that they are wired to the contacts on TB1 that *open* on alarm.
   - Note that *optional* contacts on TB1 open on error. These contacts are closed for normal operating conditions.
   - Protect alarm wiring by using shielded wires, grounding the shield, and placing wires in a conduit. See *Figure 2-10*.
8. Photocell Mounting:
   - Locate photocell where it views unobstructed polar sky with no direct or reflected artificial lighting striking it.
   - Mount the photocell vertically on the top end of a vertical length of conduit to prevent water from entering the unit.
9. Photocell Wiring
   - Connect the photocell to the PC 311-3 master Power Converter: the black wire to TB1-1 and the white wire to TB1-2.
   - Ground the wire shield around the photocell wires, if one is present. Do not ground the shield to the photocell, but ground it at the power converter.
   - After running the photocell wires, check for continuity and shorts.
   - Ensure that the terminal block TB1 on the slave power converters has a jumper between TB1-1 and TB1-2.

After completing all the steps listed above, turn on the power and perform an operational checkout from procedures in *Section 1* of this manual.

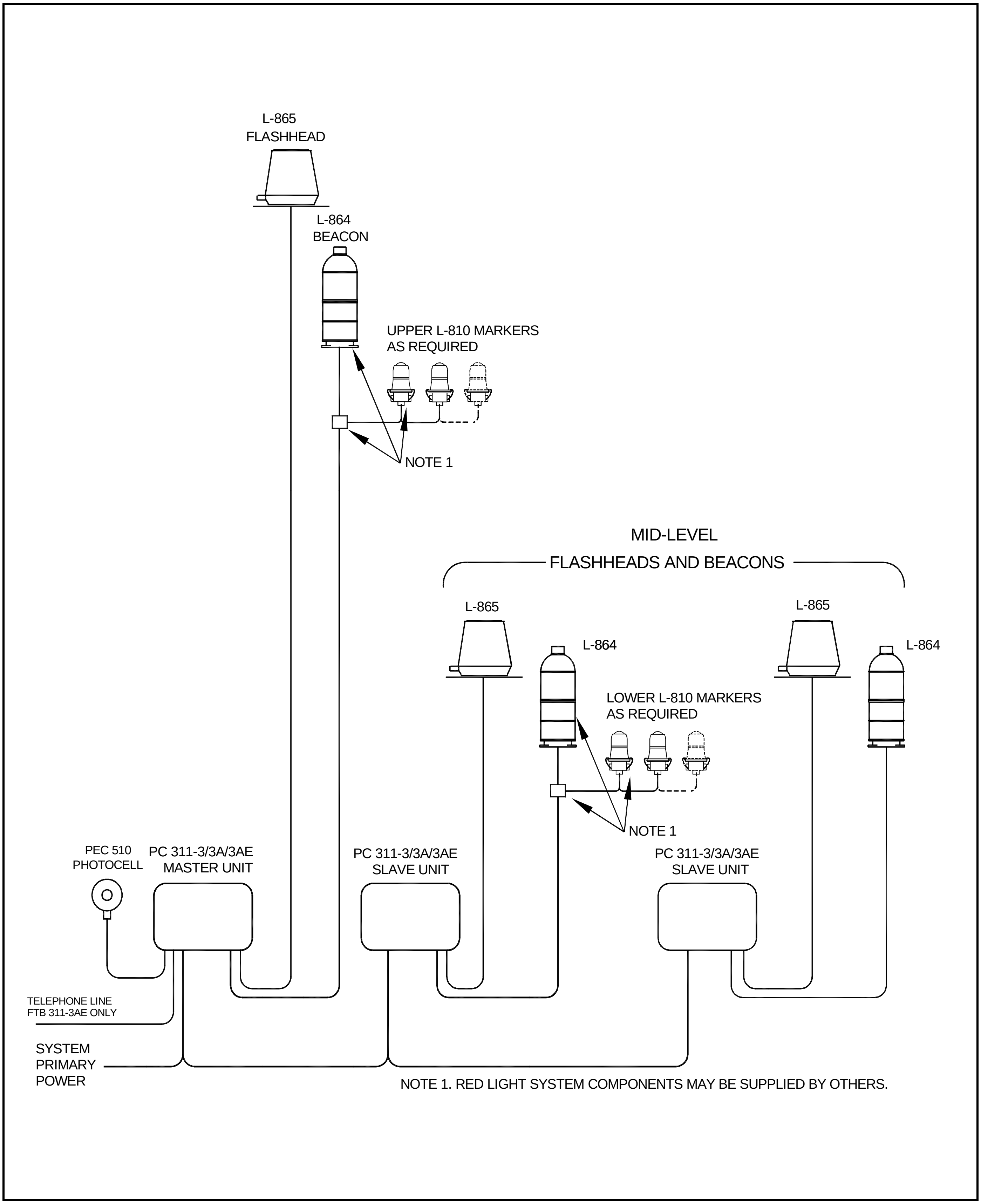
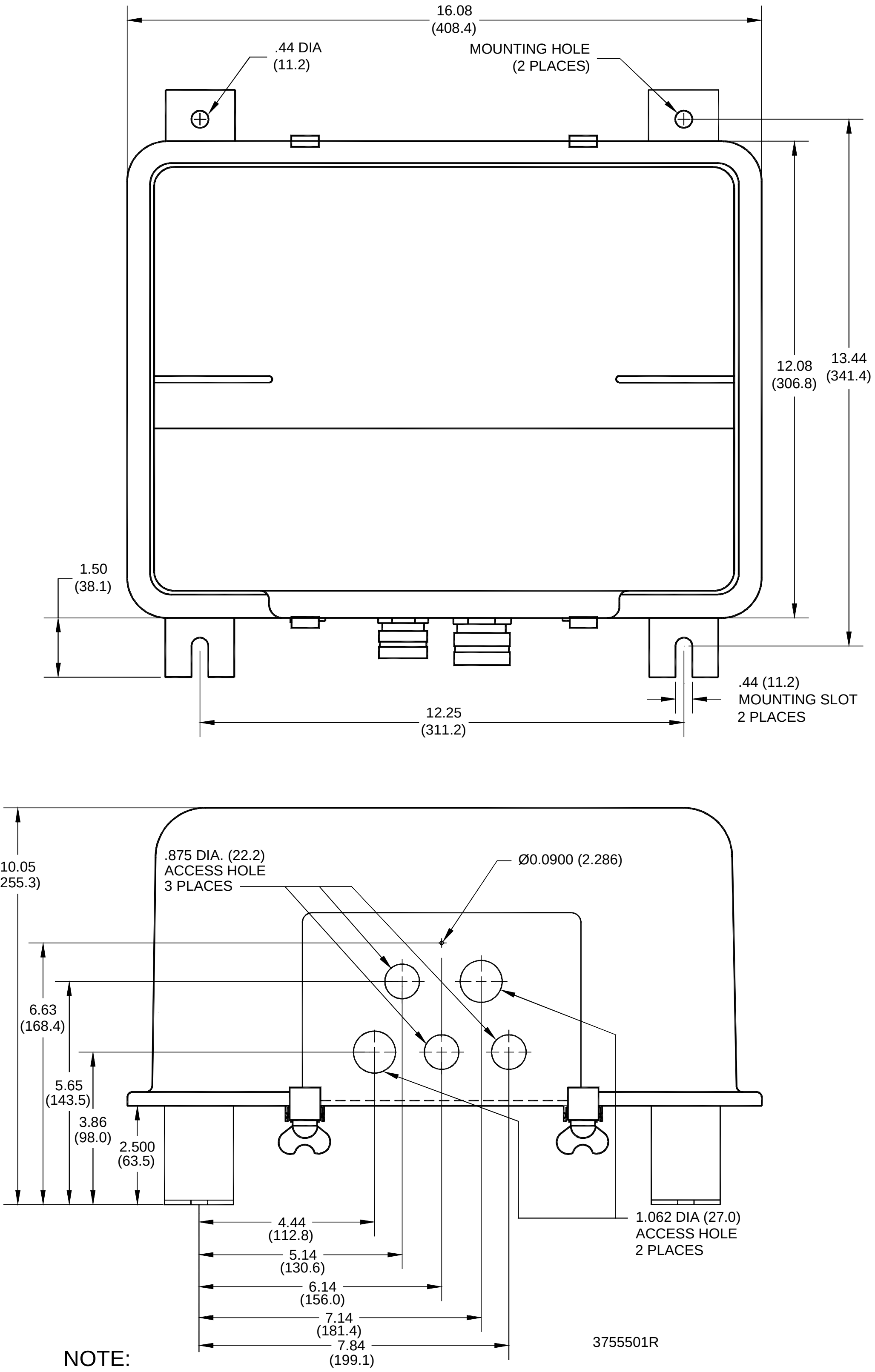


Figure 2-1 Multiple Unit Dual System Installation Guideline

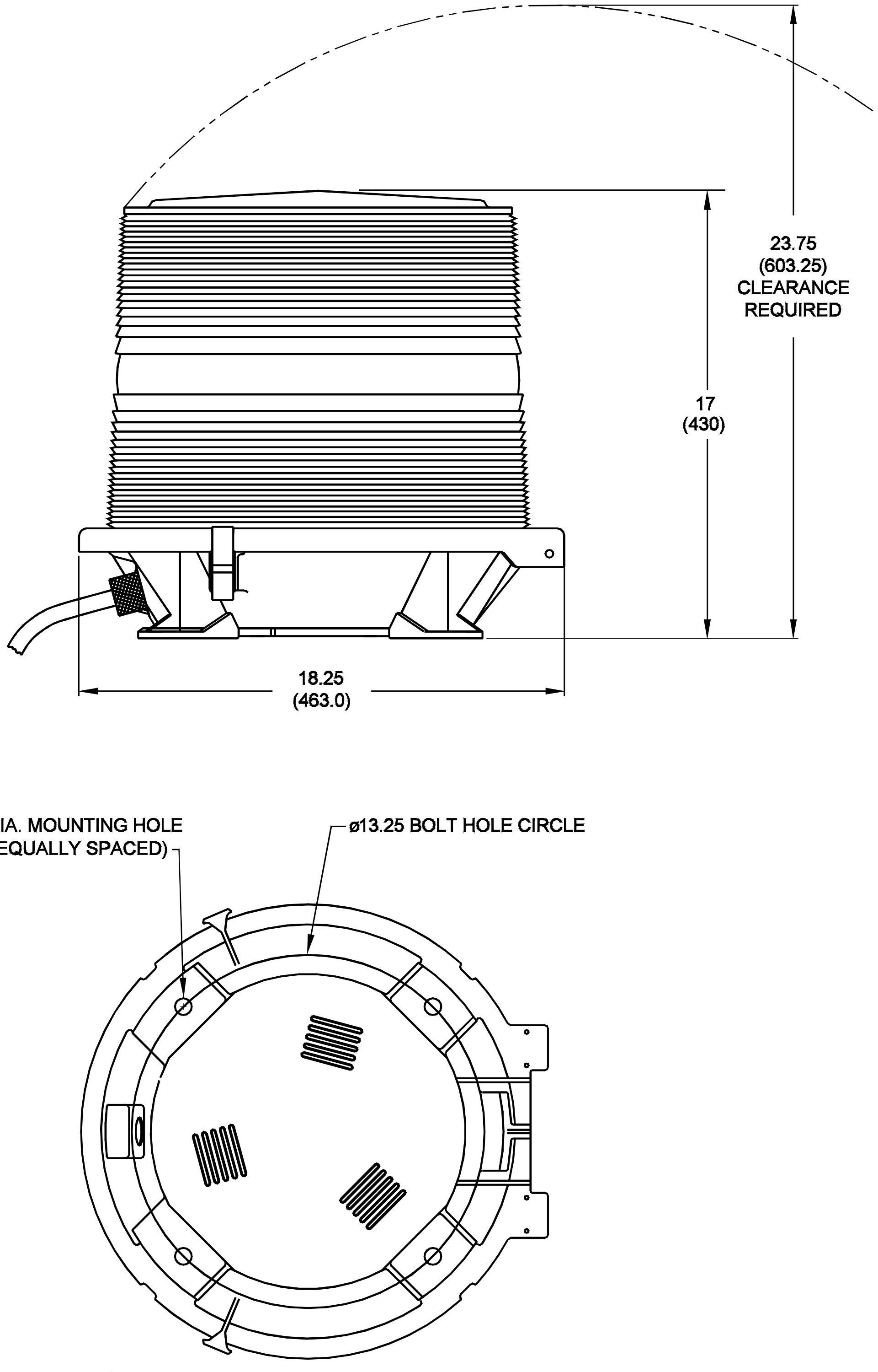


NOTE:

1. DIMENSIONS ARE IN INCHES (MILLIMETERS)

31130023

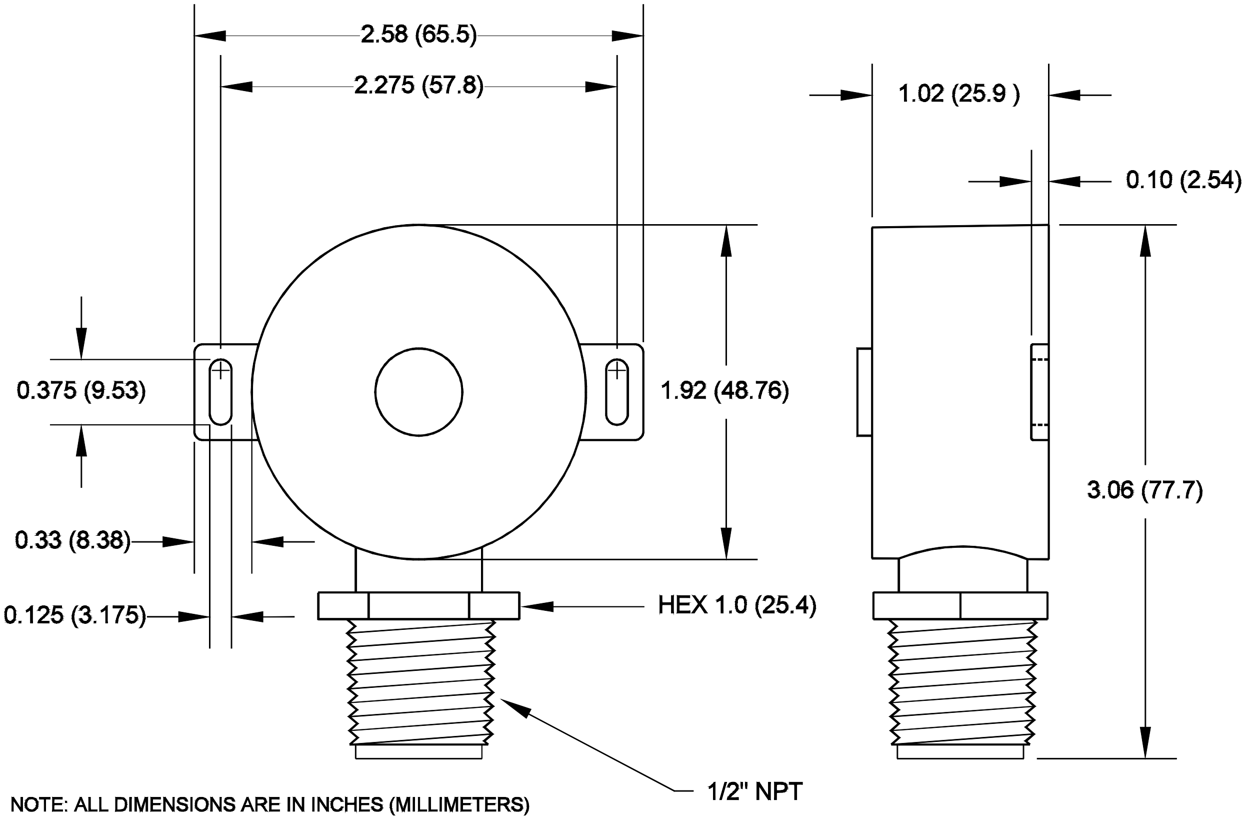
Figure 2-2 Power Converter Mounting and Outline



NOTES:
1. WEIGHT: 17 LBS (7.7 KG)
2. AERODYNAMIC WIND AREA: .93 FT^2(.0864 M^2)
3. DIMENSIONS ARE IN INCHES (MILLIMETERS)
4. ACCESS TO THE FLASHHEAD MUST REMAIN UNOBSTRUCTED
5. FLASHHEAD SHOULD HAVE LIGHTNING PROTECTION

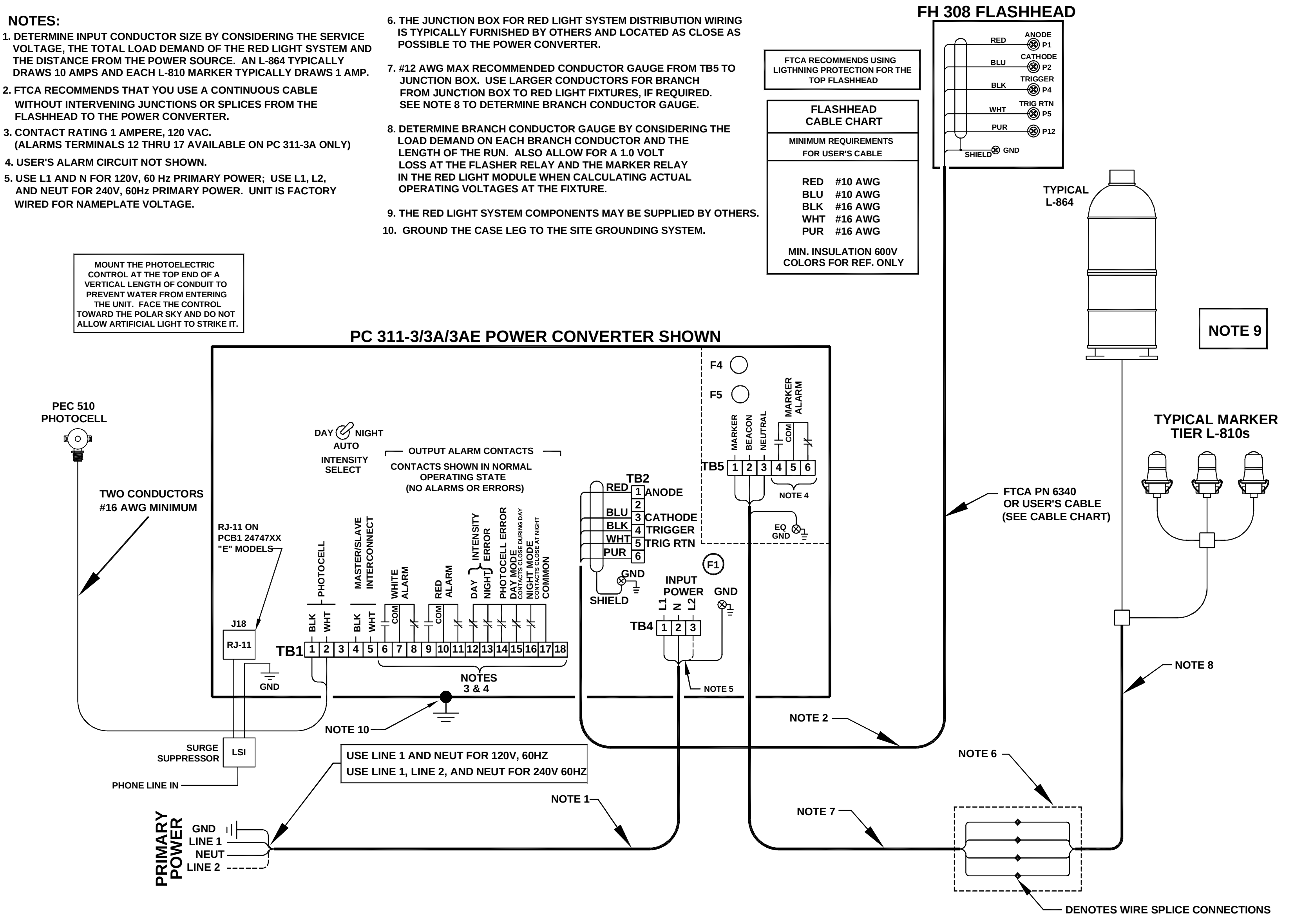
31130024

Figure 2-3 Flashhead Mounting and Outline



31130025

Figure 2-4 Photocell Mounting and Outline



NOTES:

1. DETERMINE INPUT CONDUCTOR SIZE BY CONSIDERING THE SERVICE VOLTAGE, THE TOTAL LOAD DEMAND OF THE RED LIGHT SYSTEM AND THE DISTANCE FROM THE POWER SOURCE. AN L-864 TYPICALLY DRAWS 10 AMPS AND EACH L-810 MARKER TYPICALLY DRAWS 1 AMP.
2. FTCA RECOMMENDS THAT YOU USE A CONTINUOUS CABLE WITHOUT INTERVENING JUNCTIONS OR SPLICES FROM THE FLASHHEAD TO THE POWER CONVERTER.
3. CONTACT RATING 1 AMPERE, 120 VAC. (ALARMS TERMINALS 12 THRU 17 AVAILABLE ON PC 311-3A ONLY)
4. USER'S ALARM CIRCUIT NOT SHOWN.
5. USE L1 AND N FOR 120V, 60 Hz PRIMARY POWER; USE L1, L2, AND NEUT FOR 240V, 60Hz PRIMARY POWER. UNIT IS FACTORY WIRED FOR NAMEPLATE VOLTAGE.
6. THE JUNCTION BOX FOR RED LIGHT SYSTEM DISTRIBUTION WIRING IS TYPICALLY FURNISHED BY OTHERS AND LOCATED AS CLOSE AS POSSIBLE TO THE POWER CONVERTER.
7. #12 AWG MAX RECOMMENDED CONDUCTOR GAUGE FROM TB5 TO JUNCTION BOX. USE LARGER CONDUCTORS FOR BRANCH FROM JUNCTION BOX TO RED LIGHT FIXTURES, IF REQUIRED. SEE NOTE 8 TO DETERMINE BRANCH CONDUCTOR GAUGE.
8. DETERMINE BRANCH CONDUCTOR GAUGE BY CONSIDERING THE LOAD DEMAND ON EACH BRANCH CONDUCTOR AND THE LENGTH OF THE RUN. ALSO ALLOW FOR A 1.0 VOLT LOSS AT THE FLASHER RELAY AND THE MARKER RELAY IN THE RED LIGHT MODULE WHEN CALCULATING ACTUAL OPERATING VOLTAGES AT THE FIXTURE.
9. THE RED LIGHT SYSTEM COMPONENTS MAY BE SUPPLIED BY OTHERS.
10. GROUND THE CASE LEG TO THE SITE GROUNDING SYSTEM.

FTCA RECOMMENDS USING LIGTHNING PROTECTION FOR THE TOP FLASHHEAD

FLASHHEAD CABLE CHART

MINIMUM REQUIREMENTS FOR USER'S CABLE

RED	#10 AWG
BLU	#10 AWG
BLK	#16 AWG
WHT	#16 AWG
PUR	#16 AWG

MIN. INSULATION 600V
COLORS FOR REF. ONLY

MOUNT THE PHOTOELECTRIC CONTROL AT THE TOP END OF A VERTICAL LENGTH OF CONDUIT TO PREVENT WATER FROM ENTERING THE UNIT. FACE THE CONTROL TOWARD THE POLAR SKY AND DO NOT ALLOW ARTIFICIAL LIGHT TO STRIKE IT.

USE LINE 1 AND NEUT FOR 120V, 60HZ
USE LINE 1, LINE 2, AND NEUT FOR 240V 60HZ

Figure 2-5 Stand-Alone Installation Wiring

NOTES:

1. DETERMINE INPUT CONDUCTOR SIZE BY CONSIDERING THE SERVICE VOLTAGE, THE TOTAL LOAD DEMAND OF THE RED LIGHT SYSTEM AND THE DISTANCE FROM THE POWER SOURCE. AN L-864 TYPICALLY DRAWS 10 AMPS AND EACH L-810 MARKER DRAWS 10 AMPS AND EACH L-810 MARKER TYPICALLY DRAWS 1 AMP.
2. FTCA RECOMMENDS THAT YOU USE A CONTINUOUS CABLE WITHOUT INTERVENING JUNCTIONS OR SPLICES FROM THE FLASHHEAD TO THE POWER CONVERTER.
3. CONTACT RATING 1 AMPERE, 120 VAC. (TB1-12 TO -17 ARE ALARMS AVAILABLE ON THE PC 311-3A ONLY.)
4. USER'S ALARM CIRCUIT NOT SHOWN.
5. USE L1 AND N FOR 120V, 60 Hz PRIMARY POWER; USE L1, L2, AND NEUT FOR 240V, 60 Hz. UNIT IS FACTORY WIRED FOR NAMEPLATE VOLTAGE.
6. THE JUNCTION BOX FOR RED LIGHT SYSTEM DISTRIBUTION WIRING IS TYPICALLY FURNISHED BY OTHERS AND LOCATED AS CLOSE AS POSSIBLE TO THE POWER CONVERTER.
7. #12 AWG MAX RECOMMENDED CONDUCTOR GAUGE FROM TB5 TO THE JUNCTION BOX. USE LARGER CONDUCTORS FOR BRANCH FROM THE JUNCTION BOX TO RED LIGHT FIXTURES, IF REQUIRED. SEE NOTE 8 TO DETERMINE BRANCH CONDUCTOR GAUGE.
8. DETERMINE BRANCH CONDUCTOR GAUGE BY CONSIDERING THE LOAD DEMAND ON EACH BRANCH CONDUCTOR AND THE LENGTH OF THE RUN.
9. RED LIGHT SYSTEM COMPONENTS MAY BE SUPPLIED BY OTHERS.
10. TB4 SUITABLE FOR UP TO TWO #10 AWG CONDUCTORS PER POSITION. USE A JUNCTION BOX IF LARGER CONDUCTORS ARE NEEDED AND RUN SMALLER GAUGE WIRE FROM THE JUNCTION BOX TO TB4 IN EACH POWER CONVERTER.
11. GROUND THE CASE LEG TO THE SITE GROUDNING SYSTEM.

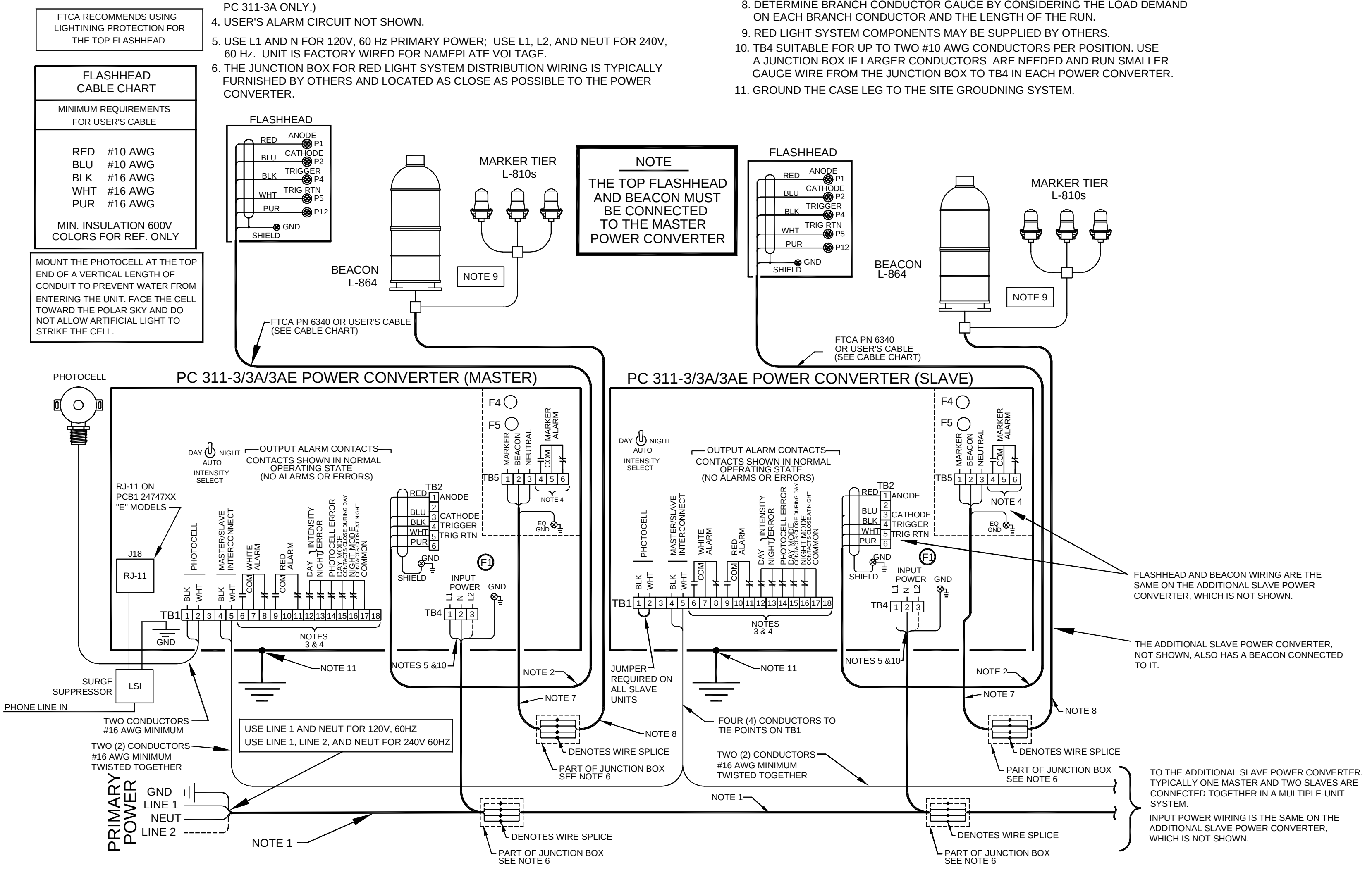


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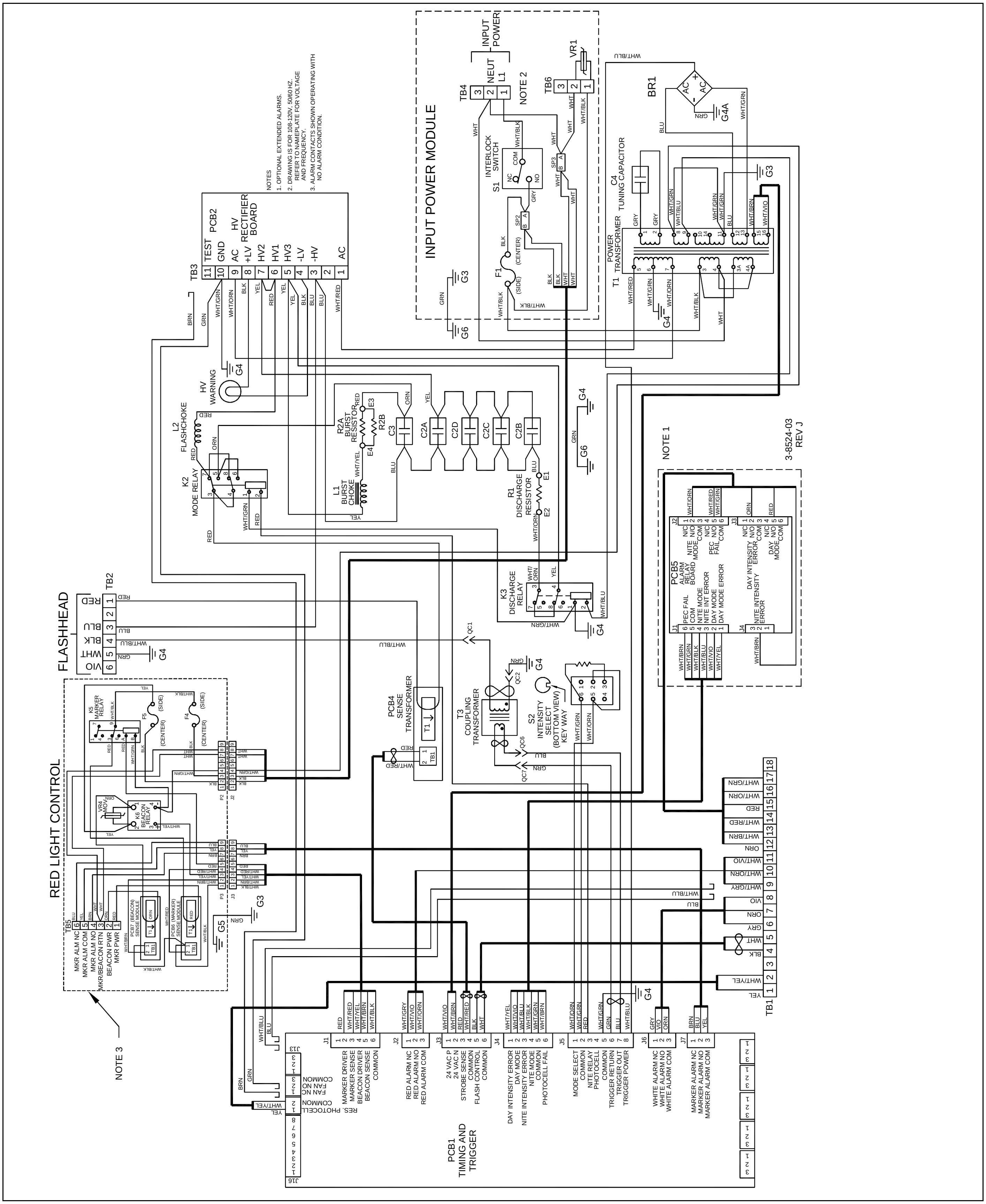
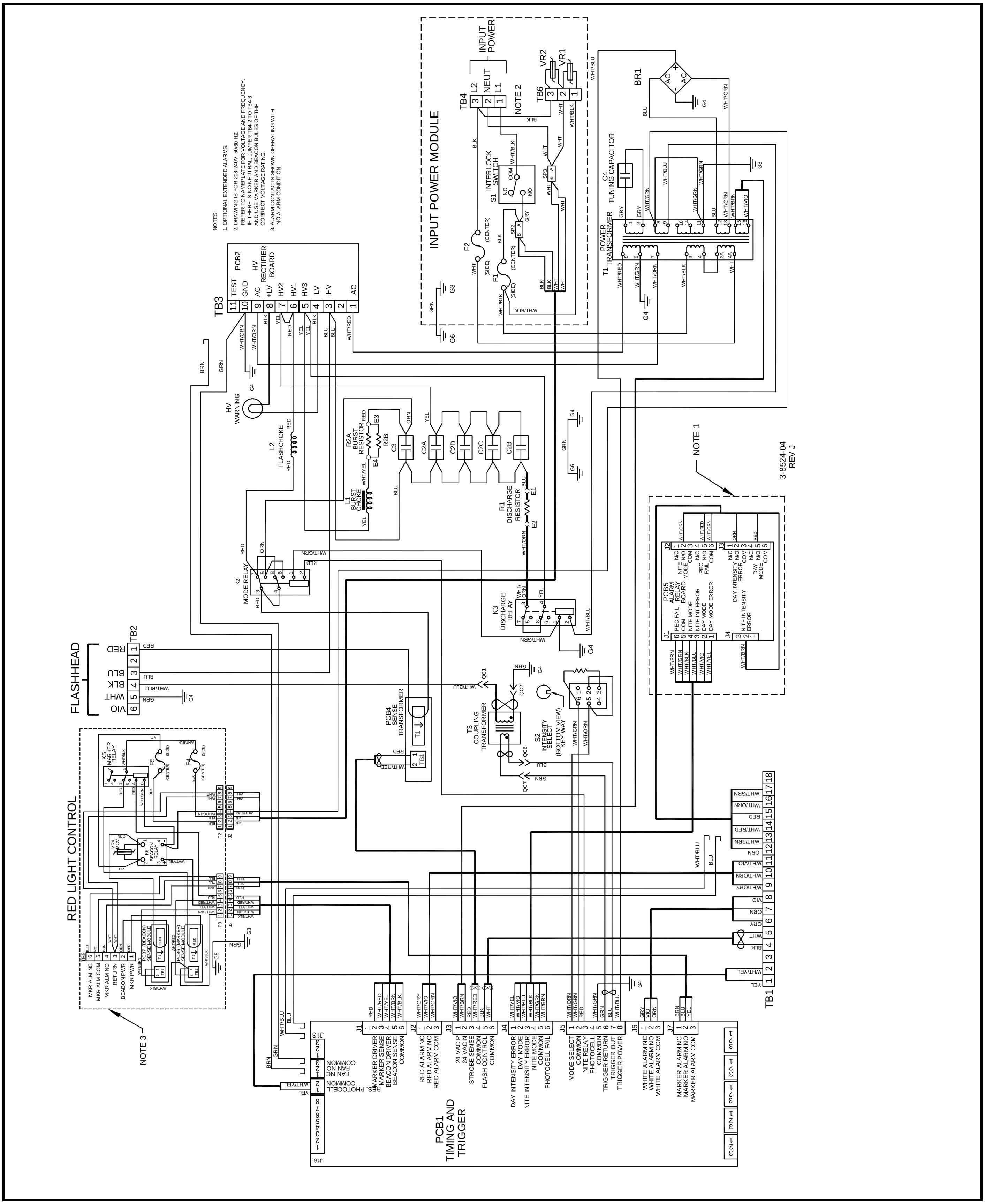
Figure 2-6 Multiple-Light Installation Wiring



311-3INTWR

Figure 2-7 FTB 311-3/3A Power Converter Internal Wiring

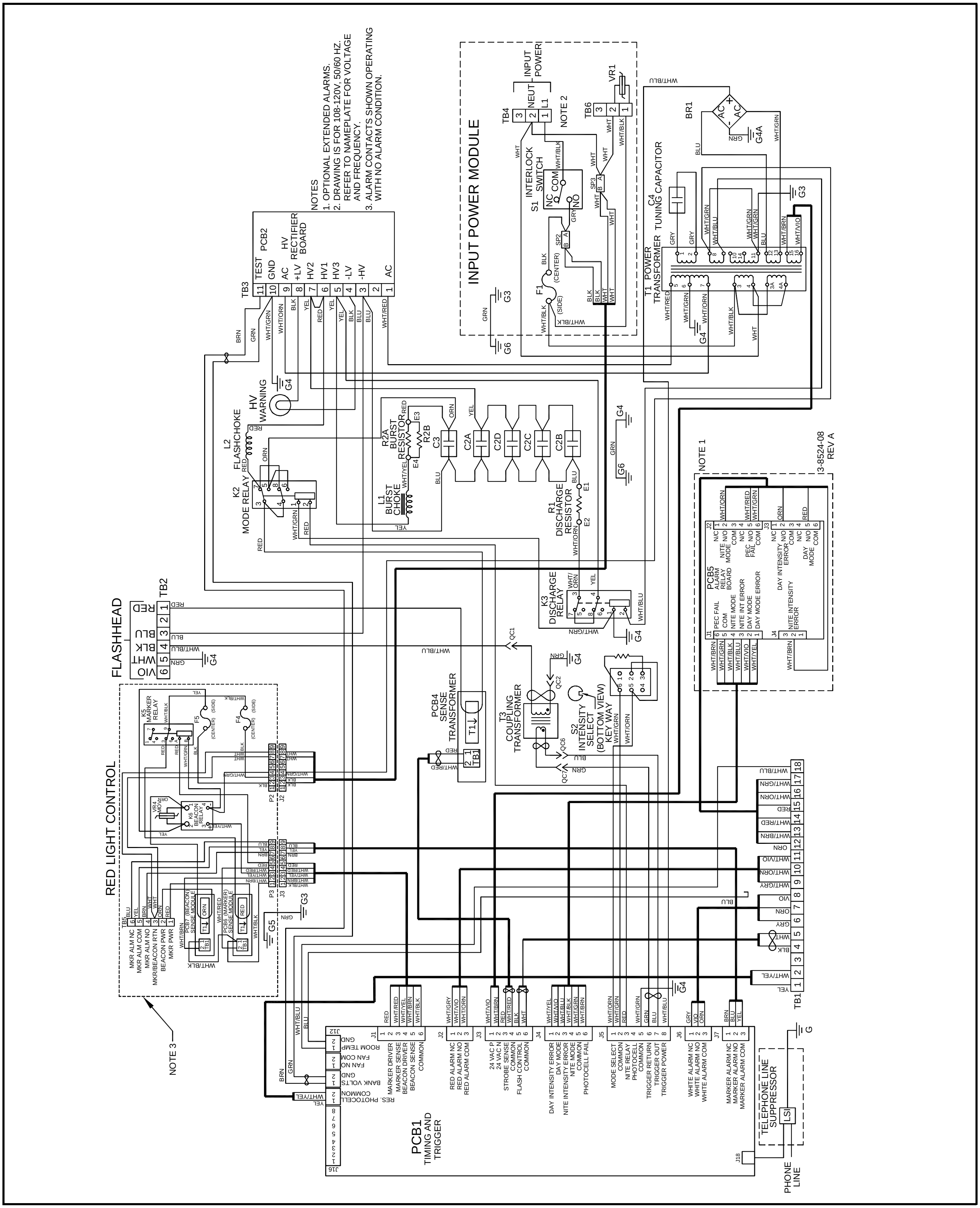


NOTES:

1. OPTIONAL EXTENDED ALARMS.
2. DRAWING IS FOR 208-240V, 50/60 HZ. REFER TO NAMEPLATE FOR VOLTAGE AND FREQUENCY. IF THERE IS NO NEUTRAL, JUMPER TB4-2 TO TB4-3 AND USE MARKER AND BEACON BULBS OF THE CORRECT VOLTAGE RATING.
3. ALARM CONTACTS SHOWN OPERATING WITH NO ALARM CONDITION.

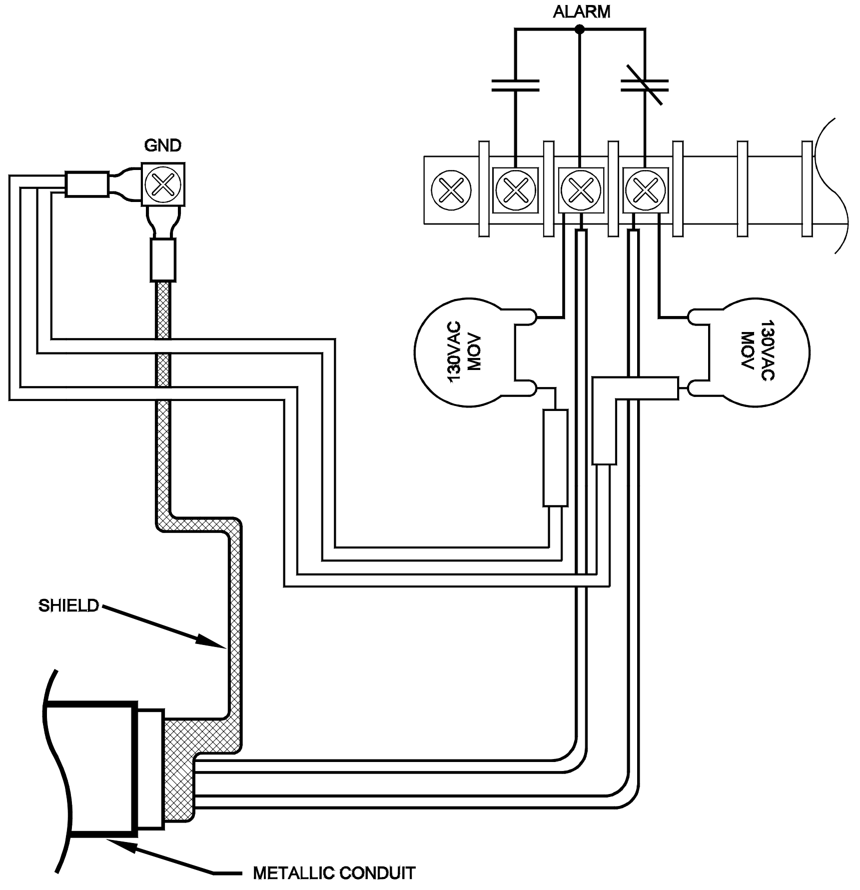
311-3 208-240 VAC 50-60 HZ

Figure 2-8 FTB 311-3 208-240 VAC 50/60 HZ Power Converter Internal Wiring



311-3AEINTWR

Figure 2-9 FTB 311-3AE Power Converter Internal Wiring



CUSTOMER CONNECTION TO ALARM RELAY CONTACTS

FLASH TECHNOLOGY ALARM RELAY CONTACTS ARE PROTECTED FROM VOLTAGE TRANSIENTS OF UP TO 1000 VOLTS. HOWEVER, WIRED ALARM CONTACTS CAN BE SUBJECTED TO VOLTAGES GREATER THAN 1000 VOLTS BECAUSE OF LIGHTNING. THE FOLLOWING RECOMMENDATIONS MINIMIZE THE POSSIBILITY OF DAMAGE CAUSED BY HIGH VOLTAGE TRANSIENTS ON THE ALARM RELAY CONTACTS OF FLASH TECHNOLOGY POWER CONVERTERS.

THE INSTALLER IS RESPONSIBLE FOR COMPLYING WITH ALL APPLICABLE ELECTRICAL CODES.

NOTES:

1. USE SHIELDED CABLE TO ATTACH FLASH TECHNOLOGY ALARM RELAY CONTACTS TO EXTERNAL EQUIPMENT.
2. ATTACH THE SHIELD WIRE TO A GND (GROUND) TERMINAL ON THE FLASH TECHNOLOGY POWER CONVERTER AS SHOWN.
3. WHEN POSSIBLE, ROUTE ALARM CONTACT WIRING IN METALLIC, GROUNDED CONDUIT.
4. FOR ADDITIONAL PROTECTION, ADD MOVs (VARISTORS) FROM EACH ALARM RELAY CONTACT TERMINAL TO A GND TERMINAL AT THE FLASH TECHNOLOGY POWER CONVERTER.

ALRMWRNG

Figure 2-10 Recommended Alarm Wiring

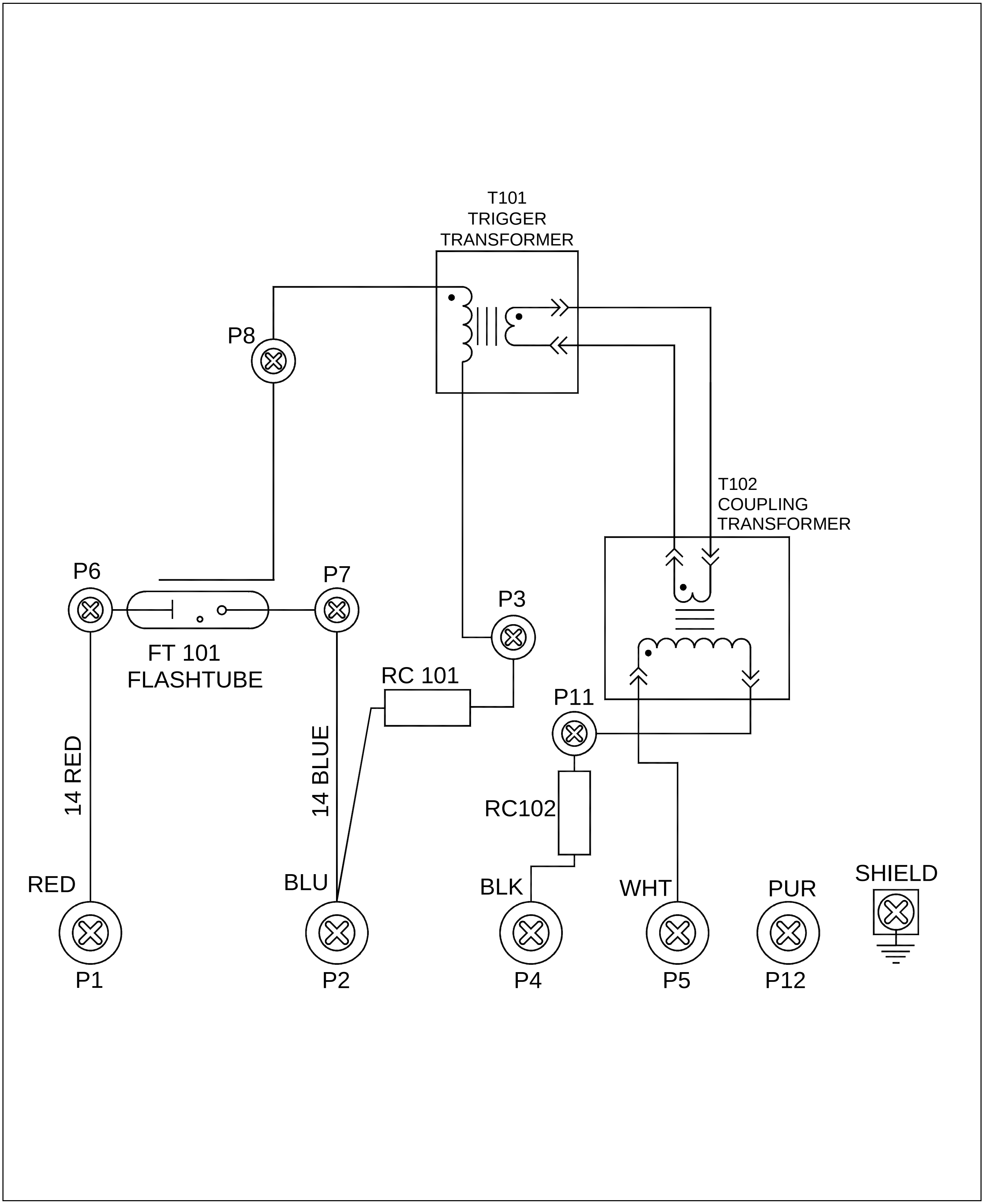


Figure 2-11 Flashhead Internal Wiring

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Section 3 — Maintenance and Troubleshooting

Safety

WARNING

STOP: Before proceeding—read the warning on Page iii.

Preventive Maintenance

Carry out the following inspection and cleaning procedures at least once a year:

1. Verify that moisture has not accidentally entered the equipment through gaskets or seals, or collected as condensation.
2. Verify that all drain holes are clear.
3. Check terminal blocks and relays for evidence of corrosion and electrical arcing. Clean or replace any component that shows evidence of high-voltage damage.
4. Check flashtube connections for signs of pitting or arcing. Verify that anode and cathode connections are firmly tightened.
5. Check all electrical connections for tightness and verify the absence of corrosion or electrical arcing.
6. Clean the outside surface of the lens with liquid detergent and water. Wipe it gently with only a soft cloth.
7. Clean the inside surface of the lens with an FTCA-approved professional plastic cleaner. Wipe the lens with cheesecloth only. *Do not use regular cloth or paper towels.* A lens cleaning kit, Part Number 8630801, is available from FTCA. Call Customer Service at 1-800-821-5825.

Storage

Long-term storage of the equipment requires no special considerations. Circuit boards, when not installed in the equipment, should be kept in anti-static bags or containers.

Diagnostic Testing

The only effective way to check out lights connected in a master/slave configuration is to disconnect the *black master/slave interconnect* wire and check them as stand-alone units, as described in *Section Stand-Alone.*

Control Signal Evaluation

Refer to *Figure 2-6 Multiple-Light Installation Wiring*. For each power converter, a master/slave interconnect line and its return line are connected to TB1-4 and TB1-5 respectively. All units place a pulse on the line, which causes the power converters to flash all the lights at the same time. This pulse is the synchronization pulse. The PCB1 Timing and Trigger Board in each power converter generates a sync pulse. The first sync pulse to be placed on the line forces the remaining units to synchronize to that pulse and flash their lights simultaneously.

In the event of a top red light failure at night, the master power converter turns on all connected units to flash at the correct backup night intensity.

The sync signal is a pulse and difficult to evaluate with a meter. You can detect the sync pulse as an instantaneous movement of the meter indicator. A digital meter with a max-min function may capture part of the pulse. This is generally a sufficient indication of a pulse being present. (A 24V pulse of 16 ms. width might read 12V on a 100 ms. capture time of a max-min function.)

RFI Problems

Presence of radio frequency interference (RFI) can cause a light to flash intermittently, at the wrong rate, or at the wrong intensity. RFI can enter the light by way of *any* wire to or from the unit. The circuits reject or bypass RFI, but FTCA cannot guarantee complete immunity beforehand. After installation, you may find it necessary to add external filters or use other methods to reduce RFI that may be entering the equipment.

Stand-Alone

A stand-alone unit operates independently of other white lights, although it may be part of a dual system. Intensity stepping is controlled by the photocell connected to the master unit. Intensity signals are sent from the master unit to the slave units over the *master/slave* interconnect line (sync line).

Figure 1-1 gives the locations of the indicator lamps on the board, while *Figure 4-1* shows the location of the board within the power converter.

For either master or slave units, use the following procedures for testing the power converter:

1. Verify Daytime Operation:
   a. Disconnect the master/slave interconnect wires at TB1-4 and TB1-5.
   b. Switch the manual intensity override switch to DAY, apply power, and verify that responses are as described in *Section Check Daytime Operation* in *Section 1*.
   c. Reconnect the master/slave interconnect wires at TB1-4 and TB1-5.
2. If Any Responses are Not Normal for Procedure 1:
   a. If Step o is correct, and Steps a, b, d, e, f, k, or i are incorrect, replace the circuit board PCB1.
   b. If d indicates an alarm (LED on), determine if the light is actually flashing at high intensity (Step o). If it is not, proceed to the troubleshooting table. If it is, change the circuit board.
   c. If c, j, and k are incorrect, place the manual intensity override switch to NITE and check j and k again. If these are now okay, test or replace the photocell. If j and k are still incorrect, change the circuit board.
   d. If h is incorrect and i is correct, change the circuit board.
3. Verify Nighttime Operation:
   a. Disconnect the master/slave interconnect wires at TB1-4 and TB1-5.
   b. Switch the manual intensity override switch to NIGHT, apply power, and verify that responses are as described in *Section Check Nighttime Operation* in *Section 1*.
   c. Reconnect the master/slave interconnect wires at TB1-4 and TB1-5.
4. If Any Responses are Not Normal for Procedure 3:
   a. If Step o is correct, and Steps a, b, d, e, f, k, or i are incorrect, replace the circuit board PCB1.
   b. If e indicates an alarm (LED on), determine if the beacon is actually flashing (Step o). If it is not, proceed to the troubleshooting table. If it is, change the circuit board.
   c. If c, j, and k are incorrect, place the manual intensity override switch to DAY and check j and k again. If these are now okay, test or replace the photocell. If j and k are still incorrect, change the circuit board.
   d. If h is incorrect and i is correct, change the circuit board.

Master Unit

A master unit is similar to a stand-alone unit (preceding), except that it is the controlling unit in a multiple-light system. Therefore, control wires are fastened to the *master/slave interconnect* at TB1-4 and TB1-5. You must temporarily remove the wires to perform diagnostic testing. Daylight testing is assumed. Use the following procedures:

1. In addition to the above tests for a stand-alone unit, check the control signal at the TB1-4 master/slave interconnect ***terminal*** with a voltmeter as described in *Section Control Signal Evaluation*. Step the unit from one intensity to the other using the methods in the test procedures in *Section Stand-Alone*. If the control signal appears to be abnormal, and RFI has been ruled out, replace the timing and trigger board.
2. Check the signal on the master/slave interconnect ***wire*** with a voltmeter as described in *Section Control Signal Evaluation*. It should exhibit a normal daytime response. If it does not, there could be a slave unit problem or RFI (see *Section Stand-Alone* and *Section RFI Problems*).
3. Reconnect the *master/slave interconnect* wires.

Photocell

To checkout the photocell, use the following procedure:

1. First, disconnect the photocell. The system should go to night operation after a few minutes.
2. Disconnect the master/slave interconnect line on each power converter.
3. Operate the manual intensity override switch on each power converter in turn.
4. If each power converter operates correctly with the manual intensity override switch, troubleshoot the photocell wiring or the circuits in the erroneously operating power converter.
5. Reconnect all wires.

During daylight, completely block light from entering the photocell. If the system does not enter night mode after a few minutes, replace the photocell. At night, shine a light on the photocell If the system does not enter day mode after a few minutes, replace the photocell.

Troubleshooting

The most effective troubleshooting begins with careful observations of operating behavior. This often leads directly to the cause of a problem. The diagnostic procedures in this subsection are divided into two categories: *system* level and *unit* level. System-level problems affect all lights in a multiple-light system in the same way. Unit-level problems originate in a single light. However, in a multiple-light system some unit-level failures could cause problems involving the entire system.

Table 3-1 directs you to the correct troubleshooting guide for the evaluation of the troublesome operation of your system.

Table 3-1 Selecting the Correct Troubleshooting Guide

	Single-Light	Multi-Light System	
	System (Standard *or* Dual)	Units Affected Differently (Usually a Unit-Level Problem)	All Lights Affected the Same Way (System-Level Problem)
Troubleshooting Guide	*Table 3-2* or *Table 3-3* and *Table 3-4*	*Table 3-2*	*Table 3-3* and *Table 3-4*

For example, if one light fails to flash, *Table 3-1* directs you to *Table 3-2*, the troubleshooting guide for a unit-level problem (as opposed to a system-level problem).

For each symptom, the troubleshooting guides list one or more possible causes in descending order of probability. Continuing with our example, let's say the flash fails for both day and night, high and low voltage are both absent, and the fuses blow when replaced. Then the most probable cause is a shorted varistor VR1, and the second most probable cause is a fault in the power transformer T1.

When a problem has been traced to a specific component, see *Section Component Testing* and *Section Component Removal and Replacement* for further assistance.

Table 3-2 Unit Trouble Shooting Guide

[‡]Flash Conditions		Other Conditions			Probable Causes
Day	Night	HV*	LV†		
No	No	No	No		• Primary Fuse F1, F2 • Interlock Switch S1 • Main power, cables, or connectors
No	No	No	No	Fuses blow when replaced	• Varistor VR1 • Power Transformer T1
No	No	No	OK		• HV Rectifier Board PCB2 • Power Transformer T1 • Main Capacitor Bank C2 • Flashhead Cable (shorted)
No	No	OK	No		• Power Transformer T1 • PCB1 failure
No	No	OK	OK		• PCB1 failure
OK	No	OK	OK		• External red light interface module • Incorrect PCB1 programming
OK	No	OK	OK	Markers are on	• External red light interface module • Defective beacon lamps • Incorrect PCB1 programming
Weak	OK	OK	OK		• HV Rectifier Board PCB2 • Mode Relay K2 • PCB1 failure
No	OK	OK	OK		• Flashtube • Flashhead cable • Mode Relay K2 • PCB1 failure • Trigger Transformer T101
Skips	OK	OK	OK		• Tuning Capacitor • Trigger Transformer T101 • Coupling Transformer T3

[*] HV denotes High Voltage. When the neon lamp (labeled HV) on the main panel of the power converter is lit, HV is present (HV = OK). Otherwise, HV is absent (HV = No).

[†] LV denotes Low Voltage. When the LEDs on PCB1 (timing and trigger board) are lit, LV is present (LV = OK). Otherwise, LV is absent (LV = No).

[‡] For a single-light system, see also *Table 3-3*.

Table 3-3 System Troubleshooting Guide (Standard System)

Flash [‡]Conditions		Other Conditions	Probable Causes
Day	Night		
No	No		• No primary power to system
OK	No		• Artificial light shining on photocell • Photocell failure • Timing and trigger board PCB1 failure[†] • Incorrect timing and trigger board programming
Weak	OK		• RFI on control or photocell wires • Timing and trigger board PCB1 failure[†] • Photocell failure
No	OK		• Photocell failure • Timing and trigger board PCB1 failure[†]
OK	Too bright	System in day mode	• Photocell failure
--	--	Flash rate too high	• RFI • Timing and trigger board PCB1 failure[†]

[‡] For single-light systems, see also *Table 3-2 Unit Trouble Shooting Guide.*

[†] The failure of timing and trigger board in any light of a multiple-light system can cause the entire system to failure.

Table 3-4 System Troubleshooting Guide (Dual System)

Flash Conditions		Other Conditions	Probable Causes[†]
Daylight	Night		
OK	Flashes (but should not)	Red lights OK at night	• PCB1 failure
OK	No	Red lights do not turn on	• Incorrect dual system wiring • PCB1 failure
OK	Flashes brightly in day mode	Red lights do not turn on	• Relay K2 failure • PCB1 failure • Photocell failure
OK	OK	Red lights do not turn off during day	• Incorrect dual system wiring • PCB1 failure
Weak	OK	Red lights do not turn off during day	• PCB1 failure

[†] The failure of a timing and trigger board in any light of a multiple-light system can cause the entire system to failure.

Component Testing

Always make resistance measurements with the primary power turned off. However, you must make voltage measurements with power applied. Thus, *for your safety*, carry out all preliminary steps such as connecting test leads or circuit jumpers, or disconnecting existing circuit connections with the power turned off and storage capacitors discharged.

WARNING

Read the warning on Page iii. Turn off power before opening covers.

Capacitors

You may test capacitors with an analog volt-ohmmeter in the resistance mode. The following method assumes an instrument with a X100 resistance scale.

Place the meter leads across the terminals of an isolated (no electrical connections to other circuits) and fully discharged capacitor. Observe the subsequent meter movement.

If the capacitor is functional, the needle initially indicates zero ohms, but soon begins to rise to higher indicated values. A capacitor that is disconnected from other circuitry is defective if it does not exhibit this behavior. The length of time it takes the needle to reach the 1-megohm reading (about 65% full-scale) is a measure of the capacitance. For example, the time is about 5 seconds for a 10-mfd. capacitor, or 10 seconds for a 20-mfd. capacitor and so forth.

Manually discharge the capacitor before repeating this measurement. *This test may not detect a malfunction that occurs only at high voltage.*

A bank of capacitors connected in parallel may be checked as a single unit. If the test indicates a short circuit, the individual capacitors have to be disconnected and checked separately. A shorted capacitor is indicated if the resistance does not rise above zero after several seconds of measurement.

Wiring and Cabling

Wires or cables that move repeatedly will ultimately break. Ensure that all cables (the flashhead cable in particular) are securely fastened at short intervals to the structure or other supports.

Inspection

Closely inspect the units and check the connections against the installation instructions. Also, a close inspection may reveal insulation breakdown, an overheated component, corrosion, loose connections, faulty relays, incorrect hookup, and so forth.

Power Converter

Burst Choke (L1)

The measured resistance of this choke from TB3-5 to ceramic post E4 (at burst resistor R2) should be approximately 7 ohms.

Relays (K2, K3)

A malfunctioning relay may have faulty contacts, a sticky mechanism, or a defective coil. You may determine the first two possibilities by inspection and manually exercising the armature. You can confirm a defective coil by measuring the resistance. To measure the resistance of relay coils, first remove the wires from one of the connections to the coil terminals on the relay.

The resistance across the coil of the K2 Mode Relay or the K3 Discharge Relay should measure approximately 290 ohms.

Timing and Trigger Board (PCB1)

Replace this circuit board with one known to be in good condition.

HV Rectifier Board (PCB2)

Replace this circuit board with one known to be in good condition.

Discharge Resistor (R1)

The measured resistance of this component, between ceramic posts E1 and E2, should be 35,000 ohms.

Burst Resistor (R2)

The measured resistance of this component, between ceramic posts E3 and E4, should be 500 ohms.

Power Transformer (T1)

To test this transformer, first remove the timing and trigger board (PCB1) and the HV rectifier board (PCB2). Apply power to the unit and measure secondary winding voltages at the terminals indicated.

Table 3-5 Power Transformer Voltages

Terminals	Voltage Range Allowed
From TB3-1 to TB3-9	900-1050 volts AC[1]
From J5-8 to chassis	100-120 volts AC
From J3-1 to J3-2	22-26 volts AC

1. If this AC voltage is substantially below the specified minimum value, check the C4 Tuning Capacitor.

PCB4 Sense Module

Replace this circuit board with one known to be in good condition.

Flashhead

The following subsections describe testing of the flashhead components.

Flashtube (FT101)

Visually inspect the flashtube for broken electrodes, cracked glass, and the solder connections of the pins. A darkened envelope does not necessarily mean the light output would be unacceptable. Before concluding that a faulty flashtube is responsible for an inadequate flash, first rule out other possible causes such as weak or absent discharge voltage or triggering pulses.

Trigger Transformer (T101)

The measured resistance of the secondary winding (potted assembly) should be approximately 150 ohms. Check the ferrite core for cracks. Check the mounting screws for tightness.

Component Removal and Replacement

Section 4 — Recommended Spare and Replaceable Parts provides component location diagrams.

Note the location and color of all wires that you disconnect. Ensure, when you replace the wiring after you replace the components, that the wiring conforms exactly to the wiring diagrams found in *Section 2 — Outline, Mounting, and Installation*.

The general procedure for removing components is:

1. Obtain access to the component in question.

   Disconnect completely or partially the wiring to components first that prevent clear access.

2. Completely remove or relocate these components.
3. Disconnect the wiring to the component that you want to replace.
4. Remove this component.
5. Replace everything in the reverse order: first the component, then the wiring, In some cases, you may have to place some wires on the component before you fasten it in place, then replace the remaining wires.
6. Most components are relatively easy to access for removal. Only those that are more difficult are described.

Power Converter Components

Capacitors

Before removing or replacing a capacitor always make sure it is discharged by checking with a voltmeter directly across the terminals. You may manually discharge a capacitor by placing a resistance (25 watts, 10,000 ohms or greater) between its terminals. Direct shorting may damage the capacitor, while connecting the terminals to the equipment chassis may fail to discharge it.

Remove the fuse removal for this procedure to prevent accidental application of power if the interlock switch is accidently pressed.

Removal

1. Disconnect the wires leading to capacitors.
2. Remove hold-down screws.
3. Lift the capacitors from their receiving holes.

Replacement

1. Reverse the Removal procedure.
2. Reconnect the wires to capacitors and verify that wiring agrees with the internal wiring diagram. Wires must be replaced *exactly* as removed. In some instances, a quick-connect wire terminal does not seat properly if it is not placed on the terminal cluster exactly as it was before removal. Interference between the insulation on the wire terminal and the insulation surrounding their terminal cluster on the capacitor may cause improper seating. Lightly squeeze the quick-connect wire terminals with pliers before reinstalling them over the capacitor terminal blades.

Timing and Trigger Board Assembly (PCB1)

The timing and trigger board is mounted on the left side of the component bracket.

Removal

1. Remove all connector plugs from timing and trigger board headers.
2. Loosen (but do not remove) the four screws located near the corners of the board.
3. Lift the board from the bracket.

Replacement

Reverse the Removal procedure.

Input Power Module

Removal

1. Remove all accessible wires and cable connectors attached to the Input Power Module and to T1 located under the Input Power Module.
2. Loosen the screw in the base of the Input Power Module that fastens the Input Power Module to the base.
3. Remove the screw under the ground terminal to the left of TB4. This screw fastens the Input Power Module bracket to the main component bracket.
4. Carefully slide the Input Power Module bracket to the right and lift it out. Ensure that connectors are not bent while doing so.
5. Remove any additional connections that you must to remove the Input Power Module bracket.

Replacement

1. Replace the Input Power Module in the reverse sequence to that of Removal.
2. Verify that wiring agrees with the internal wiring diagram, and restore the wire routing to its original state.

Red Light Module

Removal

1. Remove the external wires connected to TB5.
2. Unplug all harness connections to the Red Light Module.
3. Loosen two screws in the base that fasten the Red Light Module to the base.
4. Remove the Red Light Module. Be careful of components and connectors.

Replacement

1. Reverse the Removal procedure.
2. Verify that wiring agrees with the internal wiring diagram, and restore the wire routing to its original state.

Power Transformer (T1)

Removal

1. Remove the Input Power Module.
2. Remove the four screws holding the transformer to the chassis and remove the transformer from the chassis.

Replacement

1. Reverse the Removal procedure.
2. Verify that wiring agrees with the internal wiring diagram, and restore the wire routing to its original state.

Component Bracket

Some components can only be accessed after the component bracket is first removed.

Removal

1. Loosen, but do not remove, the four screws securing the four component bracket feet, and loosen the screw that attaches the component bracket to the input power module.
2. Slide the component bracket upward until the slots in the feet clear the screw heads.
3. Pull the bracket assembly away from the chassis and let it hang supported by the harness wires.

Replacement

Reverse the Removal procedure.

Rectifier Board (PCB2)

The HV rectifier board is mounted on the right of the main bracket between the main bracket and the Red Light Module. You access it by first removing the Red Light Module. Use the following procedure:

Removal

1. Remove the Red Light Module.
2. Loosen, but do not remove, the screws holding the HV rectifier board to the terminal block TB3. Slide the circuit board out from under the terminal block screws.

Replacement

1. Reverse the Removal procedure.
2. Verify that wiring agrees with the internal wiring diagram, and restore the wire routing to its original state.

Mode Relay (K2)

Removal

1. Remove the Component Bracket.
2. Loosen the screws that fasten the wiring connectors to K2.
3. Carefully remove the wires from the terminals of the relay and note their locations so that you may more easily replace them.
4. Remove the screws that hold K2 to the base.
5. Remove K2.

Replacement

1. Reverse the Removal procedure.
2. Verify that wiring agrees with the internal wiring diagram, and restore the wire routing to its original state.

K3 Discharge Relay

Removal

1. Remove the Component Bracket.
2. Remove K3 as in the Removal procedure for K2.

Replacement

1. Reverse the Removal procedure.
2. Verify that wiring agrees with the internal wiring diagram, and restore the wire routing to its original state.

K6 Beacon Relay

This relay is part of the Red Light Interface Module. To replace this relay, replace the entire module. See *Section Red Light Module* on Page 3-8.

Flashhead

Flashtube (FT101)

Removal

Loosen the three screws (on screw lugs)—this enables you to disengage the flashtube. Carefully lift the flashtube upward from the assembly.

Replacement

Align the pins on the flashtube base with the clamps of the terminal screw lugs, making sure that the *red dot* on the flashtube base coincides with the *red dot marked on the bracket directly under it.* Then carefully insert the flashtube and settle it into place, making sure the ceramic base is resting directly on the tops of the screw lugs. Secure the flashhead by tightening the three screws on the screw lugs.

Trigger Transformer (T101)

Removal

1. At the trigger wire post adjacent to the flashtube, remove the large diameter wire coming from the trigger transformer.
2. At one of the smaller, side-mounted ceramic posts, remove the small wire to the trigger transformer. Do not disconnect the primary winding wires (seven turns of insulated wire).
3. Remove the two 4-40 x 2" phillips head screws holding the transformer assembly to the bracket. Note the orientation of the molded secondary winding with the fixed features on the bracket, because it must be reinstalled with this same orientation.
4. Remove the outer half of the core and lift off the molded secondary winding. The seven turns of the primary winding remain hanging in place.
5. Remove the inner half of the core, taking care not to uncoil any turns of the primary winding.

Replacement

1. Reassemble the primary and secondary windings over the two halves of the core. Attach the core to the bracket using the two long screws.
2. Reattach the electrical wires. Verify that wiring agrees with the internal wiring diagram.

Trigger Coupling Transformer (T102)

Removal and replacement are similar to the procedure for the trigger transformer (T101).

Section 4 — Recommended Spare and Replaceable Parts

Customer Service

Customer Service: 1-800-821-5825
Telephone: (615) 261-2000
Facsimile: (615) 261-2600
Internet Address:
http://flashtechnology.com
Shipping and Receiving Address:
Flash Technology Corporation of America
332 Nichol Mill Lane
Franklin, TN 37067

Ordering Parts

To order spare or replacement parts, call Customer Service at 1-800-821-5825.

Power Converter Parts

Table 4-1 lists the major replaceable parts for the Power Converter.

Flashhead Parts

Table 4-2 lists the major replaceable parts for the Flashhead.

Photocell Parts

The PEC 510 Photocell part number is ***PN 1855001***.

Returning Equipment

If it is necessary to return equipment to FTCA, call Customer Service for a Return Material Authorization (RMA) number.

Repackaging

Return the equipment in a container that provides maximum protection during shipping. If the original cartons and packaging material are no longer available, package the power converter and flashhead *separately* using a double corrugated container and adequate padding. Do not drop. Use appropriate warning labels on the outside of the container.

Package and ship the power converter in an upright position; that is, with the feet downward. Pad the feet so that they cannot penetrate the box during shipment.

Attach the flashhead base to a plate measuring 18 inches square (e.g., 3/8" plywood). Use a double thickness cardboard (or wood) container that is 18 inches square by about 36 inches high (inside dimensions). Use soft packing or a cardboard collar around the lens to prevent tipping inside the container.

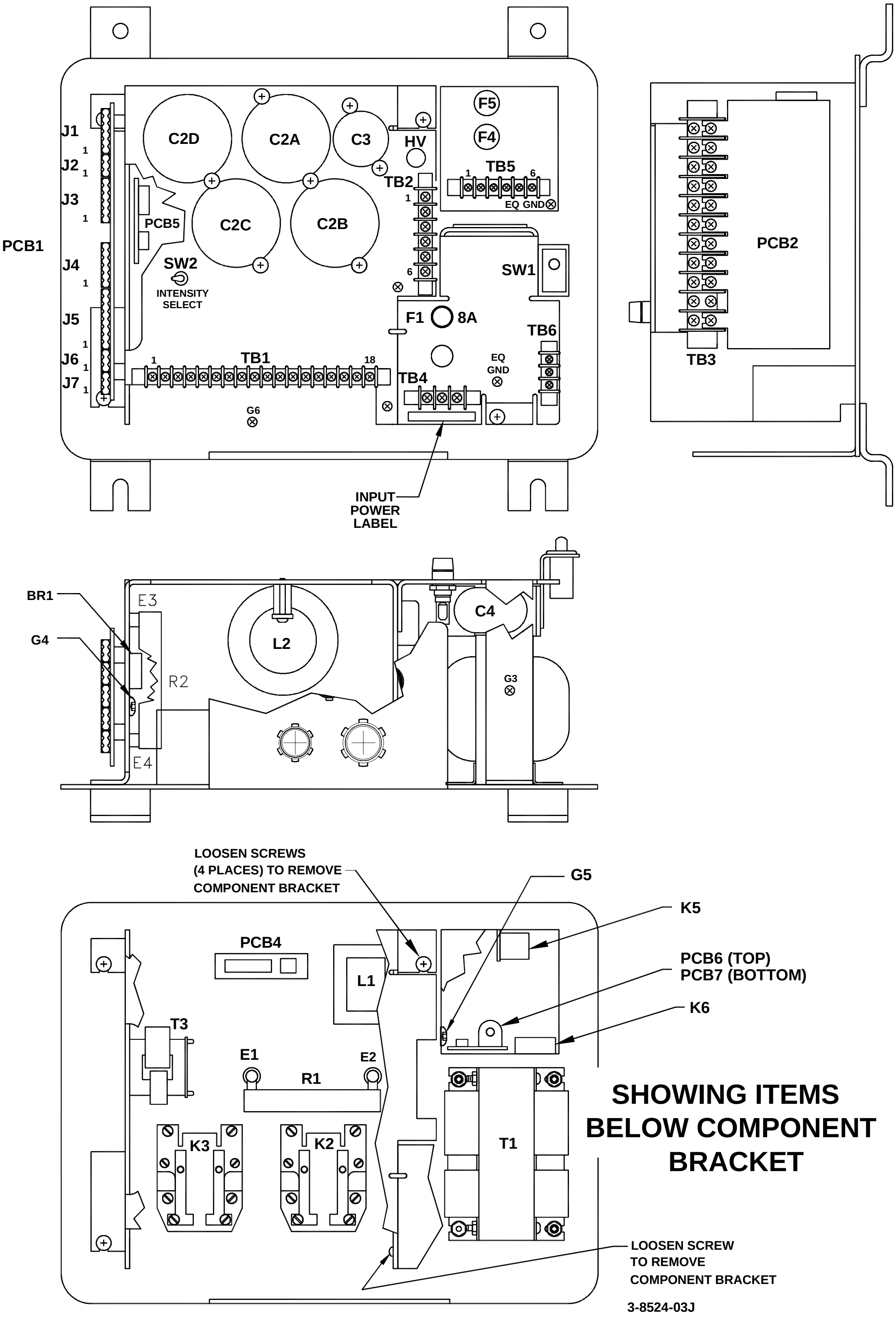
Table 4-1 Power Converter Major Replaceable Parts

Item	Description	Part Number
C2A-C	Capacitor, Main Bank	6720401
C3	Capacitor, Night Mode	6848201
C4	Capacitor, Tuning	6577903
F1	Fuse, Power, MDL 8 amp	‡4901931
F4	Fuse, Marker, 5 amp	‡4900345
F5	Fuse, Beacon, 20 amp	‡4902171
HV	Neon, High Voltage Warning Light	4902317
K2	Relay, K2, Mode, 24 VDC Coil	‡8900494
K3	Relay, K3, Discharge 120 VAC Coil	‡8900493
K8	Relay, Beacon	†
L1	Choke, Burst	4850601
L2	Choke, Flash	4175200
M1	Module, Red Light Interface	1757403
PCB1	Timing and Trigger Board (for PC 311-3AE only)	*‡24747xx
PCB1	Timing and Trigger Board (for PC 311-3 or 311-3A only)	*‡24740xx
PCB2	HV Rectifier Board	‡2458005
PCB5	Alarm Relay Board	2805404
PCB7	Beacon Sense Board	†
PCB8	Marker Sense Board	†
PCB4	Sense Module	2811101
R1	Resistor, Discharge, 35K, 50W	6900541
R2	Resistor, Burst, 500 ohm, 50W	6900532
--	Surge Suppressor Kit	8865301
SW1	Switch, Interlock	‡4901220
SW2	Switch, Intensity Control	8799201
T1	Transformer, Power	8841201
T3	Transformer, Coupling	8749801
TB1	Terminal Strip, 18 Position	4901930
TB2	Terminal Strip, 6 Position	4902257
TB3	Terminal Strip, 11 Position	8721011
TB4	Terminal Strip, 3 Position	4902134
TB5	Terminal Strip, 6 Position	†
TB6	Terminal Strip, 3 Position	4902155
VR1	Varistor, 120 VAC	6901079
BR1	Diode Bridge	6902806

† Replace entire Red Light Interface Module.

‡ Recommended as a spare part.

* Actual part number may vary depending on the board’s location in the system and its intended use. Call Customer Service for the correct number.



311-3CL

Figure 4-1 Power Converter Component Location

Table 4-2 Flashhead Major Replaceable Parts

Item	Description	Part Number
P1, P2, P4, P5, P12	Ceramic Spacer, 3/4” diameter	5900844
P3, P9, P10, P11	Ceramic Spacer, 1/2” diameter, short	5900842
P6, P7, P8	Ceramic Spacer, 1/2” diameter, tall	5900843
FT101	Flashtube	‡8384329
RC101	R.C. Network	1403411
RC102	R.C. Network	1403412
T101	Transformer, Trigger	8288201
T102	Transformer, Coupling	8336701
	Flash Tube Mounting Assembly	8812401
	Lens Assembly	8378303

‡ Recommended as a spare part.

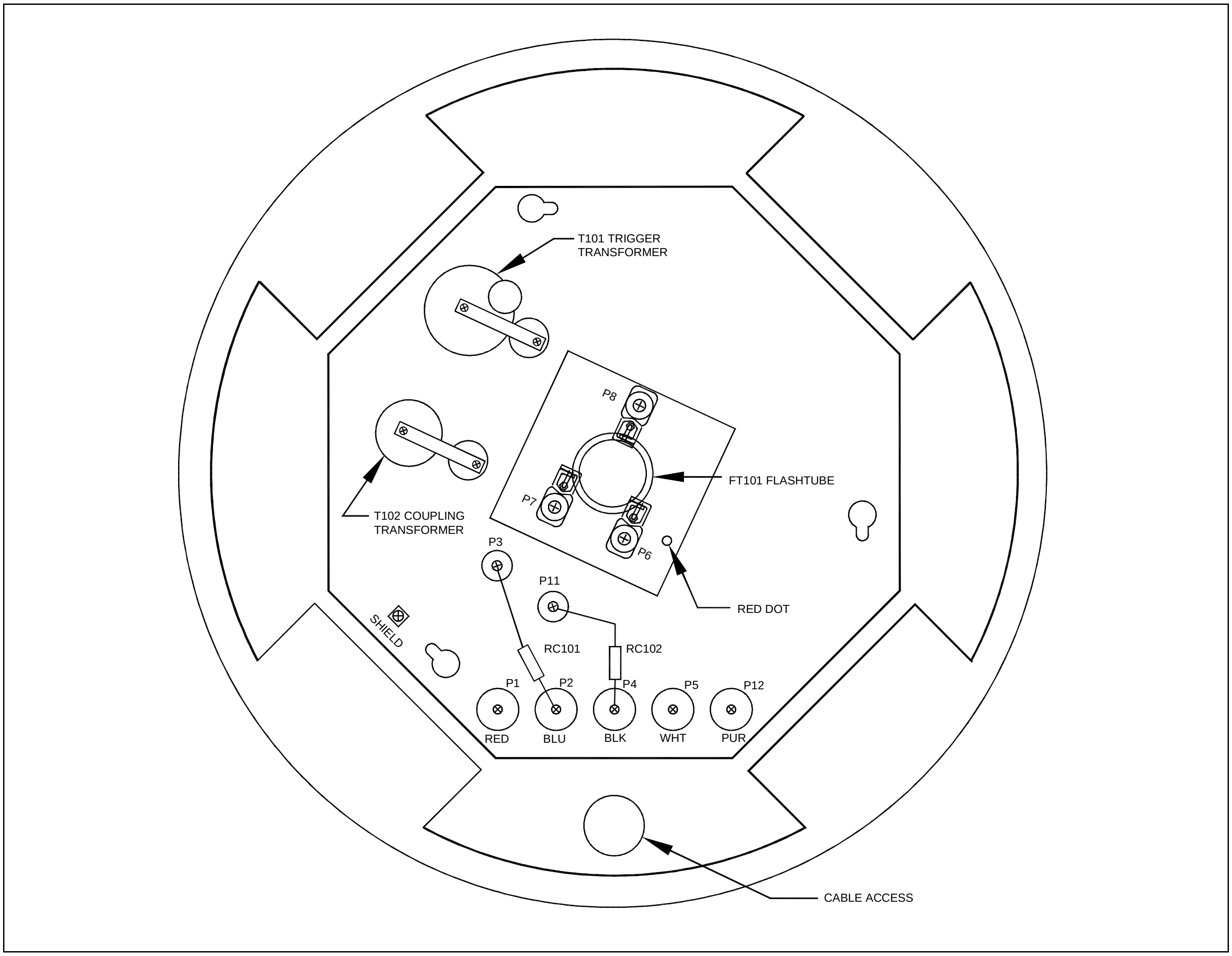


Figure 4-2 Flashhead Component Locations

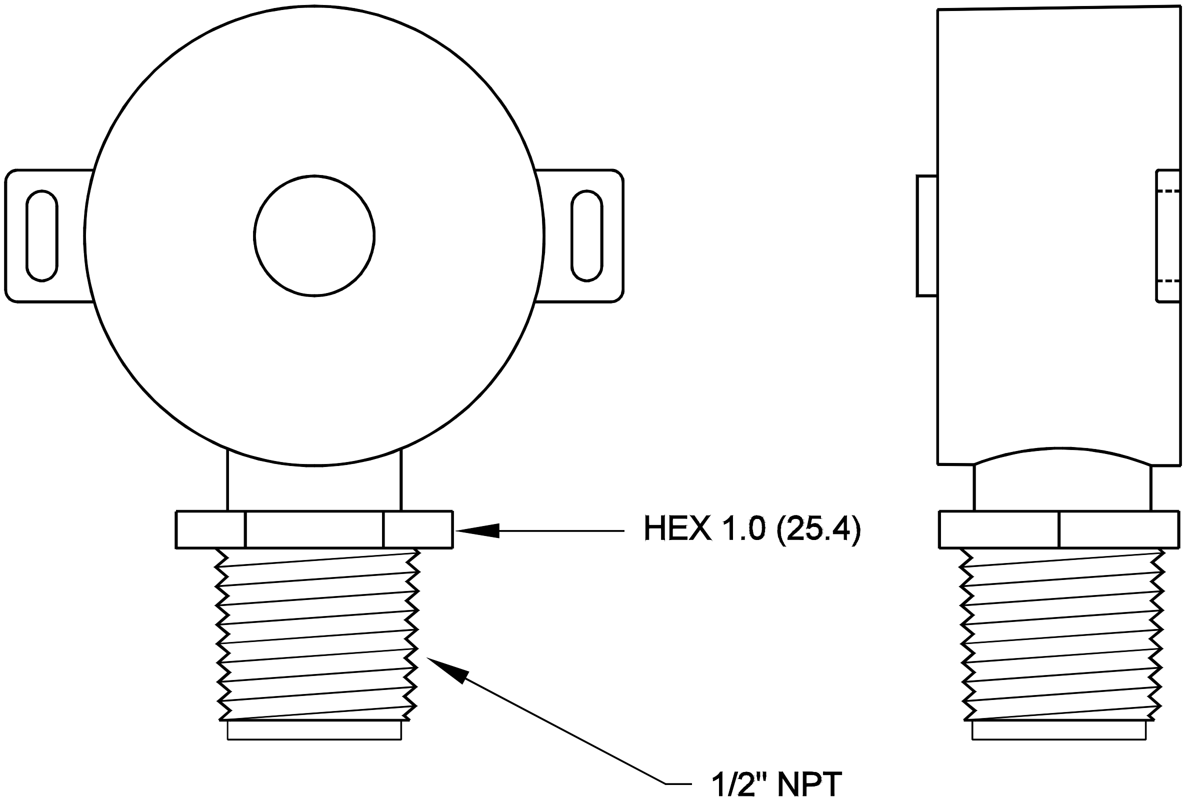


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Figure 4-3 Photocell Component Locations

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