FLASH™ TECHNOLOGY

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FTB 314-3/3A
FTB 314-3AE
FTB 314-3/3A Primary/Backup

Red, Medium Intensity, Obstruction Lighting System Reference Manual

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Abstract

This manual describes the Operation, Installation, and Maintenance of the FTB 314-3, FTB 314-3A, FTB 314-3AE, and FTB 314-3/3A Primary/Backup Obstruction Lighting Systems.

Copyright

Trademark Acknowledgments

Applicable Specification

This equipment meets or exceeds requirements in Advisory Circular 150/5345-43 for FAA Type L-864 and L-865 medium intensity obstruction lights with L-810 markers (side lights).

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.

Warranty

All components are fully warranted, under normal operating conditions, for one year.

Parts Replacement

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.

Pub. No. 0594-314305

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 flashhead 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 314-3 Introduction and Operation

System

The FTB 314-3 is a *red flashing* obstruction lighting system designed for installations that require L-864 red lights and markers at night. The red markers may be supplied by others.

A single system consists of a flashhead, a power converter, a 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 FTB 314-3A System has Extended Monitoring. Extended Monitoring is described in *Section Power Converter Main Panel: Alarms and Signals*.

The FTB 314-3 Primary/Backup System has an additional red flashhead. The system switches flashheads in the event one should fail.

The FTB 314-3AE System connects to a remote computer that uses EAGLE Software for monitoring over a telephone line.

Specifications

Physical

Power Converter (H x W x Depth, Wgt)
14.00 x 16.75 x 8.44 in., 50.5 lbs.
355.6 x 425.5 x 214.4 mm., 22.9 kg.

Flashhead (H x Diameter, Wgt)
16.95 x 18.23 in., 17 lbs
430.5 x 463.0 mm., 37.5 kg.

Aerodynamic Wind Area
.93 ft^2. (.0864 m^2)

Performance Characteristics

Application
L-864

Flashhead

Intensity
(nominal) Night (Red) 2,000 ± 25% ECD

Beam Spread
Horizontal: 360º Vertical: 5º

Flash Rate
Night (Red) 20 flashes per minute

Electrical

Voltage
120V, 120/240V, 60 HZ
230V, 50Hz, single phase

Volt-Amperes 250 peak

Watts
PC 314-3 Night (Red) 145 Watts
Markers (Sidelights) 116 each

Aerodynamic Wind Area
1.63 ft^2 (.152 m^2)

Environmental
Specification AC 150/5345-43 compliance

Options

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

Operation

The PC 314-3 Power Converter operates a red flashhead (FH 307) and a tier of red incandescent markers. It monitors the operation of the flashhead and markers and signals various system malfunctions if they occur.

Three PC 314-3s may be connected together to operate several flashheads on a structure. A master/slave control line interconnects the power converters. A signal on this line causes the power converters to flash their respective flashheads in unison and in the correct mode, day or night.

A photocell, connected to the master power converter, signals the change from day to night or from night to day for all units. Also, a provided switch can override the photocell if required.

Each power converter can operate up to six red incandescent marker lamps. The power converter turns on the marker lamps at night and turns them off at daylight. It monitors the lamp current and indicates an alarm if one of the lamps fails to light.

During the day, the PC 314-3 Power Converter does not flash lights. At night the PC 314-3 automatically switches on red flashing operation, operating the red flashhead at 20 flashes per minute and turning on steady-burning markers.

The FTB 314-3 has separate fail-safe alarm relays whose electrically isolated contacts can be connected to an external monitoring circuit. The FTB 314-3 also features control of several interconnected units. In a multiple power converter system one unit requires connection to the photocell. The unit connected to the photocell is called the master unit.

PCB1 Timing and Trigger Board

PCB1 governs all automatic functions. Two different PCB1 boards are used in the PC 314-3 Power Converter. The 24740xx board is used in all except the "AE" models. The 24747xx board is used in the "AE" models. The "xx" in the board's part number refers to its dash number, which changes with the board's internal programming. The major difference between the two is their jumpers, internal control and programming. Additionally, PCB1 for EagleWin "E" systems connects to a telephone line for remote monitoring by computer. The factory sets the jumpers and programs PCB1 before it leaves the factory.

Setting Up PCB1

Function Indicators

LED indicators on the PCB1 board signal alarms and internal functioning. Observe these LEDs to monitor equipment operations during checkout and troubleshooting. The essential features on PCB1 for troubleshooting are shown in *Figure 1-2* and *Figure 1-3*. PCB1 is located on the front of the power converter above the front panel. Refer to *Figure 4-1* for the location of PCB1.

PCB1 24740xx

PCB1 (24740xx) has the following features:

- LED indicators indicating function
- A neon lamp indicating trigger power
- Jumpers for external programming
- An RS-232 socket for internal programming

Refer to *Table 1-1* for indicator and lamp functions, and *Table 1-2* for jumper settings.

PCB1 24747xx

PCB1 (24747xx) has the following features:

- Twelve LED indicators indicating function
- One neon lamp indicating trigger power
- Two jumpers for external programming
- One RJ11 telephone line socket for remote EagleWin monitoring
- One RS-232 socket for internal programming

Refer to *Table 1-3* for indicator and lamp functions, and *Table 1-4* for jumper settings.

Table 1-1 PCB1 24740xx Neon or LED Function Indicators

LED or Neon Lamp	Function
I 1	NITE ERR — On for incorrect intensity for night operation.
I 7	DAY ERR — On for incorrect intensity for day operation.
I 2	PEC ALM — *Photocell alarm*; photocell failed to switch state within a 19-hour period; factory set.
I 8	WHT ALM — Not used.
I 3	RED ALM — *Red alarm*; on when a red alarm occurs.
I 9	MKR ALM — *Marker alarm;* on when marker alarm occurs (a marker or markers are out).
I 4	FAN — Not used.
I 10	SYNC — Flashes when flash control output is on. Flashes regularly during normal flashing operation of the power converter.
I 5	CONF — *Confirm*; Flashes after each valid flash.
I 11	DAY — The circuit board is in day mode.
I 6	NITE — The circuit board is in night mode.
I 12	MKRS — PCB1 is commanding markers to be on.
I 13	NEON — *Trigger power neon*; 120 VDC trigger power is being supplied to the circuit board.

Table 1-2 PCB1 24740xx Jumper and Switch Settings

<table>
<tr><th>Jumper or Switch†</th><th>Jumper or Switch Label</th><th>Description</th></tr>
<tr><td>JP1</td><td>INT RED</td><td>Uncut (all models).</td></tr>
<tr><td>JP2</td><td>RES PEC</td><td>Cut in all models to allow usage of a resistive photocell.</td></tr>
<tr><td>JP3</td><td>ALRMON2</td><td>Uncut.</td></tr>
<tr><td>JP4</td><td>NOBACK</td><td>Cut to disable white light backup for failure of the red flashhead.</td></tr>
<tr><td>JP5</td><td>FAILCLOSE</td><td>Uncut.</td></tr>
<tr><td>SW1-1</td><td>MRK0</td><td>Selects the marker lamp fail threshold. Chart etched on 24740 board shows “ALARM AT” thresholds.
MARKER Parameter in Board Software = 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>8</td><td>ON</td><td>ON</td><td>Six bulbs lit</td></tr>
</table></td></tr>
</table>

Table 1-2 PCB1 24740xx Jumper and Switch Settings (Continued)

Jumper or Switch†	Jumper or Switch Label	Description
SW1-2	MRK1	Selects the marker lamp fail threshold. See the chart FOR SW1-1 above in this table.
JP8	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.
JP9	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.
JP10	ISOL	**Cut** to allow an alarm for only ***local*** alarm conditions on this power converter. **Uncut** to allow an alarm for local alarms and alarms signalled though a communications device.
JP11	RETROFIT	**Cut** to allow the 24740xx Circuit Board to emulate other boards on a tower of mixed circuit boards.
JP12	MARKERNO	**Uncut** — energizes the marker relay in day mode and de-energizes it in night mode. **Cut** — de-energizes the marker relay in day mode and energizes it in night mode. An energized marker relay turns off markers.
JP13	REDSENSE	***Factory use only.***
JP14	-	***Uncut; factory use only.***
JP15	-	***Uncut; factory use only.***

† (Jumpers — OFF=CUT=OPEN)

Table 1-3 PCB1 24747xx Neon or LED Function Indicators

LED or Neon Lamp	Function
I 15	NITE ERR — On for incorrect intensity for night operation.
I 9	DAY ERR — Not applicable.
I 14	PEC ALM — On when the photocell fails to switch state within a 19-hour period; factory set.
I 8	WHT ALM — Not applicable.
I 13	RED ALM — On when a red alarm occurs.
I 7	MKR ALM — On when marker alarm occurs (a marker or markers are out).
I 12	FAN — Not used.
I 6	SYNC — Flashes when flash control output is on. Flashes regularly during normal flashing operation of the power converter.
I 11	CONF — *Confirm;* flashes after each valid flash.
I 5	DAY — The circuit board is in day mode.
I 10	NITE — The circuit board is in night mode.
I 4	MKRS — PCB1 is commanding markers to be on.
I 3	NEON — Trigger power neon; 120 VDC trigger power is being supplied to the circuit board.
I 1	TD — Modem is in transmit mode.
I 2	RD — Modem is in receive mode.

Table 1-4 PCB1 24747xx Jumper Settings

Jumper Board Name	Jumper Label	Description
JP2	INT RED	Not cut on the FTB 314-3. Applies to red beacons.
JP1	RES PEC	Cut — allows recognition of a resistive photocell.
TP1 to TP5	TEST, LTV, DAY, NITE, RED	Test points for factory use only.

Photocell

In a single unit installation, you connect the photocell to TB1-1 and TB1-2 on the main panel of the PC 314-3. In a multiple-unit installation you connect it to TB1-1 and TB1-2 of the first power converter, the *master* unit. Other units are *slaves*. Typically in multiple-unit installations, the first PC 314-3 is the one that operates the top flashhead.

NOTE

In multiple-unit installations, TB1-1 and TB1-2 of slave 1 are jumpered together, as is TB1-1 and TB1-2 of slave 2.

Power Converter Main Panel: Alarms and Signals

Terminals on TB1 of the PC 314-3 indicate various system failures and day or night modes of operation, and they are connected to electrically isolated contacts of relays inside the PC 314-3. Electrically isolated contacts are not connected to any other circuitry. They act as switches rated at 1 ampere 120 VAC, allowing you to connect the PC 314-3 to external monitoring equipment. They change state (for example, from normally closed (NC) to open or from normally open (NO) to closed) when the condition indicated on the front panel occurs.

The ability to monitor some states is available only on the “A” model power converters. These are indicated on the main panel in *Figure 1-1*.

Table 1-5 describes the available alarm functions on TB1 of the power converter.

Master/Slave Interconnect

The master/slave interconnect terminals at TB1-4 and TB1-5 are connected between power converters in a multiple-unit installation. These terminal connections supply two functions:

- A synchronization signal to flash their lights simultaneously.
- Intensity information from the photocell and master power converter.

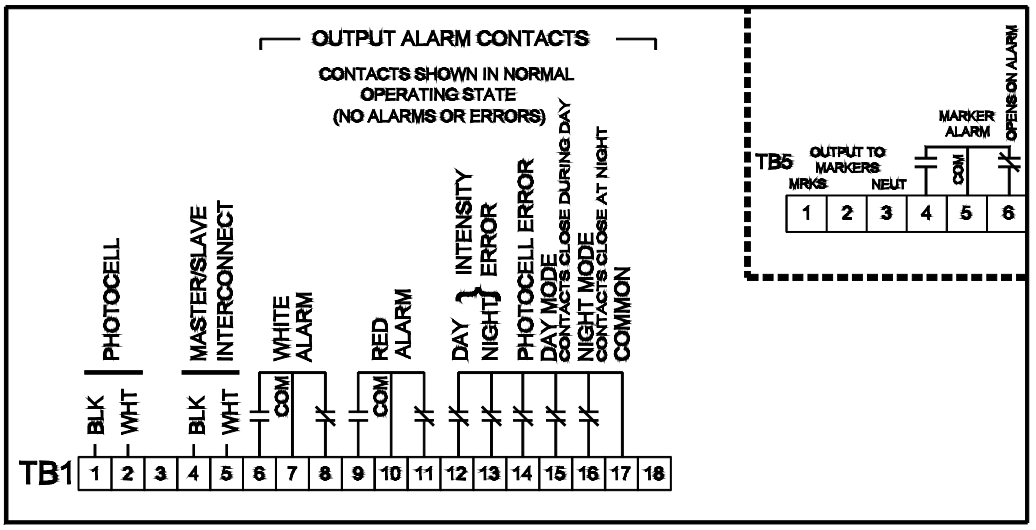

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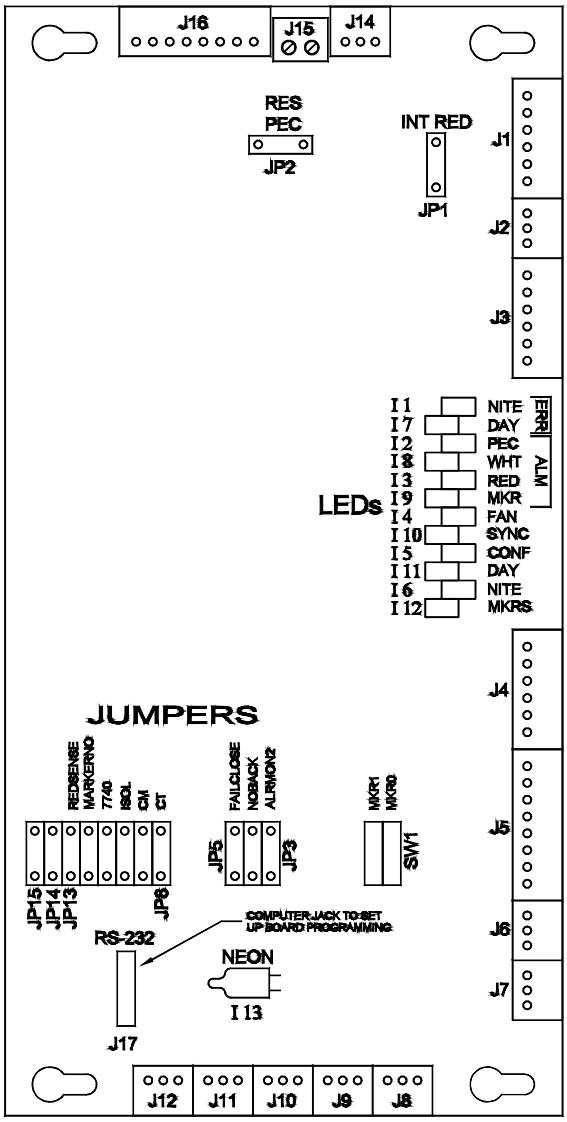
Figure 1-1 View of TB1 Wiring Functions for FTB 314-3

Table 1-5 Alarm Functions

Alarm/ System	Function
White Alarm/ all	Not used.
Red Alarm/ all	Connections between TB1-10, and TB1-9 or TB1-11 signal the alarm under the following conditions: • The flashhead malfunctioned during red operation. • The PC 314-3 detected improper flash intensity or no flash at all during red night mode operation. The normally open (NO) contacts close and the normally closed (NC) contacts open.
Marker Alarm/ all	Connections between TB5-5, and TB5-4 or TB5-6 signal the alarm under the following conditions: • One or more marker lamps is not functioning. • The marker lamp current is too low or not present. The normally open (NO) contacts close and the normally closed (NC) contacts open.
Intensity Error/ “A”	Signals a night intensity error between TB1-13 and TB1-17. Error occurs if a flashhead is flashing at the incorrect intensity for nighttime operation as determined by the photocell. The normally closed (NC) contacts open.
PEC Error/ “A”	Signals a photocell error between TB1-14 and TB1-17. The error occurs when a photocell has failed to switch state from day to night or night to day within a 19-hour period. This period is factory adjustable. The normally closed (NC) contacts open.
Day Mode/ “A”	Signals day mode operation between TB1-15 and TB1-17 when the internal operation of the power converter is in day mode. During daylight, the normally closed (NC) contacts are closed. These open at night.
Night Mode/ “A”	Signals night mode operation between TB1-16 and TB1-17 when the internal operation of the power converter is in night mode. At night, the normally closed (NC) contacts are closed. These open during daylight.



JUMPER†	FUNCTION
JP1	INT RED – Not cut. Applies to beacon lamps.
JP2	RES PEC – Cut to allow the power converter to use a resistive photocell. Cut in the PC 314-3.
JP3	ALRMON2 – Applies to beacon lamps. Not used in the PC 314-3.
JP4	NOBACK – Cut to disable white light backup upon the failure of the red night flashhead operation.
JP5	FAILCLOSE – Applies to power converters that use external red light controllers. Not cut in the PC 314-3.
SW1-1	Selects the marker lamp fail threshold. Chart etched on 24740 board shows "ALARM AT" thresholds. MARKER Parameter in Board Software = 4ORLESS Bulbs Installed / SW1-2/MRK1 / SW1-1/MRK0 / Alarm At: 0 / Off / Off / No alarms 2 / Off / On / One bulb lit 3 / On / Off / Two bulbs lit 4 / On / On / Three bulbs lit MARKER Parameter in Board Software = 5ORMORE Bulbs Installed / SW1-2/MRK1 / SW1-1/MRK0 / Alarm At: 0 / Off / Off / No alarms 5 / Off / On / Four bulbs lit 6 / On / Off / Five bulbs lit 7 / On / On / Six bulbs lit
SW1-2	MRK1 - Selects the marker lamp fail threshold. See the chart above for SW1-1 (MRK0).
JP6	CT – Cut to indicate top tier operation for this power converter in a catenary system. If both JP6 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.
JP9	CM – Cut to indicate middle tier operation for this power converter in a catenary system. If both JP6 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.
JP10	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. Factory use only.
JP11	RETROFIT – Cut to allow the 4740 board to emulate other boards on a tower of mixed circuit boards. For factory use.
JP12	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. Factory use only.
JP13	REDSENSE – Factory use only.
JP14	Unused – Factory use only.
JP15	Unused – Factory use only.

† JUMPERS – OFF=CUT=OPEN

LED Indicator	Function
I 1	NITE ERR – On for a night intensity error.
I 7	DAY ERR – Not used.
I 2	PEC ALM – On for photocell alarm (photocell failed to switch state within 19 hours).
I 8	WHT ALM – Not used.
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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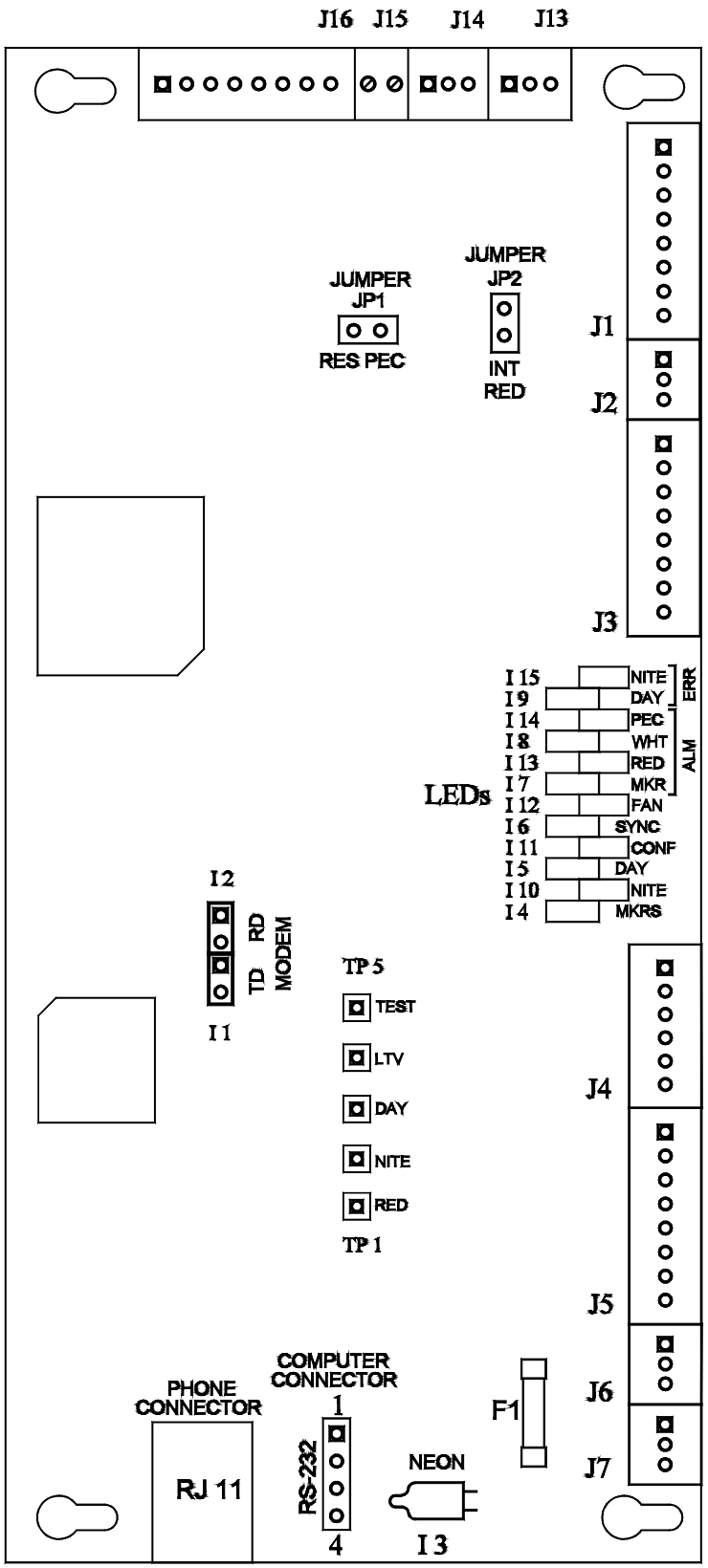
Figure 1-2 PCB1 Pictorial (24740xx)



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 314-3.
JP2	INT RED – Cut to use the internal red controller of the power converter. Not cut in the PC 314-3.

LED/LAMP	FUNCTION
I 15	NITE ERR – On for night intensity error.
I 9	DAY ERR – Not applicable.
I 14	PEC ALM – On for PEC alarm.
I 8	WHT ALM – Not applicable
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 120 VDC 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 1-3 PCB1 Pictorial (24747xx)

Section 2 — Outline, Mounting, and Installation

Unpacking

Inspect shipping cartons for signs of damage before opening them. 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

FTCA recommends the following tools and equipment for installation and maintenance:

- #2 Phillips, 9-inch shank screwdriver
- #2 flat blade screwdriver
- 5/16 inch, flat blade screwdriver
- Medium, slip joint pliers
- 8-inch or 10-inch adjustable wrench
- A set of combination wrenches
- TriplettTM Model 630-NA VOM, or equivalent analog volt-ohm meter
- Multi-purpose crimp tool

Access

WARNING

Before proceeding—read the warning on Page iii. Disconnect the primary power before opening the power converter enclosure or flashhead.

Power Converter

Latches secure the cover. When you release these you can slide open the cover for internal access.

Flashhead

The flashhead may not contain an interlock switch. Do not open the flashhead unless you have disconnected primary power from the power converter. Wait one minute for storage capacitors to drain down. Open the flashhead and use a voltmeter to ascertain that no voltage potential exists between the red and the blue wires. Look for these wires on the ceramic terminal posts.

You may pivot the lens open by disengaging two quick-release latches. Two lanyard cables secure the lens to the flashhead.

Mounting

Power Converter

Mounting and outline dimensions for the power converter are shown in *Figure 2-1*.

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

FTCA does not furnish mounting hardware unless your order it as part of an installation kit.

Flashhead

Mounting and outline dimensions for the flashhead are shown in *Figure 2-2*. Protect the flashhead from lightning strikes. The flashhead may be mounted to painted or unpainted surfaces. Use the following guidelines:

- 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.
- Use a bonding strap when mounting the flashhead to the structure, and fasten the bonding strap to the flashhead with the mounting bolt

that goes through the leg that contains the ground connection.

Leveling

The flashhead must be level for correct vertical beam alignment. Two leveling vials are permanently attached to the flashhead assembly. 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 $\frac{1}{16}$ inch (1.6 mm.) tilts the beam about $\frac{1}{2}$ 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 2-3*. Use the following guidelines:

- Locate the photocell where it has an unobstructed view of the polar sky.
- It must not view direct or reflected artificial light.
- The photocell may be supported directly by electrical conduit.
- *Mount the photocell on the top end of a vertical length of conduit to prevent water from entering and damaging the unit.*

Red Light Fixtures

Obtain outline, clearance and mounting details for L-810 markers from separate drawings provided by FTCA (or others). ***This manual does not contain information about installing red markers.***

Installation Wiring

NOTE

Only general information for a typical installation is presented here, and more specific information may be needed for your site. In particular, because the L-810 marker (side-light) lighting components for red nighttime lighting are often purchased from other, and have many variations, only general hook-up information for flashing and monitoring the red lights is included.

This manual may not contain all the information about installation wiring required for your site. Consult any installation drawings prepared especially for your site or supplied with the equipment. Site installation drawings should take precedence.

Also note that FTCA wiring diagrams define minimum requirements recommended for satisfactory equipment operation. These minimum requirements may not be enough, by themselves, to comply with local electrical codes. *It is the responsibility of the installer to comply with all applicable electrical codes.*

Consider the following wiring: power service, marker lights, power converter, control and signal, and the flashhead.

All installation wiring should have an insulation rating of 600 volts.

You can find conduit and other distribution wiring details on electrical installation diagrams provided by FTCA or others.

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

Power Converter

Power service wiring must be sized to satisfy the load demand of the red light system (markers) and the power converters. Each marker lamp draws 116 watts. Night operation of each power

converter requires 250 volt-amperes. See *Specification* in *Section 1*.

A typical installation has three power converters and two tiers of markers. Thus, the last slave power converter connected together in a chain of units is connected to a flashhead only—no marker are connected to this unit. Each steady-burning marker draws approximately 1 ampere. To determine wire gauge, consider the total ampere load and the length of the run. Please read the notes on the installation wiring diagrams supplied both in this manual and with the equipment.

Please note that FTCA recommends a maximum wire size of #12 AWG to the red light module terminal block TB5 inside the PC 314-3. However, the terminal block screw clamps will accept #10 AWG. FTCA recommends running a short length of #10 or #12 AWG wire to a junction box near the power converter when load requirements call for heavier gauge wire to red light fixtures.

Please note that FTCA recommends the following guidelines for red light wiring:

- Use a maximum wire size of #12 AWG from the red light module terminal block inside the power converter
- Run a short length of #12 AWG wire to a junction box near the power converter when lead requirements call for heavier gauge wire to red light fixtures.

Flashhead

The wiring 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. FTCA recommends using FTCA Part Number 6340 cable for this application.

To ensure reliable operation, FTCA recommends continuous wiring between the power converters and their associated flashheads without intervening junctions or splices.

If you use FTCA #6340 cable without electrical conduit, secure it to the main structure not more than 5 feet (1.5 meters) below the flashhead, and at regular intervals between the flashhead and power converter.

Securing the Cable

Use the following method for securing the cable to a skeletal structure:

1. Run the cable along one of the tower legs and wrap one full turn of two-inch Scotchrap™ #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 Scotchrap Filament #890 tape, or the equivalent, over the Scotchrap #50 tape.
3. Wrap four full turns of two-inch Scotchrap #50 tape, or the equivalent, over the Scotchrap Filament #890 tape.
4. Perform steps 1 through 3 also directly above and below any tower leg flanges that the cable may cross.

Photocell

For multiple-unit lighting, each individual lighting unit requires a power converter and flashhead, but the photocell is connected to only one unit in a group of multiple units. This unit is called the *master* unit, the others are called *slaves*.

Connect the photocell to TB1-1 and TB1-2 on the *master* power converter. The photocell terminals TB1-1 and TB1-2 on the slave power converter are jumpered together. Also, you connect the master unit (to which the photocell is directly connected) to the top flashhead and top tier of markers.

Master/Slave Interconnect

In multiple-unit systems, the master unit and slave units communicate over the “master/slave” interconnect wiring. The master and slave power converters are connected together for communica-

tion at the master/slave interconnect terminals TB1-4 and TB1-5 on the main panel. The recommended size wiring for this purpose is #16 AWG. Twist the wires together to form a twisted pair at the rate of 12 twists per foot.

Alarm Relay Wiring

The wiring for alarm relay connections in *Figure 2-9* minimizes the possibility of damage caused by high voltage transients.

Installation Checklist

Complete the following steps before applying power to the lights.

1. Inspect all equipment for damage.

2. Verify the received equipment against the packing list to ensure completeness.

3. Power Converter Mounting:

   Position and mount each unit correctly, allowing adequate clearance for opening the covers. Use the following checks:

   - Ensure that the case is mounted upright, is water tight, and grounded.
   - Check hardware inside the case to ensure that the mounting screws and nuts are 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. Flashhead Mounting

   - Ensure that the flashhead lens can be opened without striking other objects.
   - Level and aim the flashhead.

5. 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.

6. Marker Mounting (Sidelights):

   - Ensure that marker junction boxes are mounted with the weep holes down.
   - Ensure that the junction boxes are water tight.

7. 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.
   - In multiple installations, all power converters must be wired to the same electrical phase. Wire all three power converters to one 20-amp. circuit breaker.
   - Check all electrical connections for tightness.
   - Check all terminal strip connections for tightness.
   - Ground the power converter.
   - Wires at TB1-4 and TB1-5 should be daisy-chained as a twisted pair between the master power converter and the slave units. The rate of twist is 12 per foot. If a shielded cable is used, ground the shield. Ensure that TB1-4 is connected to all TB1-4 connections on all units, and TB1-5 is similarly connected to all TB1-5 connections.

8. Flashhead Wiring

   - Protect the top flashhead against lightning strikes.
   - Ground the flashhead.
   - Check the wiring of the flashhead cable to the flashhead.
   - Secure the flashhead cable to the tower. Support and tape the flashhead cable to prevent its movement by the wind.

9. Photocell Wiring

   - Connect the photocell to the master power converter: the black wire to TB1-1 and the white wire to TB1-2.
   - Ensure that TB1-1 and TB1-2 on the slave units are jumpered together.

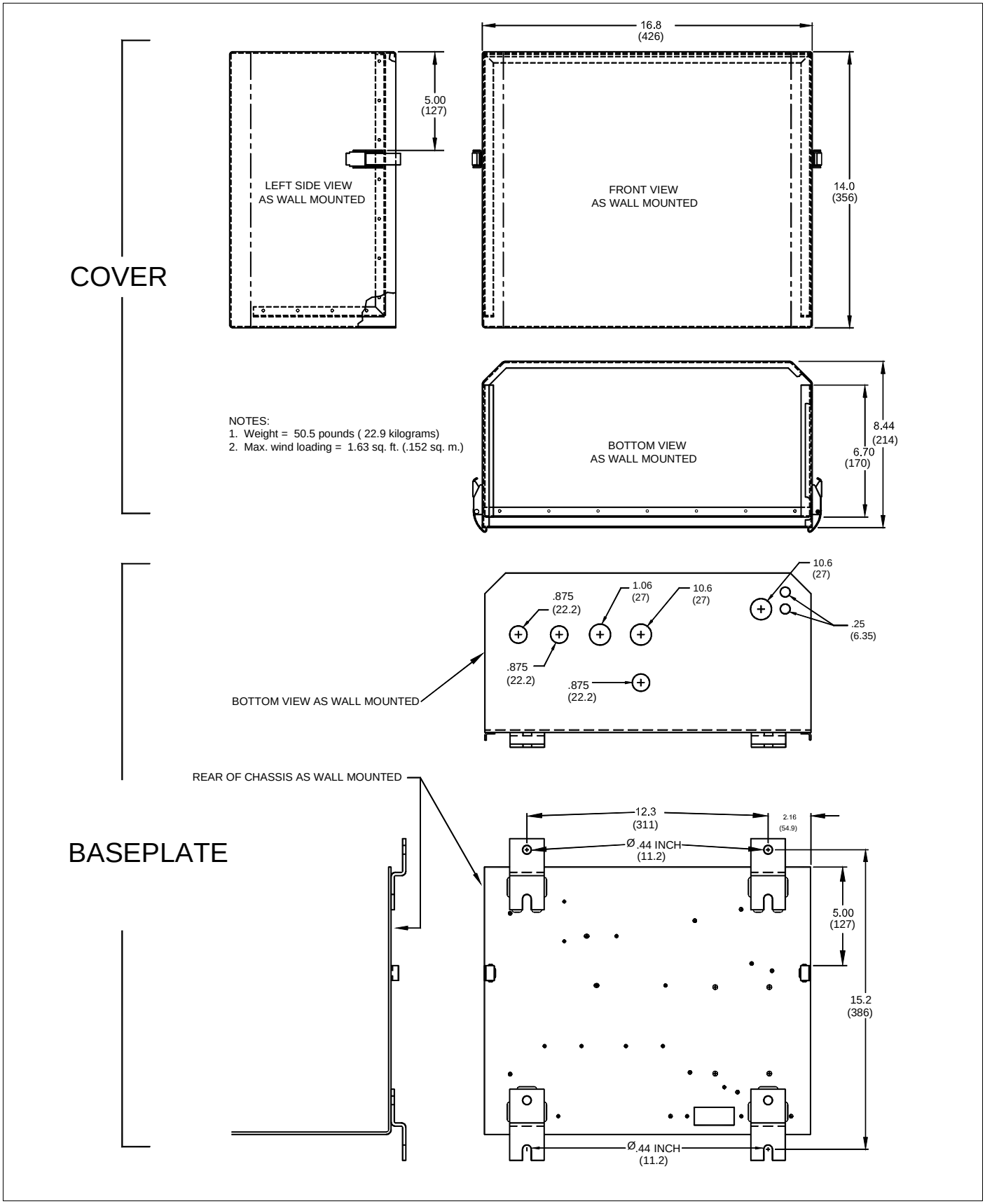
10. Alarm Wiring

    - If external alarm detection circuit responds to *closed* contacts, ensure that they are wired to the contacts on TB1 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.
    - Alarm wiring should be lightning and RFI protected: shielded, grounded shield, and in a conduit.
    - If a specific alarm is ganged together from all power converters as one, ensure that the wiring follows local installation instructions.

11. Marker Wiring (Sidelights)

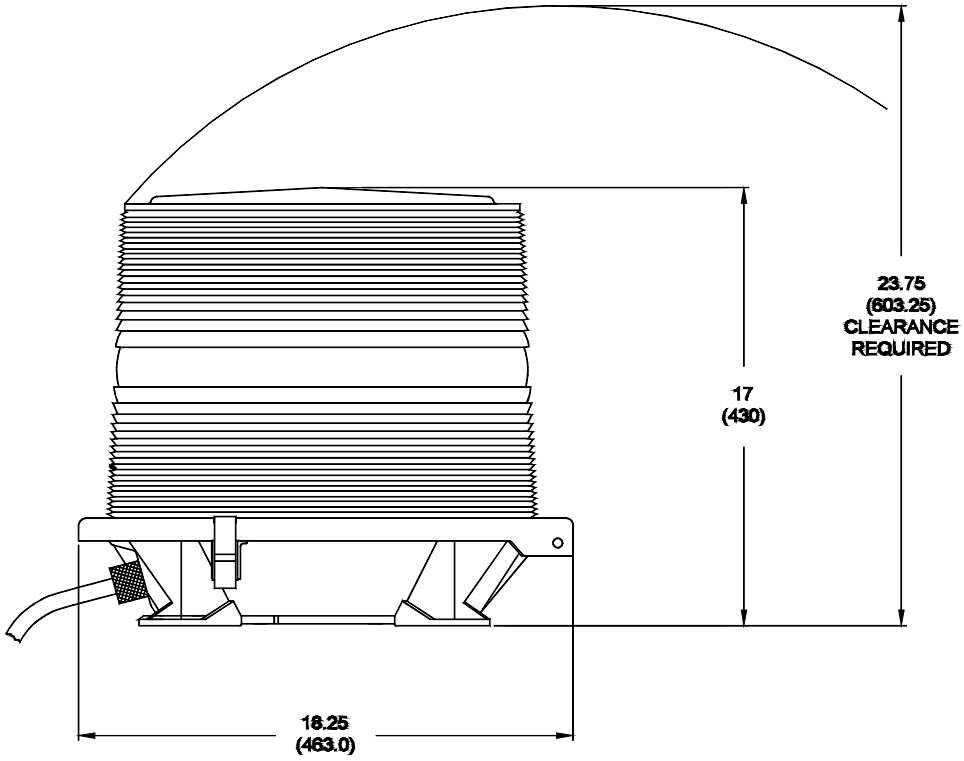
    - Ensure that each power converter powers only one tier of markers.
    - Ensure that the top tier of markers is wired to the master power converter.
    - Check the wiring gauge to the markers to ensure less than 3% voltage drop.
    - Ensure that all markers have all their lamps installed.
    - Ensure that marker lamps are 116 Watts *only*.

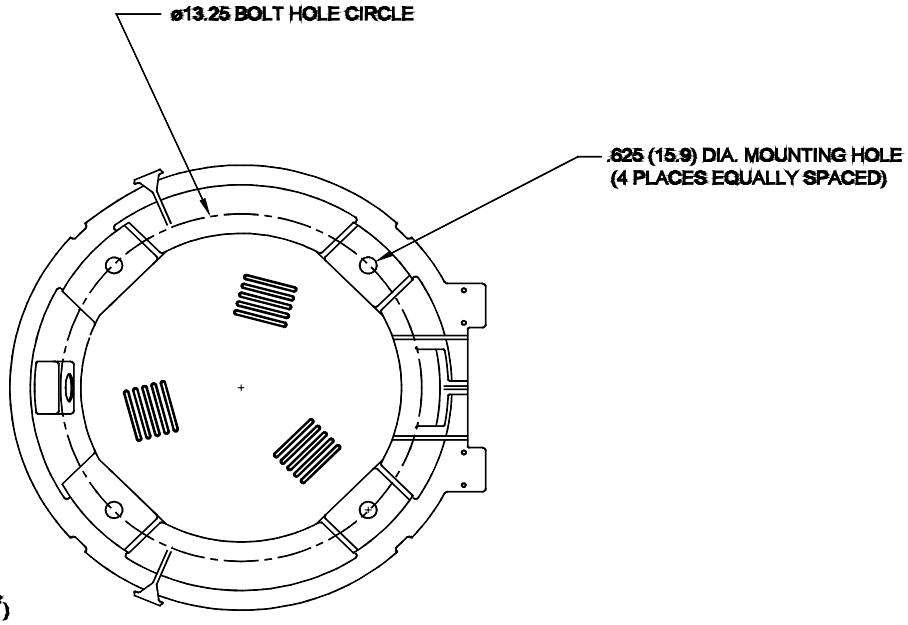
After completing all the steps listed above, turn on the power and perform the operational checkout in *Section Operational Checkout* in *Section 3 — Maintenance and Troubleshooting* of this manual.



314302003

Figure 2-1 PC 314-3 Power Converter Mounting and Outlines

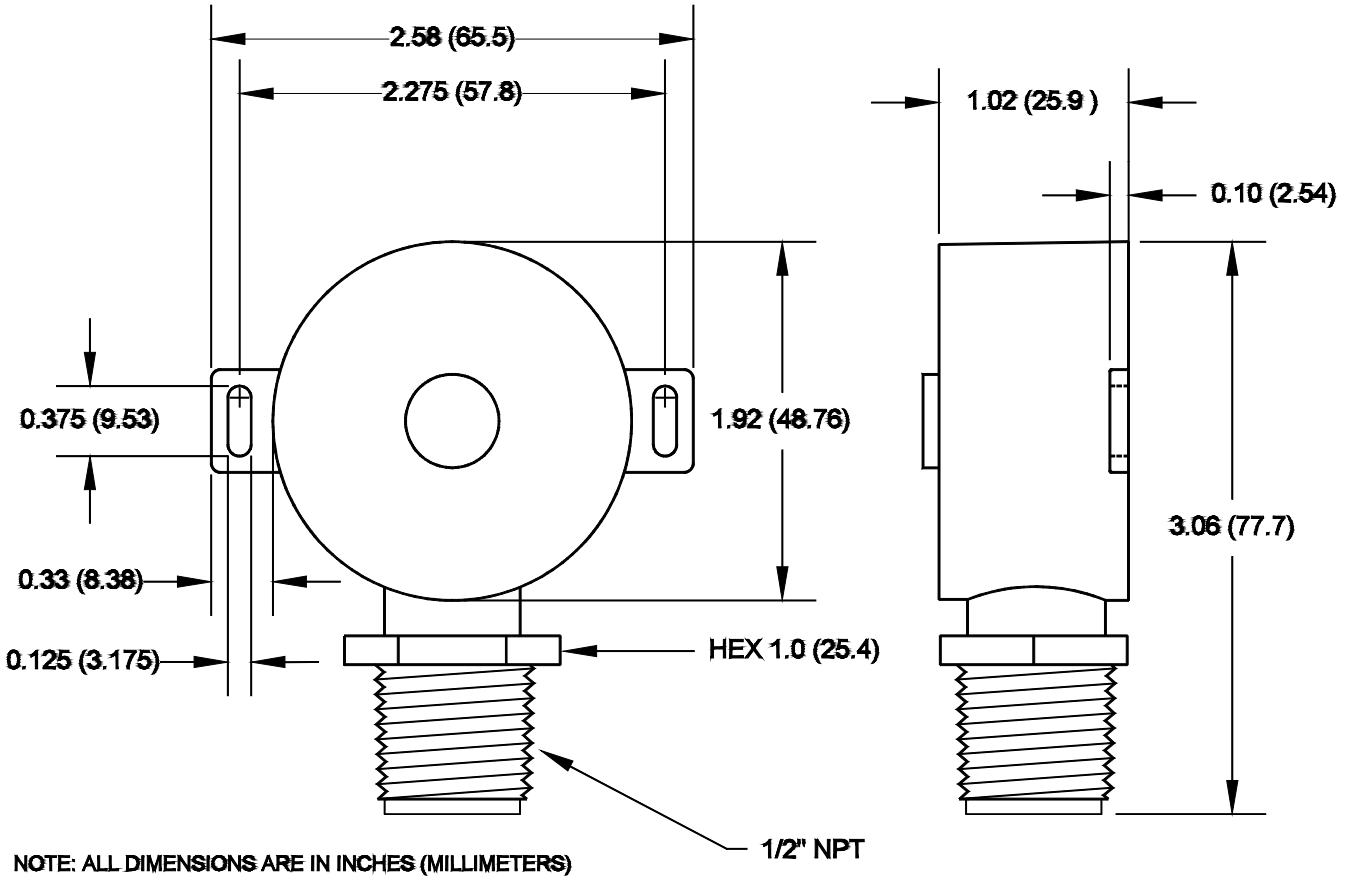




NOTES:
1. WEIGHT: 17 LBS (37.5 KG)
2. AERODYNAMIC WIND AREA: .93 FT^2 (.0864 M^2)
3. DIMENSIONS ARE IN INCHES (MILLIMETERS)
4. ACCESS TO THE FLASHHEAD MUST REMAIN UNOBSTRUCTED
5. TOPMOST FLASHHEAD SHOULD HAVE LIGHTNING PROTECTION

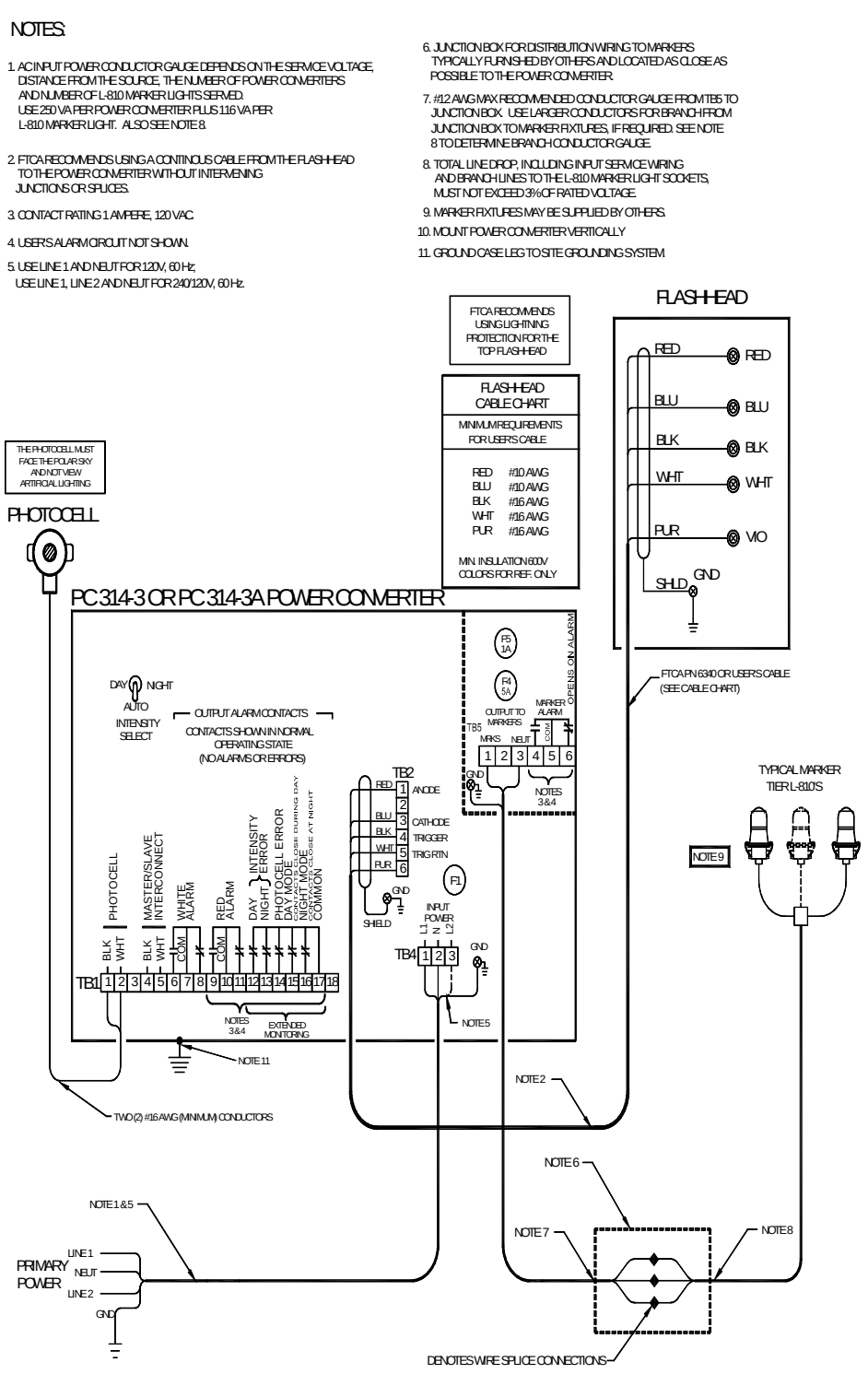
31432004

Figure 2-2 FH 307 Flashhead Mounting and Outline



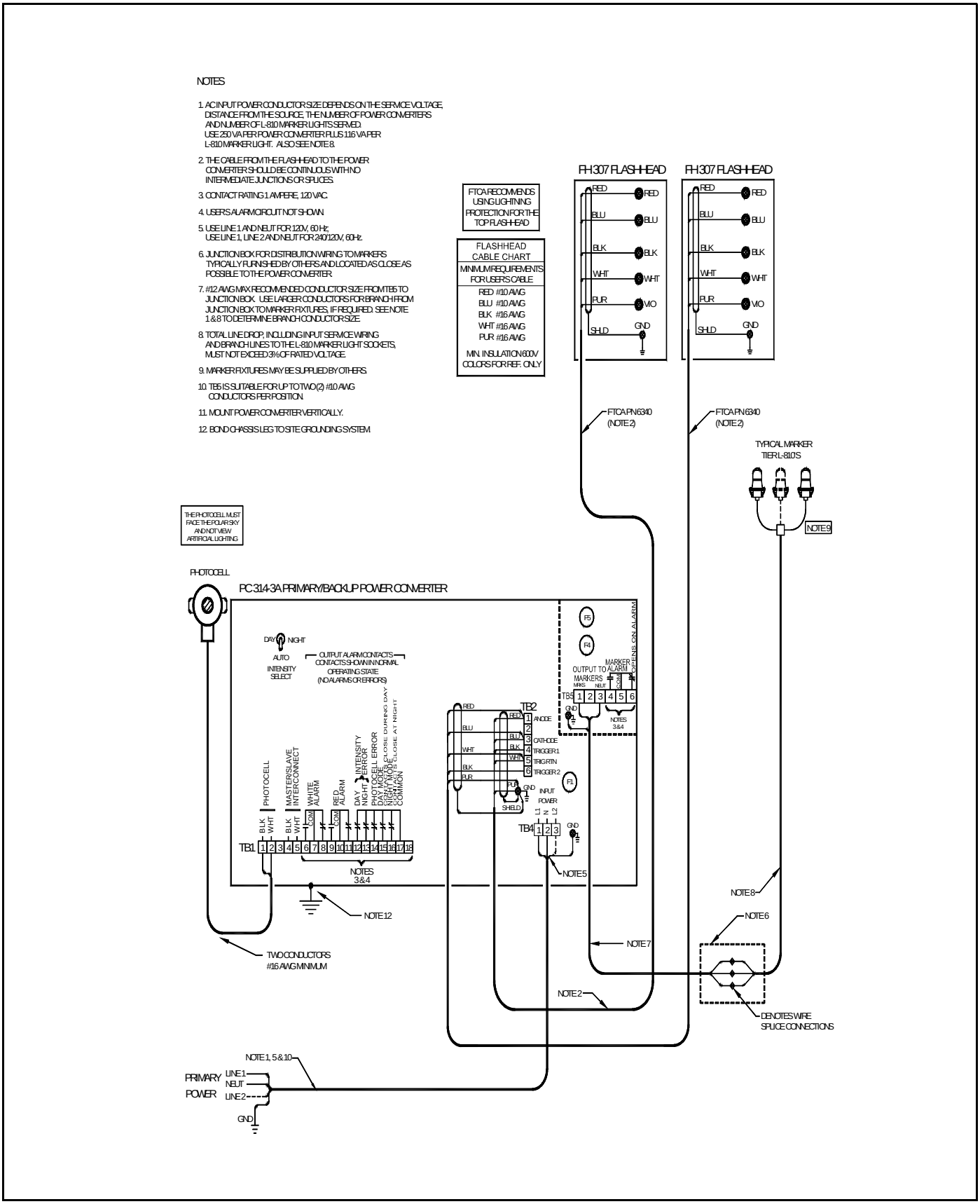
314302005

Figure 2-3 PEC 510 Photocell Mounting and Outline



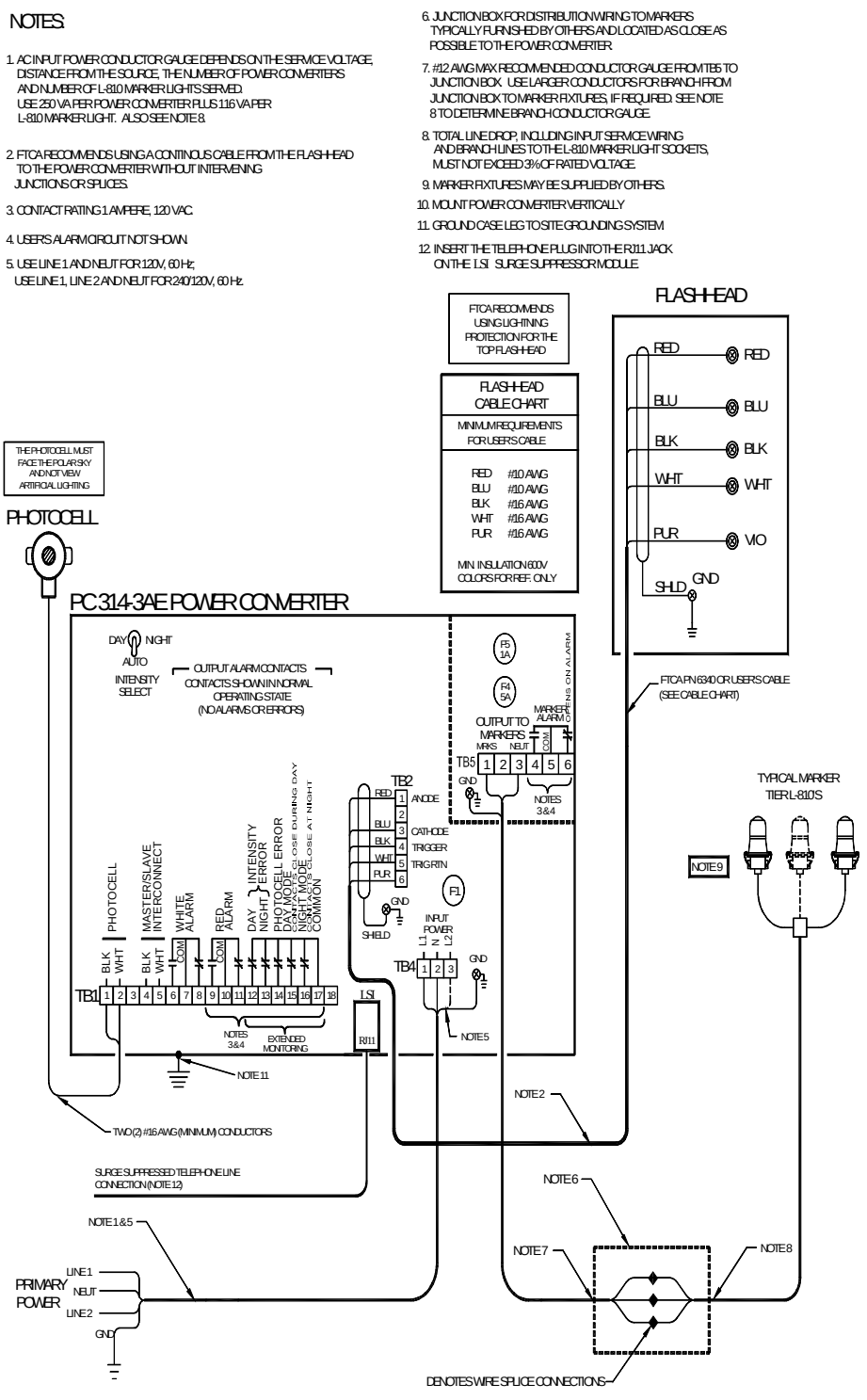
314302006

Figure 2-4 FTB 314-3 or FTB 314-3A Single Unit Installation Wiring



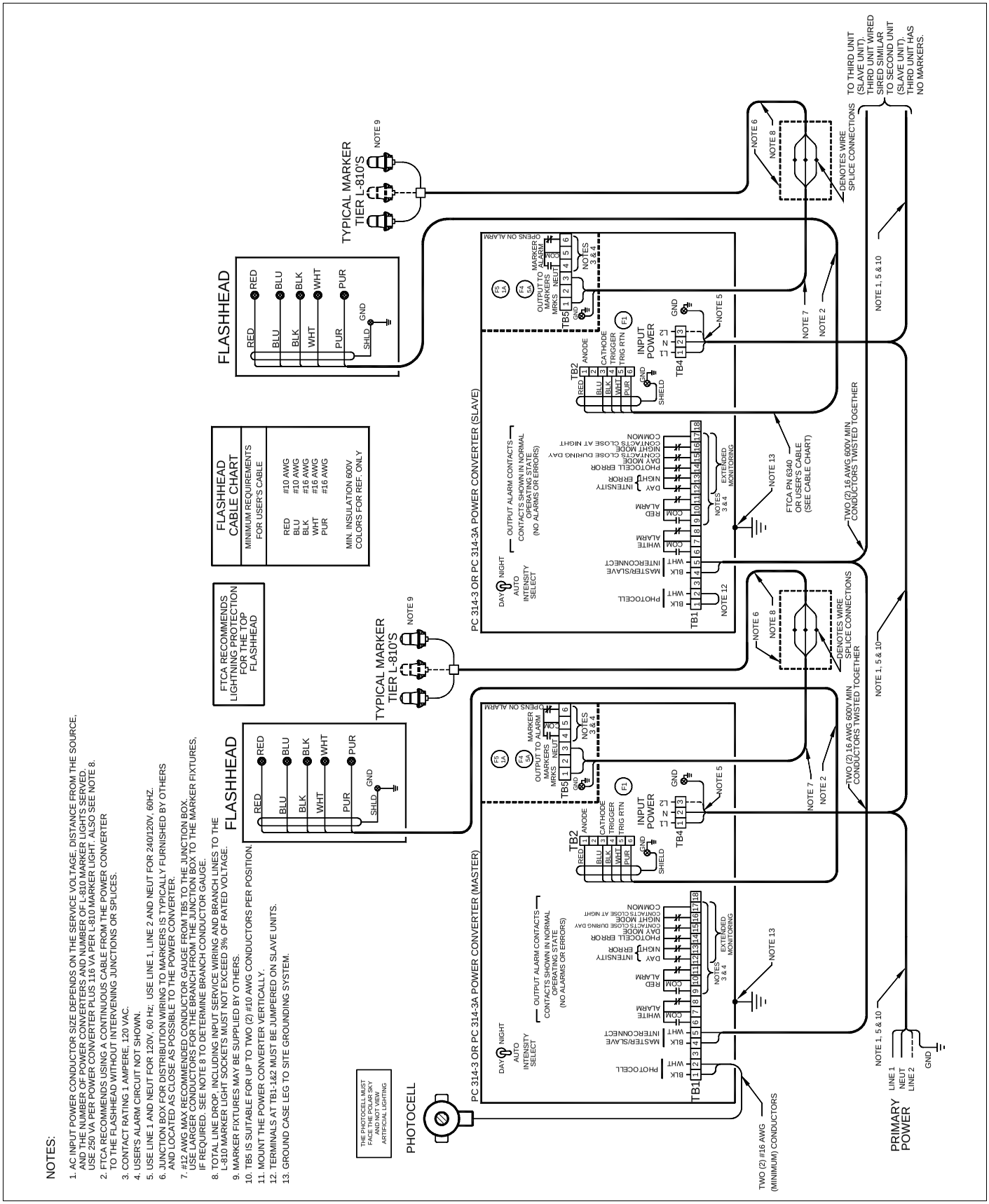
314302007

Figure 2-5 FTB 314-3A Primary/Backup Installation Wiring



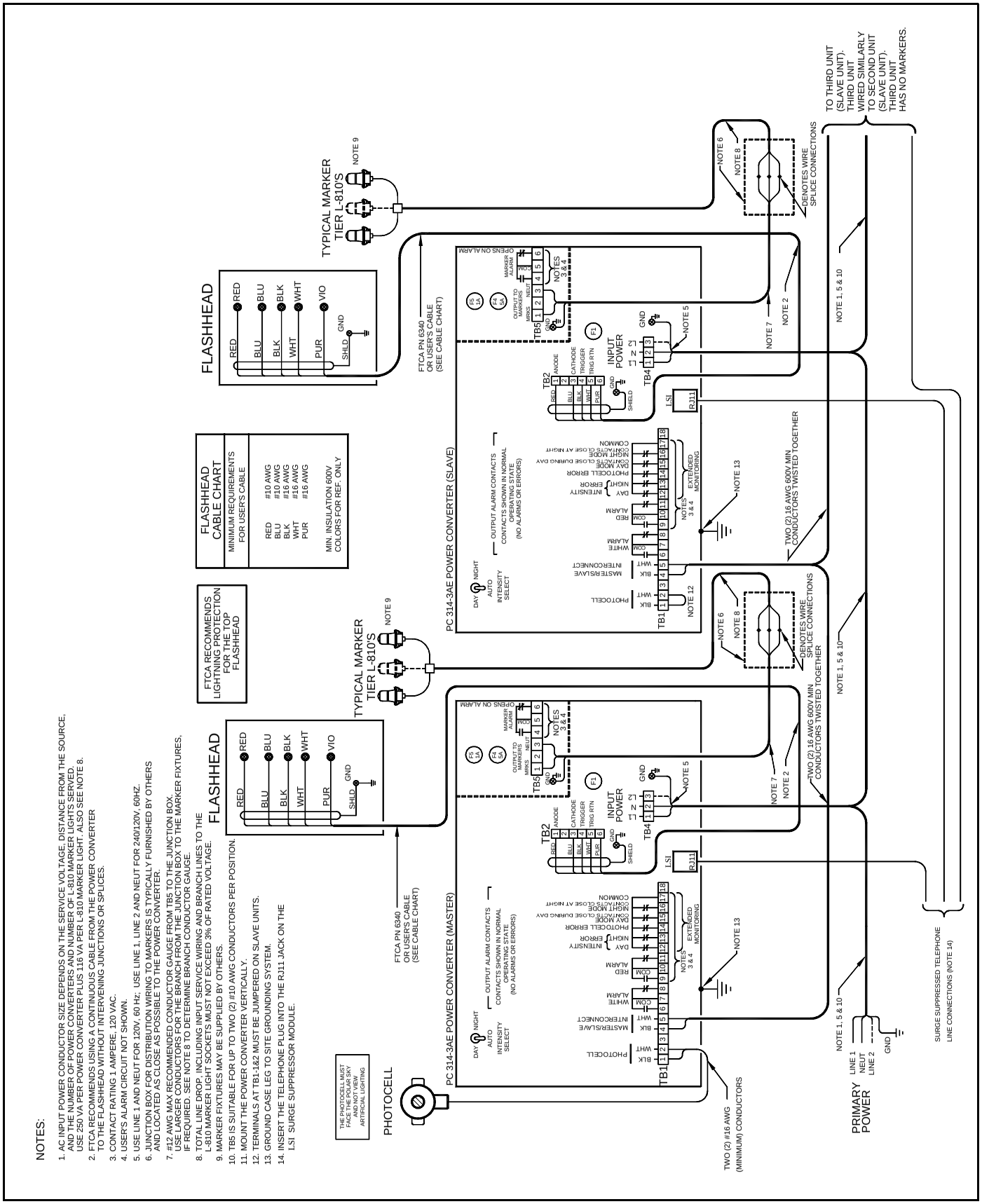
314302008

Figure 2-6 FTB 314-3AE Single Unit Installation Wiring



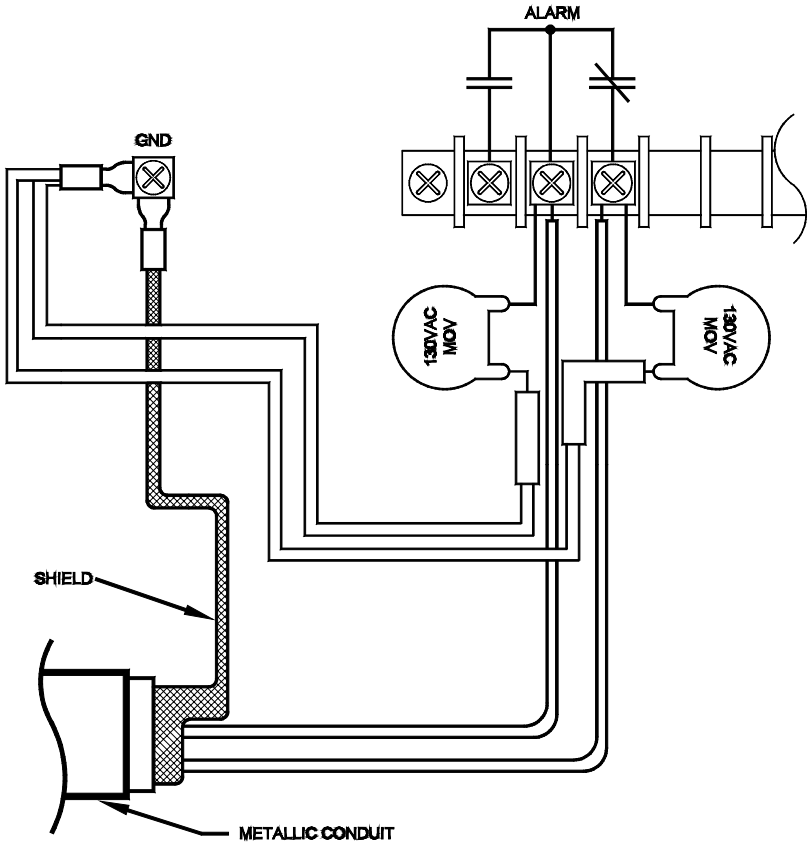
314302009

Figure 2-7 FTB 314-3 or FTB 314-3A Multiple Unit Installation Wiring



31432010

Figure 2-8 FTB 314-3AE Multiple Unit Installation 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.

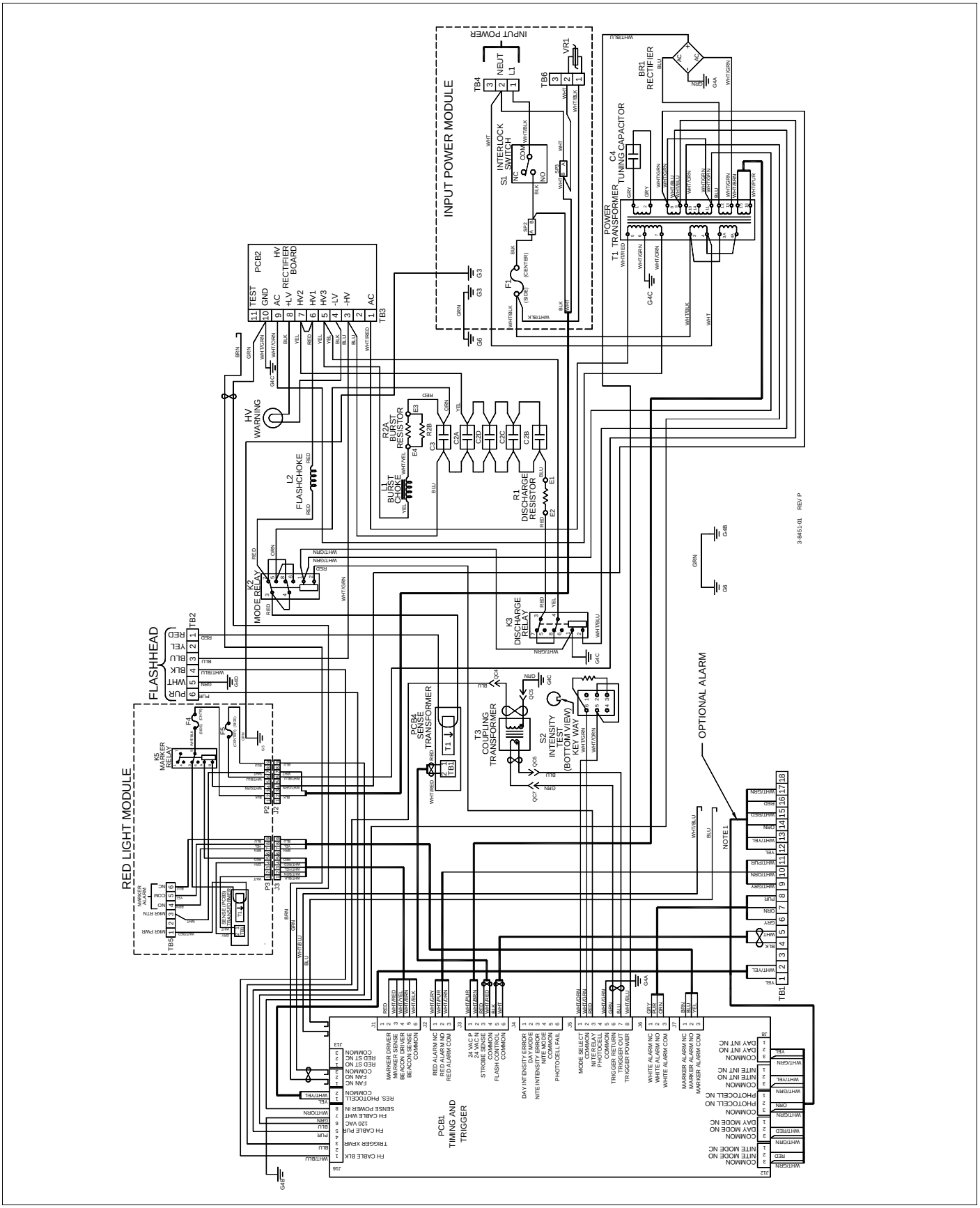
THE INSTALLER IS RESPONSIBLE FOR COMPLYING WITH ALL APPLICABLE ELECTRICAL CODES.

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.

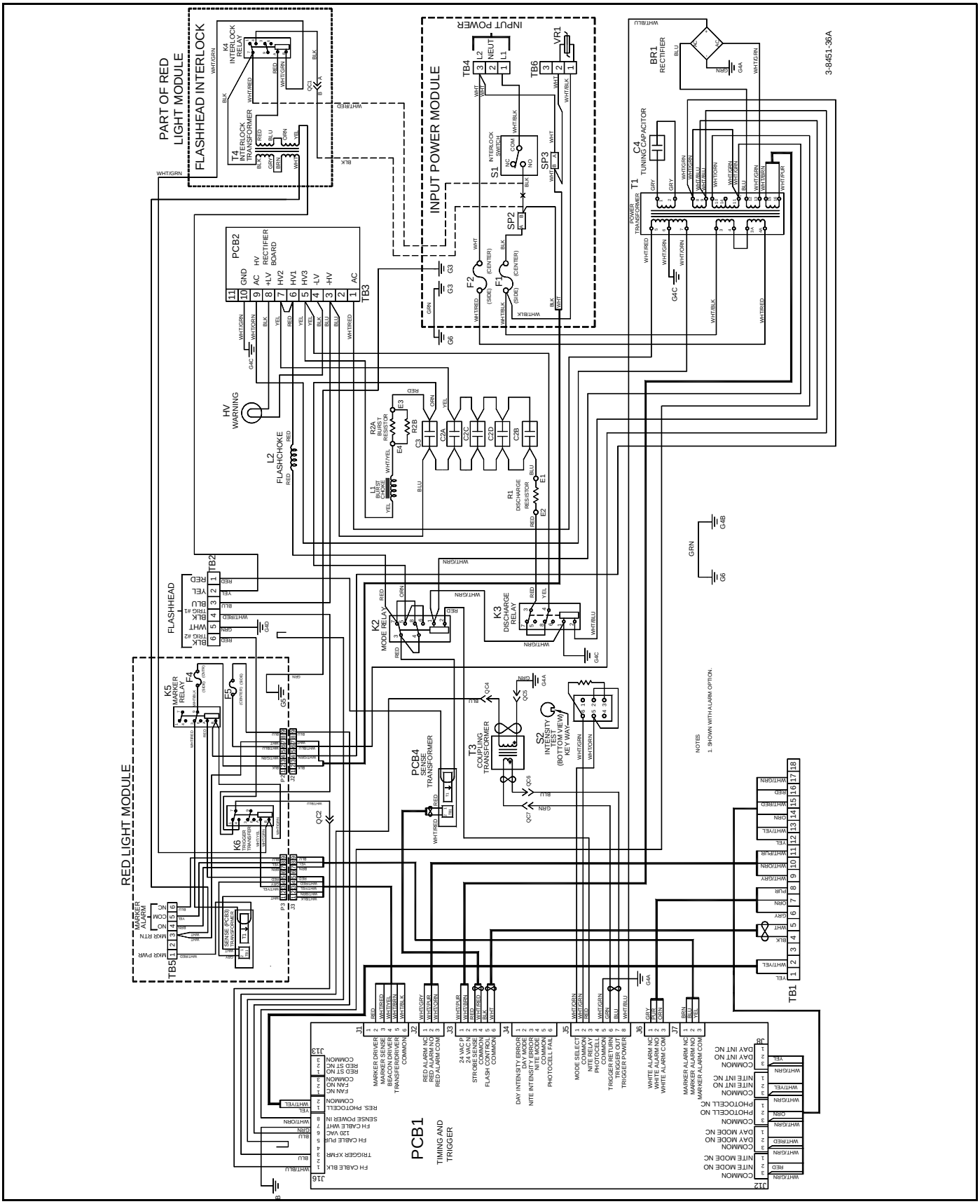
314302011

Figure 2-9 Alarm Wiring



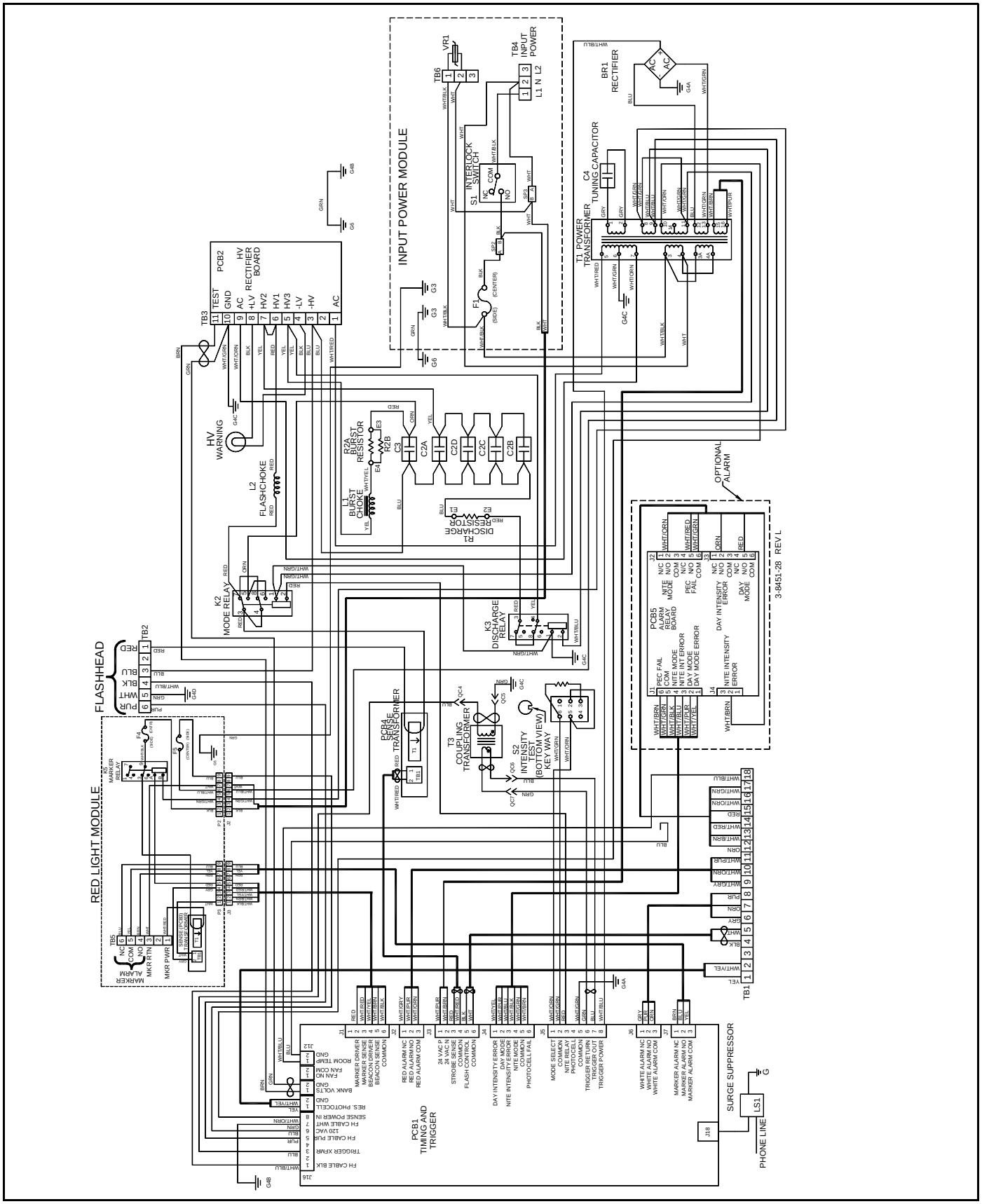
314302012

Figure 2-10 PC 314-3 or PC 314-3A Power Converter Internal Wiring



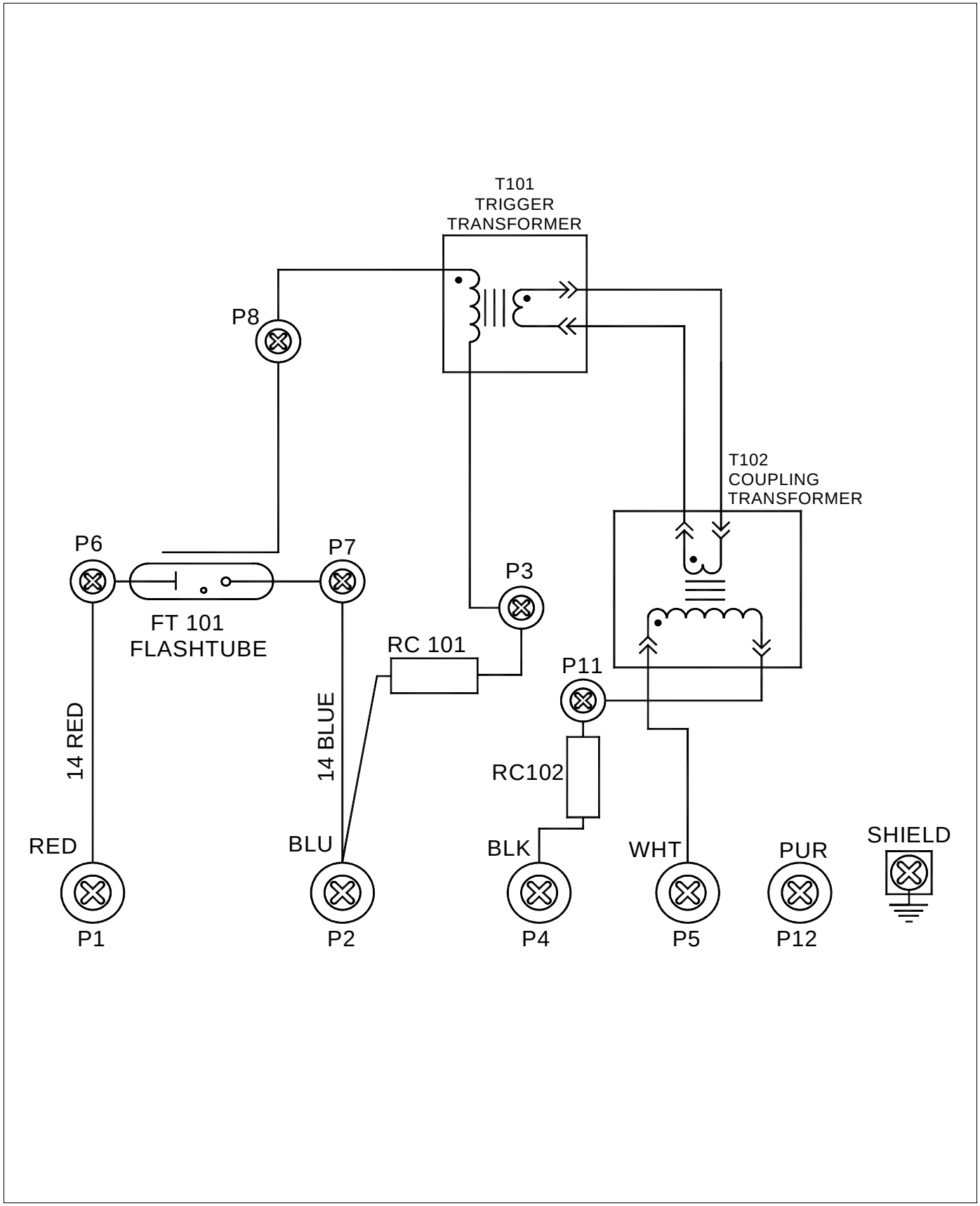
31432013

Figure 2-11 PC 314-3/3A Primary/Backup Power Converter Internal Wiring



31432014

Figure 2-12 PC 314-3AE Power Converter Internal Wiring



314302015

Figure 2-13 Flashhead Internal Wiring

Section 3 — Maintenance and Troubleshooting

Safety

WARNING

STOP: Before proceeding—read warning on Page iii.

Work safely as follows:

1. Remove rings and watches before opening the equipment.
2. Shut off the equipment.
3. Remove the component or connect the test instrument.
4. Replace the component.
5. Turn on the power and test the system.
6. Turn off the power and disconnect the test equipment.

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 inside 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 a soft cloth or paper towel.
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.

Storage

No special considerations are required for long-term storage of any major assembly. Circuit boards, when not installed in the equipment, should be kept in antistatic bags or containers.

Diagnostic Testing

The only effective way to check lights connected to interconnected power converters is to disconnect the wire labeled master/slave interconnect that is connected to TB1-4 and check the power converters as single units, as described in *Section Operational Checkout*.

Normal operation at night calls for monitoring a set of steady-burning markers installed at one structure level (tier). In configurations with more than one red flashhead at the same structure level (or tier), the additional flashhead does not have associated markers. That is, this last flashhead connected to the last power converter in a multiple-unit installation does not have associated markers. Note that only one lamp going out in a tier of marker lights may indicate an alarm.

PCB1 either senses or ignores markers. It ignores markers if the MRK0 and MRK1 jumpers on PCB1 are cut. Therefore, before troubleshooting, you must verify correct marker installation wiring and operation.

Sync Signal Evaluation

Refer to *Figure 2-7*. Note that, 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 sync pulse on the line; the first sync pulse on the line synchronizes the remaining lights to flash all the lights at the same time. PCB1 in each power converter gener-

ates a sync pulse. The width of the sync pulse controls the mode of operation.

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 max-min function.)

Check the signal on the TB1-4 and TB1-5 terminals to ensure that you have a signal for each setting of the manual intensity override switch on the unit you are testing. The signal should be as follows:

- A short pulse (a blip on the meter) each time the unit flashes the light in night mode. This is the sync pulse and it is normal operation.
- You should also see a signal during simulated daylight operation. This signal sets the power converters to day mode (no flashing).

Be careful when you check these signals to be certain that you can see the difference between them with your meter. If the signals appear to be incorrect, replace PCB1.

RFI Problems

The presence of RFI (radio frequency interference) can cause a light to flash intermittently, at the wrong rate, or at the wrong intensity. RFI can enter the light by any wire. For example:

- RFI on primary power wires could cause errors in flash rate and intensity.
- RFI on the master/slave interconnecting wire could cause a light to switch to and remain in night intensity.
- RFI on the PEC line could switch a light to night intensity and force it to remain there.
- Strong RFI could burn out circuit board components.

While FTCA designed the circuits to reject or bypass RFI, FTCA cannot guarantee complete immunity beforehand. After installation, you may find it necessary to add external filters or use other methods to reduce RFI entering the equipment.

Component Testing

Always make resistance measurements with the primary power turned off. Apply power for voltage measurements, however, you must carry out preliminary steps such as connecting test leads or circuit jumpers, or disconnecting existing circuit connections, with the power turned off and storage capacitors discharged.

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 off.

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.

Relays

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.

Power Converter

Capacitors

Evaluate the condition of a capacitor with an analog volt-ohmmeter operating 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 needle 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.

C1 Capacitor Bank

Check this capacitor bank as described in *Section Capacitors*. The bank can be checked as a whole at one time by connecting the meter leads to the terminals of any one of the individual capacitors in the bank and pressing the armature of the K3 Bleeder Relay.

C3 and C4 Capacitors

Check these capacitors as described in *Section Capacitors*.

Burst Choke (L1)

The measured resistance of this choke should be approximately 15 ohms.

Relays (K2, K3, K5)

To measure the resistance of Mode Relay K2, or Discharge Relay K3, first remove one of the wires from the coil. The resistance across the coil should measure approximately 290 ohms.

Relays K5 is part of the Red Light Module. This module must be replaced as an entire functional unit.

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.

Sense Modules (PCB3, PCB4)

Replace the PCB4 circuit board with one known to be in good condition.

PCB3 is part of the Red Light Module. This module must be replaced as an entire functional unit.

Alarm Board (PCB5)

Replace the PCB5 circuit board with one known to be in good condition.

Discharge Resistor (R1)

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

Burst Resistor (R2)

The measured resistance of this component, between posts E3 and E4, should be 250 ohms total (two resistors in parallel).

Power Transformer (T1)

To test this transformer, first remove the Timing and Trigger and the HV Rectifier Board. Apply power to the unit and measure secondary winding voltages at the terminals indicated.

Table 3-1 Transformer Winding Voltages

Terminals	Voltage Range
TB3-3 to TB3-10	900-1050 volts AC*
On the Red Light Module: J2-6 to Ground	100-120 volts AC
On PCB1, J3-1 to J3-2	22-26 volts AC

* If this AC voltage is substantially below the specified minimum value, check tuning capacitor C4.

Trigger Coupling Transformer (T3)

Visually observe the transformer for damage. Check the transformer for open windings by measuring the primary and secondary windings with an ohmmeter. An open winding indicates infinite ohms on the ohmmeter. A normal winding should indicate zero ohms.

Flashhead

Flashtube (FT101)

Visually inspecting a flashtube reveals little about its working condition or performance. 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 1.5 ohms. Check the ferrite core for cracks. Check the mounting screws for tightness.

Coupling Transformer (T102)

Visually observe the transformer for damage. Check the transformer for open windings by measuring the primary and secondary windings with an ohmmeter. An open winding indicates infinite ohms on the ohmmeter. A normal winding should indicate zero ohms.

Photocell

To test the photocell, cover the photocell and ensure that the manual Intensity Control switch on the power converter is set to Auto. The power converter should switch the light system to red night operation in about a minute. Then remove the cover and allow the power converter to switch back to day mode.

If either the daytime or nighttime conditions is not exactly as described, replace the photocell.

Component Removal and Replacement

Refer to *Figure 4-1 PC 314-3/PC 314-3A Power Converter Component Locations* and *Figure 4-4 Flashhead Component Locations*. Also, refer to *Figure 2-10 PC 314-3 or PC 314-3A Power Converter Internal Wiring* and *Figure 2-13 Flashhead Internal Wiring*.

Power Converter

Capacitors

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

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

Removal

1. Disconnect the wires leading to capacitors.
2. Remove the hold-down screws, then lift the capacitors from their receiving holes.

Replacement

Reverse the removal procedure. Reconnect the wires to capacitors and verify that wiring agrees with *Figure 2-10 PC 314-3 or PC 314-3A Power Converter Internal Wiring*. 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. This occurs by interference between the insulation on the wire terminal and the insulation surrounding their terminal cluster on the capacitor. FTCA recommends that you lightly squeeze the quick-connect wire terminals with pliers before reinstalling them over the capacitor terminal blades.

Timing and Trigger Board (PCB1)

Removal

1. Remove all connector plugs from PCB1 headers.
2. Loosen (but do not remove) the four screws located near the corners of the board.
3. Slide the board so that it clears the four screws and remove it from the power converter.

Replacement

1. Reverse the removal sequence.

Input Power Module

Removal

1. Remove all accessible wires and cable connectors attached to the Input Power Module and to T1 located under the Module.
2. Loosen the screws in the base that fasten the Module to the base.
3. Remove the screw under the ground terminal to the left of TB4. This screw fastens the Module bracket to the main component bracket.
4. Carefully slide the 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 Module bracket.

Replacement

1. Reverse the removal sequence.
2. Verify that wiring agrees with *Figure 2-10 PC 314-3 or PC 314-3A Power Converter Internal Wiring* 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 Module to the base.
4. Remove the Module. Be careful of components and connectors.

Replacement

1. Reverse the removal sequence.
2. Verify that wiring agrees with *Figure 2-10 PC 314-3 or PC 314-3A Power Converter Internal Wiring* 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 sequence.
2. Verify that wiring agrees with *Figure 2-10 PC 314-3 or PC 314-3A Power Converter Internal Wiring* and restore the wire routing to its original state.

HV Rectifier Board (PCB2)

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. Slide the circuit board under the terminal block screws and tighten them.
2. Replace the Red Light Module.

3. Verify that wiring agrees with *Figure 2-10 PC 314-3 or PC 314-3A Power Converter Internal Wiring* and restore the wire routing to its original state.

Mode Relay (K2)

Removal

1. Remove the Red Light Module.
2. Remove the Input Power Module.
3. Remove the capacitors.
4. Remove PCB1.
5. Loosen the four screws that hold the Main Bracket to the base.
6. Slide the Main Bracket up off the screws. Be careful of the cable and cable connectors. You may hang the Main Bracket over the edge of the connector panel to perform the remaining steps.
7. Loosen the screws that fasten the wiring connectors to K2.
8. Carefully remove the wires from the terminals of the relay and note their locations so that you may more easily replace them.
9. Remove the screws that hold K2 to the base.
10. Remove K2.

Replacement

1. Reverse the removal sequence.
2. Verify that wiring agrees with *Figure 2-10 PC 314-3 or PC 314-3A Power Converter Internal Wiring* and restore the wire routing to its original state.

Discharge Relay (K3)

Removal

1. Remove K3 as in the Removal procedure for K2.

Replacement

1. Reverse the removal sequence as in the removal and replacement sequence for K2.
2. Verify that wiring agrees with *Figure 2-10 PC 314-3 or PC 314-3A Power Converter Internal Wiring* and restore the wire routing to its original state.

Marker Control Relay (K5)

The Red Light Module including K5 is replaced as a unit.

Trigger Transfer Relay (K6)

The Red Light Module including K6 is replaced as a unit.

Trigger Coupling Transformer (T3)

Removal

1. Remove the Red Light Module .
2. Remove the Input Power Module.
3. Remove the capacitors.
4. Remove PCB1.
5. Loosen the four screws that hold the Main Bracket to the base.
6. Slide the Main Bracket up off the screws. Be careful of the cable and cable connectors. You may hang the Main Bracket over the edge of the connector panel to perform the remaining steps.
7. Loosen the screws that fasten the wiring connectors to T3. One thin blue wire goes to ground. The other thin blue wire goes J16 on PCB1. Both thick blue wires go to J5 of PCB1. Pay special attention to the orientation of the wires on the transformer and their connection to the other components. *Replace them in the same orientation.*

Replacement

1. Reverse the removal sequence. Note the connections to T3 as in Step 7 of the Removal, and replace the wires to their connections in the same way.
2. Verify that wiring agrees with *Figure 2-10* and restore the wire routing to its original state.

Burst Choke (L1)

Removal

1. Remove the Red Light Module.
2. Remove the wire connections to L1.
3. Remove the two screws that hold L1 on the Main Bracket.

Replacement

1. Reverse the removal sequence.

Discharge Resistor (R1)

Removal

1. Remove the Red Light Module.
2. Remove the Input Power Module.
3. Remove the capacitors.
4. Remove PCB1.
5. Loosen the four screws that hold the Main Bracket to the base.
6. Slide the Main Bracket up off the screws. Be careful of the cable and cable connectors. You may hang the Main Bracket over the edge of the connector panel to perform the remaining steps.
7. Loosen the screws that fasten the wiring connectors to Resistor R1.

Replacement

1. Reverse the removal sequence.

Burst Resistors (R2A AND R2B)

Removal

1. Remove the Red Light Module.
2. Remove the Input Power Module.
3. Remove the capacitors.
4. Remove PCB1.
5. Loosen the four screws that hold the Main Bracket to the base.
6. Slide the Main Bracket up off the screws. Be careful of the cable and cable connectors. You may hang the Main Bracket over the edge of the connector panel to perform the remaining steps.
7. Loosen the screws that fasten the wiring connectors to Resistors R2A and R2B.

Replacement

1. Reverse the removal sequence.

Sense Transformer (PCB4)

Removal

1. Remove the Red Light Module.
2. Remove the Input Power Module.
3. Remove the capacitors.
4. Remove PCB1.
5. Loosen the four screws that hold the Main Bracket to the base.
6. Slide the Main Bracket up off the screws. Be careful of the cable and cable connectors. You may hang the Main Bracket over the edge of the connector panel to perform the remaining steps.
7. Remove the wiring connections to PCB4. Note their locations.

Replacement

1. Reverse the removal sequence.

Flashhead

Flashtube (FT101)

Removal

1. Loosen the three screws (on screw lugs) directly under the flashtube, which hold the flashtube connector pins. Doing this enables you to disengage the flashtube. Carefully lift the flashtube upward from the assembly.

Replacement

1. 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 support column directly under it.
2. 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 hook-up 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 respect to fixed fea-

tures on the bracket, since 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 will 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 wires. Verify that wiring agrees with *Figure 2-13 Flashhead Internal Wiring.*

Coupling Transformer (T102)

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

Operational Checkout

Single-Unit System

During testing expose the photocell to normal outdoor daylight. Carefully perform the following steps and take the suggested action if any of the responses differ from the response described.

Multiple-Unit System

A system with more than one power converter unit is a multiple-unit system. Refer to any figure in *Section 2* that shows multiple-unit installation. You connect the first unit; the designated master unit, from terminals TB1-1 and TB1-2 directly to the photocell. The two other power converters each jumper together their terminals TB1-1 and TB1-2. Intensity information is supplied over the master/slave interconnect line to all power converters.

Each power converter, in the chain of power converters, sends a synchronization signal over the bidirectional wires at terminals TB1-4 and TB1-5 to flash all lights together. Note that a lamp going out in a tier of red incandescent marker lights indicates a marker alarm.

Normal operation at night calls for monitoring a set of steadily burning markers installed at one structure level (tier). In configurations with more than one flashhead at the same structure level (or tier), the additional flashhead does not have associated markers. That is, this last flashhead connected to the last power converter in a multiple-unit installation does not have associated markers.

PCB1 can sense or ignore markers. It senses them by examining the marker current. It ignores them if the MRK0 and MRK1 jumpers on the 24740xx PCB1 are clipped (or switches SW1 and SW2 are *off*), or the internal programing of the 24747xx PCB1 is programmed for no markers. Therefore, before troubleshooting, you must verify correct marker installation wiring, programming, and operation.

Testing Each Unit

To test each unit in a multiple-unit system, use the following procedures:

1. Disconnect the wires labeled master/slave interconnect at TB1-4 and TB1-5.
2. Test this unit as described in *Section Single-Unit System*.

PEC Testing

The photocell is wired directly to the first (master) power converter at TB1-1 and TB1-2.

1. First, disconnect the photocell. The single unit, or multiple unit, system should revert to nighttime operation.
2. Disconnect TB1-4 and TB1-5 on each power converter.
3. Operate the intensity control switch on each power converter in turn.
4. If each power converter operates correctly with the intensity control switch, troubleshoot

the PEC wiring or the circuits in the incorrectly operating power converter.

5. Reconnect all wires.

Checkout Procedures

Use instructions in *Table 3-2* and *Table 3-3* to checkout the equipment. To perform the procedures, you must open the cover of the power converter or converters. To check out multiple units, all units must be operating. Observe and confirm the operation for each power converter individually.

The procedures assume the photocell (PEC) is exposed to daytime sky conditions.

Set all intensity select switches to AUTO, which allows the photocell to control the intensity.

The steps in *Table 3-2* or *Table 3-3* are related to each other and should be performed together in the sequence given here. If a unit does not behave *exactly* as described, proceed to *Troubleshooting the System* in this section.

Table 3-2 Checkout of Power Converters with PCB1 24740xx Board

Setup to Check Normal Daytime Operation	Response — LEDs and Structure Lights	
PEC in daylight. 1) Intensity Select Switch in AUTO. 2) Apply power (pull out interlock switch plunger).	• HV Warning Light is ON • NITE ERR LED (I 1) is off. • DAY ERR LED (I 7) is off. • PEC ALM (I 2) is off. • WHT ALM LED (I 8) is off. • RED ALM LED (I 3) is off. • MKR ALM LED (I 9) is off. • FAN LED (I 4) not used. • SYNC LED (I 10) is off. • CONF LED (I 5) is off.	• DAY LED (I 11) is on. On during daylight. • NITE LED (I 6) is off. Off during daylight. • MKRS LED (I 12) is off during daylight. • NEON bulb (I 13) is on; trigger voltage is available. • Red markers are off.
Setup to Check Normal Nighttime Operation	**Response — LEDs and Structure Lights**	
Place opaque cover over photocell (block all light). 1) Intensity Select Switch in AUTO. 2) Apply power (pull out interlock switch plunger).	• HV Warning Light is ON • NITE ERR LED (I 1) is off. • DAY ERR LED (I 7) is off. • PEC ALM (I 2) is off. • WHT ALM LED (I 8) is off. • RED ALM LED (I 3) is off. • MKR ALM LED (I 9) is off. • FAN LED (I 4) not used. • SYNC LED (I 10) flashes on in a regular pattern. May be difficult to see. • CONF LED (I 5) “flashes” on after each strobe flash. May be difficult to see.	• DAY LED (I 11) is off. Off at night. • NITE LED (I 6) is on. On at night. • MKRS LED (I 12) is on at night if markers are associated with the power converter being observed. • NEON bulb (I 13) is on; trigger voltage is available; this bulb may flash. • Red strobe is flashing. • Associated red markers are on.

Table 3-2 Checkout of Power Converters with PCB1 24740xx Board (Continued)

Setup to Check Marker Alarm	Response — LEDs and Structure Lights	
1) Place opaque cover over photocell (block all light). 2) Intensity Select Switch in AUTO. 3) Remove power. 4) Remove fuse F4. 5) Apply power.	Responses are the same as those for normal nighttime (previous) except for the following: • MKR ALM LED (I 9) is on. • MKRS LED (I 12) is on.	• Red strobe is flashing at night intensity. • Red markers are off. *Remove opaque cover over photocell.* *Remove power.* *Replace fuse F4.* *Reapply power.*
Setup to Check Red Alarm for Night Operation	**Response — LEDs and Structure Lights**	
1) Place opaque cover over photocell (block all light). 2) Intensity Select Switch in AUTO. 3) Remove power. 4) Disconnect black wire from TB2-4. 5) Apply power.	Responses are the same as those for normal nighttime (previous) except for the following: • NITE LED (I 6) is on. • WHT ALM LED (I 8) is off. • RED ALM LED (I 3) is on. Turns on in three flash cycles after applying power.	• CONF LED (I 5) is off. *Remove power.* *Replace wire on TB2-4.* *Reapply power.*

Table 3-3 Checkout of Power Converters with PCB1 24747xx Board

Setup to Check Normal Daytime Operation	Response — LEDs and Structure Lights	
1) Apply power (pull out the interlock switch plungers to the service position). 2) Set the intensity select switch or switches to AUTO. 3) Verify that the responses occur at each power converter in the system.	Verify that the following responses occur at each power converter in the system: • The HV Warning Light is on. • The NITE ERR LED (I 15) is off. • The DAY ERR (I 9) is off. • The PEC ALM (I 14) is off. • The WHT ALM LED (I 8) is off. • The RED ALM LED (I 13) is off. • The MKR ALM LED (I 7) is off. • The FAN LED (I 12) is off. • The SYNC LED (I 6) is off. • The CONF (confirm) LED (I 11) is off.	• The DAY LED (I 5) is on. It is on during daylight. • The NITE LED (I 10) is off for daylight operation. • The MKRS (markers) LED (I 4) is off during daylight operation. • The clear NEON bulb (I 3) is on indicating the presence of trigger voltage for the flash tube. • The associated red incandescent markers are off.

Table 3-3 Checkout of Power Converters with PCB1 24747xx Board (Continued)

Setup to Check Normal Nighttime Operation	Response — LEDs and Structure Lights
1) Place an opaque (blocks all light) cover over the photocell (PEC). Several seconds may pass before the PEC responds to the darkened condition after power is applied. 2) Set the intensity select switch or switches to AUTO. 3) Apply power (pull out the interlock switch plungers to the service position).	Verify that the responses occur as in Daytime (previous) except for those in the following list: • The DAY LED (I 5) is off. • The NITE LED (I 10) is on for night operation. • The MKRS (markers) LED (I 4) is on if markers are associated with the power converter being observed. • The red light is flashing at the nighttime intensity for this unit. • The associated red incandescent markers are on.
Setup to Check Marker Alarm Operation	**Response — LEDs and Structure Lights**
1) Cover the PEC with an opaque (blocks all light) cover. 2) Set the intensity select switch or switches to AUTO. 3) Remove power. 4) Remove fuse F4. 5) Reapply power.	Verify that the following responses occur as compared to those in Check Normal Daytime Operation, except for those in the following list (after three flash cycles): • The DAY LED (I 5) is off. • The NITE MODE LED (I 10) is on. • The MKRS (I 4) LED is on indicating that markers should be on. • The MKR ALM (I 7) LED is on indicating a marker alarm. • The light is flashing in red mode. • Remove power. • Replace F4 and recycle the unit with the Intensity Select Switch as done in Setup • Reapply power. • The unit should now be operating normally in night mode; that is: red light flashing, markers turned on, and no alarm. *Remove the temporary opaque cover placed over the PEC in Step 2.* *Set Intensity Select Switch to AUTO.* *Replace Fuse F4.*
Setup to Check Red Alarm for Night Operation	**Response — LEDs and Structure Lights**
1) Place the opaque cover over the PEC. 2) Set the intensity select switch or switches to AUTO. 3) Remove power. 4) Disconnect the black wire from TB2-4. 5) Reapply power.	The following responses denote a light failure during normal nighttime operation. Verify that they occur as compared to those in Check Normal Daytime Operation, except for those in the following list (after three flash cycles): • The DAY MODE LED (I 5) is off. • The NITE MODE LED (I 10) is on. • The WHT ALM LED (I 8) is on. • The RED ALM LED (I 13) is on. (The power converter cycles executes 3 internal flash cycles before turning on the Red Alarm.) • The SYNC LED (I 6) flicks on regularly. • The CONF (flash confirm) LED (I 11) is off. These denote a light failure during normal nighttime operation. *Remove power.* *Reconnect the black wire to TB2-4.* *Reapply power.* *Remove cover from photocell.* *Verify operation as in Daytime Operation.* *Reapply power.*

Troubleshooting the System

Effective troubleshooting begins with careful observations of operating behavior, often leading directly to the cause of a problem. Diagnostic procedures in this subsection are divided into two categories: *unit* level, originating in a single unit; and *system* level, problems affecting all units in a multiple-unit system in the same way. However, in a multiple-unit system some *unit-level* malfunctions could cause problems involving the entire system.

For example, if one light in a multiple-unit system fails to flash, *Table 3-4* directs you to *Table 3-5*, the troubleshooting guide for a unit-level problem (but not a system-level problem).

For each symptom, the troubleshooting guides list one or more probable causes in descending order of probability. Continuing with our example, assume that the light fails to flash during the day (No in column 1) and at night (No in column 2). High voltage is absent (No in column 3), but low voltage is present (OK in column 4). This condition is described in the fourth row of *Table 3-5*. The last column lists possible causes. The most probable cause is a shorted capacitor, the second most probable cause is a shorted flashhead cable, and so on.

When you trace a problem to a specific component, see *Section Component Testing* and *Section Component Removal and Replacement*, in this Section.

Table 3-4 Selecting the Correct Troubleshooting Guide

	Single-Light System	Multiple-Unit System	
		Units Affected Differently, Usually Only One Failing Unit A Unit-Level Problem	All Units Affected the Same Way A System Level Problem
Troubleshooting Guide	*Table 3-5*	*Table 3-5*	*Table 3-6*

Table 3-5 Unit Troubleshooting Guide

Night Flash Conditions	Other Conditions			Probable Causes (All Units Unless Specifically Indicated)	
	HV†	LV*			
No	OK†	OK		• FT101 Flashtube • Flashhead cable connections • T101 Transformer	• T1 Transformer • T3 Transformer • BR1 Bridge • PCB1
No	No	No	Blows Fuse F1	• Varistor MOV	• T1 Transformer
No	No	No		• F1 Fuse • S1 Interlock	• T1 Transformer • Connections - main power
No	No	OK		• C2A-D, or C3 shorted	• Shorted FH Cable
No	OK	No	No indicators lit on PCB1	• PCB1 Board • T1 Power Transformer	• BR1 Bridge
OK	OK	OK	Red Alarm	• PCB1 Board • Photocell circuit	• K2 Relay • Intensity select switch setting
OK	OK	OK	All Markers Out	• F4 Fuse • K5 Marker Control Relay‡	• PCB1 Board
			Markers Stay On	• K5 Marker Control Relay‡	• PCB1 Board
OK	OK	OK	Marker Alarm	• One or more marker lamps out or incorrect wattage	• K5 Marker Control Relay‡ • PCB1 Board
-	OK	OK	Incorrect Mode	• S2 Intensity Select Switch is not in AUTO position	• PEC or PEC wiring • PCB1
No	OK	OK	Red Alarm	• Flashtube • K6 Trigger Transfer Relay • PCB1 Board • K2 Relay	• C3 Burst Capacitor Open • L1 Burst Choke • R2 Burst Resistor

† HV = High voltage. PCB2 or HV neon lamp lit confirms HV.
‡ Replace the entire red light module if any components therein fail.
* LV = Low voltage. Any PCB1 LEDs on confirms LV.

Table 3-6 System Troubleshooting Guide

Night Flash Conditions	Other Conditions	Probable Causes	
No Flash	Possible PEC Error	• PEC Photocell • PCB1 Board • Intensity Select Switch	• Jumper on TB1 & 2 on slave units missing
OK	Units not flashing together	• Master/slave interconnect cable connected to TB1-4 and TB1-5.	• PCB1 in one unit.
No	No lights	• Main power line	

Using the Intensity Select Switches — Finding the Failing Unit at Night

For normal operation, set the intensity select switches on each unit to AUTO. In AUTO, an intensity signal through the master/slave interconnect wires on TB1-4 and TB1-5 controls the night intensity of all power converters and associated lights. Any power converter may send the sync signal on these wires, which flashes all lights at the same time.

You can switch any unit from day to auto or night operation (manual operation) with its Intensity Select Switch. Disconnect the wires at TB1-4 and TB1-5 on each unit and operate the Intensity Select Switch on each unit.

In manual operation, the following conditions occur on the switched power converter:

In Night Mode:

- It operates the red light only.
- It clears its red alarm (if it has one) and then re-establishes the alarm.
- It does not affect the other units.

In Day Mode:

- No operation.

Section 4 — Replaceable and Spare Parts

Customer Service

Customer Service:	1-800-821-5825
Telephone:	(615) 261-2000
Facsimile:	(615) 261-2600

Shipping Address:

Flash Technology Corporation of America

332 Nichol Mill Lane

Franklin, TN 37067

Ordering Parts

To order spare or replacment parts, call FTCA 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 part number for the PEC 510 Photocell is ***PN 1855001***.

Returning Equipment

To return equipment to FTCA, contact Customer Service for a Return Material Authorization (RMA) number.

Repackaging

Equipment must be returned in a container that provides maximum protection during shipping and handling. If the original cartons and packaging material are no longer available, package the power converter and flashhead separately as described in the following sections.

Power Converter

The power converter must be packaged and shipped horizontally (on its back); that is, with the feet downward. Pad the power converter so that the feet cannot penetrate the box during shipment. Box each power converter separately using a double thickness cardboard container and adequate padding. Do not drop. Use appropriate warning labels on the outside of the container.

Flashhead

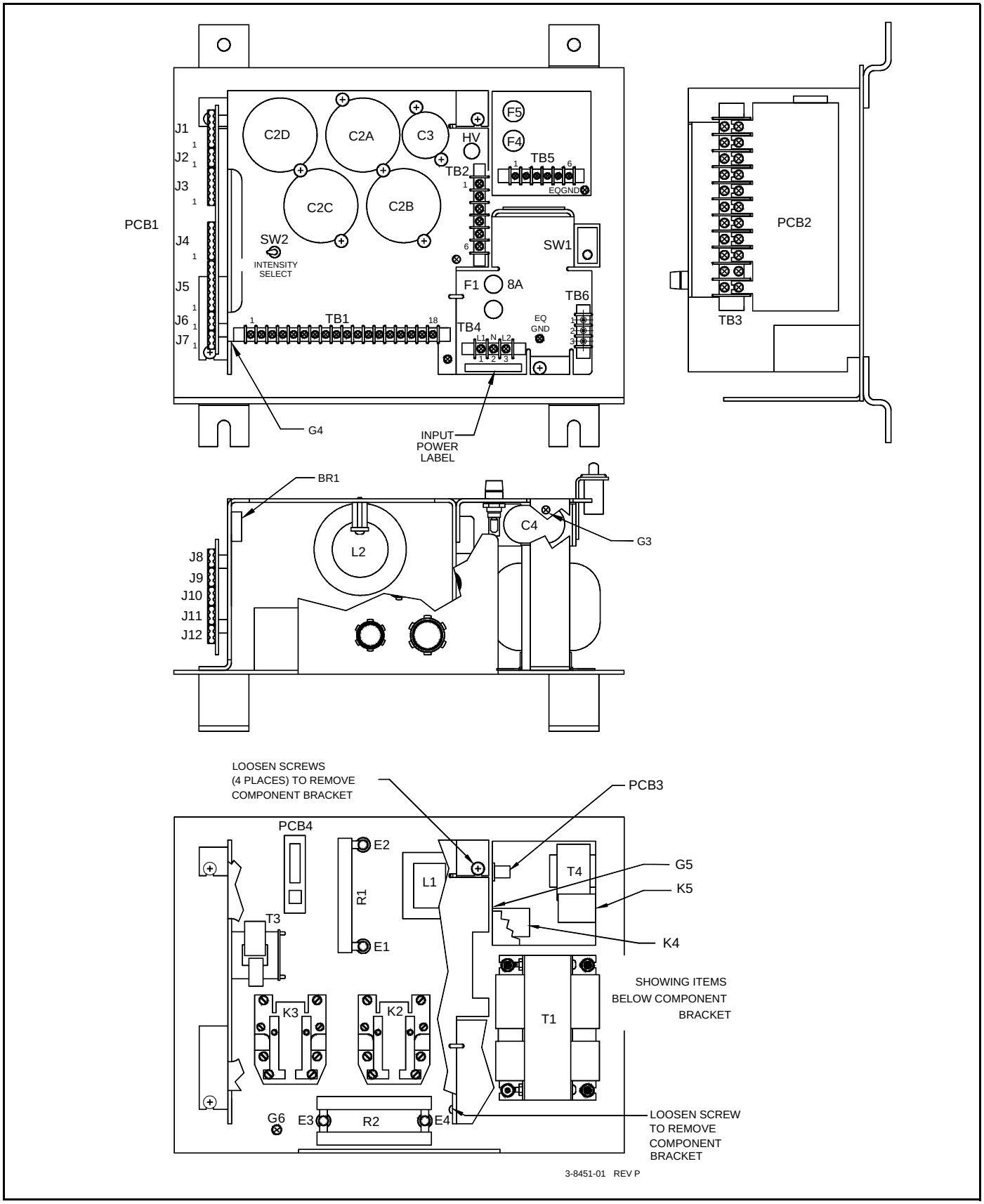
The flashhead must be packaged and shipped in an upright position. Box each flashhead separately and use adequate padding. Attach the flashhead base to a plate measuring 19 inches square (e.g., 3/8 inch plywood). Use a double thickness cardboard (or wood) container which is 19 inches square by about 25 inches high (inside dimensions). Use soft packing or a cardboard collar around the lens to prevent tipping inside the container. Do not drop. Use appropriate warning labels on the outside of the container.

Table 4-1 Power Converter Replaceable Parts

Item	Description	Part Number
C2A-C	Capacitor, Main Bank, 70 µfd	6720401
C3	Capacitor, 1 µfd	6848202
C4	Capacitor, 3 µfd	6577903
F1, F2	Fuse, Power, MDL8	†4901931
F4	Fuse, Marker Control, MDL1	4900337
F5	Fuse, Marker, MDL5	4900345
HV	Neon, High Voltage Light	4902317
K2	24V Relay, Mode	†8940094
K3	120V Relay, Discharge	†8900493
L1	Choke, Burst	4850601
L2	Choke, Flash	4175200
PCB1	Timing and Trigger Board, PC 314-3AE	*†24747xx
PCB1	Timing and Trigger Board, PC 314-3, 314-3A, 314-3 Primary/Backup	*†24740xx
PCB2	HV Rectifier Board	†2458005
PCB4	Sense Module	2811101
PCB5	Alarm Board — FTB 314-3AE	8805404
BR1	Diode Bridge	6902806
M1	Red Light Module	†1811502
R1	Resistor, Discharge, 35K 50W	6900541
R2A & R2B	Resistor, Burst, quantity two (2), 500 ohms each	6900532
S1	Switch, Interlock	4901220
S2	Switch, Toggle	†8799201
T1	Transformer, Power	8841201
T3	Transformer, Trigger	8288201
TB1	Terminal Strip, 18 position	4901930
TB2	Terminal Strip, 6 position	4902257
TB3	Terminal Strip, 11 position	8721011
TB4, TB5	Terminal Strip, 3 position	4902134
TB6	Terminal Strip, 3 position	4902157
TB7	Terminal Strip, 6 position	4902257
MOV	MOV Varistor, 120V	6901079

† Recommended as a spare part.

* This part number varies according to the specific equipment configuration and function. Be prepared to describe the system configuration when you call Customer Service for the correct PCB1 Timing and Trigger Board or fuse part number for your particular system. Have available the part number of your current PCB1 when you call.



314304001

Figure 4-1 PC 314-3/PC 314-3A Power Converter Component Locations

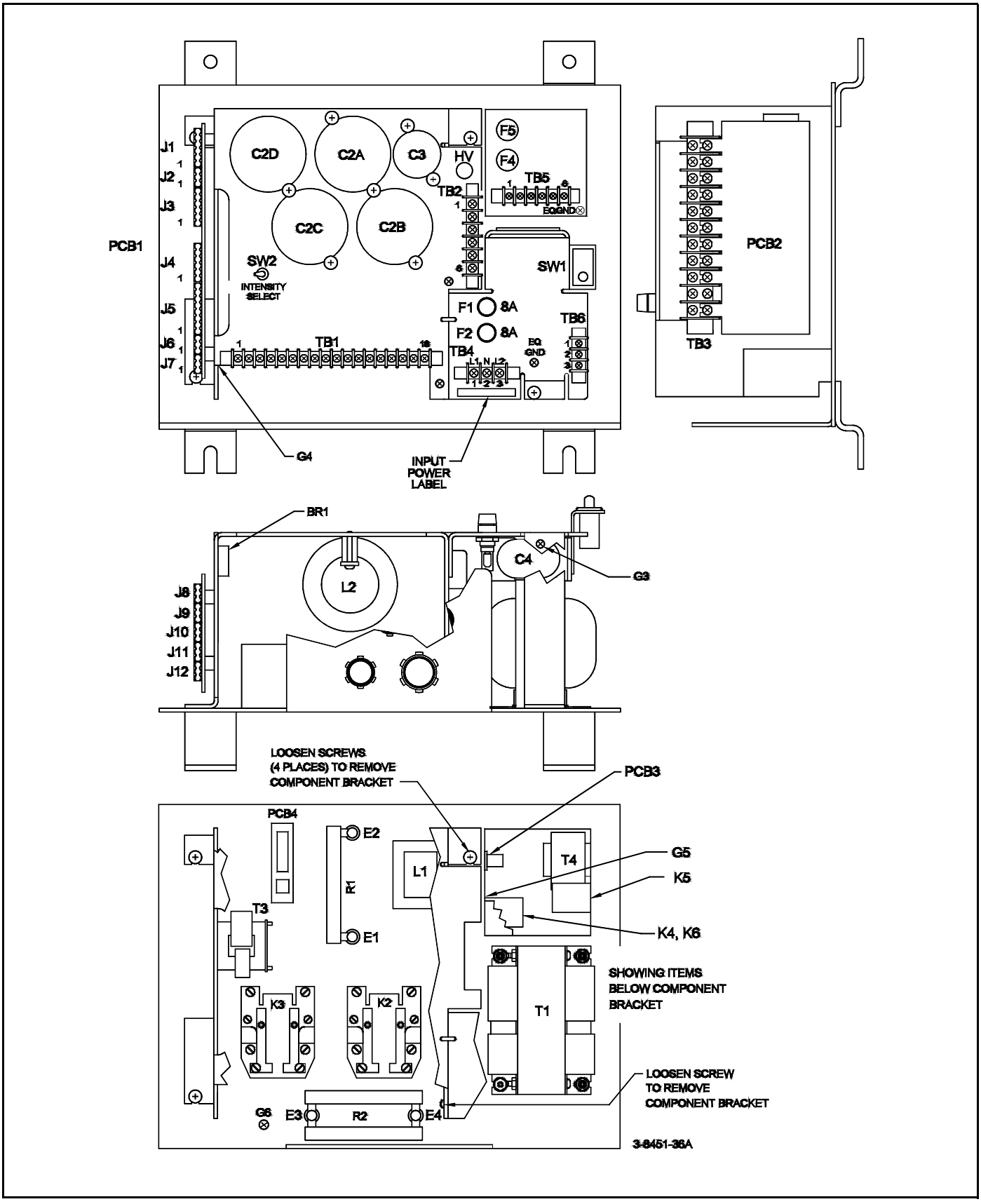


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Figure 4-2 PC 314-3A Primary/Backup Power Converter Component Locations

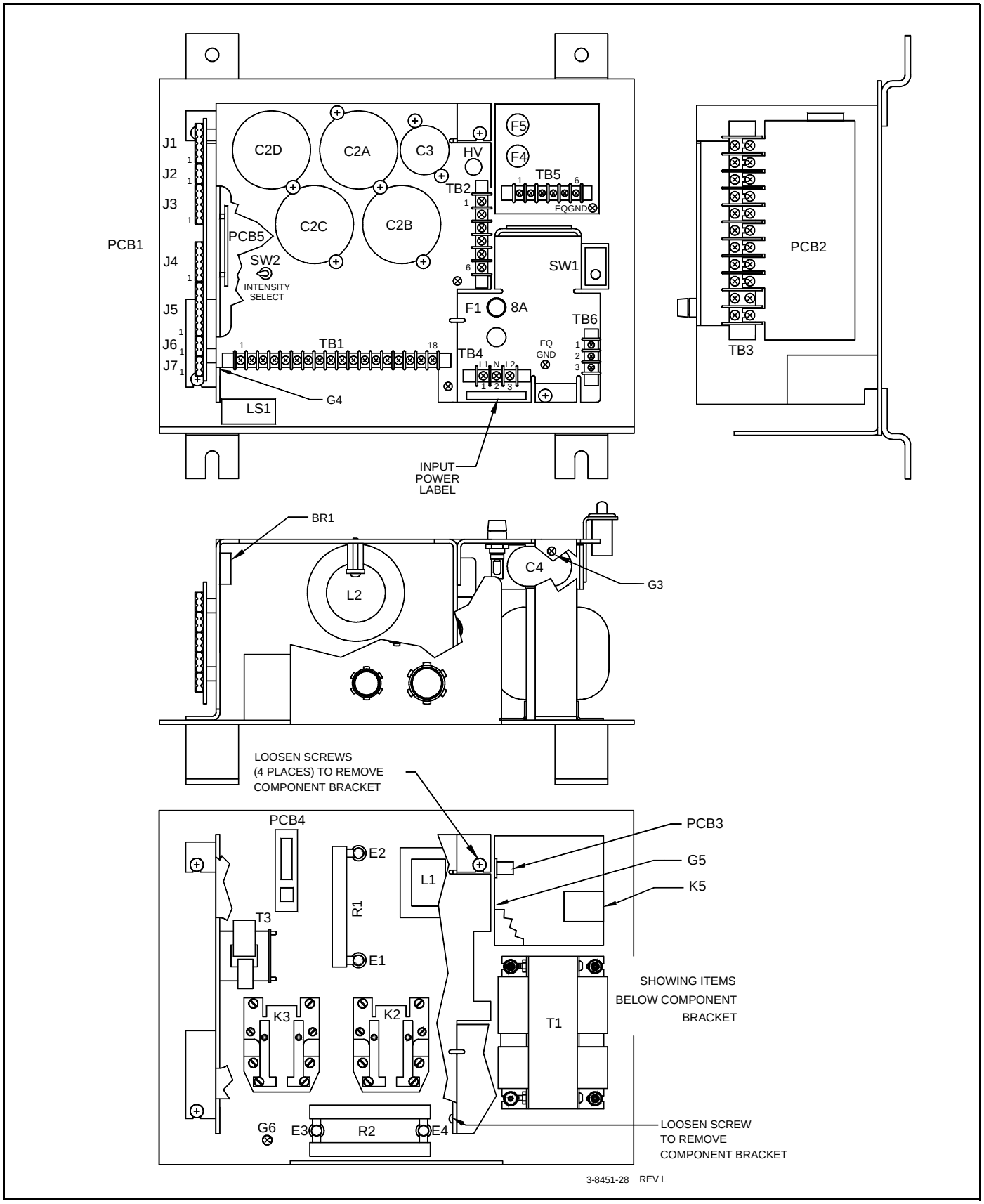

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Figure 4-3 PC 314-3AE Power Converter Component Locations

Table 4-2 Flashhead Replaceable Parts

Reference Item	Description	Part Number
FT101	Flashtube	†8384308
T101	Transformer, Trigger	8288201
T102	Transformer, Coupling	8336701
RC101	Resistor-capacitor network	1403411
RC102	Resistor-capacitor network	1403412

† Recommended as a spare part.

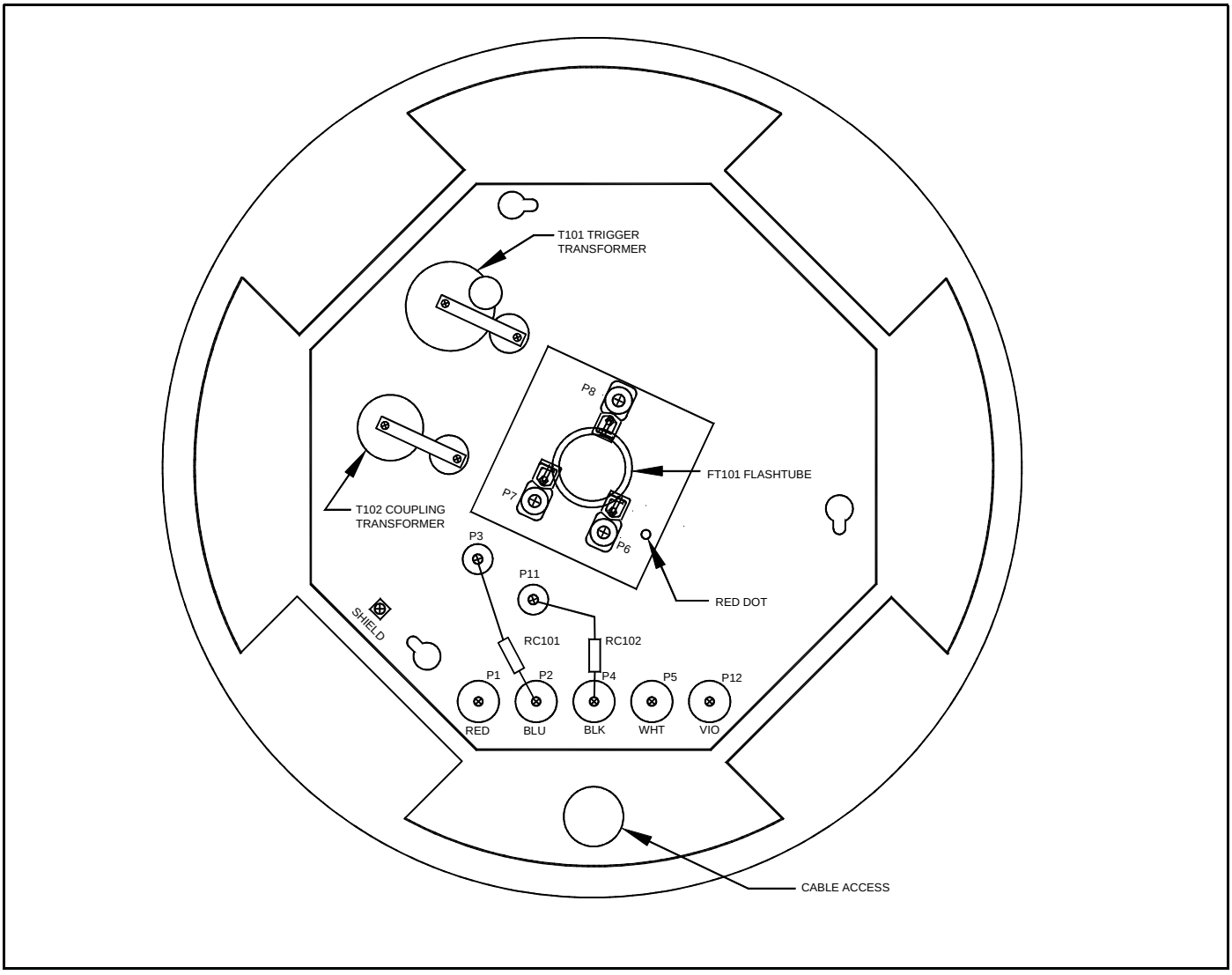

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Figure 4-4 Flashhead Component Locations

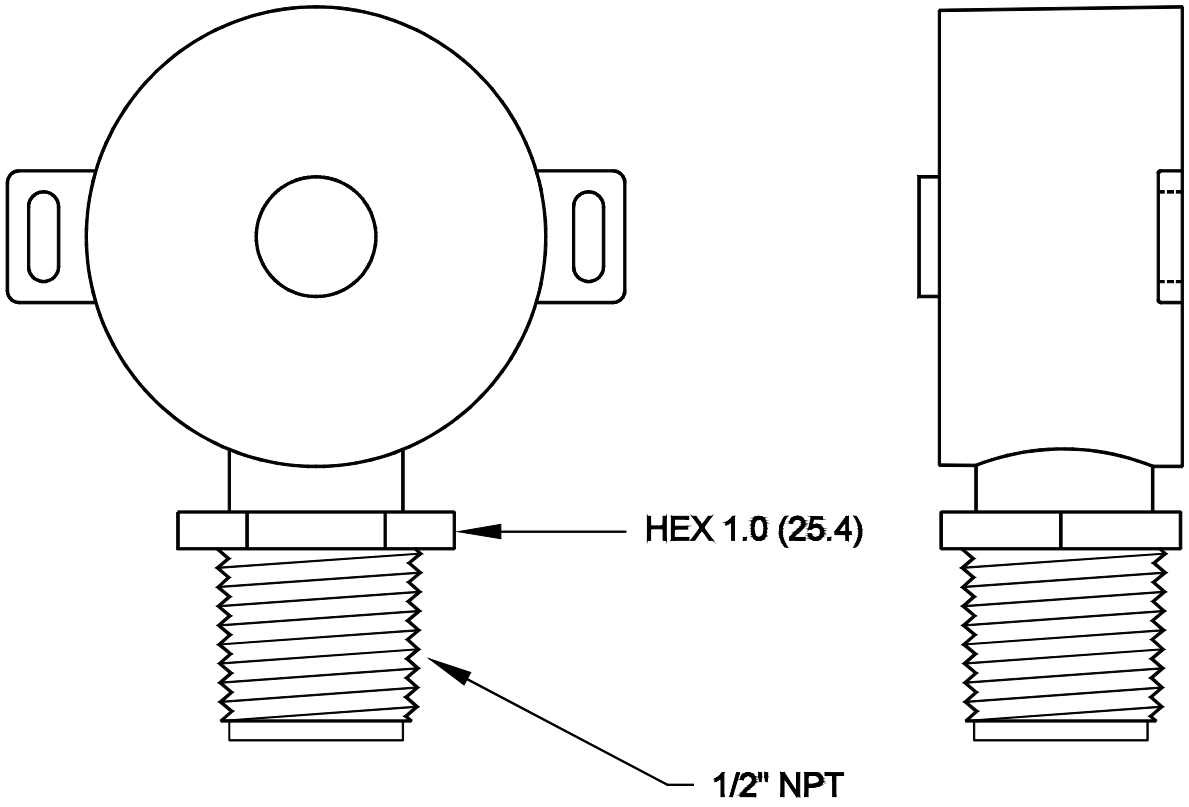

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Figure 4-5 Photocell Component Locations

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