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**FTB 302-2D**

**Dual, Medium Intensity Obstruction Light**

**FTB 224-2**

**FTB 225-2**

**Dual, High Intensity Obstruction Beacon**

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**Reference Manual**

**Part #791302D22X2**

# Front Matter

## Abstract

This manual contains information and instructions for installing, operating, and maintaining the FTB 302-2D, FTB 224-2, and FTB 225-2 Obstruction Lights.

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## Applicable Specification

This equipment meets or exceeds requirements for an FAA Type L-849 Styles A, C, and E, and Type L-859, Styles B, D, and F.

## Disclaimer

While every effort has been made to ensure that the information in this manual is complete, accurate and up-to-date, Flash Technology 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 reserves the right to revise this manual without obligation to notify any person or organization of the revision.

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

## Warranty

Flash Technology warrants all components, under normal operating conditions, for two years.

## Replacement Parts

*The use of parts not manufactured or supplied by Flash Technology or unauthorized modification of this equipment voids the warranty and could invalidate the assurance of complying with FAA requirements for Type L-849 Style A and E lights as published in Advisory Circular 150/5345-51.*

Pub. No. 0594-302/224/225-0010

## **PERSONNEL HAZARD WARNING**

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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**RMA Policy - Return Material Authorization Policy**

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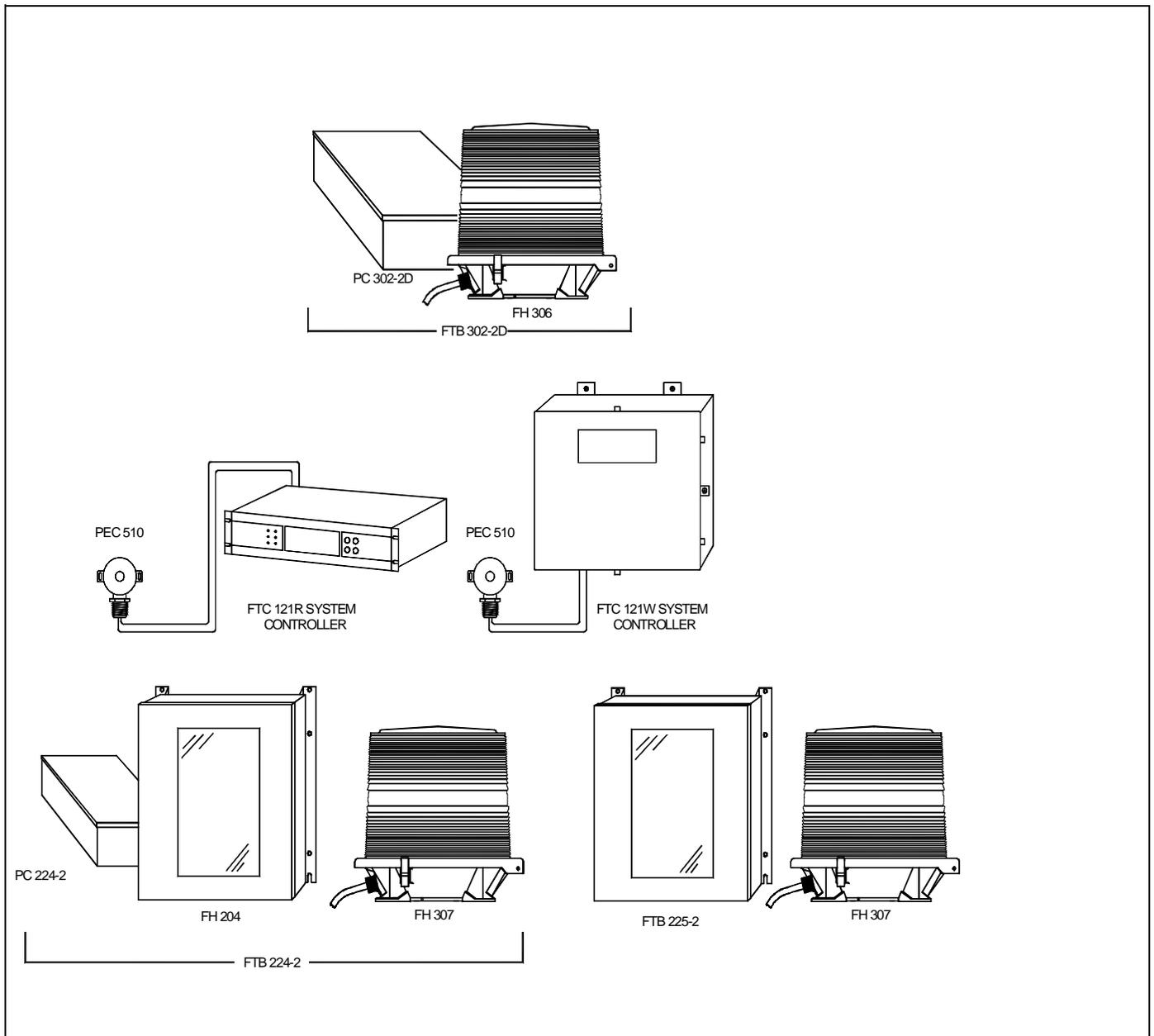
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# Section 1 — Introduction and Operation

## System

The FTB 302-2D, FTB 225-2 and FTB 224-2 ElectroFlash™ Lights are flashing lights designed and manufactured by Flash Technology Corporation of Amer-

ica® (FTCA) for obstruction lighting applications. Flash Technology's ElectroFlash Lights meet or exceed the requirements for lights as published in FAA Advisory Circular 150/5345-43.



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Figure 1-1 Related Equipment

# Specifications

These specifications do not include the power required to operate marker lights (side lights).

## Dimensions and Weight:

### PC 302-2D Power Converter:

(H x W x Depth, Wgt.):  
23 x 17.1 x 9.44 in., 90 lbs.  
584 x 435 x 240 mm., 41 kg.

### PC 224-2 Power Converter:

(H x W x Depth, Wgt.):  
23 x 17.1 x 9.44 in., 67 lbs.  
584 x 435 x 240 mm., 30 kg.

### FTB 225-2 Beacon:

(H x W x Depth, Wgt.):  
22.5 x 20.5 x 9.25 in., 85 lbs.  
572 x 521 x 285 mm., 38.6 kg.

### Flashhead:

(H x Diam, Wgt.):

<b>FH 307</b>	17 x 18.25 in., 17 lbs. 431 x 464 mm., 7.72 kg
<b>FH 306</b>	17 x 18.25 in., 23 lbs. 431 x 464 mm., 10.5 kg
<b>FH 324</b>	37.25 x 18.25 in., 31 lbs. 946 x 464 mm., 16.4 kg
<b>FH 204</b>	23 x 18.2 x 12.8 in., 18 lbs. 584 x 463 x 326 mm., 8.2 kg.

## Performance Characteristics:

### Application:

<b>FTB 302-2D</b>	L-865 (white), L-864 (red)
<b>FTB 224-2</b>	L-856 (white)
<b>FTB 225-2</b>	L-856 (white)

### Flash Intensity<sup>1</sup> (nominal):

<b>FH 306, 324 Day</b>	20,000 ±25% ECD
------------------------	-----------------

1. Intensity values in Effective Candelas (ECD) is determined by the method in the *IES Lighting Handbook, 1981 Reference Volume*, page 3-25.

<b>FH 306, 307, 324 Night</b>	2,000 ±25% ECD
<b>FH 204 &amp; FTB 225-2</b>	
Day intensity	270,000 ±25% ECD
Twilight intensity	20,000 ±25% ECD

### Beam Spread:

#### FH 307, FH 306, FH 324

Horizontal	360° (omnidirectional)
Vertical	5°

#### FH 204 & FTB 225-2 Optical Assembly:

Horizontal	120°
Vertical	3°

### Flash Rate:

#### All:

Day & Twilight	40 flashes per minute
Night	20 flashes per minute

### Electrical:

#### All:

AC Voltage:  
120, 208, 240, 480 ±10% at 60 Hz ±1%  
230 ±10% at 50 Hz ±1%

#### FTB 302-2D:

Volt-Amperes:	250 VA peak; 175 VA avg.
Watts:	Day: 130 Night (red): 75

#### FTB 224-2 or FTB 225-2:

Volt-Amperes:	600 VA peak; 400 VA avg.
Watts:	Day: 255 Night: 145

### Aerodynamic Wind Area:

#### Flashheads:

<b>FH 204</b>	1.99 sq. ft., .18 sq. m.
<b>FH 307, 306</b>	1.1 sq. ft.; .10 sq. m.
<b>FH 324</b>	1.86 sq. ft.; .173 sq. m.

#### Power Converters:

<b>PC 302-2D</b>	2.75 sq. ft.; .255 sq. m.
<b>PC 224-2</b>	2.2 sq. ft., .2 sq. m.

#### Beacon:

<b>FTB 225-2</b>	2.9 sq. ft., .27 sq. m.
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### Environmental:

FAA Advisory Circular 150/5345-43E compliance.

### Control and Monitoring:

ElectroFlash FTC 121 System Controller

## Options

Call Customer Service at 1-800-821-5825 for available options.

## Operation

### **EQUIPMENT CAUTION**

Do not operate any power converters with parts missing. Doing so may damage the equipment.

The lights begin to operate as soon as power is applied and they flash together synchronously. All lights in the FTB 302-2D, FTB 224-2, and FTB 225-2 Systems communicate with and are under the control of an FTC 121 System Controller. The controller monitors the status and operating parameters of the lights. The lights can be interrogated by the controller, or remotely by using a computer and a telephone line connected to the controller. The controller sends light intensity information, sensed by a photocell, to the lights to make them operate in the correct mode for day, twilight, or night lighting. The controller sends and receives coded signals over a two-wire shielded communications cable (COMM LINK). Programming allows a controller to distinguish the signal of each individual light for monitoring and control purposes.

The PCB1 Timing and Trigger Board in each unit controls the internal operations of the power converter or beacon. See *Section PCB1 Programming* and *Figure 1-2*. PCB1 contains indicator lights that are useful in performing an operational check and troubleshooting.

## Marker Lights

System power converters may also operate a tier of marker lights depending on the installation requirements. Each power converter is connected to the designated tier of markers through a Marker Interface Unit that contains a marker power relay, and sensing circuits for total marker current and socket voltage.

An example of a typical installation is shown in *Figure 2-14*.

## FTB 302-2D Light

The FTB 302-2D is a two-part light consisting of a PC 302-2D Power Converter and an associated FH 306 or FH

324 Flashhead. The flashhead has dual red/white operation. The FTB 302-2D usually operates with the simultaneous operation of FTB 224-2 or FTB 225-2 High Intensity Lights.

In a system that incorporates an AOL, the FTB 302-2D is the sole light of the top tier, and is programmed as Beacon 2 of that tier. The FTB 302-2D contains circuitry for two flash intensity levels and switches from one intensity level to the other in response to a signal from the controller. If the system controller should be disconnected or fail, the FTB 302-2D continues to flash at full intensity. Simultaneous flashing with the other lights usually continues even without the controller.

The flashhead and PC 302-2D Power Converter are in separate outdoor enclosures. (See *Figure 2-15*.) An electrical flashhead cable connects these two units. If a very long cable is required, consult Flash Technology by calling Customer Service at 1-800-821-5825.

## FTB 224-2 System

The FTB 224-2 is a dual system operating in white day and twilight, and red night modes. The FTB 224-2 consists of a PC 224-2 Power Converter and a separate FH 204 Flashhead. The flashhead flashes white during the day at 270,000 ECD and during twilight at 20,000 ECD. At night, the red FH 307 Flashhead flashes at 2,000 ECD.

## FTB 225-2 System

The FTB 225-2 is a dual system operating in white day and twilight, and red night modes. The FTB 225-2 operates a self-contained Optical Assembly that flashes white during the day at 270,000 ECD and during twilight at 20,000 ECD. At night, the red FH 307 flashhead flashes at 2,000 ECD.

## PCB1 Programming

*The factory programs PCB1 in each power converter or beacon for its tower address and functions.* The program is done internally and with the handheld terminal, which is used to select the specific tier and beacon number of the power converter and associated light that the PCB resides in.

Programming for a position on the structure consists of entering the numbers via the handheld terminal. The num-

bers for each light is determined by two factors: the light's height on the structure, known as its *tier*, and its location or compass point around the structure (Beacon 1 is northerly; Beacon 2 is easterly; Beacon 3 is southerly; and Beacon 4 is westerly). According to FTCA convention, the lowest tier of lights on a structure is designated Tier 1, the next highest tier is Tier 2, and so on. In a lighting system that incorporates an AOL, the FTB 302-2D is the sole light of the top tier, and is programmed as Beacon 2 of that tier. See section 5.

## **PCB1 Indicator LEDs and Lamps**

PCB1 contains indicators that are useful in performing an operational check and troubleshooting.

Nine indicator LEDs and one neon lamp on PCB1 monitor equipment operation. A name imprinted on the board adjacent to the indicator identifies it. The neon lamp has no name next to it. *Figure 1-2* shows the location of the LEDs and lamp on the board.

**Table 1-1 Timing and Trigger Board LEDs and Lamps**

LED/Lamp	Name	Color	Function
ALARM	I 1	Red	Indicates a flash failure, usually. Other alarms may be present (determined at the system controller).
SYNC	I 2	Grn	Indicates that a valid sync signal was received from the system controller (once every 6 seconds).
CONF	I 3	Grn	Indicates that the power converter flash sensing circuit issued a flash confirmation signal because the flash energy was good.
NITE	I 4	Grn	Indicates that the current operating mode is <i>night</i> mode.
TWI	I 5	Grn	Indicates that the current operating mode is <i>twilight</i> mode.
DAY	I 6	Grn	Indicates that the current operating mode is <i>day</i> mode.
	I 7	Grn	
	I 8	Grn	Indicates Intensity Alarm
NEON Lamp (Trigger)	I 9	Clear	Indicates the presence of 120VAC trigger voltage on the trigger capacitor. This lamp may flicker when a triggering pulse is applied to the flashtube.

## FTB 302-2D Operation Check

Operate the FTB 302-2D from the controller. You can switch the operation of the FTB 302-2D from day mode to night mode. As you do so, you can observe the operation of the flashhead and the LED indicators on PCB1.

### Observing FTB 302-2D Day Operation

Switch the controller to day mode and observe the operation of the flashhead connected to the PC 302-2D Power Converter. It should be operating at 40 flashes per minute at normal bright white day intensity. Observe the LED indicators.

### LED Daylight Response

- I 6 DAY is on indicating that the current operation is day mode.
- I 5 TWI is off.
- I 4 NITE is off.
- I 2 SYNC flashes each time a valid sync signal is received from the System Controller.
- I 3 CONF blinks on indicating that PCB1 issued a flash confirmation signal because the flash was good.
- I 1 ALARM is off indicating that no alarm is present in the board. On indicates a flash failure but it may indicate other failures.
- NEON I 9 is on indicating that trigger voltage is present on PCB1.

## Observing FTB 302-2D Night Operation

Switch the controller to night mode and observe the operation of the flashhead connected to the PC 302-2D Power Converter. It should be operating at 20 flashes per minute at normal red night intensity. Observe the LED Indicators.

### LED Nighttime Response

- I 6 DAY is off.
- I 5 TWI is off.
- I 4 NITE is on indicating that the current operation is night mode.
- I 2 SYNC flashes each time a valid sync signal is received from the System Controller.
- I 3 CONF blinks on indicating that PCB1 issued a flash confirmation signal because the flash was good.
- I 1 ALARM is off indicating that no alarm is present in the board. On indicates a flash failure but it may indicate other failures.
- NEON I 9 is on indicating that trigger voltage is present on PCB1.

## FTB 224-2 Operation Check

Operate the FTB 224-2 from the controller. You can switch the operation of the FTB 224-2 from day mode to night mode while observing the operation of the flashhead and the LED indicators on PCB1.

### **Observing FTB 224-2 Day Operation**

Switch the controller to day mode and observe the operation of the FH 204 flashhead connected to the PC 224-2 Power Converter. It should be operating at 40 flashes per minute at normal bright white day intensity. Observe the LED Indicators as discussed in *LED Daylight Response* for the FTB 302-2D.

### **Observing FTB 224-2 Night Operation**

Switch the controller to night mode while observing the operation of the FH 307 Flashhead connected to the PC 224-2 Power Converter. It should be operating at 20 flashes per minute at normal red night intensity. Observe the LED Indicators as discussed in *LED Nighttime Response* for the FTB 302-2D.

### **FTB 225-2 Operation Check**

Operate the FTB 225-2 from the controller. You can switch the operation of the FTB 225-2 from day mode to

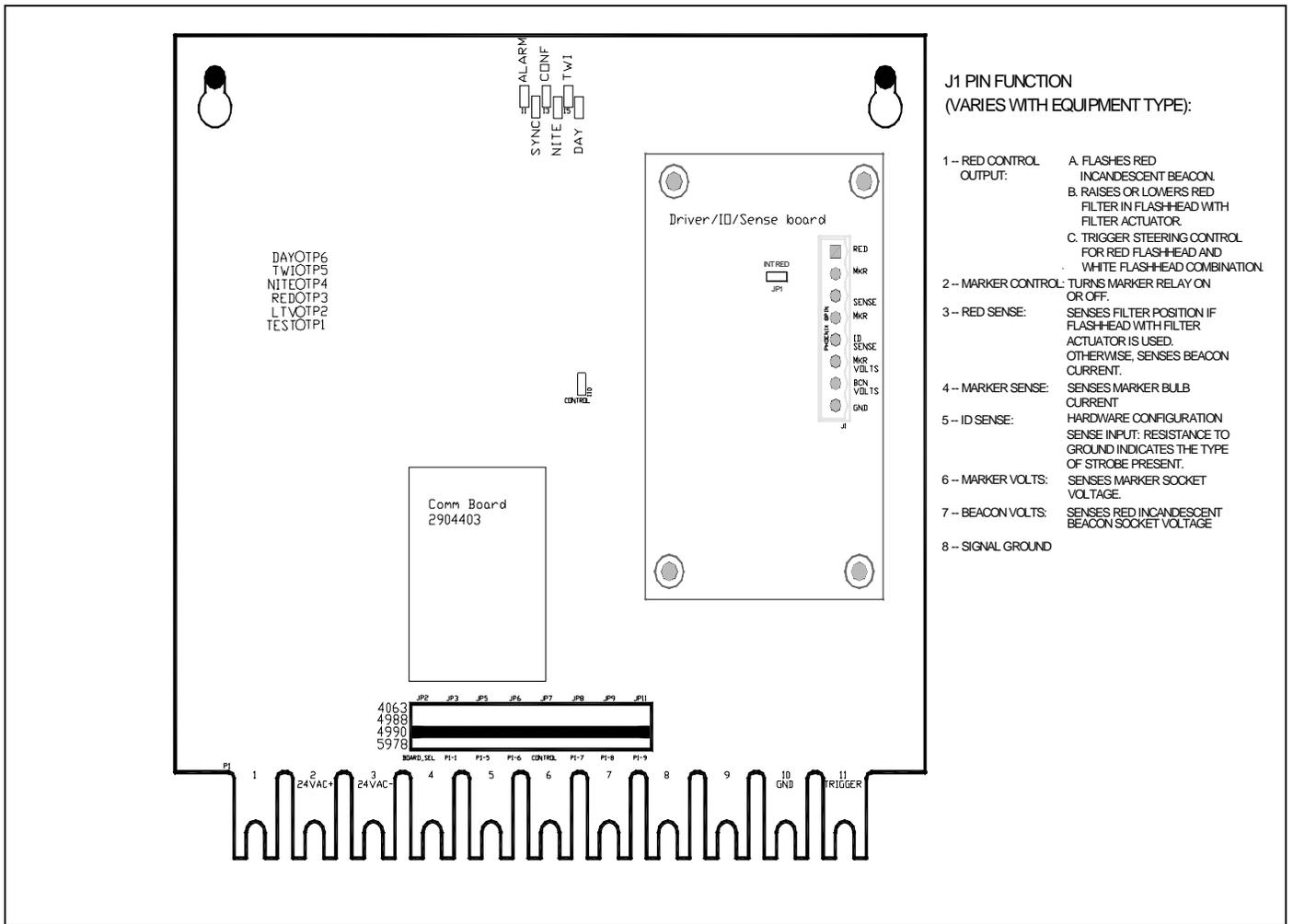
night mode while observing the operation of the beacon and the LED indicators on PCB1.

### **Observing FTB 225-2 Day Operation**

Switch the controller to day mode while observing the operation of the beacon. It should be operating at 40 flashes per minute at normal bright white day intensity. Observe the LED Indicators as discussed in *LED Daylight Response* for the FTB 302-2D.

### **Observing FTB 225-2 Night Operation**

Switch the controller to night mode while observing the operation of the FH 307 Flashhead connected to the FTB 225-2 Beacon. It should be operating at 20 flashes per minute at normal red night intensity. If you do this during daylight, the flashes may be difficult to observe at a location near the tower base because the lens directs the light in a horizontal pattern. Observe the LED Indicators as discussed in *LED Nighttime Response* for the FTB 302-2D.



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**Figure 1-2 PCB1 Timing and Trigger Board**

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# Section 2 — Outline, Mounting, and Installation

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## Unpacking

Inspect 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

Although no special tools are necessary, the following hand tools are suggested for installation:

- Phillips®-head screwdriver, #2
- 9- or 12-inch (# 2 -  $\frac{3}{16}$ "), flat-blade screwdriver
- 9- or 12-inch (# 3 -  $\frac{5}{16}$ "), flat-blade screwdriver
- Medium, slip joint pliers
- Set of combination wrenches
- Long-nose pliers
- 8-in. adjustable wrench
- Assorted nut-driver handles ( $\frac{1}{4}$ ",  $\frac{5}{16}$ ",  $\frac{3}{8}$ " )
- Universal terminal crimper
- Triplet™ Model 630-NA VOM, or equivalent analog volt-ohm meter

## Access

### **WARNING**

Before proceeding, read the warning on Page iii. Disconnect the primary power before opening the power converter cover.

## **Power Converter or Beacon**

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

## **Flashhead**

You may pivot the lens open by disengaging quick-release latches. Be careful that the lens or glass window clears nearby objects when you open and close it.

## Mounting

### **Power Converter or Beacon**

Mounting and outline dimensions for the power converter and beacon are shown in *Figure 2-1* and *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 dimensions for flashheads are shown in *Figure 2-2* through *Figure 2-4*. 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 FH 306 and FH 307 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.*

## **Wiring**

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 site installation drawings should take precedence. Consult any site-specific installation wiring diagram supplied with your equipment.

Primary power connections for single-phase systems use the same phase for all beacons.

Installation wiring is shown in Figures 2-16 through 2-18. NOTE: FTCA wiring diagrams define minimum requirements recommended for satisfactory equipment operation. *It is the responsibility of the installer to comply with all applicable electrical codes.*

The factory wires the power converters to the voltage and frequency imprinted on the equipment label. Two internal fuses reside in the power converter, sized according to the operating voltage.

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.*

## **PC 302-2D Power Converter**

For service wiring, consider the voltage, length of the wire run, and the total load (number of lights). Assume a load of 175 volt-amperes per light, and do not permit the line voltage to drop by more than 5% caused by 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).

## **PC 224-2 Power Converter or FTB 225-2 Beacon**

For service wiring, consider the voltage, length of the wire run, and the total load (number of lights). Assume a load of 400 volt-amperes per light, and do not permit the line voltage to drop by more than 5% caused by wire resistance. Use a value of 400 volt-amperes per light to determine circuit breaker or slow-acting fuse ratings at the power distribution panel. Use a value of 600 volt-amperes to determine fast-acting fuse rating and to select a system feeder transformer (if used).

## **FH 306, 307, 324 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 shielded cable, which does not require conduit for this application.

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

If you use FTCA Part Number 6340 cable without electrical conduit, you should secure it to the main structure.

## Securing the Cable

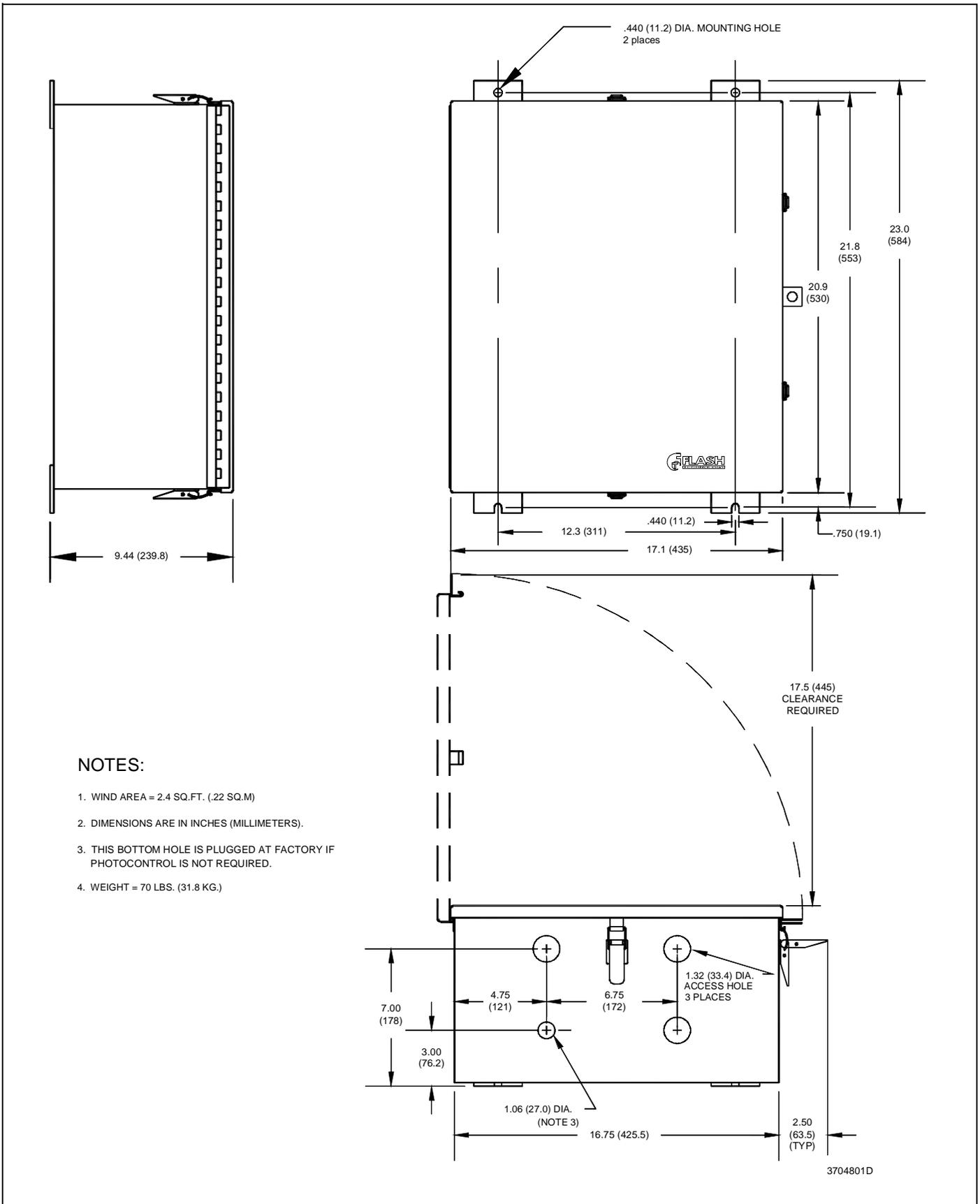
Use the following method for securing the flashhead cable to a skeletal structure:

1. Run the cable along one of the tower legs and wrap one full turn of two-inch 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.

## Installation Checklist

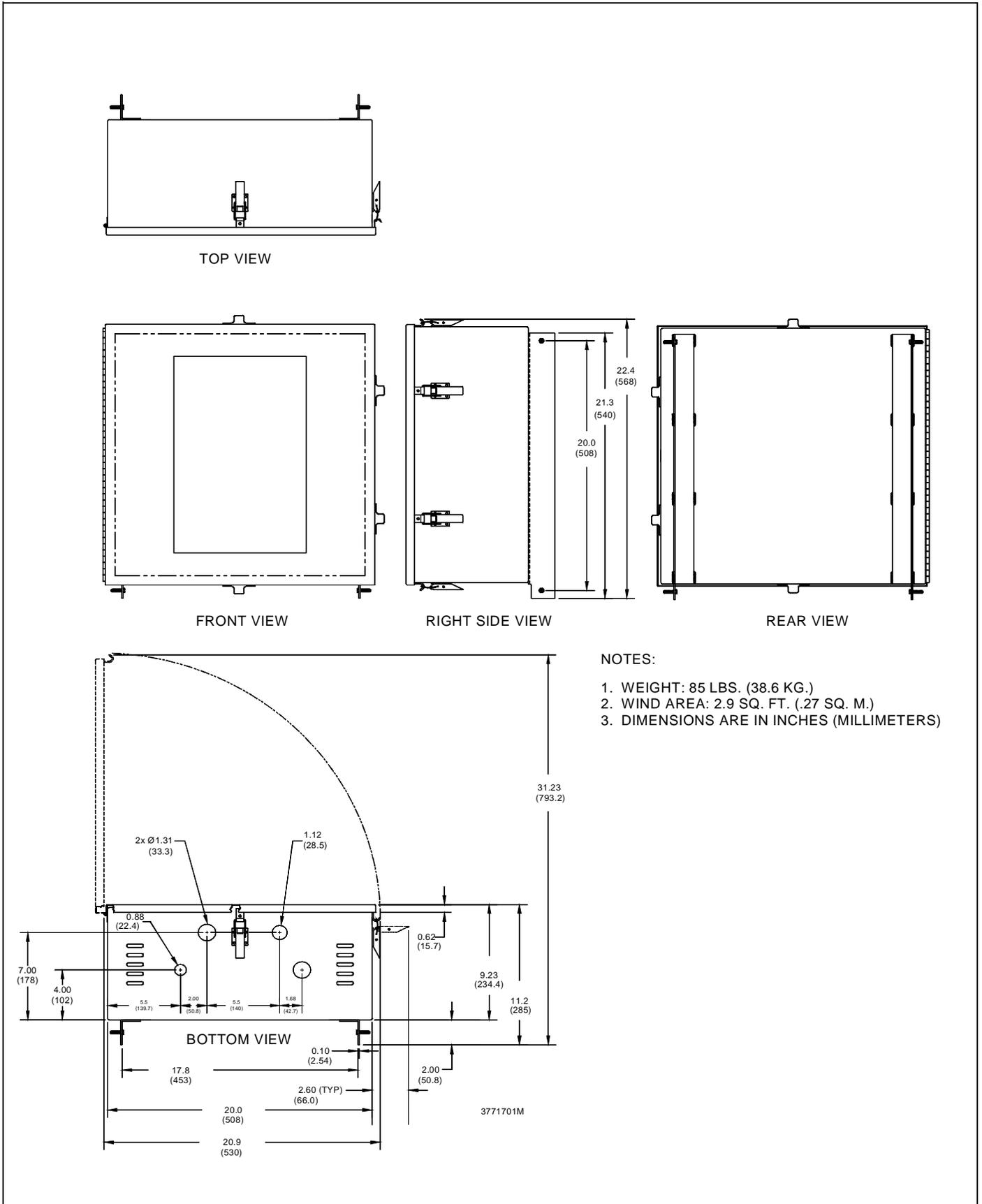
Complete the following steps before applying power:

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. Also, use the following guidelines:
    - Ensure that the case is mounted upright and grounded.
    - Check hardware inside the case to ensure that the chassis 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. **Power Converter Wiring:**  
Examine the installation drawings and use the following guidelines:
    - 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.
  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.
    - 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.
- After completing all the steps listed above, turn on the power and perform an operational checkout from procedures in Section 3 of this manual.



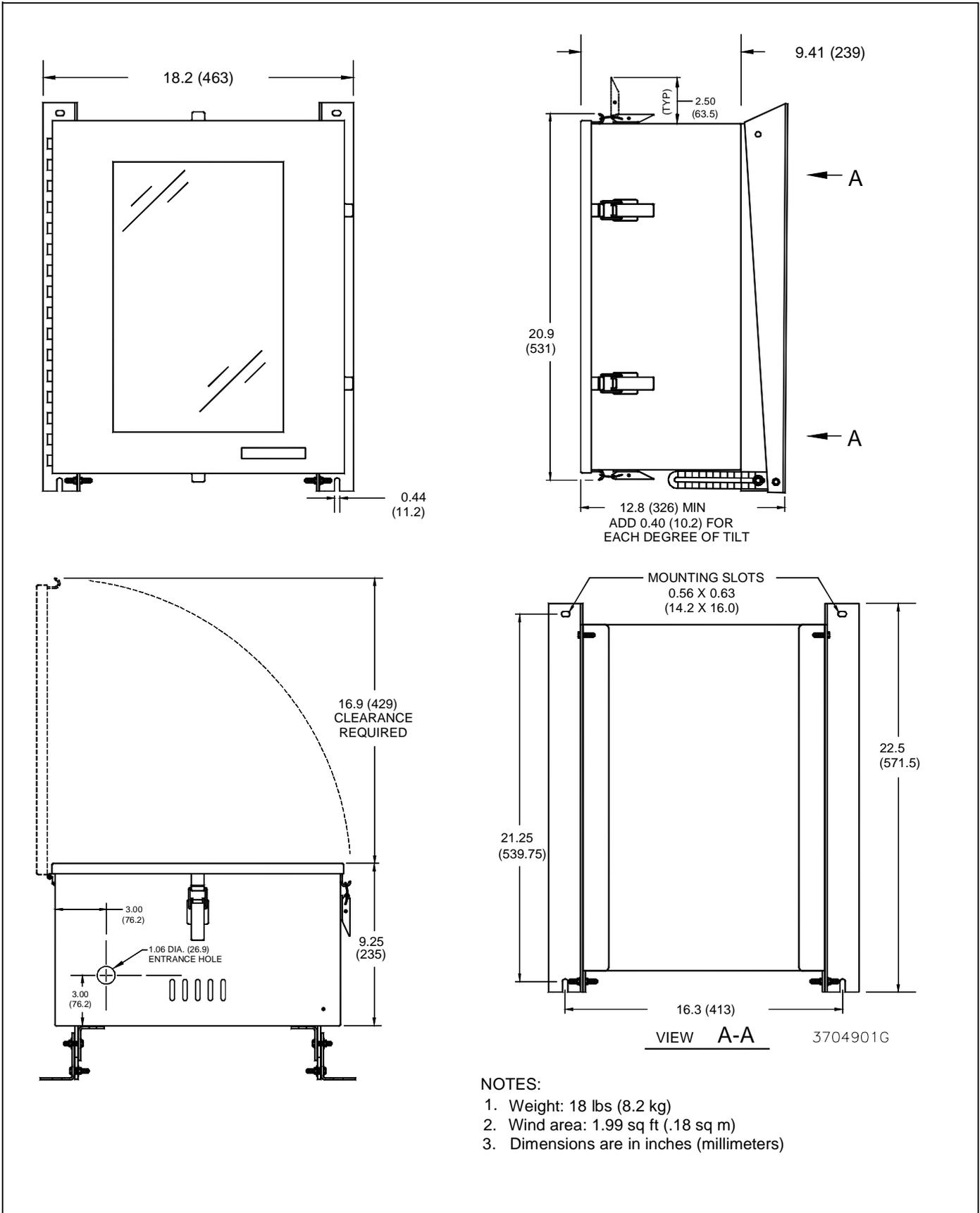
20457821

**Figure 2-1 PC 302-2D and PC 224-2 Power Converter Mounting and Outline**



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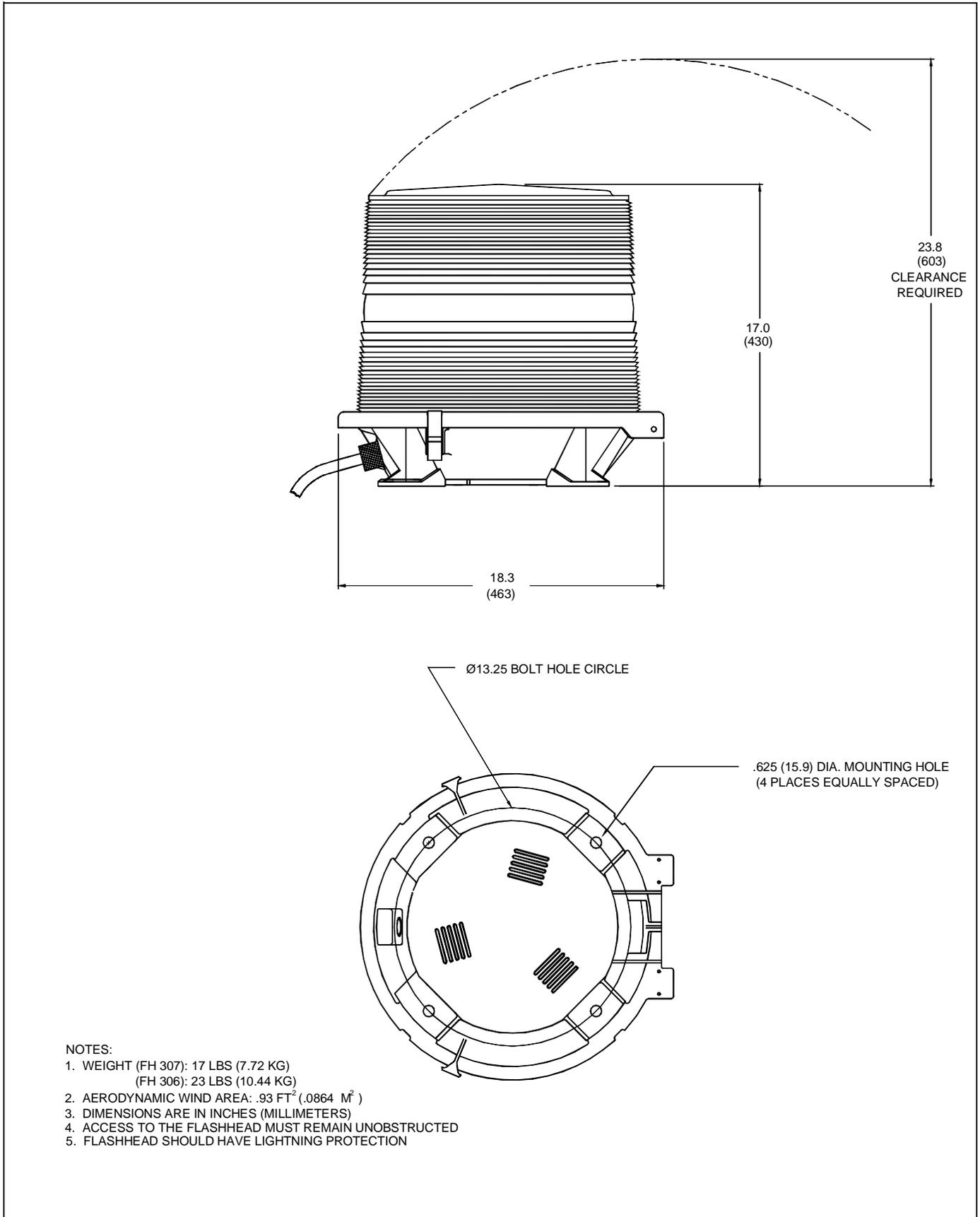
**Figure 2-2 FTB 225-2 Beacon Mounting and Outline**



- NOTES:
1. Weight: 18 lbs (8.2 kg)
  2. Wind area: 1.99 sq ft (.18 sq m)
  3. Dimensions are in inches (millimeters)

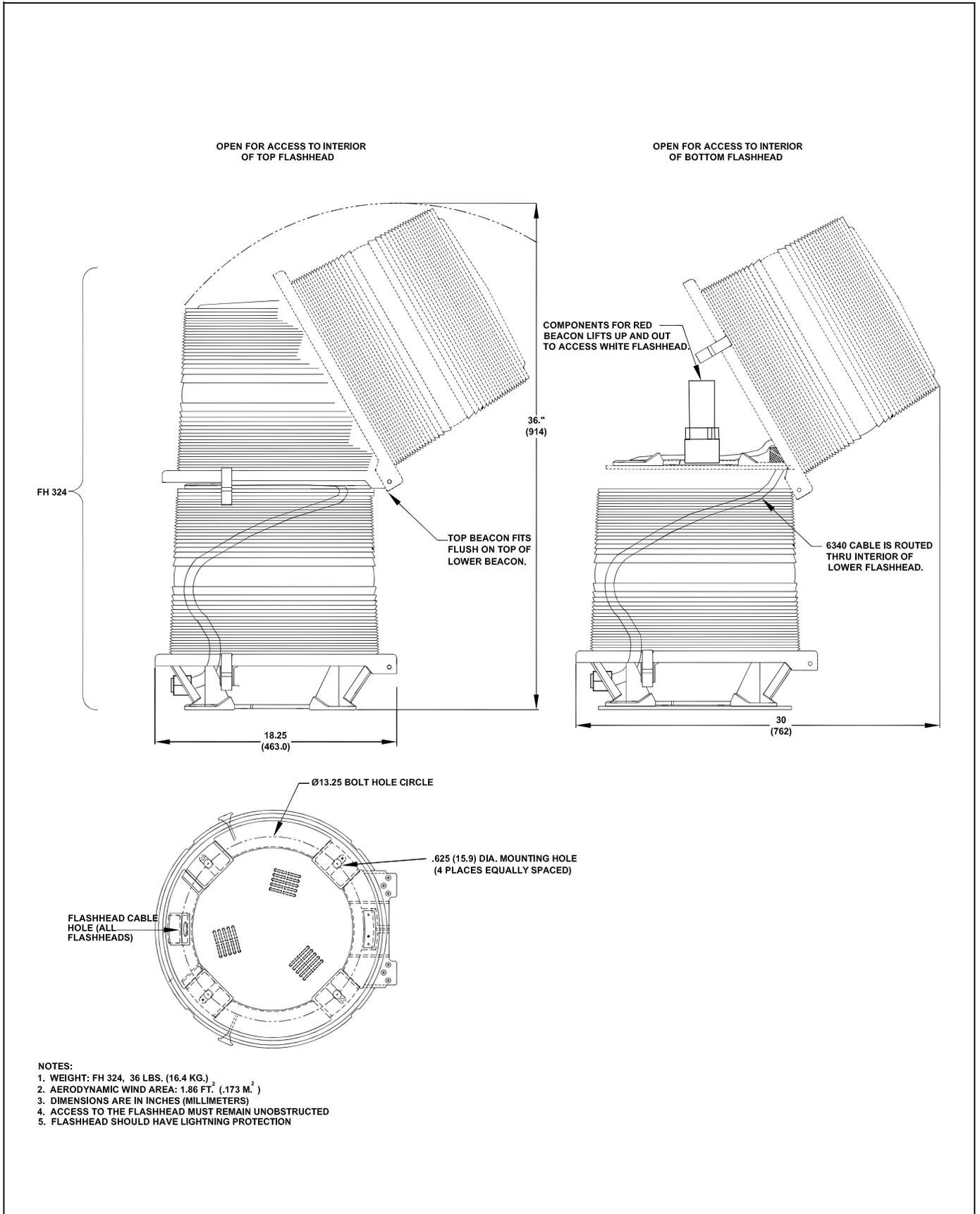
ch2024

**Figure 2-3 FH 204 Flashhead Mounting and Outline**



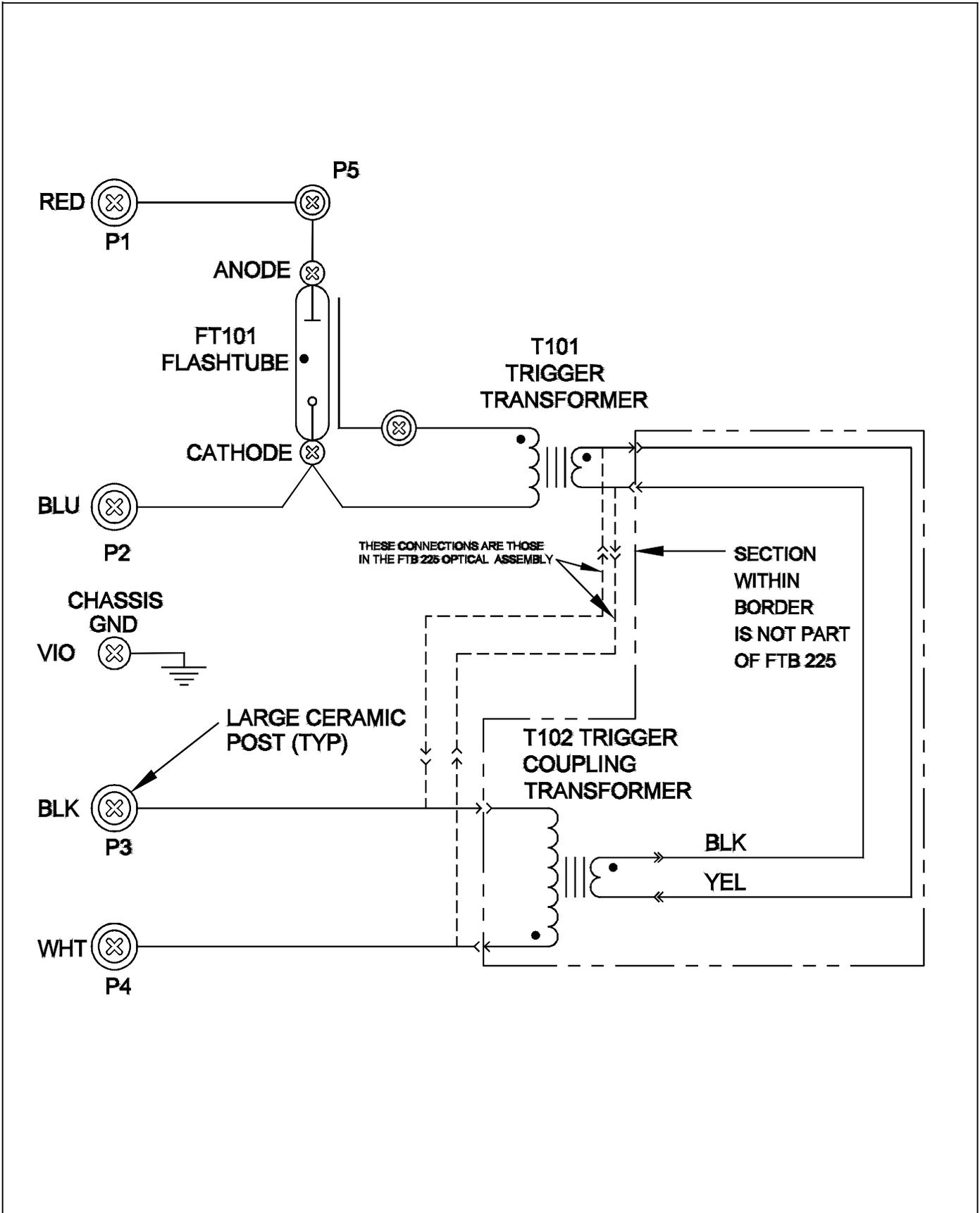
ch2021

**Figure 2-4 FH 306 and FH 307 Flashhead Mounting and Outline**



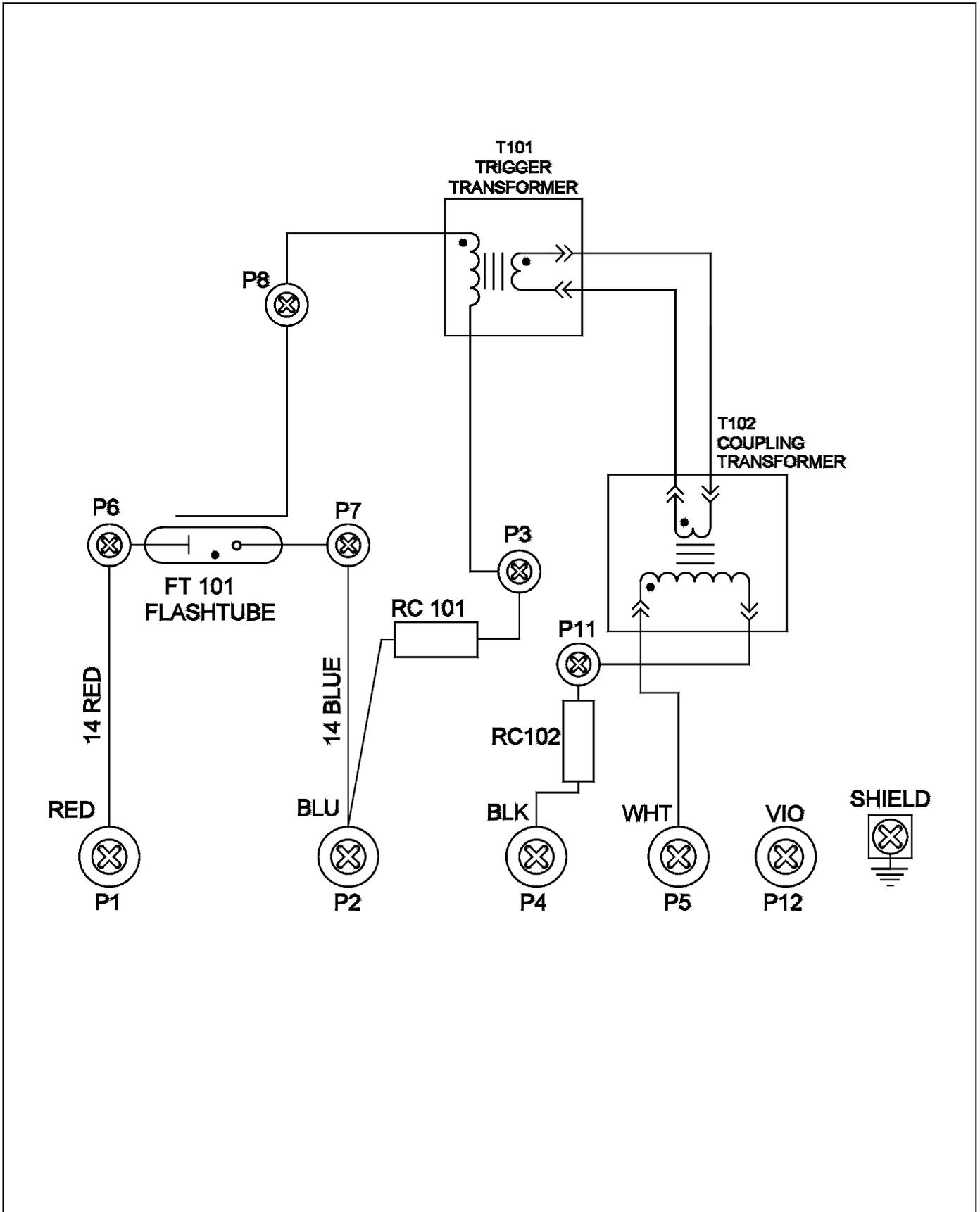
FH324IW

**Figure 2-5 FH 324 Flashhead Mounting and Outline**



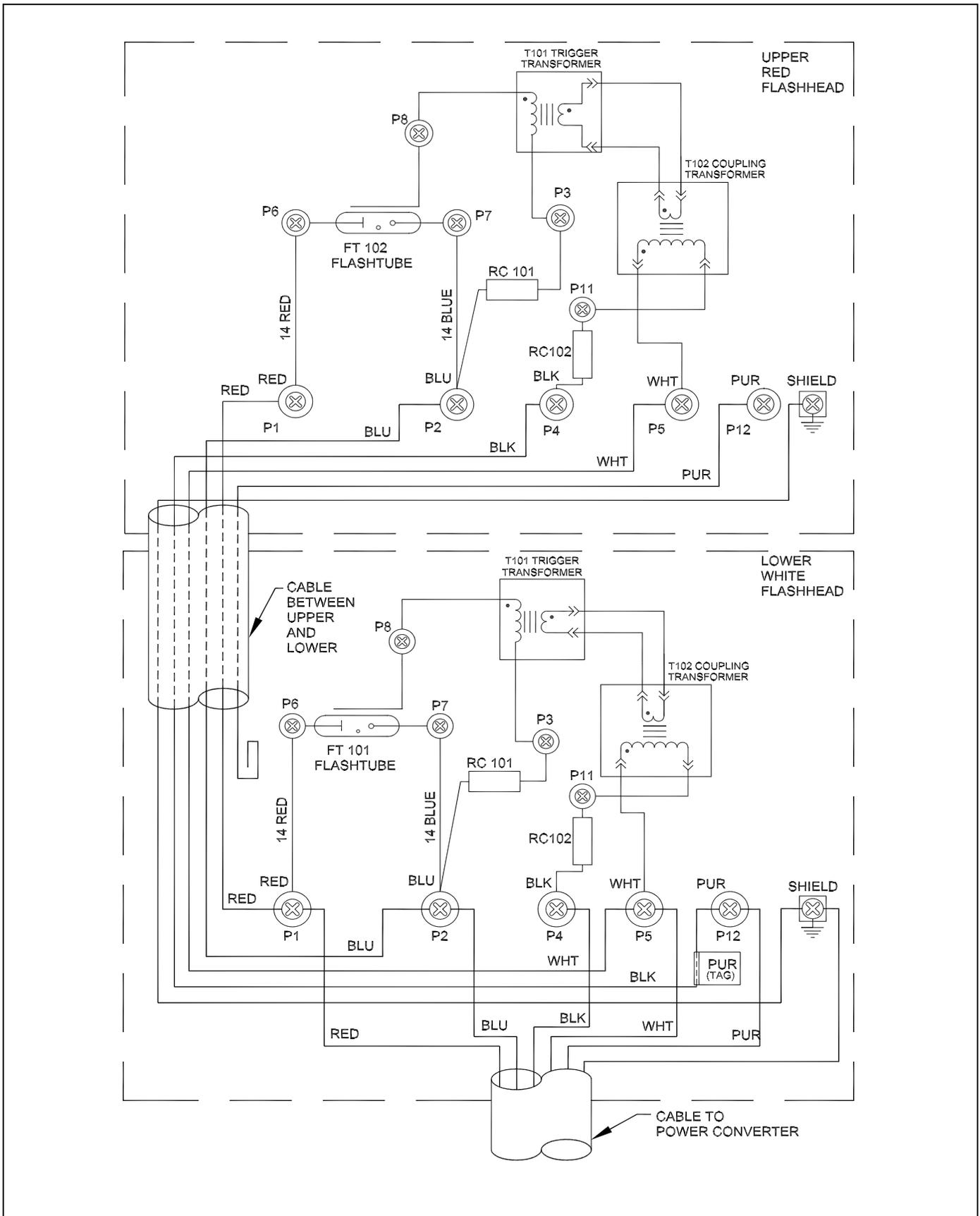
FH204IW

Figure 2-6 FH 204 Flashhead and FTB 225-2 Optical Assembly Internal Wiring



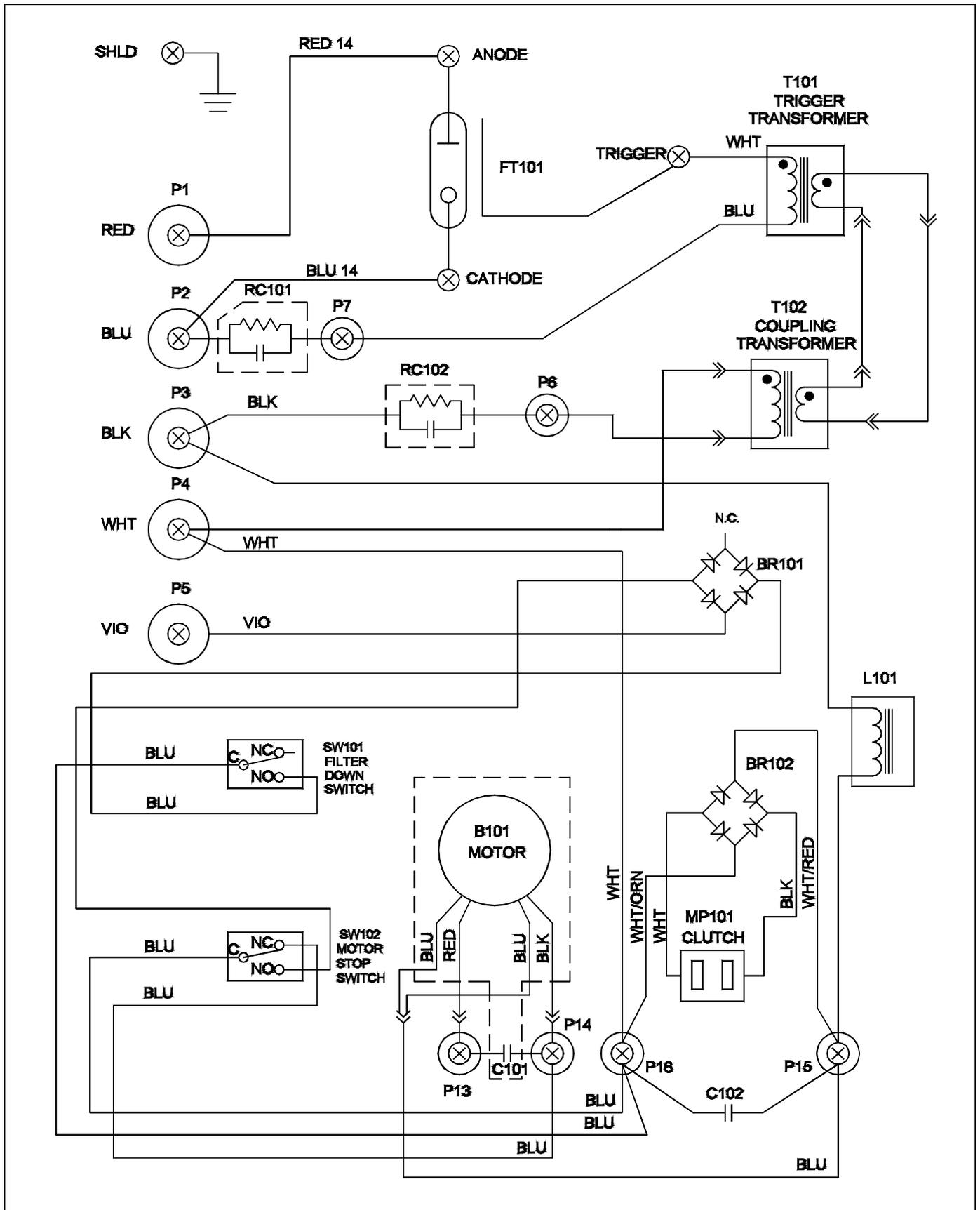
3081W

**Figure 2-7 FH 307 Flashhead Internal Wiring**



324IW

Figure 2-8 FH 324 Flashhead Internal Wiring



30621W

Figure 2-9 FH 306 Flashhead Internal Wiring

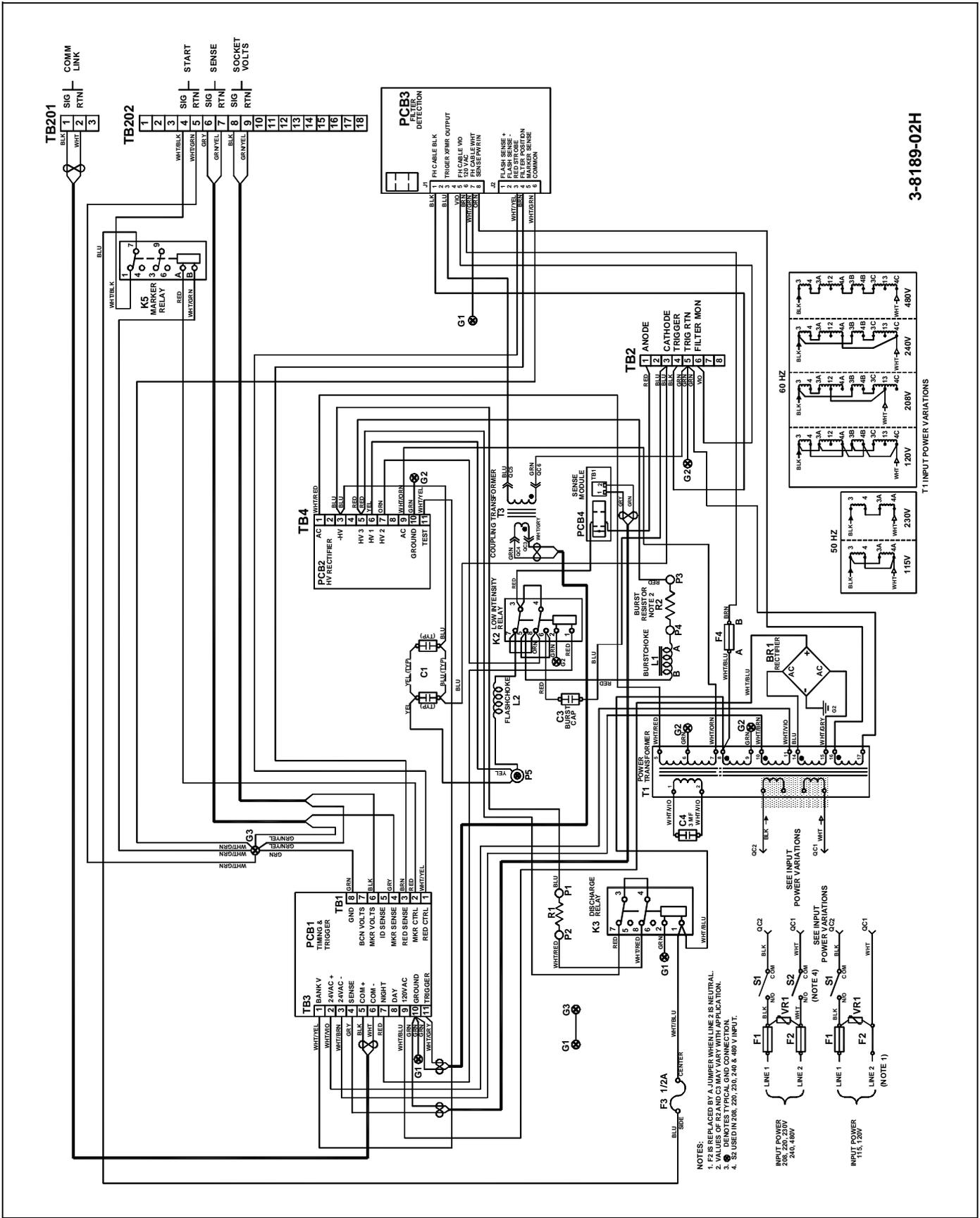


Figure 2-10 PC 302-2D Power Converter Internal Wiring (FH 306)

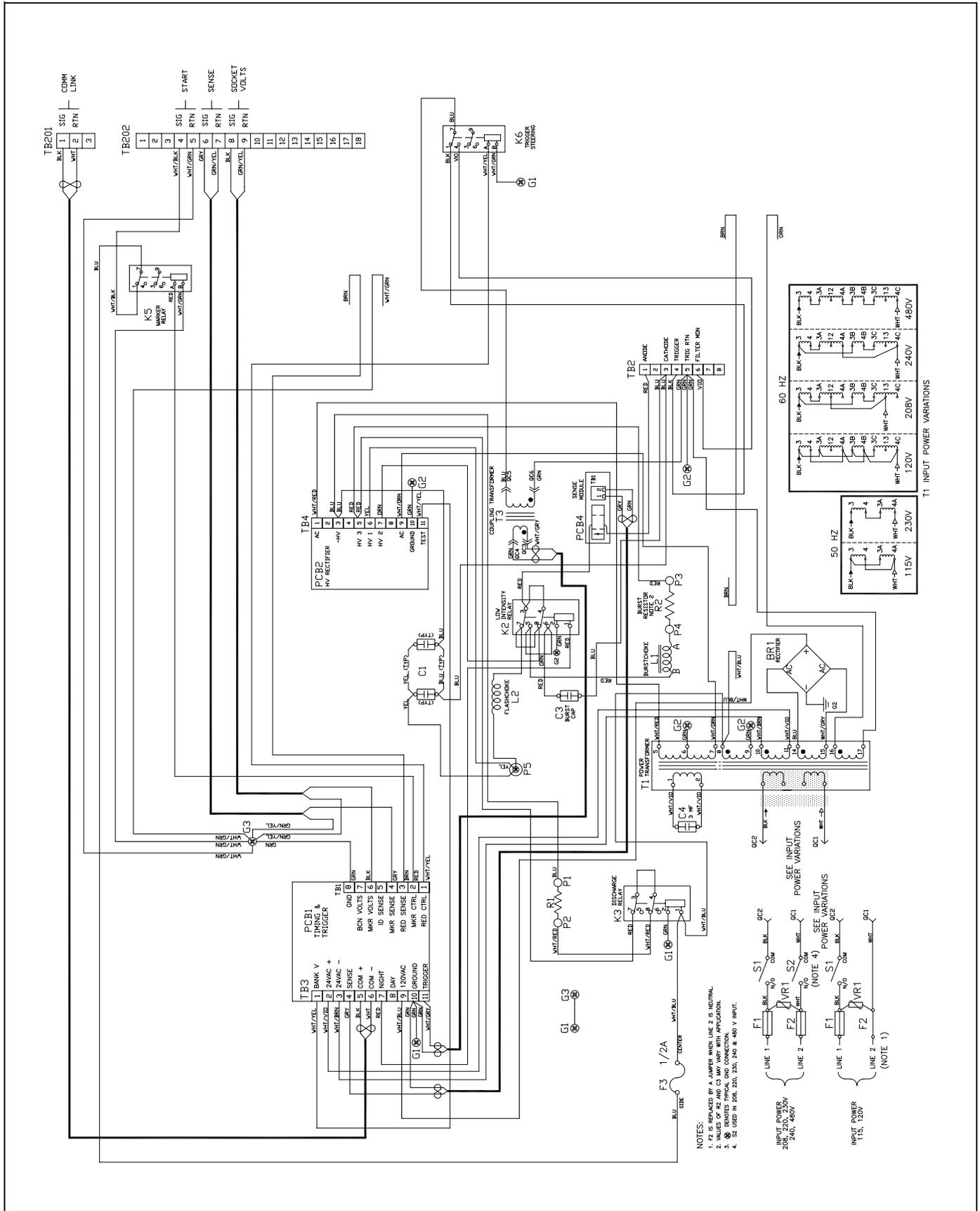
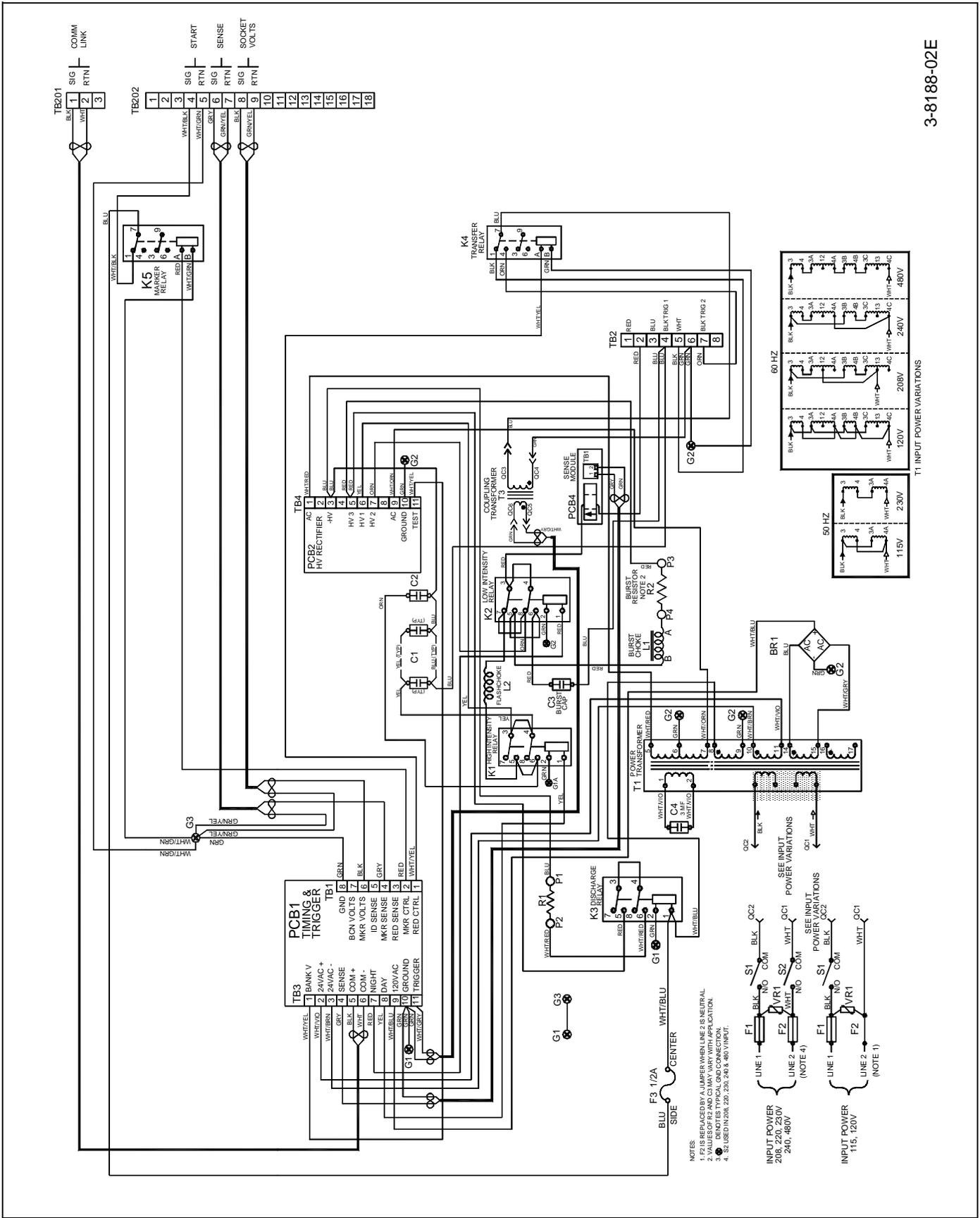


Figure 2-11 PC 302-2 Power Converter Internal Wiring (FH 324)

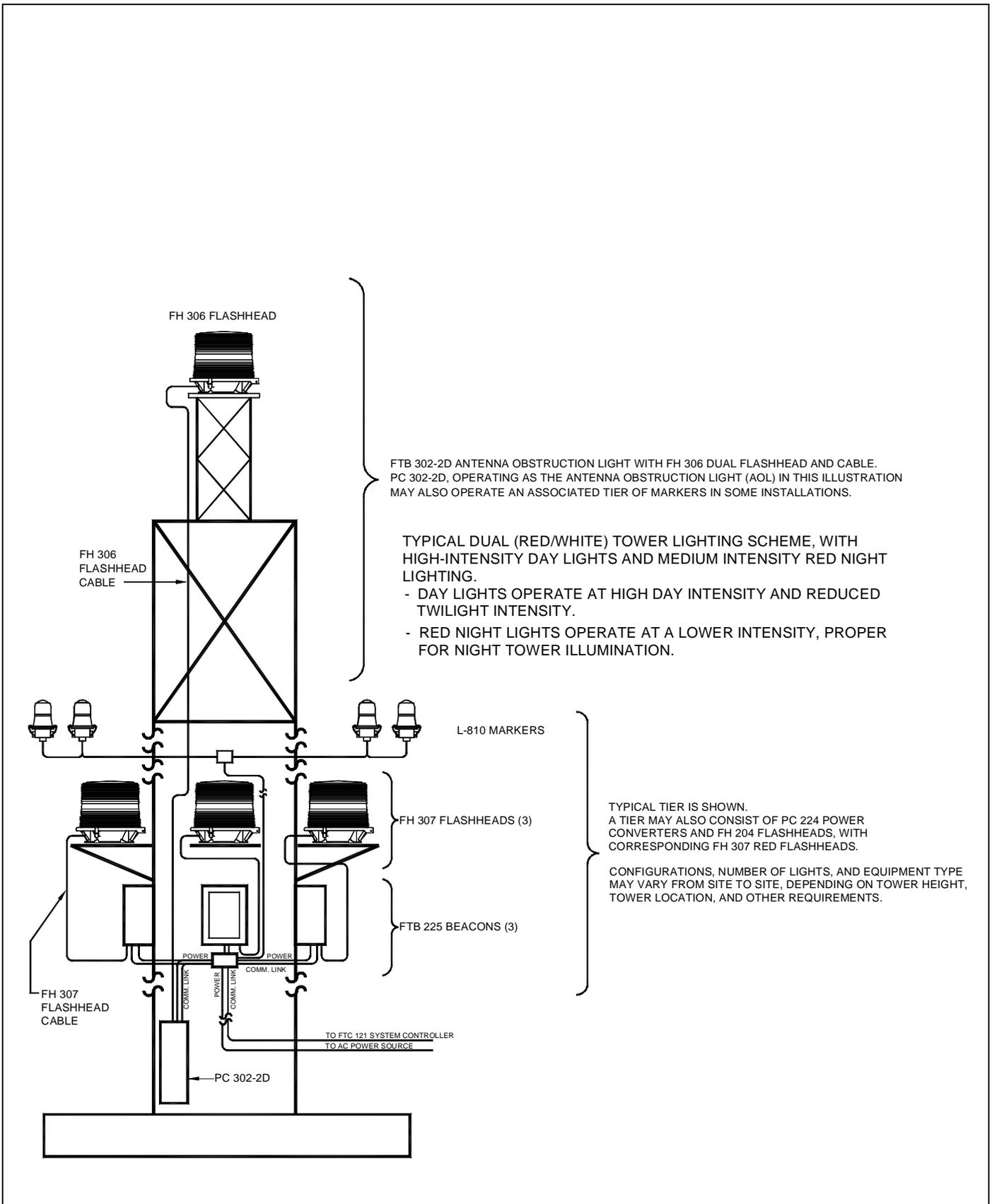


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Figure 2-12 PC 224-2 Power Converter Internal Wiring







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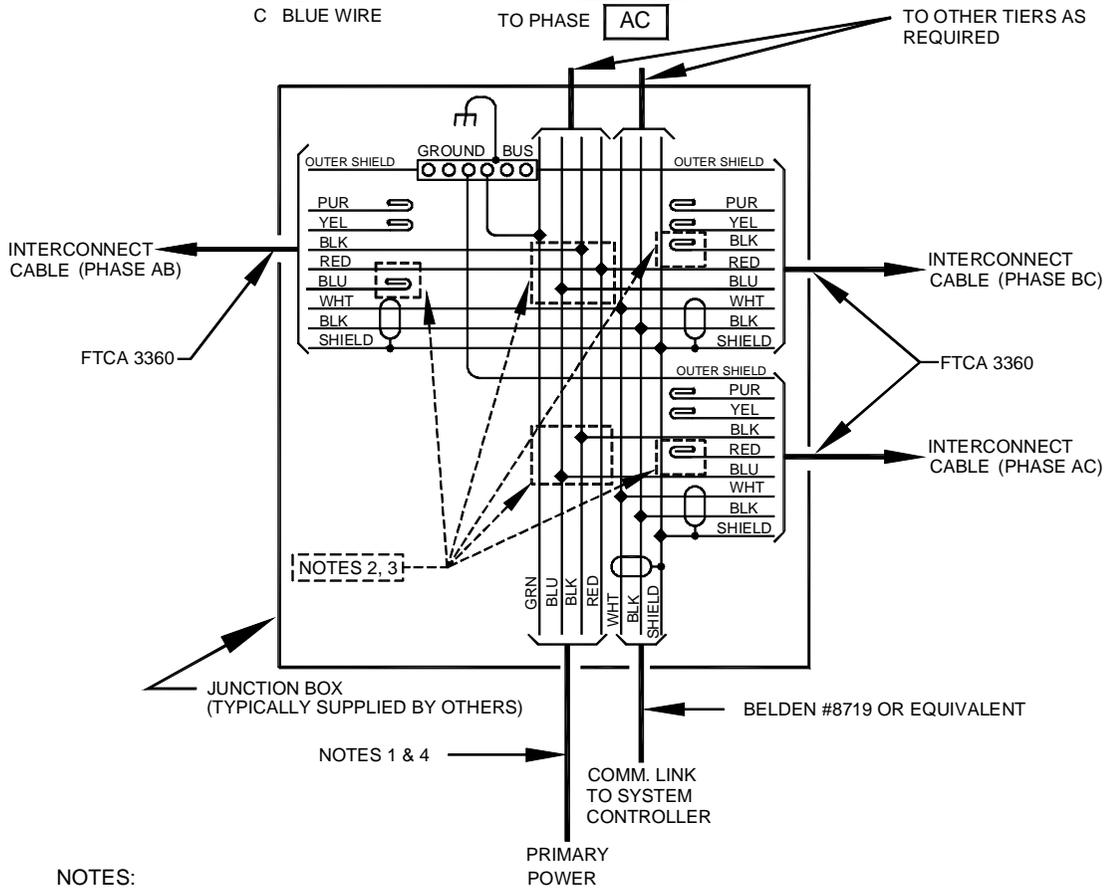
**Figure 2-15 Typical Tower Lighting Scheme with High-Intensity Lights and Red Night Lights**

### THREE-PHASE CONNECTION CHART

	BEACON 1		BEACON 2		BEACON 3		BEACON 4 (IF USED)	
TIER	F1	F2	F1	F2	F1	F2	F1	F2
6	B	C	A	C	A	B	B	C
5	A	C	A	B	B	C	A	C
4	A	B	B	C	A	C	A	B
3	B	C	A	C	A	B	B	C
2	A	C	A	B	B	C	A	C
1	A	B	B	C	A	C	A	B

PHASE: A BLACK WIRE  
B RED WIRE  
C BLUE WIRE

NOTE:  
CONTROLLER WIRED  
TO PHASE AC

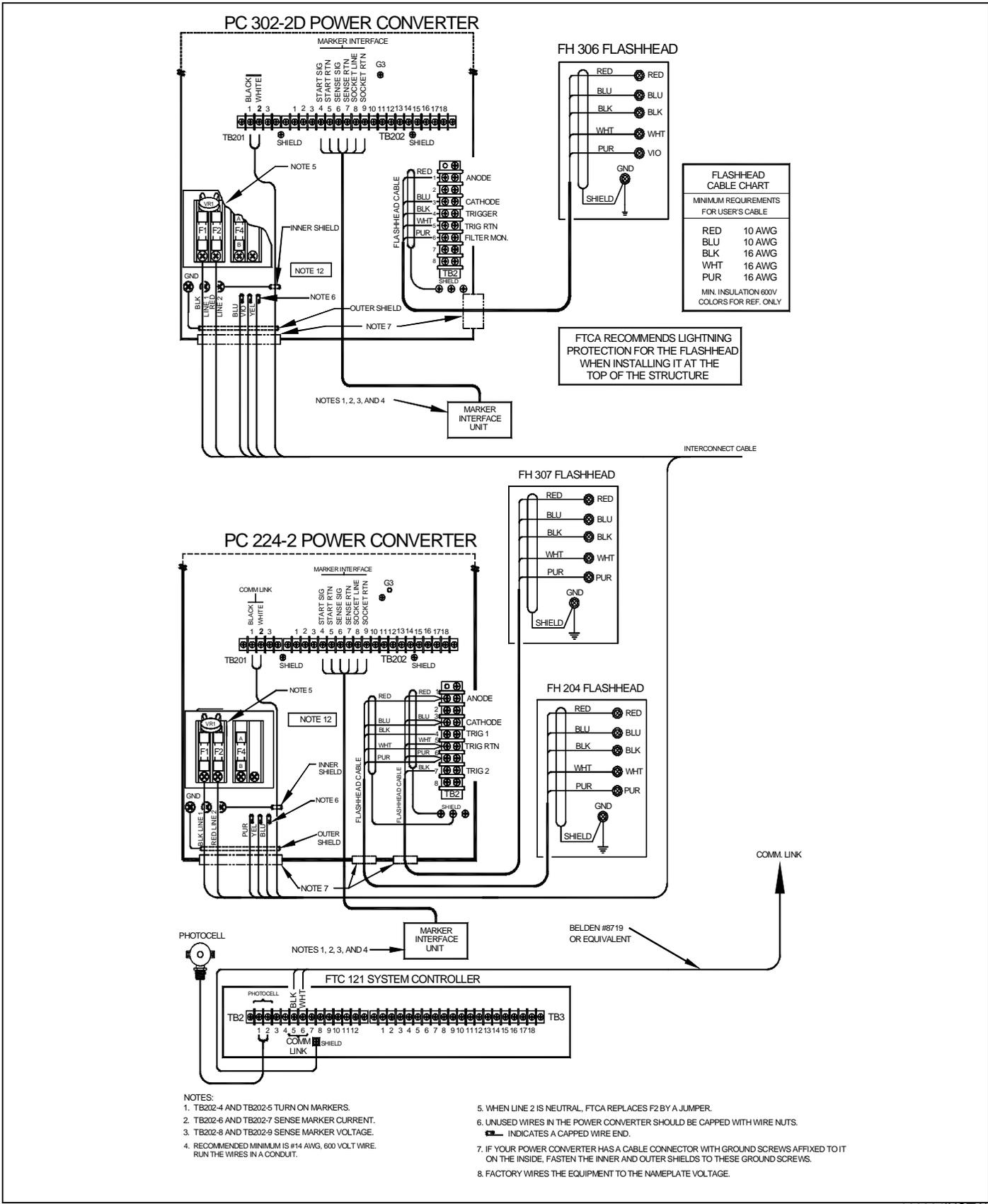


**NOTES:**

1. CONDUCTOR GAUGE DEPENDS ON THE SERVICE VOLTAGE, THE LENGTH OF THE WIRE RUN, AND THE NUMBER OF BEACONS CONNECTED. USE 400 VOLT-AMPERES PER BEACON TO DETERMINE THE VOLTAGE DROP CAUSED BY WIRE RESISTANCE. THE VOLTAGE DROP MUST NOT EXCEED 5% AT ANY BEACON. SEE THE EQUIPMENT LABEL FOR UNIT VOLTAGE AND FREQUENCY.
2. ◆ DENOTES WIRE NUT CONNECTION.
3. UNUSED WIRES IN THE JUNCTION BOX MUST BE CAPPED WITH WIRE NUTS.  INDICATES A CAPPED WIRE END.
4. PRIMARY POWER CONNECTIONS FOR THREE-PHASE SYSTEMS ARE CONNECTED AS REQUIRED BY THE THREE-PHASE CONNECTION CHART.

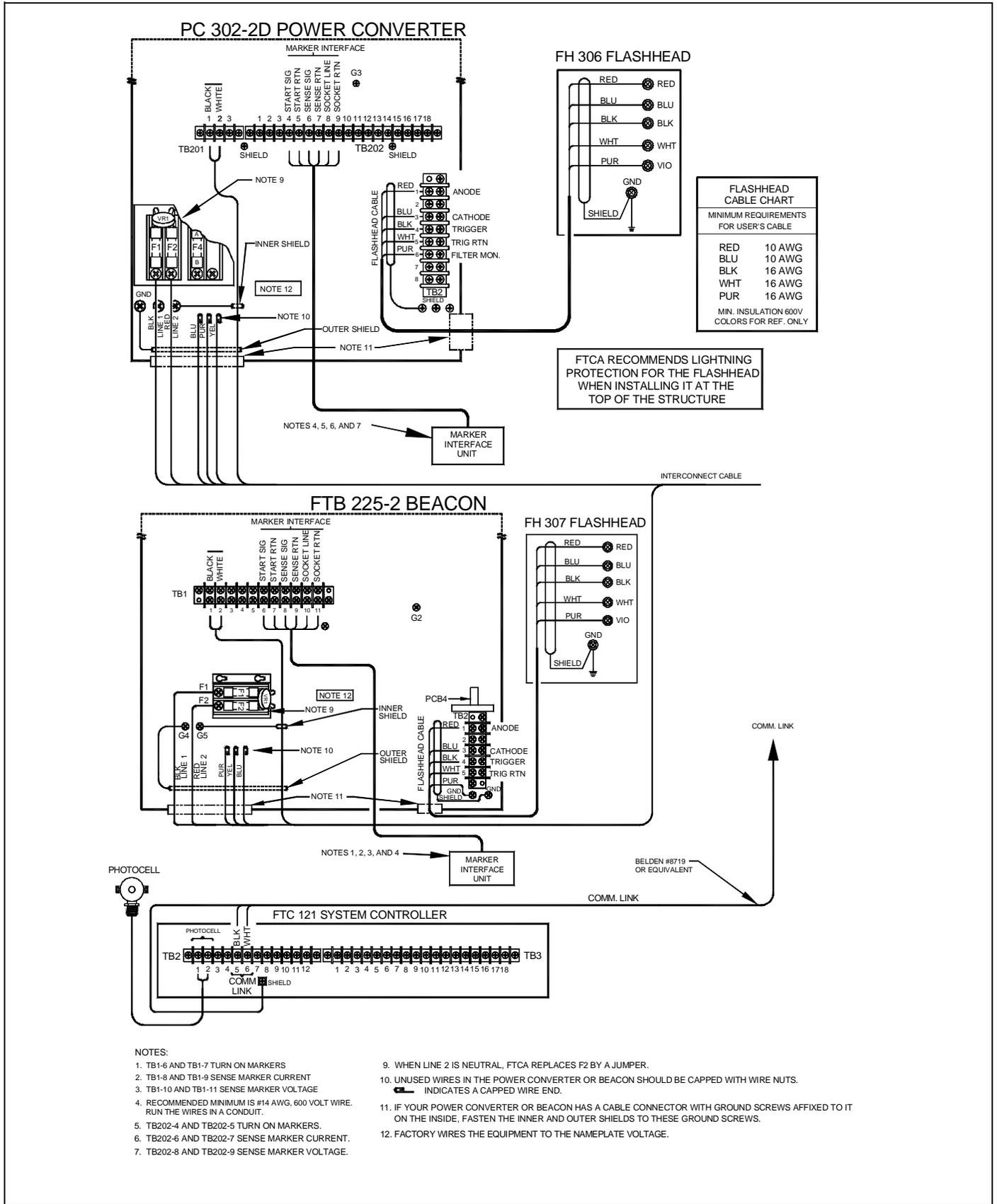
3PHASEWRNG

**Figure 2-16 Junction Box; Three-Phase Wiring Guideline**



**Figure 2-17 FTB 302-2D and FTB 224-2 Installation Wiring Guideline**

302224INSTW



302225INSTW

Figure 2-18 FTB 302-2D and FTB 225-2 Installation Wiring Guideline

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# Section 3 — Maintenance and Troubleshooting

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## Safety

### **WARNING**

Before proceeding — read the 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 does not accidentally enter the equipment through gaskets or seals, or collect 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 ensure the absence of corrosion or electrical arcing.
6. Clean the inside and outside surface of the glass on the FH 204 or the FTB 225 Beacon with liquid detergent and water. Wipe it gently with a soft cloth or paper towel.
7. Clean the inside surface of the lens on the FH 306 or FH 307 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,

PN 8630801, is available from FTCA. Call Customer Service at 1-800-821-5825.

## Storage

No special considerations are required for long-term storage of any major assembly, such as the power converter or beacon, flashhead, photoelectric control or any internal component. Circuit boards, when not installed in the equipment, should be kept in antistatic bags or containers.

## Diagnostic Testing

### **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. For example:

- RFI on *primary power* wires could cause errors in flash rate and intensity.
- RFI on the *COMM LINK* wire could cause a light to stay at NITE mode. RFI would not normally cause a light to stay at DAY mode. Also, it could cause lights and the system controller to malfunction.
- Strong RFI could burn out circuit board components.

While FTCA designed circuits to reject or bypass RFI, complete immunity cannot be guaranteed beforehand. It may be necessary after installation to add external filters or use other methods to reduce RFI entering the equipment. FTCA provides all reasonable technical assistance to achieve satisfactory operation.

## Diagnostic Troubleshooting

The most effective troubleshooting begins with careful observation of operating behavior. This often leads directly to the cause of the problem. Therefore, become familiar with operation of the power converter or beacon in your system. Note how the LED indicators operate in

daytime and nighttime conditions. Observe the power converter or beacon at the same time that you observe the LEDs on PCB1. Listen to the sounds of the power converter or beacon as it triggers the flashhead in both daytime and nighttime conditions, and watch LEDs and relays as the power converter or beacon switches from day to night and night to day.

Check LED and neon indicators. Are they lit? Are the correct ones lit? Check the power cable and flashhead cable screw connections. Are they tight? Corroded? Has water entered the unit?

Refer to *Section 1 — Introduction and Operation* for power converter or beacon operation specifics and LED functions. *Table 3-1* describes basic operation.

You can control the operation of the power converter or beacon from the System Controller. You can also interrogate and receive status information from the controller if you have a computer connected to it over a telephone line.

## Troubleshooting Charts

*Table 3-1* through *Table 3-6* provide an approach and some solutions to troubleshooting problems that you may encounter with the lighting systems.

See *Table 3-2* to direct you to the correct troubleshooting tables for your system. *For example: Table 3-3* lists some symptoms a malfunctioning light might exhibit. *Table 3-4* and *Table 3-5* correlate these symptoms with component assemblies or conditions that might cause the malfunction.

**Table 3-1 Basic Power Converter or Beacon Operation for Troubleshooting**

Power Converter or System	Lights	System Type	Daylight/Twilight/Night Operating Mode†
PC 302-2D	One dual FH 306 flashhead	Dual white/red system	Operates FH 306 white at 20,000 candelas in daylight and twilight. Operates FH 306 red at 2,000 candelas at night and turns on tower marker lamps if so installed.
PC 224-2	One white FH 204 flashhead One red FH 307 flashhead		Operates FH 204 white at 270,000 candelas in daylight and white at 20,000 candelas in twilight. Operates FH 307 red at 2,000 candelas at night and turns on tower marker lamps if so installed.
FTB 225-2	One white beacon One red FH 307 flashhead		Operates beacon white at 270,000 candelas in daylight and white at 20,000 candelas in twilight. Operates FH 307 red at 2,000 candelas at night and turns on tower marker lamps if so installed.

† The combined operation of a photocell and an FTC 121-1 System Controller determine intensity mode.

**Table 3-2 Troubleshooting Tables**

System	Symptoms	Fault Locator
FTB 302-2D	Table 3-3	Table 3-4
FTB 224-2		Table 3-5
FTB 225-2		

For example, each item in *Table 3-3* is weighted to indicate the estimated likelihood that it would be causing the problem. For example, suppose the light does not flash at

all but some of its circuits are still functioning; that is, fuses are not blown, relays operate, and so forth. This is symptom C in *Table 3-4*. *Table 3-4* indicates that symp-

tom C behavior would most likely be caused by a defective PCB1 board. The next most likely cause would be a defective rectifier board. The third would be the NITE capacitor, and so on.

You can check out most suspect components by following the procedures in this section. When you trace a problem to a specific component, see *Section Component Testing* and *Section Component Removal and Replacement* for further assistance.

**Table 3-3 Major Troubleshooting Symptoms**

Symptoms	Flash Conditions		Code†
	Day/twilight	Night	
All circuits are dead	NO	NO	A
Primary line fuse repeatedly blows	NO	NO	B
Some circuits functioning	NO	NO	C
No confirmation	OK	OK	D
Night flash fails	OK	NO	E
Night too bright - ragged flash	OK	HIGH	F
--	SKIPS	OK	G
--	LOW	HIGH	H
--	LOW	SKIPS	I
--	SKIPS	SKIPS	J
Resistor on PCB2 burned out	NO	NO	K
Inconsistent and erratic flash behavior	--	--	L
No fail indication	NO	NO	M
Flash errors	NO	OK	N
	OK	NO	N
	NO	NO	N

† See Table 3-4.

**Table 3-4 FTB 302-2D Fault Locator**

Probable Cause		A	B	C	D	E	F	G	H	I	J	K	L	M	N
Day capacitor bank	C1A-C1x			4											
Night capacitor	C3			3		5									
Tuning capacitor	C4							2							
Primary line Fuses	F1/F2	1													
Flashtube	FT101			6							2				
Low intensity relay	K2					3	2		1	1				1	2
Burst choke	L1					4									
Timing and trigger board	PCB1			1	1		1		2	2			2	2	3
Rectifier board	PCB2			2		2									
Filter detection board	PCB3														4
Sense module	PCB4				2										
Flashhead baseplate	A101														1
Burst resistor	R2					1									
Interlock switch	S1	2													
Power transformer	T1	3	2	5											
Trigger transformer	T3			7							3				
Suppressor assembly	VR1		1												
Note 1								1							
Note 2								1							
Note 3										1		3			
Note 4					3										
Note 5												1	1		
Note 6													4		

Note 1 Blown fuse in one leg of 3-phase power distribution: all beacons on the same phase would be affected.

Note 2 Wrong phase between system controller and light.

Note 3 Trigger potential arcing to chassis.

Note 4 Wrong confirmation programming at light.

Note 5 RF interference

Note 6 Poor connection in discharge circuit between capacitors and flashtube or arcing to chassis.

**Table 3-5 FTB 224-2 and FTB 225-2 Fault Locator**

Probable Cause		A	B	C	D	E	F	G	H	I	J	K	L	M	N
Day capacitor bank	C1A-C1x			4											
Night capacitor	C3			3		5									
Tuning capacitor	C4							2							
Primary line Fuses	F1/F2	1													
Flashtube	FT101			6							2				
Low intensity relay	K2					3	2		1	1				1	2
Burst choke	L1					4									
Timing and trigger board	PCB1			1	1		1		2	2			2	2	3
Rectifier board	PCB2			2		2									
Sense module	PCB4				2										
Burst resistor	R2					1									
Interlock switch	S1	2													
Power transformer	T1	3	2	5											
Trigger transformer	T3			7							3				
Suppressor assembly	VR1		1												
Note 1								1							
Note 2								1							
Note 3										1			3		
Note 4					3										
Note 5												1	1		
Note 6													4		

- Note 1 Blown fuse in one leg of 3-phase power distribution: all beacons on the same phase would be affected.
- Note 2 Wrong phase between system controller and light.
- Note 3 Trigger potential arcing to chassis.
- Note 4 Wrong confirmation programming at light.
- Note 5 RF interference
- Note 6 Poor connection in discharge circuit between capacitors and flashtube or arcing to chassis.

## **Component Testing**

The following procedures describe how to check most of the unit's major electrical components. 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.

### **Power Converter or Beacon**

### **Capacitors**

You may test capacitors with an analog ohmmeter capable of measuring one megohm or greater. Use the procedure described below. Resistance measured between the terminals of a fully discharged capacitor is initially zero and increases steadily with time if analog ohmmeter leads are left across the terminals. Eventually, an open circuit condition occurs. The time it takes for the complete transition depends upon the total amount of capacitance. A capacitor, disconnected from other circuitry, is defective if it does not exhibit this behavior. The capacitor must be manually discharged before this measurement can be

repeated. *This procedure may not detect a failure that occurs only at high voltage.*

A bank of capacitors connected in parallel may be checked as a single unit. First disconnect any leads that connect the capacitors to external circuits. Connect the ohmmeter leads to the terminals of any one of the capacitors. If a short circuit is indicated, the individual capacitors must be disconnected and checked separately. A shorted capacitor is indicated if the measured resistance does not rise above zero after several seconds of measurement.

#### **NOTE**

Some instruments may have erroneous readings when used near a radiating antenna. Make measurements when the power to the antenna is turned OFF or use a meter known to be unaffected by an RF field.

### **C1 and C2 Capacitor Banks**

Check these capacitor banks as described in *Section Capacitors*. Each bank can be checked as a whole at one time by connecting the meter leads to the terminals of anyone 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*.

### **Relays**

A malfunctioning relay may have faulty contacts, a sticky mechanism or a defective coil. The first two possibilities may be determined by inspection and manually exercising the armature. A defective coil can be confirmed by measuring the resistance.

#### **K1 — High Intensity Relay**

To measure the resistance of this relay, first remove PCB1. The resistance from TB3-8 and TB3-10 or chassis should be approximately 290 ohms.

#### **K2 — Low Intensity Relay**

To measure the resistance of this relay, first remove PCB1. The resistance from TB3-7 and TB3-10 or chassis should be approximately 290 ohms.

#### **K3 — Discharge Relay**

The K3 coil should measure approximately 290 ohms.

#### **K4 — Transfer Relay**

The K4 coil should measure approximately 290 ohms.

#### **K5 — Marker Relay**

The K5 coil should measure approximately 290 ohms.

#### **L1 — Burst Choke**

L1 should measure approximately 15 ohms.

#### **PCB1 — Timing and Trigger Board**

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

#### **PCB2 — HV Rectifier Board**

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

#### **PCB3 — Filter Detection Board**

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

#### **PCB4 — Sense Board**

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

#### **R1 — Discharge Resistor**

R1 should measure 35K ohms.

#### **R2 — Burst Resistor**

Each resistor of this component should measure 500 ohms.

## T1 — Power Transformer

To test this transformer, first remove PCB1 and PCB2. Apply power to the unit and measure secondary winding voltages at the terminals indicated.

**Table 3-6 Power Transformer Voltage Ranges**

Terminals	Voltage Range Allowed
From TB4-1 to TB4-9	900-1050 volts AC <sup>1</sup>
From TB3-9 to TB3-10	110 to 120 VDC (full-wave rectified AC)
From TB3-2 to TB3-3	22 to 26 VAC
Fuse F3	120 VAC
Across C4	550 to 600 VAC

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

## T3 — Coupling Transformer

Check the continuity of the wires in the primary and secondary windings of this transformer. Ensure that the transformer core is not cracked.

## VR1 — Suppressor Assembly

To check this component first remove one of its leads from a fuse block terminal. The measured resistance across VR1 on the x110k ohm scale should be infinite.

## Flashhead Component Testing

### FLASHTUBE HANDLING PRECAUTIONS FH 204 AND FTB 225-2 OPTICAL ASSEMBLY

**Always handle a flashtube by grasping the metallic end caps. Never touch the glass section with bare hands because skin oils or other contaminants can shorten flashtube life.**

One quick way to determine flashhead malfunction is to switch the flashhead cables on multiple-unit installations. If the flash problem moves with the cable, the problem is likely in the flashhead or the flashhead cable. Of the two possibilities, the flashhead cable is less likely to fail than the flashhead. However, a flashhead cable can fail because of damage caused by improper installation

(stretching excessively or sharp bends), lightning strikes, or physical deterioration (age, cuts, and so forth).

A failing flashtube can produce either defective light output, intermittent light output (skip), or no light at all. Most likely, a flashtube will fail completely.

Replace the entire Flashtube Mounting Plate Assembly (A101) in the FH 306 Flashhead (see *Section 4 — Spare & Replaceable Parts*) if the filter motion is defective or if the flashhead malfunctions with a good flashtube installed.

## FT101 — Flashtube

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.

## T101 — Trigger Transformer

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.

## T102 — Coupling Transformer

Check the continuity of the wires in the primary and secondary windings of this transformer. Ensure that the transformer core is not cracked.

## Component Removal and Replacement

This section contains instructions for removal and replacement of most major replaceable components. *Section 4 — Spare & Replaceable Parts* provides component location diagrams. For the internal wiring, see *Section 2 — Outline, Mounting, and Installation*.

## Power Converter or Beacon

### C1A - C1x 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 Fuse F1 for this procedure to prevent accidental application of power if the interlock switch is accidentally pressed.

### PC 302-2D and PC 224-2 Capacitors

#### Removal

1. Remove circuit boards PCB1 and PCB2 for access to the capacitors.
2. Loosen two screws at the corners of the circuit boards.
3. Loosen the screws holding the boards to their respective terminal blocks.
4. Slide the board to clear the screw heads. Remove the boards from the unit.
5. Remove the wires on TB3 and TB4 that come from the internal cabling.
6. Remove any external connecting wires from TB201 and TB202.
7. Loosen the screws that hold the bracket that supports PCB1 and PCB2.
8. Slide the bracket up to clear the screws and remove the bracket for access to the capacitors.
9. The capacitors are mounted in holes in a bracket and held down to the chassis with a bolted washer. Disconnect the wires leading to capacitors.
10. Remove the bolt and washer.
11. Lift the capacitors from their receiving holes.

#### Replacement

1. Insert the capacitors into their respective receiving holes.
2. Replace the hold-down bolt and washer to secure the capacitors to the chassis.
3. Reconnect the wires to capacitors and verify that wiring is the same as shown in *Figure 2-12 PC 224-2 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 is caused 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.

### FTB 225-2 Capacitors

#### Removal

1. Disconnect the wires leading to capacitors.
2. The capacitors are mounted in holes in a bracket and held down to the bracket with a screw. Remove the screw.
3. Lift the capacitors from their receiving holes.

#### Replacement

1. Insert the capacitors into their respective receiving holes.
2. Replace the hold-down screws to secure the capacitors to the chassis.
3. Reconnect the wires to capacitors and verify that wiring is in accordance with *Figure 2-13 FTB 225-2 Beacon 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 is caused 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.

### PCB1 — Timing and Trigger Board

#### Removal

1. Loosen (but do not remove) the two screws near the corners of the board.
2. Disconnect the plug (PCB1-TB1) on the board.
3. Loosen the screws holding the board to its terminal block.
4. Slide the board to the right and lift the board from the chassis.

#### Replacement

1. Use the steps of the Removal procedure in the reverse order.

### PCB2 — HV Rectifier Board

#### Removal

1. Loosen the two screws near the corners of the board.

2. Loosen, but do not remove, the screws holding the HV rectifier board to the terminal block.
3. Slide the circuit board out from under the terminal block screws.

#### *Replacement*

Use the steps of the Removal procedure in the reverse order.

### **PC 302-2D, PCB3 — Filter Detection Board**

#### *Removal*

1. Remove the two screws that fasten the board to the chassis.
2. Unplug J1 and J2.
3. Remove PCB3.

#### *Replacement*

Use the steps of the Removal procedure in the reverse order.

### **PCB4 — Sense Board**

#### **PC 302-2D, PC 224-2 Sense Board**

#### *Removal*

1. Remove the two screws that fasten the PCB4 board to the chassis.
2. Loosen, but do not remove, the screws holding the two wires to the TB1 terminal block on PCB4.
3. Disconnect the red wire from the relay that passes through the coil on PCB4. **Important:** *Note the position and connections of this wire. It must be replaced exactly as it was removed.*

#### *Replacement*

1. Use the steps of the Removal procedure in the reverse order.
2. Pass the red wire from the relay through the coil on PCB4 in the same direction that it was originally.

### **FTB 225-2 Sense Board**

#### *Removal*

1. Remove the flashhead cable wires from TB2.
2. Remove the wires from TB2 that are internal to the chassis.
3. Remove the screws that hold the flashhead cable bracket to the chassis.
4. Carefully lift the bracket from the chassis and remove any wires that may hold down the bracket and prevent it from clearing the chassis.
5. Remove the two screws that fasten the PCB4 board to the bracket.
6. Loosen, but do not remove, the screws holding the two wires to the TB1 terminal block on PCB4.
7. Disconnect the two red wires from the relay that pass through the coil on PCB4. **Important:** *Note the position and connections of these wires. They must be replaced exactly as they were removed.*

#### *Replacement*

Use the steps of the Removal procedure in the reverse order. Pass the red wire from the relay through the coil on PCB4 in the same direction that it was originally.

## T1 — Power Transformer

### PC 302-2D, PC 224-2, FTB 225-2:

#### Removal

1. Disconnect wires attached to the transformer and observe how each wire is routed from the harness to its terminal on the transformer.
2. Remove the four screws holding the transformer to the chassis and remove transformer from the chassis.  
*NOTE: The T1 Transformer in FTB 225-2 is fastened by nuts. A socket wrench is useful here.*

#### Replacement

1. Carry out the steps of the removal procedure in reverse order.
2. Verify that wiring is in accordance with *Figure 2-10*, *Figure 2-12*, or *Figure 2-13* and that you restore wire routing to its original state.

## T3 — Coupling Transformer

### PC 302-2D, 224-2 Coupling Transformer:

#### Removal

1. Remove the two blue wires from the primary (small number of turns) of the coupling transformer.
2. Remove the two blue wires from the secondary of T3 (large number of turns) to TB2-4 and TB2-5.
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 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.

## FTB 225-2 Coupling Transformer:

#### Removal

1. Remove the flashhead cable wires from TB2 on the remote flashhead bracket.
2. Remove the harness wires from TB2 that are internal to the chassis.
3. Remove the screws that hold the remote flashhead bracket to the chassis.
4. Carefully lift the bracket from the chassis and remove any wires that may hold down the bracket and prevent it from clearing the chassis.
5. Remove any components that prevent access to T3.
6. Remove the two blue wires from the primary (small number of turns) of T3.
7. Remove the two blue wires from the secondary of T3 (large number of turns) to TB2-4 and TB2-5.
8. 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 features on the bracket, because it must be reinstalled with this same orientation.
9. 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.
10. 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 is in accordance with *Figure 2-13 FTB 225-2 Beacon Internal Wiring*.

## All Other Power Converter or Beacon Components

All other components are mounted in the base or attached to the side walls of the power unit. They are attached by Phillips-head screws. You may need a short screwdriver for some removals.

#### Removal

1. Carefully note the position and color of wires on the connectors to the component you want to remove.

2. Note any other components, *and its wires and connections*, that you may need to remove to access the component that you are replacing.
3. Remove the wires either fastened by screws or connector plugs (this depends on the component you are removing).
4. Remove the screws that hold the component to the chassis.

### *Replacement*

Replace components in the reverse order of removal. That is:

1. Attach the component with its mounting screws.
2. Reattach the connecting wires by using the plugs or hold-down screws. (Because of position or convenience, some wires may have to be connected before you mount the component.)

## **Flashhead**

### **FH 306 Flashhead**

Note that the only replaceable parts in the flashhead assembly are the FT101 flashtube, RC101 and RC102 resistor-capacitor networks, and T102 Coupling Transformer. Any other defective part inside the flashhead located on the mounting plate requires that you replace the entire mounting plate as an assembly.

#### **Flashtube (FT101)**

##### *Removal*

1. Manually lift the red filter actuator arm to allow access to the three screws under the flashtube that hold the flashtube assembly in place.
2. 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**

The trigger transformer is not replaceable in the field. You must replace the entire baseplate assembly.

#### **Coupling Transformer, T102**

##### *Removal and Replacement*

Removal and replacement are similar to the procedure for the T3 Coupling Transformer in the power converter or beacon.

#### **FH 306 Flashtube Mounting Assembly**

Replace the entire A101 Flashtube Mounting Plate if the filter motion is defective or if the flashhead malfunctions with a good flashtube installed.

##### *Removal*

1. Remove the flashhead cable wires from the ceramic posts on the flashtube mounting plate assembly.
2. Loosen the three mounting screws that hold the flashtube mounting plate assembly to the flashhead.
3. Turn the flashtube mounting plate assembly slightly to allow the screws that you loosened to clear the mounting holes.
4. Lift the flashtube mounting plate clear of the base.

### *Replacement*

1. Replace the flashhead mounting plate assembly in the reverse sequence to that of Removal.

## **FH 307 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*

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 bracket directly under it*.
2. 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 molded 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 base. Note the orientation of the molded secondary winding with respect to 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 is in accordance with *Figure 2-7*.

### **Trigger Coupling Transformer (T102)**

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

## **FH 324 Flashhead**

### **Red Lens Section:**

#### *Removal*

1. Unlatch the two latches and lift the red lens to allow access to the three screws holding the flashtube pins.
2. Using a #2 Phillips-blade screwdriver, loosen the three screws (on screw lugs) directly under the flash-tube, which hold the flashtube connector pins. This enables you to remove the flashtube.

#### *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 wire 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.
3. Ensure that the tube is vertical.
4. Tighten the three screws on the screw lugs to secure the flashtube.

### **White Lens Section:**

#### *Removal*

1. Loosen the two screws securing the upper flashtube assembly and lift the plate up and out of the way to allow access to the bottom flashtube.
2. Pull out the flashtube in the white lens bottom section. You may have to rock it back and forth slightly to remove the tube.

#### *Replacement*

1. Align the pins on the flashtube base with their sockets. Notice that the spacing of the flashtube pins must match that of its sockets.
2. Insert the flashtube and settle it into place, making sure the ceramic base is resting directly on the tops of the pin sockets.
3. Ensure that the tube is vertical.
4. Close the top red lens section and secure the latches.

## Trigger Transformer, T101

Refer to *Figure 4-8 FH 324 Flashhead Component Locations* .

### 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 features 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 primary winding will remain hanging in place.
5. Remove the inner half of the core.

### 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 is in accordance with *Figure 2-8 FH 324 Flashhead Internal Wiring*.

## Coupling Transformer, T102

Refer to the flashhead component locations diagram *Figure 4-8* and internal wiring diagram *Figure 2-8*.

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

## FH 204 Flashhead, FTB 225-2 Beacon

### FT101 Flashtube

#### FOLLOW FLASHTUBE HANDLING PRECAUTIONS

Always handle a flashtube by grasping the metallic end caps. Never touch the glass section with bare hands because skin oils or other contaminants can shorten flashtube life.

### Removal

1. Loosen two screws that hold each plate that covers each end of the flashtube on the optical assembly.
2. Disconnect the trigger wire at the P101 ceramic post on the left side of the optical assembly viewed as in *Figure 4-4*.
3. The flashtube is supplied with connecting leads soldered to its ends. Loosen the screw on the end of each flashtube lead.
4. At one end of the flashtube, use a slender, pointed tool between the end of the flashtube and the spring-loaded clip to pop the flashtube up and out of the clip. Do the same at the other end and carefully pull the flashtube out of the optical assembly.

### Replacement

*Observe the flashtube handling precaution noted previously.*

1. Determine the anode and cathode ends: the anode has red wire soldered to it and red ink or dye on the end of the tube.
2. Ensure that the trigger extension wire has a short length of high voltage sleeving installed.
3. Insert the flashtube with the cathode end (no red ink) toward the trigger lead ceramic post.
4. Align the flashtube with the retaining clips at each end and press it down into the clips one end at a time. Press only at the metallic end caps.
5. Attach the trigger wire (white insulation) at the ceramic post P101. Remove any excess wire and do not leave a tail extending from under the screw. Do not forcefully tighten the screw.
6. Attach the red anode wire to its connection directly above the tube mounting clip.
7. Attach the black cathode wire of the flashtube to the screw on the upper end of the plate on the left side of the optical assembly viewed as in *Figure 4-4*.
8. Reinstall each plate on each side of the flashtube and tighten the screws.

### Flashtube Clip Assemblies

#### Removal

1. Remove the flashtube as described in *Section Flashtube (FT101)*.
2. Remove two 8-32 screws from each flashtube clip plate.

#### Replacement

1. Reverse the Removal procedure. Be sure that joining surfaces are clean. Tighten the screws firmly.

### **Trigger Transformer T101**

#### *Removal*

1. At the flashtube, remove the large diameter white wire to the molded secondary winding of the transformer.
2. At a chassis ground screw remove the small wire to the transformer secondary winding.
3. Do not disconnect the primary winding wires (seven turns of the hook-up wire).
4. Remove the two 4-40 x 2-inch screws phillips-head screws that hold the transformer assembly to the plate.
5. At this point note the orientation of the molded secondary winding with respect to fixed features on the

plate because its replacement must be installed with this same orientation.

6. Remove the outer half of the core and lift off the molded secondary winding. The seven turns of the small primary winding remain hanging in place.
7. Remove the inner half of the core taking care not to uncoil any of the turns of the small primary winding.

#### *Replacement*

1. Reassemble the small primary and molded secondary windings over the two halves of the core and attach the core to the bracket by means of the long screws. Do not overtighten.
2. Reattach the electrical wires. Refer to the internal wiring in *Figure FH 204 Flashhead and FTB 225-2 Optical Assembly Internal Wiring* to verify the connections.

# Section 4 — Spare & Replaceable Parts

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## Customer Service

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

<http://www.flashtechnology.com>

Shipping Address:

Flash Technology Corporation of America  
332 Nichol Mill Lane  
Franklin, TN, 37067

## Ordering Parts

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

## Power Converter/Beacon Parts

*Table 4-1* lists the major replaceable parts.

## Flashhead Parts

*Table 4-2* lists the major replaceable parts.

## Returning Equipment

Contact Customer Service at 1-800-821-5825 for a Return Material Authorization (RMA) number before returning equipment.

## Repackaging

You must return the equipment 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 or beacon and flashhead *separately* as described in the following subsections.

### **Power Converter, Beacon, or FH 204 Flashhead**

Package and ship the unit in an upright position; that is, with the feet downward. Pad the power converter or beacon so that the feet cannot penetrate the box during shipment. Box each power converter or beacon separately using a double thickness cardboard container and adequate padding. Do not drop. Use appropriate warning labels on the outside of the container.

### **Flashhead (FH 306, FH 307, FH 324)**

Package and ship the flashhead in an upright position. Box each flashhead separately and use adequate padding. Attach the flashhead base to a plate an inch wider than the width of the flashhead (e.g., 3/8" plywood). Use a double thickness cardboard (or wood) container that clears the width, height, and depth of the flashhead by at least one inch (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 or Beacon Major Replaceable Parts**

Item	Power Converter/ Beacon	Description	Part Number
C1A - C1x	All	Capacitor, 70 mfd, main	6720401
C2	224-2, 225-2	Capacitor, 40 mfd, twilight	6386504
***C3	All	Capacitor, 1 mfd, burst	6848202
C4	All	Capacitor, 3 mfd, tuning	6577903
L1	All	Choke, Burst	4850601
L2	All	Choke, Flash	4175200
BR1	All	Diode Bridge	6902806
F1/F2	All	‡Fuse, Power, FNM 8, 120V	†4900307
F1/F2	All	‡Fuse, Power, FNM 4, 208, 230, 240V	†4900303
F1/F2	All	‡Fuse, Power, KTK 8,480V	†4900335
F3	All	‡Fuse, Marker	4900294
K1	PC 224-2, FTB 225-2	‡Relay, 24V, High Intensity	8900494
K2	All	‡Relay, 24V, Low Intensity	8900494
K3	All	‡Relay, 120V, Discharge	8900493
K4	PC 224-2, FTB 225-2	‡Relay, 24V, Trigger Transfer	4901233
K5	All	‡Relay, 24V, Marker	4901233
**PCB1	All	‡Timing and Trigger Board	2904410xx
PCB2	All	‡HV Rectifier Board	2458005
PCB4	All	Sense Module	2811101
R1A & R1B	All	Resistor (2), Discharge, 35K 50W	6900541
***R2A & R2B	All	Resistor (2), Burst, 500 Ohm, 50W each	6900532
S1 & S2	All	Switch, Interlock (2)	8205501
ALL	T1	Power Transformer, 120V, 60 Hz	†8841501
ALL	T1	Power Transformer, 208V, 60 Hz	†8841502
ALL	T1	Power Transformer, 240V, 60 Hz	†8841503
ALL	T1	Power Transformer, 480V, 60 Hz	†8841504
ALL	T1	Power Transformer, 230V, 50 Hz	†8841001
T3	PC 302-2D	Transformer, Coupling	8336701
T3	PC 224-2, FTB 225-2	Transformer, Coupling	8336701
TB201	PC 302-2D	Terminal Strip, 3 Position	4902157
TB202	PC 302-2D	Terminal Strip, 18 Position	4901930
TB3, TB4	PC 302-2D, PC 224-2	Terminal Strip, 11 Position	8721011
TB201	PC 224-2	Terminal Strip, 3 Position	4902157
TB202	PC 224-2	Terminal Strip, 18 Position	4901930
TB1, TB3, TB4	FTB 225-2	Terminal Strip, 11 Position	8721011
TB2	FTB 225-2	Terminal Strip, 5 Position	4902154
VR1	All	‡Suppressor Asm., 120V	8250801
VR1	All	‡Suppressor Asm., 230/240V	8250802
VR1	All	‡Suppressor Asm., 480V	8250804

† The part number of power fuses, power transformers, and suppressors depend on the voltage of the equipment. The voltage is printed on a label on the equipment case.

‡ Recommended as a spare part.

\*\* The part number for PCB1 may vary with the specific installation. When you order this part, call Customer Service. The part number varies with types of internal board programming for structure configuration and lighting scheme. Be prepared to answer questions about the type, number, lighting sequence, and arrangement of lights on the structure.

\*\*\* Value and part number varies with application.

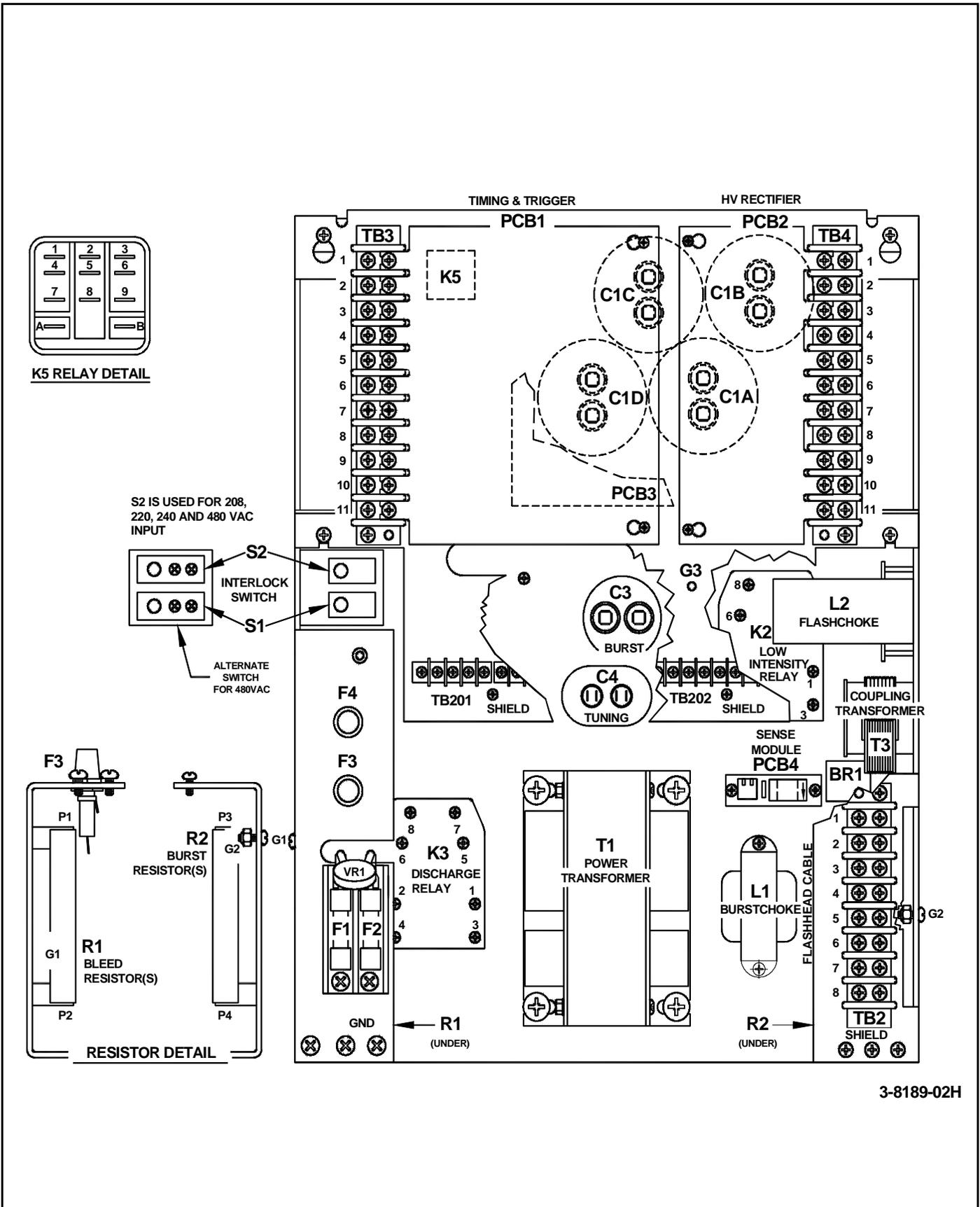
**Table 4-2 Flashhead Major Replaceable Parts**

Item	System Unit	Description	Part Number
P1, P2, P4, P5, P12	FH 307, FH 324	Ceramic Spacer, 3/4" X 1-1/4"	5900844
P1, P2, P3, P4, P5	FH 306	Ceramic Spacer, 3/4" X 1-1/4"	5900844
P3, P11	FH 307, FH 324	Ceramic Spacer, 1/2" X 1"	5900842
P6, P7, P13, P14, P15, P16	FH 306	Ceramic Spacer, 1/2" X 1"	5900842
P6, P7, P8	FH 307, FH 324	Ceramic Spacer, 1/2" diameter, short	5900842
FT101	FH 204, FTB 225-2	‡Flashtube	4587703
FT101	FH 307	‡Flashtube	8384309
FT101	FH 306	‡†Flashtube	8384308
FT101	FH 324	‡Flashtube	8384329
FT102	FH 324	‡Flashtube	8384309
A101	FH 324	†Flashhead Mounting Plate Assembly (Upper)	8905338
A101	FH 307, FH 324	†Flashhead Mounting Plate Assembly (Lower)	8905341
RC101	FH 306, 307, 324	†R.C. Network	1403411
RC102	FH 306, 307, 324	†R.C. Network	1403412
T101	FH 307, FH 324	†Transformer, Trigger	8288201
T101	FTB 225-2, FH 204	Transformer, Trigger	8288201
T102	FH 204	Transformer, Coupling	8336701
T102	FH 306, 307, 324	†Transformer, Coupling	8336701

† If you suspect or find any failing parts in the FH 306 flashhead (except the flashtube, RC networks, ceramic spacers, or coupling transformer), replace the entire flashhead baseplate. The flashtube may be replaced as a single unit.

‡ Recommended as a spare part.

\* A flashhead mounting plate assembly for the FH 307 flashhead may be mounted in a separate location for testing power converters or troubleshooting. An alternate scheme is to use it as a portable flashhead to isolate a problem to the flashhead or to the power converter. Doing this may help you avoid climbing to the tower flashheads if you thus immediately prove the problem is in the power converter.



**Figure 4-1 PC 302-2D Power Converter Component Locations**

302-1DCL

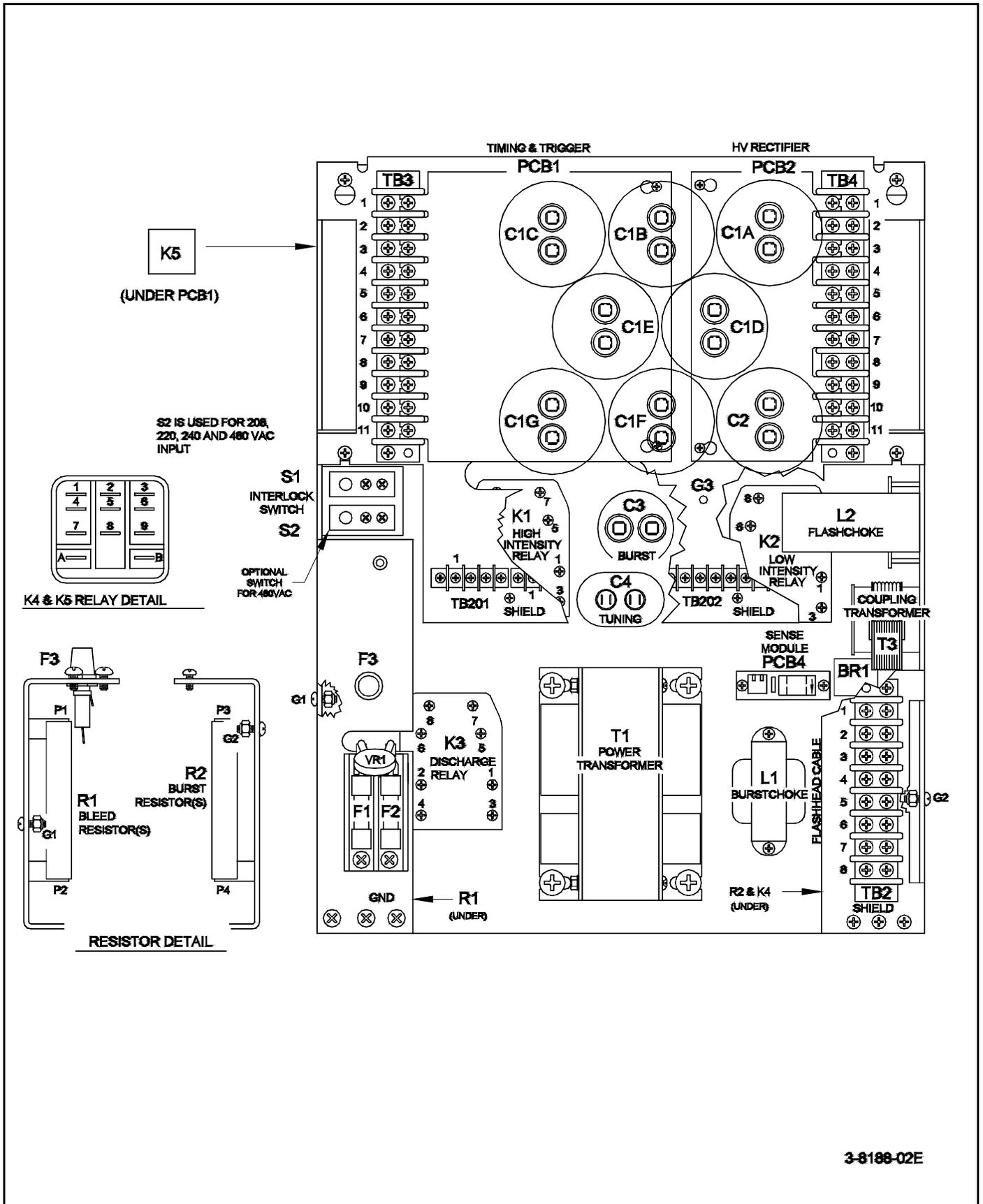
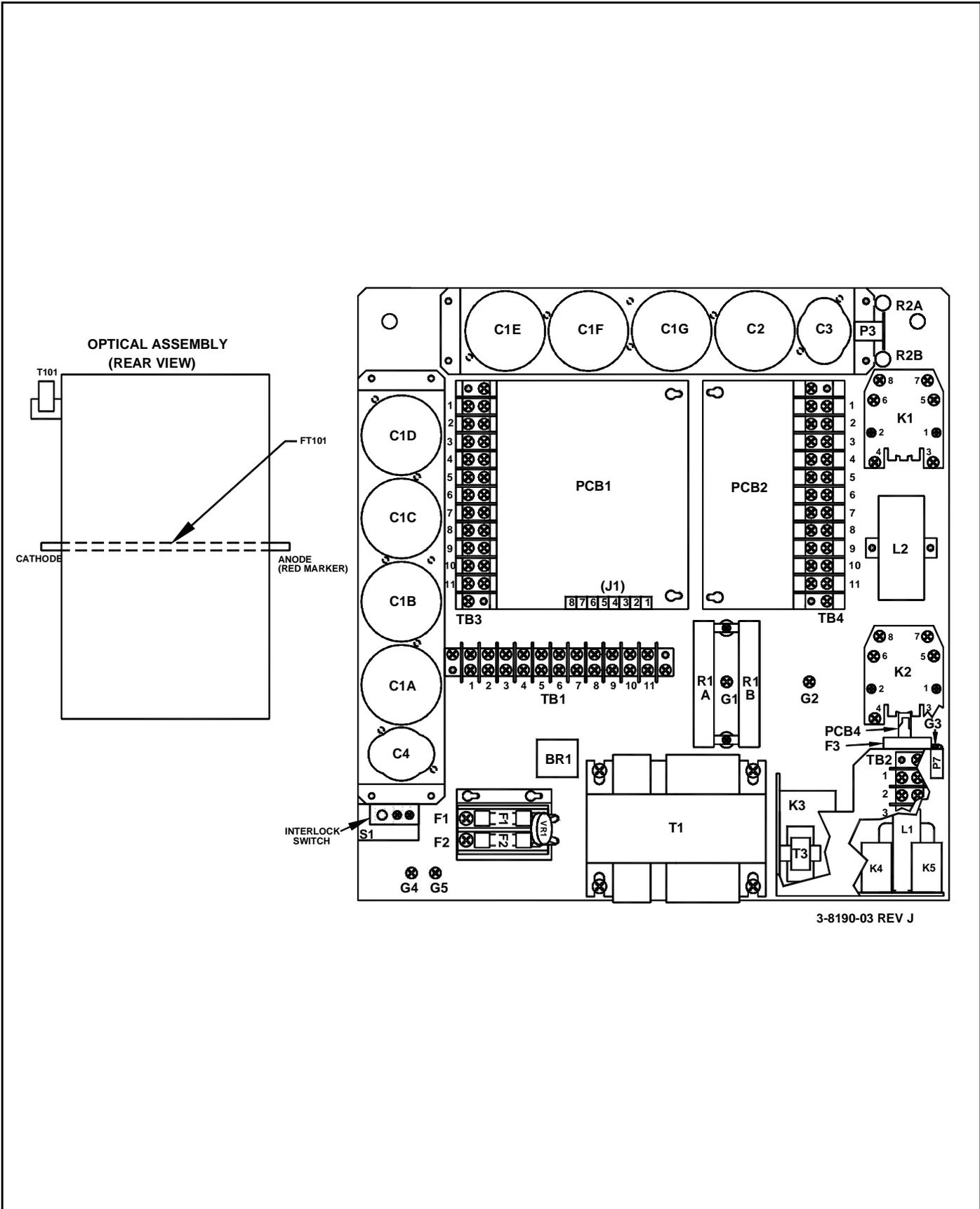
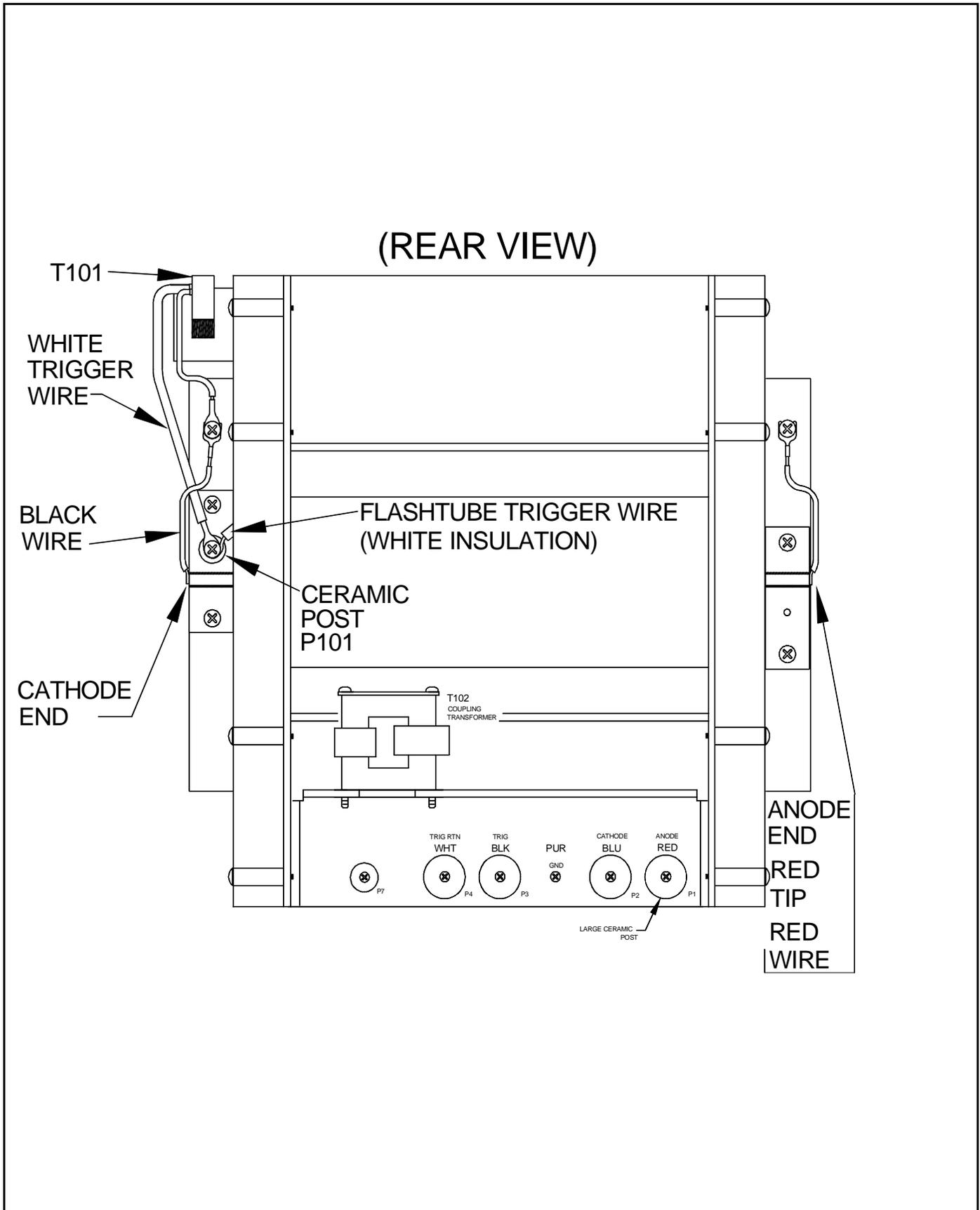


Figure 4-2 PC 224-2 Power Converter Component Locations



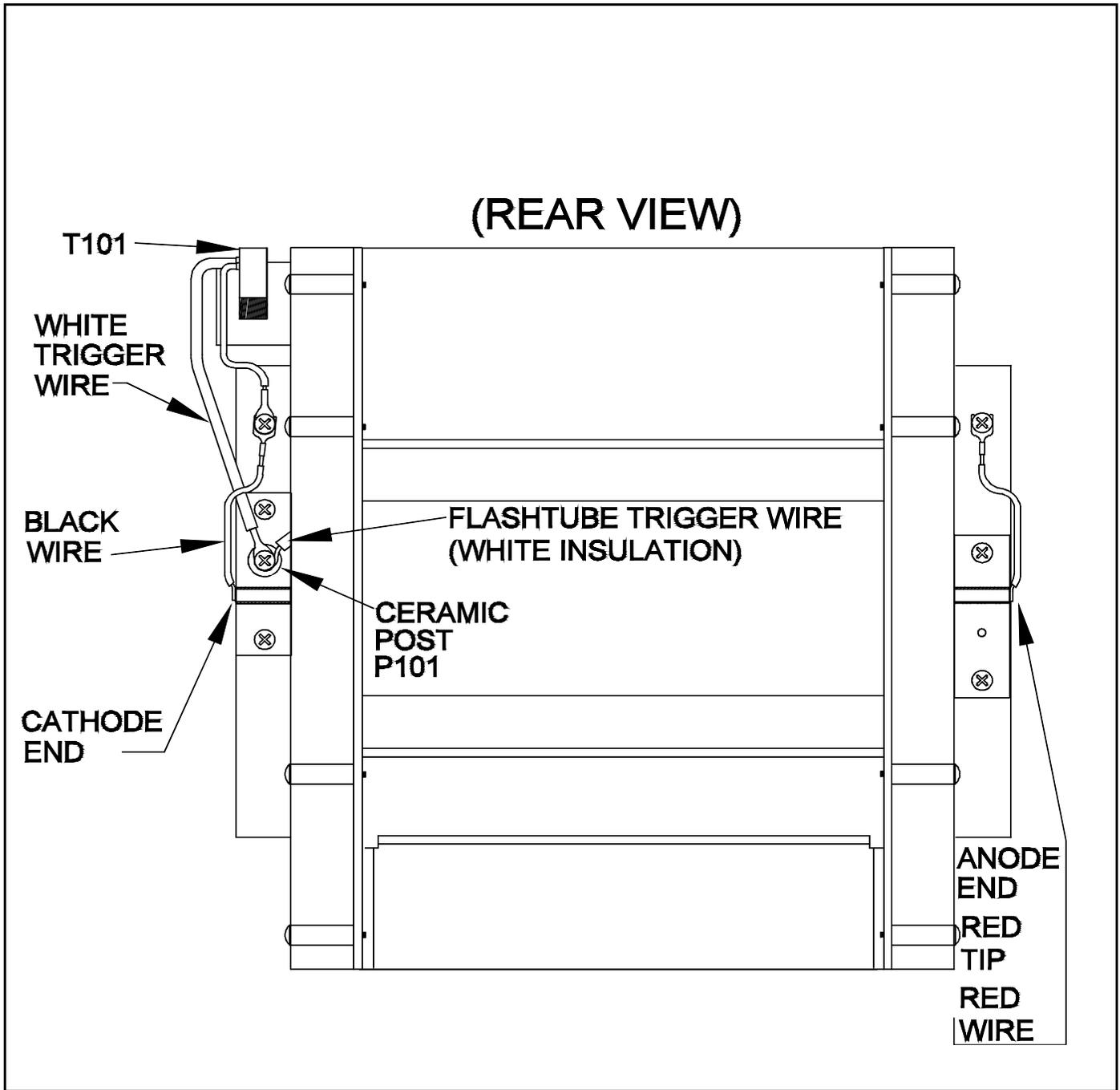
**Figure 4-3 FTB 225-2 Beacon Component Locations**

PC225-1CL



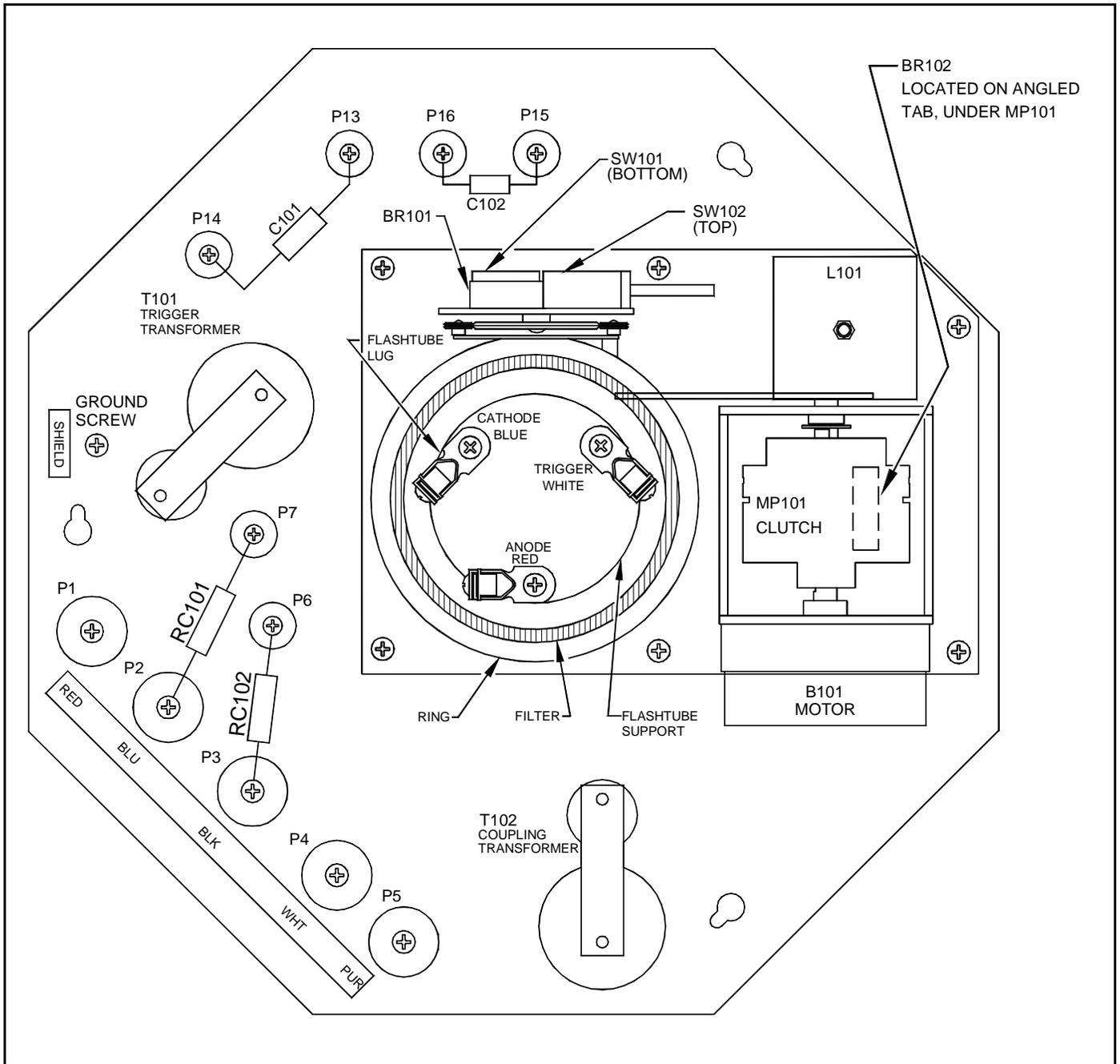
CH6064

**Figure 4-4 FH 204 Flashhead Component Locations**



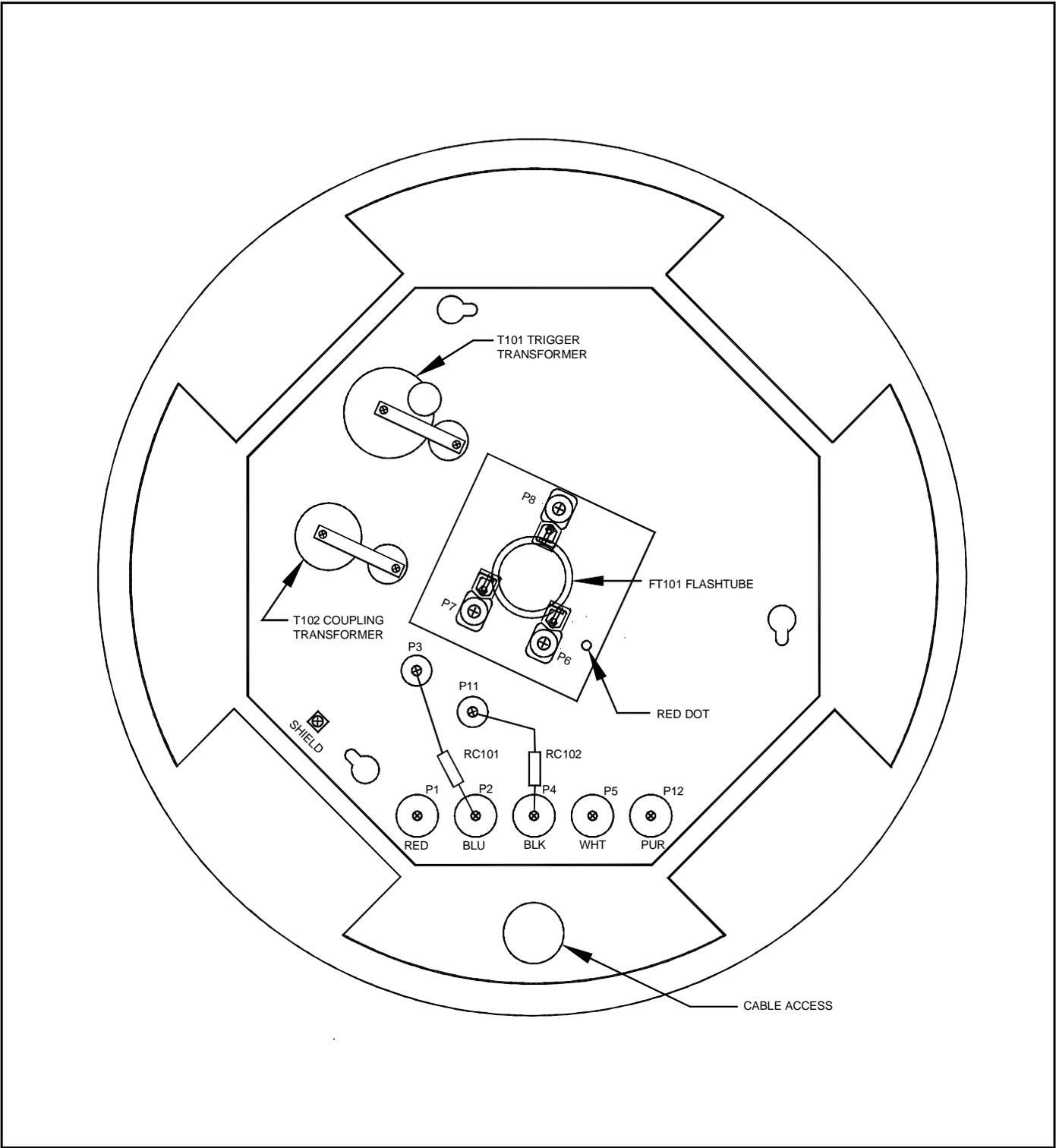
CH6065

**Figure 4-5 FTB 225-2 Optical Assembly Component Locations**



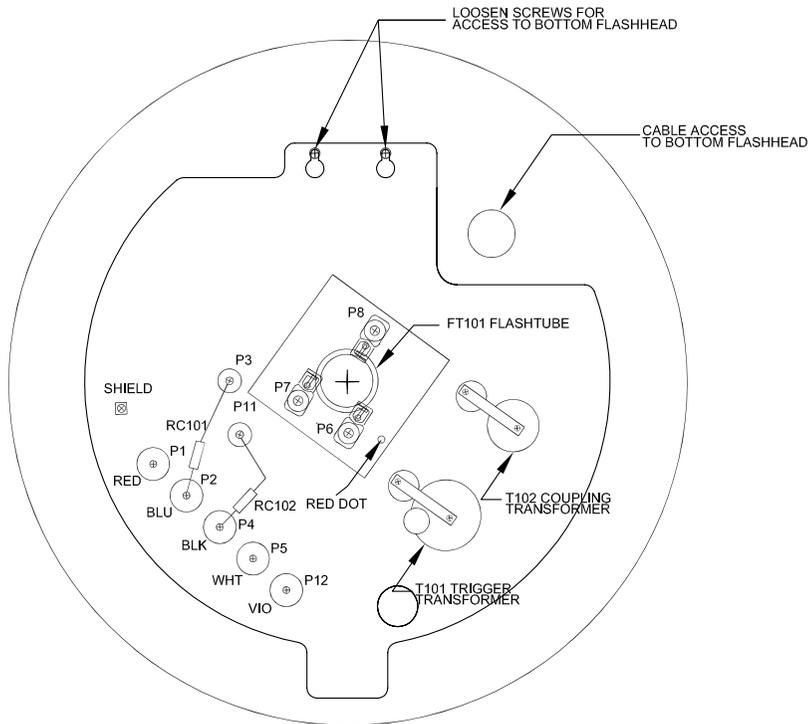
3062CL

**Figure 4-6 FH 306 Flashhead Component Locations**

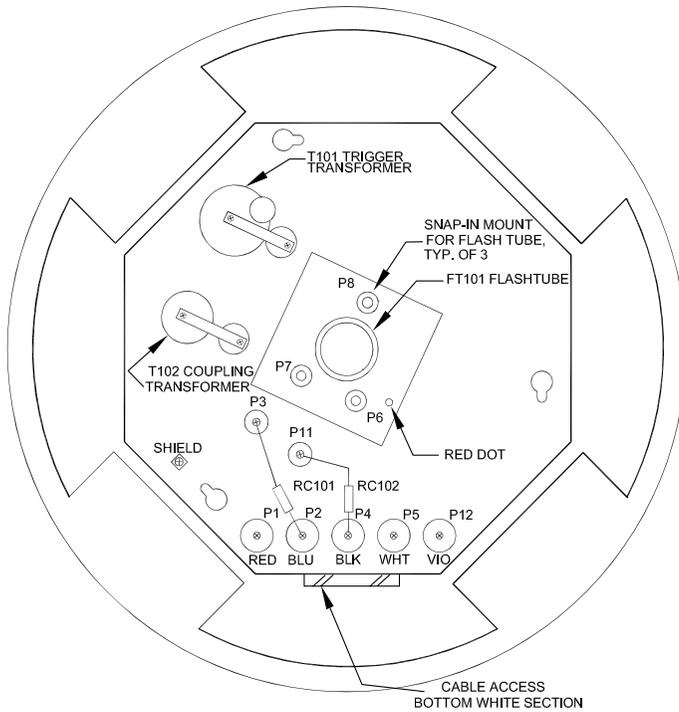


307308CL

**Figure 4-7 FH 307 Flashhead Component Locations**



FH 324 Red (Upper) Flashhead Component Location



FH 324 White (Lower) Flashhead Component Location

FH324CL

**Figure 4-8 FH 324 Flashhead Component Locations**

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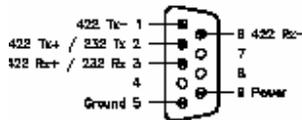
# Section 5 — Programming T&T Board P/N 2904410

## Connecting the Handheld

Table 5-1 shows the connector pin assignments for the handheld. The receive and transmit directions shown in the table are with respect to the handheld. The DB9 connector is located at the top of the handheld programmer.

**Table 5-1**

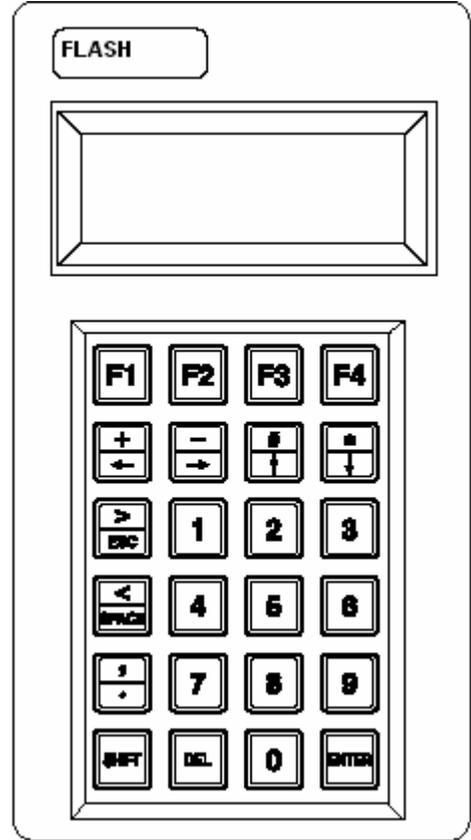
DB9 Female	EIA-232 Function
3	Receive +receive
6	No connection -receive
2	Transmit +transmit
1	No connection -transmit
9	Power
5	Ground



DB9 Female

A 9-pin RS-232 cable is used to connect the handheld to the 9044-01 controller board at connector J2 (9 pin Male connector). Power and ground is provided by this connector.

The same connector J2 on the 9044-01 is also used to connect a computer serial port for the enhanced user interface. This interface is used to set parameters, run production and vendor tests and display general operating information.



**Figure 5-1** FIGURE 5-1 Handheld Programmer

## Using the Programmer

The programmer has a four line LCD display and 24 keys as shown in fig. 5.1.

The following is a general discussion of how the programmer works. See Parameters under the SETUP section below for more details.

In the discussions to follow the 4 line LCD display will be represented as shown:

L1: \*\*\*\*\*

L2: \*\*\*\*\*

L3: \*\*\*\*\*

L4: \*\*\*\*\*

All the messages displayed on the LCD will be in capital letters.

The display does not show the L1: etc. this is used to represent line 1, 2, 3 and 4 on the LCD.

Once the handheld programmer is connected to the 9044-01 and power is applied the 9044-01 will automatically recognize that the terminal is connected to it and will display the sign on message . Only terminals provided by Flash Technology will work with the 9044-01.

The general format of the sign on message is:

L1: FLASH TECHNOLOGY

L2: BOARD 4990

L3: (Blank or further information)

L4: ENTER TO CONTINUE

Once enter is pressed the first menu is displayed as follows:

L1: PRESS A FUNC KEY

L2: F1. SETUP F2. INFO

L3: F3. SHORTTEST

L4: F4. MODE CHANGE

To continue further a function key must be pressed. The function keys are on the top row of the terminal. See fig. 5.1.

F1: Enters the setup menus, used to configure the 9044-01.

F2: Enters the information menu, used to show a limited amount of useful operating info.

F3: Causes the 9044-01 to perform the short test.

F4: Enters the mode change menu, used to manually change the operating mode (DAY, TWI, and NITE).

Note: The handheld terminal will return to the sign on message from any other menu if no key is pressed within two minutes. The 9044-01 does this to take the serial port out of the handheld terminal mode if the terminal has been removed to allow the serial port to be used for the enhanced user interface. This means that if you remove the handheld terminal and connect a computer to use the enhanced interface you must wait at most two minutes before pressing any key on the computer. You can cycle the power to the 9044-01 for faster access to the computer interface.

## SETUP

The setup menu has the following format:

L1: SETUP

L2: DASH 10 T 1 B 1

L3:

L4: OK NEXT BACK EXIT

The first line displays the current menu. The second line displays the current setup. The numbers correspond to the dash number tier and beacon selected. The third line is blank. The fourth line displays what functions the keys F1 thru F4 will perform if pressed; the words are spaced to be over the corresponding function key. So, to move to the next menu you would press F2 (NEXT).

F1: OK- is used to enter data.

F2: NEXT- moves to the next item.

F3: BACK- moves to the previous item.

F4: EXIT- exits the setup menu.

## Parameters

Pressing the NEXT or BACK function key from the SETUP menu takes you to the parameters. The general format is:

L1: SETUP

L2: DASH # 10

L3: Enter Dash #

L4: OK NEXT BACK EXIT

To change the dash number enter a number and press F1 OK. Press NEXT to continue. Note: Dash numbers should only be programmed by trained Flash Technology personell or under the direction of same.

The display will change to:

L1: SETUP

L2: TIER # 1

L3: Enter TIER #

L4: OK NEXT BACK EXIT

Press the number keys to select the tier number you wish this board to be and then press F1 (OK). The tier number displayed will change. When you are done press NEXT or BACK.

The display will change to:

L1: SETUP

L2: BEACON # 1

L3: Enter BEACON #

L4: OK NEXT BACK EXIT

Press the number keys to select the beacon number you wish this board to be and then press F1 (OK). The beacon number displayed will change. When you are done press NEXT, BACK or EXIT.

## INFO

The info menu has the following format:

L1: INFO

L2: BOARD 4990

L3:

L4: NEXT BACK EXIT

This menu is used to show a limited amount of information about the current 9044-01 operation and configuration.

The first line displays the current menu. The second and third lines display board information. The fourth line displays what functions the keys F2 thru F4 will perform if pressed; the words are spaced to be over the corresponding function key. So, to move to the next item you would press F2 (NEXT).

F2: NEXT- moves to the next item.

F3: BACK- moves to the previous item.

F4: EXIT- exits the setup menu.

Items like energy, trigger voltage, flash rate and operating mode are displayed.

## MODE CHANGE

The mode change menu has the following format:

L1: MODE CONTROL

L2: CURRENT DAY

L3:

L4: DAY TWI NITE EXIT

F1: DAY- Changes the mode to DAY.

F2: TWI- Changes the mode to TWI.

F3: NITE- Changes the mode to NITE.

F4: EXIT- exits the mode change menu and returns the mode to automatic.

This menu item is used to manually change the operating modes and functions just like the test jumpers on the board.

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~ End of Document ~

## Return Material Authorization (RMA) Policy

**IF A PRODUCT PURCHASED FROM FLASH TECHNOLOGY MUST BE RETURNED FOR ANY REASON (SUBJECT TO THE WARRANTY POLICY), PLEASE FOLLOW THE PROCEDURE BELOW:**

**Note: An RMA number must be requested from Flash Technology prior to shipment of any product. No returned product will be processed without an RMA number. This number will be the only reference necessary for returning and obtaining information on the product's progress. Failure to follow the below procedure may result in additional charges and delays. Avoid unnecessary screening and evaluation by contacting Technical Support prior to returning material.**

**1. To initiate an RMA: Call Flash Technology's National Operations Center (NOC) at (800-821-5825) to receive technical assistance and a Service Notification number. The following information is required before a Service Notification number can be generated:**

- Site Name/Number / FCC Registration number/ Call Letters or Airport Designator
- Site Owner (provide all that apply – owner, agent or subcontractor)
- Contractor Name
- Contractor Company
- Point of Contact Information: Name, Phone Number, Email Address, Fax Number and Cell Phone (or alternate phone number)
- Product's Serial Number
- Product's Model Number or part number
- Service Notification Number (if previously given)
- Reason for call, with a full description of the reported issue

**2. The Service Notification number will then serve as a precursor to receiving an RMA number if it is determined that the product or equipment should be returned. To expedite the RMA process please provide:**

- Return shipping method
- Shipping Address
- Bill to Address
- Any additional information to assist in resolving the issue or problem

**3. Product within the Warranty Time Period**

- a. If to be returned for repair;
  - RMA # is generated
  - Once product is received and diagnosed;
    - Covered under warranty – product is repaired or replaced
    - Not covered under warranty – quote is sent to the customer for a bench fee of **\$350 plus parts** for repair
      - If the customer does not want the product repaired, a **\$50 test fee** is charged before being returned
- b. If advance replacement;
  - Purchase order may be required before the advance replacement order is created
  - RMA # is generated and the advance replacement order is created
  - Once product is received and diagnosed;

- Covered under warranty – credit given back if PO received
- Not covered under warranty – credit **will not** be applied to PO
- Flash Technology has sole discretion in determining warranty claims. Flash Technology reserves the right to invoice for parts advanced if the associated failed parts are not returned within 15 days of issue or if product received is diagnosed to be non-warranty.
- Advance replacements will be shipped ground unless the customer provides alternative shipping methods.

**4. Product outside the Warranty Time Period**

- a. For Xenon System board repair; a purchase order is required at time of request for a RMA # for a standard **\$350 repair bench fee**
  - RMA # is generated with the PO attached
  - If the board is deemed non-repairable after diagnosis, the customer is notified. If the customer purchases a new board, the repair bench fee is waived. If the customer does not buy a new board, a **\$50 test fee** is charged before being returned or scrapped.
- b. For all other products; no purchase order is required to return the product for diagnosis
  - RMA # is generated
  - Once product is diagnosed, quote is sent to the customer for a bench fee of **\$350 plus parts** for repair
  - Once the purchase order is received, the product will be repaired and returned
    - If the customer does not want the product repaired, a **\$50 test fee** is charged before being returned or scrapped.

**5. After receiving the Flash Technology RMA number, please adhere to the following packaging guidelines:**

- All returned products should be packaged in a way to prevent damage in transit. Adequate packing should be provided taking into account the method of shipment.
- Note: Flash Technology will not be responsible for damaged items if product is not returned in appropriate packaging.**

**6. All packages should clearly display the RMA number on the outside of all RMA shipping containers. RMA products (exact items and quantity) should be returned to:**

Flash Technology  
 Attn: RMA #XXX  
 332 Nichol Mill Lane  
 Franklin, TN 37067

**7. All RMA numbers:**

- Are valid for 30 days. Products received after 30 days may result in extra screening and delays.
- Must have all required information provided before an RMA number is assigned.