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FTB 204

FTB 205

FTB 207

FTB 208

**High Intensity Obstruction Lighting System
Reference Manual**

Front Matter

Abstract

This manual contains information and instructions for installing, operating, and maintaining the FTB 204 and 205 High Intensity Obstruction Lighting Systems and FTB 207, 208 and 208P Catenary Obstruction Lighting Systems.

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Applicable Specification

This equipment meets or exceeds requirements in FAA Advisory Circulars 150/5345-43, 70/7460-1, and 150/5345-1 for an FAA Type L-856 and L-857 white high intensity obstruction light.

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 two years.

Parts Replacement

The use of non-OEM parts or unauthorized modification of this equipment will void the warranty and could invalidate the assurance of complying with FAA requirements as published in Advisory Circular 150/5345-43, 70/7460-1, and 150/5345-1.

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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Section 1 — Introduction and Operation

The FTB 204 High Intensity Beacon consists of an FH 204 Flashhead and a PC 204 Power Converter in separate enclosures.

The FTB 207 High Intensity Catenary Beacon consists of an FH 204 Flashhead and a PC 207 Power Converter in separate enclosures.

The FTB 205 High Intensity Beacon is a self-contained unit with an optical assembly mounted in the enclosure.

The FTB 208 High Intensity Catenary Beacon is a self-contained unit with an optical assembly mounted in the enclosure.

System Controller

An ElectroFlash FTC 140 System Controller directs flash timing and intensity, and records and reports Beacon operating status. It enables either automatic or manual intensity control, and it continuously displays the flashing status of each Beacon. For further information, consult the FTC 140 System Controller Manual.

Variations and Options

Contact Customer Service at 1-800-821-5825 for a description of equipment variations and options.

Equipment Specifications

Dimensions are nominal. See Section 2 for mounting dimensions.

Physical

PC 204 or PC 207 (or PB) Power Converter):

(H x W x Depth, Wgt.)

23 x 17.13 x 9.44 in., 70 lbs.

584.2 x 435.1 x 239.8mm., 31.8 kg.

Wind Area: 2.4 sq. ft., .22 sq. m.

FH 204 Flashhead:

(H x W x Depth, Wgt.)

23 x 18.6 x 12.8 in., 18 lbs.

584 x 472 x 325 mm., 8.2 kg.

Wind Area: 1.99 sq. ft., .18 sq. m.

FTB 205 or 208 (or PB) Beacon:

(H x W x Depth, Wgt.)

22.35 x 20.88 x 11.23 in., 85 lbs.

567.7 x 530.4 x 285.2 mm. 38.6 kg.

Wind Area: 2.9 sq. ft., .27 sq. m.

Application

FTB 204, 205 L-856

FTB 207, 208 Catenary L-857

Flash Intensity: (nominal)

FTB 204, 205:

Day Intensity 270,000 ± 25% ECD

FTB 207, 208:

Day Intensity 140,000 ± 25% ECD

All Units:

Twilight Intensity 20,000 ± 25% ECD

Night Intensity 2,000 ± 25% ECD

Beam Spread:

Horizontal: 120°; Vertical: 3°

Flash Rate:

FTB 204, FTB 205 40 flashes per min.

FTB 207, FTB 208 Catenary 60 flashes per min.

Electrical (factory pre-wired):

AC Voltage

120, 208, 240, 480VAC ± 10%, 60 Hz ± 1% 1Ø

230 VAC 50Hz

Volt-Amperes 600 VA peak; 400 VA avg.

Watts Day Mode: 255

Environmental: 55 to +55 degrees Centigrade

Control: Responds to system controller

Operation

The controller determines the operating intensity of the structure lights, and then informs the Timing and Trigger Board (PCB1) in each beacon.

Beacon/Power Converter

The beacon starts flashing when power is applied.

A pair of shielded conductors between the beacons and the controller carry the control and monitoring signals for an entire system. A beacon sends a flash confirmation signal to the controller for

monitoring. Individual encoding identifies the beacon of origin, thus enabling all beacons in a system to individually report to the controller.

All beacons are capacitive discharge lights that use a xenon flashtube.

If the controller is disconnected, or fails, all beacons flash by default at high intensity.

Catenary Operation (FTB 207, 208, 208PB)

High intensity lights for towers that support catenary wires provides the highest degree of visibility in daylight and night. Three levels (tiers) of sequentially flashing lights are required. One tier of lighting is required at the top, one tier at the midpoint, and one tier at the bottom.

The tier flash sequence is middle, top, bottom. All lights at the same tier flash simultaneously. The catenary flash rate is 60 flashes per minute. See jumper JP13 in *Table 1-2* for catenary programming.

FTCA uses a standard format: it refers to the lowest level as Tier 1 and the most northerly facing light as beacon 1. Higher numbered beacons are placed around the structure in a North-East-South-West direction. *Figure 1-2* shows a typical installation.

Flash Modes

Night: At nightfall, the controller switches the beacon to *night mode* operation; the flashhead flashes at the night intensity of $2,000 \pm 25\%$ ECD.

Twilight: At twilight, the controller switches the beacon to *twilight mode* operation; the flashhead flashes at the twilight intensity of $20,000 \pm 25\%$ ECD.

Day: At daybreak, the controller switches the beacon to *day mode* operation; the flashhead flashes at the daylight intensity of $270,000 \pm 25\%$ ECD.

60/50 Hz Operation

PCB1 can operate from either a 60Hz or a 50Hz power source. Cut JP12 jumper on PCB1 for 50 Hz operation.

Fixed Mode Operation

Table 1-1 explains how to force the beacon to operate continuously at a fixed flash intensity (mode). Use *Table 1-1* to check its operation at all three flash intensities.

Table 1-1 Mode Control

Intensity	Procedure†
DAY (High)	Place a jumper between Test Point 1 (TP1) labelled TEST and TP5 labelled DAY.
TWI (Twilight)	Place a jumper between Test Point 1 (TP1) labelled TEST and TP4 labelled TWI.
NITE (Low)	Place a jumper between Test Point 1 (TP1) labelled TEST and TP3 labelled NITE.
LTV	<i>Factory use only.</i> Causes continuous triggering. Do not use.

† Be certain to remove all jumpers after checking the beacon.

Setting Up PCB1

PCB1 (24988xx) governs all the functions pertaining to operation. It has eight red light emitting diode (LED) indicators, and one clear neon indicator that you can use to monitor equipment operations during checkout and troubleshooting. To monitor operation the following subsections instruct you to observe specified LEDs. The LEDs are mounted at the top left edge of PCB1. The essential features on PCB1 for troubleshooting are shown in *Figure 1-1*.

The factory programs PCB1 according to your purchase order.

When replacing PCB1 in the field, ensure that the jumpers on the replacement board are cut in the same manner as the jumpers on the board you are

replacing. You can change some operations in the field by using the information in the *Figure 1-1* and *Table 1-2*. *Figure 1-1* shows the locations of programming jumpers and of indicator lights useful for monitoring the equipment's operation. *Table 1-2* shows the jumper functions.

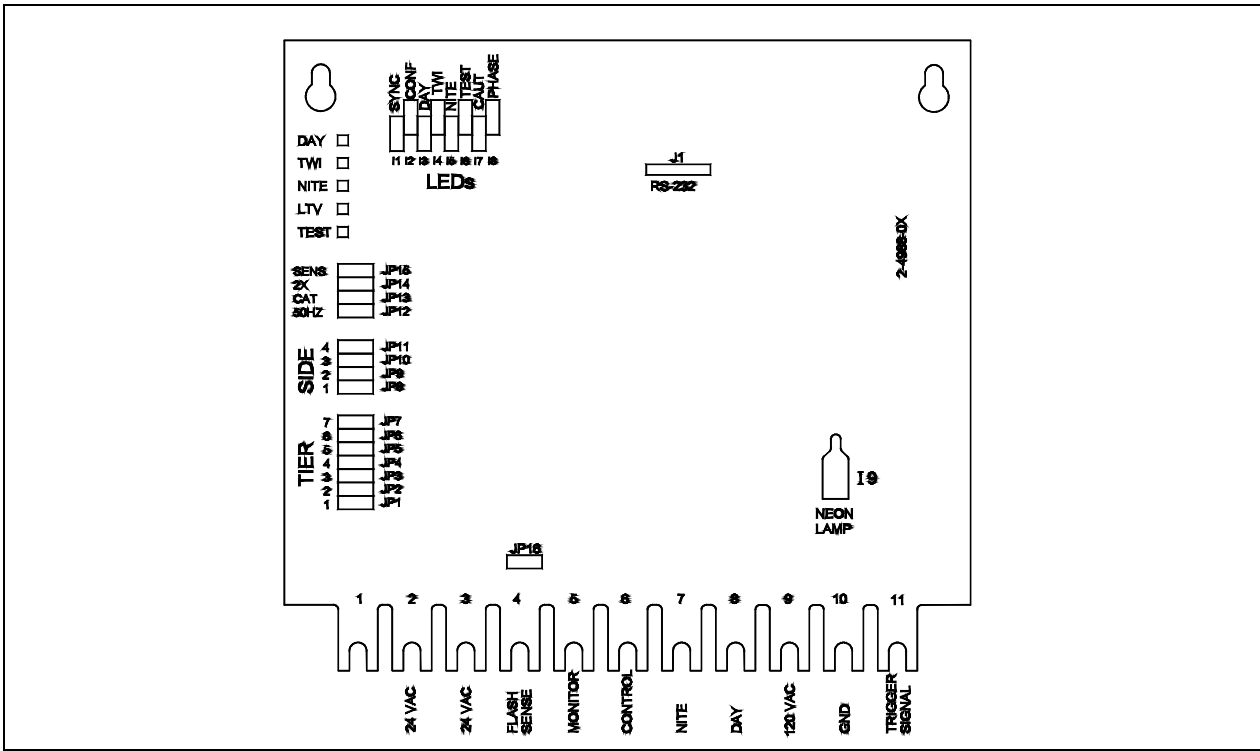
Cutable Jumpers

NOTE

Cutable jumpers JP12, JP14, JP15, and JP16 are for factory use only. The factory cuts all jumpers according to the installation requirements. Other jumpers are cut according to the location (on the structure) or use (catenary or not), only if necessary.

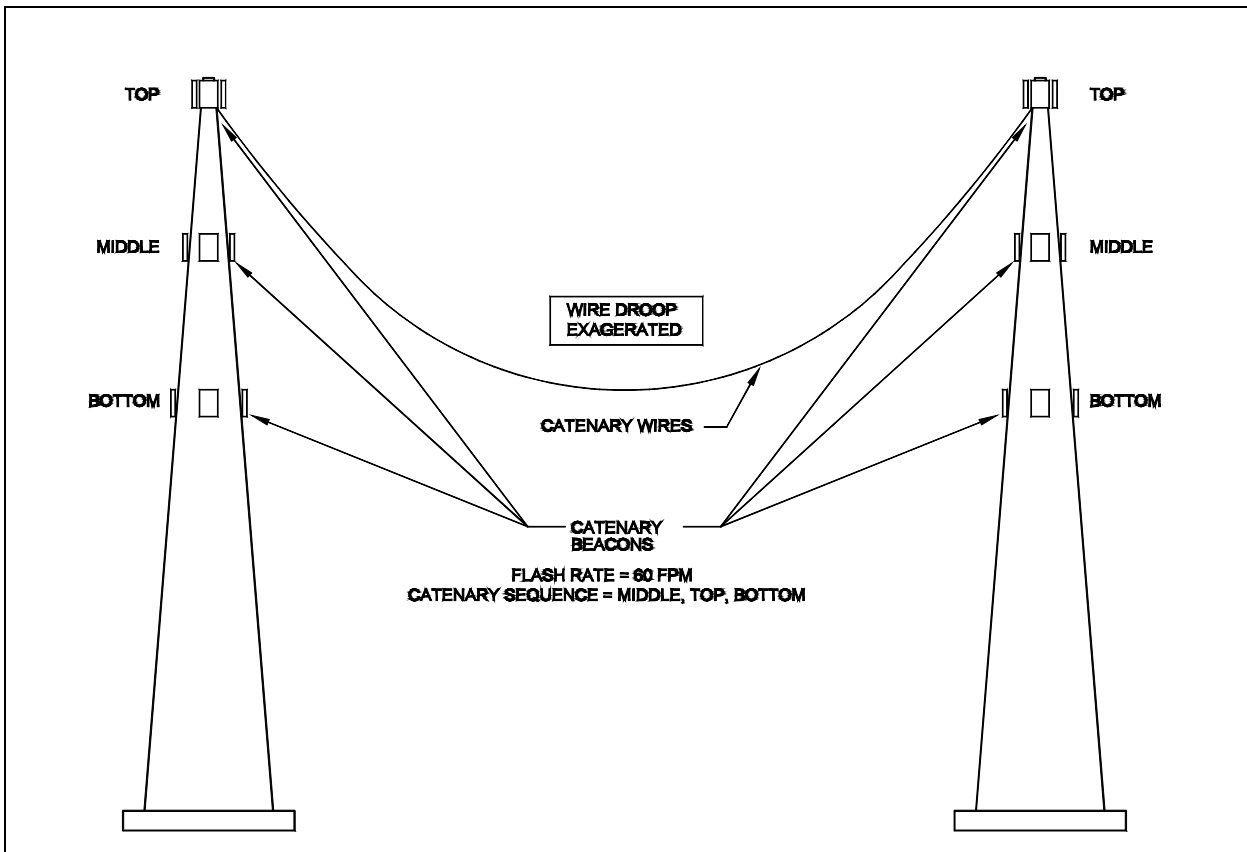
Table 1-2 Cutable Jumper Programming and Use

Jumper	Name	Purpose
JP1	TIER 1	Cut jumper selects tier #1.
JP2	TIER 2	Cut jumper selects tier #2.
JP3	TIER 3	Cut jumper selects tier #3.
JP4	TIER 4	Cut jumper selects tier #4.
JP5	TIER 5	Cut jumper selects tier #5.
JP6	TIER 6	Cut jumper selects tier #6.
JP7	TIER 7	Cut jumper selects tier #7. NOTE: This jumper is cut in the backup lighting unit of primary/backup systems, such as the FTB 208PB. For these systems JP7 and the proper Tier and Side Jumpers are also cut.
JP8	SIDE 1	Cut jumper selects side #1.
JP9	SIDE 2	Cut jumper selects side #2.
JP10	SIDE 3	Cut jumper selects side #3.
JP11	SIDE 4	Cut jumper selects side #4.
JP12	50Hz	Cut jumper selects 50Hz board operation for 50Hz power source. <i>Factory cut; internal power converter wiring is also changed for 50Hz.</i>
JP13	CAT	Cut jumper allows catenary operation for this power converter. The controller directs catenary operation. <i>Factory cut</i> for your installation. (For FTB 207, 208, or 208PB only.)
JP14	2X	<i>Factory cut.</i>
JP15	SENS	Cut jumper selects energy thresholds appropriate for a ferrite core sense transformer. <i>Factory cut.</i>
JP16	SENS	Cut jumper configures sense signal hardware for ferrite core sense transformer. <i>Factory cut.</i>



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Figure 1-1 PCB1 (24988xx) Timing and Trigger Board



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Figure 1-2 Typical 2-Tower 3-Tier Layout and Catenary Beacon Operation

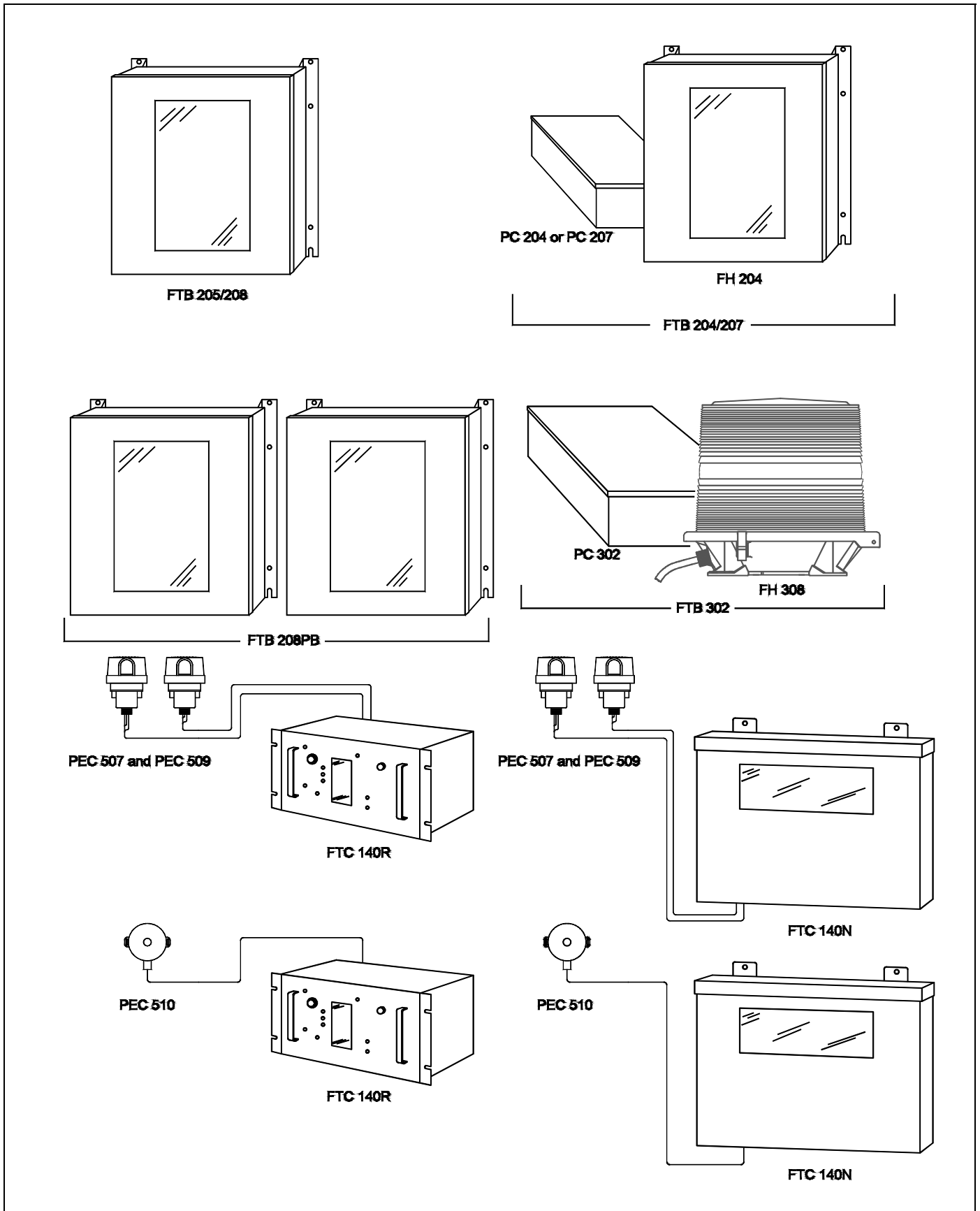


Figure 1-3 High Intensity Lighting Equipment

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Section 2 — Outline, Mounting, and Installation

Unpacking

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

FTCA factory programs beacons for operation at particular locations, and marks the shipping containers accordingly on the outside. FTCA refers to the lowest level as Tier 1 and the most northerly facing light as Beacon 1. Higher numbered beacons are placed around the structure in a North-East-South-West direction. Therefore, you must maintain the beacon's identity according to the package identity of each beacon (for example, Beacon 1, Tier 1; Beacon 2, Tier 1; and so forth), and install it as called out on drawings.

Tools

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

- #1 Phillips-head screwdriver, 8-inch long shank
- #2 Phillips-head screwdriver
- 3/16-in. flat blade screwdriver
- 1/4-inch flat blade screwdriver
- Medium slip-joint pliers
- 8-in. or 10-in. adjustable wrench
- Assorted nut drivers and combination wrenches
- Hand tools for electrical wiring
- Triplet™ Model 630-NA VOM, or equivalent analog volt-ohm meter, or a digital meter with an averaging function.

Access

HAZARD WARNING

Disconnect the primary power before opening the beacon or flashhead enclosures.

Beacon/Power Converter

Latches secure the hinged cover of the power converter or the beacon. When you release these you can swing open the cover for access to the inside.

Flashhead

Latches secure the hinged cover of the flashhead. When you release these you can swing open the cover for access to the inside.

Mounting

Outline, mounting, and clearance dimensions for your equipment are shown in the following figures:

- *Figure 2-1 PC 204 or PC 207 Power Converter Mounting and Outline*
- *Figure 2-2 FH 204 Flashhead Mounting and Outline*
- *Figure 2-3 FTB 205 or FTB 208 Beacon Mounting and Outline*

Beacon Location

FAA Guidelines for beacon placement are published in AC 70/7460-1. Avoid placing a beacon within a strong radio frequency (RF) field. For example, a beacon within four feet of a radiating FM antenna is likely to pick up electromagnetic interference (EMI) that could cause improper operation or damage. Place a beacon at an adequate distance from a powerful RF radiator. Contact the factory for instructions when you cannot avoid this situation.

Beacon Angle

NOTE

Beacons (except AOL lights) are installed with specific elevation angles.

Various factors may influence the angle of beacon elevation for the units on your structure. These

include: location of the structure, height of the beacon above ground, and other characteristics of the site and surrounding terrain. Advisory Circular 70-7460-1 contains guidelines for setting the elevation angle. Information derived from that source forms *Table 2-1 Beacon/Flashhead Elevation Angle*.

Table 2-1 Beacon/Flashhead Elevation Angle

Tier Level - Above Ground Level (AGL)	Elevation Angle
0 to 300 feet (91 meters)	+3 degrees
300 feet to 400 feet (122 meters)	+2 degrees
400 feet to 500 feet (152 meters)	+1 degree
500 feet and higher	0 degree

First, level the unit to obtain a reference elevation angle (the specified elevation angle is added to the reference angle). Use the spirit level located inside the enclosure for initial leveling—the tilting bracket has an incremental scale. The tilt mechanism is part of the permanently attached mounting bracket. To level the enclosure, tilt it by using the mounting brackets.

- Vertically on the top end of a vertical length of conduit to prevent water from entering.

Refer to the system controller manual for mounting and outline dimensions of the FTC 140R/W Controller and PEC.

Controller Mounting

Locate the system controller in an area with restricted access. Controllers are available either in outdoor enclosures that can be attached to any vertical surface, or as an indoor, rack-mounted controller.

You can place the system controller anywhere within 2500 feet of the most distant beacon without further consideration. Consult with the factory if a greater distance is necessary.

PEC Mounting

You may locate the PEC at any practical distance from the system controller. To ensure proper operation, observe the following requirements. Mount the PEC:

- With an unobstructed view of the polar sky.
- In a way that direct or reflected sunlight does not strike it.

Wiring

NOTE

Only general information for a typical installation is presented here. Thus, more specific information may be needed for your site.

Consult any installation drawings prepared especially for your site or supplied with the equipment.

If installation drawings prepared specifically for your site disagree with information provided in this manual, the installation drawings should take precedence.

See *Figure 2-4 Wiring Overview of a System*. System wiring consists of primary power and signal distribution wiring. Primary power is usually taken from a load center to the various items of equipment. Signal wiring is between the beacons and the system controller. Make connections to beacons at nearby junction boxes. Always position junction boxes below the beacons with drain holes facing downward.

Beacon Wiring

Three-phase power often supplies large systems. However, the beacons are single-phase units that are connected from line-to-line (A-B, B-C, A-C). Therefore, phase differences occur between groups of beacons in the same three-phase system. In a three-phase system, phase A-C must supply the controller (not C-A) to allow the controller to be compatible with all beacons. Failure to ensure optimum phasing as described could result in intensity control problems.

Use circuit breakers or a safety switch with fuses for the primary power load center. Insulation should be rated at 600 VDC minimum. Wire size is a factor affected by the service voltage, the number of beacons in the system, and the length of the wire run to the beacons. To determine wire gauge, consider each beacon as a 400 volt-ampere load and do not permit the voltage drop caused by wire resistance to exceed 5% at any beacon. You may use this volt-ampere value to determine ratings for slow-acting fuses or circuit breakers for the system. For fast-acting fuses and a system feeder transformer (if used) consider a peak load of 600 volt-amperes for each beacon. *FTCA recommends that you use National Electric Code guidelines for all primary wiring.*

A label inside the beacon near the fuse block indicates the operating voltage and frequency of your beacon. Two internal fuses are sized according to the operating voltage. When Line 2 is neutral, the factory replaces the F2 fuse with a jumper wire.

Make connections to distribution wiring at a nearby junction box. Consult the following installation wiring diagrams to guide you in wiring the equipment at your installation:

CAUTION

These figures are guidelines only. If they differ from the installation drawings for your site, use the site installation drawings.

Installation drawings in this manual are as follows:

- *Figure 2-5 Junction Box; Three-phase Installation Wiring*

- *Figure 2-6 Single-Phase Installation Wiring for FTB 204 or 207*
- *Figure 2-7 Single-Phase Installation Wiring for FTB 205 or 208*
- *Figure 2-8 Single-Phase Installation Wiring for FTB 208 and FTB 208PB*

Lightning Protection

Though ElectroFlash equipment is designed to withstand severe transient over-voltages, a lightning arresting system must be installed to prevent damage by lightning. Install a lightning arresting system to protect a light at the top of a mast or antenna. Transient suppressors from line-to-line and line-to-neutral are recommended at the primary power load center.

Installation Checklist

Complete the following steps before applying power to the lights.

1. **Equipment Damage:**
Inspect all equipment for damage.
2. **Required Equipment:**
Verify the received equipment against the packing list to ensure completeness.
3. **Beacon/Power Converter Mounting:**
Position and mount each unit correctly, allowing adequate clearance for opening the covers. Also, use the following guidelines:
 - 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 unit away from radio frequency interference (RFI).

4. Beacon/Power Converter Wiring:

Use the installation drawings and the following guidelines:

- Check for proper incoming service voltage.
- Wire each unit according to the instructions.
- In installations with multiple units, ensure that all units are wired to the same phase. In installations with multiple tiers and three phase wiring, follow the phasing chart in the installation drawings, or site drawings.
- Check all electrical connections for tightness.
- Check all terminal strip connections for tightness.
- Ground the power converter/beacon using a bonding strap from the case leg to the structure.

5. Flashhead Mounting:

Ensure that the flashhead lens can be opened without striking other objects.

- Level and set the flashhead at the required elevation angle.

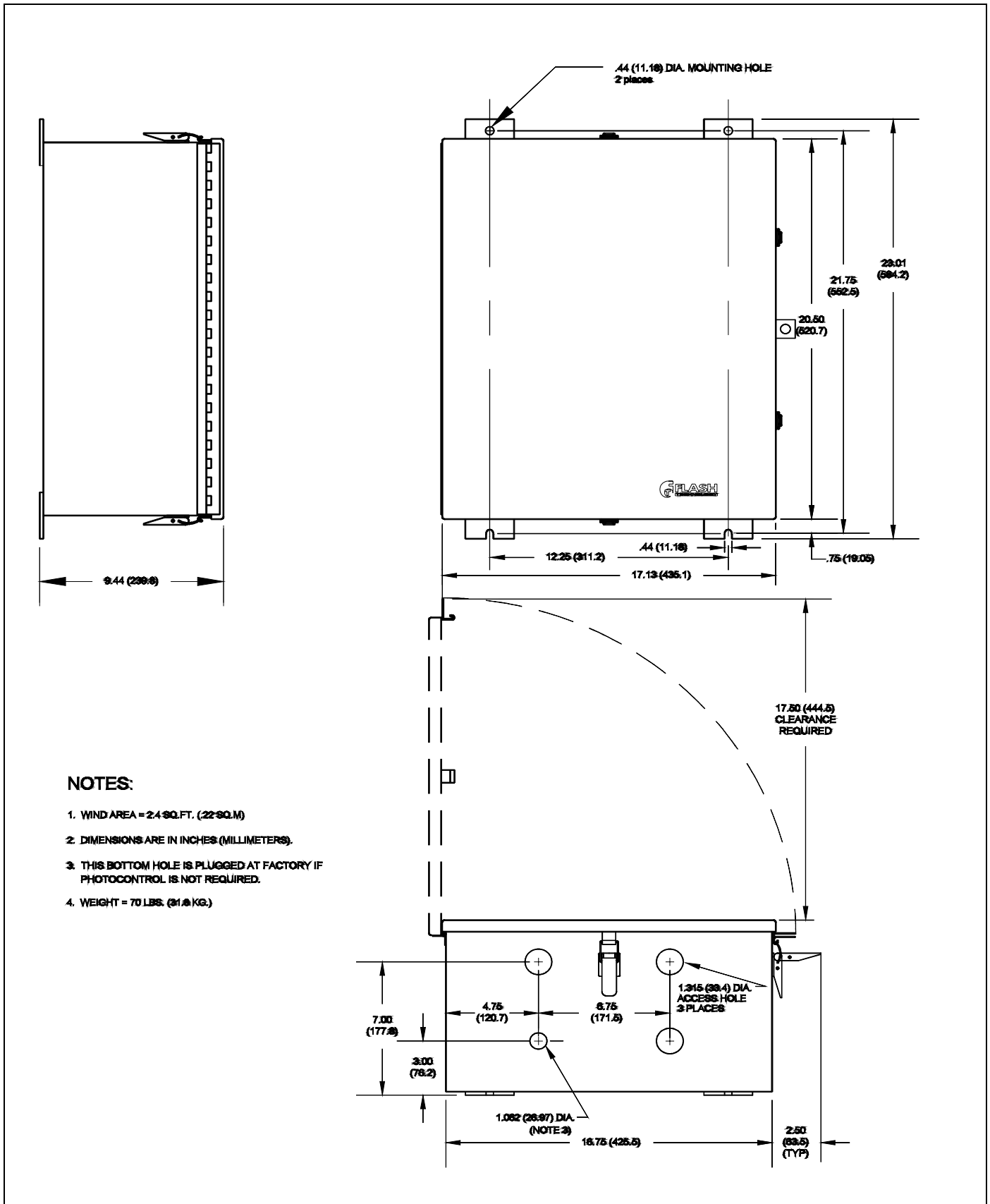
6. Flashhead Wiring:

- 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.

7. Photocell:

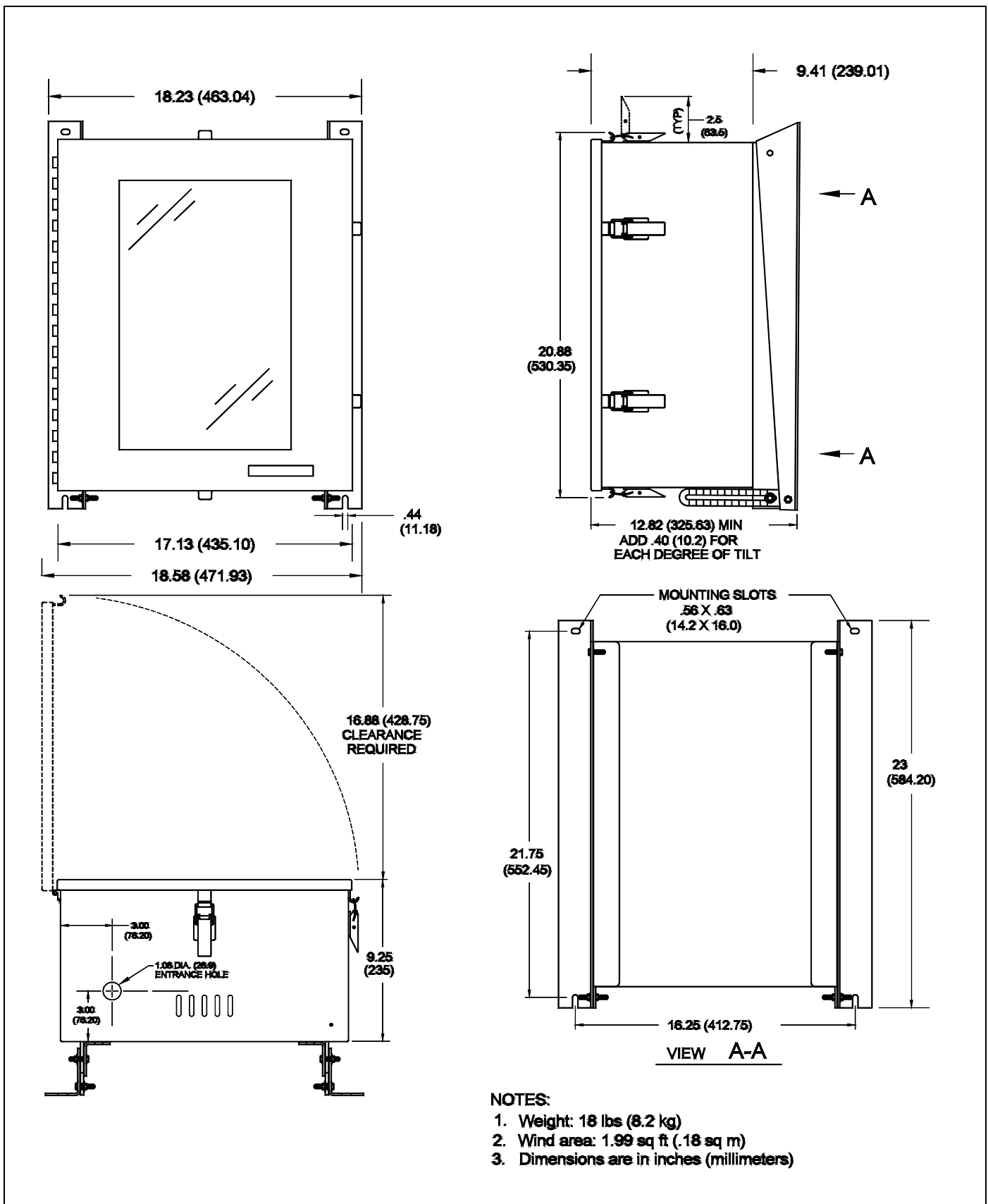
- Locate photocell where it views unobstructed polar sky with no direct or reflected artificial lighting striking it.
- Mount the photocell vertically on the top end of a vertical length of conduit to prevent water from entering the unit.
- Ground the wire shield around the photocell wires, if one is present.
- After running the photocell wires, check for continuity and shorts.

After completing all the steps listed above, turn on the power and perform an operational check-out from procedures in Section 3 of this manual.



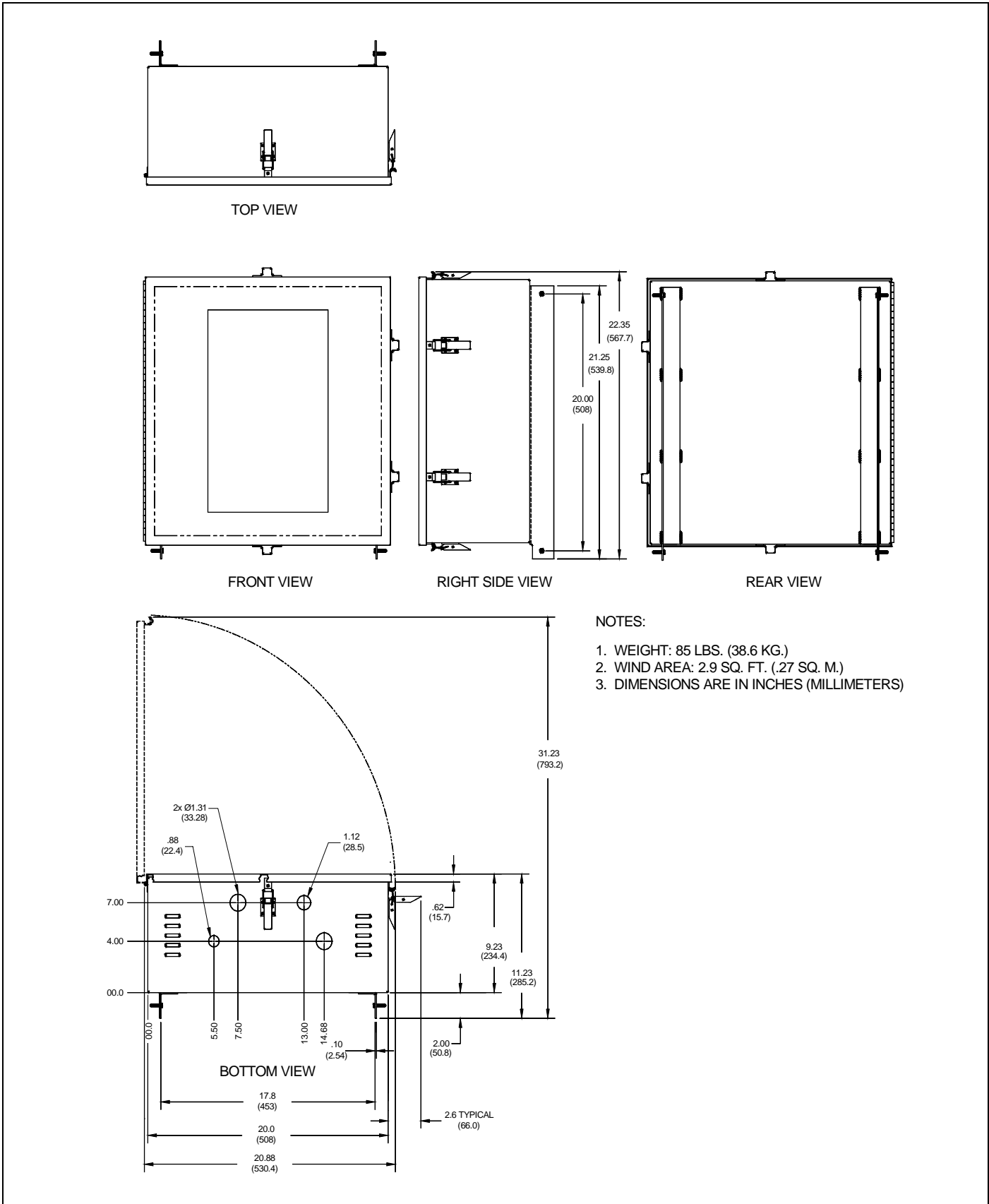
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Figure 2-1 PC 204 or PC 207 Power Converter Mounting and Outline



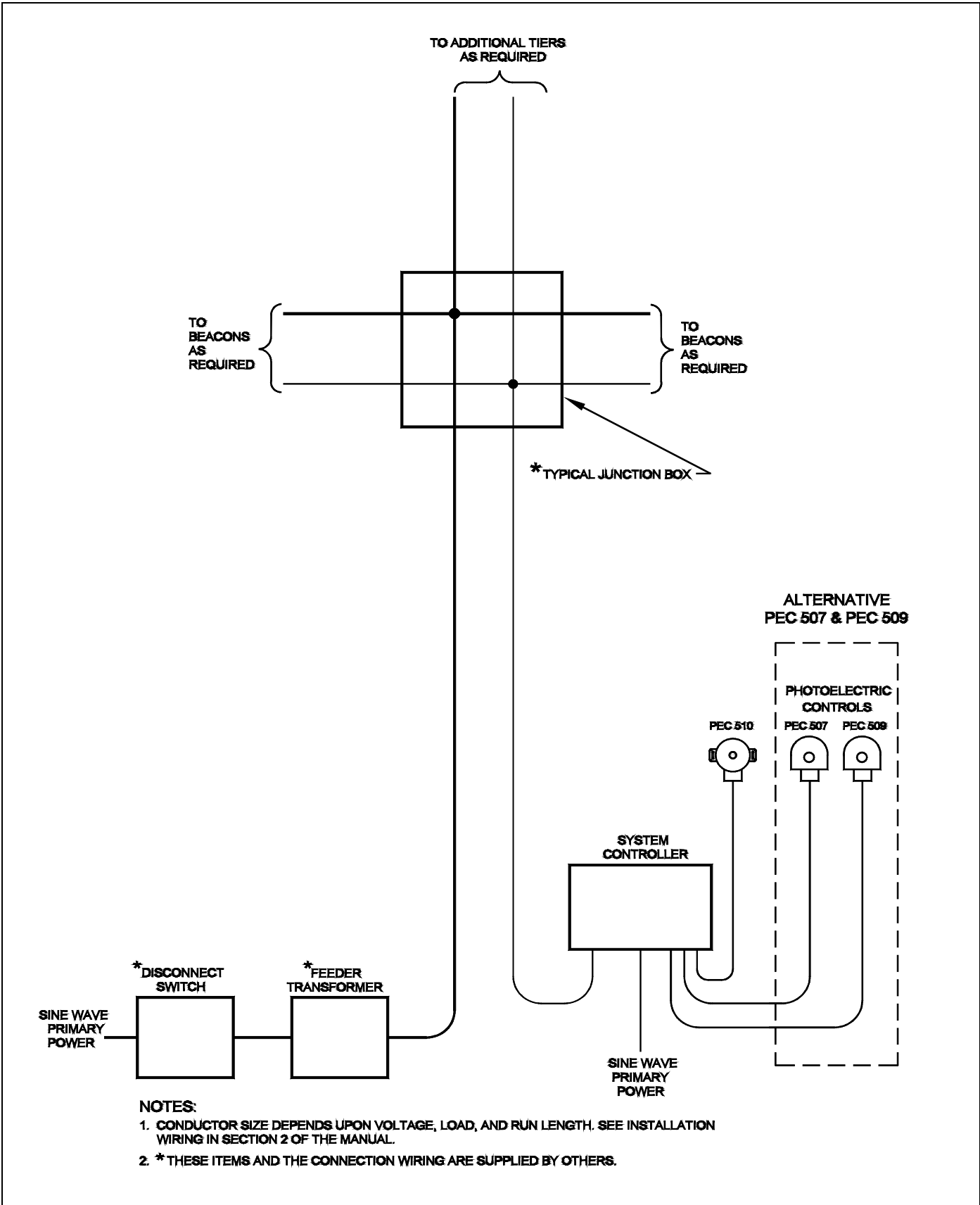
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Figure 2-2 FH 204 Flashhead Mounting and Outline



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Figure 2-3 FTB 205 or FTB 208 Beacon Mounting and Outline



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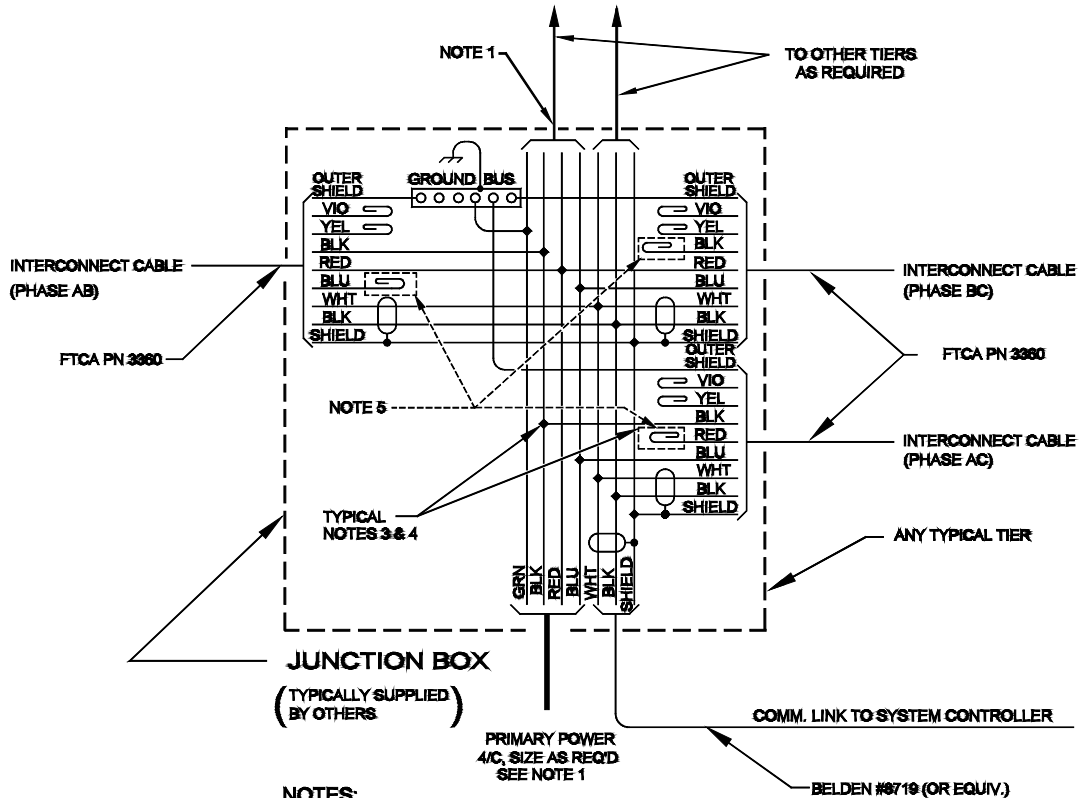
Figure 2-4 Wiring Overview of a System

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 SIZE DEPENDS ON THE SERVICE VOLTAGE, THE LENGTH OF THE WIRE RUN, AND THE NUMBER OF BEACONS CONNECTED. USE 400-VOLT AMPERES PER BEACON TO CALCULATE THE TOTAL LOAD. DETERMINE THE WIRE GAUGE REQUIRED TO PREVENT THE VOLTAGE DROP CAUSED BY WIRE RESISTANCE FROM EXCEEDING 5% AT ANY BEACON. SEE THE EQUIPMENT LABEL FOR UNIT VOLTAGE AND FREQUENCY.
2. THE CONTROLLER MIGHT OPERATE AT A LINE VOLTAGE DIFFERENT FROM THE BEACONS. CHECK THE EQUIPMENT LABEL AND ENSURE CORRECT LINE PHASING.
3. ♦ DENOTES WIRE NUT CONNECTION.
4. UNUSED WIRES IN THE JUNCTION BOX MUST BE CAPPED WITH NUTS. ◯ INDICATES A CAPPED WIRE END.
5. PRIMARY POWER CONNECTIONS IN THE JUNCTION BOX ARE CONNECTED AS REQUIRED BY THE THREE-PHASE CONNECTION CHART.

Figure 2-5 Junction Box; Three-phase Installation Wiring

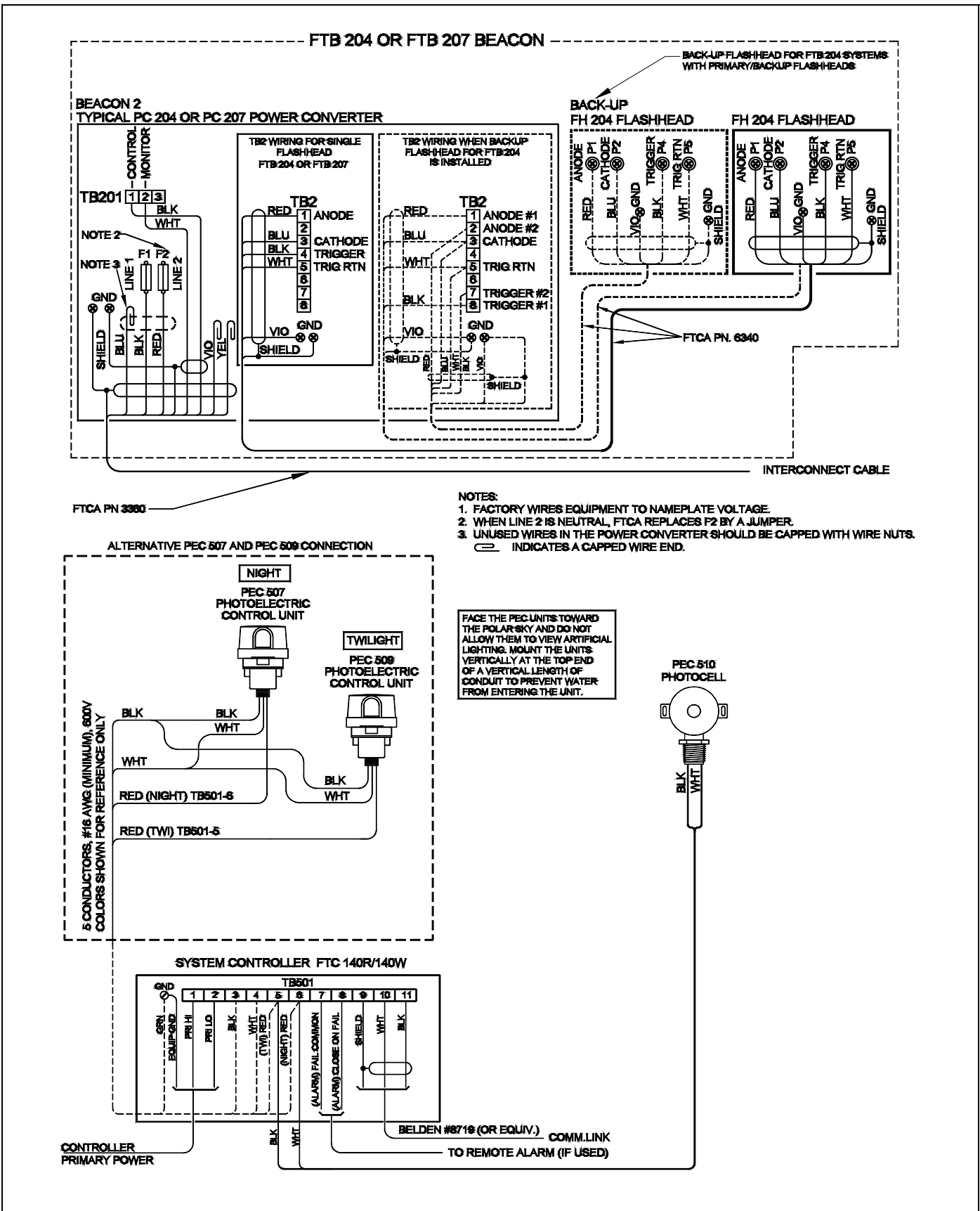
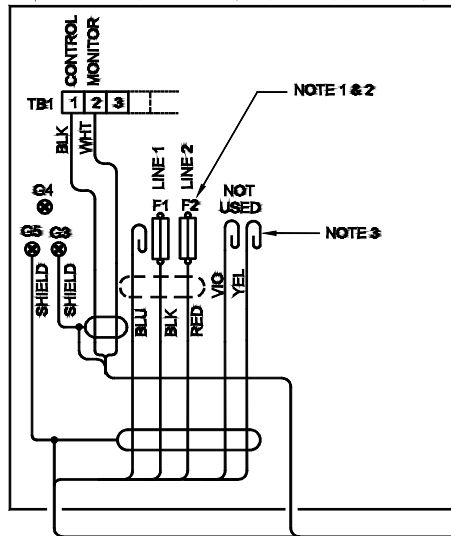


Figure 2-6 Single-Phase Installation Wiring for FTB 204 or 207

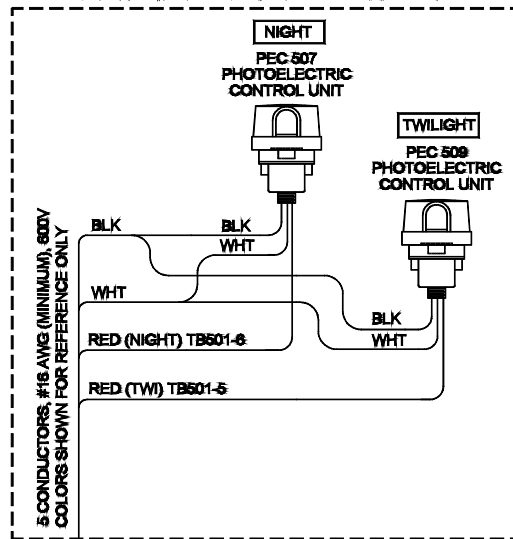
204207INSWRNG

TYPICAL FTB 205 OR FTB 208 BEACON

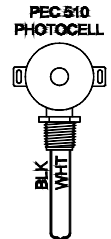


INTERCONNECT CABLE

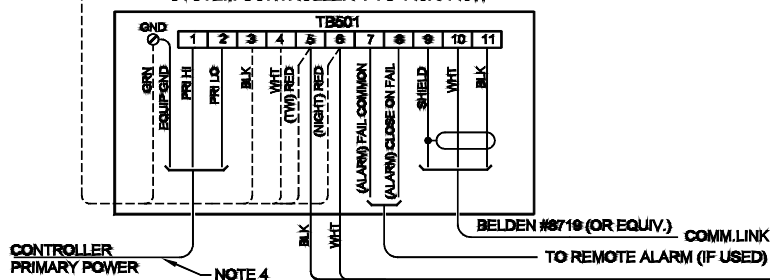
ALTERNATIVE PEC 507 AND PEC 509 CONNECTION



FACE THE PEC UNITS TOWARD THE POLAR SKY AND DO NOT ALLOW THEM TO VIEW ARTIFICIAL LIGHTING. MOUNT THE UNITS VERTICALLY AT THE TOP END OF A VERTICAL LENGTH OF CONDUIT TO PREVENT WATER FROM ENTERING THE UNIT.



SYSTEM CONTROLLER FTC 140R/140W

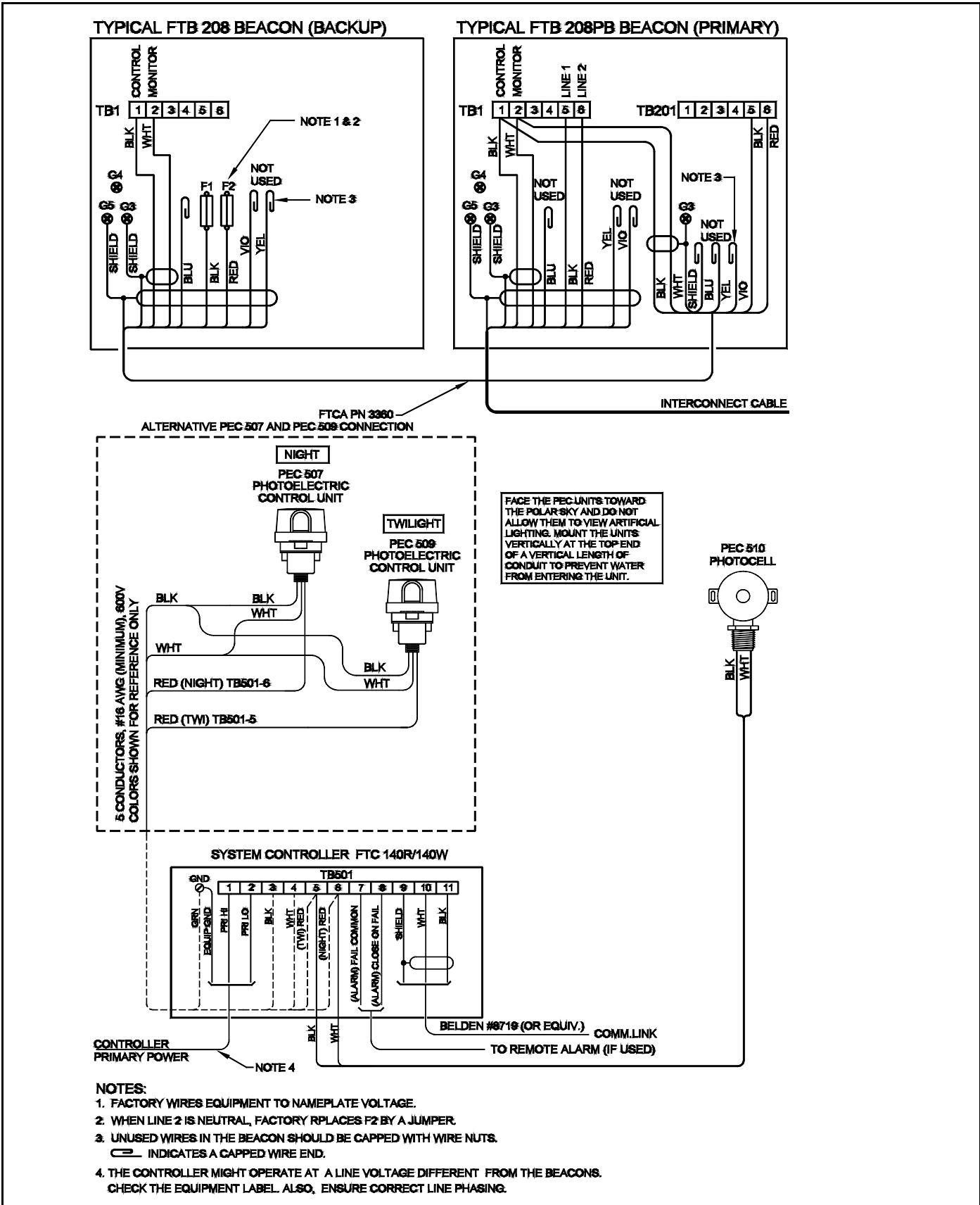


NOTES:

1. FACTORY WIRES EQUIPMENT TO NAMEPLATE VOLTAGE.
2. WHEN LINE 2 IS NEUTRAL, FACTORY REPLACES F2 BY A JUMPER.
3. UNUSED WIRES IN THE BEACON SHOULD BE CAPPED WITH WIRE NUTS.
 INDICATES A CAPPED WIRE END.
4. THE CONTROLLER MIGHT OPERATE AT A LINE VOLTAGE DIFFERENT FROM THE BEACONS. CHECK THE EQUIPMENT LABEL. ALSO ENSURE CORRECT LINE PHASING.

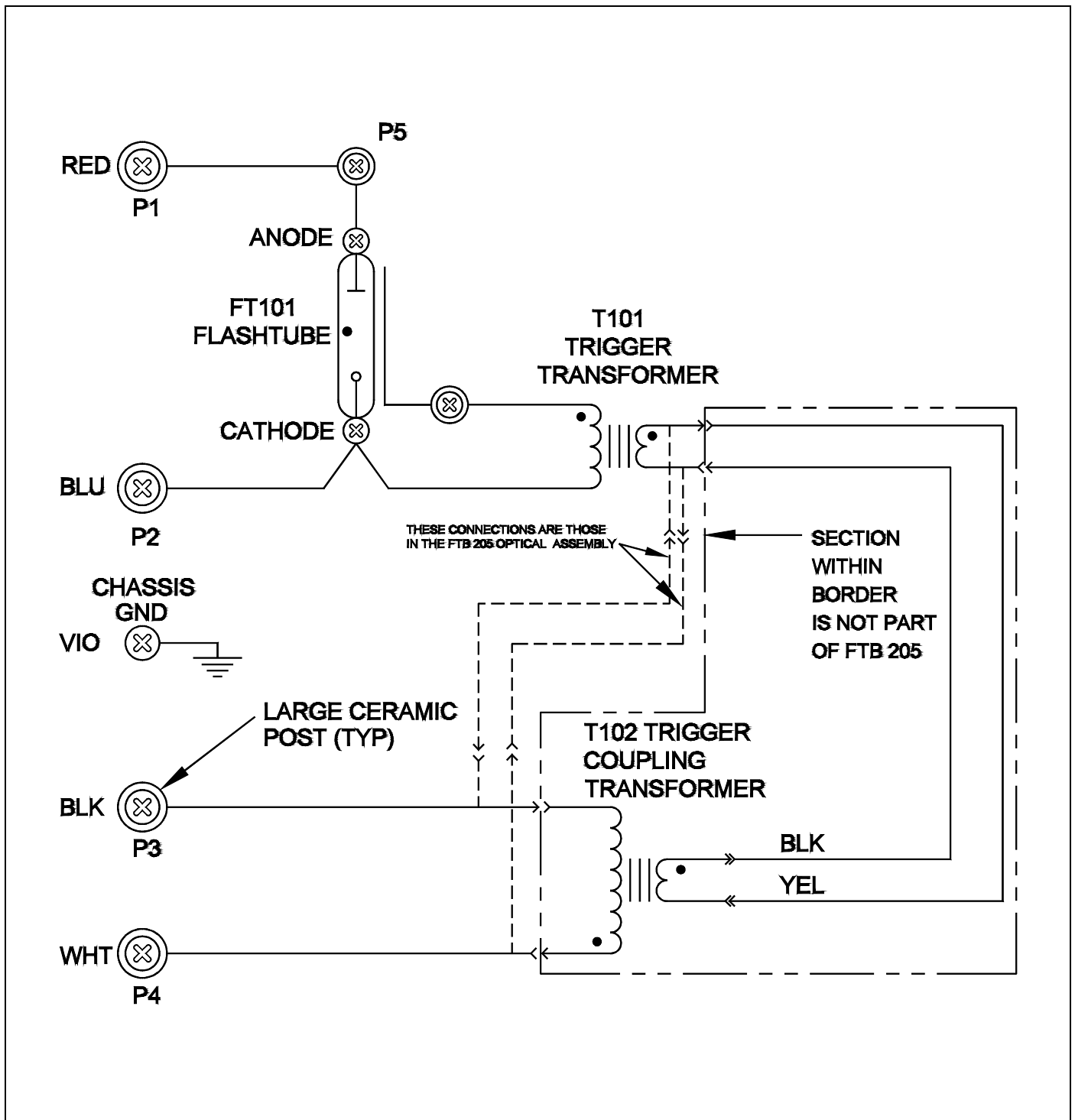
205208INSTWRG

Figure 2-7 Single-Phase Installation Wiring for FTB 205 or 208



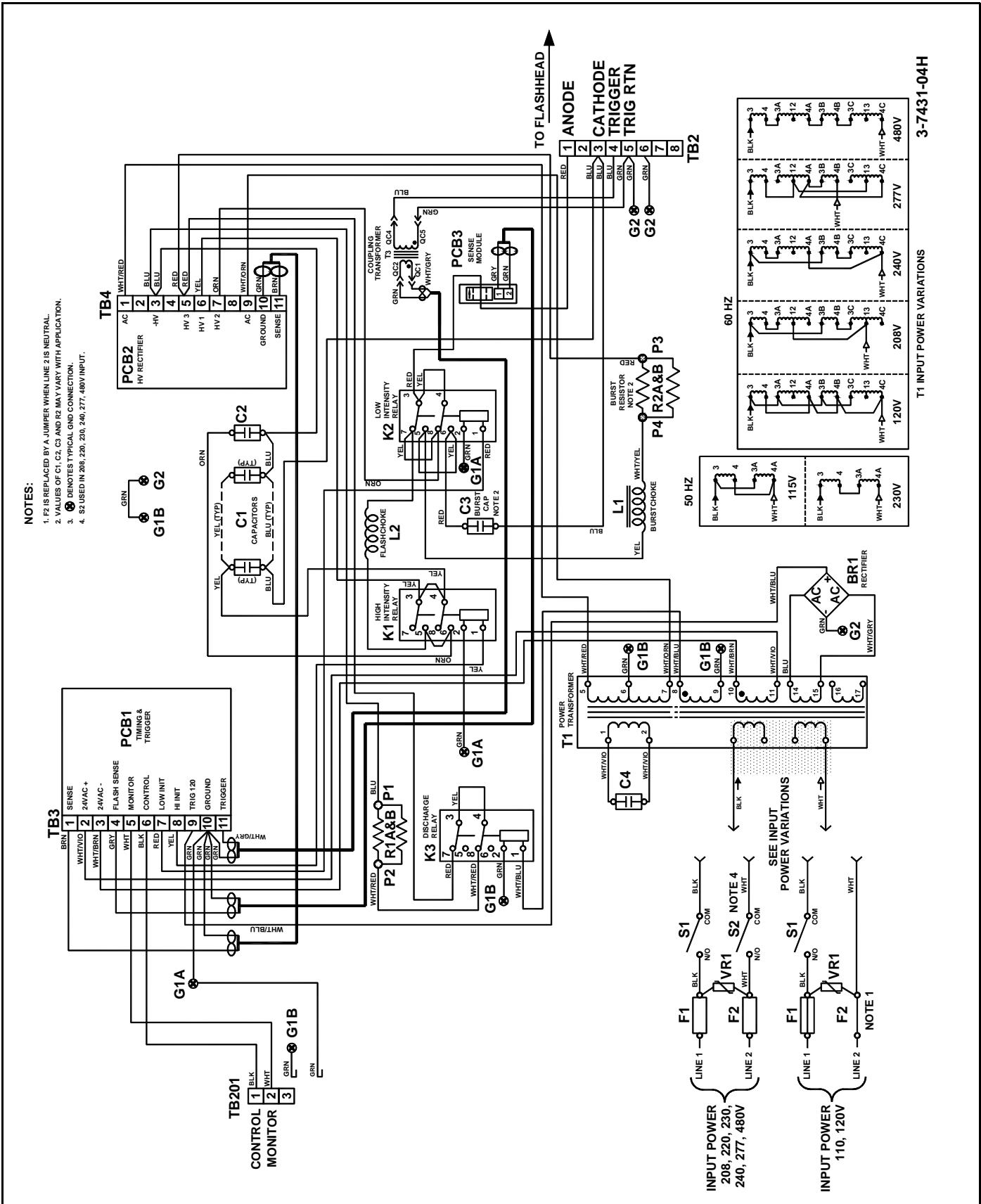
208208PINSWRNG

Figure 2-8 Single-Phase Installation Wiring for FTB 208 and FTB 208PB



FH2041W

Figure 2-9 Optical Assembly Internal Wiring



3743104HIW

Figure 2-10 PC 204 and PC 207 Power Converter Internal Wiring

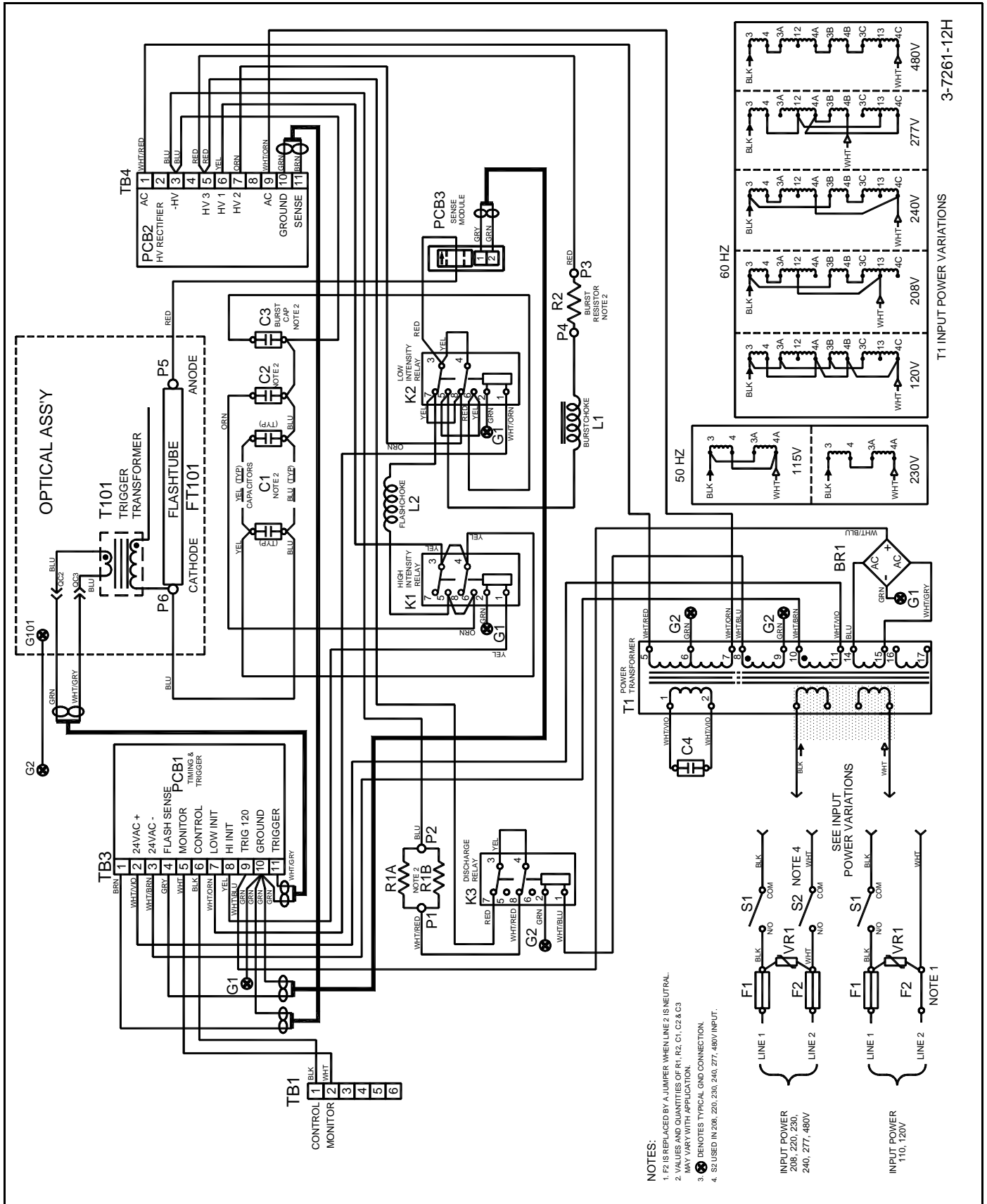


Figure 2-11 FTB 205 and FTB 208 Beacon Internal Wiring
 FTB 204, 205, 207, 208 Revision 13 — 5-8-01

3726112HIW

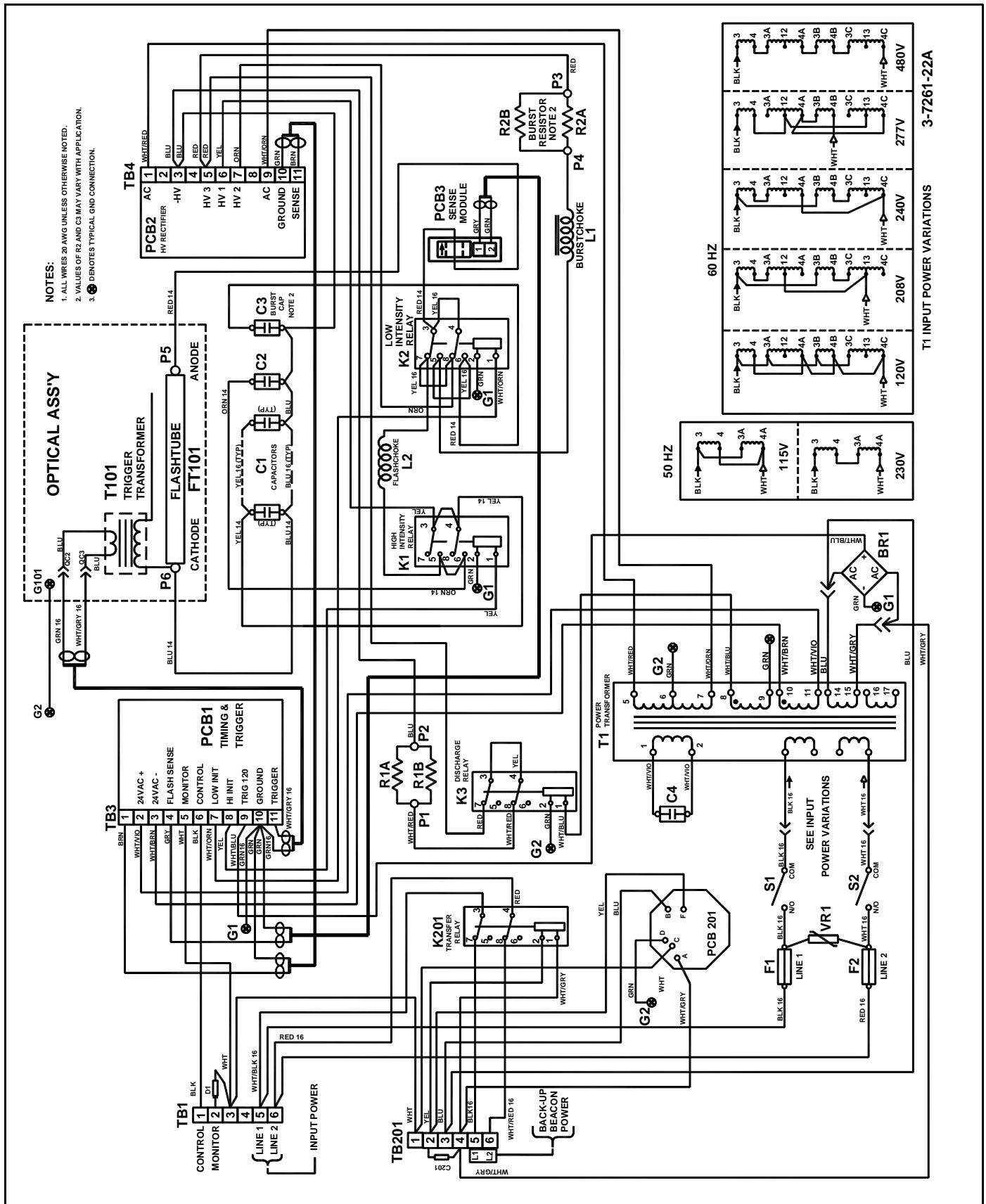


Figure 2-12 FTB 205PB/FTB 208PB Beacon Internal Wiring

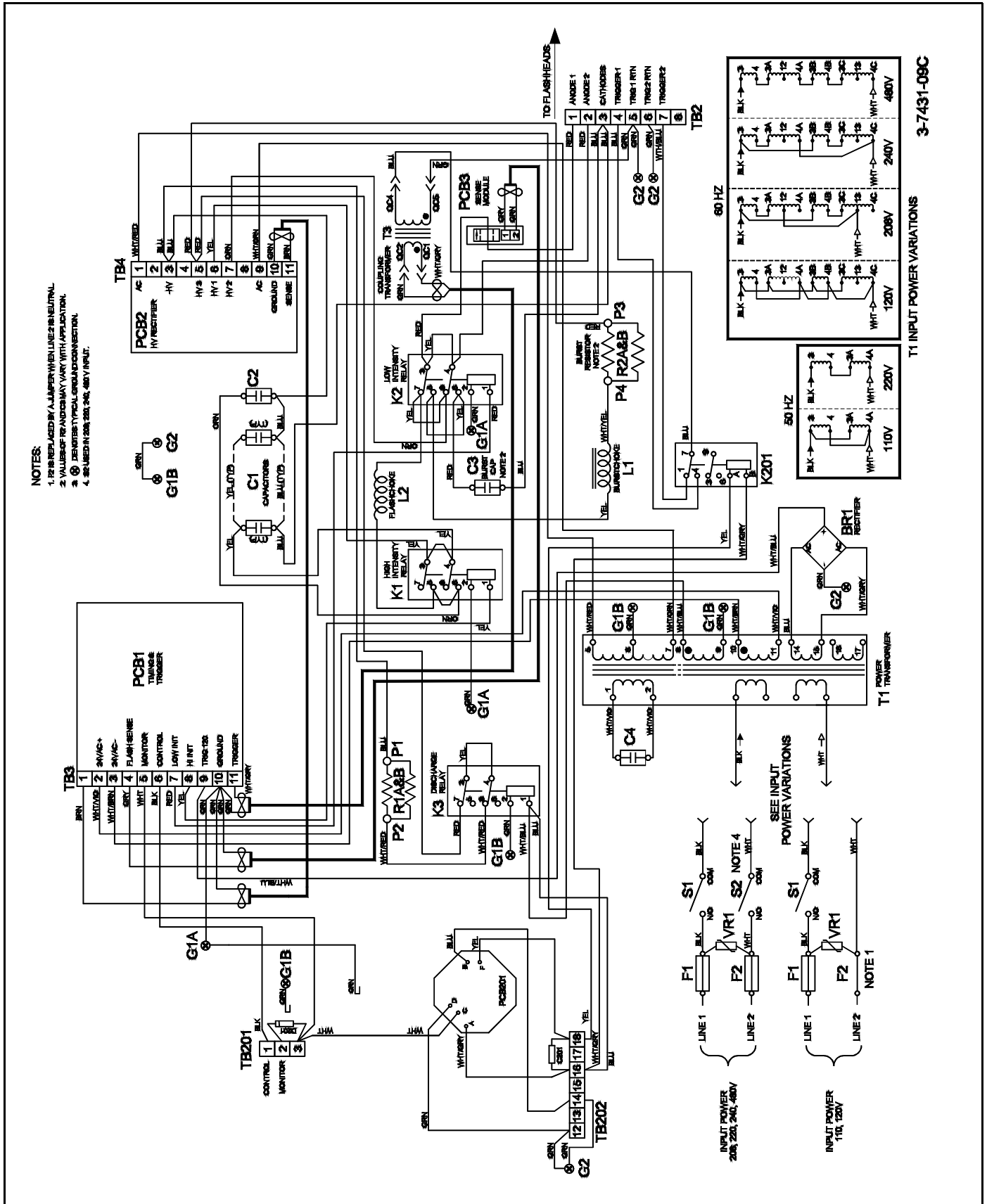


Figure 2-13 PC 204PB/PC 207PB Power Converter Internal Wiring

FTB 204, 205, 207, 208

Revision 13 — 5-8-01

2-17

3743109CIW

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Section 3 — Maintenance and Troubleshooting

Safety

HAZARD WARNING

Some procedures in this section may require making contact with electrical circuits. 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 instruments.
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 twice a year:

1. Verify that moisture has not entered the equipment accidentally through gaskets or seals, or collected as condensation.
2. Verify that all drain holes are clear.
3. Check terminal blocks and relays for evidence of corrosion and electrical arcing. Clean or replace any component that shows evidence of high-voltage damage.
4. Check flashtube connections for signs of pitting or arcing. Verify that anode and cathode connections are firmly tightened.
5. Check all electrical connections for tightness and verify the absence of corrosion or electrical arcing.
6. Clean the inside and outside surface of the glass with a non-abrasive glass cleaner.

Storage

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

RFI Problems

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 control wire could cause a light to stay at night intensity.
- RFI on the PEC line could cause a light to stay at night intensity. RFI would not normally cause a light to stay at day/twilight intensity.
- Strong RFI could burn out PCB1 Timing and Trigger Board components.

The circuits are designed to reject or bypass RFI, but 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.

Component Testing

The following procedures describe how to check most of the major electrical components. Always make resistance measurements with the power turned off. However, you must make voltage measurements with power applied. Thus, *for your safety*, perform 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.

Refer to *Figure 4-1*, *Figure 4-3*, *Figure 4-4*, and *Figure 4-5* for component layouts and locations.

Wiring and Cabling

Wires or cables that move repeatedly will ultimately break. Ensure that all cables (the flash-head 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, and overheated component, corrosion, loose connections, faulty relays, incorrect hookup, and so forth.

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, and observe the subsequent needle movement.

If the capacitor is OK, the needle initially indicates zero ohms, but soon begins to rise 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 (about 65% of full-scale) reading is a measure of the capacitance. For example, the time is about 5 seconds for a 10 mfd capacitor; 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 a short circuit is indicated, 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 — High Intensity Capacitor Bank

The C1 main capacitor bank consists of several capacitors. Test these capacitors as described in *Section Capacitors*.

If the meter indicates a short circuit, you must isolate the individual capacitors and check them one at a time until you locate the defective capacitor.

C2 — Medium Intensity Capacitor

Test C2 as described in *Section Capacitors*. Check the bank as a whole by placing the meter leads to the terminals of any C2 capacitor and pressing down the armature of the K3 discharge relay.

If a short circuit is indicated, you must isolate the capacitors and check them one at a time.

C3 — Low Intensity Capacitor

Test C3 as described in *Section Capacitors*. Remove all leads from one terminal cluster of this capacitor. The measured resistance across this capacitor should increase from zero to one megohm in approximately 1.5 seconds.

C4 — Tuning Capacitor

Test C4 as described in *Section Capacitors*. Remove the lead from one terminal of this capacitor. The measured resistance across the capacitor should increase from zero to one megohm in approximately 1.5 seconds.

FT101 — Flashtube

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

K1, K2 — Mode Relays, 24-volt DC Coil

First remove PCB1. The resistance from TB3-8 and TB3-7 to TB3-10 or the chassis should be approximately 290 ohms.

K3 — Discharge Relay, 120 VAC Coil

Disconnect one of the coil wires from the relay (terminal 1 or 2). The resistance across the relay coil should be approximately 290 ohms.

L1 — Burst Choke

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

L2 — Flash Choke

The resistance of this coil should be zero ohms. An infinite reading indicates an open coil.

PCB1 — Timing and Trigger Board

Replace this circuit board with one known to be in good condition. Be careful. For testing by substitution, the circuit board must have the same jumper configuration for JP12 through JP16 as the one being replaced in the unit. If the board is to remain in the unit, JP1 through JP11 must also be configured as the one being replaced.

R1A, R1B — Bleed Resistors

The measured resistance of the discharge resistors in parallel should be 17,500 ohms.

PCB2 — HV Rectifier Board

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

R2A, R2B — Burst Resistors

The measured resistance of the burst resistors in parallel should be 600 ohms.

T1 — Power Transformer

Prepare to test this transformer by removing PCB1 and PCB2. Energize the unit and measure secondary winding voltages as described in *Table 3-1*.

Table 3-1 Power Transformer Voltage Test

Test Points	Voltage
TB4-1 to TB4-9	900 - 1050 VAC ¹
TB3-9 to TB3-10	110 - 120 VAC
TB3-2 to TB3-3	22- 26 VAC
Across C4	550 to 600 VAC

1. If this AC voltage is substantially less than the specified minimum value, check the C4 tuning capacitor.

PCB3 — Sense Module

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

T101 — Trigger Transformer

The measured resistance of the flashtube cathode and trigger wire should be approximately 180 ohms. Check the potted secondary winding for evidence of high-voltage breakdown. Check the assembly screws for tightness and verify that the ferrite core is not fractured.

VR1 — Suppressor Assembly

First remove one of the VR1 leads from the fuse block terminal. The resistance across VR1 on the x100K ohm scale should be infinite.

Troubleshooting

Effective troubleshooting procedure, beginning with the observation of beacon behavior, often leads directly to a faulty component or other abnormal condition. *Table 3-2 Major Troubleshooting Symptoms* lists many of the symptoms that a malfunctioning beacon might exhibit. In *Table 3-3 Defective Component Locator Code* these symptoms are correlated with components, assemblies, or conditions that, if defective or abnormal, could cause the beacon to behave as observed.

For example, assume that the beacon does not flash at all but some of its circuits are still operating; that is, fuses are not blown, relays operate, and so forth. This behavior is symptom C in *Table 3-2*. *Table 3-3* indicates that a defective timing and trigger board would most likely cause symptom C behavior. The next most likely cause would be a defective rectifier board. The third would be the NITE capacitor, and so forth. Each item in *Table 3-3* is listed in the order of its likelihood of causing the failure.

Observe components carefully. Check for loose connections. Many times, components such as resistors and relays show signs of their failures. Resistors discolor when overheated. Relay contacts may become dirty, or pitted and corroded. Check relay armatures, to see if they function freely, by moving the armature by hand (with power off). Most components suspected of causing a problem can be checked by following the procedures in *Section Component Testing*.

Table 3-2 Major Troubleshooting Symptoms

OBSERVED BEHAVIOR				
Symptom Code	Flash Condition			Comments
	Day (Full) Intensity	TWI Intensity	NITE (Low) Intensity	
A	NO	NO	NO	All circuits are dead
B	NO	NO	NO	Primary line fuse repeatedly blows
C	NO	NO	NO	Some circuits functioning
D	OK	OK	OK	No confirmation
E	OK	OK	OK	No DAY confirmation, but NITE OK
F	OK	OK	NO	
G	OK	OK	HIGH	NITE too bright; ragged flash
H	SKIPS	OK	OK	
I	LOW	OK	HIGH	
J	SKIPS	SKIPS	SKIPS	
K	NO	NO	NO	PCB2
L	—	—	—	Inconsistent and erratic flash
M	NO	NO	NO	No FAIL indication

Table 3-3 Defective Component Locator Code

Item No.	Component	Codes												
		A	B	C	D	E	F	G	H	I	J	K	L	M
C1A-C1M	DAY Capacitor Bank			4										
C2A-C2B	TWI Capacitor Bank			4										
C3	NITE Capacitor			3										
C4	Tuning Capacitor								2					
F1, F2	Line Fuses	1												
FT101	Flashtube			6							2			
K1	Day Mode Relay									2				
K2	Nite Mode Relay						1	1						
L2	Burst choke						3							
PCB1	Timing and Trigger Board			2		1	2	2						
PCB2	HV Rectifier Board			1			2					1		
R2	Burst Resistor						1							
S1	Interlock Switch	2												
T1	Power Transformer	3	2	5										
PCB3	Sense Board				3	2								
T101	Trigger Transformer			7							3			
VR1	Suppressor		1											
Footnote 1									1					
Footnote 2										1				
Footnote 3											1			
Footnote 4					2									
Footnote 5												1	1	1
Footnote 6											2	1		
Footnote 7					1									
Footnote 8					1									

1. Blown fuse in one leg of 3-phase power distribution; all beacons on the same phase are affected.
2. Wrong phase between system controller and beacon.
3. Trigger potential arcing to chassis.
4. Wrong confirmation programming at the beacon.
5. RF interference (RFI).
6. Poor connection in the discharge circuit between capacitors and the flashtube; or arcing to chassis.
7. Monitor wiring.
8. Controller setup.

Component Removal and Replacement

The following procedures explain how to remove and re-install selected components that may require procedures that are not self-evident.

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 & Replacement — General

Typically, follow these steps:

- Locate the component using the component location figures in *Section 4*.
- Note the location of the wire connections and the wire colors. *Record these for reassembly.*
- Disconnect the wire terminals.
- Remove or loosen as necessary the screws or nuts that hold the component.
- Remove the component.
- For replacement, typically reverse the removal procedure. Replace the wires to the correct terminals. Position the wires as closely as possible to their original routing position.

Capacitors

Removal

1. Using long-nose pliers, remove the wire terminals from the capacitor terminals.
2. Each capacitor is fastened by two Phillips-head screws. Remove these screws.
3. Lift the capacitor out of its retaining hole.

Replacement

1. Reverse the Removal procedure.

BR1 — Bridge Rectifier

Removal

1. Using long-nose pliers, pull off the wire terminals from the rectifier.

2. Remove the screw that holds the rectifier to the chassis.
3. Remove the rectifier

Replacement

1. Reverse the Removal procedure.

K1/K2/K3 — Relays

Removal

1. Remove the wires on the relay terminals that connect the relays to the wiring harness or other components. *Note the position and color of the wires.*
2. Each relay has two screws that fasten the relay to the chassis. Remove these screws.
3. Lift the relay from the chassis.

Replacement

1. Reverse the Removal procedure.

L1 — Burst Choke

Removal

1. Remove the two wires that connect to the choke.
2. Remove the two screws that fasten the choke to the base plate.
3. Remove the choke.

Replacement

1. Reverse the Removal procedure.

L2 — Flash Choke

Removal

1. Find the connection points on relays K1 and K2 of the two wires connected to the flash choke.
2. Remove these two wires from the relays that connect to the choke. *Note the color and connections of these wires.*
3. Remove the two screws that fasten the choke to the base plate. **NOTE:** *The choke is held by two screws with insulation. Be sure the insulation stays in place.*

Replacement

1. Reverse the Removal procedure.
2. *Replace the wires on their correct terminals.*

R1A/R1B & R2A/R2B — Resistors

Removal

1. Remove the wires connected to the resistors.
Note the color and connections of these wires.
2. Remove the two screws that hold the resistors to their ceramic posts.
3. Remove the resistors.

Replacement

1. Reverse the Removal procedure.

T1 — Power Transformer

Removal

1. Many wires connect to the power transformer.
Note the wire colors and numbers on the transformer to which these wires are connected.
2. Using long-nose pliers, remove the easily-accessible wire terminals from the transformer.
3. Remove the nuts holding the transformer to the base plate.
4. Partially lift out the transformer.
5. Remove the remaining wires.

Replacement

1. Reverse the Removal procedure.

T3 — Coupling Transformer (PC 204, 207)

Removal

1. Remove the two Phillips-head screws in the top of the transformer retaining bar that hold the transformer to the chassis.
2. The core is in two parts. Separate the core halves and slide the coils off the core.
3. Disconnect the wire terminals of the coils from their connections.

Replacement

1. Re-assemble the coils on the cores. NOTE: The coils must have the same winding direction on the core. That is, the coils are wound clockwise looking down at the top retainer strap of the transformer. The top wire, using a male Fas-

ton connector, leaves the coil in a clockwise direction. Refer to *Figure 3-1*.

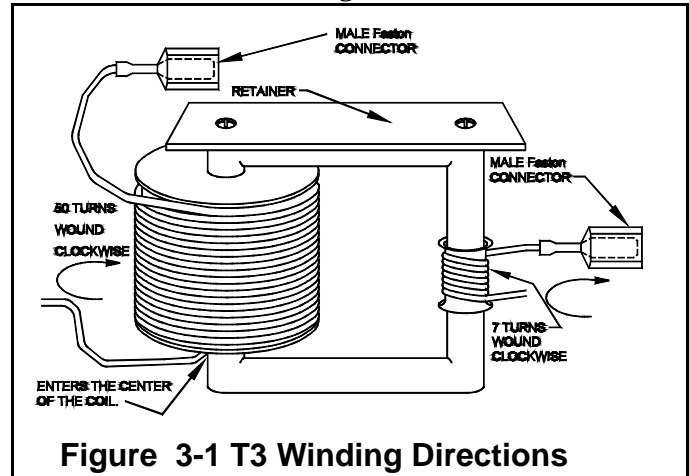


Figure 3-1 T3 Winding Directions

2. Fasten the assembled transformer to the chassis using the two long 4-40 Phillips-head screws.

PCB1/PCB2 Circuit Boards

Removal

1. Loosen the screws on the terminal block that connect the wires to the Circuit Board.
2. Loosen the two screws (one in each corner of the Circuit Board) that fasten the Circuit Board to the chassis. Do not remove these screws because the board sits on standoffs, and if you remove the screws the standoffs will fall out of position.
3. Slide the board slightly to clear the heads of the four retaining screws.
4. Lift the board slightly to clear the four retaining screws and slide it out from under the screws on the terminal block.

Replacement

1. Reverse the Removal procedure.

Flashtube

Location: Part of the optical assembly

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 4-5*.

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:

1. Observe the flashtube handling precaution noted previously.
2. 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.
3. Ensure that the trigger extension wire has a short length of high voltage sleeving installed.
4. Insert the flashtube with the cathode end (no red ink) toward the trigger lead ceramic post.
5. 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.
6. 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.
7. Attach the red anode wire to its connection directly above the tube mounting clip.
8. 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 4-5*.
9. Reinstall each plate on each side of the flashtube and tighten the screws.

Flashtube Clips

Location: Part of the optical assembly

Removal:

1. Remove the flashtube as described in *Section Flashtube*.

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

Location: On the optical assembly

Removal:

1. At the flashtube, remove the large diameter white wire to the transformer secondary winding.
2. At a chassis ground screw remove the small wire to the transformer secondary winding.
3. Do not disconnect the primary winding wires. Remove the two 4-40 x 2-inch screws Phillips-head screws that hold the transformer assembly to the plate.
4. Note the orientation of the molded secondary winding with respect to fixed features on the plate because you must install its replacement with this same orientation.
5. Remove the outer half of the core and lift off the molded secondary winding. The primary winding remain hanging in place.
6. Remove the inner half of the core.

Replacement:

1. Reassemble the primary and 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 electrical wiring diagram in *Figure 2-11* to verify the connections.

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 replacement parts, contact FTCA customer service at 1-800-821-5825.

Beacon/Power Converter Parts

Table 4-1 lists the major replaceable parts of the beacons.

Flashhead Parts

Table 4-2 lists the major replaceable parts of the Flashheads.

Returning Equipment

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

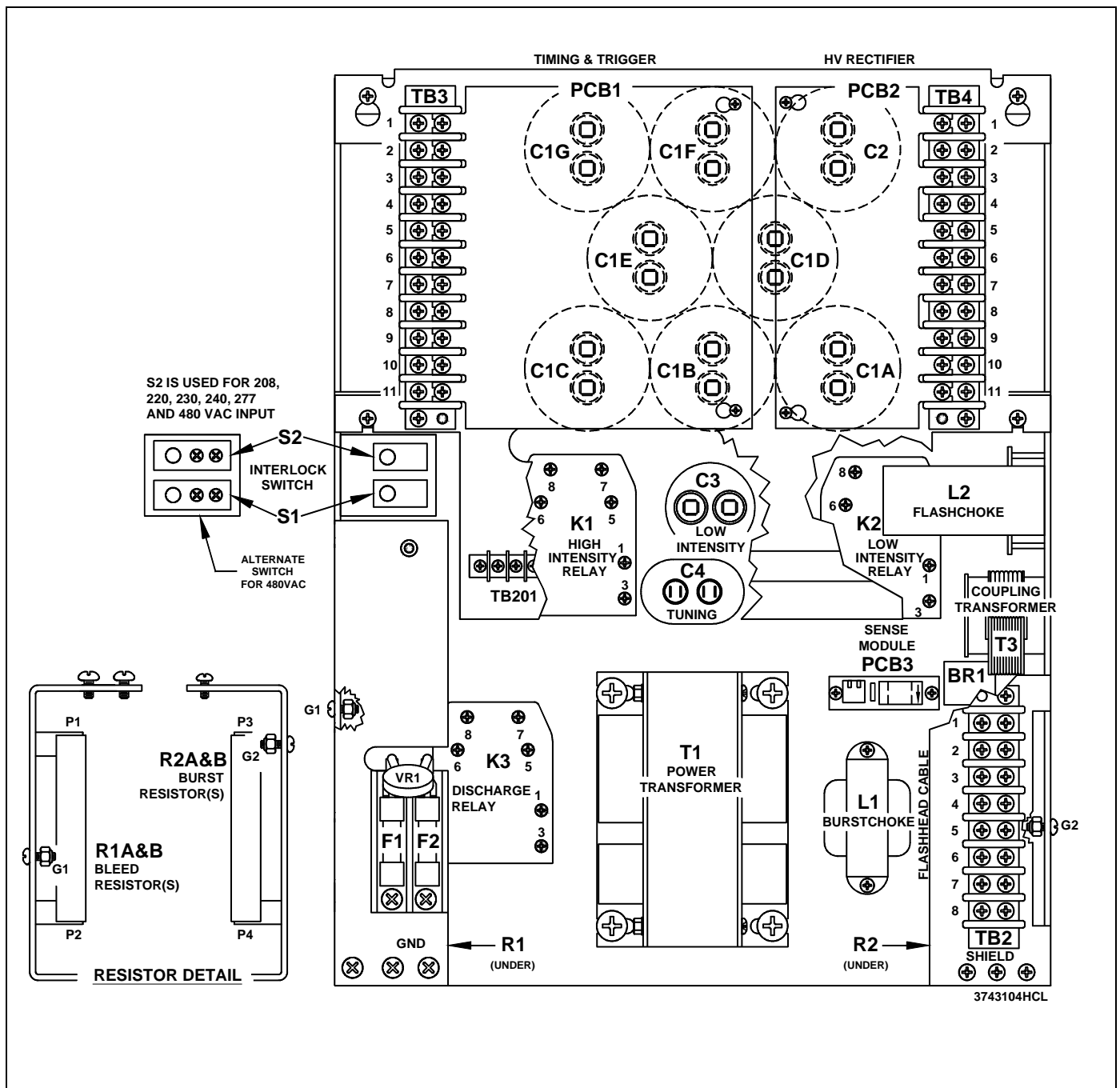
Repackaging

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 unit in a strong double corrugated carton on its back; that is, with the feet downward against the bottom of the box. Pad the unit so that the feet cannot penetrate the box during shipment. Box each unit separately using a double thickness cardboard container and adequate padding. Do not drop. Use appropriate warning labels on the outside of the container.

Table 4-1 Beacon/Power Converter Replaceable Parts

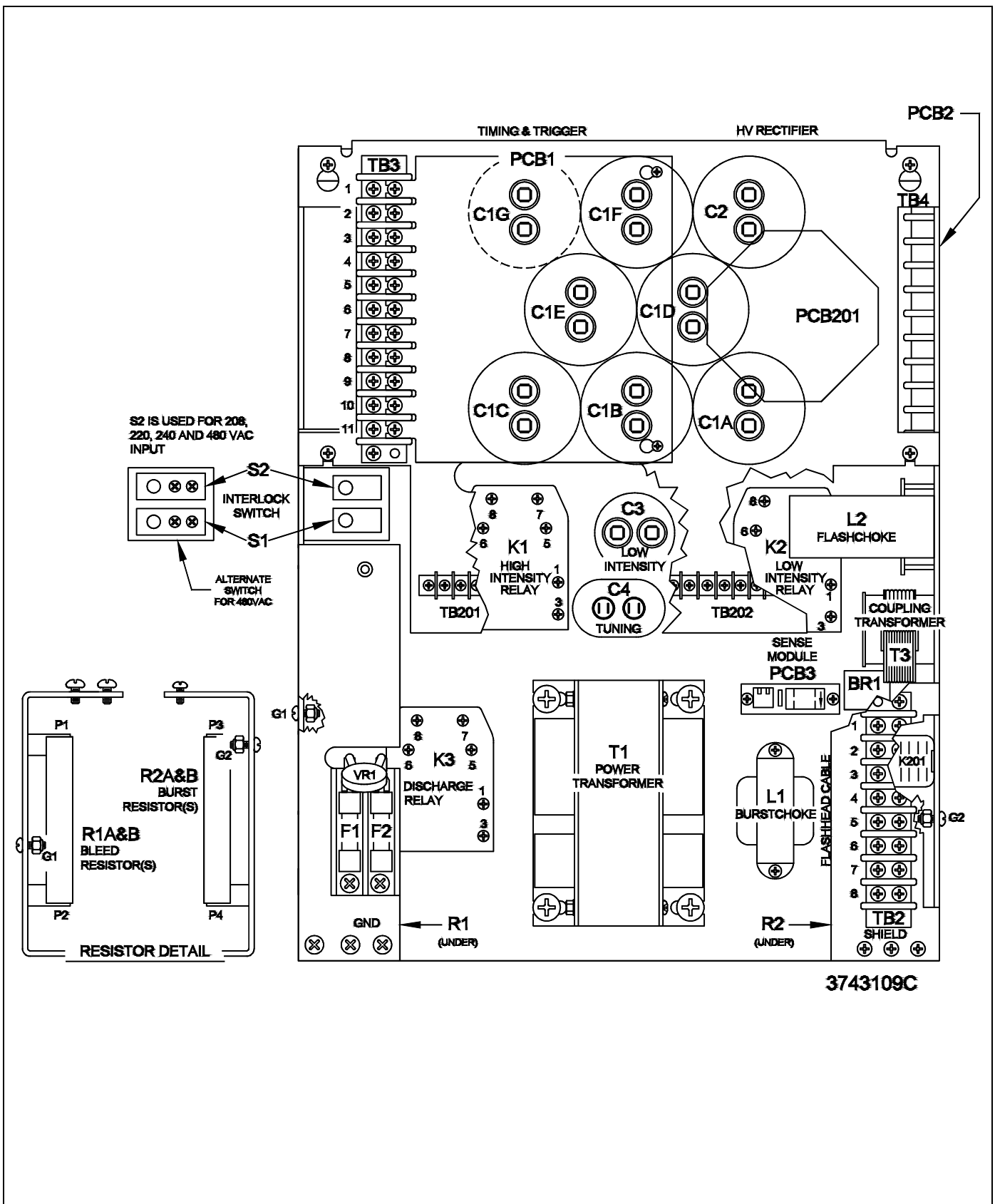
System	Item	Description	Part Number
ALL	BR1	Diode Bridge	6902806
ALL	C1A-C1G	Capacitor, Day, 70 mfd	6720401
ALL	C2A	Capacitor, Twilight, 40 mfd	6386503
ALL	C3	Capacitor, Night, 1 mfd	6848202
ALL	C4	Capacitor, Tuning, 3 mfd	6577903
ALL	F1, F2	Fuse, 120V	†4900307
ALL	F1, F2	Fuse, 208/230/240V	†4900303
ALL	F1, F2	Fuse, 480V	†4900335
ALL	K1, K2	Mode Relay, 24 VDC	†8900494
ALL PB	K201	Transfer Relay, 120 VAC	8900493
ALL	K3	Bleed Relay, 120 VAC	8900493
ALL	L1	Burst Choke	4850601
ALL	L2	Flash Choke	4175201
ALL	PCB1	Timing and Trigger Board	†24988xx
ALL	PCB2	HV Rectifier Board	†2458005
ALL	PCB3	Sense Board	2811101
ALL PB	PCB201	Monitor Board	8853002
ALL	R2A, R2B	Burst Resistor, 1.5K 50W	6900535
ALL	R1A & R1B	Bleed Resistor 35K, 50W	6900541
ALL	S1/S2	Interlock Switch Assembly	8205501
205, 208	TB1	Terminal Block, 6 position	8721006
204, 207	TB2	Terminal Block, 8 position	8721008
205PB/208PB	TB201	Terminal Block, 6 position	8721006
204PB/207PB	TB202	Terminal Block, 18 position	4901903
ALL	TB3 & TB4	Terminal Block, 11 position	8721011
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
204, 207	T3	Coupling Transformer	8336701
ALL	T101	Transformer, Trigger	8288201
ALL	VR1	Suppressor, 120V	8250801
ALL	VR1	Suppressor, 208/230/240V	8250802
ALL	VR1	Suppressor, 480V	8250804

† Recommended as a spare part.



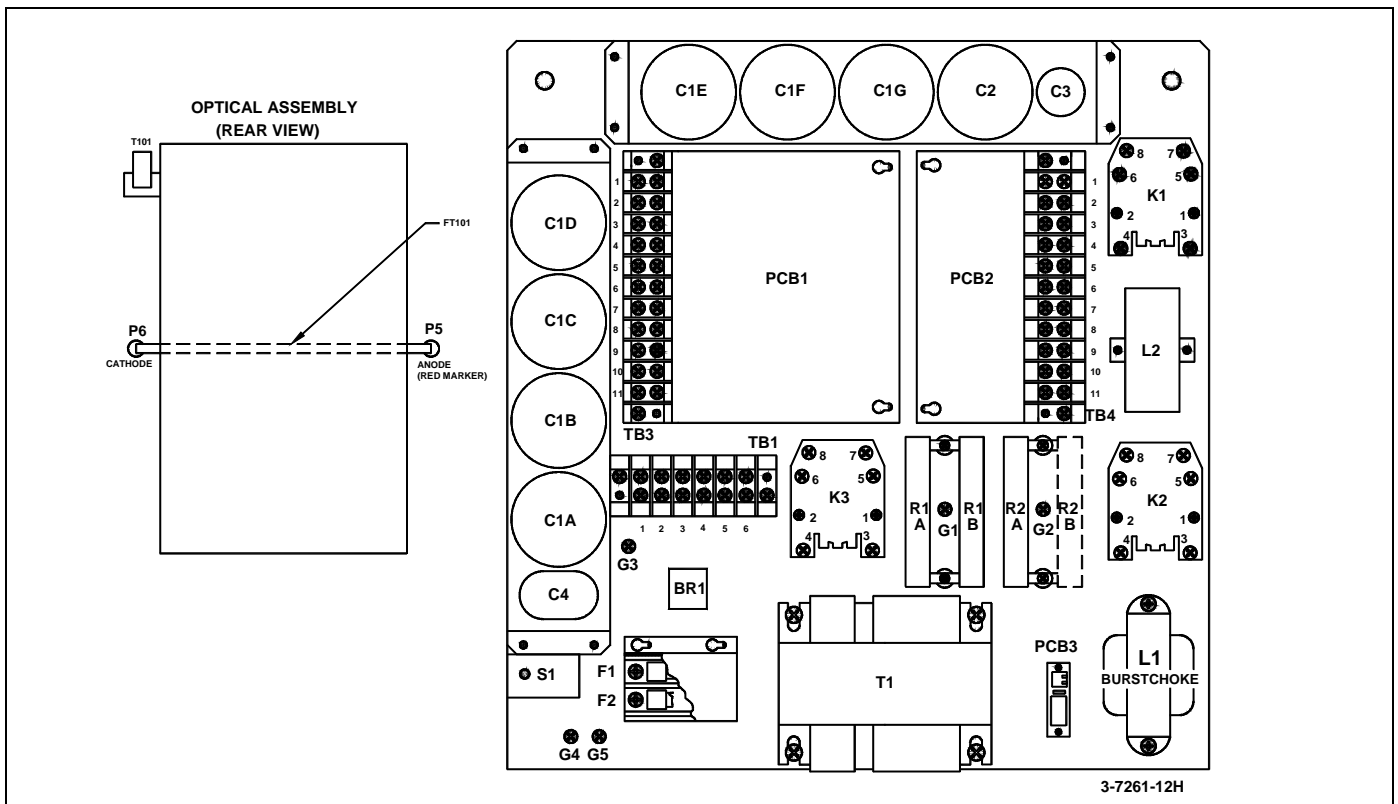
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Figure 4-1 PC 204 and PC 207 Power Converter Component Locations



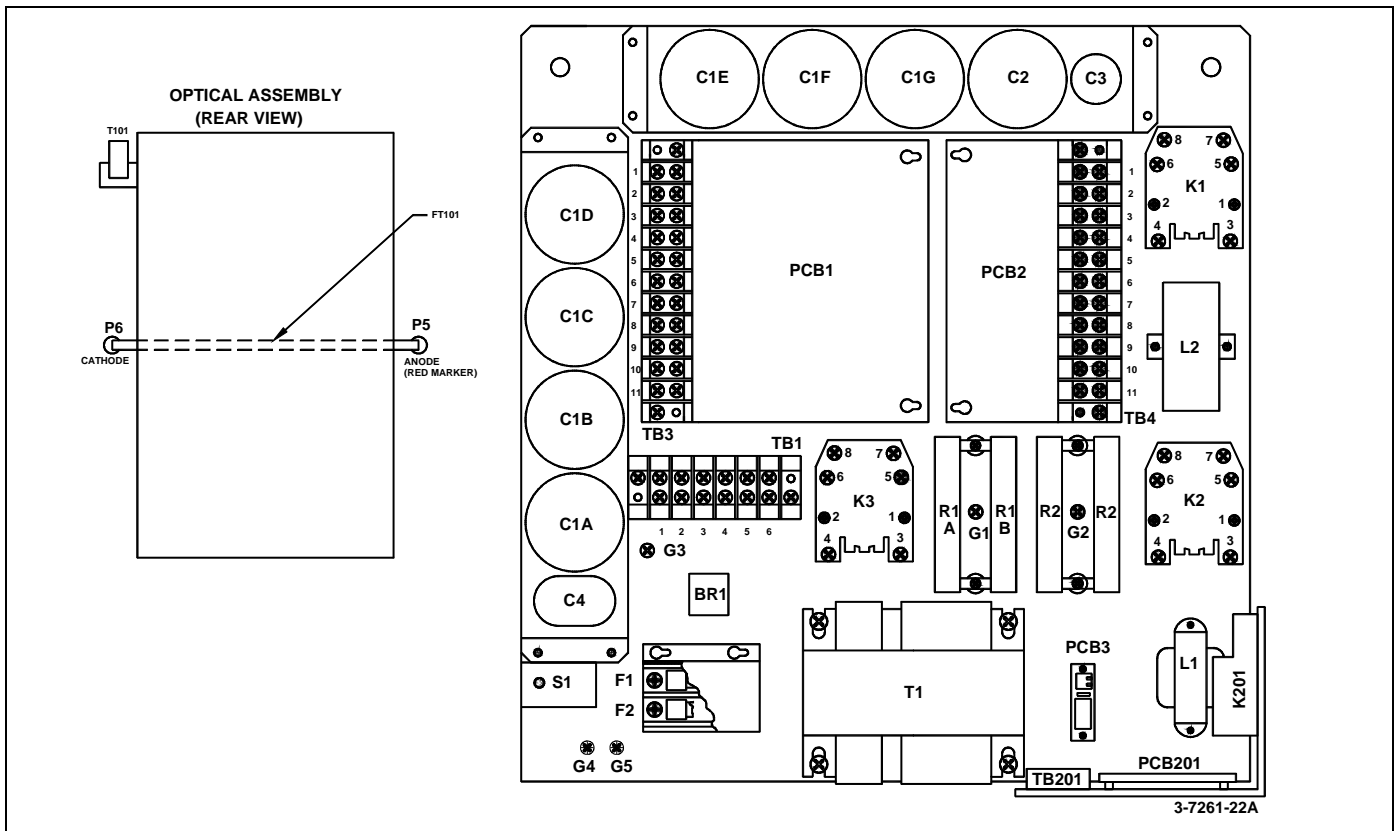
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Figure 4-2 PC 204PB and PC 207PB Power Converter Component Locations



3726112HCL

Figure 4-3 FTB 205 and FTB 208 Beacon Component Locations



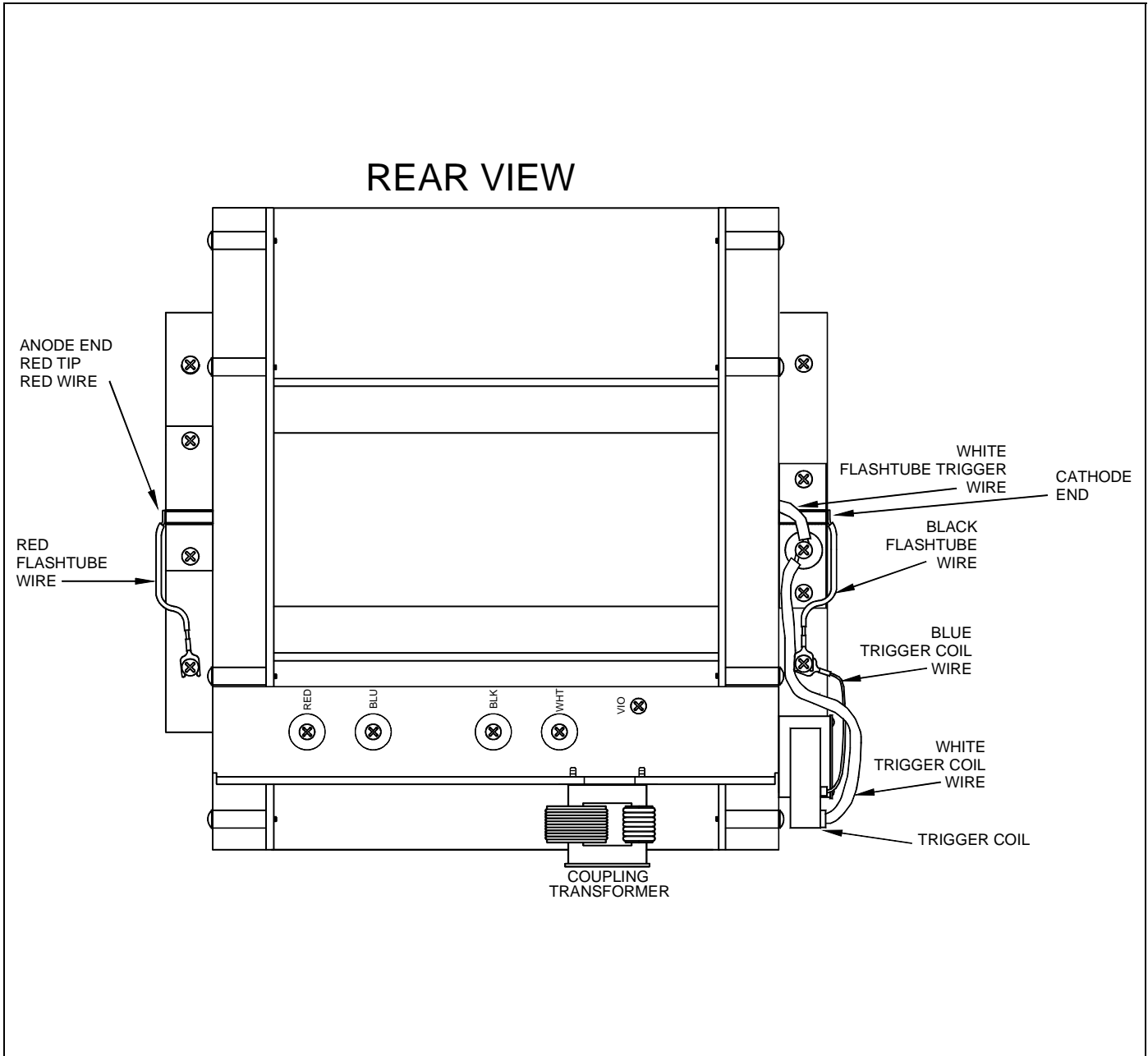
3726122ACL

Figure 4-4 FTB 205PB/FTB 208PB Beacon Component Locations

Table 4-2 Flashhead Replaceable Parts

Item	Description	Part Number
FT101	Flashtube	†8671301
T101	Trigger Transformer	8288201
T102	Coupling Transformer	8336701

† Recommended as a spare part.



FH204CL

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