FLASH™ TECHNOLOGY

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FTB 310-4

Medium Intensity Obstruction Lighting System
Reference Manual

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Front Matter

Abstract

This manual contains information and instructions for installing, operating, and maintaining the FTB 310-4 Medium Intensity Obstruction Lighting System.

Copyright

Trademark Acknowledgments

Disclaimer

Warranty

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

Replacement Parts

The use of parts not manufactured or supplied by FTCA or unauthorized modification of this equipment voids the warranty and could invalidate the assurance of complying with FAA requirements.

Pub. No. 0594-3104-0010

PERSONNEL HAZARD WARNING

Dangerous Voltages

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

Avoid Touching Live Circuits

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

Dangerous Voltages Can Persist with Power Disconnected

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

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

Do Not Depend on Interlocks

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

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Section 1 — FTB 310-4 Introduction and Operation

System

A single system consists of a flashhead, a power converter, a photocell, and a connecting cable from the power converter to the flashhead.

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

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

Specifications

Physical

PC 310-4 Power Converter

(H x W x Depth, Wgt.)
14.875 x 16.08 x 10.05 in., 33 lbs.
377.8 x 408.4 x 255.3 mm., 14.85 kg.

FH 308 Flashhead

(H x Diam., Wgt.) 17 x 18.25 in., 17 lbs.
431.8 x 463.5 mm., 7.7 kg.

PEC 510 Photocell

(H x W x Depth) 3.06 x 2.58 x 1.02 in.
77.7 x 65.5 x 25.9 mm.

Performance Characteristics

Application: L-865

Flash Intensity (nominal):
Day/Twilight Intensity: 20,000 ± 25% ECD
Night Intensity (standard): 2,000 ± 25% ECD

Beam Spread: Horizontal: 360º; Vertical: 5º

Flash Rate: 40 flashes per minute

Electrical:

Voltage: 120 or 240 VAC ± 10%, 60 Hz
230 VAC, 50 Hz, single phase

Volt-Amperes: 250 VA peak; 175 VA avg.

Watts: Day: 130; Night: 75

Flashhead Aerodynamic Wind Area:.93 sq. ft.
.0864 sq. m.

Environmental: Complies with AC 150/5345-43

Monitoring Alarms

The transfer of electrically isolated relay contacts in the power converter indicates alarms. The type of alarm depends on the type of system (See *Table 1-1* for system configurations.) A system using a red external controller senses an alarm received from that controller. Alarm contact rating is 120V, 1A.

System Configurations

Systems may be combined to form a multiple lighting scheme for structures. The operation of the various available FTB 310-4 Systems is described in *Table 1-1* and *Table 1-2*.

System Operation

The PC 310-4 Power Converter operates an FH 308 white flashhead. It monitors flashhead operation and signals an alarm if a failure occurs. The flashhead begins to operate as soon as power is applied. A photocell controls intensity for the system.

In daylight, lights flash white at a rate of 40 flashes per minute (FPM) at an intensity of 20,000 candelas. At night lights flash at a rate of 40 FPM at an intensity of 2,000 candelas.

Obstructions over 350 feet above ground level require several interconnected PC 310-4 power converters (typically three) operating the corresponding number of flashheads. A master/slave control line (two-wire) at terminals TB1-4 and -5 at the front panel interconnects the units. A sync pulse on the line flashes all the lights in unison and at the same rate.

Table 1-1 System Configurations

FTB System	Alarms	Lights	Flashes per Minute (FPM)	Operation	White-light Backup
310-4 Standard	White	L-865 White 20,000 candelas day 2,000 candelas night	 40 40	Photocell control for day or night White during daylight White low intensity at night	No
310-4E	White	L-865 White 20,000 candelas day 2,000 candelas night	 40 40	Photocell control for day or night White during daylight White low intensity at night	No
310-4A uses extended monitoring	White, intensity, PEC, day mode, night mode	L-865 White 20,000 candelas day 2,000 candelas night	 40 40	Photocell control for day or night White during daylight White low intensity at night	No
310-4I controls an external red light controller	White, red	L-865 White 20,000 candelas day 2,000 candelas night† L-864 Red Beacon	 40 40† On On	Photocell control for day or night White during daylight Turn on red external controller at night for beacons.	White night intensity backup for red system failure†
310-4AI uses extended monitoring and controls an external red light controller	White, red, intensity, PEC, day mode, night mode	L-865 White 20,000 candelas day 2,000 candelas night† L-864 Red Beacon	 40 40† On On	Photocell control for day or night White during daylight Turn on red external controller at night for beacons	White night intensity backup for red system failure†

† White light is off when red beacon is on. Values are for white backup operation.

Photocell

The photocell changes resistance as ambient light changes from day to night or from night to day. The Timing and Trigger Board (PCB1) in the master power converter then converts the changes into the necessary circuit operation to flash the lights at the appropriate intensity for day or night operation.

PCB1 Timing and Trigger Board

PCB1 governs all automatic functions. Two different PCB1 boards are used in the PC 310-4 Power Converter. The 24740xx board is used in all except the "E" models. The 24747xx board is used in the "E" models. The "xx" in the board's part number refers to its dash number, which changes with the board's internal programming. The major difference between the two is their jumpers, internal control and programming. Additionally, PCB1 (24747xx) for EagleWin "E" systems connects to a telephone line for remote monitoring by computer. The factory sets the jumpers and programs PCB1 before it leaves the factory.

Setting Up PCB1

Function Indicators

LED indicators on the PCB1 board signal alarms and internal functioning. Observe these LEDs to monitor equipment operations during checkout and troubleshooting. The essential features on PCB1 for troubleshooting are shown in *Figure 1-1* and *Figure 1-2*.

PCB1 24740xx
PCB1 (24740xx) has the following features:

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

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

PCB1 24747xx
PCB1 (24747xx) has the following features:

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

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

Jumpers, Controls, and Indicators

The system is pre-set at the factory according to the Purchase Order requirements. Its operation can be altered by the use of programming jumpers on PCB1 (see *Figure 1-1* and *Figure 1-2*). Only authorized service personnel should modify these settings.

PCB1 indicator lights help you to determine whether PCB1 is operating correctly. Additionally, a manual override intensity control switch (SW2) is located on the main chassis panel. (See *Figure 4-1*).

Operating Modes

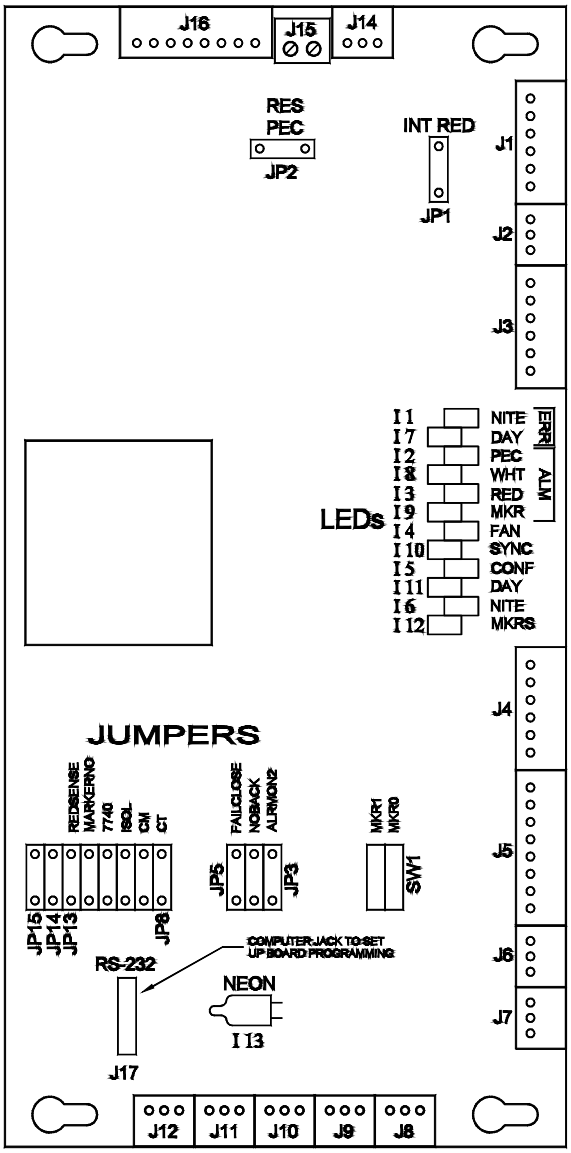
Table 1-2 shows the operating modes for standard and dual modes of operation.

Table 1-2 Operating Modes

Operating Mode	Flash Characteristic		Red System Operation	Operating Alarms
	Day	Night		
White: PC 310-4 (standard mode)	Flash white at day intensity	Flash white at night intensity	No red light system.	White Alarm
†White: PC 310-4E (standard mode)	Flash white at day intensity	Flash white at night intensity	No red light system.	White Alarm;
White: PC 310-4A (“A” models)	Flash white at day intensity	Flash white at night intensity	No red light system.	“A” Models; Extended Alarms: • White Alarm • Intensity Error Day — Indicates that the light is flashing at an intensity that does not agree with the day signal from the photocell. • Intensity Error Night — Indicates that the light is flashing at an intensity that does not agree with the night signal from the photocell. • Photocell Error — Indicates that the photocell has failed to switch state during a 24-hour period. • Day Mode — Indicates that the power converter is operating in day mode. • Nite Mode — Indicates that the power converter is operating in night mode
Dual System: PC 310-4I (“I” models)	Flash white at day intensity	White backup available if red system fails	For “I” Models — The optional FTB 310-4I System turns off white lights and turns on red lights by starting an external red light controller supplied by others. Electrically isolated relay contacts, rated at 120V 1A, close at night and open during daylight to turn the controller on or off. Senses a red alarm condition from electrically isolated contacts in the external controller. Can operate in back-up mode, resuming white flashing at night intensity if the red light system fails.	“I” Models; Red Alarm: • White Alarm • Red Alarm — Indicates a red light controller failure if so wired to the controller[1].
Dual System: PC 310-4AI	Flash white at day intensity	White backup available if red system fails	Red system operation as described for PC 310-4I, above.	Operating alarms as described for PC 310-4A, above.

1. Normally, only alarms of red *beacons* are wired to the “I” model from the external red light controller.

† Communicates with EAGLE Software over a connected telelphone line.



JUMPER†	FUNCTION
JP1	INT RED — NOT CUT IN THE 310-4.
JP2	RES PEC — CUT TO ALLOW THE POWER CONVERTER TO USE A RESISTIVE PHOTOCELL. CUT IN THE PC 310-4.
JP3	ALRMON2 — APPLIES TO BEACON LAMPS. NOT USED IN THE PC 310-4.
JP4	NOBACK — CUT - DISABLES WHITE LIGHT BACKUP UPON THE FAILURE OF THE EXTERNAL RED LIGHT CONTROLLER. NOT CUT - NORMAL OPERATION (THE WHITE LIGHT BEGINS FLASHING AT NIGHT INTENSITY IF A RED LIGHT FAILURE OCCURS.
JP5	FAILCLOSE — APPLIES TO USE OF EXTERNAL RED LIGHT CONTROLLERS. CUT TO ALLOW CLOSED CONTACTS CONTACTS IN THE CONTROLLER TO INDICATE AN ALARM. NOT CUT TO ALLOW OPEN CONTACTS IN THE CONTROLLER TO INDICATE AN ALARM.
SW1-1	NOT USED.
SW1-2	NOT USED.
JP8	CT — CUT TO INDICATE TOP TIER OPERATION FOR THIS POWER CONVERTER IN A CATENARY SYSTEM. IF BOTH JP8 AND JP9 ARE CUT OR BOTH UNCUT, OPERATION IS FOR THE BOTTOM TIER. FACTORY USE ONLY.
JP9	CM — CUT TO INDICATE MIDDLE TIER OPERATION FOR THIS POWER CONVERTER IN A CATENARY SYSTEM. IF BOTH JP8 AND JP9 ARE CUT OR BOTH UNCUT, OPERATION IS FOR THE BOTTOM TIER. FACTORY USE ONLY.
JP10	ISOL — CUT TO ALLOW AN ALARM FOR ONLY LOCAL CONDITIONS ON THIS POWER CONVERTER. NOT CUT TO ALLOW AN ALARM FOR LOCAL ALARMS AND ALARMS SIGNALLED TO THIS POWER CONVERTER THROUGH A COMMUNICATIONS BUS WIRE.
JP11	RETROFIT — CUT TO ALLOW THE 4740 BOARD TO EMULATE OTHER BOARDS ON A TOWER OF MIXED CIRCUIT BOARDS. FACTORY USE ONLY.
JP12	MARKERNO — NOT USED.
JP13	REDSENSE — CUT TO ENABLE THE 4740 BOARD TO BE USED WITH SENSE BOARDS. FACTORY USE ONLY.
JP14	FACTORY USE ONLY.
JP15	FACTORY USE ONLY.

† JUMPERS – OFF=CUT=OPEN

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

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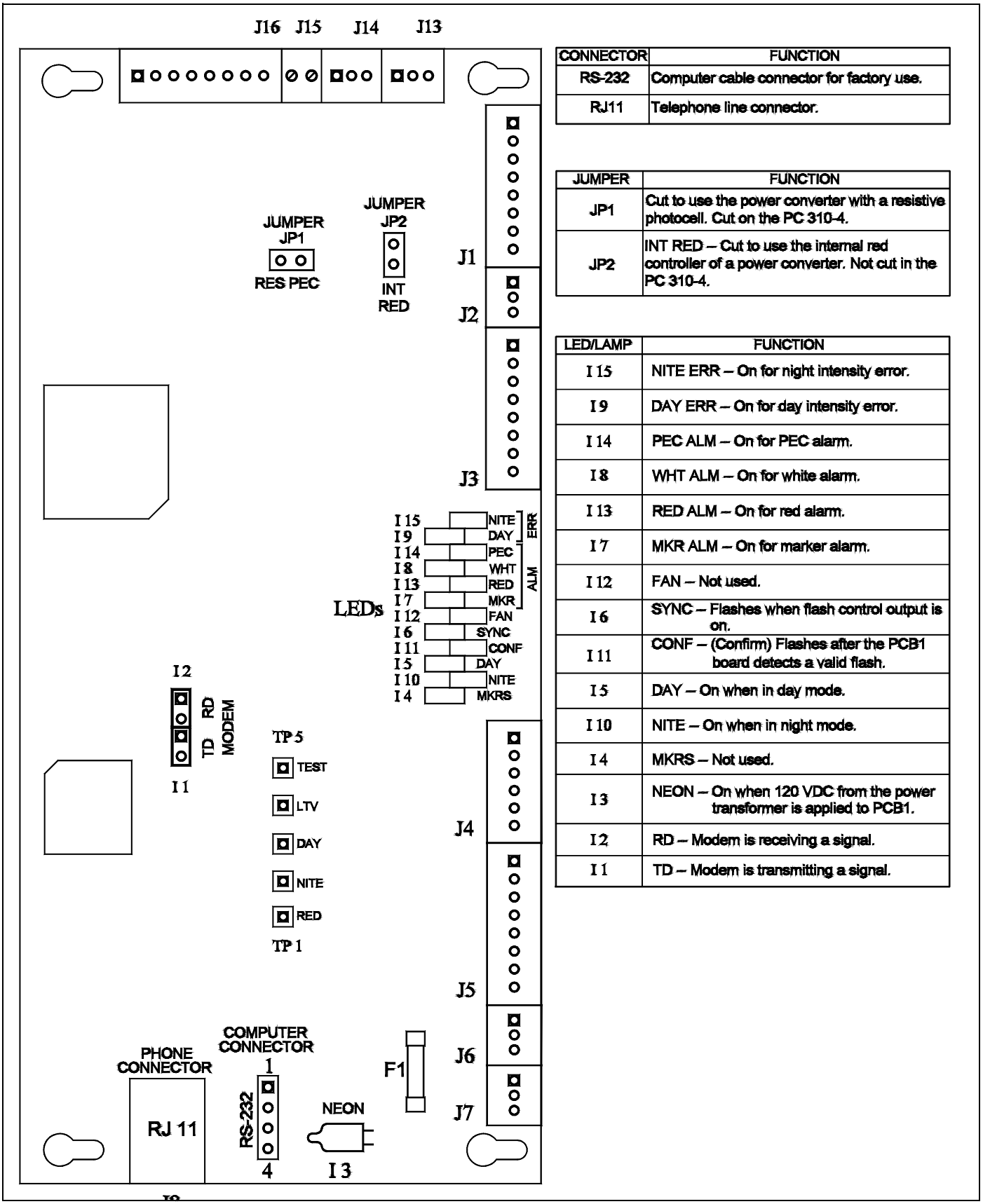
Figure 1-1 PCB1 Pictorial (24740xx)



CONNECTOR	FUNCTION
RS-232	Computer cable connector for factory use.
RJ11	Telephone line connector.

JUMPER	FUNCTION
JP1	Cut to use the power converter with a resistive photocell. Cut on the PC 310-4.
JP2	INT RED – Cut to use the internal red controller of a power converter. Not cut in the PC 310-4.

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

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Figure 1-2 PCB1 Pictorial (24747xx)

Section 2 — Outline, Mounting, and Installation

Unpacking

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

Tools

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

- 9- or 12-inch, flat-blade #2 screwdriver
- #2 Phillips®-head screwdriver
- Medium, slip joint pliers
- Set of combination wrenches
- Long-nose pliers
- Assorted nut driver handles: 1/4", 5/16", 3/8" recommended
- Triplett™ Model 630-NA VOM, or equivalent analog volt-ohm meter
- Multi-purpose crimp tool

Access

WARNING

Before proceeding—read the warning on Page iii. Disconnect the primary power before opening enclosures.

Power Converter

The base of the power converter has mounting feet. The cover lifts off for unrestricted access to the interior. Release the latches that secure the cover to remove it for internal access.

Flashhead

Pivot the lens open by disengaging two quick-release latches. Two lanyard cables secure the lens. The flashhead normally contains no interlock. Disconnect primary power to the power converter before you open the flashhead. Wait one minute for storage capacitors to drain down. Open the flashhead and use a voltmeter to check that no voltage potential exists between the red and the blue wires on the ceramic terminal posts.

Mounting

Power Converter

Mounting and outline dimensions for the power converter are shown in *Figure 2-1*. FTCA does not furnish mounting hardware unless ordered as part of an installation kit. Use the following guidelines for mounting the power converter:

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

Flashhead

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

- Use a lightning rod extended above the flashhead to protect it when it is mounted at the uppermost part of the structure.
- Avoid locating a lightning rod where it would prevent tilting the lens open or interfere with access by maintenance or service personnel.

- You must use a bonding strap with a flashhead mounting bolt when mounting the flashhead to the structure, using the mounting bolt to fasten the strap to the leg that contains the ground connection.

Flashhead Leveling

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

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

Photocell

Mounting and outline dimensions for the photocell are shown in *Figure 2-3*. The photocell uses a male 1/2" NPT for mounting. Use the following guidelines to mount the photocell:

- Locate the photocell where it has an unobstructed view of the polar sky.
- It must not view direct or reflected artificial light.
- The photocell may be supported directly by electrical conduit.
- *Ensure that the installation is watertight.*

Installation

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

NOTE

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

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

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

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

Power Converter Wiring

Consult the installation wiring drawings. 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% due to wire resistance. Assume a load of 175 volt-amperes per light to determine the *slow-acting* fuse ratings at the power distribution panel. Use a value of 250 volt-amperes per light to determine *fast-acting* fuse ratings at the power distribution panel and to select a system feeder transformer (if used).

In multiple-unit systems, the master unit and slave units communicate over the "master/slave" interconnect wiring. Twist the wires together at the rate of 12 twists per foot. The recommended minimum size for control and signal conductors is #14 AWG.

Flashhead Wiring

The power converter and flashhead are interconnected by the flashhead cable. When FTCA Part Number 6340, or equivalent cable, is used, the two may be separated by a distance up to 600 feet. Consult the factory when a greater separation is necessary. The cable between the power converter and flashhead requires five conductors with 600 volts (minimum) insulation. Two of the conductors must be #10 AWG. The other three may be #16 AWG (minimum; for mechanical strength) if you are cabling together individual wires.

To ensure long-term equipment reliability, use continuous wiring between the power converters and their flashheads without intervening junctions or splices.

Securing the Cable

FTCA recommends 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 4 also directly above and below any tower leg flanges that the cable may cross.

Photocell Wiring

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

The photocell terminals on the slave power converters must be jumpered from TB1-1 to TB1-2. (An alternative jumper may be installed on PCB1 J15-1 to J15-2.) Also, you connect the master unit (to which the photocell is directly connected) to the top flashhead.

Installation Checklist

Complete the following steps before applying power to the lights.

1. Inspect all equipment for damage.
2. Verify the received equipment against the packing list to ensure completeness.
3. Power Converter Mounting:

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

   - Ensure that the case is mounted upright, is water tight, and grounded to the site grounding system.
   - Check hardware to ensure that all mounting hardware is tight.
   - Ensure that only the bottom of the case has drain holes and that they are clear.
   - Ensure that no holes are punched or drilled on the top surface of the case.
   - Ensure that air can flow around the case.
   - Mount the power converter away from radio frequency interference (RFI).
4. Power Converter Wiring:

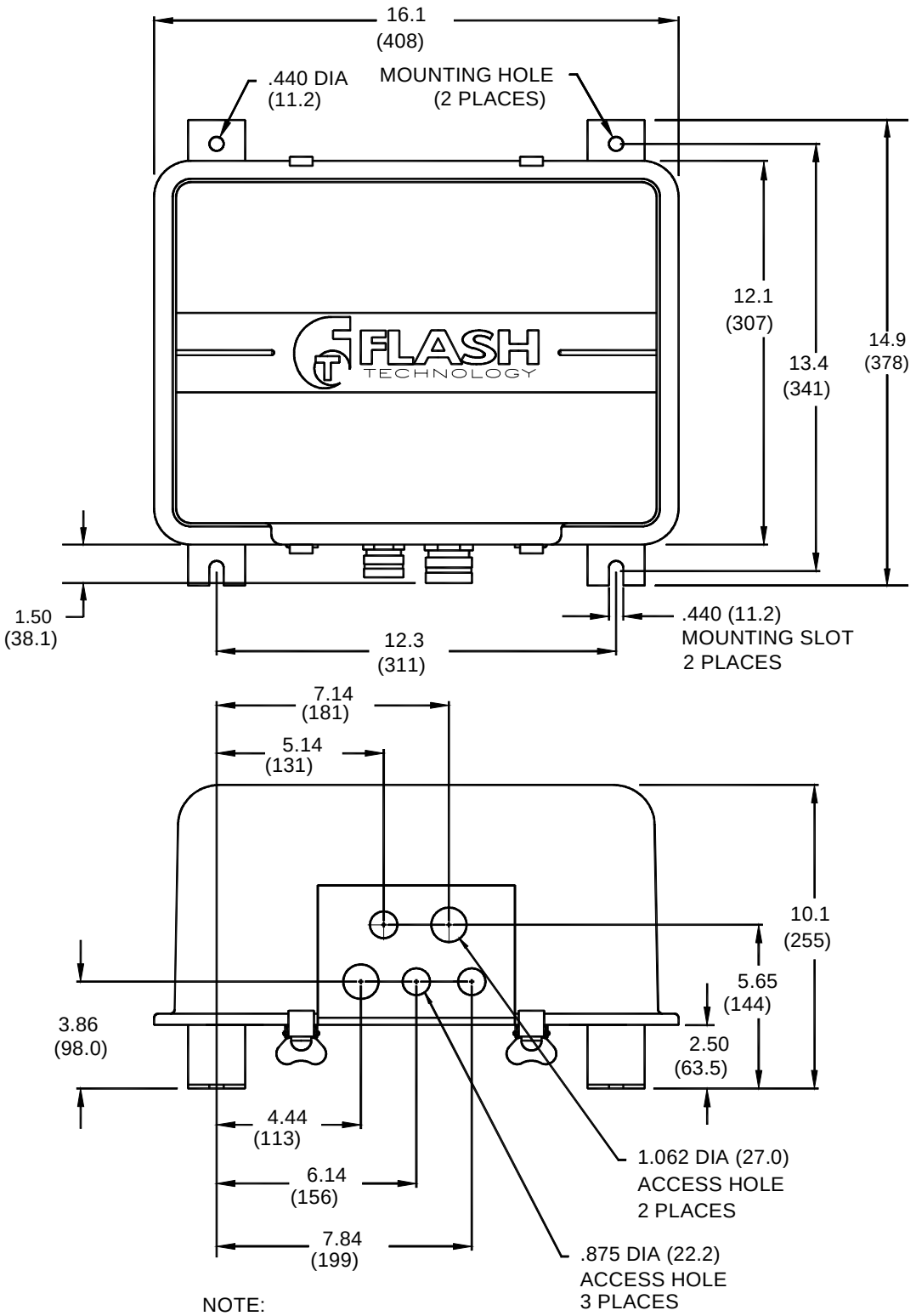
   Examine the installation drawings and use the following checks:

   - Check for proper incoming service voltage.
   - Wire each unit according to the instructions.
   - In multiple installations of three systems, all three power converters should be on the same breaker.

- Check all electrical connections for tightness.
- Check all terminal strip connections for tightness.
- Ground the power converter.
- Wires at master/slave interconnect terminals should be daisy-chained as a twisted pair between the master power converter and the slave units. The rate of twist is 12 per foot. If a shielded cable is used, ground the shield. For example, ensure that TB1-4 is connected to all TB1-4 connections on all units, and TB1-5 is similarly connected.

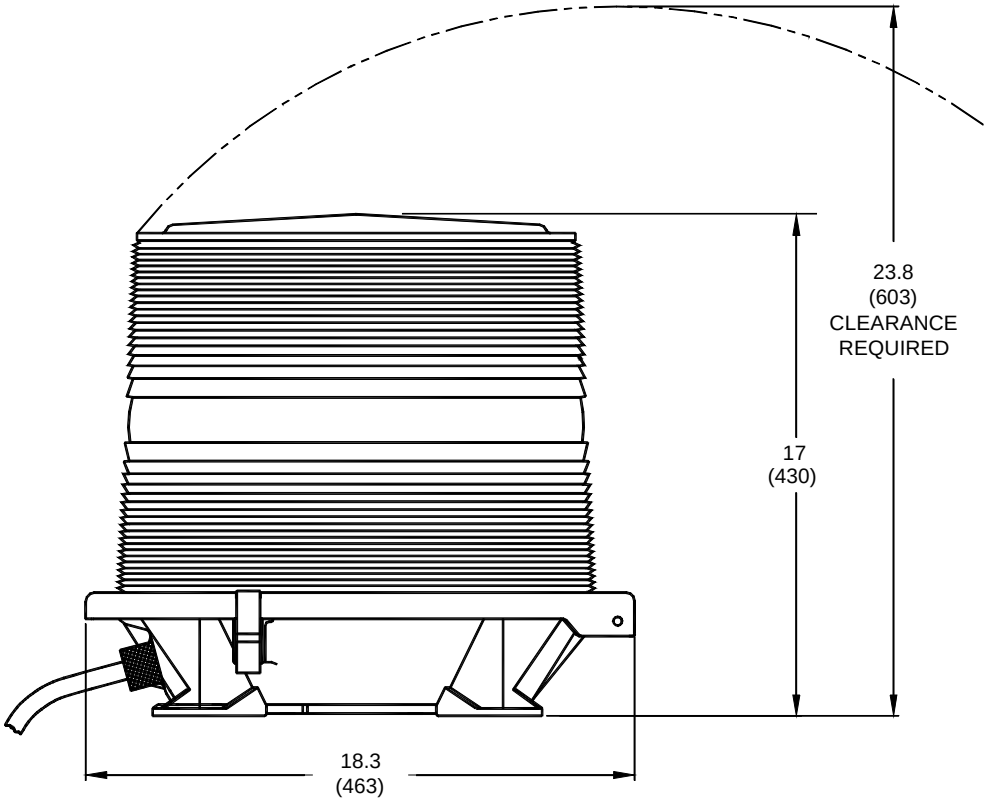
5. Alarm Wiring:
   - If external alarm detection circuit responds to *closed* contacts, ensure that they are wired to the contacts on TB1 that *close* on alarm.
   - If external alarm detection circuit responds to *open* contacts, ensure that they are wired to the contacts on TB1 that *open* on alarm.
   - Alarm wiring should be lightning and RFI protected: shielded, grounded shield, and in a conduit.
   - If a specific alarm is ganged together from all power converters as one, ensure that the wiring follows local installation instructions.
6. Flashhead Mounting:
   - Ensure that the flashhead lens can be opened without striking other objects.
   - Level and aim the flashhead.
7. Flashhead Wiring:
   - Protect the top flashhead against lightning strikes.
   - Ground the flashhead.
   - Check the wiring of the flashhead cable to the flashhead.
   - Secure the flashhead cable to the tower. Support and tape the flashhead cable to prevent its movement by the wind.
8. Photocell:
   - Locate photocell where it views unobstructed polar sky with no direct or reflected artificial lighting striking it.
   - Mount the photocell vertically to prevent water from entering the unit. Ensure watertight connections.
   - Connect the photocell to the master power converter.

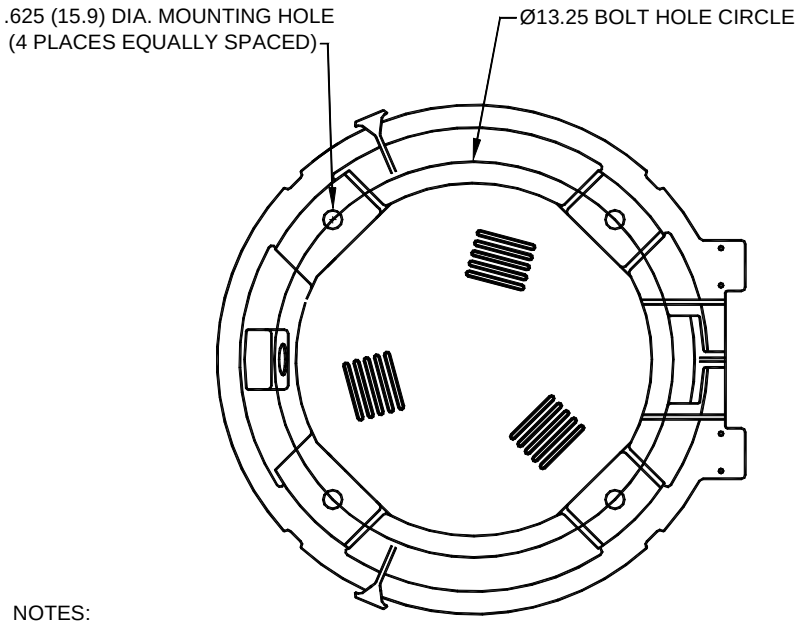
After completing all the steps listed above, turn on the power and perform an operational checkout from procedures in *Section 3* of this manual.



3104PCMO

Figure 2-1 Power Converter Mounting and Outline

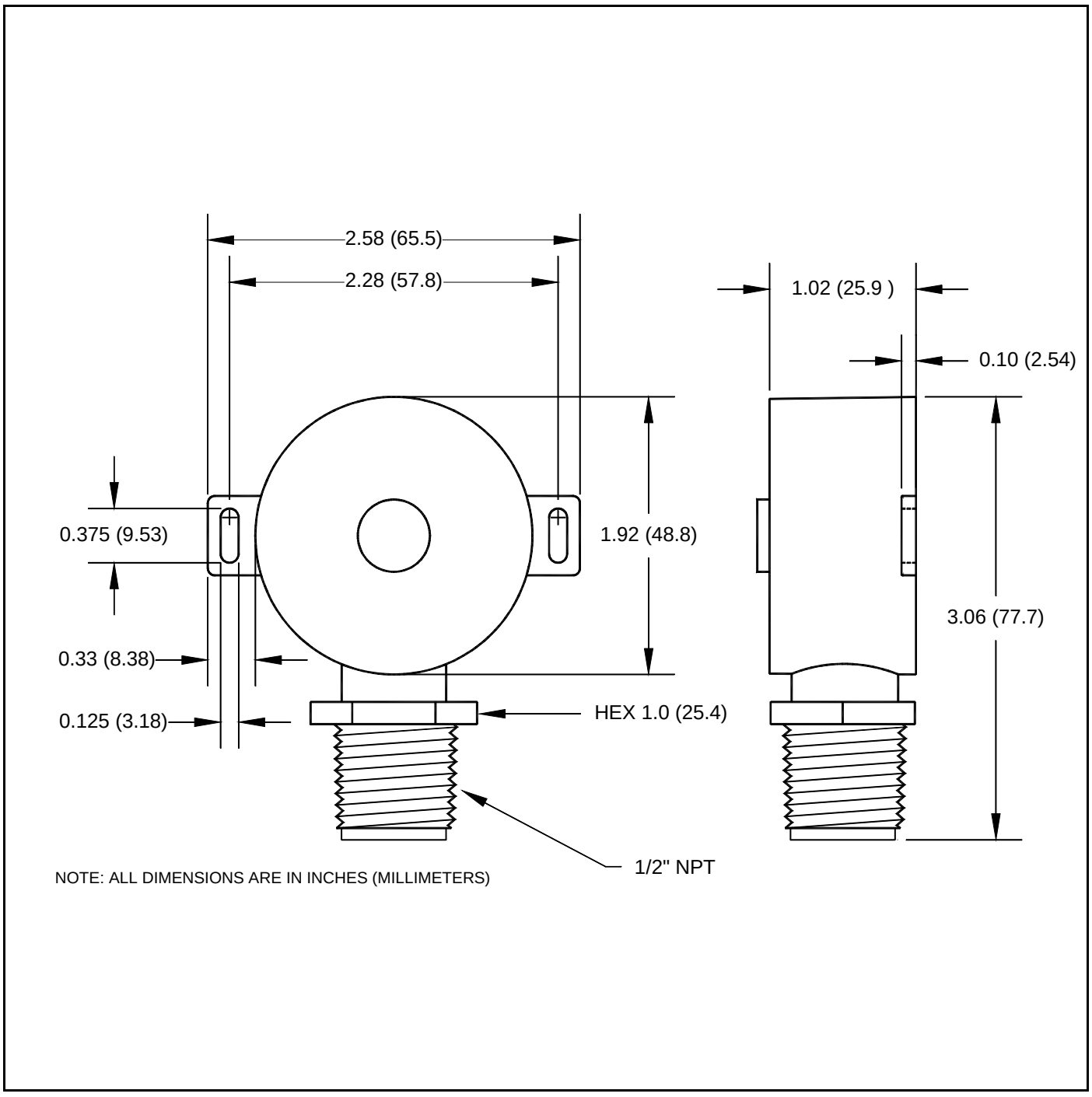




NOTES:
1. WEIGHT: 17 LBS (7.7 KG)
2. AERODYNAMIC WIND AREA: .93 FT^2 (.0864 M^2)
3. DIMENSIONS ARE IN INCHES (MILLIMETERS)
4. ACCESS TO THE FLASHHEAD MUST REMAIN UNOBSTRUCTED
5. FLASHHEAD SHOULD HAVE LIGHTNING PROTECTION

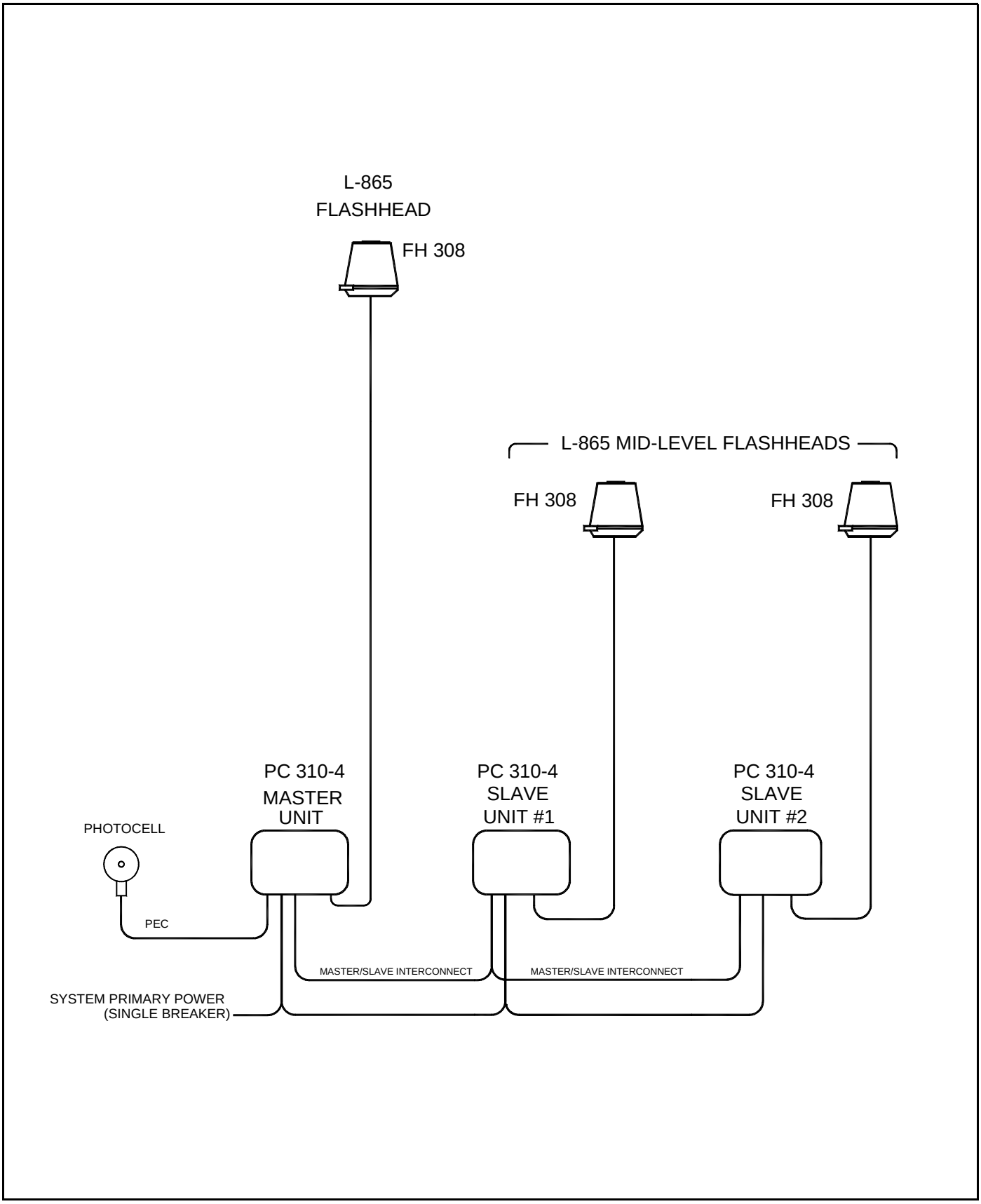
308MO

Figure 2-2 Flashhead Mounting and Outline



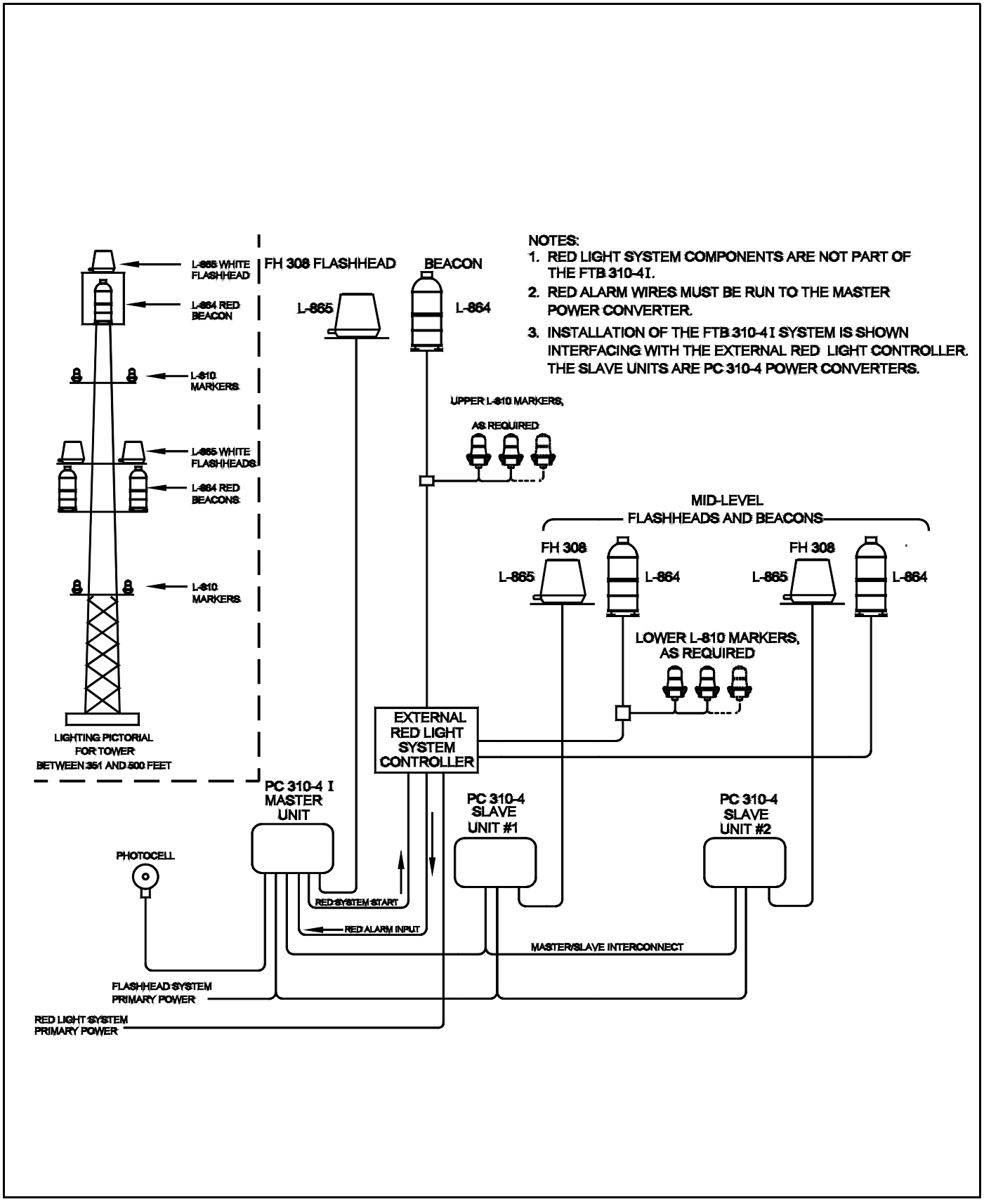
PEC510MO

Figure 2-3 Photocell Mounting and Outline



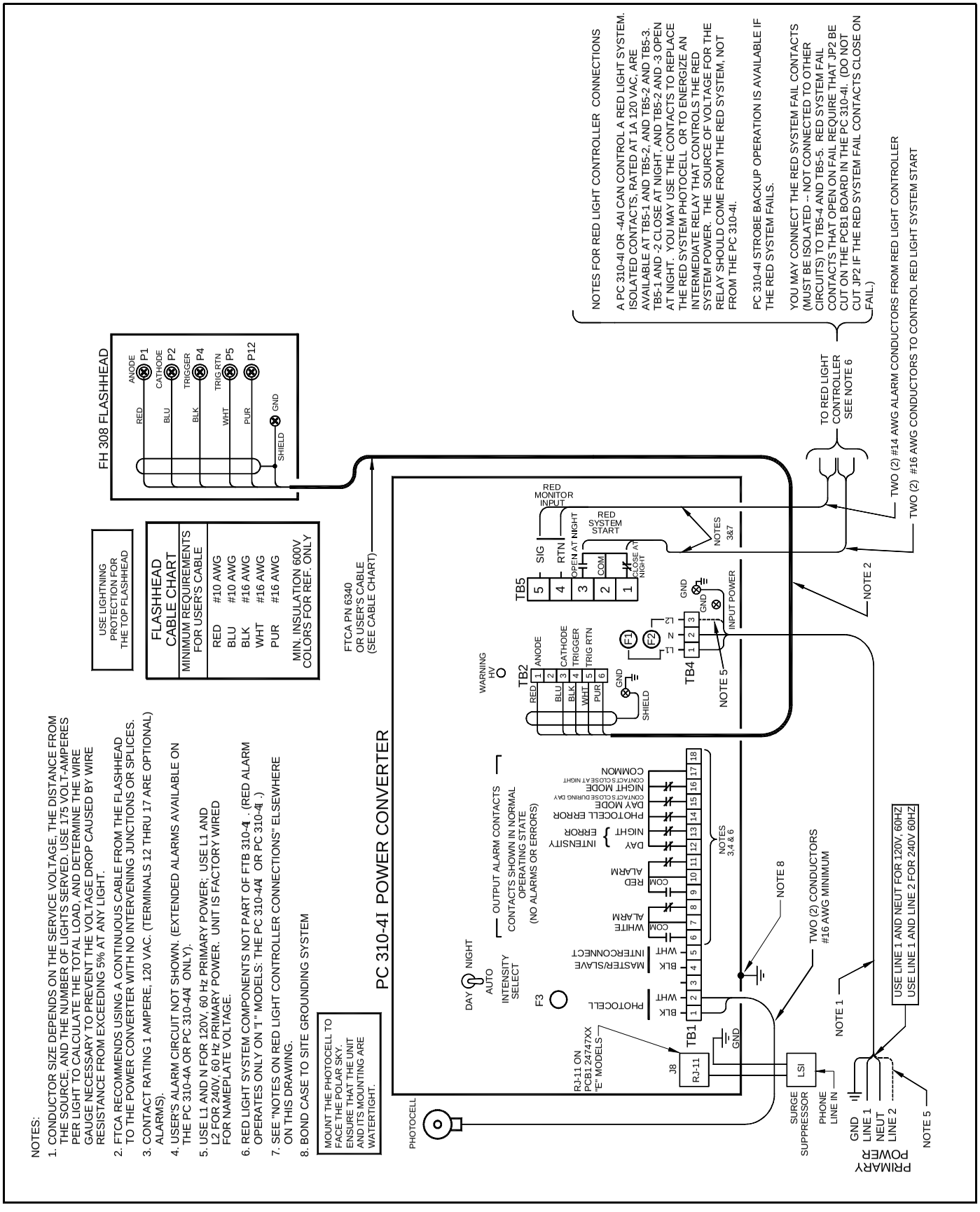
31040024

Figure 2-4 Typical System — Wiring Guideline



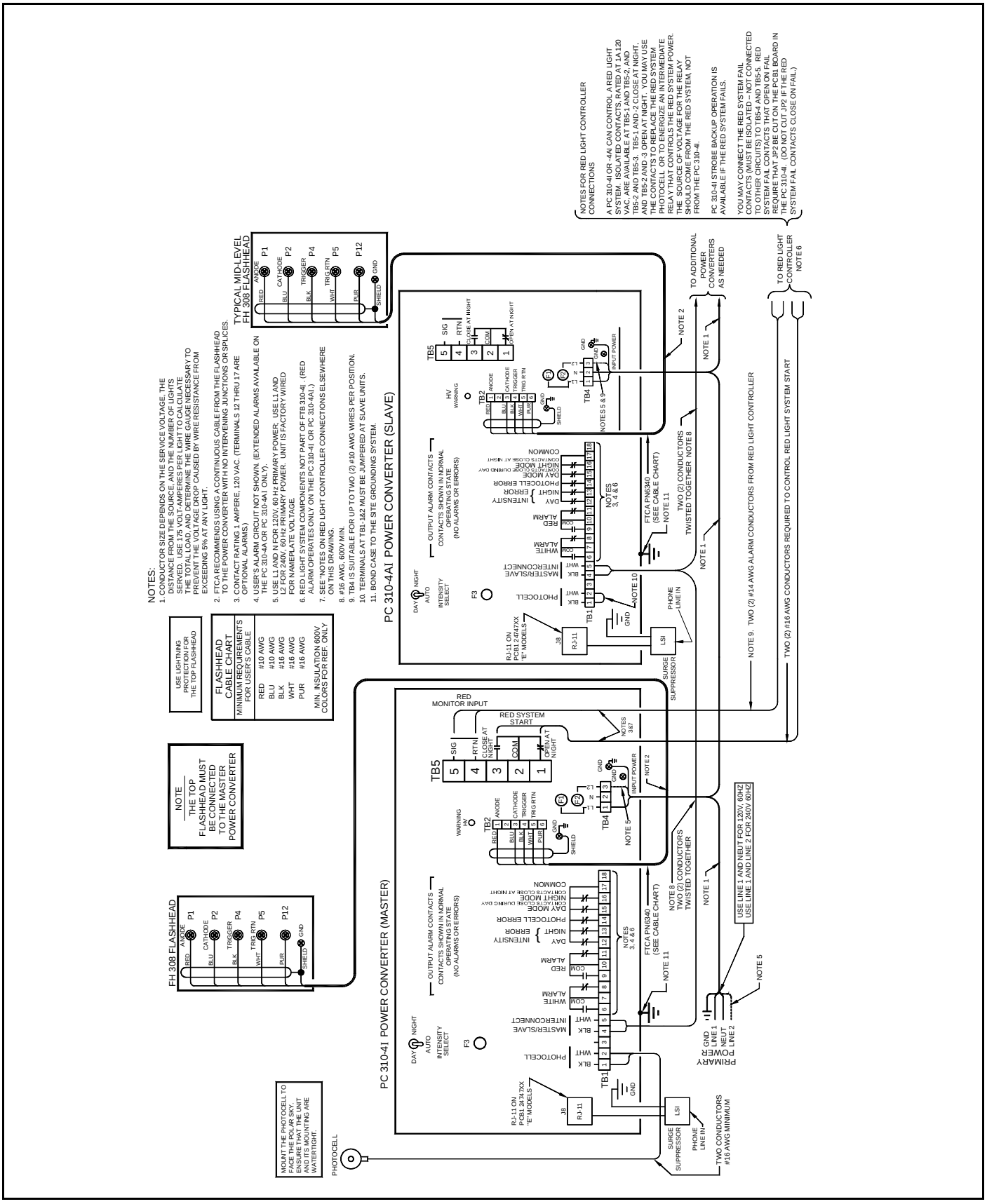
31040025

Figure 2-5 Multiple Dual System with External Red Light Controller Guideline



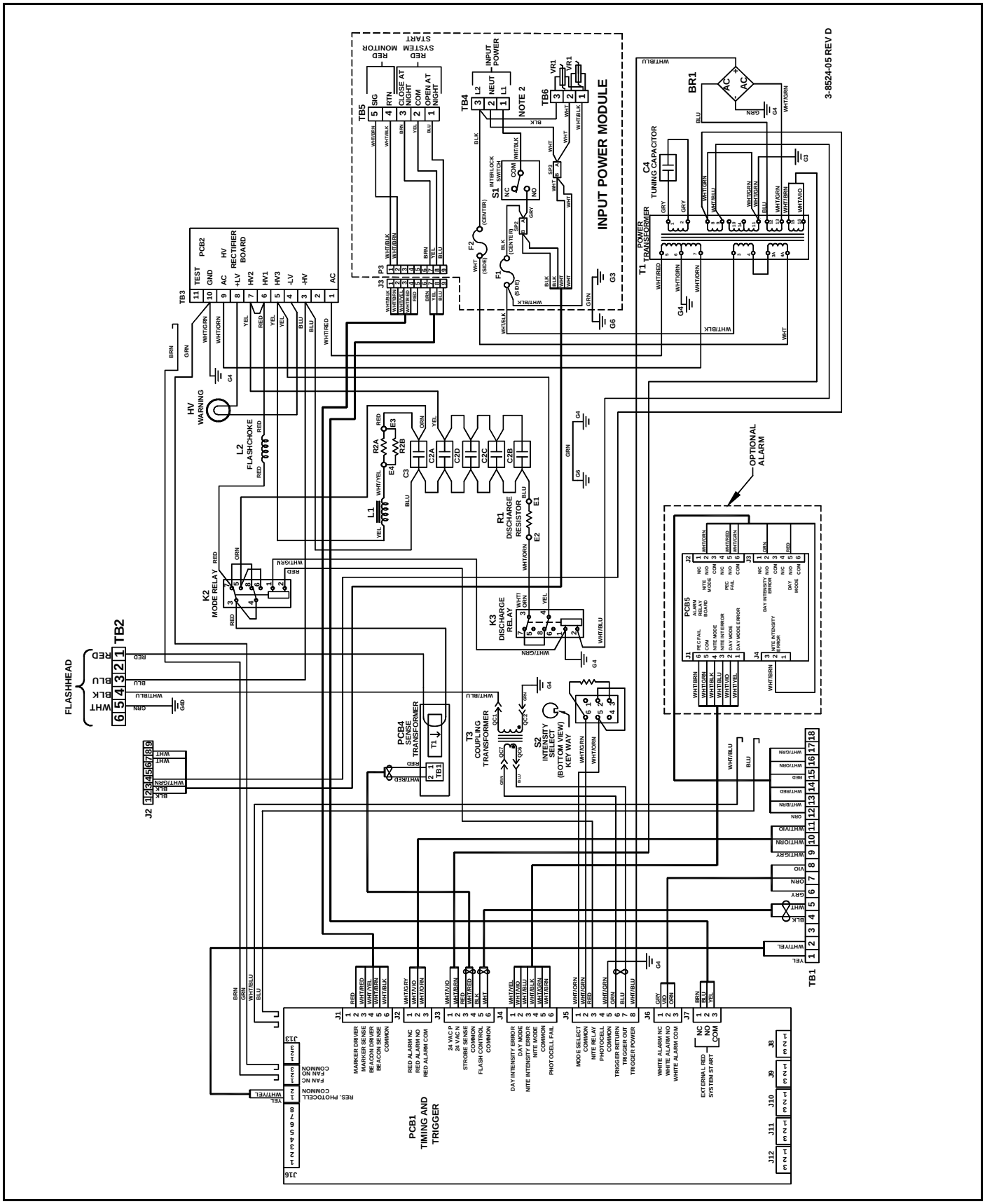
31040026

Figure 2-6 Typical Dual System Installation



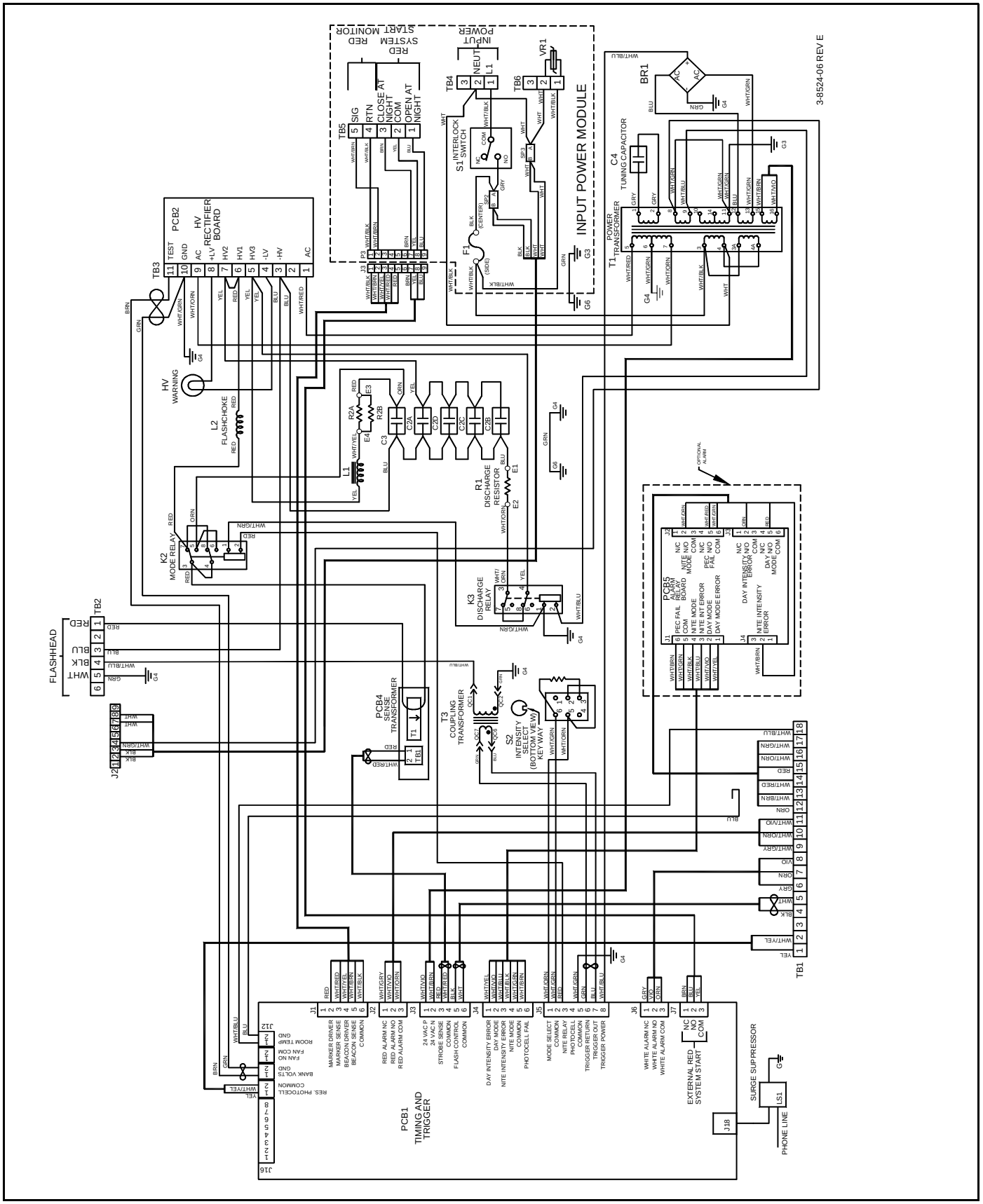
31040027

Figure 2-7 Multiple Dual System Installation



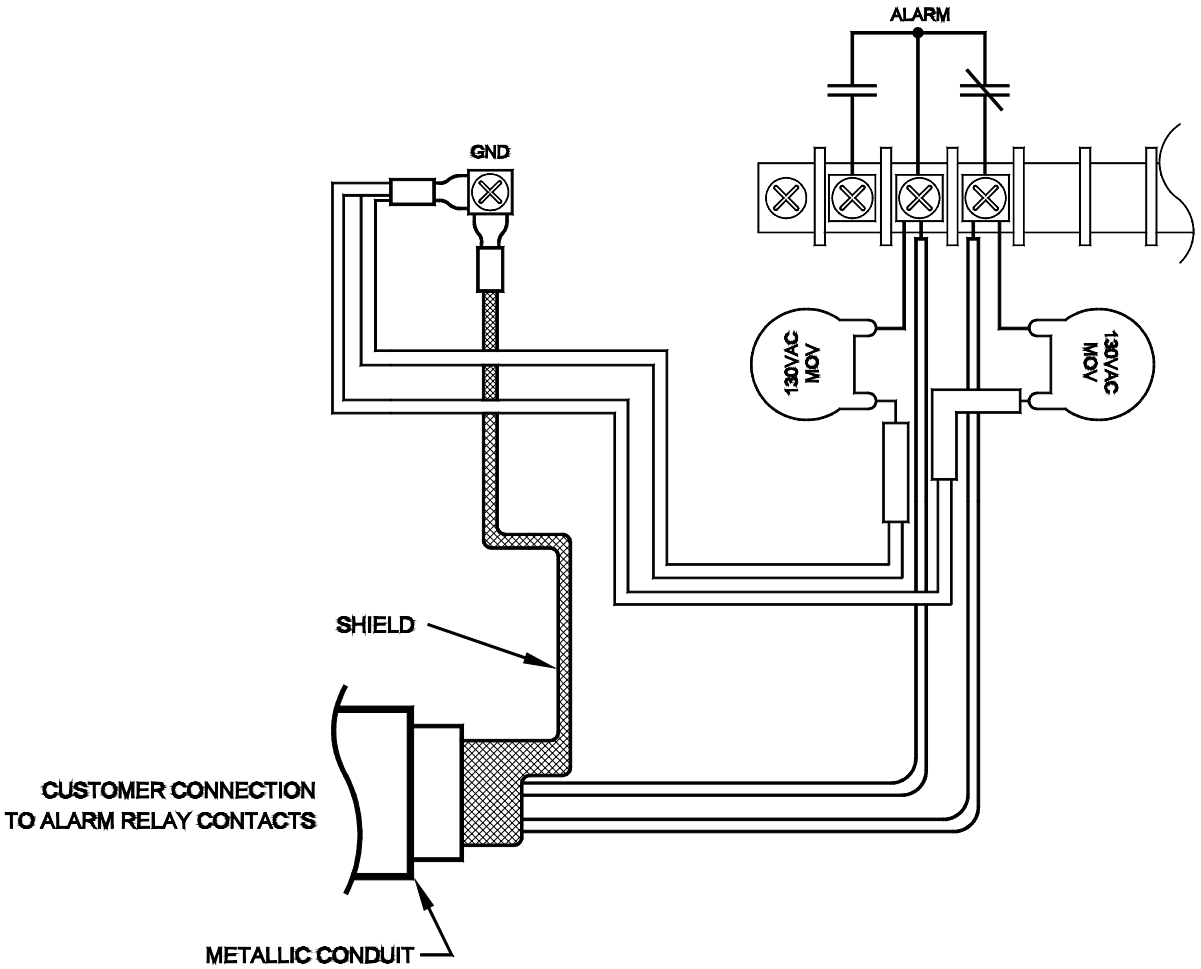
3104INTW

Figure 2-8 PC 310-4 or PC 310-4A Power Converter Internal Wiring



3104INTWE

Figure 2-9 PC 310-4E Power Converter Internal Wiring



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

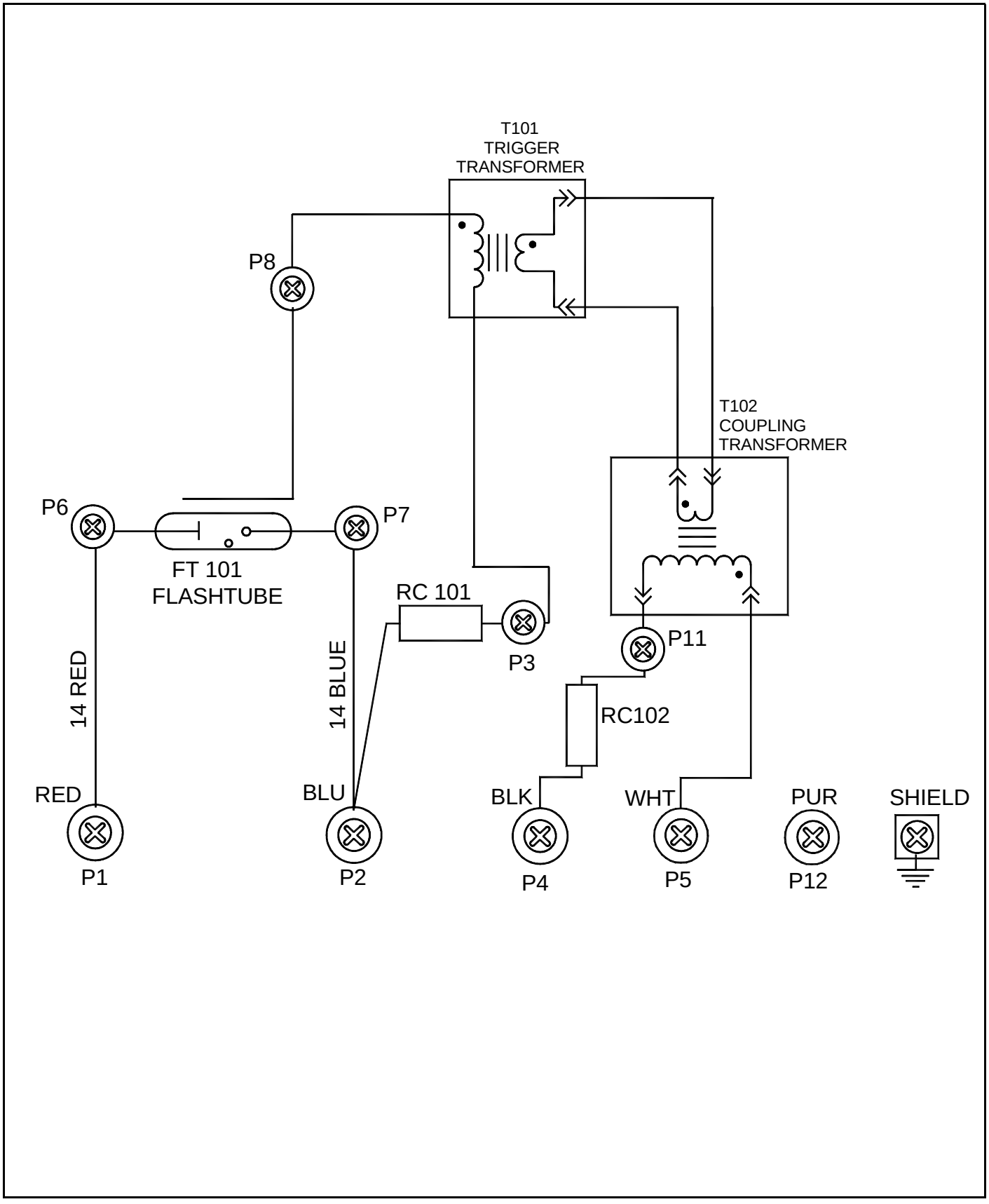
THE INSTALLER IS RESPONSIBLE FOR COMPLYING WITH ALL APPLICABLE ELECTRICAL CODES.

NOTES:

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

ALRMWRNG

Figure 2-10 Recommended Alarm Wiring



307308IW

Figure 2-11 Flashhead Internal Wiring

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Section 3 — Maintenance and Troubleshooting

Safety

WARNING

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

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 once a year:

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

Storage

Long-term storage of the equipment requires no special considerations.

Diagnostic Testing

The only effective way to check out interconnected lights is to disconnect the *master/slave interconnect* wire that is connected between power converters and check the power converters as single units, as described in *Master Unit*.

Sync Signal Evaluation

Refer to *Figure 2-7*. Note that, for each power converter, a master/slave interconnect line and its return line are connected to TB1-4 and TB1-5 respectively. All units place a pulse on the line, which causes the power converters to flash all the lights at the same time. This pulse is the synchronization pulse. PCB1 in each power converter generates a sync pulse. The first sync pulse to be placed on the line synchronizes the remaining lights. The width of the sync pulse controls the mode of operation.

In the event of a top-most red light failure at night, the power converter places a back-up signal on the line that causes all connected units to flash the white lights at the correct night intensity.

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

RFI Problems

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

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 off.

Capacitors

Evaluate the condition of a capacitor with an analog volt-ohmmeter operating in the resistance mode. The following method assumes an instrument with a X100 resistance scale.

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

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

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

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

Wiring and Cabling

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

Inspection

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

Power Converter

Burst Choke (L1)

Measure the resistance of L1 from TB3-5 to ceramic post E4 (at burst resistor R2). Its resistance should be approximately 7 ohms.

Relays (K2, K3)

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

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

Timing and Trigger Board (PCB1)

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

HV Rectifier Board (PCB2)

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

Sense Board (PCB4)

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

Discharge Resistor (R1)

The resistance of R1 between ceramic posts E1 and E2 should be 35,000 ohms.

Burst Resistor (R2)

The resistance of R2 between posts E3 and E4 should be 500 ohms.

Power Transformer (T1)

To test this transformer, first remove the PCB1 and the HV rectifier board (PCB2). Apply power to the unit and measure secondary winding voltages at the terminals indicated in *Table 3-1*.

Table 3-1 Power Transformer Voltages

Terminals	Voltage Range Allowed
TB3-1 to TB3-9	900-1050 VAC[1]
Terminal 2 of Relay K2 or K3 to chassis	100-120 VAC
J3-1 to J3-2 on PCB1	22-26 VAC

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

Flashhead

Flashtube (FT101)

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

Trigger Transformer (T101)

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

Trigger Coupling Transformer (T102)

The coupling transformer should not have open windings. An ohmmeter will indicate a shorted winding because of the wire size. Check with an ohmmeter at the wire terminals.

Photocell Testing

Use the following procedure:

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

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

Component Removal and Replacement

A power converter component location diagram is provided in *Figure 4-1*. A flashhead component location diagram is provided in *Figure 4-2*. A flashhead electrical wiring diagram is provided in *Figure 2-11*. A *power converter internal wiring diagram* is provided in *Figure 2-8*.

Note the location and color of all wires that you disconnect. When you replace the wiring after you replace the components, ensure that the wiring agrees with *Figure 2-8*.

The general procedure for removing components follows:

1. Obtain access to the component in question.
    a. Disconnect completely or partially the wiring to components first that prevent clear access.
2. Completely remove or relocate these components.
3. Disconnect the wiring to the component that you want to replace.
4. Remove this component.
5. Replace everything in the reverse order: first the component, then the wiring. In some cases, you may have to place some wires on the component before you fasten it in place, then replace the remaining wires.

Most components are relatively easy to access for removal. Only those that are more difficult are described.

Power Converter Components

Capacitors

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

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

Removal

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

Replacement

1. Reverse the removal procedure.
2. Verify that wiring is in accordance with the wiring diagram in *Figure 2-8*. Wires must be replaced exactly as removed. In some instances, a quick-connect wire terminal does not seat properly if it is not placed on the terminal cluster exactly as it was before removal. This occurs by interference between the insulation on the wire terminal and the insulation surrounding their terminal cluster on the capacitor.

   FTCA recommends that you lightly squeeze the quick-connect wire terminals with pliers before reinstalling them over the capacitor terminal blades.

Timing and Trigger Board Assembly (PCB1)

PCB1 is mounted on the left side of the component bracket.

Removal

1. Remove all green connector plugs from PCB1 headers.
2. Loosen (but do not remove) the four screws located near the corners of the board.
3. Lift the board from the bracket.

Replacement

1. Cut the appropriate program jumpers according the the board just removed.
2. Reverse the removal procedure.

Input Power Module

Removal

1. Remove all accessible wires and cable connectors attached to the module and to T1 located under the module.
2. Loosen the truss-head screws in the base that fasten the module to the base.

3. Remove the screw under the ground terminal to the left of TB4. This screw fastens the module to the component bracket.
4. Carefully slide the module to the right and lift it out. Ensure that connectors are not bent while doing so.
5. Remove any additional connections necessary to remove the module.

Replacement

1. Reverse the removal procedure.
2. Verify that wiring agrees with *Figure 2-8* and restore the wire routing to its original state.

Power Transformer (T1)

Removal

1. Remove the Input Power Module.
2. Remove the four screws holding the transformer to the base plate and remove the transformer.

Replacement

1. Reverse the removal procedure.
2. Verify that wiring agrees with *Figure 2-8* and restore the wire routing to its original position.

Component Bracket

The Component Bracket supports the capacitors, terminal blocks, PCB1, PCB2, and other components.

Removal

1. Loosen the four screws holding PCB1 to the bracket and lift PCB1 up and out.
2. Loosen the two truss-head screws below PCB1 on the left side of the bracket that hold the bracket to the base plate.
3. Remove the screw on the left front side of the bracket that fastens the bracket to the Input Power Module.
4. Loosen the two truss-head screws in the base plate on the right side of the bracket that hold the bracket to the base plate.
5. Slide the bracket up off the screws. Be careful of the cable and cable connectors. You may hang the bracket over the edge of the connector panel to perform the remaining steps.

Replacement

1. Reverse the removal procedure.

HV Rectifier Board (PCB2)

The HV rectifier board is mounted on the right of the Component Bracket.

Removal

1. Remove the Component Bracket to gain access to PCB2.
2. Loosen, but do not remove, the screws holding PCB2 to the terminal block TB3.
3. Slide the circuit board out from under the terminal block screws.

Replacement

1. Reverse the removal procedure.
2. Restore the wire routing to its original state.

Mode Relay (K2), Discharge Relay (K3)

Remove the Component Bracket for adequate access to Relay K2.

Removal

1. Remove the capacitors.
2. Remove PCB1.
3. Remove the Component Bracket.
4. Loosen the screws that fasten the wiring connectors to the relay.
5. Carefully disconnect the wires from the terminals of the component and note their locations so that you may more easily replace them.
6. Remove the screws that hold the component to the base plate.
7. Remove the component

Replacement

1. Reverse the removal procedure.
2. Verify that wiring agrees with *Figure 2-8 and* restore the wire routing to its original state.

Flashhead Components

Flashtube (FT101)

Use the following removal and replacement procedures:

Removal

1. Using a #2 flat-blade screwdriver, loosen the three screws (on screw lugs)—this enables you to disengage the flashtube.
2. 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.
3. Secure the flashtube by tightening the three screws on the screw lugs.

Trigger Transformer (T101)

Use the following removal and replacement procedures:

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.
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.

Trigger Coupling Transformer (T102)

Removal

Removal and replacement are similar to the procedure for the Trigger Transformer (T101).

Operational Checkout

This section describes basic functional testing.

Observe the response of the equipment as indicated in *Table 3-2*. If the system contains more than one light, and the lights are interconnected for master/slave synchronization, perform the actual checkout steps described below only at the master unit. However, observe all lights for responses. These procedures assume that the following conditions are present:

1. The photocell is subjected to normal outdoor daylight.
2. All installation steps in *Installation Checklist* have been completed.
3. PCB1 is correctly programmed.

Table 3-2 PCB1 Function Indicators

LED Indicator	LED Function Description	LED Normal Operation		
		Day	Night	Dual System Night
I 1	NITE ERR — On for night intensity error.	OFF	OFF	OFF
I 2	PEC ALARM — On for Photocell alarm (Photocell failed to switch state).	OFF	OFF	OFF
I 3	RED ALARM — On for optional red alarm (red light failure occurred).	OFF	OFF	OFF
I 4	FAN — Not used.	NOT USED	NOT USED	NOT USED
I 5	CONFIRM — On when PCB1 detects a valid flash. I 5 flickers at flash rate.	FLICK	FLICK	OFF
I 6	NITE — On when the power converter is in night mode.	OFF	ON	ON
I 7	DAY ERR — On when a day intensity error has occurred (light flashed at the incorrect intensity).	OFF	OFF	OFF
I 8	WHT ALM — On when a white alarm occurs (white light failed).	OFF	OFF	OFF
I 9	MRK ALM — Not used.	OFF	OFF	OFF
I 10	SYNC — Flicks on every six seconds.	FLICK	FLICK	FLICK
I 11	DAY — On when power converter is in day mode.	ON	OFF	OFF
I 12	MARKERS — Not used.	NOT USED	NOT USED	NOT USED
I 13 (neon)	TRIGGER POWER — Indicates 120 VDC trigger voltage is available.	ON	ON	ON

Manual Override: Fixed Intensities

You may manually override automatic intensity control (as when the manual intensity override switch S2 is set to AUTO), but only if no synchronization line connects to other lights. Remove any wire from external circuitry attached to the *master/slave interconnect* terminals. Do this either for temporary purposes (testing) or for permanent operation at a fixed flash intensity.

Daytime: Switch the Intensity Control Switch (S2) to DAY

Night: Switch the Intensity Control Switch (S2) to NIGHT.

PCB1 Indicator Lamps

See *Figure 1-1* or *Figure 1-2* for a description of LED indicators on the PCB1 board for system checkout.

Standard System

The following procedures check normal operation.

1. Check Normal Daytime Operation: Apply power to the system (pull the plunger of the interlock switch or switches outward to the service position). Ensure that the manual intensity override switch or switches are set to AUTO and verify that the daytime responses at each power converter in the system are the same as those shown in *Table 3-2* for *Daytime* operation.

- Note that the white light is flashing at the daytime high-intensity.

2. Check Normal Nighttime Operation: Place an opaque (blocks all light) cover over the photocell and verify that the white night responses at each power converter in the system are the same as those shown in *Table 3-2* for *Nighttime* operation.

NOTE

A minute may pass before the photocell responds to the darkened condition after power is applied.

- Note that the strobe is flashing at the nighttime intensity. The strobe does not flash if a red light system is used.

3. Check Alarm Sensing: Remove primary power and temporarily disconnect the *black* wire on TB2. Apply primary power and verify the following:

- The light does not flash.
- The WHT ALM LED (I 8) is lit after three missed flashes.
- The DAY ERR LED (I 7) is lit.
- The alarm circuit operates according to installation requirements.

4. Restore the Equipment After Checking: Replace all disconnected wires. Remove the cover that you placed on the photocell. Ensure that the manual intensity override switch is in the AUTO position.

5. If Any Responses are Not Normal: If any of the responses above are not *exactly* as described, proceed to *Troubleshooting.*

Dual System (White in Daylight, Red at Night)

The following procedures check normal operation of a dual system, a system with red lights operated by an external red light controller. The external red light controller is connected to TB5.

1. Check Daytime Operation: Apply primary power and verify that daytime operation is identical to that for a standard system, step *1. Check Normal Daytime Operation*.

2. Check Nighttime Operation: Cover the photocell and verify that the white light is not flashing and the red lights are be operating normally. The MKRS LED (I 12) is off.

3. Check Alarm Sensing by Simulating a Failure of the Red Light System: In this step, you *simulate a failure of the red light system*. In some installations, you can do this by removing one of the wires (*red* or *black*) from the Red Light Controller that connects to the RED MONITOR INPUT at TB5-4 and TB5-5, if an alarm is signalled by contacts that open in the red light controller. See *Figure 2-6* and *Figure 2-7*. Verify the following:

- The system resumes strobe flashing (at night intensity).
- The WHT ALM LED (I 8) is not lit.
- The RED ALM LED (I 3) is lit.
- The alarm circuit operates according to installation requirements.

4. Restore the Equipment After Checking: Replace all disconnected wires. Remove the cover that you placed on the photocell.

5. If Any Responses are Not Normal: If any of the responses above are not *exactly* as described, proceed to *Troubleshooting.*

Intensity stepping is controlled by a photocell. For testing, the photocell should be exposed to normal outdoor daylight. *Figure 1-1* and *Figure 1-2* give the locations of the indicator lamps on the board, while *Figure 4-1* shows the location of the board within the power converter.

6. Verify Daytime Operation: Use the procedure in *1. Check Normal Daytime Operation* for testing the power converter.

7. Verify Nighttime Operation: Use the procedure in *2. Check Normal Nighttime Operation* for testing the power converter.

Troubleshooting

Careful observation of operation often leads directly to a symptom cause. System-level problems affect all lights in a multiple-light system in the same way. Unit-level problems originate in a

single light. However, some unit-level malfunctions can effect the entire multi-light system. See the Troubleshooting Charts starting at *Figure 3-1* on Page *3-10*.

When you trace a problem to a specific component, see *Component Testing* and *Component Removal and Replacement* for further assistance.

Master Unit

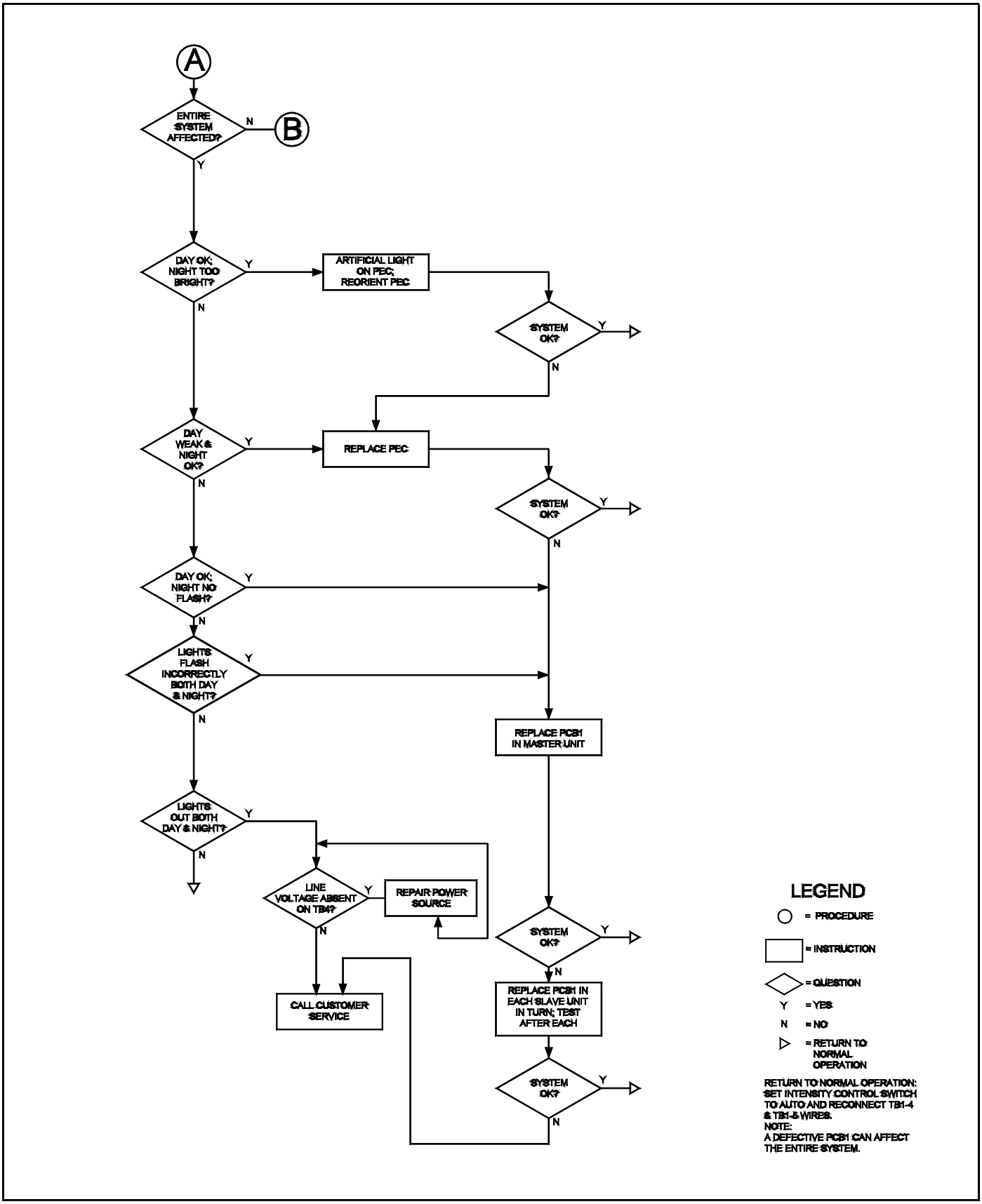
A stand-alone unit is a single FTB 310-4. A master unit is similar to a stand-alone unit, except that it is the controlling unit in a multiple-light system. A master unit has the photocell connected and, in a multiple-light system, is the controlling unit with synchronization wires connected at the master/slave interconnect terminals at TB1-4 and TB1-5.

1. Temporarily disconnect the *black master/slave interconnect* wire at TB1-4.
2. Temporarily set the manual intensity override switch S2 to DAY.
3. Verify the *Daytime* responses are the same as those in *Table 3-2* and *Section 1. Check Normal Daytime Operation* on Page *3-7*.
4. Verify that the strobe is operating at daytime intensity (high intensity).
5. Check the synchronization signal at the *black* TB1-4 *master/slave interconnect* terminal with a voltmeter as in *Sync Signal Evaluation*. Use the intensity control switch to step the unit from one intensity to the other, or cover and uncover the photocell. If the synchronization signal is absent, replace PCB1. A signal response could indicate a slave unit problem or RFI (see *Slave Unit*, and *RFI Problems*).
6. Reconnect the *black master/slave interconnect* wire.
7. Place the manual intensity override switch in the AUTO position.

Slave Unit

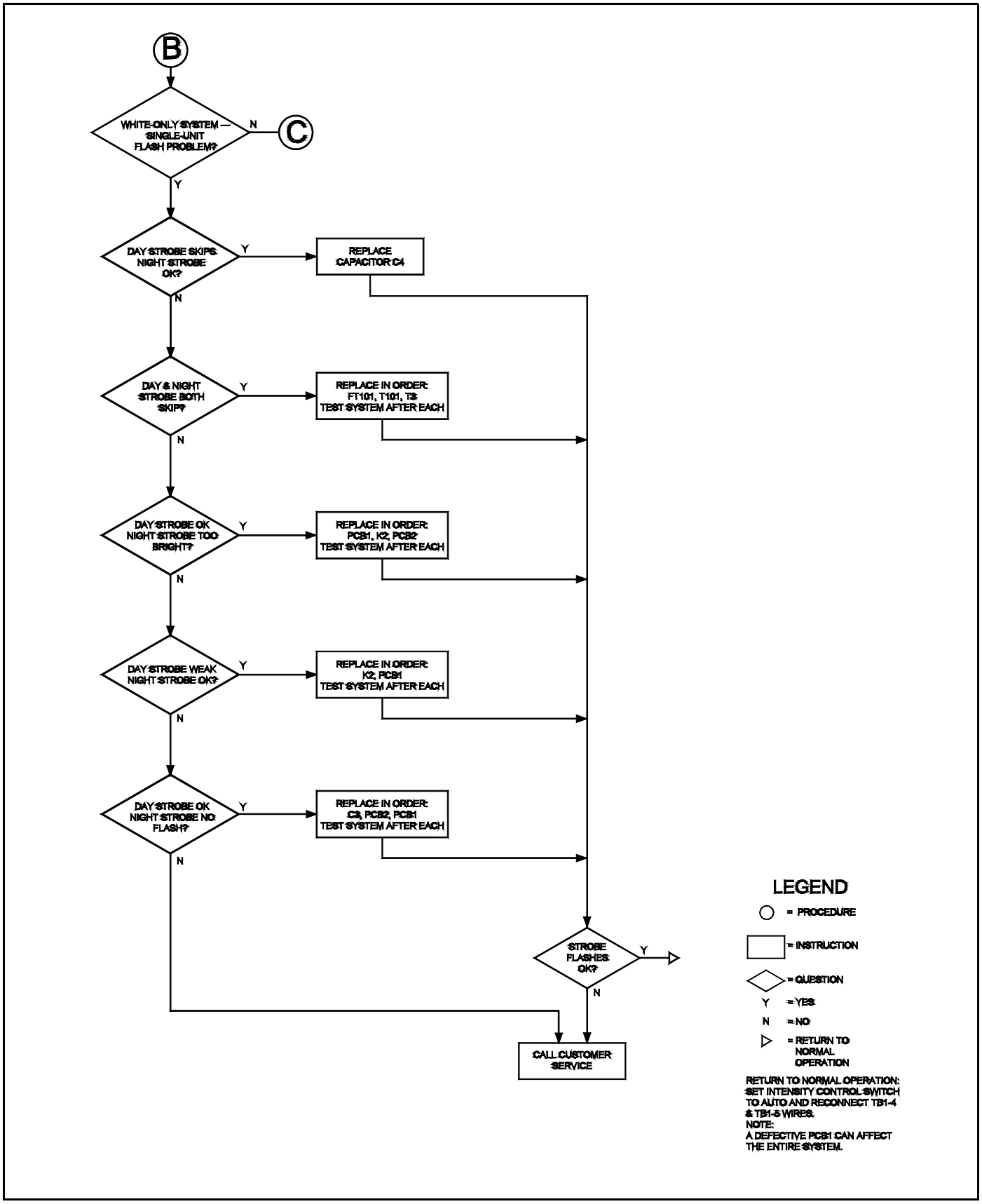
A slave unit receives intensity information from a master unit over the *master/slave interconnect* wires at TB1.

1. Temporarily disconnect the *black master/slave interconnect* wire at TB1-4. The unit will go into day operation.
2. Verify the *Daytime* responses are the same as those in *Table 3-2* and *Section 1. Check Normal Daytime Operation* on Page *3-7*.
3. Check the synchronization signal at the *black master/slave interconnect* terminal with a voltmeter. The sync pulse must be present as described in *Sync Signal Evaluation*. Check wiring if sync is not present.
4. Select NIGHT at the manual intensity override switch. The unit will go into night mode with the strobe flashing at night intensity (low intensity). Note that if a red system is used, the white strobe does not flash at night.
5. Check the signal on the *master/slave interconnect* wire at TB1-4 with a voltmeter, as described in *Sync Signal Evaluation*. An absent pulse requires checking the system for RFI (see *RFI Problems*) and for another malfunctioning unit connected to the *master/slave interconnect* wire.
6. Reconnect the *master/slave interconnect* wire to TB1-4.
7. Place the manual intensity override switch in the AUTO position.



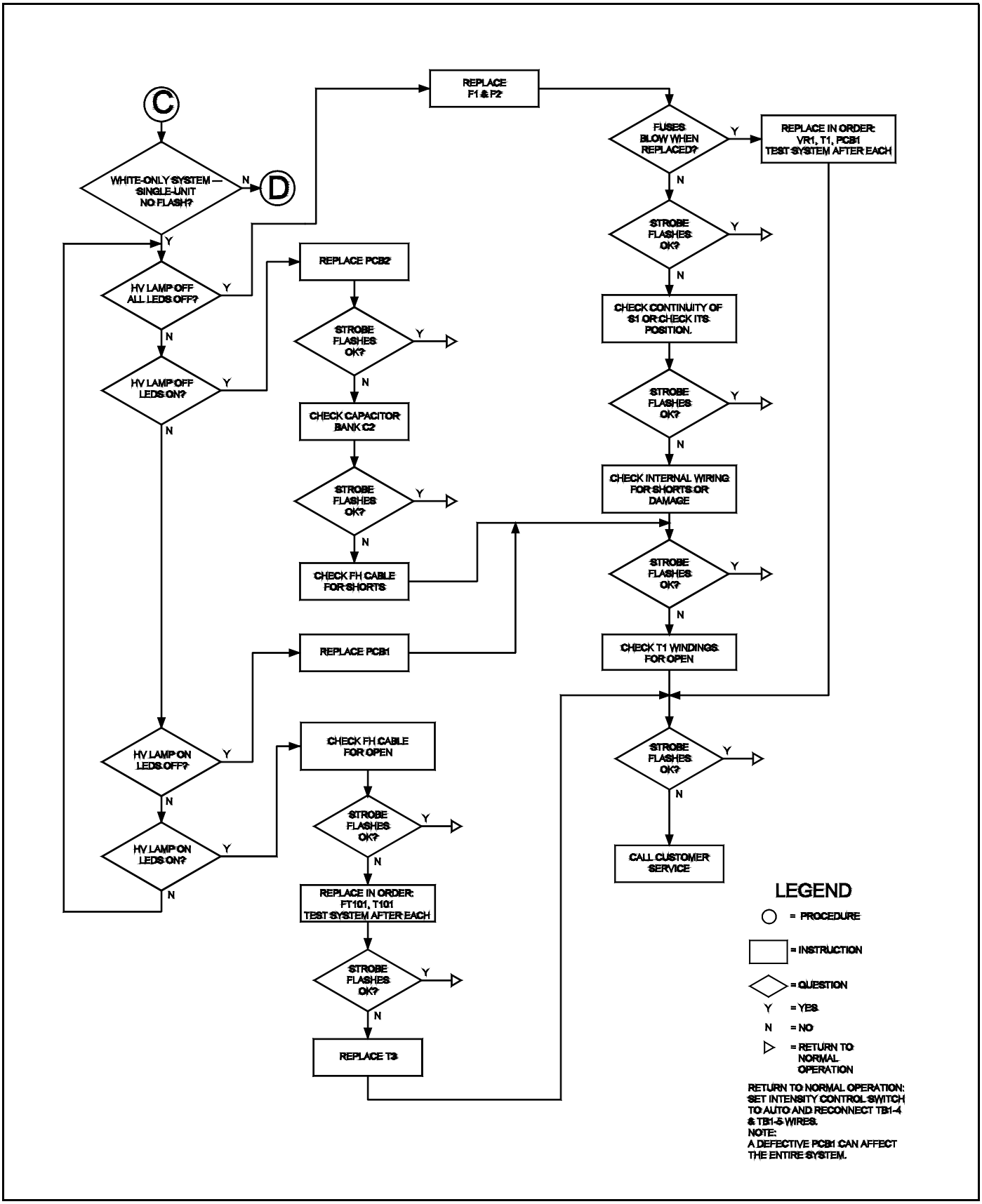
TC1

Figure 3-1 Troubleshooting Chart (Part 1 of 4)



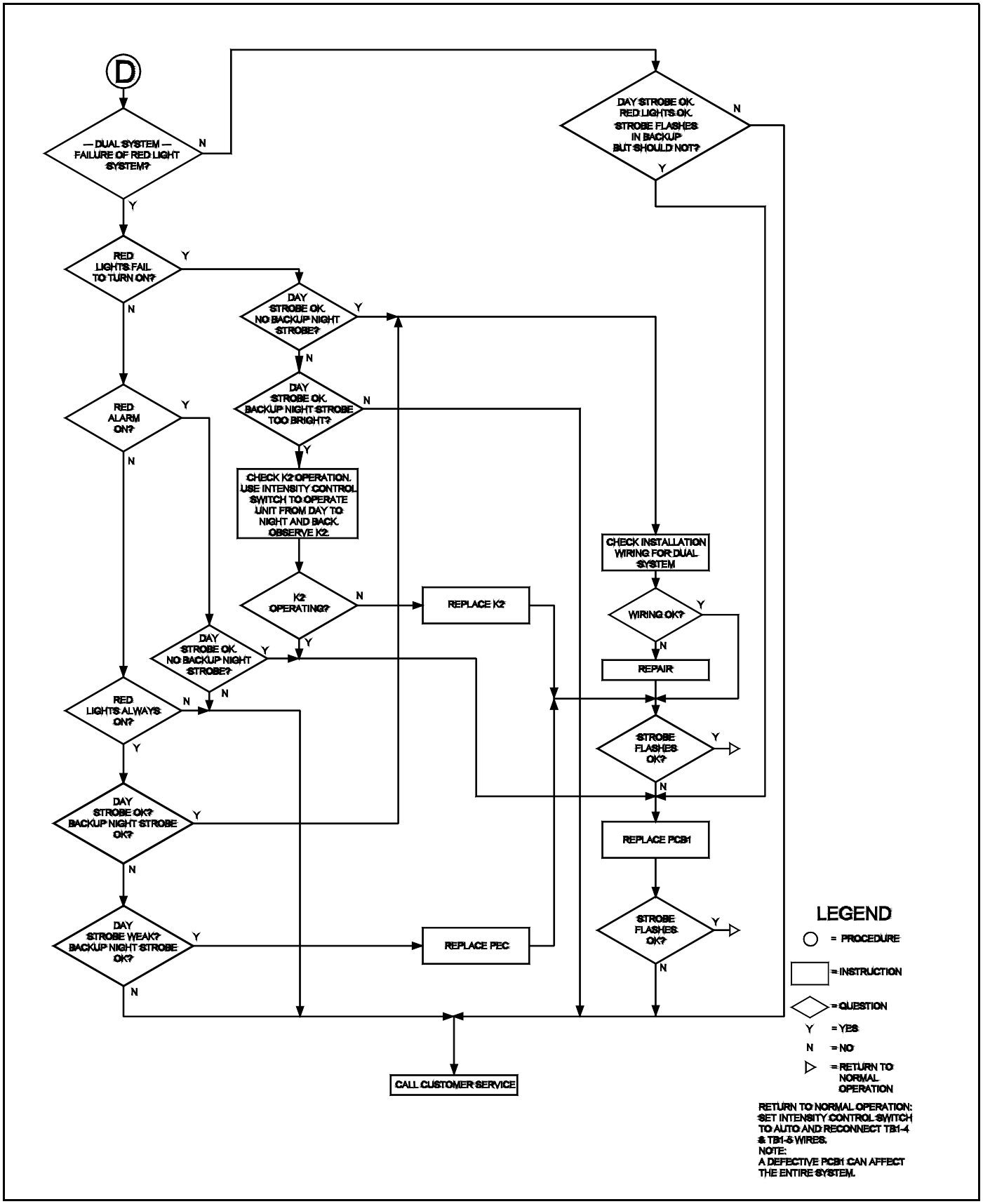
TC2

Figure 3-2 Troubleshooting Chart (Part 2 of 4)



TC3

Figure 3-3 Troubleshooting Chart (Part 3 of 4)



TC4

Figure 3-4 Troubleshooting Chart (Part 4 of 4)

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Section 4 — Recommended Spare & Replaceable Parts

Customer Service

Customer Service 1-800-821-5825

FTCA 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.

Power Converter Parts

Table 4-1 Power Converter Major Replaceable Parts lists the major replaceable parts for the power converter.

Flashhead Parts

Table 4-2 lists the part numbers for the major replaceable parts

Photocell Parts

The part number for the single assembly PEC 510 Photocell is ***PN 1855001***.

Returning Equipment

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

Repackaging

Return equipment in a container that provides maximum protection. If the original cartons and packaging material are no longer available, package the power converter and flashhead *separately* as follows:

Power Converter

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

Flashhead

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

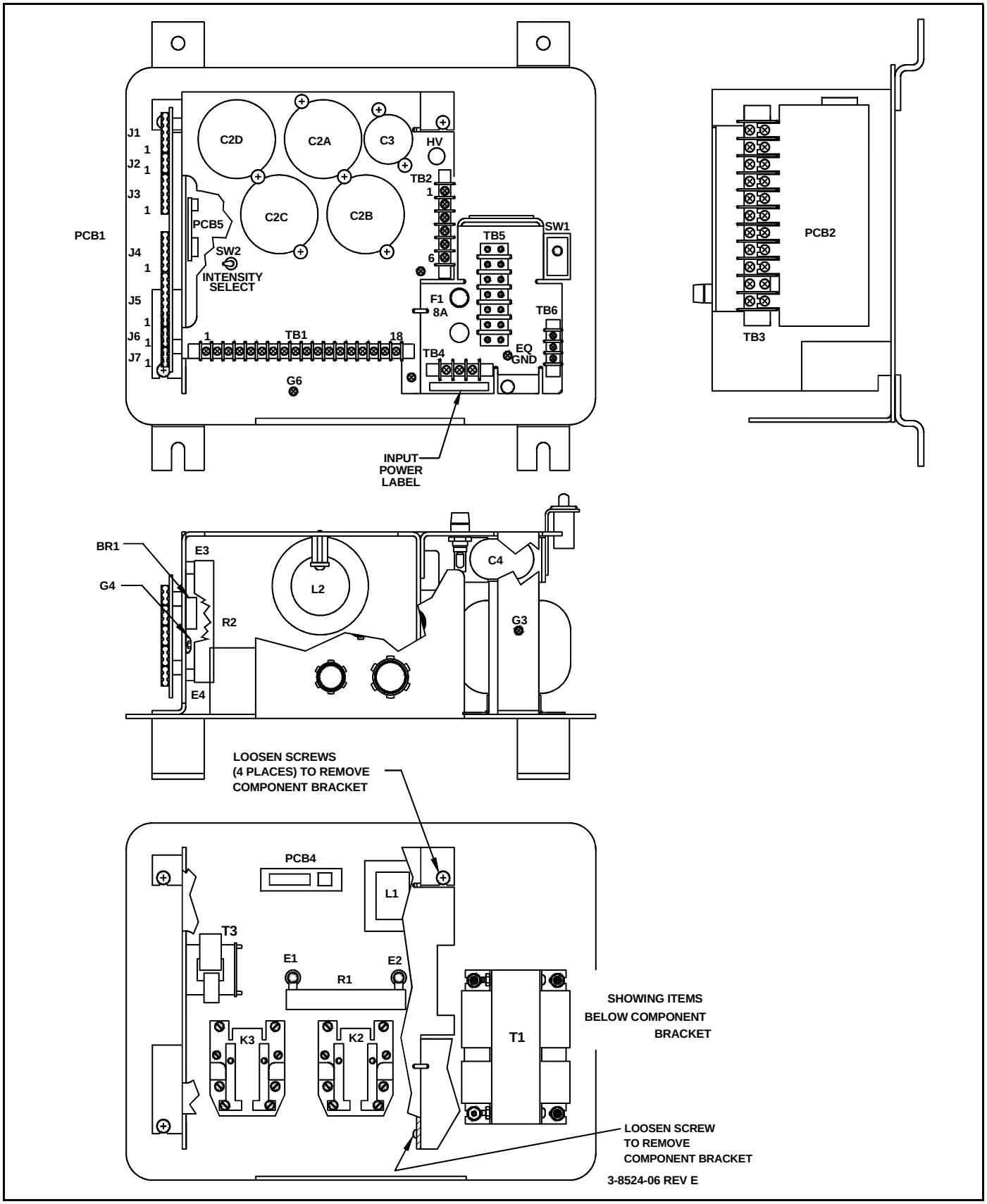
Table 4-1 Power Converter Major Replaceable Parts

Reference Item	Description	Part Number Reference	
		50Hz	60Hz
BR1	Diode Bridge		6902806
C2A, C, D	Capacitor, Main Bank, 70 mfd.		6720401
C2B	Capacitor, Main Bank, 40 mfd.		6386503
C3	Capacitor, Night Mode, .5 mfd.		*6848201
C4	Capacitor, Tuning, 3 mfd.		6577903
F1	†Fuse, Power, MDL8	*4901931 (2 req'd)	*4901931
HV	Neon, High Voltage Warning Light		4902317
K2	†Relay 24V, Mode		8900494
K3	†Relay 120V, Discharge		8900493
L1	Choke, Burst		4850601
L2	Choke, Flash		4175200
PCB1	†Timing and Trigger Board (PC 310-4E models)		**24747xx
PCB1	†Timing and Trigger Board		**24740xx
PCB2	†HV Rectifier Board		2458005
PCB4	Sense Board		2811101
R1	Resistor, Discharge		6900541
R2	Resistor, Burst, 500 ohm		6900532
--	Surge Suppressor Assembly, (PC 310-4E models)		1865301
SW1	†Switch, Interlock		4901220
T1	Transformer, Power	8842901	8841201
T3	Transformer, Coupling		8336701
TB1	Terminal Strip, 18 Position		4901930
TB2	Terminal Strip, 6 Position		4902257
TB3	Terminal Strip, 11 Position		8721011
TB4	Terminal Strip, 3 Position		4902134
TB6	Terminal Strip, 3 Position		4902157
-	TB1-1 to TB1-2 Jumper		5901232
VR1	Varistor	6901081	*6901079

† Recommended as a spare part.

* This part number varies according to the specific equipment voltage configuration.

** The part number for the PCB1 Timing and Trigger Board may vary depending on the equipment and its function at your installation. You must call Customer Service for the correct part number of this board if you are replacing it. When you call, have at hand the number of lights, the type of lights, the tower configuration, and the model of power converter in which you are replacing the board.

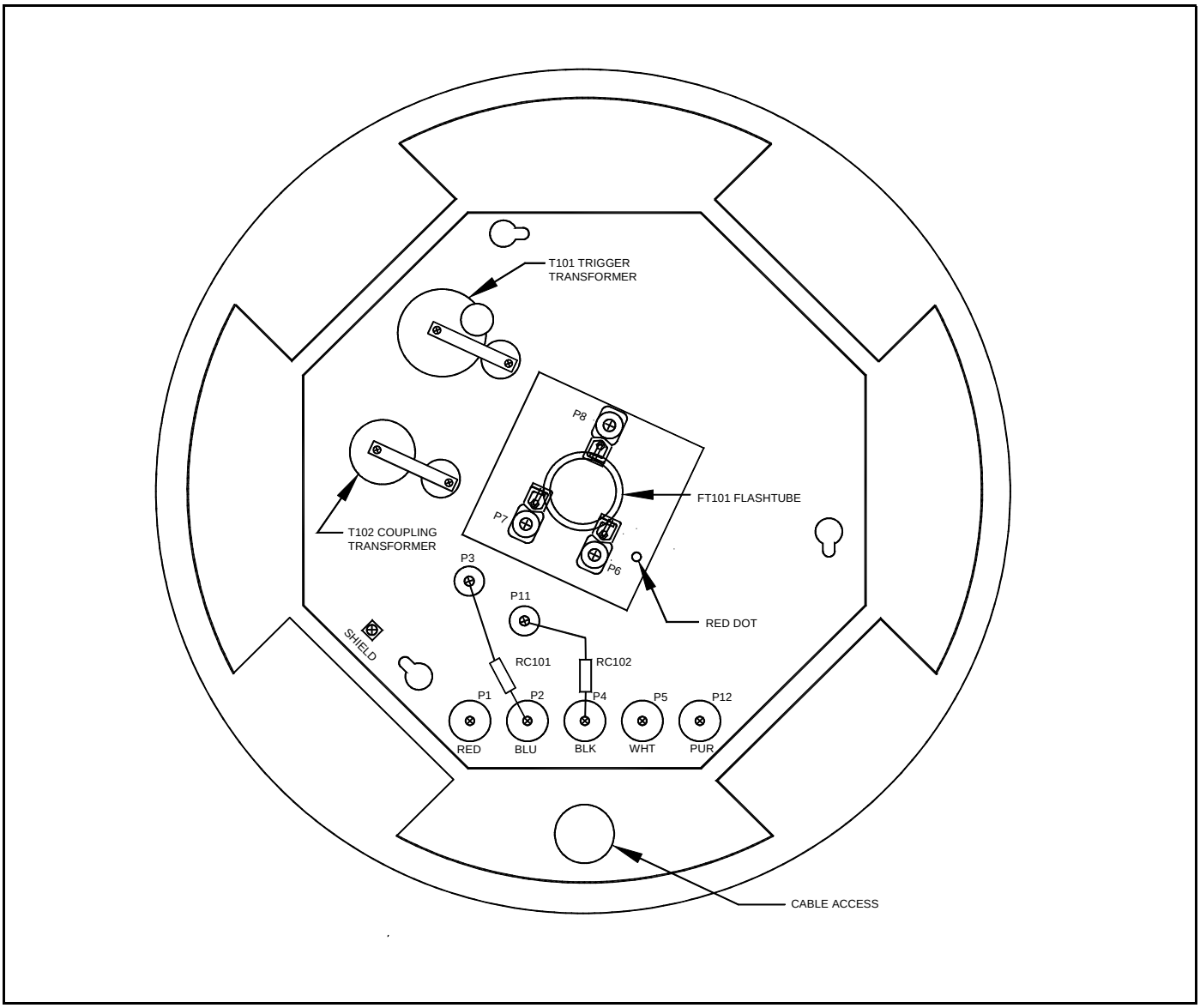


3104PCCL

Figure 4-1 Power Converter Component Layout

Table 4-2 Flashhead Major Replaceable Parts

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



307308CL

Figure 4-2 Flashhead Component Layout

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