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**FTS 430/830**  
**Approach Lighting Systems**

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**Reference Manual**

# Front Matter

## Abstract

This manual describes the *Installation, Maintenance, and Operation* of the FTS 430 and FTS 830 Approach Lighting Systems manufactured by Flash Technology Corporation of America®.

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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.

## Applicable Specification

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

## Warranty

Flash Technology Corporation of America warrants all components, 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 150/5345-51.*

0594-430/830-0007

## **PERSONNEL HAZARD WARNING**

### **DANGEROUS VOLTAGES**

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

### **Avoid Touching Live Circuits**

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

### **Dangerous Voltages Can Persist with Power Disconnected**

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

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

### **Do Not Depend on Interlocks**

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

## **EQUIPMENT CAUTION**

Do not apply power to this equipment if ***any*** Printed circuit board, or ***any*** components have been removed. Serious damage ***will*** occur!

If any components have been removed, and you want to close the cover, which automatically applies power because of the interlock switch, then you ***MUST*** ensure that TB1, terminals 10 and 11 are shorted to each other. If you do not use this procedure, damage will occur and it is not covered under warranty.

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# Section 1 — FTS 430/830 Introduction and Operation

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## System

**FTS 430 System:** An FTS 430 Approach Lighting System is a current driven system consisting of two or more lighting units. Each lighting unit is composed of a white FH 400 Flashhead and PC 430 Power Converter.

**FTS 830 System:** An FTS 830 Approach Lighting System is a current driven system consisting of two or more lighting units. Each lighting unit is composed of a white FH 800 Flashhead and PC 830 Power Converter.

The FH 400 Flashhead produces a beam covering 360 degrees horizontally and 8 degrees, or more, vertically. The lens directs the main part of the beam upward toward the airways, while limiting stray light toward the ground.

The FH 800 Flashhead directs the beam 30 degrees horizontally and 10 degrees vertically. The flashhead is attached to a two-inch threaded pipe by a yoke that has provisions for horizontal and vertical aiming and locking.

## Specifications

### **Physical:**

**FTS 430** Comounted Assembly: (H x W x D)  
28.50 x 25 x 14.00 in., 25 lbs.  
724 x 635 x 355.60 mm, 11.53 kg.

**FTS 830** Comounted Assembly: (H x W x D)  
24.50 x 25 x 14.00 in., 25 lbs.  
622.30 x 635 x 355.60 mm, 11.53 kg.

**PC 430 or PC 830** Power Converter: (H x W x D)  
12.25 x 20.00 x 14.00 in., 21 lbs.  
311.2 x 508.0 x 355.6 mm, 9.53 kg.

**FH 400** Flashhead: (H x W x D)  
16.5 x 13.5 x 13.5 in., 10 lbs.  
419 x 342.9 x 342.9 mm., 4.5 kg.

**FH 800** Flashhead: (H x W x D)  
10.75 x 7.80 in., 4 lbs.  
273.1 x 198.1 mm, 1.82 kg.

Heights include dimensions of the units only and do not include the distance from the bottom of each unit to the ground.

### **Performance Characteristics:**

Application L-849

### **Power Requirements:**

Current and Frequency	2.8A to 6.6A, 50/60 Hz
Isolation Transformer	FAA Type L-830
FTS 430 Power (Watts)	high int. 80 medium int. 50 low int. 30
FTS 830 Power (Watts)	120 fpm 60 fpm
	high int. 175 medium int. 65 low int. 30 high int. 100 medium int. 45 low int. 25

### **FTS 430 Flash Intensity:**

High Intensity	5,000 cd
Medium Intensity	1,500 cd
Low Intensity	300 cd

### **FTS 830 Flash Intensity:**

High Intensity	20,000 cd
Medium Intensity	2,000 cd
Low Intensity	450 cd

### **Flash Rate:**

<b>FTS 430</b>	60 flashes per minute
<b>FTS 830</b>	120 flashes per minute

### **Flash Coverage:**

<b>FH 400:</b>	
Horizontal	360 degrees
Vertical	8 degrees (minimum)

<b>FH 800:</b>	
Horizontal	30 degrees (minimum)
Vertical	10 degrees (minimum)

### **Control Interface:**

Senses constant current level in a series line.

### **Inter-Unit Control:**

Master/slave with common reference timing.

### **Monitoring:**

FAA Advisory Circ. AC 150/5345-51 compliance.

### **Environmental:**

FAA Advisory Circ. AC 150/5345-51 compliance.



## Options

### Elapsed Time Meter

The Elapsed Time Meter shows the hours of operation at high intensity. You can use this timer, for example, to schedule inspections, cleaning, or flashtube replacement as preventive maintenance.

### Flash Monitor

The Flash Monitor allows monitoring flash operation with external monitoring equipment. The main terminal block TB1 has two connections at TB1-4 and TB1-5 to which you can connect the monitoring device. These contacts *open* upon failure of the flashtube for more than approximately 12 seconds. When you first turn the unit on, a failure may be indicated for about 12 seconds until the monitor detects sufficient flashes to close the contacts. After this initial period, the contacts remain closed until a failure occurs or the power is removed.

## Operation

The lights operate when power is applied.

A REIL (Runway End Identifier Lights) system consists of only two lights that are located on each side of the runway at the landing threshold. The REIL lights flash (simultaneously) after the last center line light has flashed.

In ALS applications, the lights are aligned with the center line of the runway, and they flash sequentially toward the landing threshold. An ALS installation may have from 3 to 21 (or more) sequentially flashing lights. FTS 430 or 830 lights are also used in a combined ALS and REIL configuration where the REILs flash (simultaneously) after the last center line light has flashed.

Intensity stepping or either light is controlled by the level of current from a constant current regulator. They are designed for use with L-828, Class 1, Styles 1 and 2 constant current regulators.

Internal timing circuitry in each lighting unit (power converter) fixes the instant at which it flashes. The factory sets simultaneous or sequential flashing. The *master unit* is the one designated by the factory. It distributes a reference timing signal to all units in a system. The reference timing signal from the master also contains encoded flash intensity information. A *control* line, which enables sequential flashing, interconnects all the lights.

## Setup

This section applies to FTS 430 or FTS 830 Systems drawing power from an L-828, Class 1 Constant Current Regulator. A Class 1 regulator delivers a maximum of 6.6 amps. Two styles are in general use for runway lighting: Style 1 and Style 2. The Style 1 regulator has three current steps and the Style 2 has five.

FTS 430 or FTS 830 Systems can be set to step from one of three intensity levels to another as the equipment input current changes. *Table 1-1* and *Table 1-2* summarize typical ways to set up the operation of the equipment.

### **EQUIPMENT CAUTION**

Do not apply power to this equipment if **any** Printed circuit board, or **any** components have been removed. Serious damage **will** occur!

If any components have been removed, and you want to close the cover, which applies power because of the interlock switch, you **MUST** ensure that TB1, terminals 10 and 11 are shorted to each other. If you do not use this procedure, damage will occur and it is not covered under warranty.

**Table 1-1 Style 1 Current Regulator**

Current Step	Flash Intensity				
	Three Levels	Two Levels			
1 (4.8A)	LOW	OFF	OFF	OFF	OFF
2 (5.5 A)	MED	LOW	LOW	MED	OFF
3 (6.6 A)	HIGH	HIGH	MED	HIGH	ANY

**Table 1-2 Style 2 Current Regulator**

Current Step	Flash Intensity
1 (2.8 A)	OFF
2 (3.4 A)	LOW
3 (4.1 A)	MED
4 (5.2 A)	MED
5 (6.6 A)	HIGH

Step-by-step procedures for obtaining these operations follow in *Section Setup Preliminaries*.

## Setup Preliminaries

Follow these general rules:

1. You cannot achieve full HIGH intensity light output at any input current level lower than 6.6 amps.
2. You may not be able to achieve reliable MEDIUM intensity switching at an input current level less than 4.0 amps.
3. FTCA expects operation of the FTS 430 or FTS 830 System from the same constant current regulator that

powers the runway lights. If the total number of lights changes substantially any time after you make FTS 430 or FTS 830 set-up adjustments, it could affect system switching operation. Permanent changes, such as adding or deleting runway lights, require making readjustments to FTS 430 or FTS 830 lights.

4. To calculate the power required from the CCR, use 400 watts per light.

## Setup Procedures

If you do not understand how to set up your system, consult Customer Service 1-800-821-5825.

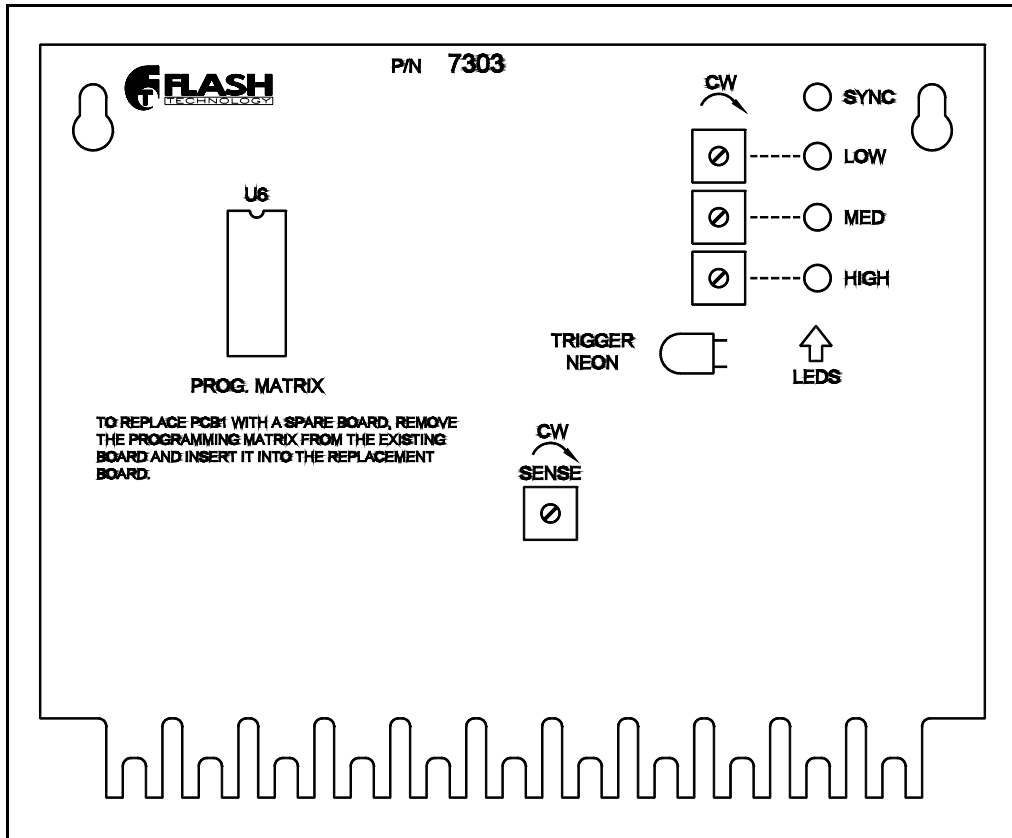
Adjustment potentiometers and indicator LEDs reside on the Timing and Trigger Board (PCB1) of each unit. Figure 1-1 shows potentiometer and LED locations. Set up each unit in the system as described in the following text.

### CAUTION

Setting up the system requires operation of lighting units while enclosures are opened, thus exposing dangerous potentials. Do not touch any component except PCB1 during these procedures.

Tilt the enclosure open and pull the interlock plunger up to the service position to perform set-up procedures. The following abbreviations apply:

- CCR (Constant Current Regulator)
- CCW (Counterclockwise)
- CW (Clockwise)
- LED (Light Emitting Diode)



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

### Style 1 Current Regulator — Three Intensity Levels

For this style, the lighting system switches off only when the CCR is switched off.

1. Turn the HIGH, MED, and LOW controls fully CW.
2. Set the CCR to STEP 1 and adjust the LOW pot CCW until LOW LED just comes on.
3. Set the CCR to STEP 2 and adjust MED pot CCW until the MED LED just comes on.
4. Set the CCR to Step 3 and adjust the HIGH pot CCW until the HIGH LED just comes on.
5. Recheck the light at all current steps and verify that LEDs respond correctly at each step. Also verify by visual comparison that flashing intensity decreases when the CCR is switched from Step 3 to Step 2, and that it decreases further when the CCR is switched from Step 2 to Step 1.

6. Recheck each light in the system. It may be necessary to readjust some lights after all lights are operational and flashing.

### Style 1 Current Regulator — Two Intensity Levels

For this style, the lighting system switches off when the CCR is at Step 1. It flashes at LOW intensity when the CCR is at Step 2, and at HIGH intensity when the CCR is at Step 3.

1. Turn the HIGH, MED, and LOW control fully CW.
2. Set the CCR to Step 2 and adjust the LOW control CCW until the LOW LED just comes on and the strobe light flashes in low intensity.
3. Set the CCR to Step 3 and adjust the HIGH control CCW until the HIGH LED just comes on.
4. Recheck the light at all current steps and verify that LEDs respond correctly at each step. Also verify by visual comparison that flashing intensity decreases

when the CCR is switched from Step 3 to Step 2, and that the light switches off completely when the CCR is switched from Step 2 to Step 1.

5. Recheck each light in the system. It may be necessary to readjust some lights after all lights are operational and flashing.

### **Style 2 Current Regulator — Three Intensity Levels**

For this style, the lighting system switches on when the CCR is at Step 1 and switches to progressively higher intensities as you switch the CCR to higher steps.

1. Turn the HIGH, MED, and LOW controls fully CW.
2. Set the CCR to Step 1 and adjust the LOW control CCW until the LOW LED just comes on.
3. Set the CCR to Step 3 and adjust the MED control CCW until the MED LED just comes on.

4. Set the CCR to Step 5 and adjust the HIGH control CCW until the HIGH LED just comes on.
5. Set the CCR to Step 4 and verify that the HIGH LED goes off. If not, you may need to adjust the HIGH control slightly CW until it does.
6. Set the CCR to Step 2 and verify the MED LED goes off.
7. Recheck the light at all current steps and verify that LEDs respond correctly at each step. Make trimming adjustments if necessary. Also verify by visual comparison that flashing intensity decreases when the CCR is switched from Step 5 to Step 4, and that it decreases further when the CCR is switched to Step 2.
8. Recheck each light in the system. It may be necessary to readjust some lights after all lights are operational and flashing.

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## Section 2 — Outline, Mounting, and Installation

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### Unpacking

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

### Tools

The following are hand tools suggested for installation and maintenance:

- #2 Phillips-head screwdriver
- #2 flat-blade screwdriver
- 1/8" flat blade screwdriver (for adjustments)
- Spanner wrench (or large slip-joint pliers) for 2-inch conduit locking nut
- Triplet™ Model 630-NA VOM, or equivalent analog volt-ohm meter

### Access

#### **WARNING**

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

### Power Converter

Five latches secure the cover. Turn the latch handles to release the cover, which swings open for access.

### FH 400 Flashhead

Retaining clips secure the lens. Loosen the two screws that hold each of these to turn and then lift the lens off the base.

### FH 800 Flashhead

Screws fasten the bezel ring, which retains the flashtube, to the housing. Remove the screws and bezel, and then remove the flashtube for access to the interior.

### Mounting

#### **ATTENTION**

Each light is packaged in its own shipping carton. The position at which the light is to be installed is marked on the outside of the carton and on an ID label on the outside of the power converter. Refer to *Figure 2-1* and *Figure 2-2* to identify positions.

The light's position is particularly important in a system of sequentially flashing lights. In-general, lights at the runway threshold are labeled A and B. Sequential lights are labeled numerically in the order of the flashing sequence. Thus PC #1 is to be installed farthest from the runway threshold.

Mounting and outline information for the FTS 430 and FTS 830 Systems are shown in: *Figure 2-3*, *Figure 2-4*, *Figure 2-5*, *Figure 2-6*, and *Figure 2-7*. Use the following guidelines:

- Allow adequate space around the equipment for access during installation and service.
- Connect the power converter to a grounding rod or the site grounding system, but not to the counterpoise. See the installation guideline in *Figure 2-8*.

### Installation

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

If any components have been removed, and you want to close the cover, which causes the interlock switch to apply power, you **MUST** ensure that TB1, terminals 10 and 11 are shorted to each other. If you do not do this, damage will occur and it is not covered under warranty.

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 connect FTS 430 or 830 lights directly to the series runway lighting circuit through the same type of isolation transformer used for incandescent runway edge and threshold lights. In this case, *a voltage conversion adaptor is not required.*

Conduit and other distribution wiring details can be found on electrical installation diagrams provided by FTCA or others.

You may couple FTS 430 and FTS 830 Systems directly to the series runway lighting circuit through a Type L-830-10 or Type L-830-11 (300 watt) isolation transformer. You must use one isolation transformer for each light.

*Figure 2-1 Typical REIL Configuration on Page 2-4* shows a typical REIL configuration. For the FTS 430, the two lights are functionally and physically interchangeable. The master light is designated as A. Although these lights flash simultaneously, lights for positions A and B should not be interchanged unless each one is re-aimed. The factory presets aiming for the position. Flashheads are typically comounted with power converters for REIL applications.

Fixed rules regarding the size (power rating) of the constant current regulator required for FTS 430 or FTS 830 Systems are difficult to establish because of the following installation variables:

*Figure 2-2 Typical ALS Configurations on Page 2-5* shows a typical RAILS. The five RAILS are labeled from 1 to 5 to identify their positions; the light with the lowest number is located farthest from the runway and is the first to flash. RAILS are typically configured by mounting power converters and flashheads as separate units. The two REILs are labeled A and B, with the master light as A.

1. The number of steady burning runway lights taking power from the same series lighting circuit
2. The number of FTS 430 or FTS 830 lights
3. The flash rate (60 or 120 FPM) of the FTS 430 or FTS 830 System

However, general practice has led to the guidelines in *Table 2-1*. The recommended sizes allow up to 50% of the rated capacity for shared loading with steady-burning runway and approach lights.

## Power Rating Guidelines

### EQUIPMENT CAUTION!

Do not apply power to this equipment if **any** Printed circuit board, or **any** components have been removed. Serious damage **will** occur!

**Table 2-1 L-828 Power Rating Guidelines**

Number of FTS Approach Lights	Constant Current Regulator Rating
2-7	4 KW
8-15	7.5 KW
16-21	10 KW

## EQUIPMENT CAUTION!

Do not attempt to operate this equipment from a voltage adaptor. Connection to a voltage adaptor could cause internal damage and will void the warranty.

## Isolation Transformer

When the series line is driven by a Class 1 (6.6 ampere) constant current regulator, each light should be coupled to the series line through a Type L-830-10 (6.6/6.6 amperes, 300 watt) isolation transformer. If the series line is driven by a class 2 (20 ampere) constant current regulator, each light should be coupled to the series line by a Type L-830-11 (20/6.6 amperes, 300 watt) isolation transformer. Either a Style 1 (3 current steps) or a Style 2 (5 current steps) regulator may be used.

## Wiring

*Figure 2-8* provides wiring guidelines for FTS 430 or FTS 830 Systems.

Connect the power from the airport series line to an isolation transformer (FAA Type L-830) placed near each power converter. Connect each transformer to its respective power converter by using two conductors.

All power converters must be interconnected for synchronous timing with two unshielded #14 AWG (or larger) conductors, twisted together (6 turns per foot is recommended). **NOTE:** FTCA recommends 600 Volt insulation on all wires that interconnect the lighting system.

FTCA recommends a counterpoise using bare solid copper.

When you mount flashheads separately from power converters, wire each flashhead to its corresponding power

converter. You must use five conductors. FTCA PN 6340 cable is recommended.

Ground all cases. FTCA provides a grounding lug on each power converter base. Install a grounding rod at each unit. **Do not ground to the counterpoise for lightning protection.**

## Installation Checklist

Carry out the following steps before applying power:

1. Inspect equipment for shipping damage.
2. Verify equipment against the packing list to ensure completeness.
3. Examine and verify installation drawings.
4. Position and mount each unit correctly according to packaging and labeling.
5. Ensure that the case is mounted upright, water-tight, and grounded.
6. Check to ensure that all mounting hardware is tight.
7. Ensure that no holes are punched or drilled in the top surface of the case.
8. Wire units according to instructions.
9. Check for proper series current.
10. Check all electrical connections for tightness.
11. Check all terminal strip connections for tightness.
12. Ground the power converter.
13. Install the proper isolation transformer (L-830) to match series line current (either 6.6 to 6.6 amp or 20 to 6.6 amp).
14. Do not use voltage adaptors.

When you are certain that the installation is correct and complete, use the set-up instructions in *Section Setup* on Page 1-2.



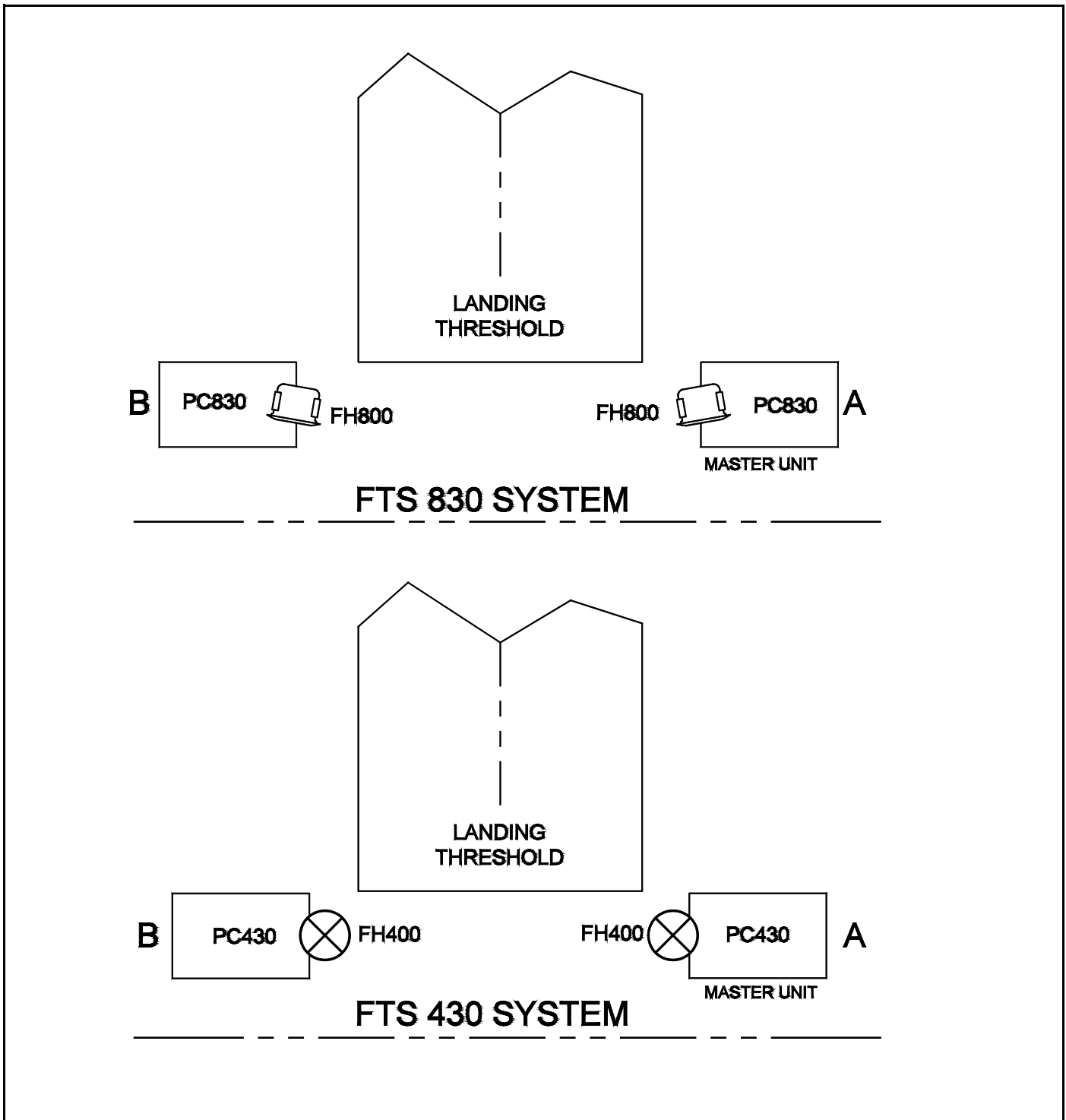
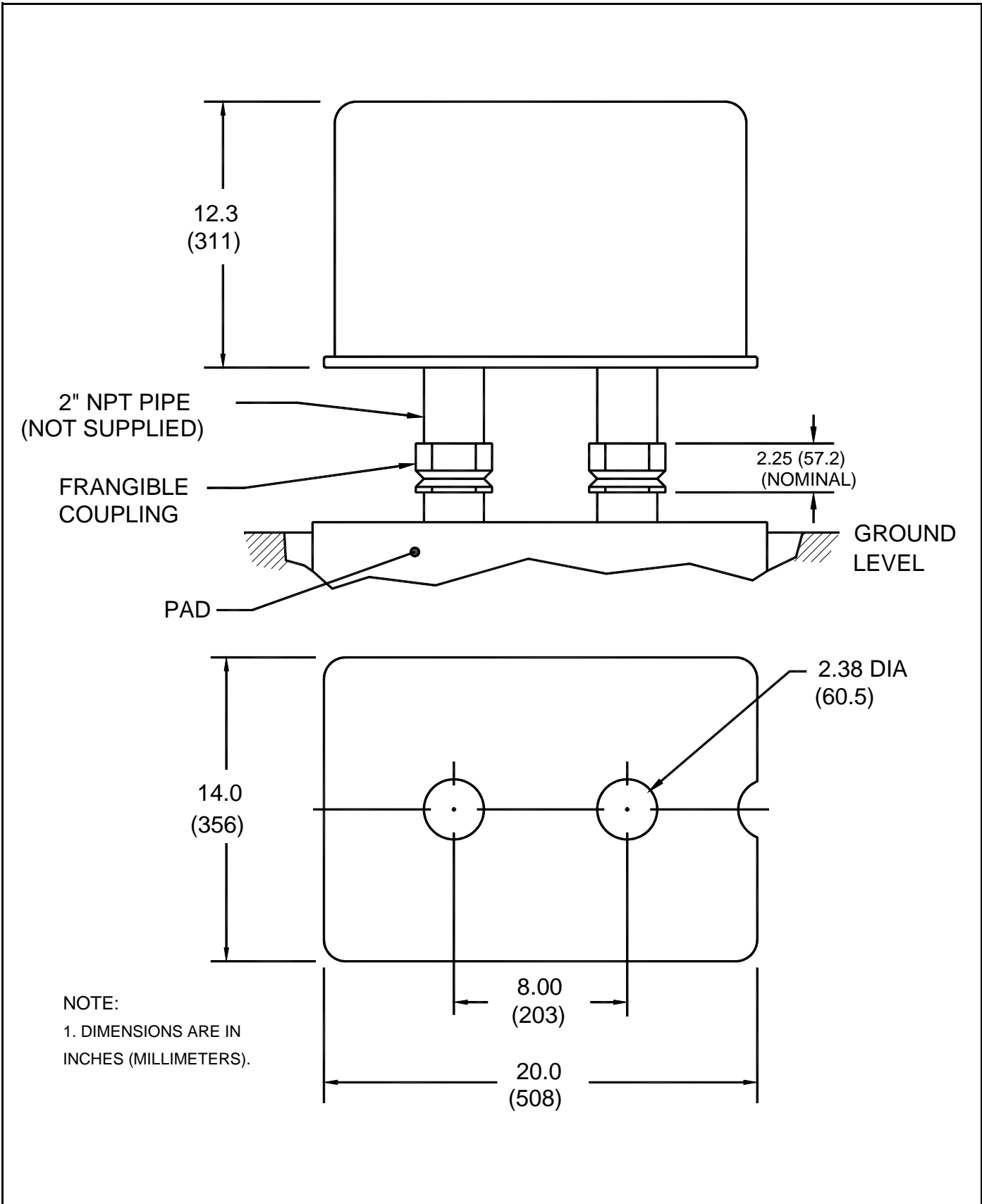


Figure 2-1 Typical REIL Configuration

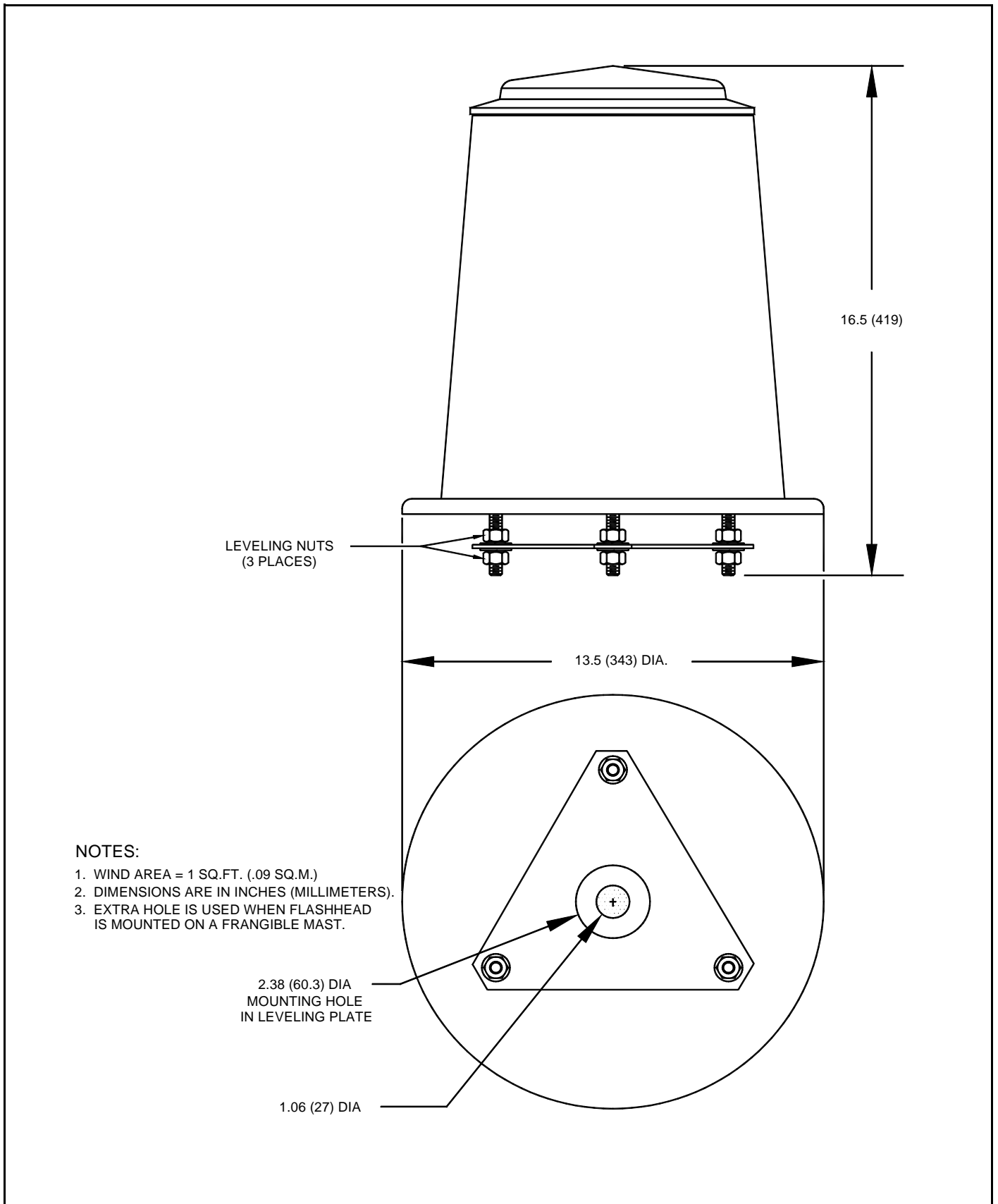
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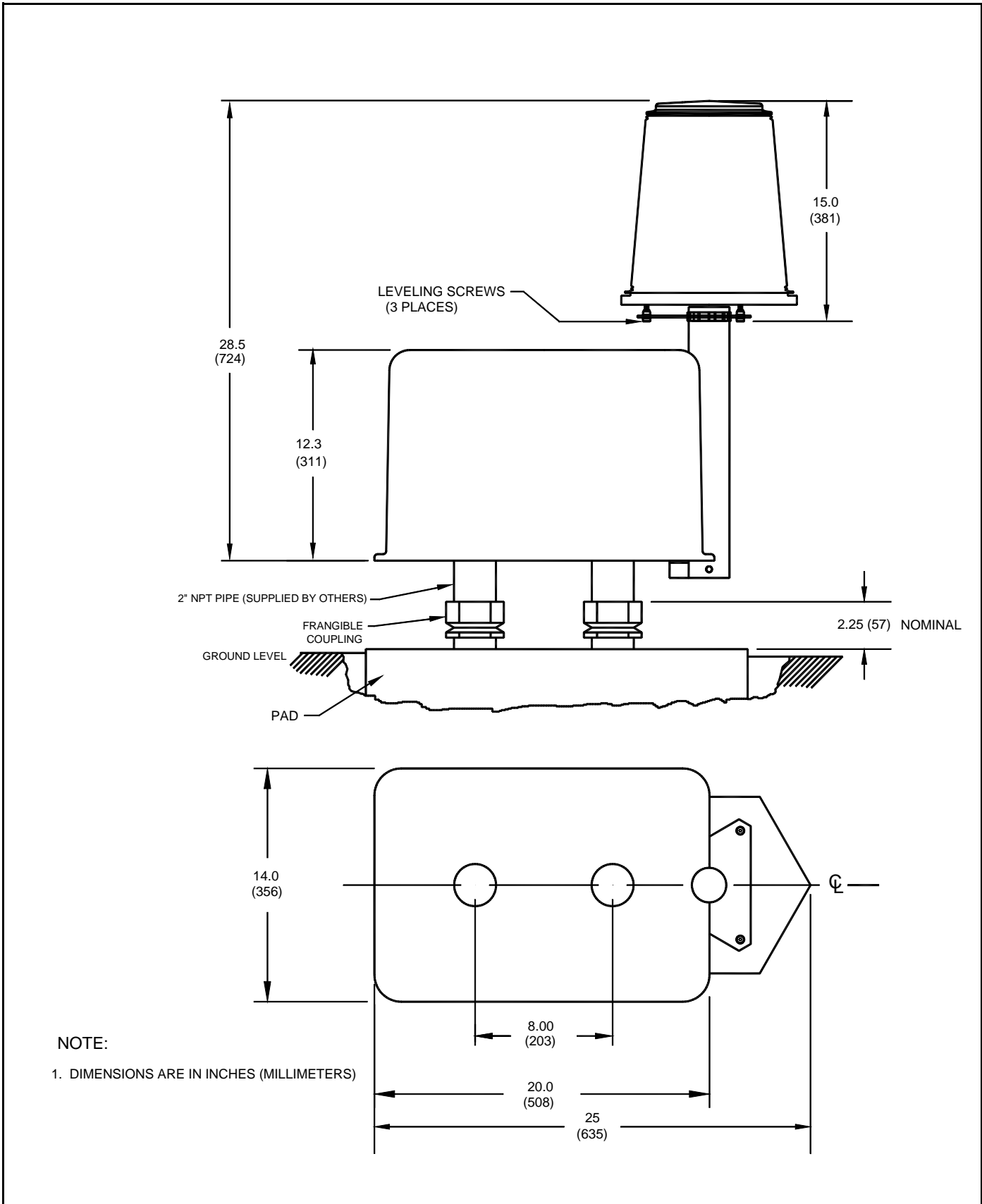
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**Figure 2-3 PC 430 or PC 830 Power Converter Mounting and Outline**



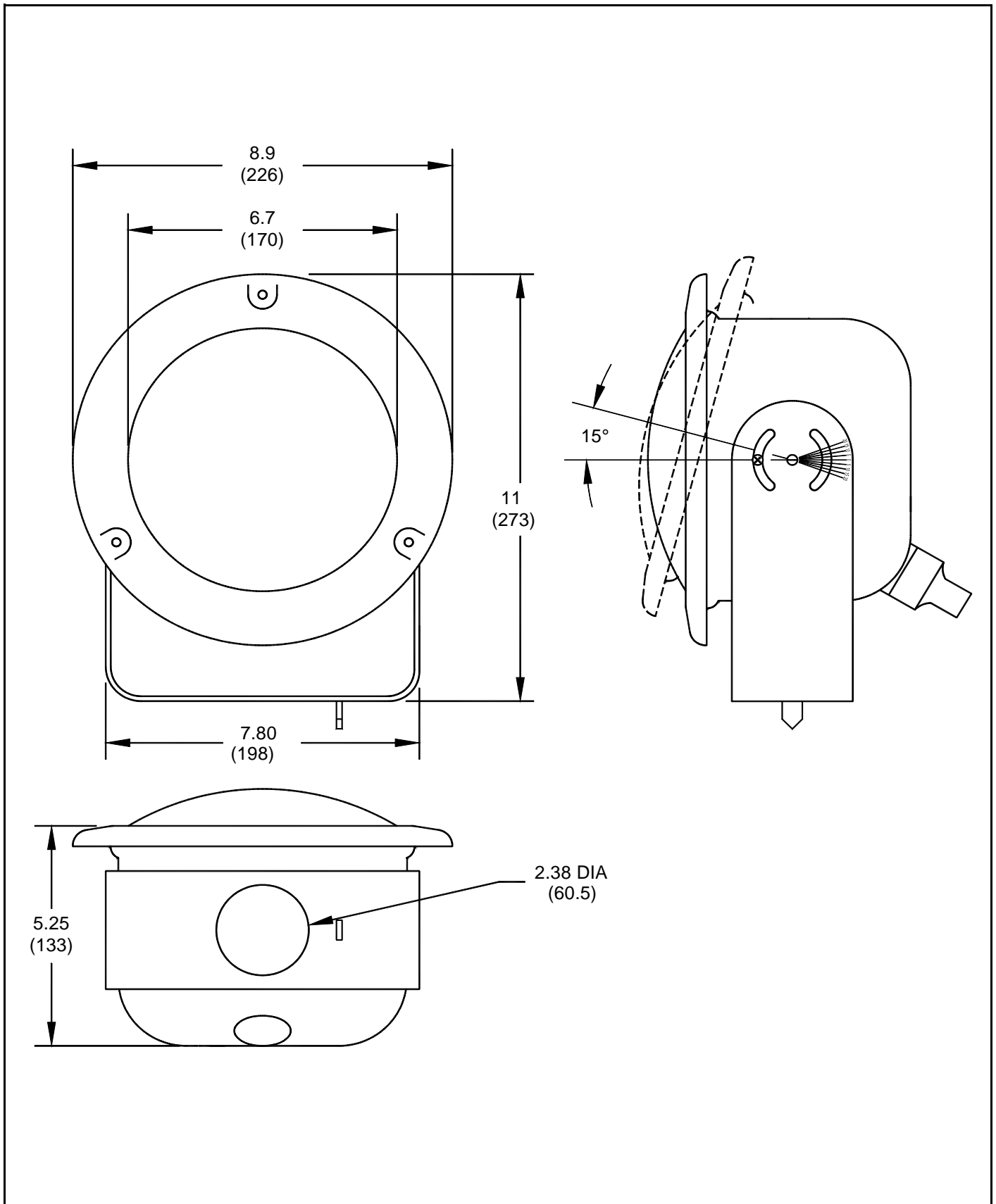
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**Figure 2-4 FH 400 Flashhead Mounting and Outline**



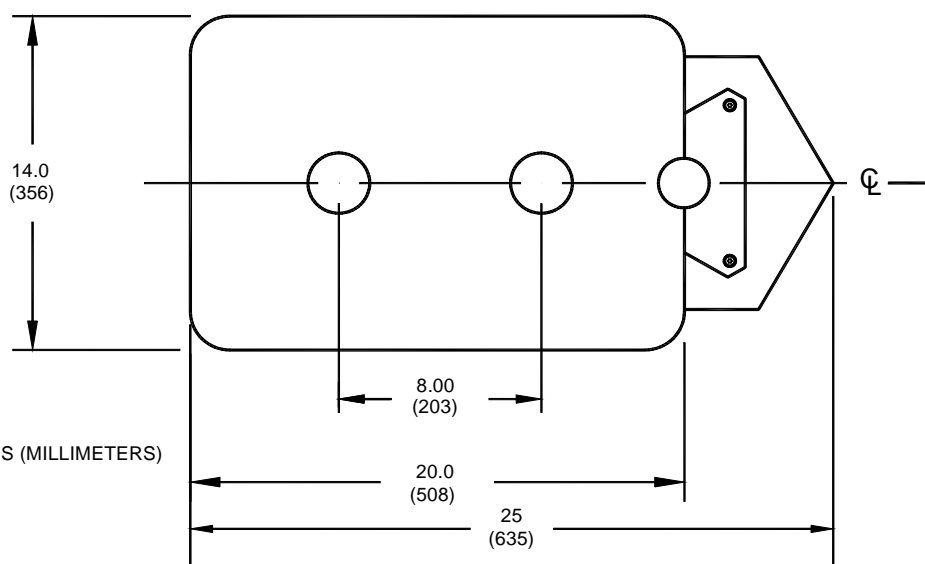
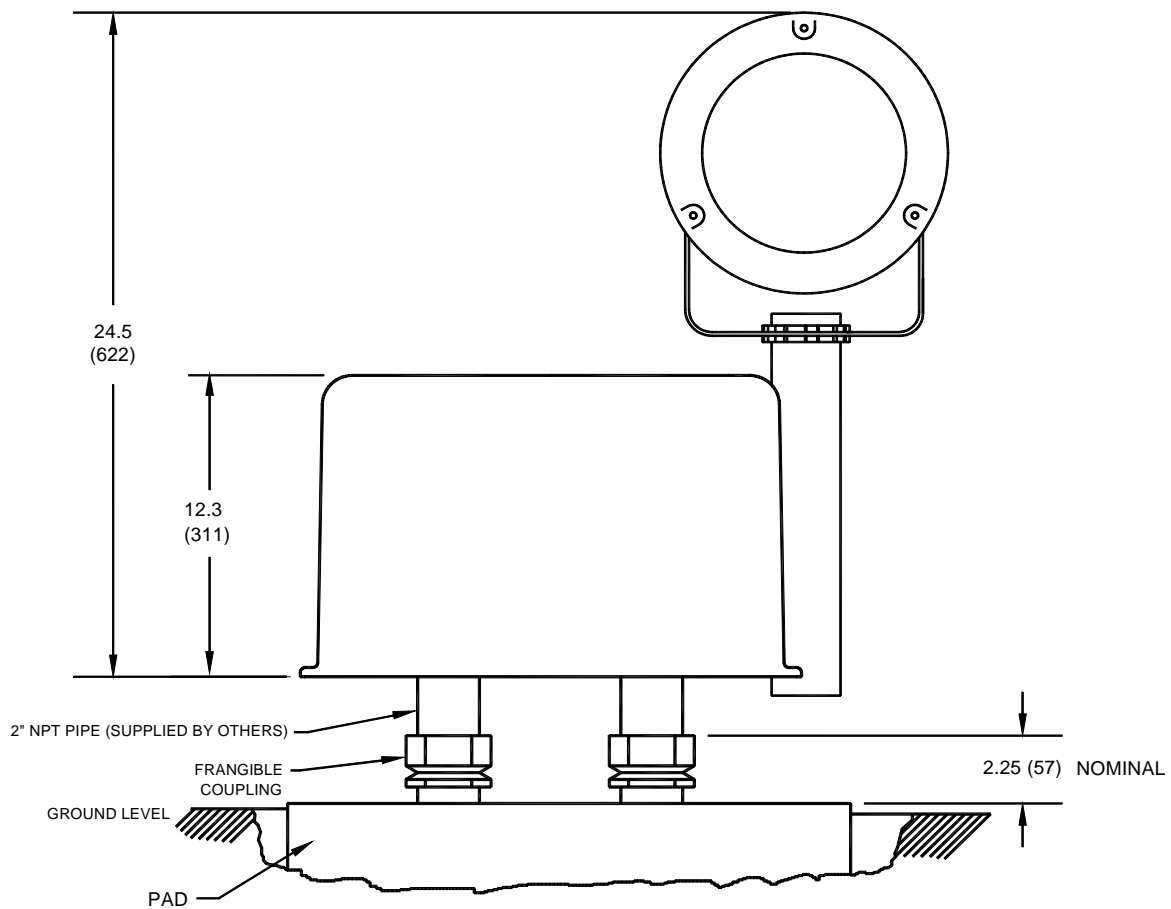
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Figure 2-5 FTS 430 Comounted Unit Mounting and Outline



FH800MO

**Figure 2-6 FH 800 Flashhead Mounting and Outline**



**NOTE:**

1. DIMENSIONS ARE IN INCHES (MILLIMETERS)

**Figure 2-7 FTS 830 Comounted Unit Mounting and Outline**

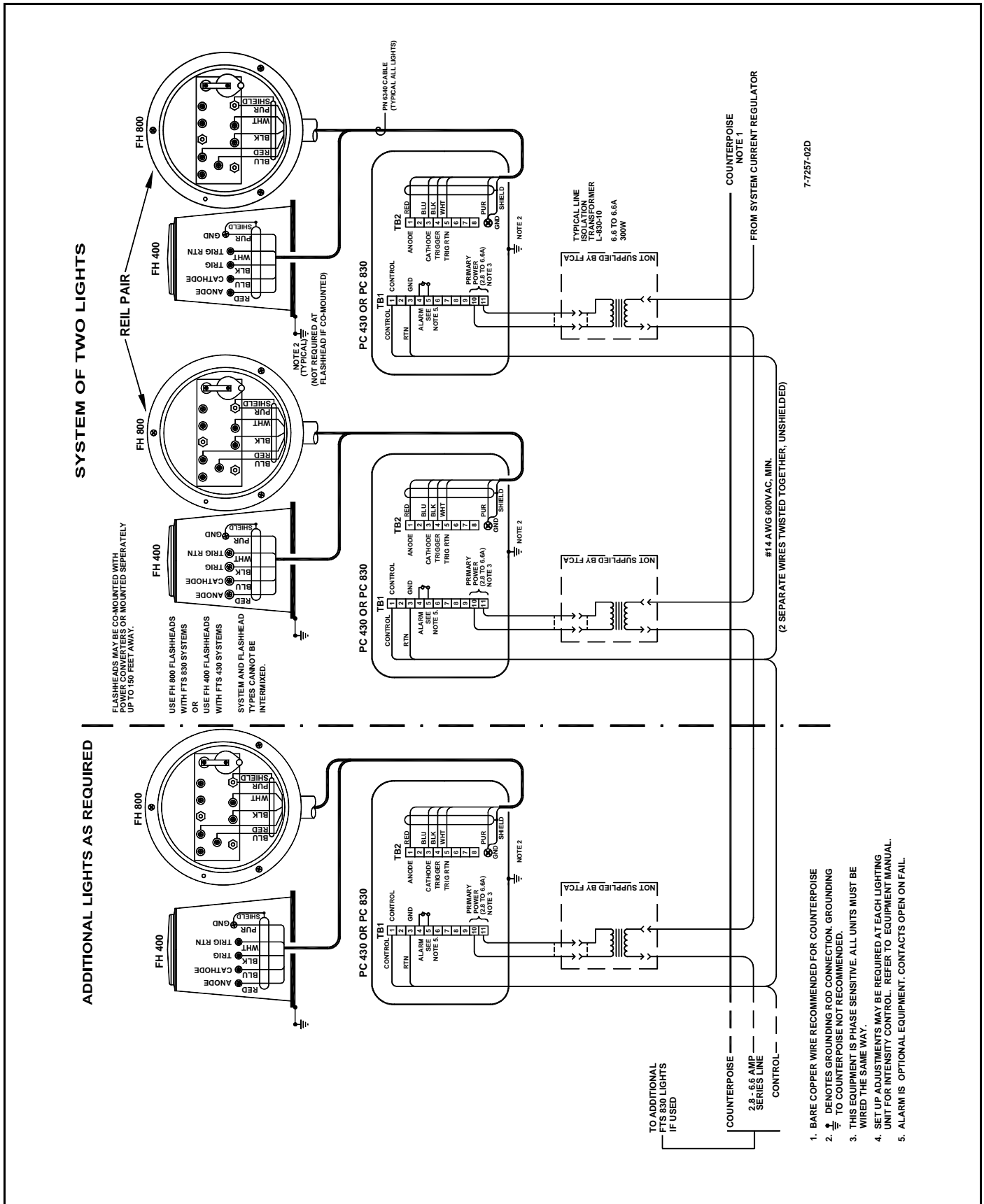


Figure 2-8 Typical FTS 430/830 System Installation Wiring





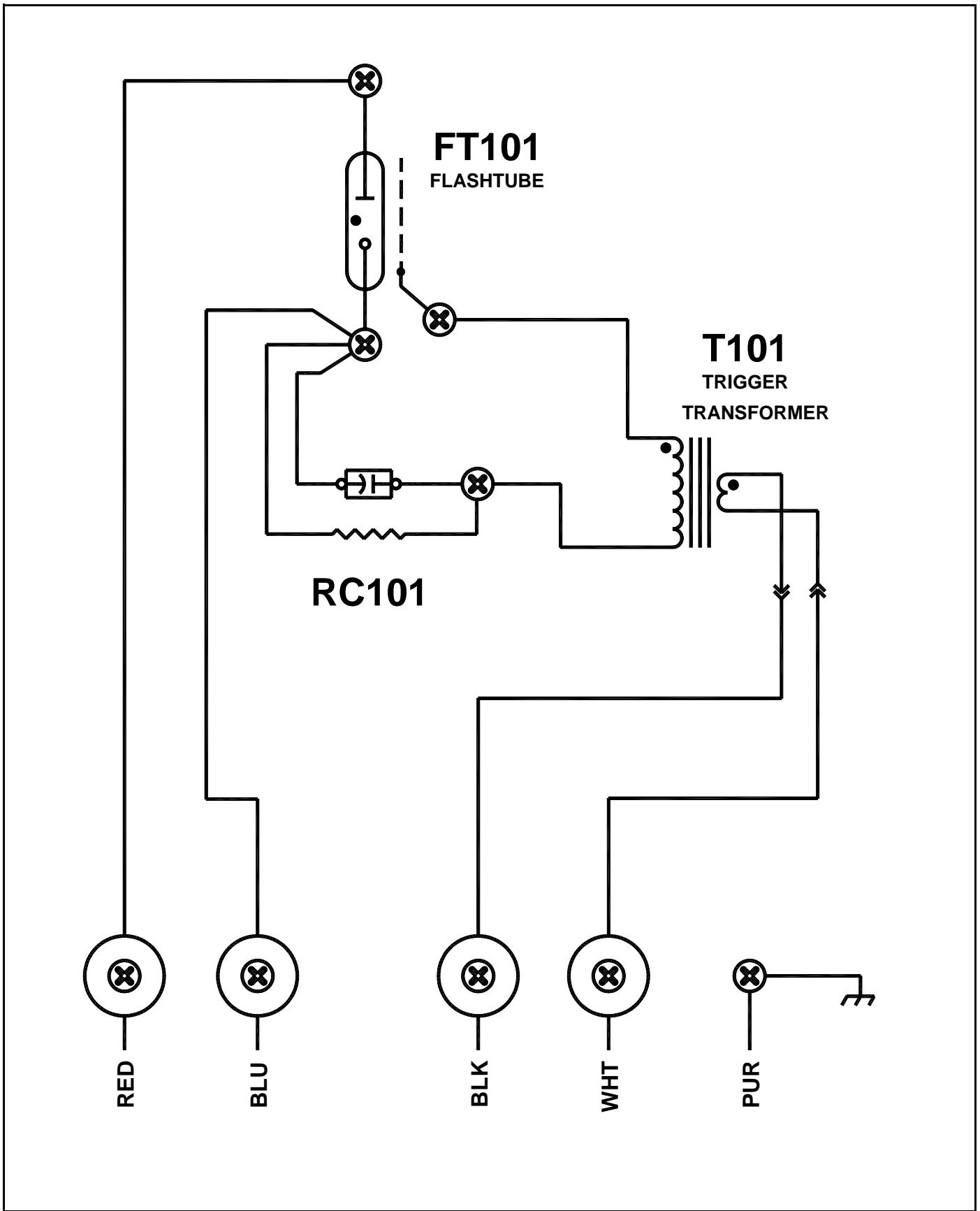


Figure 2-10 FH 400 or FH 800 Flashhead Internal Wiring

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## Section 3 — Maintenance and Troubleshooting

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### Safety

#### **SAFETY**

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.
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 FH 800 glass with liquid detergent and water. Wipe it gently with a soft cloth or paper towel.
7. Clean the outside and inside surface of the FH 400 lens with an FTCA-approved professional plastic cleaner. Wipe lens with cheesecloth only. *Do not use regular cloth or paper towels.* A lens cleaning kit, Part Number 8630801, is available from FTCA.

#### **EQUIPMENT CAUTION!**

Do not apply power to this equipment if ***any*** Printed circuit board, or ***any*** components have been removed. Serious damage ***will*** occur!

If any components have been removed, and you want to close the cover, which automatically applies power because of the interlock switch, then you ***MUST*** ensure that TB1, terminals 10 and 11 are shorted to each other. If you do not use this procedure, damage will occur and it is not covered under warranty.

### Preventive Maintenance

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

1. Verify that moisture does not enter the equipment through gaskets or seals, or collected inside as condensation.
2. Verify that all drain holes are clear.
3. Check terminal blocks and relays for evidence of corrosion and electrical arcing. Clean or replace any component that shows evidence of high-voltage damage.

### Storage

No special considerations are required for long-term storage of any major assembly. Keep circuit boards, when not installed in the equipment, in anti-static bags or containers.

### Diagnostic Testing

In performing *functional tests*, observe the operation of the system or of individual lights as you step the input current from one level to another. You must understand what is *proper* operation at *this* particular installation; that is, how the equipment was set up initially (see *Section 1 — FTS 430/830 Introduction and Operation*). If the system does not operate exactly according to its set up, you may need to repeat the set-up adjustments described in *Section 1*.

Line interference or an incompatibility between the power system and the lights may prevent obtaining the desired set-up performance of the *system*. If *only one light* fails to set up properly, a malfunction in that particular light may be the cause.

### **Control Line Interference**

Electrical interference on the *control* line can cause system problems. Interference can occur if the line is open, shorted, or not a twisted pair. Suspect a *control* line prob-

lem if all units respond correctly to checkout only when you disconnect the *control* wire. Sometimes, you can eliminate marginal interference by placing a 470 ohm resistor from the *control* line terminal to the component bracket at one or more lighting units.

## **Component Testing**

Always make resistance measurements with the primary power turned off. However, you must make voltage measurements with the 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.

### **Relays (K1, K2)**

A malfunctioning relay may have faulty contacts, a sticky mechanism, or a defective coil. Determine the first two possibilities by inspection and manually exercising the armature. Confirm a defective coil by measuring its 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 measured coil resistance for both relays should be approximately 290 ohms.

### **Timing and Trigger Board (PCB1)**

Carry out the adjustment procedures in *Section 1* before concluding that PCB1 is faulty. Then replace this circuit board with one known to be in good condition. You must remove the programming matrix (see *Figure 1-1* for location) from the existing circuit board and plug it into the replacement board.

### **HV Rectifier Board (PCB2)**

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

### **Bleed Resistor (R1, R2)**

The resistance of R1 is 35 kohms. The resistance of R2 is 50 kohms.

### **Interlock Switch (S1)**

Readjust the interlock switch bracket, if necessary.

### **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.

## High Voltage Transformer (T1)

Measure the voltage between the terminals TB4-3 and TB4-11 on PCB2. The voltage should be between 900 and 1050 volts AC.

# Component Removal and Replacement

For the power converter, refer to *Figure 4-1* and *Figure 2-9*.

## High Voltage Transformer (T1)

### *Removal*

1. Disconnect wires leading to the transformer.
2. Remove four screws holding the transformer to the rear of the chassis and remove the transformer from the chassis.

### *Replacement*

Reverse the removal procedure. Verify the wiring with *Figure 2-9*.

## Low Voltage Transformer (T4)

### *Removal*

1. Disconnect wires leading to the transformer.
2. Remove the two screws holding the transformer to the side of the chassis and remove transformer from the chassis.

### *Replacement*

Reverse the removal procedure. Verify the wiring with *Figure 2-9*.

## Trigger Coupling Transformer (T3)

Removal and replacement are similar to the procedure for the Low Voltage Transformer.

## Timing and Trigger Board (PCB1)

### *Removal*

1. Loosen, but do not remove, all eleven screws holding the circuit board to TB3.
2. Loosen the screws at the top that hold the board to the chassis and lift the board from TB3.

### *Replacement*

1. To replace PCB1 with a spare board, remove the programming matrix from the existing board and insert it into the replacement board. See *Figure 1-1* for the location of the programming matrix.
2. Reverse the removal procedure.

## HV Rectifier Board (PCB2)

Removal and replacement are similar to the procedure for PCB1 (except for programming).

## Capacitors

### *Removal*

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

### *Replacement*

Insert capacitors into their respective receiving holes.

Replace hold-down screws to secure capacitors to the chassis.

Reconnect wires to capacitors and verify the wiring with *Figure 2-9*. Wires must be replaced exactly as removed. In some instances, a quick-connect wire terminal will not seat properly if it is not placed on the terminal cluster exactly as it was before removal. This is caused by interference between the insulation on the wire terminal and the insulation surrounding the terminal cluster on the capacitor.

## Flashhead

For the flashhead refer to *Figure 4-2*, *Figure 4-3*, and *Figure 2-10*.

### WARNING

Before opening the flashhead, verify that the power converter has been disabled and that the capacitors have been completely discharged.

### FH 400 Lens

#### Removal

1. Loosen the two screws holding down each of three clamps.
2. Rotate the lens so that the hold-down tabs slide out from under the clamps, and then lift the lens free.

#### Replacement

1. Place the lens so that its bottom rests on the base.
2. Rotate the lens so that its hold-down tabs slide under the clamps. Tighten the two screws on each of the three clamps to secure the lens.

### FH 400 Flashtube (FT101)

#### Removal

Loosen the three screws on the three screw lugs to free the flashtube base pins then lift the flashtube from the assembly.

#### Replacement

Align the pins on the flashtube base with the clamps of the terminal screw lugs and insert the pins into place. Tighten the screws on the terminal screw lugs to secure the flashtube.

### FH 800 Flashtube (FT 101)

#### Removal

1. Remove the three screws and nuts holding down the flashtube bezel.

2. Carefully pry the flashtube free of the neoprene washer around the edge.
3. Lift out the flashtube assembly and disconnect the attached wires. Note the color of the wires and their connections.

#### Replacement

1. Connect the flashhead wires to the flashtube.
2. Place the flashtube so that its edge rests squarely on the neoprene washer on the base.
3. Rotate the flashtube so that the small arrow on the edge of the lens aligns next to the tiny hole at the edge of the base lip.
4. Fasten the flashtube by re-attaching the bezel to the flashhead using the three screws and nuts previously removed.

### Trigger Transformer (T101)

#### Removal

1. At the trigger wire post adjacent to the flashtube, remove the large diameter wire coming from the trigger transformer.
2. Remove the two smaller wires originating at the trigger transformer from the ceramic spacers. Do not disconnect the primary winding wires (seven turns of hook-up wire).
3. Remove the two 4-40 x 2" Phillips-head screws holding the transformer assembly to the bracket. Note the orientation of the molded secondary winding with respect to fixed features on the bracket, since it must be re-installed with this same orientation.
4. Remove the outer half of the core and lift off the molded secondary winding. The seven turns of the primary winding will remain hanging in place.
5. Remove the inner half of the core, taking care not to uncoil any turns of the primary winding.

#### Replacement

1. Re-assemble the primary and secondary windings over the two halves of the core. Attach the core to the bracket using the two long screws.
2. Re-attach the electrical wires. Verify that the wiring agrees with *Figure 2-10*.

## Troubleshooting

The most effective troubleshooting procedure begins with accurate observations of the system's operation. These

observations often lead directly to the cause of a problem. The diagnostic procedures in this subsection are divided into two categories: system-level malfunctions, where all lighting units exhibit the same abnormal behavior; and symptoms applying to one or more individual lighting units, but not to all of them.

## System-Level Problems

*Table 3-1* identifies symptoms affecting all lighting units in the same way. Use it to determine possible causes. W

**Table 3-1 System-Level Troubleshooting**

Flash Conditions			Other Conditions	Probable Cause
High	Med.	Low		
No	No	No		Series current too low
Weak	Weak	OK		PCB11
Weak	OK	OK		PCB11
OK	Bright	Bright		PCB11
No	No	No		Series current too low
OK	OK	Bright		PCB11
No	OK	OK		Series current too low <sup>2</sup>
OK	OK	OK	Units may flash out of sequence	Control line interference <sup>3,4</sup>

1. Improper adjustment causes most PCB1 problems. If adjustments cannot be made or do not solve the problem, replace the board.
2. High intensity can be achieved only at the highest (6.6 amp) current step.
3. Control wires that are not a twisted pair can cause interference.
4. Control lines exceeding about 7500 feet (2500 meters) may have too much distributed capacitance. Operation may be improved by installing a 470 ohm resistor from TB1-1 to the chassis on one or more lighting units.



## Problems with Individual Lights

Table 3-2 identifies symptoms that apply to a particular lighting unit.

Each symptom has one or more suggested causes listed in descending order of probability with the most probable cause first. As an example, suppose one of the lights does not flash in any mode (low, medium, high), but mode relays operate and circuit board LEDs are lit, indicating

the presence of low voltage (LV). The symptom best describing this condition is **No No No OK OK**. This symptom has three possible causes listed. The most likely cause, the first one listed, is the flashtube; the next likely cause is PCB1, and so on.

All neon lights out on PCB2 indicates the absence of HV. LEDs out on PCB1 indicates the absence of LV.

**Table 3-2 Lighting Unit Troubleshooting**

Flash Conditions			Other Conditions		Probable Cause
High	Med.	Low	HV	LV	
No	No	No	No	No	S1
No	No	No	No	OK	PCB2
No	No	No	OK	No	PCB1
No	No	No	OK	OK	FT 101 PCB1 T102
No	No	OK	OK	OK	PCB2
OK	OK	No	OK	OK	PCB2 PCB1 C3
OK	Bright	Bright	OK	OK	K1 PCB2 PCB1
Weak	OK	OK	OK	OK	K1 PCB1
Weak	Weak	OK	OK	OK	K2 PCB1
OK	OK	Bright	OK	OK	K2 PCB1
Skips	Skips	Skips	OK	OK	FT101

# 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. *Figure 4-1*, *Figure 4-2*, and *Figure 4-3* show component locations.

## Power Converter Parts

*Table 4-1* lists the parts for emergency repairs.

## Flashhead Parts

*Table 4-2* lists the parts for emergency repairs.

## 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.

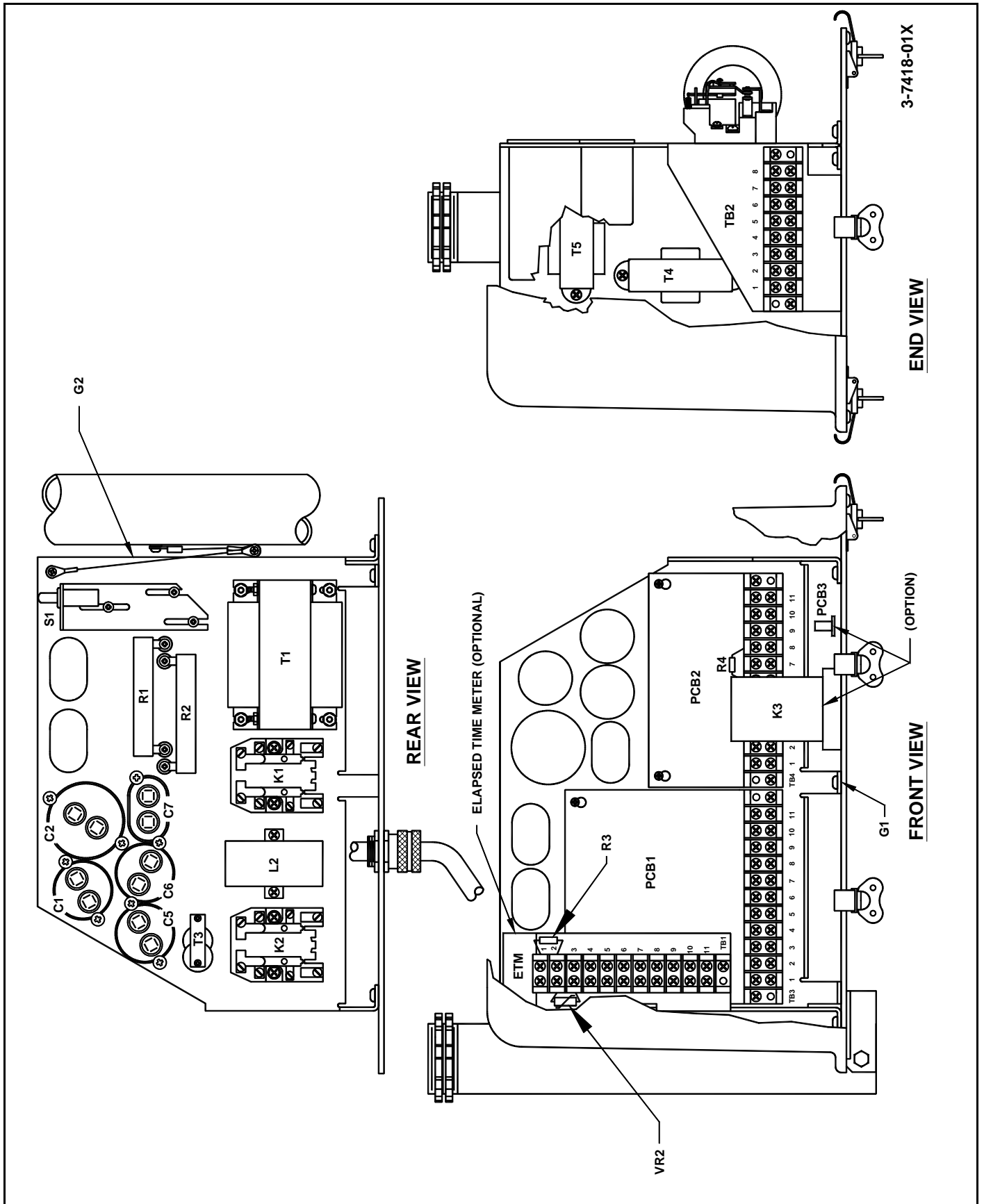
Package and ship the unit with the mounting feet downward against the bottom of the box. Pad the unit so that the feet cannot penetrate the box during shipment. Box each unit separately using a double thickness cardboard container and adequate padding. Do not drop. Use appropriate warning labels on the outside of the container.

**Table 4-1 Power Converter Replaceable Parts**

Unit	Description	Part No.	Quantity
430	Capacitor, (C1), 20 mfd.	6731401	1
430	Capacitor, (C2), 40 mfd.	6386503	1
430	Capacitor, (C5), 15 mfd.	6731301	1
430	Capacitor, (C6), 15 mfd.	6731301	1
430	Capacitor, (C7), 8 mfd.	6731201	1
830	Capacitor, (C1), 20 mfd.	6731401	1
830	Capacitor, (C2), 70 mfd.	6720401	1
830	Capacitor, (C5), 15 mfd.	6731301	1
830	Capacitor, (C6), 15 mfd.	6731301	1
830	Capacitor, (C7), 5 mfd.	6731101	1
All	Choke, Flash (L2)	4175200	1
All	Elapsed Time Meter (optional)	1749201	1
All	Enclosure	3727901	1
All	Flash Monitor Module (K3; optional)	1851001	1
All	HV Rectifier Board (PCB2)	2711402	1 <sup>†</sup>
All	Interlock Switch (S1)	4901220	1
All	Relay, Mode (K1, K2)	8900494	2 <sup>†</sup>
All	Resistor, Bleed (R1), 35K	6900541	1
All	Resistor, Bleed (R2), 50K	6900542	1
All	Resistor, 1K 1W (R3)	8435211	1
All	Resistor, 1K 2W (R4)	8435212	1
All	Resistor, 1M 2W (R5)	8435206	1
All	Spacer, Ceramic	5900844	2
All	Terminal Strip, 8-Position (TB2)	8721008	1
All	Terminal Strip, 11-Position (TB1, TB3, TB4)	8721011	3
All	Timing and Trigger Board (PCB1)	2730300	1 <sup>†‡</sup>
All	Transformer, Power (T1)	4738302	1
All	Transformer, Trigger Coupling (T3)	8336710	1
All	Transformer, Low Voltage (T4)	8734500	1
All	Transformer, Isolation (T5)	4852801	1
All	Varistor (VR2)	6901079	1

<sup>†</sup> Recommended as a spare part.

<sup>‡</sup> Remove the programming matrix from the existing installed board and insert it into the new replacement board..



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END VIEW

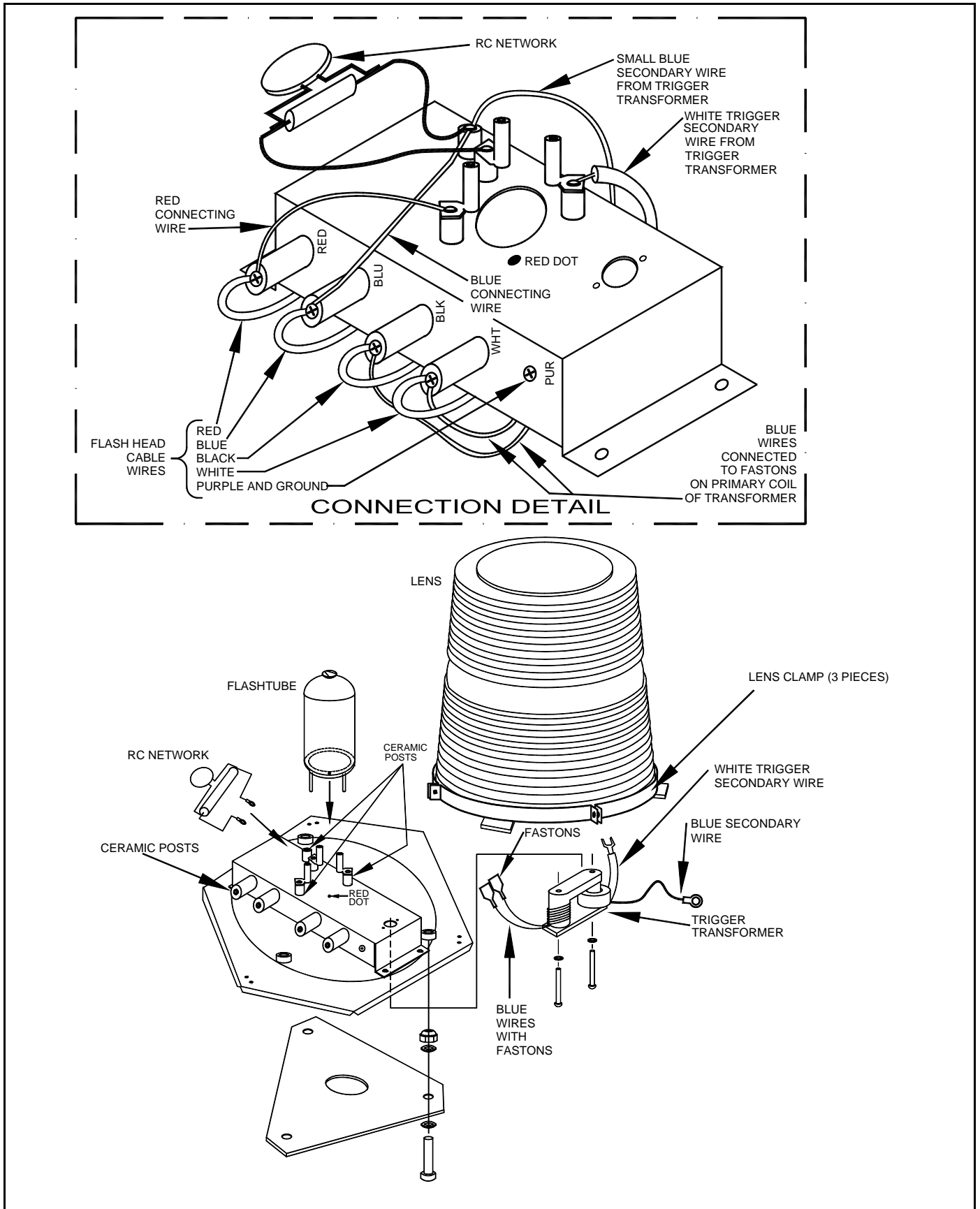
FRONT VIEW

Figure 4-1 PC430 or PC 830 Power Converter Component Locations

**Table 4-2 Flashhead Replaceable Parts**

Unit	Description	Part No.	Quantity
FH 400	Lens	8743701	1
FH 400	Trigger Transformer (T101)	8288201	1 <sup>†</sup>
FH 400	Clamp, Lens	3893201	3
FH 400	Spacer, Ceramic	5900844	4
FH 400	RC Network (RC 101)	1403411	1
FH 400	Flashtube	8384329	1 <sup>†</sup>
FH 400	Terminal Screw Lug	3379102	3
FH 400	Spacer, Ceramic	5900842	4
FH 800	Flashtube (FT 101)	8901701	1 <sup>†</sup>
FH 800	RC Network (RC 101)	1403411	1
FH 800	Trigger Transformer (T101)	8288201	1 <sup>†</sup>
FH 800	Post, Ceramic	5900842	4
FH 800	Retaining Bezel	3735202	1

† Recommended as a spare part.



**Figure 4-2 FH 400 Flashhead Component Locations**

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