

FLASH TECHNOLOGY



FTB 310-7VM

**Medium Intensity Obstruction Lighting System
Reference Manual**

Part Number 11000000093

SERIAL NUMBER

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Front Matter

Abstract

This manual contains information and instructions for installing, operating and maintaining the FTB 310-7VM Medium Intensity Obstruction Lighting System.

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Trademark Acknowledgements

Flash Technology® is a registered trademark name.

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Applicable Specifications

This equipment meets or exceeds requirements for an FAA Type L-865 except when inputs 1 and/or 2 are used to affect the operation.

Disclaimer

While every effort has been made to ensure that the information in this manual is complete, accurate and up-to-date, Flash Technology assumes no liability for damages resulting from any errors or omissions in this manual, or from the use of the information contained herein. Flash Technology reserves the right to revise this manual without obligation to notify any person or organization of the revision.

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

Warranty

Flash Technology warrants all components, under normal operating conditions, for 2 years.

Parts Replacement

The use of parts or components, in this equipment, not manufactured or supplied by Flash Technology voids the warranty and invalidates the third party testing laboratory certification which ensures compliance with FAA Advisory Circulars 150/5345-43E, 150/5345-51 and 150/4345-53B. The certification is valid as long as the system is maintained in accordance with FAA guidelines (FR doc. 04-13718 filed 6-16-04).

Personnel Hazard Warning

Dangerous Voltages

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

Avoid Touching Live Circuits

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

Dangerous Voltages Can Persist with Power Disconnected

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

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

Do Not Depend on Interlocks

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

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Section 1 – 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 signaling the power converter to change its operation appropriately. Also, a provided switch can manually override the photocell if required.

Inputs 1 and 2 control the operation of the power converter during the day mode.

Note: The use of inputs 1 and/or 2 to affect the operation of this system voids any certification or compliance to FAA circulars cited in this manual. It may also void other certifications not cited herein.

Specifications

Physical

PC 310-7VM (H x W x D, Weight)

14.00 x 16.75 x 8.44 in., 51 lbs.

355.6 x 425.5 x 214.4 mm, 23 kg.

FH 308 (H x Diameter, Weight)

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 2.59 mm

Aerodynamic Wind Area

Flashhead 0.93 ft², 0.0864 m²

Power Converter 1.63 ft², 0.15 m²

Environmental

Complies with FAA specifications in AC 150/5345-43.

Performance Characteristics

Application - L-865

Flash Intensity (nominal):

Day (White) 20,000 ± 25% ECD

Day (White) 6,000 ± 25% ECD

White Backup 2,000 ± 25% ECD

Beam Spread Horizontal: 360°
Vertical: 5°

Flash Rate

Day (White) 40 flashes per min.

White backup 40 flashes per min.

Electrical (PC 310-7VM)

AC Voltage 120 or 240V, 60 Hz

110 or 230V, 50 Hz

208-240V 50 Hz

Volt-Amperes 250 peak

Day (White) 130W

White Backup 75W

Operation

The PC 310-7VM 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, inputs 1 and 2 control 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 if input 1 and 2 are open. If input 1 is closed the intensity is 6,000 candelas. If input 2 is closed the intensity is 2,000 candelas (system changes to night mode). 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 310-7VM power converters (typically three) operating the corresponding number of flashheads. A master/slave control line (two-wire) at terminals TB1-4 and TB1-5

at the front panel interconnects the units.
A sync pulse on the line flashes all the
lights in unison and at the same rate.

Configurations

Models	Lights	Operation	White Night Backup
310-7VM 310-7VME	L-865 White (40 FPM)	White During Daylight White Low Intensity At Night	No

The “E” option shown above denotes the addition of the optional modem card for remote diagnostics and monitoring.

Alarm Contacts and Inputs

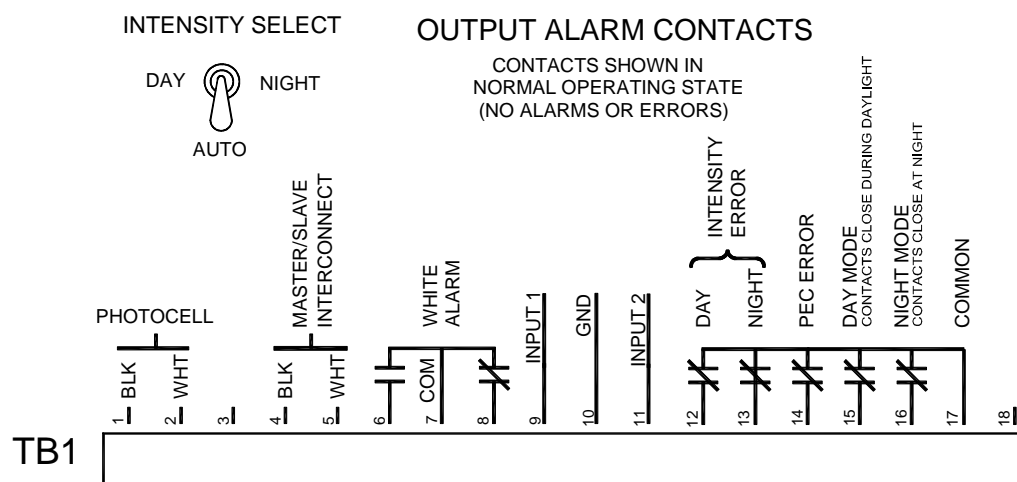


Figure 1-1 – TB1 Alarm Contacts and Inputs

Contact/Input	Indication
White Alarm	Combination of Day Intensity and Photocell Errors.
INPUT 1	Dry contact input. If closed, day intensity is 6,000 candelas.
INPUT 2	Dry contact input. If closed, system switches to night operation.
Day Intensity Error	Incorrect day intensity.
Night Intensity Error	Not used.
Photocell Error	Photocell alarm. The PEC failed to transition within 19 hours.
Day Mode	Day mode operation.
Night Mode	Night mode 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 controls and monitors the operation of the PC 310-7VM. Status indicators and setup options are shown in the figure below and on the following pages. The figure shows the newer 290381X version of the PCB which is a direct plug-in replacement for the previous 290380X version.

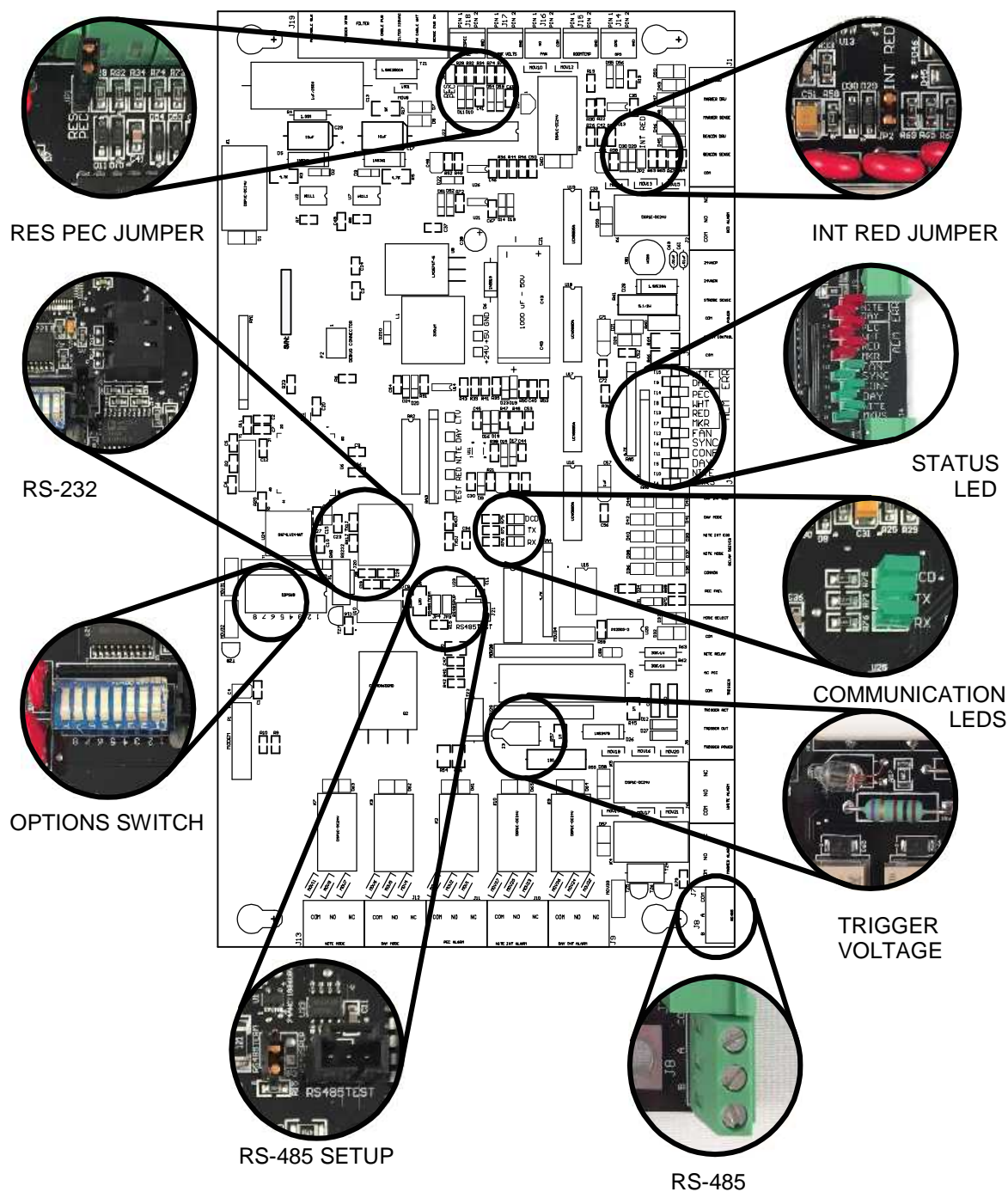


Figure 1-2 – 2903810 Board Configuration (replacement for the 2903800)

Options Switch



The options switch allows configuration of the RS-485 address, number of markers and alarm isolation.

Switch	Function
1	Alarm Isolation (OFF – Isolate (default)) (ON – Report Alarm)
2-4	RS-485 Address
5-7	Number of Markers

Alarm Isolation

Not used, no red system can be controlled with the 310-7VM.

RS-485 Communication

The RS-485 port is used for communication from one or more power converters to a monitoring unit (FTM-5000 or FTW-17X). The connections are available on J8 in the lower right corner.



When all switches are OFF, the RS-485 is disabled. Once addressed, modem communication will be disabled and the RS-485 will become active.

Switches #2-4 define the address as follows:

2	3	4	Address
OFF	OFF	OFF	RS-485 Disabled
ON	OFF	OFF	1
OFF	ON	OFF	2
ON	ON	OFF	3
OFF	OFF	ON	4

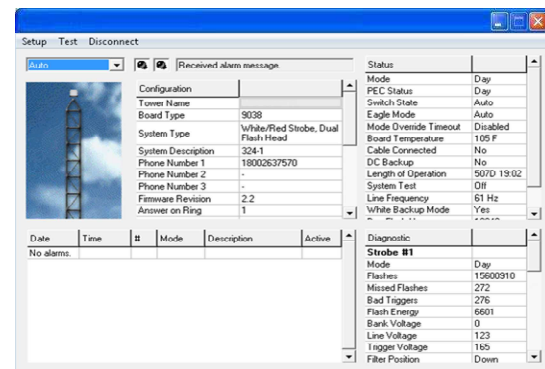
Number of Markers

Not used in the 310-7VM.

RS-232

The RS-232 port allows connection to a laptop for programming and troubleshooting using Tech-Eagle. A Tech-Eagle screenshot is shown below. Tech-Eagle is available for download from www.flashtechology.com.

If the RS-232 port on a 290380X version PCB is permanently connected or used for some other purpose than configuration and troubleshooting, external electrical isolation of the connection is required. The 290381X version of the PCB has electrical isolation built in.



A direct connect cable, part number 3859001, is required for connection between the 2903810 board and the PC. For more information, select the Help menu in Tech Eagle.



Note: The RS 485 address must be disabled (DIP switches 2 – 4 set to the OFF position) before attempting to connect to the unit with Tech-Eagle. See “RS 485 Communication” for additional information.

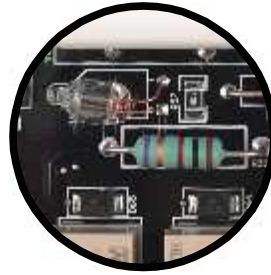
RES PEC Jumper



The FTB 310-7VM uses a PEC 510 resistive photocell for determining mode transition. The “RES PEC” jumper must be “open” (jumper installed on one pin) on the master unit and “closed” (jumper installed on both pins) on all connected slave units.

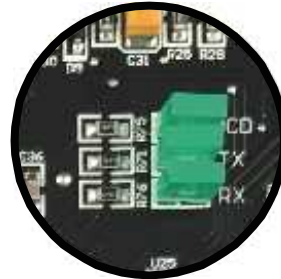
Note: The PC 324-3 is shipped with the “RES PEC” jumper “open” by default.

Trigger Voltage



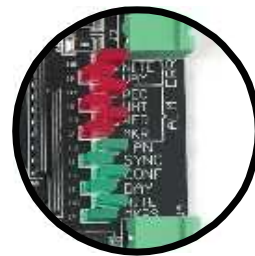
The trigger voltage neon provides an indication that voltage to power the trigger circuit is being supplied to the 2903810 board.

Communication LEDs



The TX and RX LED’s indicate the transmission and reception of data through the board’s serial port via the RS-232, RS-485 or the modem card. The DCD LED will be active when a connection has been made via the modem.

Status LEDs



Twelve LEDs provide information regarding system status and any errors or alarms that are present as follows:

LED	Indication
NITE ERR	Incorrect night intensity.
DAY ERR	Incorrect day intensity.
PEC ALM	Photocell alarm. The

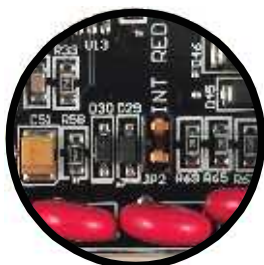
	PEC failed to transition within 19 hours.
WHT ALM	Combination of DAY ERR and PEC alarm.
RED ALM	Combination of NITE ERR and PEC alarm.
MKR ALM	Detected markers have fallen below the level set by the options switch.
FAN	Not used.
SYNC	The Master / Slave Interconnect is active. Flashes during normal operation.
CONF	A valid flash has been detected.
DAY	Day mode operation.
NITE	Night mode operation.
MKRS	Marker output is active.

RS-485 Setup



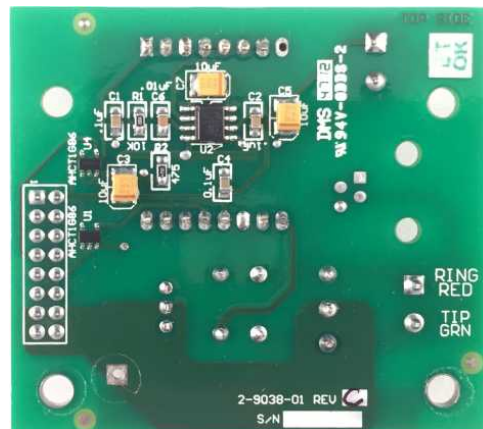
RS485TERM jumper is open by default and should be shorted only on the last 2903810 board in the series of power converters connected to the monitoring unit.

Internal Red Jumper

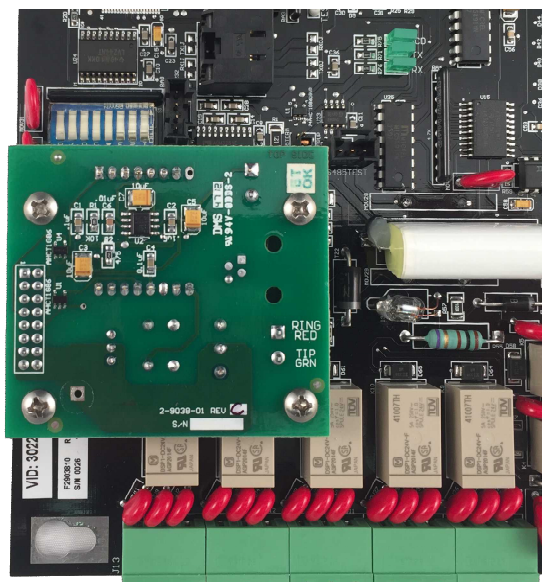


The INT RED jumper is always shorted (jumper placed over both pins) for the FTB 310-7VM.

Optional Modem Card



The 2903801 modem board is installed in the lower left corner of the board.



The terminal block can be removed for easy connection of the phone wires.

The modem is included with all “E” (Eagle) systems or can be added later as an upgrade to non “E” systems.

Section 2 - 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, Flash Technology suggests 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
- 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. Flash Technology 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.

Flash Technology 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 Flash Technology 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. You must 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 2-7 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 Flash Technology 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

Flash Technology 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 two full turns 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 J18-1 to J18-2.) 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:
 1. Ensure that the case is mounted upright, is water tight, and grounded to the site grounding system.
 2. Check hardware to ensure that all mounting hardware is tight.

3. Ensure that only the bottom of the case has drain holes and that they are clear.
 4. Ensure that no holes are punched or drilled on the top surface of the case.
 5. Ensure that air can flow around the case.
 6. Mount the power converter away from radio frequency interference (RFI).
4. Power Converter Wiring. Examine the installation drawings and use the following checks:
1. Check for proper incoming service voltage.
 2. Wire each unit according to the instructions.
 3. In multiple installations of three systems, all three power converters should be on the same breaker.
 4. Check all electrical connections for tightness.
 5. Check all terminal strip connections for tightness.
 6. Ground the power converter.
 7. 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.
1. If external alarm detection circuit responds to closed contacts, ensure that they are wired to the contacts on TB1 that close on alarm.
 2. If external alarm detection circuit responds to open contacts, ensure that they are wired to the contacts on TB1 that open on alarm.
 3. Alarm wiring should be lightning and RFI protected: shielded, grounded shield, and in a conduit.
 4. If a specific alarm is ganged together from all power converters as one, ensure that the wiring follows local installation instructions.
6. Flashhead Mounting.
1. Ensure that the flashhead lens can be opened without striking other objects.
 2. Level and aim the flashhead.
7. Flashhead Wiring.
1. Protect the top flashhead against lightning strikes.
 2. Ground the flashhead.
 3. Check the wiring of the flashhead cable to the flashhead.
 4. Secure the flashhead cable to the tower. Support and tape the flashhead cable to prevent its movement by the wind.
8. Photocell.
1. Locate photocell where it views unobstructed polar sky with no direct or reflected artificial lighting striking it.
 2. Mount the photocell vertically to prevent water from entering the unit. Ensure watertight connections.
 3. 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.

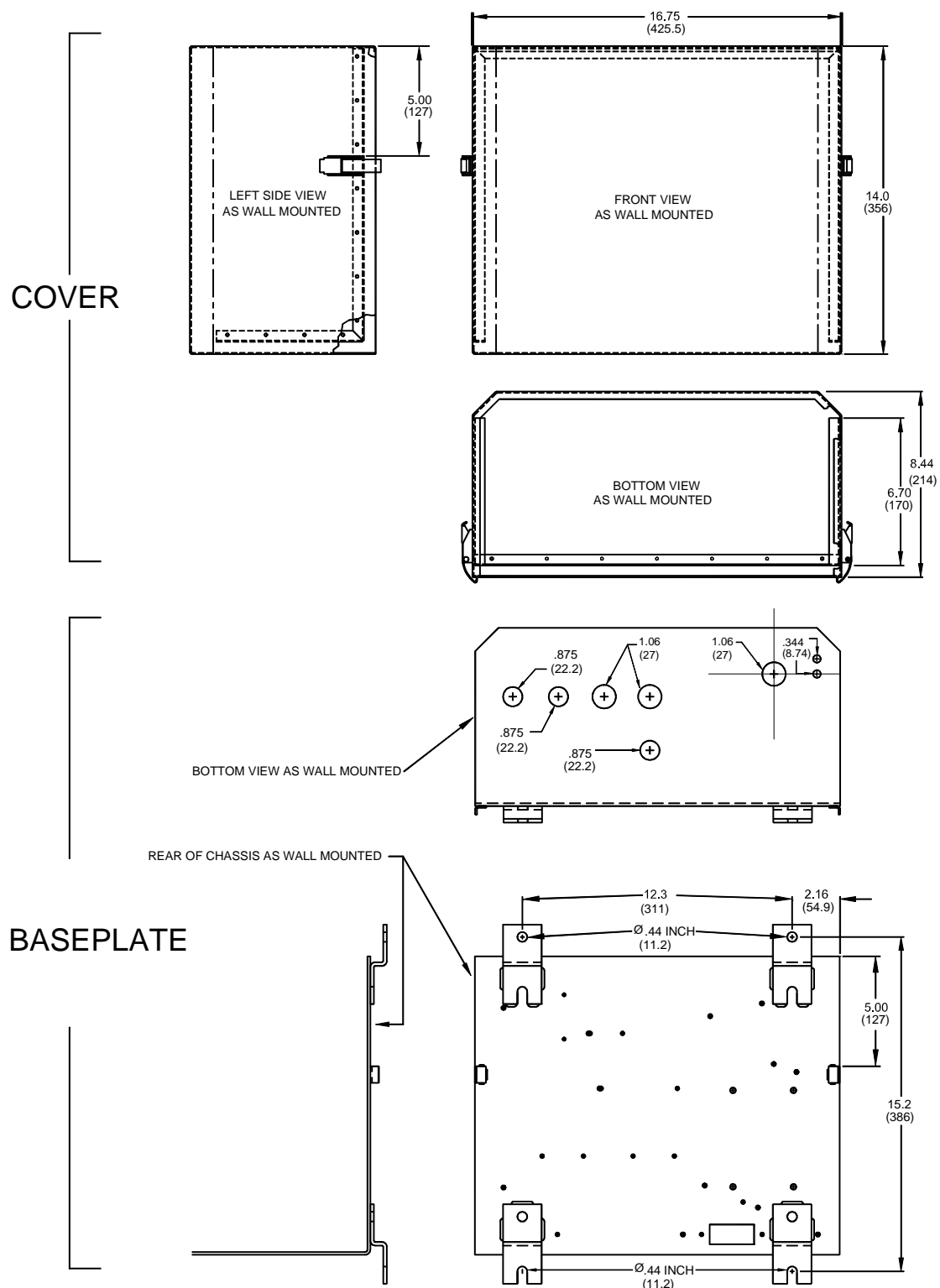
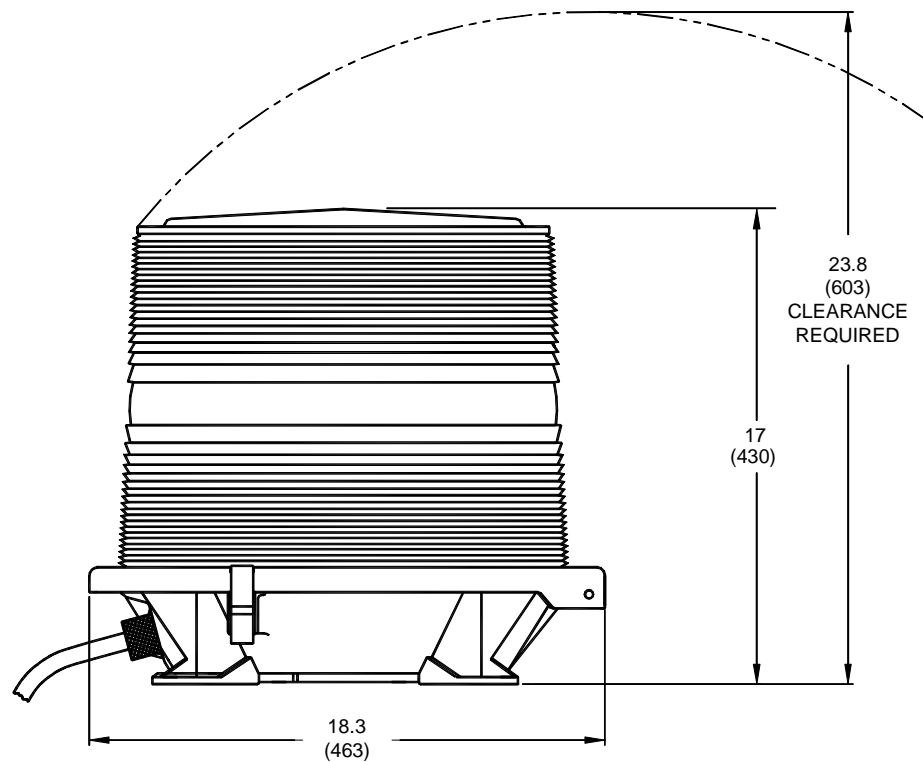
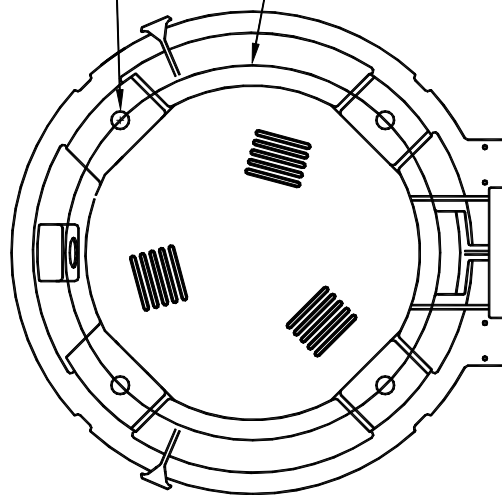


Figure 2-1 – Power Converter Mounting and Outline



.625 (15.9) DIA. MOUNTING HOLE
(4 PLACES EQUALLY SPACED)

Ø13.25 BOLT HOLE CIRCLE



NOTES:

1. WEIGHT: 17 LBS (7.7 KG)
2. AERODYNAMIC WIND AREA: .93 FT² (.0864 M²)
3. DIMENSIONS ARE IN INCHES (MILLIMETERS)
4. ACCESS TO THE FLASHHEAD MUST REMAIN UNOBSTRUCTED
5. FLASHHEAD SHOULD HAVE LIGHTNING PROTECTION

Figure 2-2 – Flashhead Mounting and Outline

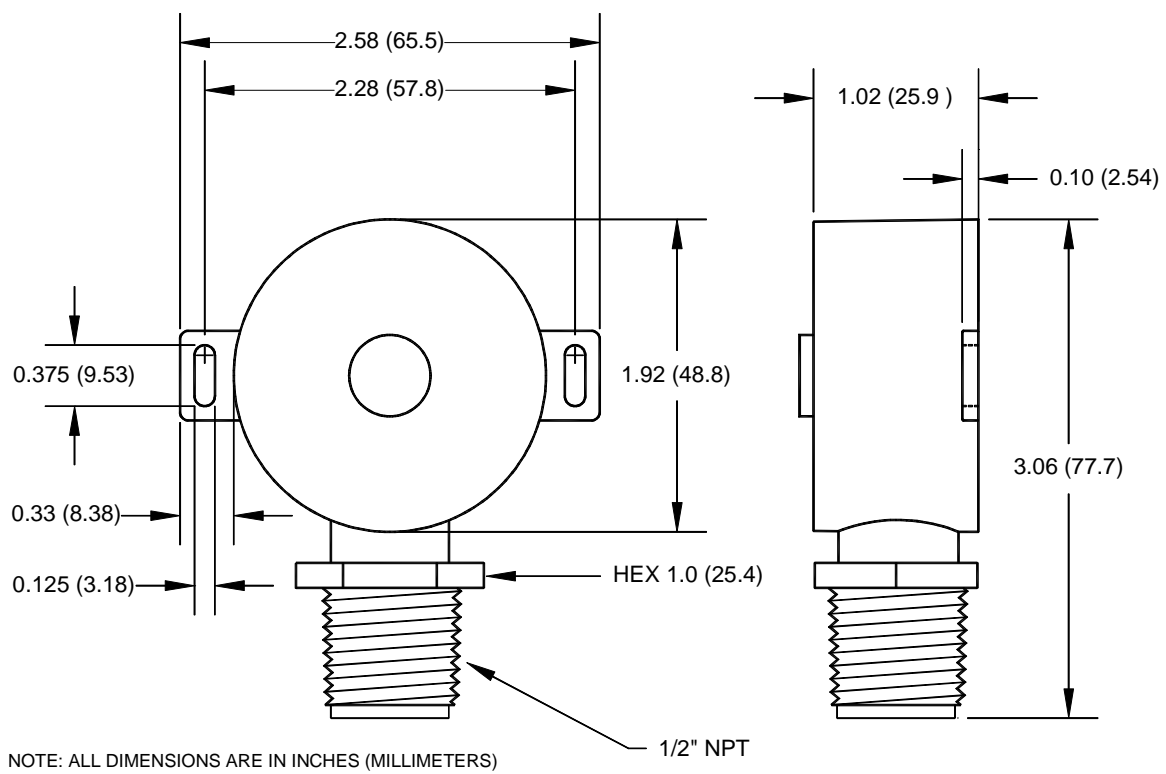


Figure 2-3 – Photocell Mounting and Outline

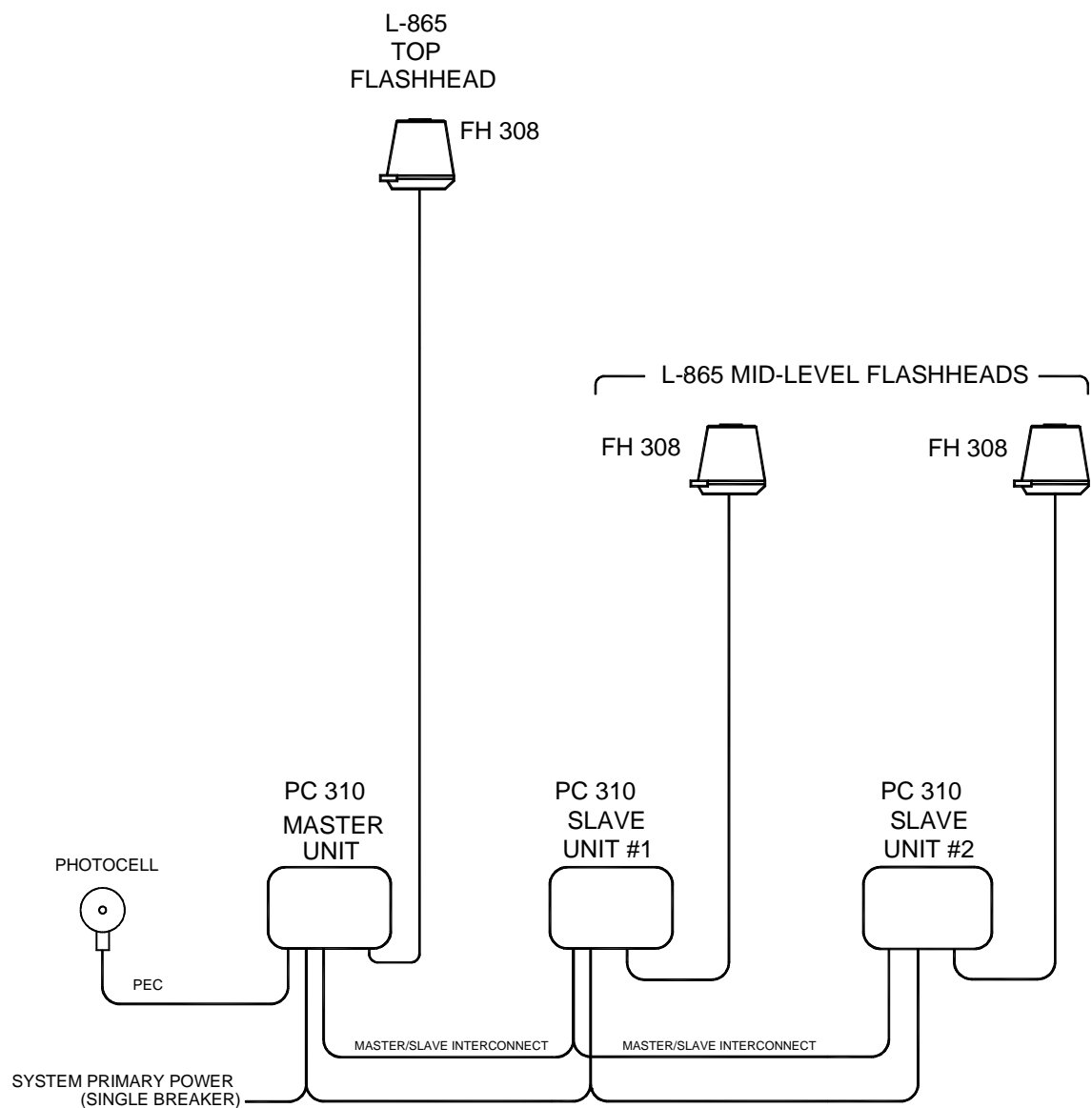


Figure 2-4 – Typical System – Wiring Guideline

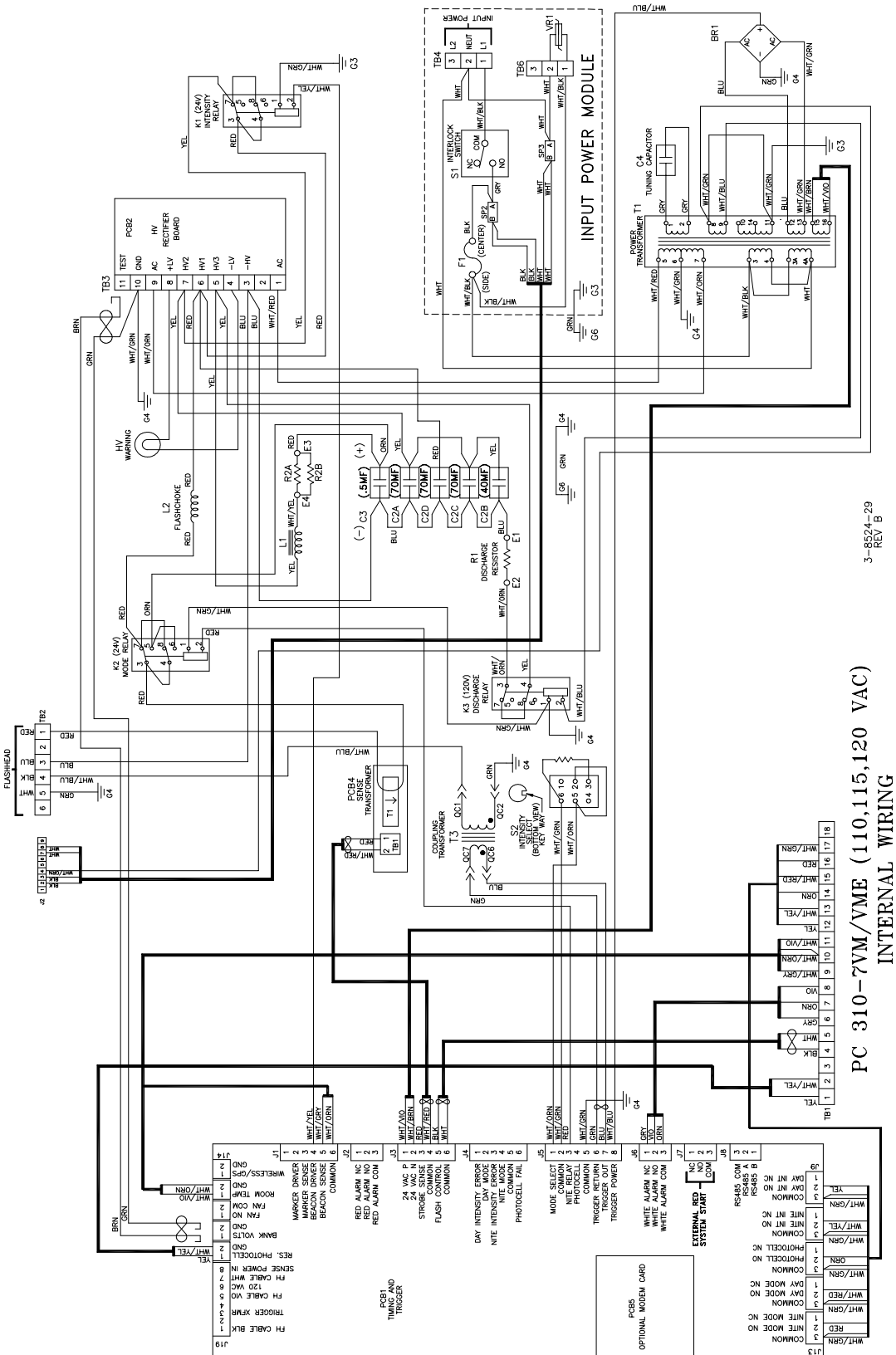
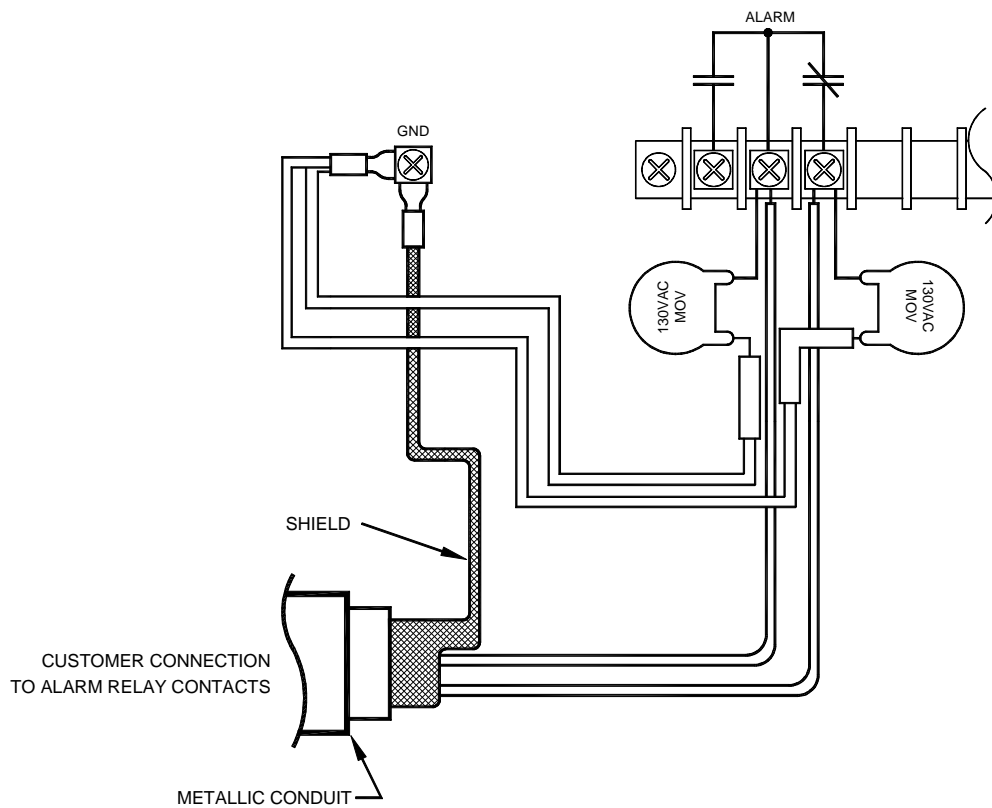


Figure 2-5 – PC 310-7VM Power Converter Internal Wiring (110-120V)



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.

Figure 2-7 – Recommended Alarm Wiring

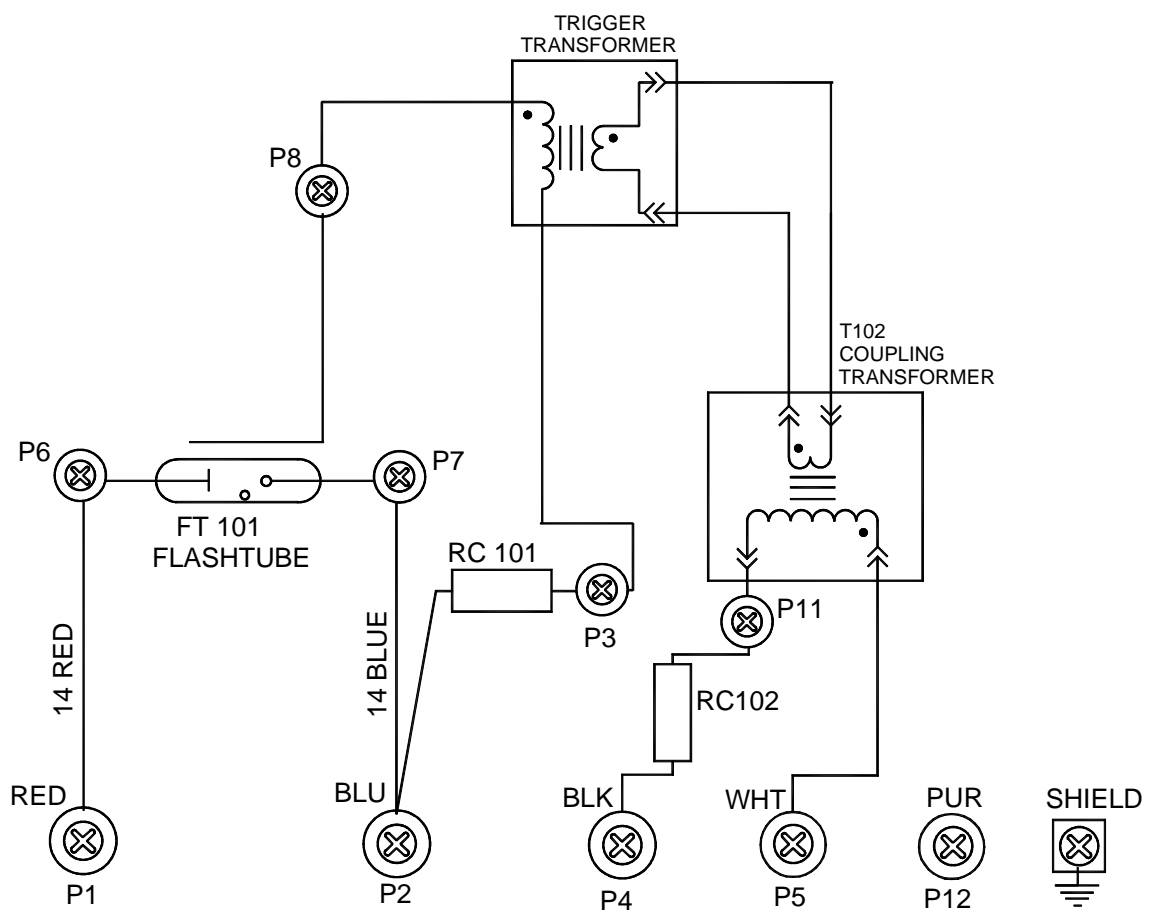


Figure 2-8 – FH 308 Internal Wiring

1. PHOTO CELL MUST BE CONNECTED TO J4 ON FTM 5000.
2. PHOTOCELL MUST BE CONNECTED TO J5 PIN 4 INPUT ON MASTER UNIT.
3. RS485 PORT J6 PINS 1, 2, AND 3 ON THE FTM 5000 MUST BE CONNECTED TO J8 ON PCB 9038.

- J6 PIN 1 TO J8 PIN 1
- J6 PIN 2 TO J8 PIN 2
- J6 PIN 3 TO J8 PIN 3

4. THE LAST POWER CONVERTOR 9038 PCB IN THE CHAIN MUST JUMPER PINS RS485TERM AND RS485SUP.

5. EACH 310 MUST HAVE A UNIQUE ADDRESS. THE ADDRESS IS SET BY THE FTM 5000.

6. THE FTM 5000 MUST BE SETUP FROM THE EAGLE SOFTWARE. AFTER CONNECTING WITH EAGLE GO TO THE SETTINGS TAB AND AT THE BOTTOM OF THE SCREEN IS THE EXTERNAL SERIAL ADDRESS. SET IT TO 9038. IN THE BOX LABELED 485 SET IT TO THE NUMBER OF BOARDS YOU HAVE CONNECTED. ONCE YOU SET IT TO 9038, IN THE BOX LABELED 485 A NEW TAB OR TABS WILL APPEAR, ONE FOR EACH UNIT.

7. SHORT TB1 PINS 1 & 2 FOR SLAVE OPERATION
8. SHORT TB1 PINS 1 & 2 WHEN USING 120V PHOTOCELL INPUT

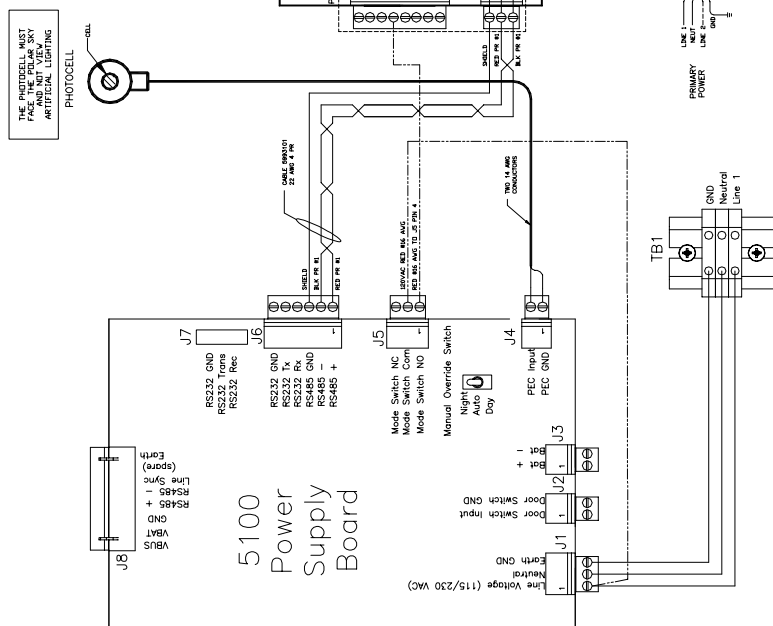


Figure 2-9 – RS-485 Installation

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 Flash Technology-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 Flash Technology. Contact Customer Service at 1-800-821-5825.

Storage

Store equipment indoors when not in use.

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 2-9. Note that, for each power converter, the 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 Flash Technology 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. To minimize interference, ensure proper installation in accordance with AC 70-7460, Appendix 1, Figure 2.

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 (K1, 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 K1 Intensity Relay, 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 below:

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

If the voltage on TB3-1 to TB3-9 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. If multiple beacon system, 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 4-3. A flashhead electrical wiring diagram is provided in Figure 2-8. A power converter internal wiring diagram is provided in Figure 2-5.

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 2-5 or 2-6.

The general procedure for removing components follows:

1. Obtain access to the component in question.
 - 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 accidentally 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 2-5. 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. Flash Technology 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 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 2-5 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 2-5 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.

Intensity Relay (K1), Mode Relay (K2), Discharge Relay (K3)

Remove the Component Bracket for adequate access to Relay K2. For K1 skip to step 4.

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 2-5 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 3-1. 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.

Indicator	Function Description	Normal Operation	
		Day	Night
I15	NITE ERR – On for night intensity error.	OFF	OFF
I9	DAY ERR – On when a day intensity error has occurred (light flashed at the incorrect intensity).	OFF	OFF
I14	PEC ALARM – On for Photocell alarm (Photocell failed to switch state).	OFF	OFF
I8	WHT ALM – On when a white alarm occurs (white light failed).	OFF	OFF
I13	RED ALARM – Not used.	OFF	OFF
I7	MRK ALM – Not used.	OFF	OFF
I12	FAN – Not used.	NOT USED	NOT USED
I6	SYNC – Flicks on every six seconds.	FLICK	FLICK
I11	CONFIRM – On when PCB1 detects a valid flash. I 5 flickers at flash rate.	FLICK	FLICK
I5	DAY – On when power converter is in day mode.	ON	OFF
I10	NITE – On when the power converter is in night mode.	OFF	ON
I4	MKRS – Not used.	NOT USED	NOT USED
I3	TRIGGER POWER – Indicates 120 VDC trigger voltage is available.	ON	ON

Figure 3-1 – Function Indicators

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 Section 1 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, if input 1 and 2 are open. 6,000 candelas if input 1 is closed and

nighttime intensity if input 2 is closed.

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.

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.

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 affect the entire multiple-light system. See the Troubleshooting Charts starting with Figure 3-1.

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 310-7VM. 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 29.
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 29.
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.

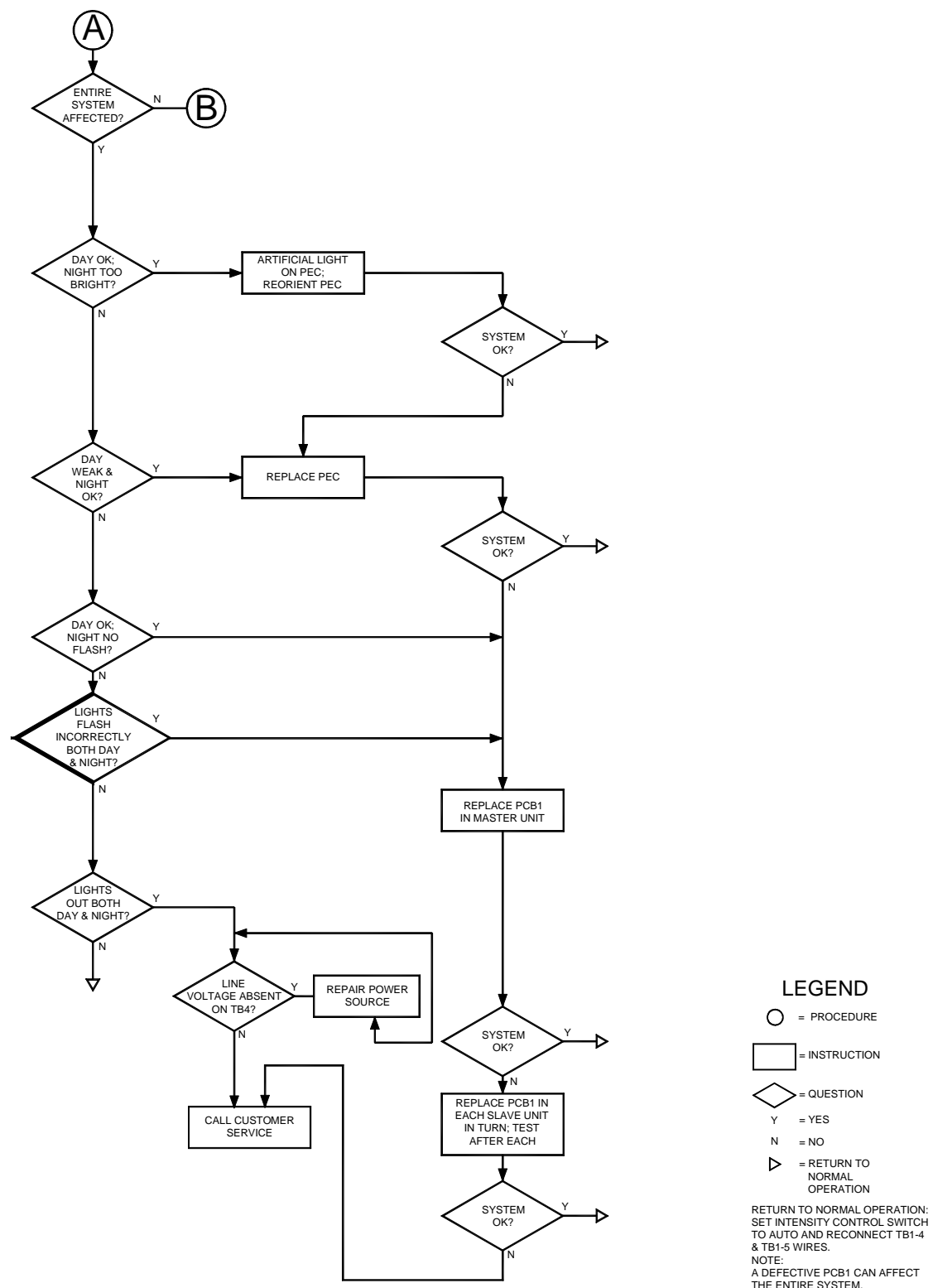


Figure 3-2 – Troubleshooting Chart (Part 1 of 4)

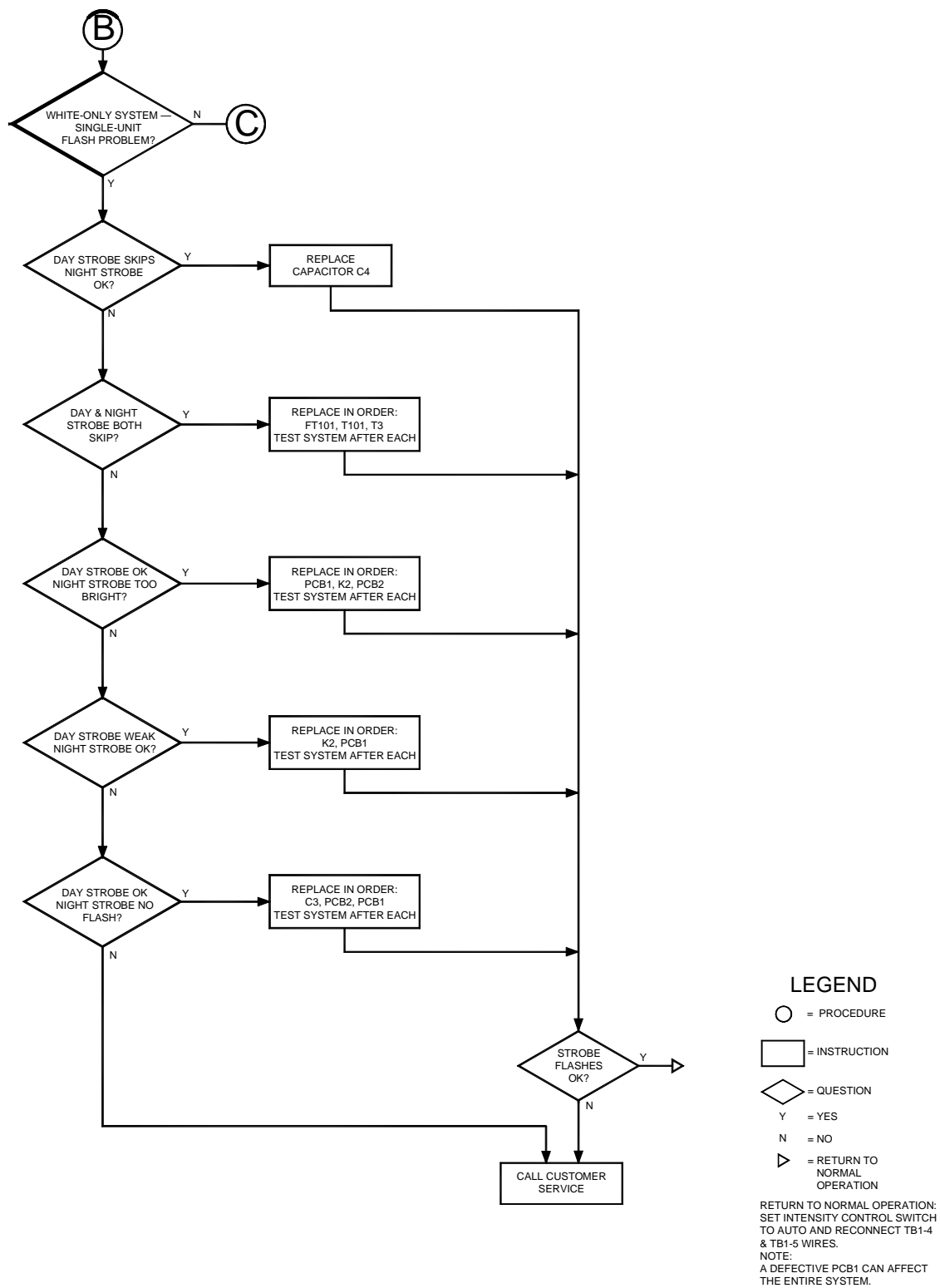


Figure 3-3 – Troubleshooting Chart (Part 2 of 4)

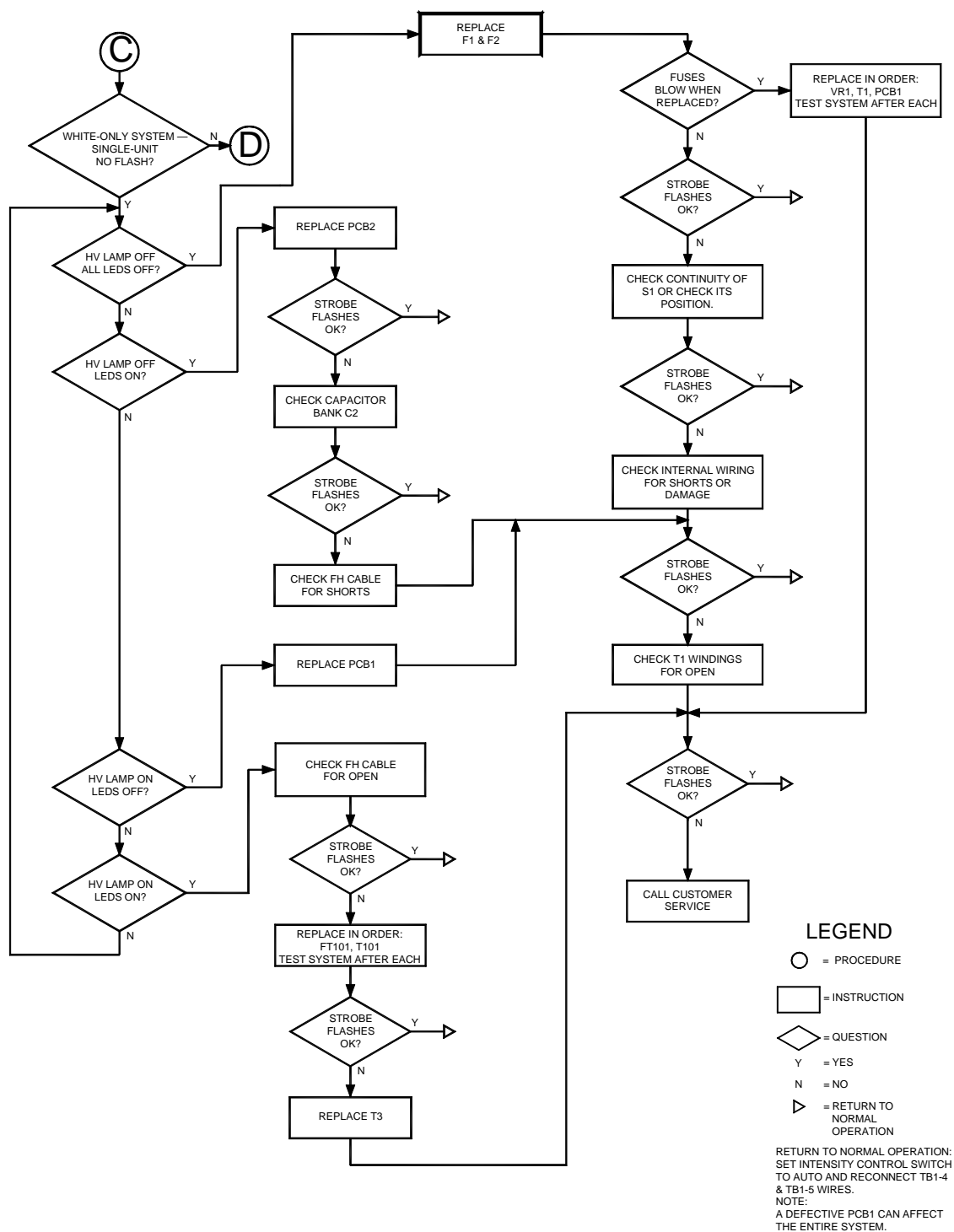


Figure 3-4 – Troubleshooting Chart (Part 3 of 4)

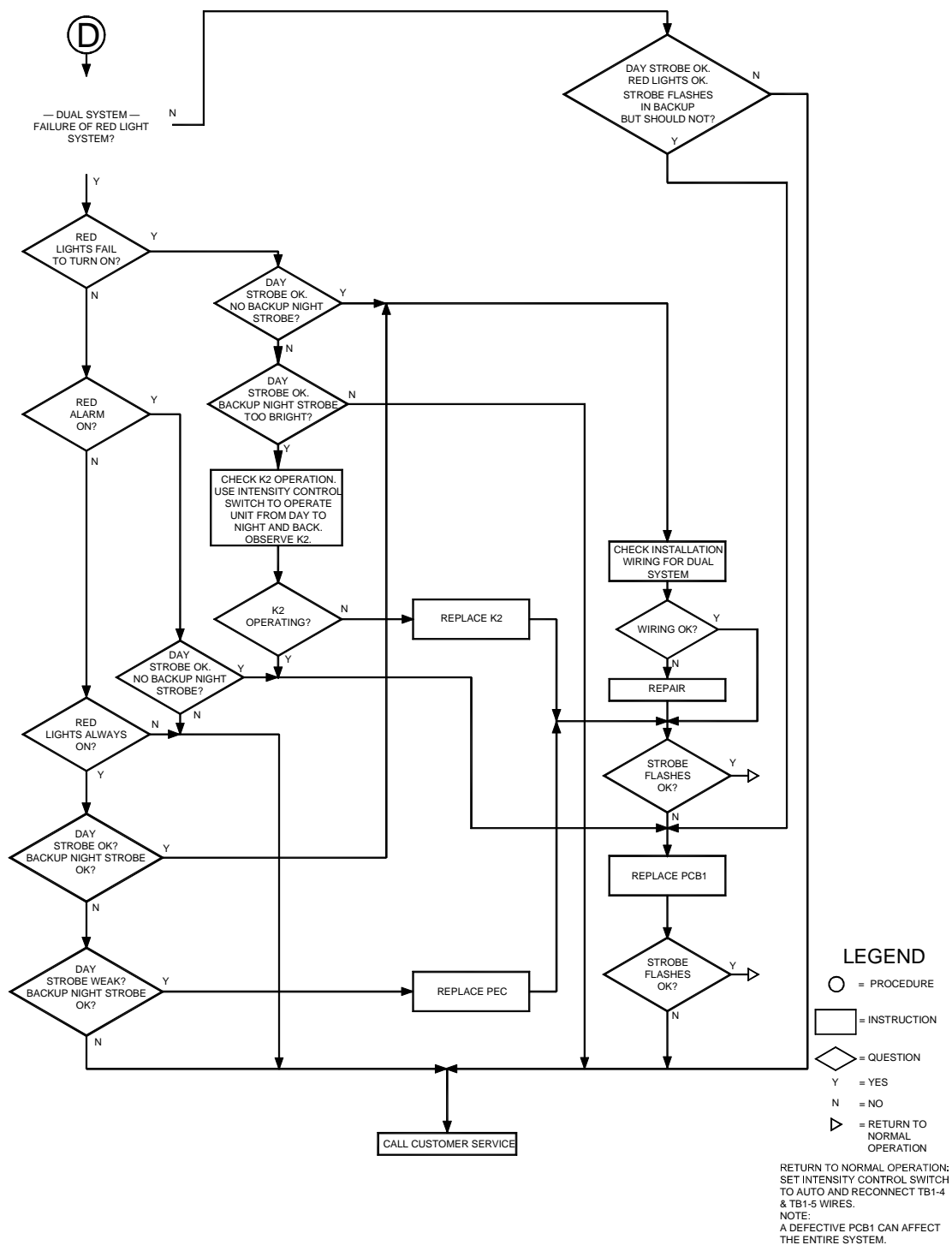


Figure 3-5 – Troubleshooting Chart (Part 4 of 4)

Section 4 – Recommended Spare & Replaceable Parts

Customer Service

Customer Service: 1-800-821-5825

Telephone: (615) 261-2000

Facsimile: (615) 261-2600

Shipping Address:

Flash Technology
332 Nichol Mill Lane
Franklin, TN 37067

Ordering Parts

To order spare or replacement parts, contact customer service at 1-800-821-5825.

Power Converter Parts

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

Flashhead Parts

Figure 4-3 lists the part numbers for the major replaceable parts

Photocell Parts

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

Reference	Description	Part Number	
		50 Hz	60 Hz
BR1	Diode Bridge		6902806
C2A,C,D	Capacitor, Main Bank, 70 mfd.		6720401
C2B	Capacitor, Main Bank, 40 mfd.		6386503
C3	Capacitor, Night Mode, 0.5 mfd.		6848201*
C4	Capacitor, Tuning, 3 mfd.		6577903
F1	► Fuse, Power, MDL8	4901931* (2 Required)	4901931*
HV	Neon, High Voltage Warning Light		4902317
K1,K2	► Relay 24V, Intensity, Mode		8900494
K3	► Relay 120V, Discharge		8900493
L1	Choke, Burst		4850601
L2	Choke, Flash		4175200
PCB1	► Timing and Trigger Board**		2903810
PCB2	► HV Rectifier Board		2458005
PCB4	Sense Board		2811101
PCB5	Modem Board		2903801
R1	Resistor, Discharge		6900541
R2	Resistor, Burst, 500 ohm		6900532
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 (110-120V)		8250801*
	► Varistor (208-240V)	8250802*	8250802*

► Recommended as a spare part.

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

**Please specify the model number of the equipment when calling for a replacement.

Figure 4-1 – Power Converter Major Replacement Parts

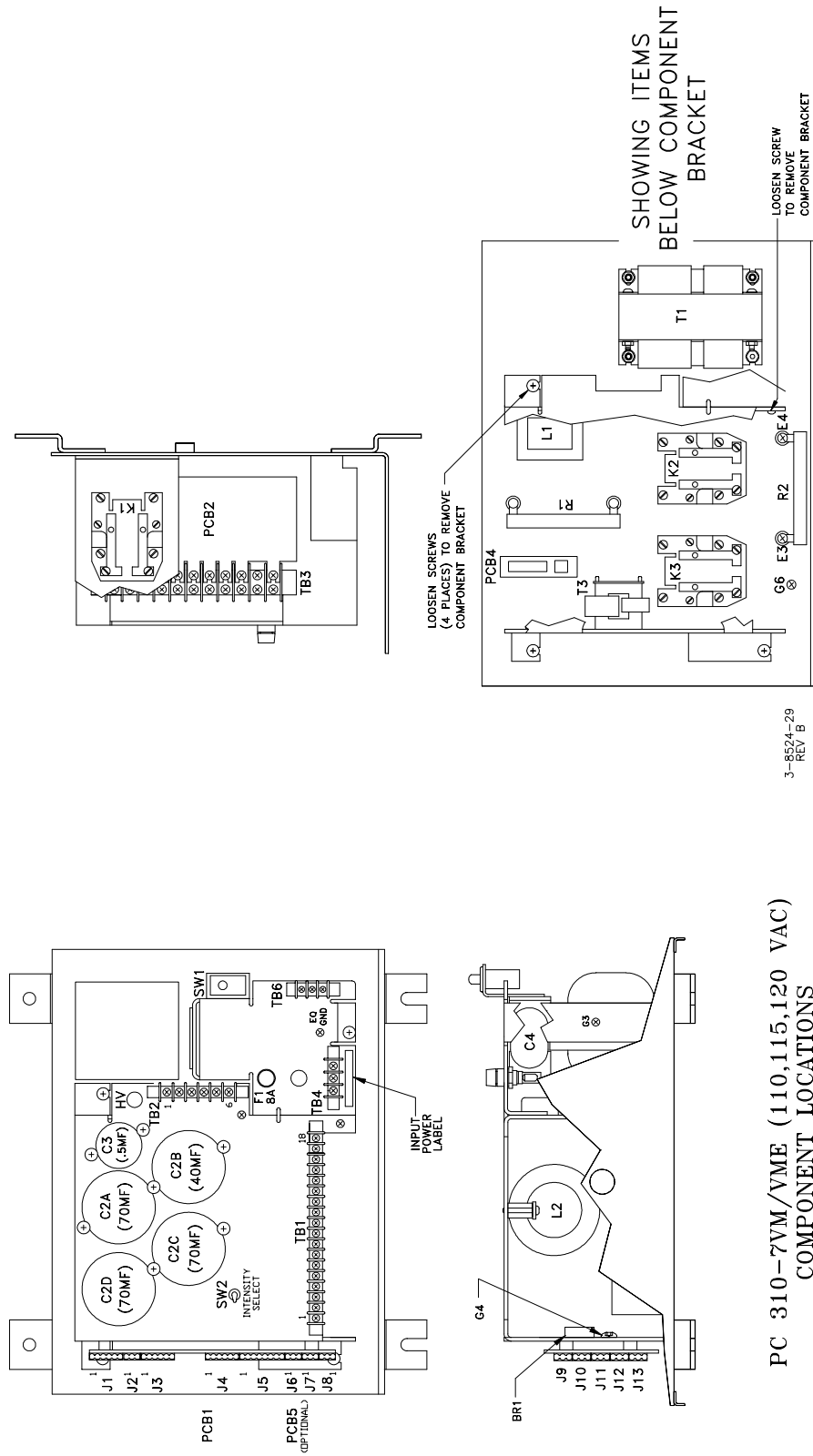


Figure 4-2 – Power Converter Component Layout

Reference	Description	Part Number
P1,P2,P4,P5,P12	Ceramic Spacer, 3/4" diameter	5900844
P3,P11	Ceramic Spacer, 1/2" diameter, 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

Figure 4-3 – Flashhead Major Replacement Parts

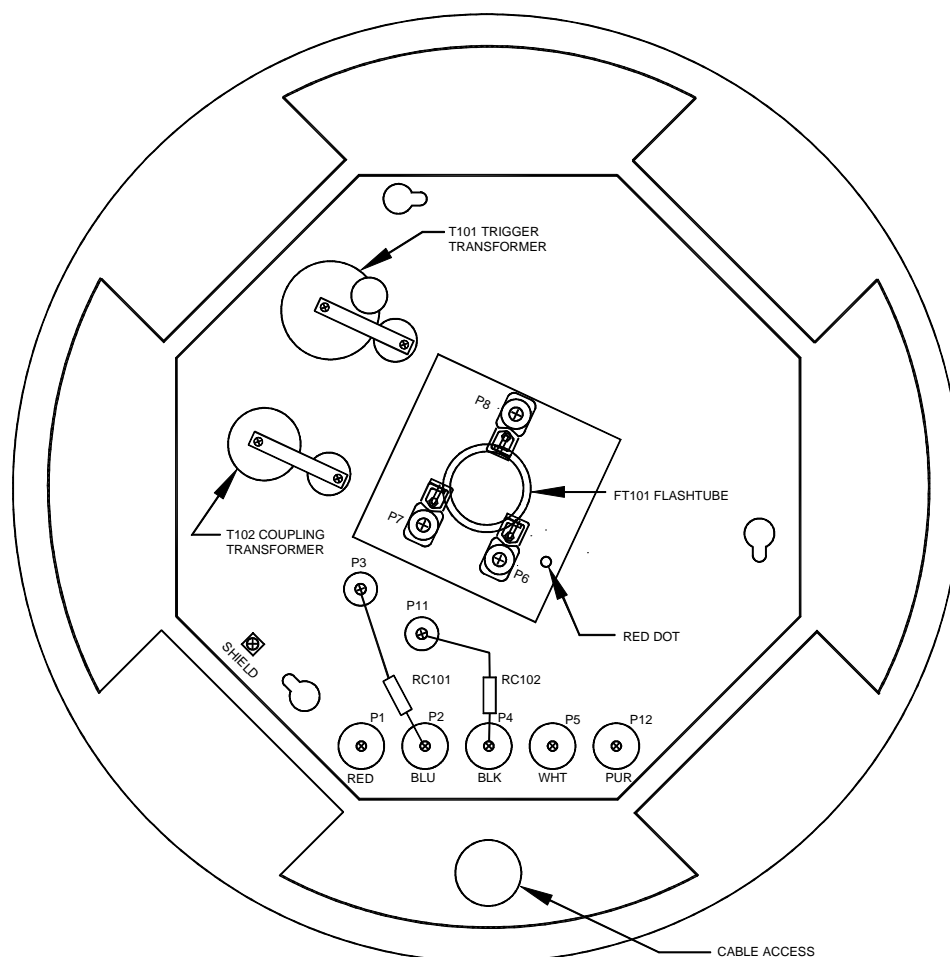


Figure 4-4 – Flashhead Component Layout

Return Material Authorization (RMA) Policy

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

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

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

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

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

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

3. Product within the Warranty Time Period

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

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

4. Product outside the Warranty Time Period

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

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

- All returned products should be packaged in a way to prevent damage in transit. Adequate packing should be provided taking into account the method of shipment.

Note: Flash Technology will not be responsible for damaged items if product is not returned in appropriate packaging.

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

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

7. All RMA numbers:

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