FLASH™ TECHNOLOGY

SN

FTB 312-3, 312-3A, 312-3AE, 312-3T, 312-3TA
FTS 316-2 and 316-2AE
FTS 316-3 and 316-3AE

Dual Medium Intensity, Obstruction Lighting Systems Reference Manual

Flash Technology Corporation of America®, 332 Nichol Mill Lane, Franklin TN 37067
(615) 261-2000

Front Matter

Abstract

This document describes the: FTB 312-3, 312-3A, 312-3AE, 312-3T, and 312-3TA; FTS 316-2, 316-2AE, 316-3, and 316-3AE Medium Intensity Obstruction Lighting Systems.

Copyright

Trademark Acknowledgments

Applicable Specification

This equipment meets or exceeds requirements in Advisory Circular 150/5345-43 for FAA Type L-864 and L-865 medium intensity obstruction lights with L-810 markers (side lights).

Disclaimer

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

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

Warranty

FTCA 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 150/5345-43.

Pub. No. 0594-312/316-00012

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.

Table of Contents

Table of Contents (cont'd)

List of Figures

List of Tables

This page is intentionally blank.

Section 1 — FTB 312-3 Introduction and Operation

System

The ElectroFlash™ FTB 312-3 and FTS 316-2 or FTS 316-3 Systems are *dual (white/red) flashing*, medium intensity, obstruction lighting systems designed and manufactured by Flash Technology Corporation of America® (FTCA) for installations that require white L-865 lights during the day and L-864 red lights and markers at night.

A system consists of a power converter, a dual flashhead or red and white flashheads, photocell, and a cable between the flashhead and power converter. *Table 1-1* provides an overview of system features.

The power converter provides discharge energy to the flashhead, and contains components and circuitry to control flashing. The power converter operates a white light at 40 flashes per minute during the day. At night, it switches to a red light at 20 flashes per minute, and turns on steadily-lit markers. It is usually installed near ground level.

The FH 306 Flashhead is a dual (white/red) flashhead; it has an internal red filter. An actuator raises the filter to operate the flashhead in red mode and lowers the filter to operate it in white mode. Together, the lens and base enclose the flashtube and other interior components. Latches secure the lens, which tilts open for internal access. Position the flashhead to comply with FAA regulations in Advisory Circular 70/7460-1J, *Obstruction Lighting and Marking.*

A flashhead cable interconnects the power converter and flashhead. When FTCA Part Number 6340, or equivalent cable, is used, the two may be separated by up to 600 feet (180 meters). Consult the factory when a greater separation is necessary.

The photocell is connected directly to the main panel of the power converter at TB1-1 and TB1-2 to control switching between day and night operation. It may be located any practical distance from the power converter.

FTS 316 Systems

An FTS 316 System combines an FTB 312-3 System with a 24VDC battery and DC-to-AC inverter for continued operation if the main power fails.

The FTS 316-2 System consists of an FTB 312-3 System and an FIV 1100 Inverter.

The FTS 316-3 System consists of an FTB 312-3 System and an FIV 2000 Inverter.

Specifications

Electrical specifications are listed for a single power converter or an inverter supplying a single power converter.

Physical:

PC 312-3: (H x W x Depth, Wgt.)
14.00 x 16.75 x 8.44 in., 51 lbs.
355.6 x 425.5 x 214.4 mm., 23 kg.

FH 306 Flashhead: (H x Diam, Wgt.)
17 x 18.25 in., 23 lbs.
430.5 x 463 mm., 10.4 kg.

FH 307T or FH 308 Flashhead: (H x Diam, Wgt.)
17 x 18.25 in., 17 lbs.
430.5 x 463 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.

FIV 1100 Inverter: (H x W x Depth, Wgt.)
8.44 x 14.00 x 16.57 in., 35.05 lbs.
214.4 x 355.6 x 425.5 mm., 15.9 kgs.

FIV 2000 Inverter: (H x W x Depth, Wgt.)
8.44 x 14.00 x 16.57 in., 45.05 lbs.
214.4 x 355.6 x 425.5 mm., 20.44 kgs.

Aerodynamic Wind Area:

Flashheads	.93 $ft.^2$, .0864 $m.^2$
Power Converter	1.63 $ft.^2$, .15 $m.^2$
Inverter	1.63 $ft.^2$, .15 $m.^2$

Environmental:
Complies with FAA specifications in AC 150/5345-43

Performance Characteristics:

Application: L-865 and L-864

Flash Intensity (nominal):

Day (White)	20,000 ± 25% ECD
Night (Red)	2,000 ± 25% ECD
Default Night (White Backup)	2,000 ± 25% ECD
Beam Spread:	Horizontal: 360º Vertical: 5º

Flash Rate:

Day (White)	40 flashes per minute
Night (Red)	20 flashes per minute
Default Night (White backup)	40 flashes per min.

Electrical: ***Power Converter***

AC Voltage	sine-wave, 120 or 240V, 60 Hz
Volt-Amperes	250 peak
Watts:	
Day (White)	130W
Night (Red)	145W
Night (Default White)	55W
Markers (Sidelights)	(each) 116W

Inverter

DC Voltage In	24 VDC (nominal), 19.2 to 34 VDC
AC Voltage Out	120VAC ±5%, 60 Hz. ±.1%
Watts (with a power converter):	
Day (White)	VDC 125W
Night (Red)	VDC 275W

FIV 1100 and FIV 2000 Power Inverter

The FIV 1100 and FIV 2000 Power Inverters provide automatic battery backup power source connection for FTS 316 Systems if primary AC power fails. The FIV 1100 is typically connected to a battery source and to the primary 120VAC power source. It provides 120VAC power for a single medium intensity power converter. The FIV 2000 provides 120VAC power for up to three medium intensity power converters.

FIV Inverter Operation

- Normal Operation — Line Power Active
  - AC source power energizes the transfer relay in the FIV, which applies the 120VAC source power to the power converter.
- Battery Back-up Operation — Line Power Interrupted
  - Interrupted 120VAC source power de-energizes the transfer relay allowing 24VDC battery power to be applied to the power inverter. The power inverter changes the 24VDC to 120VAC ±5% at 60 Hz ±.1% and applies the resulting AC power to the power converter.

Protection

CAUTION

When you use a DC power source, operate the FTS 316 Systems directly from the battery. Do not operate from a charging source without the battery.

Carefully maintain the batteries and be careful of the voltage on the charging circuitry. If the battery voltage drops too low, or if the DC charging voltage is too high, the system stops operating. The operating input voltage range is 19.2 to 34 volts DC.

Low Battery Voltage: Low battery voltage causes the inverter to shut off. Low battery voltage can be caused by corroded terminals or an old battery. Restoring battery voltage causes the inverter to restart.

High Battery Voltage: High battery voltage (incorrect battery connections or batteries) causes the inverter to shut off. Restoring the correct operating voltage causes the inverter to restart.

Over-temperature: If the inverter overheats, it shuts off. Restoring reasonable operating temperatures causes the inverter to restart.

Over-power: If the load requires power higher than the rating of the inverter, the inverter lowers its output voltage to supply no more than its rated power. Restoring the proper load on the inverter restores the operating voltage.

Table 1-1 FTB 312-3 and FTS 316 System Features

System	Features				
	Multiple Light Systems	Flashheads		Alarms	
		Dual	‡Twin	Standard	Extended Alarms & Signals
FTB 312-3	Yes - 3 typical	Yes - FH 306	No	White, red, marker	No
FTB 312-3A	Yes - 3 typical	Yes - FH 306	No	White, red, marker	Day intensity, night intensity, PEC, day mode, night mode
FTB 312-3AE	Yes - 3 typical	Yes - FH 306	No	White, red, marker	Day intensity, night intensity, PEC, day mode, night mode; †EAGLE monitoring
FTB 312-3T	Yes - 3 typical	No	‡Yes - FH 307T & FH 308	White, red, marker	No
FTB 312-3TA	Yes - 3 typical	No	‡Yes - FH 307T & FH 308	White, red, marker	Day intensity, night intensity, PEC, day mode, night mode
FTS 316-2	No	Yes - FH 306	No	White, red, marker	No
FTS 316-2AE	No	Yes - FH 306	No	White, red, marker	Day intensity, night intensity, PEC, day mode, night mode; †EAGLE monitoring
FTS 316-3	Yes - 3 typical	Yes - FH 306	No	White, red, marker	No
FTS 316-3AE	Yes - 3 typical	Yes - FH 306	No	White, red, marker	Day intensity, night intensity, PEC, day mode, night mode; †EAGLE monitoring

Alarm & Signal Definition:

White Alarm — Failure while in white flashing mode.

Red Alarm — Failure while in red flashing mode.

Marker Alarm — Failure of one or more marker lights.

Day Intensity Error — The flashhead flashed at an intensity too low for day lighting conditions.

Night Intensity Error — The flashhead flashed at an incorrect intensity (too low or too high) for night lighting conditions.

PEC Error — The photocell failed to switch state within a 19-hour period.

Day Mode — Indicates that the power converter is in day mode.

Night Mode — Indicates that the power converter is in night mode.

† **EAGLE:** The “AE” models contain a built-in modem. This allows them to communicate over a telephone line to a remote computer running EagleWin software. Each “AE” power converter, or only the “AE” master unit, at the tower site may have an assigned telephone number. This telephone connection allows remote monitoring of the system’s operation. An alarm is communicated to the remote computer.

‡ **Twin Flashheads:** During the day, the FTB 312-3T or FTB 312-3TA System operates an FH 308 Flashhead (white). At night, it operates an FH 307T Flashhead (red).

NOTE - Contact Rating: All alarm connections are electrically isolated contacts rated at 120V 1A.

System Operation

PCB1 Timing and Trigger Board

PCB1 governs all automatic functions. Two different PCB1 boards are used in the PC 312-3 Power Converter. The 24740xx board is used in all except the "AE" models. The 24747xx board is used in the "AE" models. The "xx" in the board's part number refers to its dash number, which changes with the board's internal programming. The major difference between the two is their jumpers, internal control and programming. Additionally, PCB1 for EagleWin "E" systems connects to a telephone line for remote monitoring by computer. The factory sets the jumpers and programs PCB1 before it leaves the factory.

Setting Up PCB1

Function Indicators

LED indicators on the PCB1 board signal alarms and internal functioning. Observe these LEDs to monitor equipment operations during checkout and troubleshooting. The essential features on PCB1 for troubleshooting are shown in *Figure 1-2* and *Figure 1-3*.

PCB1 24740xx

PCB1 (24740xx) has the following features:

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

Refer to *Table 1-2* for indicator and lamp functions, and *Table 1-3* for jumper settings.

PCB1 24747xx

PCB1 (24747xx) has the following features:

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

Refer to *Table 1-4* for indicator and lamp functions, and *Table 1-5* for jumper settings.

Table 1-2 PCB1 24740xx Neon or LED Function Indicators

LED or Neon Lamp	Function
I 1	NITE ERR — On for incorrect intensity for night operation.
I 7	DAY ERR — On for incorrect intensity for day operation.
I 2	PEC ALM — *Photocell alarm*; photocell failed to switch state within a 19-hour period; factory set.
I 8	WHT ALM — *White alarm;* on when a white alarm occurs.
I 3	RED ALM — *Red alarm*; on when a red alarm occurs.
I 9	MKR ALM — *Marker alarm;* on when marker alarm occurs (a marker or markers are out).
I 4	FAN — Not used.
I 10	SYNC — Flashes when flash control output is on. Flashes regularly during normal flashing operation of the power converter.
I 5	CONF — *Confirm*; Flashes after each valid flash.
I 11	DAY — The circuit board is in day mode.
I 6	NITE — The circuit board is in night mode.
I 12	MKRS — PCB1 is commanding markers to be on.
I 13	NEON — *Trigger power neon*; 120VDC trigger power is being supplied to the circuit board.

Table 1-3 PCB1 24740xx Jumper and Switch Settings

<table>
<tr><th>Jumper or Switch†</th><th>Jumper or Switch Label</th><th>Description</th></tr>
<tr><td>JP1</td><td>INT RED</td><td>Uncut (all models).</td></tr>
<tr><td>JP2</td><td>RES PEC</td><td>Cut in all models to allow usage of a resistive photocell.</td></tr>
<tr><td>JP3</td><td>ALRMON2</td><td>Uncut.</td></tr>
<tr><td>JP4</td><td>NOBACK</td><td>Cut to disable white light backup for failure of the red flashhead. Installation dependent.</td></tr>
<tr><td>JP5</td><td>FAILCLOSE</td><td>Uncut.</td></tr>
<tr><td>SW1-1</td><td>MRK0</td><td>Selects the marker lamp fail threshold. Chart etched on 24740 board shows “ALARM AT” thresholds.
MARKER Parameter in Board Software = 4ORLESS
<table>
<tr><th>Bulbs Installed</th><th>SW1-2/MRK1</th><th>SW1-1/MRK0</th><th>Alarm At</th></tr>
<tr><td>0</td><td>OFF</td><td>OFF</td><td>No alarms</td></tr>
<tr><td>2</td><td>OFF</td><td>ON</td><td>One bulb lit</td></tr>
<tr><td>3</td><td>ON</td><td>OFF</td><td>Two bulbs lit</td></tr>
<tr><td>4</td><td>ON</td><td>ON</td><td>Three bulbs lit</td></tr>
</table>
MARKER Parameter in Board Software = 5ORMORE
<table>
<tr><th>Bulbs Installed</th><th>SW1-2/MRK1</th><th>SW1-1/MRK0</th><th>Alarm At</th></tr>
<tr><td>0</td><td>OFF</td><td>OFF</td><td>No alarms</td></tr>
<tr><td>5</td><td>OFF</td><td>ON</td><td>Four bulbs lit</td></tr>
<tr><td>6</td><td>ON</td><td>OFF</td><td>Five bulbs lit</td></tr>
<tr><td>8</td><td>ON</td><td>ON</td><td>Six bulbs lit</td></tr>
</table></td></tr>
<tr><td>SW1-2</td><td>MRK1</td><td>Selects the marker lamp fail threshold. See the chart FOR SW1-1 above in this table.</td></tr>
<tr><td>JP8</td><td>CT</td><td>Cut to indicate top tier operation for this power converter in a catenary system. If both JP8 and JP9 are cut or both uncut, operation is for the bottom tier.</td></tr>
<tr><td>JP9</td><td>CM</td><td>Cut to indicate middle tier operation for this power converter in a catenary system. If both JP8 and JP9 are cut or both uncut, operation is for the bottom tier.</td></tr>
<tr><td>JP10</td><td>ISOL</td><td>Cut to allow an alarm for only local alarm conditions on this power converter.
Uncut to allow an alarm for local alarms and alarms signalled though a communications device.</td></tr>
<tr><td>JP11</td><td>RETROFIT</td><td>Cut to allow the 24740xx Circuit Board to emulate other boards on a tower of mixed circuit boards.</td></tr>
<tr><td>JP12</td><td>MARKERNO</td><td>Uncut — energizes the marker relay in day mode and de-energizes it in night mode.
Cut — de-energizes the marker relay in day mode and energizes it in night mode. An energized marker relay turns off markers.</td></tr>
<tr><td>JP13</td><td>REDSENSE</td><td>Cut to enable the usage of sense boards. Uncut to allow usage with laminated transformers (#8111). For internal design changes. Factory use only.</td></tr>
<tr><td>JP14</td><td>-</td><td>Uncut; factory use only.</td></tr>
<tr><td>JP15</td><td>-</td><td>Uncut; factory use only.</td></tr>
</table>

† (Jumpers — OFF=CUT=OPEN)

Table 1-4 PCB1 24747xx Neon or Lamp Function Indicators

LED or Neon Lamp	Function
I 15	NITE ERR — On for incorrect intensity for night operation.
I 9	DAY ERR — On for incorrect intensity for day operation.
I 14	PEC ALM — On when the photocell fails to switch state within a 19-hour period; factory set.
I 8	WHT ALM — On when a white alarm occurs.
I 13	RED ALM — On when a red alarm occurs.
I 7	MKR ALM — On when marker alarm occurs (a marker or markers are out).
I 12	FAN — Not used.
I 6	SYNC — Flashes when flash control output is on. Flashes regularly during normal flashing operation of the power converter.
I 11	CONF — *Confirm;* flashes after each valid flash.
I 5	DAY — The circuit board is in day mode.
I 10	NITE — The circuit board is in night mode.
I 4	MKRS — PCB1 is commanding markers to be on.
I 3	NEON — Trigger power neon; 120VDC trigger power is being supplied to the circuit board.
I 1	TD — Modem is in transmit mode.
I 2	RD — Modem is in receive mode.

Table 1-5 PCB1 24747xx Jumper Settings

Jumper Board Name	Jumper Label	Description
JP2	INT RED	Not cut (all models).
JP1	RES PEC	Cut to allow PCB1 to recognize a resistive photocell connection.
TP1 to TP5	TEST, LTV, DAY, NITE, RED	Test points for factory use only.

Photocell

In a single unit installation, you connect the photocell to TB1-1 and TB1-2 on the main panel of the PC 312-3. In a multiple-unit installation you connect it to TB1-1 and TB1-2 of the first power converter, the *master* unit. Other units are *slaves*. Typically in multiple-unit installations, the first PC 312-3 is the one that operates the topmost flashhead. In multiple-unit installations, TB1-1 and TB1-2 of slave 1 are jumpered together, as is TB1-1 and TB1-2 of slave 2.

Power Converter Main Panel: Alarms and Signals

Terminals on TB1 of the PC 312-3 indicate various system failures and day or night modes of operation, and they are connected to electrically isolated contacts of relays inside the PC 312-3. Electrically isolated contacts are not connected to any other circuitry. They act as switches rated at 1 ampere 120 VAC, allowing you to connect the PC 312-3 to external monitoring equipment. They change state (for example, from normally closed (NC) to open or from normally open (NO) to

closed) when the condition indicated on the front panel occurs.

The ability to monitor some states is available only on the "A" model power converters. These are indicated on the main panel in *Figure 1-1*.

Table 1-6 describes the available alarm functions on TB1 of the power converter.

Master/Slave Interconnect

The master/slave interconnect terminals at TB1-4 and TB1-5 are connected between power converters in a multiple-unit installation. These terminal connections supply two functions:

- A synchronization signal to flash their lights simultaneously.
- A failure of a top light in night mode causes the master power converter for that failing light to signal backup mode to all power converters; all flashheads on the structure flash in backup mode (correct night intensity white back-up). Marker lights are turned off.

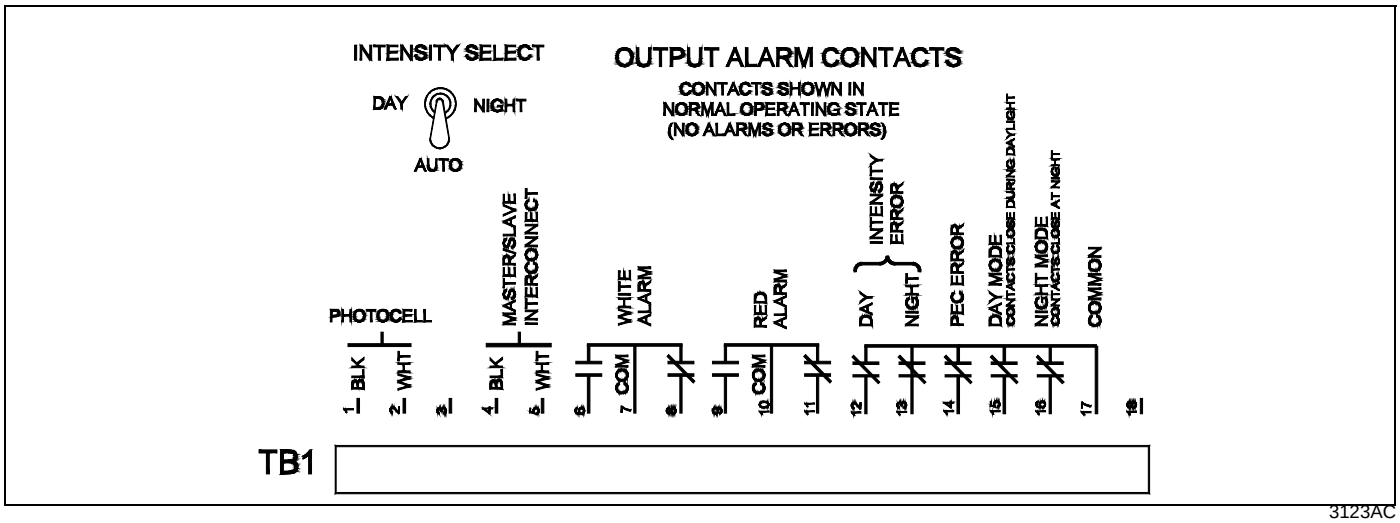


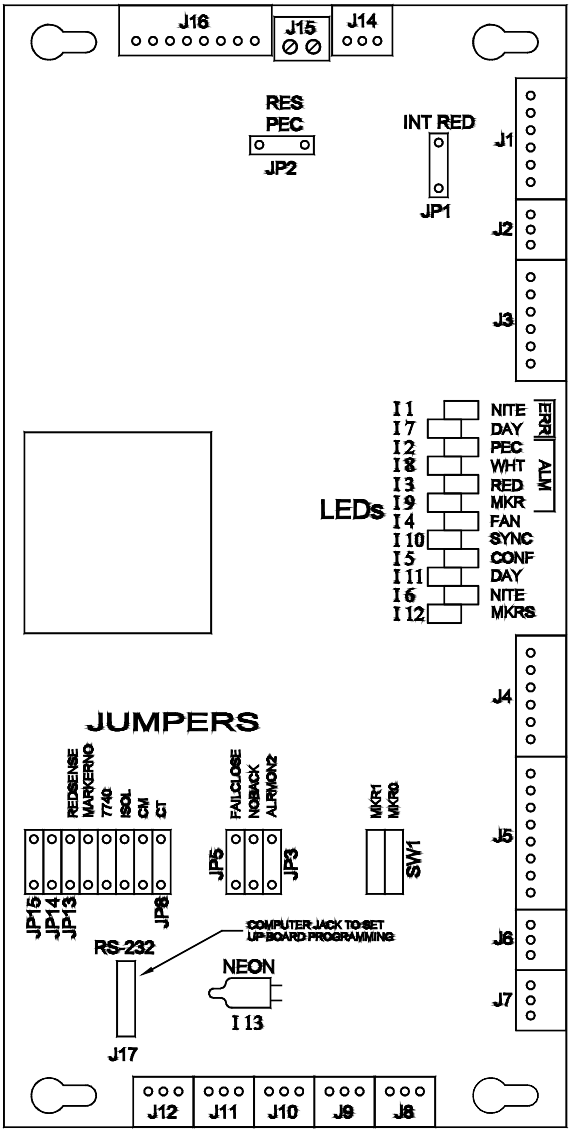
Figure 1-1 View of TB1 Wiring Functions for FTB 312-3A/AE or FTB 312-3T/TA

Table 1-6 Alarm Functions

Alarm/ System	Function
White Alarm/ all	Connections between TB1-7, and TB1-6 or TB1-8 signal the alarm for improper flash intensity or no flash at all. The normally open (NO) contacts close and the normally closed (NC) contacts open.
Red Alarm/ all	Connections between TB1-10, and TB1-9 or TB1-11 signal the alarm under the following conditions: • The flashhead malfunctioned during red operation. • The PC 312-3 detected improper flash intensity or no flash at all during red night mode operation. The normally open (NO) contacts close and the normally closed (NC) contacts open.
Marker Alarm/ all	Connections between TB5-5, and TB5-4 or TB5-6 signal the alarm under the following conditions: • One or more marker lamps is not functioning. • The marker lamp current is too low or not present. The normally open (NO) contacts close and the normally closed (NC) contacts open.
Intensity Error/ "A"	"A" models signal a day intensity error between TB1-12 and TB1-17 or a night intensity error between TB1-13 and TB1-17. Error occurs if a flashhead is flashing at the incorrect intensity for the day or night lighting condition determined by the photocell. The normally closed (NC) contacts open.

Table 1-6 Alarm Functions (Continued)

Alarm/ System	Function
PEC Error/ "A"	"A" models signal a photocell error between TB1-14 and TB1-17. The error occurs when a photocell has failed to switch state from day to night or night to day within a 19-hour period. This period is factory adjustable. The normally closed (NC) contacts open.
Day Mode/ "A"	"A" models signal day mode operation between TB1-15 and TB1-17 when the internal operation of the power converter is in day mode. When the signal occurs as it should during daylight, the normally closed (NC) contacts are closed. These contacts open at night.
Night Mode/ "A"	"A" models signal night mode operation between TB1-16 and TB1-17 when the internal operation of the power converter is in night mode. When the signal occurs as it should during nighttime, the normally closed (NC) contacts are closed. These contacts open during daylight.



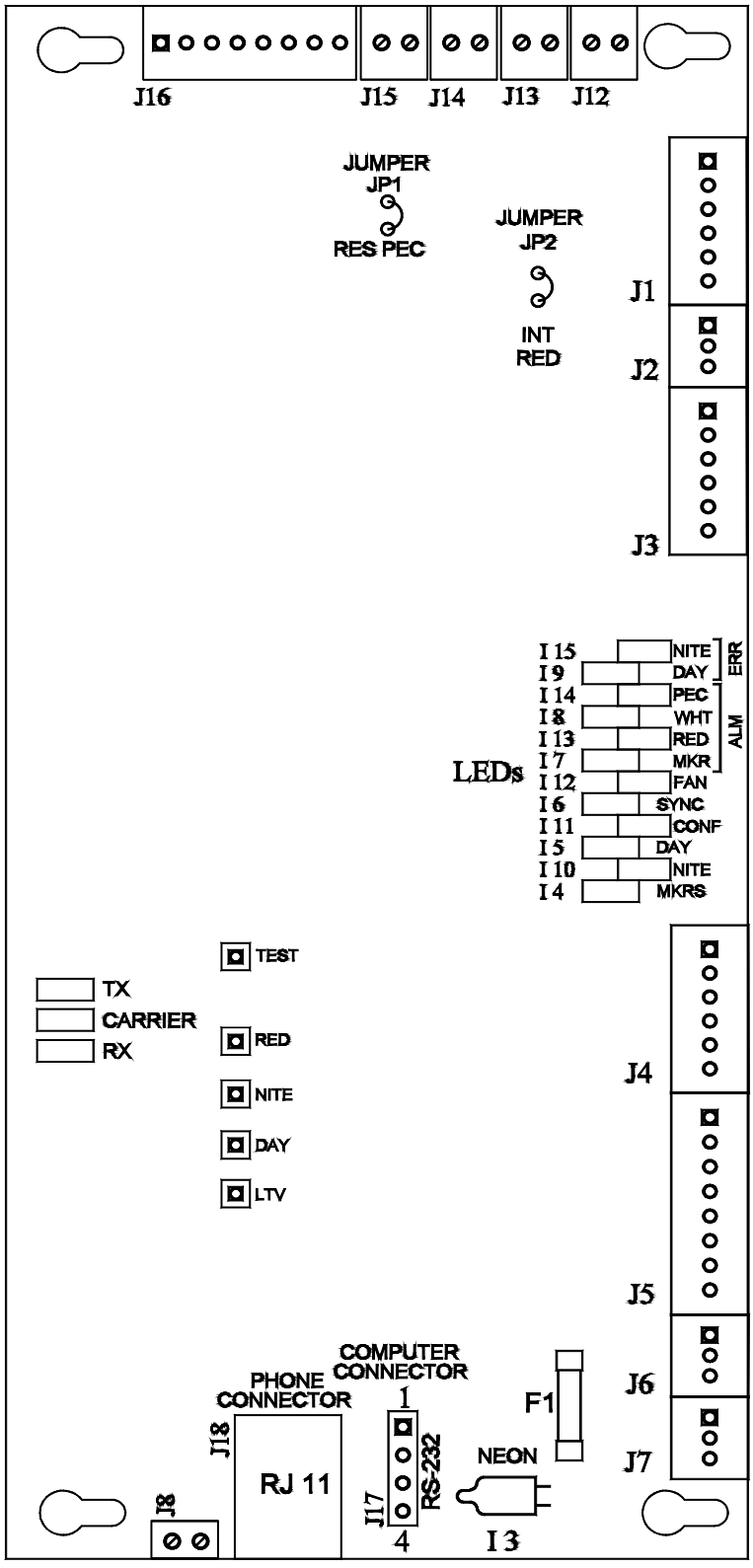
JUMPER†	FUNCTION
JP1	INT RED – Not cut in the 312-3. This jumper is for power converters with internal controllers for external red beacon lamps.
JP2	RES PEC – Cut to allow the power converter to use a resistive photocell. Cut in the PC 312-3.
JP3	ALRMON2 – Applies to beacon lamps. Not used in the PC 312-3.
JP4	NOBACK – Cut to disable white light backup upon the failure of the red night flashhead operation.
JP5	FAILCLOSE – Applies to power converters that use external red light controllers. Not cut in the PC 312-3.
SW1-1	Selects the marker lamp fail threshold. Chart etched on 24740 board shows "ALARM AT" thresholds. MARKER Parameter in Board Software = 4ORLESS Bulbs Installed / SW1-2/MRK1 / SW1-1/MRK0 / Alarm At: 0 / Off / Off / No alarms 2 / Off / On / One bulb lit 3 / On / Off / Two bulbs lit 4 / On / On / Three bulbs lit MARKER Parameter in Board Software = 5ORMORE Bulbs Installed / SW1-2/MRK1 / SW1-1/MRK0 / Alarm At: 0 / Off / Off / No alarms 5 / Off / On / Four bulbs lit 6 / On / Off / Five bulbs lit 7 / On / On / Six bulbs lit
SW1-2	MRK1 - Selects the marker lamp fail threshold. See the chart above for SW1-1 (MRK0).
JP8	CT – Cut to indicate top tier operation for this power converter in a catenary system. If both JP8 and JP9 are cut or both uncut, operation is for the bottom tier. Internal programming must be set to CATENARY or RED CAT for this jumper to be operative.
JP9	CM – Cut to indicate middle tier operation for this power converter in a catenary system. If both JP8 and JP9 are cut or both uncut, operation is for the bottom tier. Internal programming must be set to CATENARY or RED CAT for this jumper to be operative.
JP10	ISOL – Cut to allow an alarm for only local alarm conditions on this power converter. Not cut to allow an alarm for local alarms and alarms signaled to this power converter through a communications bus wire.
JP11	RETROFIT – Cut to allow the 4740 board to emulate other boards on a tower of mixed circuit boards. The parameter RETROFIT TYPE in internal programming on the 4740 must also be set to the board type that the 4740 is to emulate: 7413, 7740-CMOS, or 7740-PLD.
JP12	MARKERNO – Uncut to energize the power converter marker relay during the day and de-energize it at night. Cut to de-energize the power converter marker relay in day mode and energize it at night.
JP13	REDSENSE – Cut to enable the 4740 board to be used with sense boards. Uncut to allow use with laminated transformers (#8111). This refers to internal design changes. Factory use only.
JP14	Unused – Factory use only.
JP15	Unused – Factory use only.

† JUMPERS – OFF=CUT=OPEN

LED Indicator	Function
I 1	NITE ERR – On for a night intensity error.
I 7	DAY ERR – On when a day intensity error occurred (the light flashed at an incorrect intensity).
I 2	PEC ALM – On for photocell alarm (photocell failed to switch state within 19 hours).
I 8	WHT ALM – On when a white alarm occurs (white light failed).
I 3	RED ALM – On for a red alarm (a red light failure occurred).
I 9	MRK ALM – On when a marker alarm occurs (a marker or markers are out).
I 4	FAN – Not used.
I 10	SYNC – Flashes when flash control is present on the master/slave interconnect line.
I 5	CONF – (Confirm) Flashes after the timing and trigger board detects a valid flash.
I 11	DAY – On when the power converter is in day mode.
I 6	NITE – On when the power converter is in night mode.
I 12	MKRS – On when PCB1 is commanding markers to be on.
I 13	TRIGGER POWER NEON – On when the 120VDC trigger power circuit for the flashhead is active.

474031

Figure 1-2 PCB1 Pictorial (24740xx)



CONNECTOR	FUNCTION
RS-232	Computer cable connector used to program the circuit board at the factory.
RJ11	Telephone line connector.

JUMPER	FUNCTION
JP1	Cut to use the power converter with a resistive photocell. Cut on the PC 312-3.
JP2	INT RED – Cut to use the internal red controller of the power converter. Not cut in the PC 312-3.

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

474732

Figure 1-3 PCB1 Pictorial (24747xx)

Section 2 — Outline, Mounting, 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. Damage claims should be reported promptly to the freight handler.

Tools

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

- #2, flat-blade screwdriver
- 5/16 inch, flat blade screwdriver
- #2, Phillips® 9-inch shank screwdriver
- Set of combination wrenches
- Medium, slip joint pliers
- Long-nose pliers
- 8- or 10-inch adjustable wrench
- Triplett ™ Model 630-NA VOM, or equivalent, analog volt-ohm meter
- Multi-purpose crimp tool

Access

WARNING

STOP: Before proceeding—read warning on Page iii. Disconnect the primary power before opening the power converter enclosure or flashhead.

Power Converter

Quick-release latches secure the cover. When you release these you can open the cover for internal access.

Flashhead

The flashhead normally contains no interlock. Do not open the flashhead unless you have disconnected primary power from the power converter. 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. Look for these wires on the ceramic terminal posts.

You may pivot the lens open by disengaging quick-release latches. Be careful when opening the lens to ensure that it does not strike adjacent objects. Two lanyard cables secure the lens to the flashhead.

Mounting

Power Converter

Mounting and outline dimensions for the power converters are shown in *Figure 2-1*. 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.

FTCA does not furnish mounting hardware unless you order it as part of an installation kit.

Flashhead

Mounting and outline dimensions for the flashhead are shown in *Figure 2-2*. Protect the flashhead from lightning strikes. The flashhead may be mounted to painted or unpainted surfaces. Use the following guidelines:

- 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.
- Use a bonding strap when mounting the flashhead to the structure, and fasten the bonding strap to the flashhead with the mounting bolt that goes through the leg that contains the ground connection.

Leveling

The flashhead must be level for correct vertical beam alignment. Two leveling vials are permanently attached to the flashhead assembly. 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*. Use the following guidelines:

- 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.
- *Mount the photocell vertically on the top end of a vertical length of conduit to prevent water from entering and damaging the unit.*

Red Light Fixtures

Obtain outline, clearance and mounting details for L-810 markers from separate drawings provided by FTCA (or others). ***This manual does not contain information about installing red markers.***

Installation Wiring

NOTE

Only general information for a typical installation is presented here, and more specific information may be needed for your site. In particular, because the L-810 marker (side-light) lighting components for red nighttime lighting are often purchased from others, and have many variations, only general hook-up information for flashing and monitoring the red lights is included.

This manual may not contain all the information about installation wiring required for your site. *Consult any installation drawings prepared especially for your site or supplied with the equipment. Site installation drawings should take precedence*.

Also note that FTCA wiring diagrams define minimum requirements recommended for satisfactory equipment operation. These minimum requirements may not be enough, by themselves, to comply with local electrical codes. *It is the responsibility of the installer to comply with all applicable electrical codes.*

Consider the following wiring: power service, marker lights, power converter, control and signal, and the flashhead.

All installation wiring should have an insulation rating of 600 volts.

You can find conduit and other distribution wiring details on electrical installation diagrams provided by FTCA or others.

FAA Advisory Circular 70/7460-1J gives the lighting requirements for various types of structures.

Power Converter Wiring

Power Service Wiring

Power service wiring must be sized to satisfy the load demand of the red light markers and the

power converters. Each marker lamp draws 116 watts. Night operation of each power converter requires 250 volt-amperes. See *Specifications* in *Section 1*.

A typical installation has three power converters and two tiers of markers. Thus, the *last* slave power converter connected together in a chain of units is connected to a flashhead only—no markers are connected to this unit. Each steady-burning marker draws approximately 1 ampere. To determine wire gauge, consider the *total* ampere load and the length of the run. Please read the notes on the installation wiring diagrams supplied both in this manual and with the equipment.

Please note that FTCA recommends the following guidelines for red light wiring:

- Using a maximum wire size of #12 AWG from the red light module terminal block inside the power converter
- Running a short length of #12 AWG wire to a junction box near the power converter when load requirements call for heavier gauge wire to red light fixtures.

Flashhead Wiring

The wiring between the power converter and flashhead requires five conductors with 600 volts (minimum) insulation. Two of the conductors must be #10 AWG. The other three may be #16 AWG (minimum; for mechanical strength) if you are cabling together individual wires. FTCA recommends using FTCA Part Number 6340 cable for this application.

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

If you use FTCA Part Number 6340 cable without electrical conduit, you should secure it to the main structure not more than 5 feet (1.5 meters) below the flashhead and at regular intervals between the flashhead and power converter.

Securing the Cable

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

1. Run the cable along one of the tower legs and wrap one full turn of two-inch Scotchrap™ #50 tape, or the equivalent, around the cable and tower leg at regular intervals of about 5 feet (1.5 meters).
2. Wrap three full turns of one-inch Scotchrap Filament #890 tape, or the equivalent, over the Scotchrap #50 tape.
3. Wrap four full turns of two-inch Scotchrap #50 tape, or the equivalent, over the Scotchrap Filament #890 tape.
4. Perform steps 1 through 3 also directly above and below any tower leg flanges that the cable may cross.

Photocell Wiring

For multiple-unit lighting, each individual lighting unit requires a power converter and flashhead, but the photocell is connected to only one unit in a group of multiple units. This unit is called the *master* unit, the others are called *slaves*.

Connect the photocell to TB1-1 and TB1-2 on the master power converter. The photocell terminals TB1-1 and TB1-2 on the slave power converters are jumpered together. Also, you connect the master unit (to which the photocell is directly connected) to the topmost flashhead and top tier of markers.

Master/Slave Interconnect Wiring

In a multiple-unit system, the master unit and slave units communicate over the “master/slave” interconnect wiring. The master and slave power converters are connected together for communication at the master/slave interconnect terminals TB1-4 and TB1-5 on the main panel. The recommended size wiring for this purpose is #16 AWG. Twist the wires together to form a twisted pair at the rate of 12 twists per foot.

FTS 316-2 and FTS 316-3 DC Back-Up Power Source

Use the installation drawings in this manual in *Figure 2-6* and *Figure 2-12* or site installation drawings.

The FTS 316 systems switch from AC power lines to a DC back-up power source if the AC power fails. These systems use a 24 VDC battery back-up power source. Mount the batteries and the voltage inverters closely together to keep the battery cables as short as possible. Use braided battery cables of a gauge determined by their length as shown in *Figure 2-13* or *Figure 2-14*. Use soldered-lug battery connectors on the cable.

Alarm Relay Wiring

The wiring for alarm relay connections in *Figure 2-15* minimizes the possibility of damage caused by high voltage transients.

Installation Checklist

Complete the following steps before applying power to the lights.

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

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

   - Ensure that the case is mounted upright, is water tight, and grounded.
   - Check hardware inside the case to ensure that the mounting screws and nuts are tight.
   - Ensure that only the bottom of the case has drain holes and that they are clear.
   - Ensure that no holes are punched or drilled on the top surface of the case.
   - Ensure that air can flow around the case.
   - Mount the power converter away from radio frequency interference (RFI).
4. Flashhead Mounting

   - Ensure that the flashhead lens can be opened without striking other objects.
   - Level and aim the flashhead.
5. Photocell Mounting

   - Locate photocell where it views unobstructed polar sky with no direct or reflected artificial lighting striking it.
   - Mount the photocell vertically on the top end of a vertical length of conduit to prevent water from entering the unit.
6. Marker Mounting (Sidelights):

   - Ensure that marker junction boxes are mounted with the weep holes down.
   - Ensure that the junction boxes are water tight.
7. Power Converter Wiring

   Examine the installation drawings and use the following checks:

   - Check for proper incoming service voltage.
   - Wire each unit according to the instructions.
   - In multiple installations, all power converters must be wired to the same electrical phase. Wire all three power converters to one 20-amp. circuit breaker.
   - Check all electrical connections for tightness.
   - Check all terminal strip connections for tightness.
   - Ground the power converter.
   - Wires at TB1-4 and TB1-5 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. Ensure that TB1-4 is connected to all TB1-4 connections on all units, and TB1-5 is similarly connected.

8. Flashhead Wiring

   - Protect the top flashhead against lightning strikes.
   - Ground the flashhead.
   - Check the wiring of the flashhead cable to the flashhead.
   - Secure the flashhead cable to the tower. Support and tape the flashhead cable to prevent its movement by the wind.

9. Photocell Wiring

   - Connect the photocell to the master power converter: the black wire to TB1-1 and the white wire to TB1-2.
   - Ensure that TB1-1 and TB1-2 on the slave units are jumpered together.

10. Inverter Wiring

    Check the DC power connections for the power inverter and the battery as follows:

    - Make certain that the cables are the correct size (see *Figure 2-13* or *Figure 2-14*).
    - Ensure that the connections are clean and tight.
    - Ensure that the battery voltage is correct (19.2 to 34).

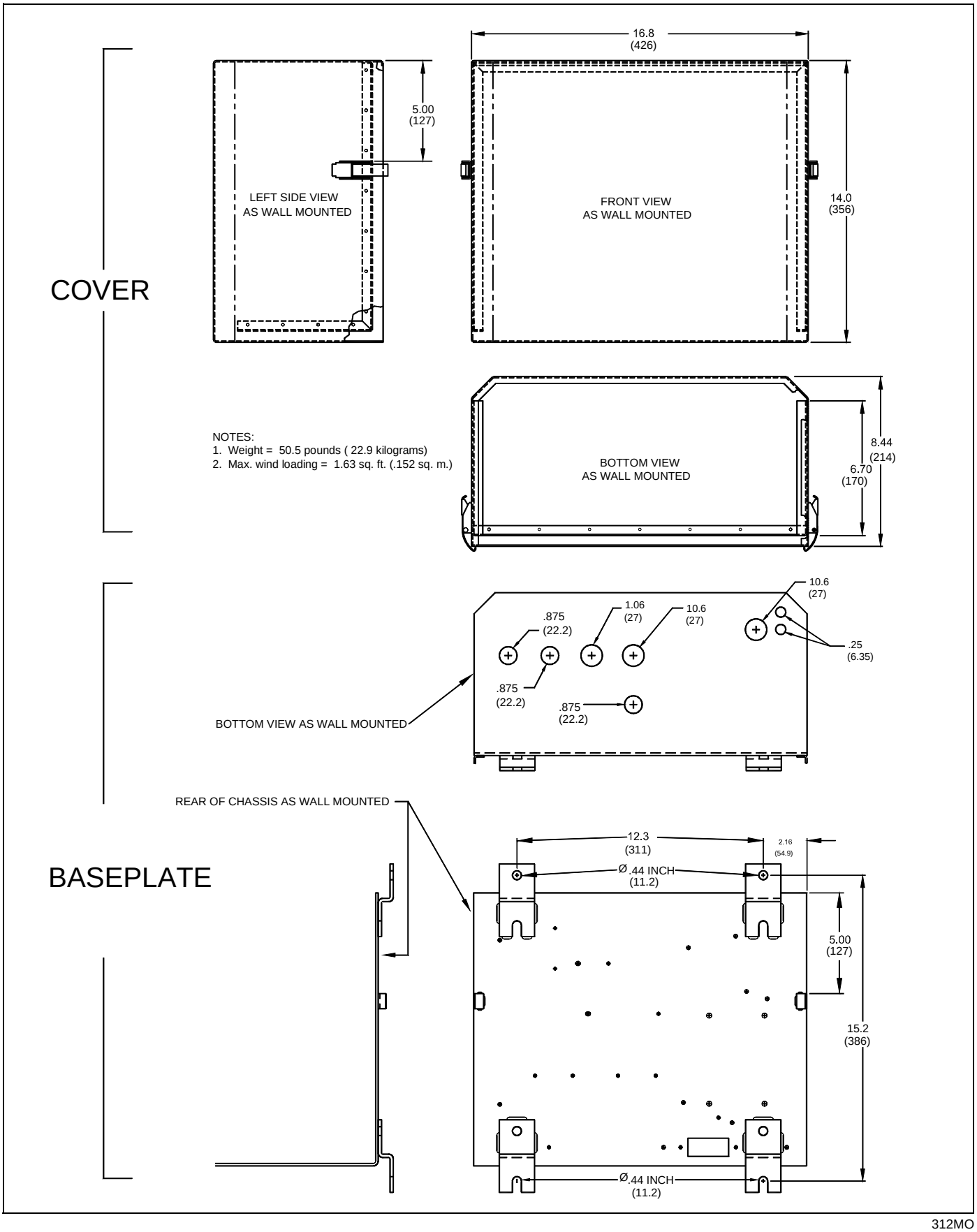
11. Alarm Wiring

    - If external alarm detection circuit responds to *closed* contacts, ensure that they are wired to the contacts on TB1 that *close* on alarm.
    - If external alarm detection circuit responds to *open* contacts, ensure that they are wired to the contacts on TB1 that *open* on alarm.
    - Alarm wiring should be lightning and RFI protected: shielded, grounded shield, and in a conduit.
    - If a specific alarm is ganged together from all power converters as one, ensure that the wiring follows local installation instructions.

12. Marker Wiring (Sidelights)

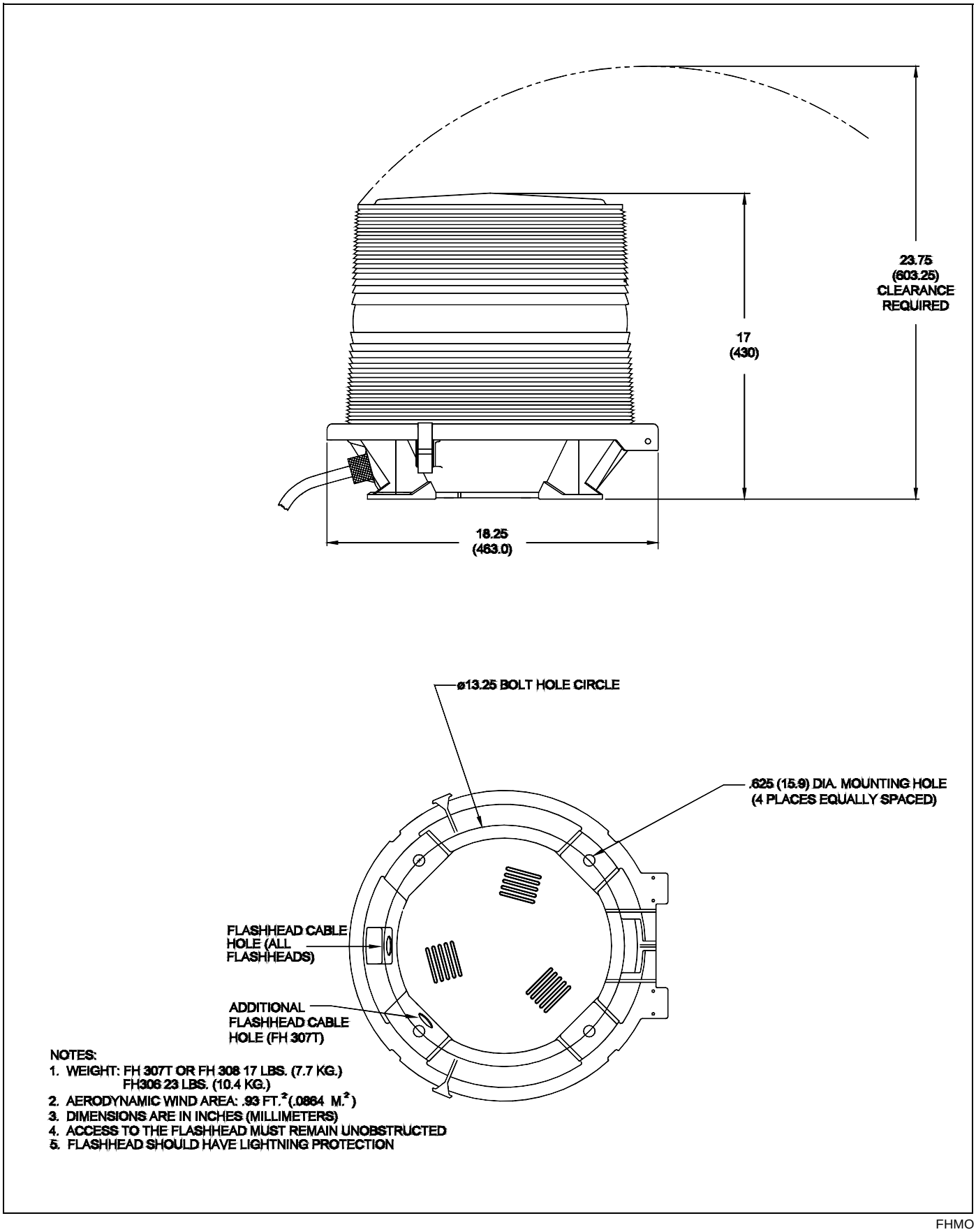
    - Ensure that each power converter powers only one tier of markers.
    - Ensure that the top tier of markers is wired to the master power converter.
    - Check the wiring gauge to the markers to ensure less than 3% voltage drop.
    - Ensure that all markers have all their lamps installed.
    - Ensure that marker lamps are 116 Watts *only*.

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



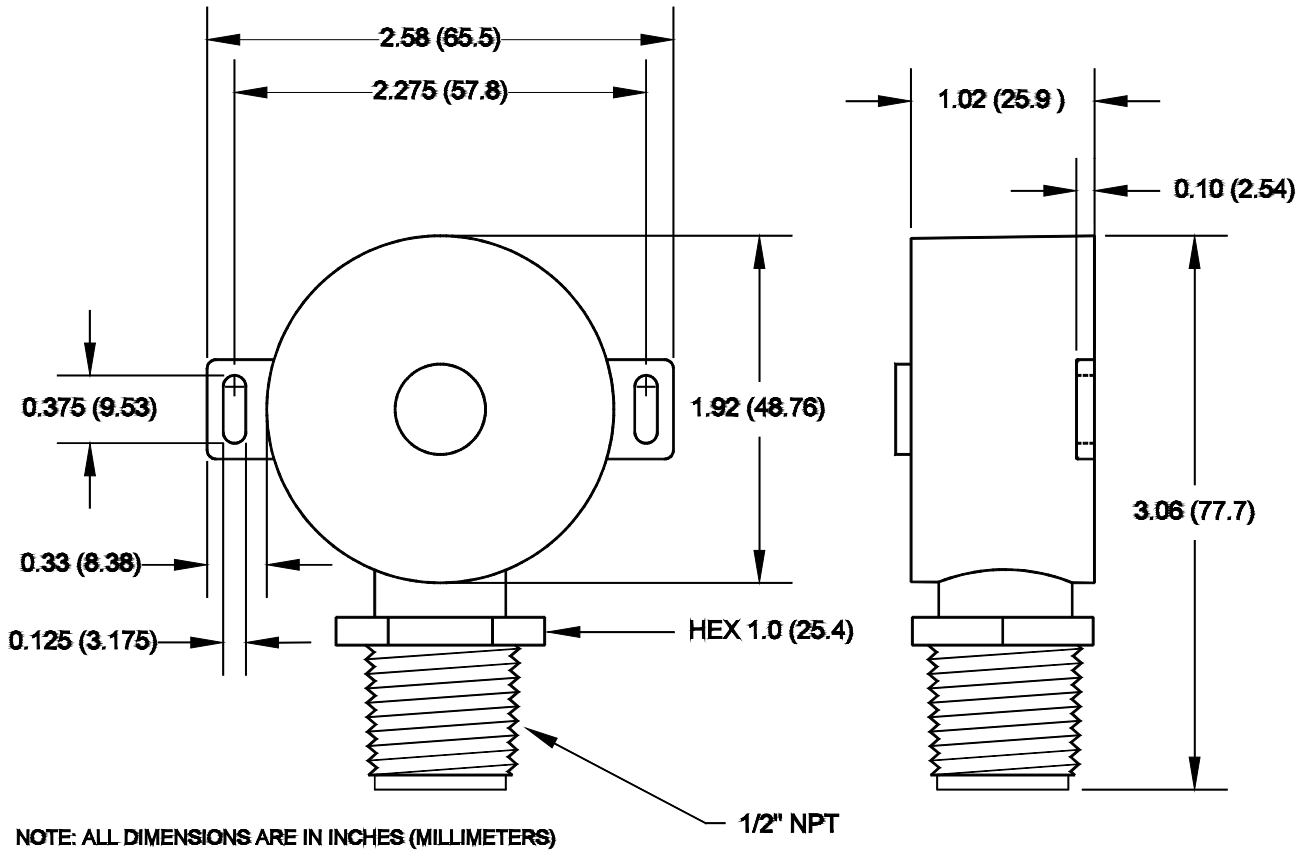
312MO

Figure 2-1 Power Converter Mounting and Outline



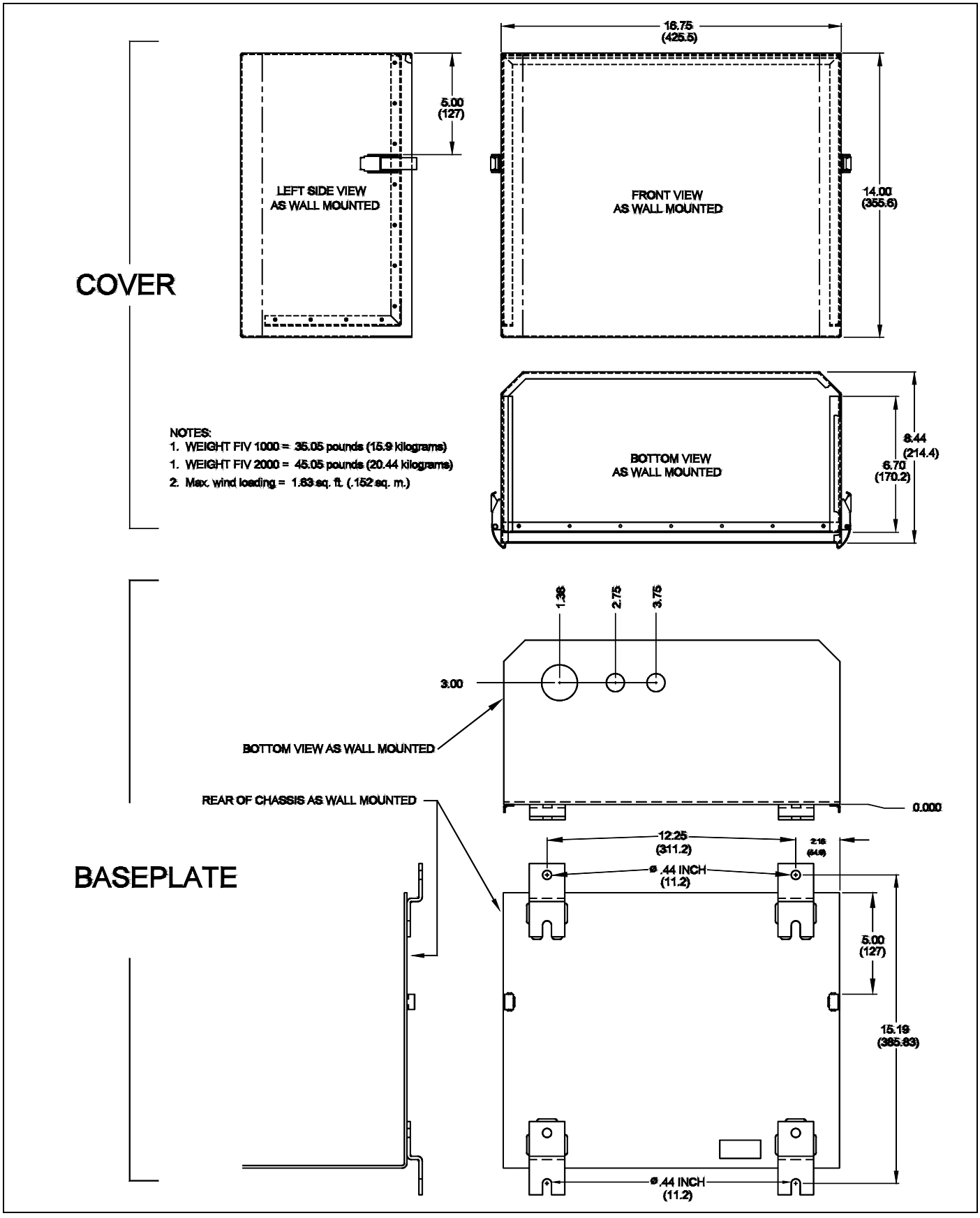
FHMO

Figure 2-2 Flashhead Mounting and Outline



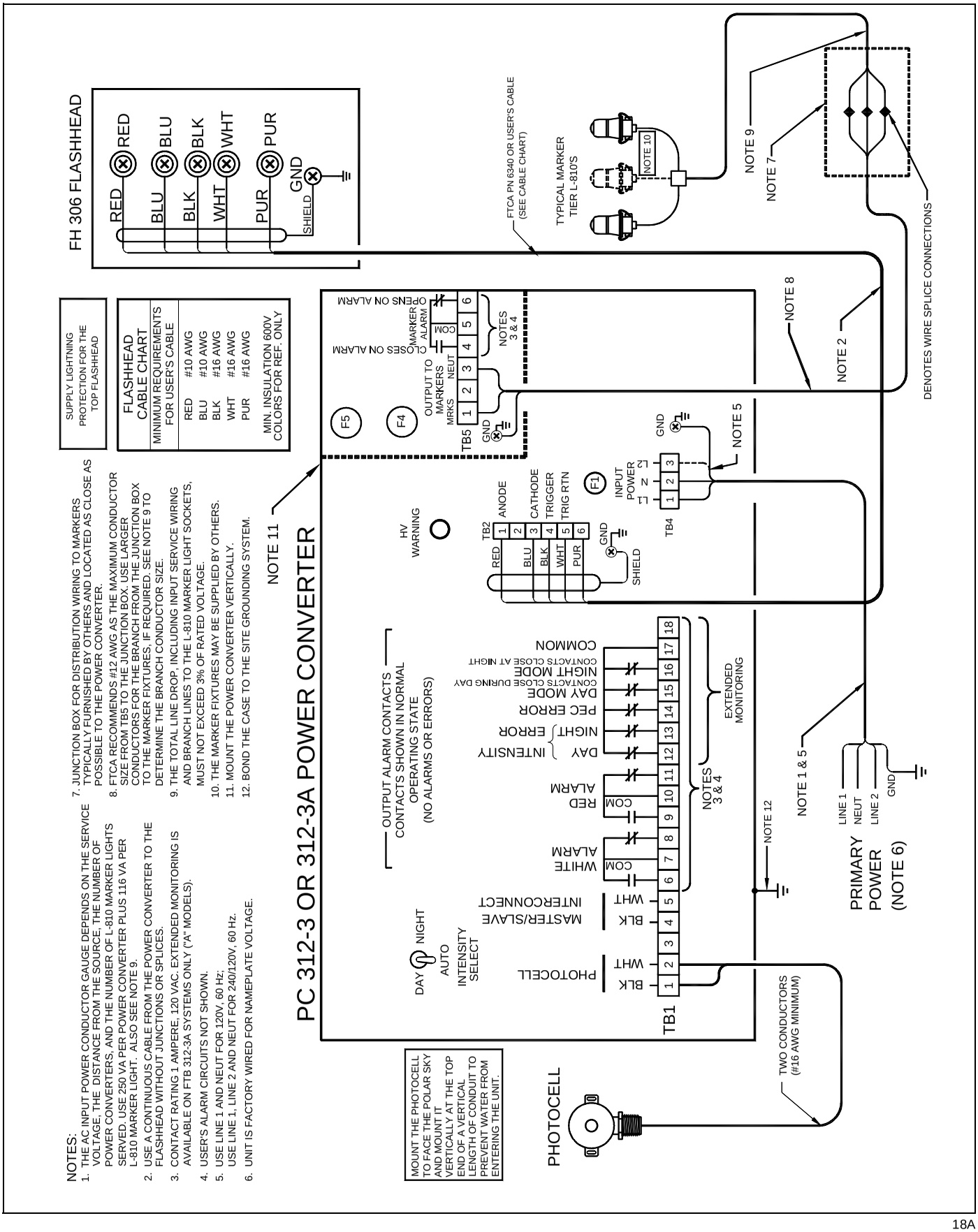
PEC510MO

Figure 2-3 Photocell Mounting and Outline



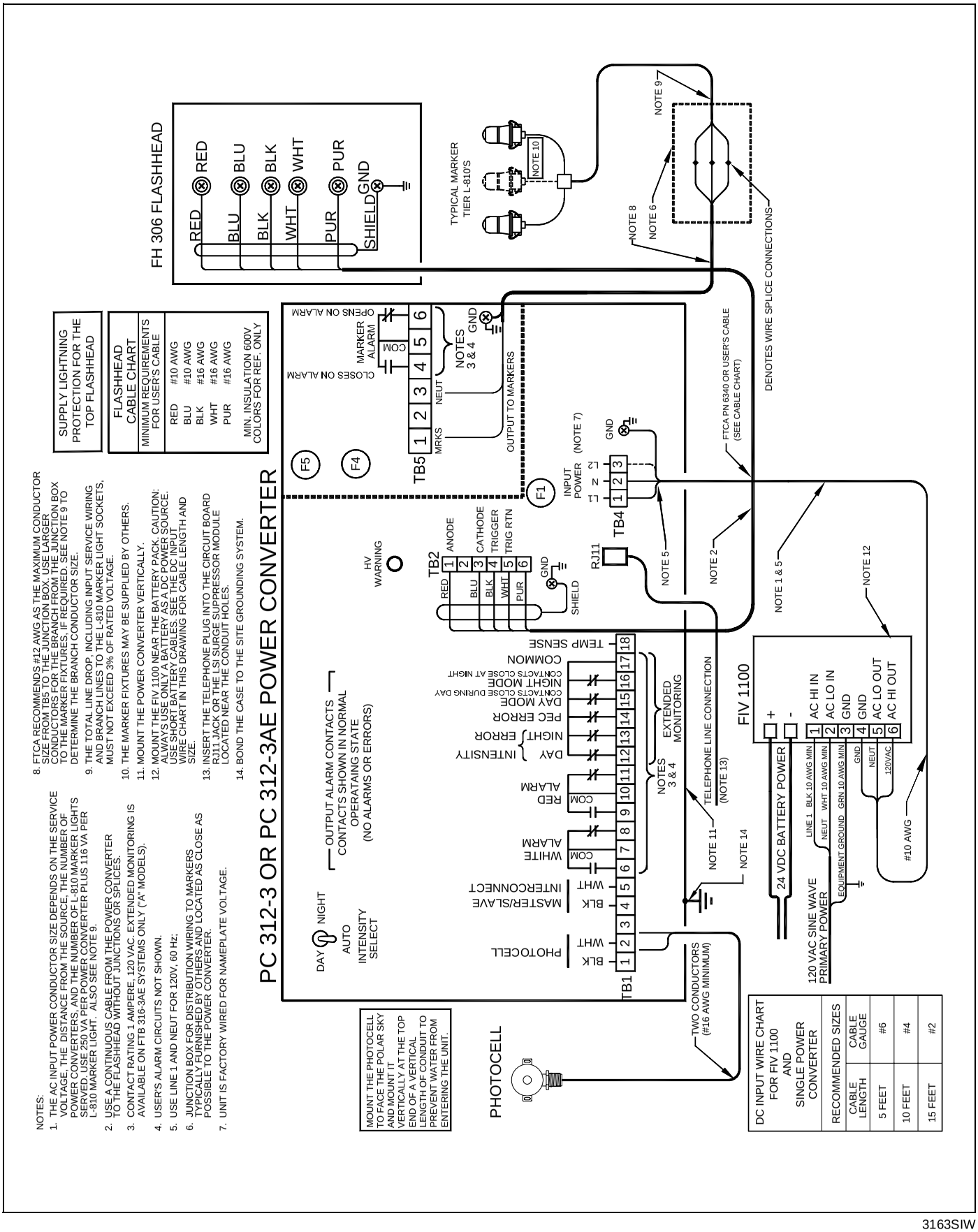
FIV1100MO

Figure 2-4 Inverter Mounting and Outline



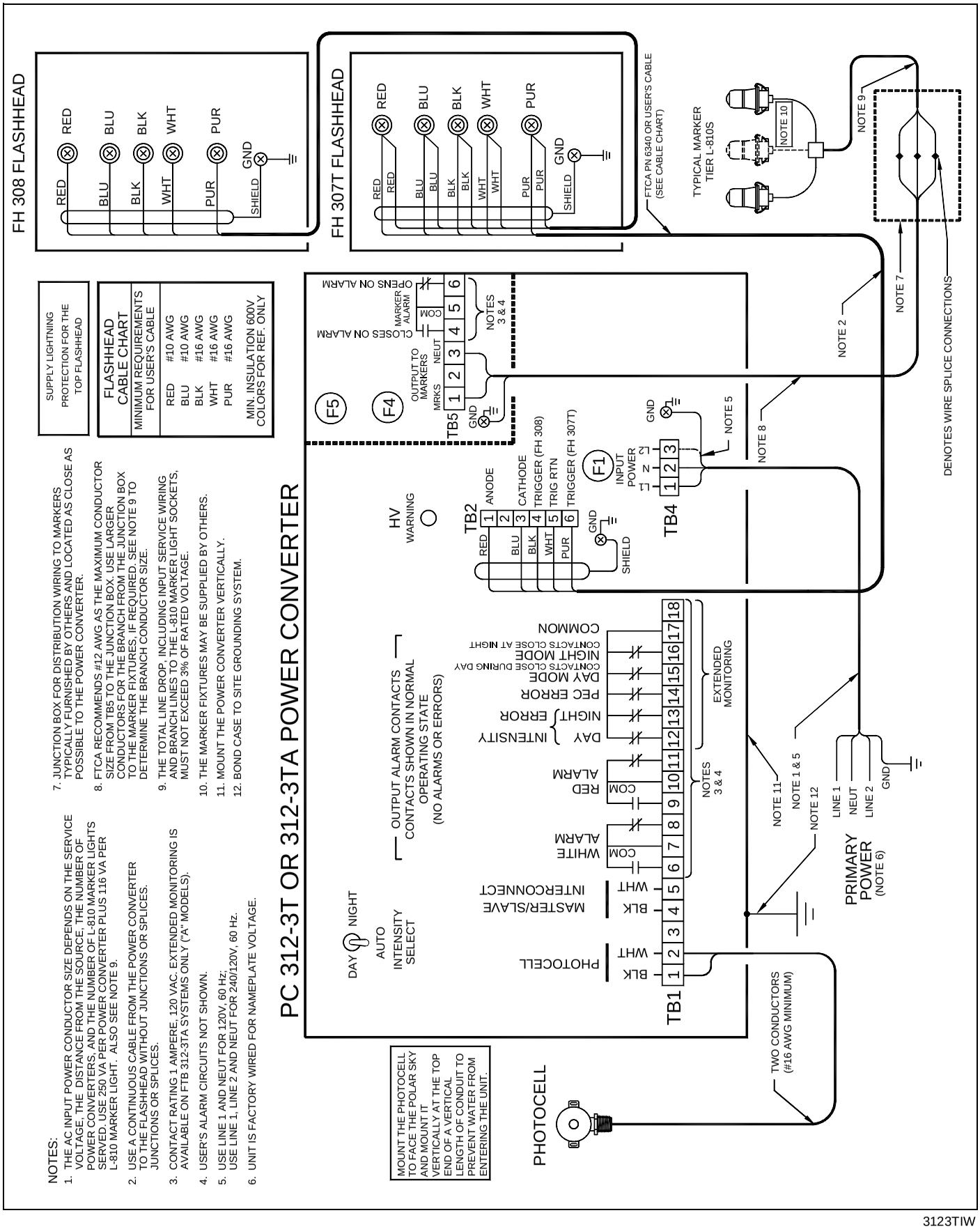
18A

Figure 2-5 FTB 312-3 or FTB 312-3A System Installation Wiring



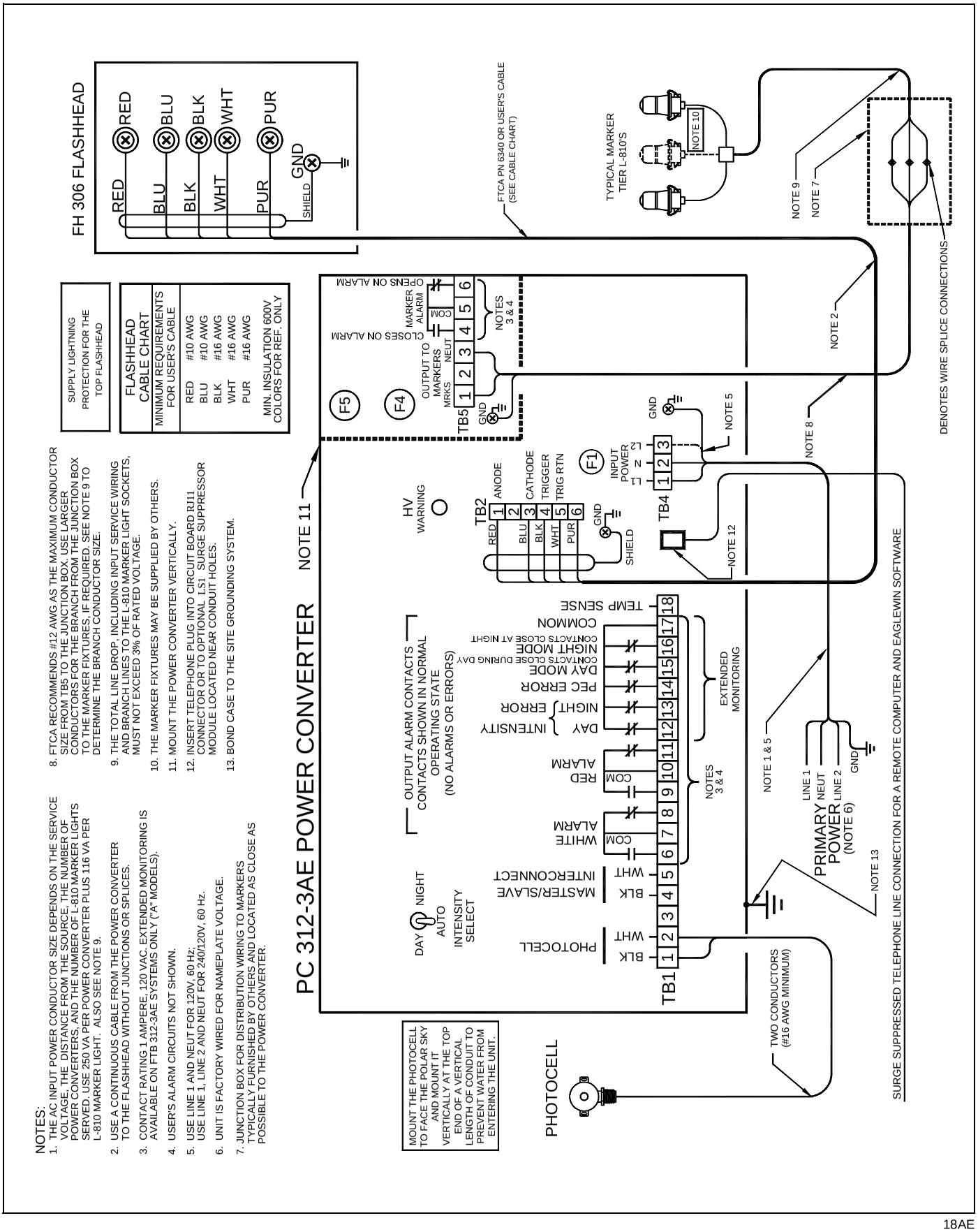
3163SIW

Figure 2-6 FTS 316-2 and FTS 316-2AE System Installation Wiring



3123TIW

Figure 2-7 FTB 312-3T or FTB 312-3TA System Installation Wiring



18AE

Figure 2-8 FTB 312-3AE Single Unit System Installation Wiring

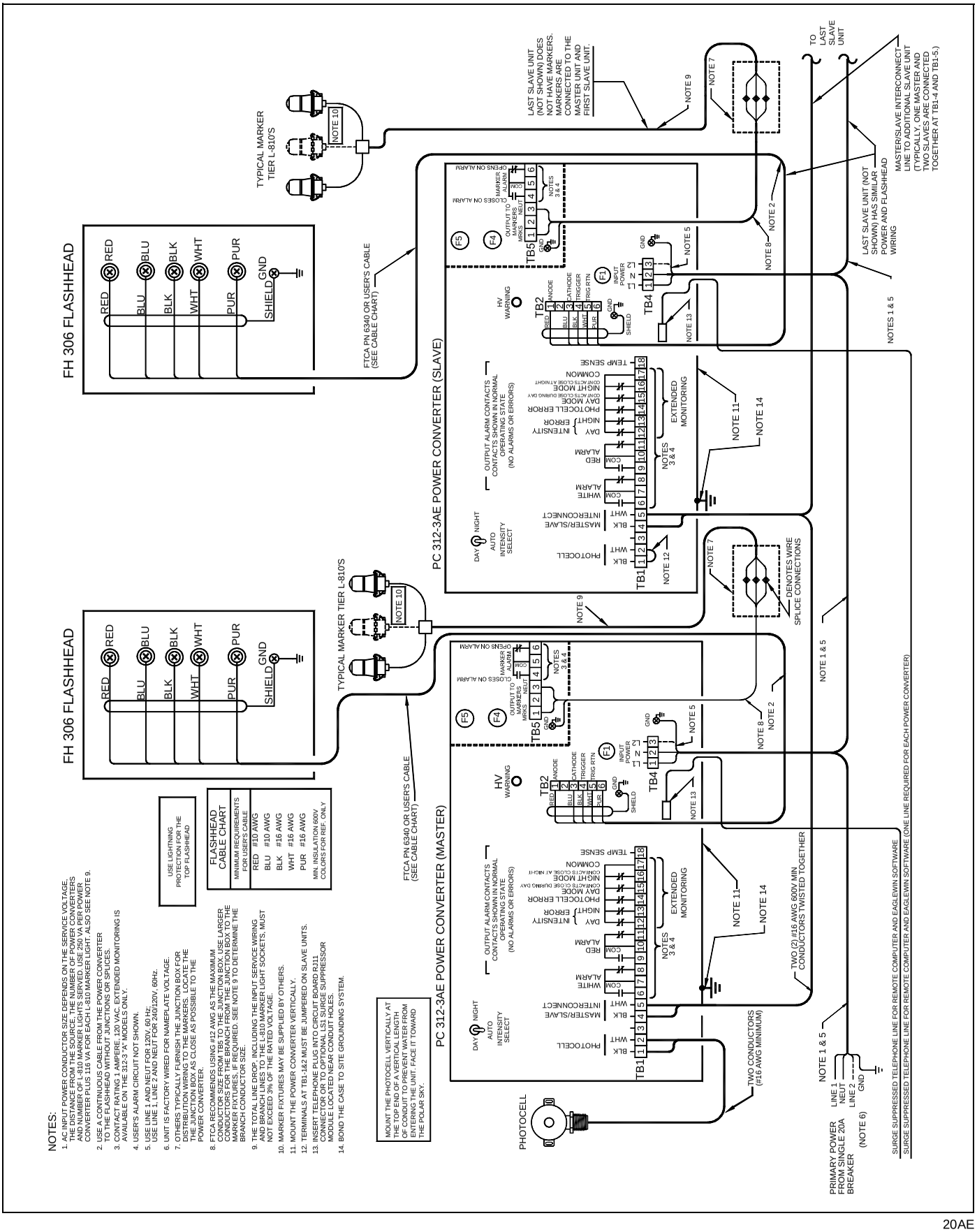
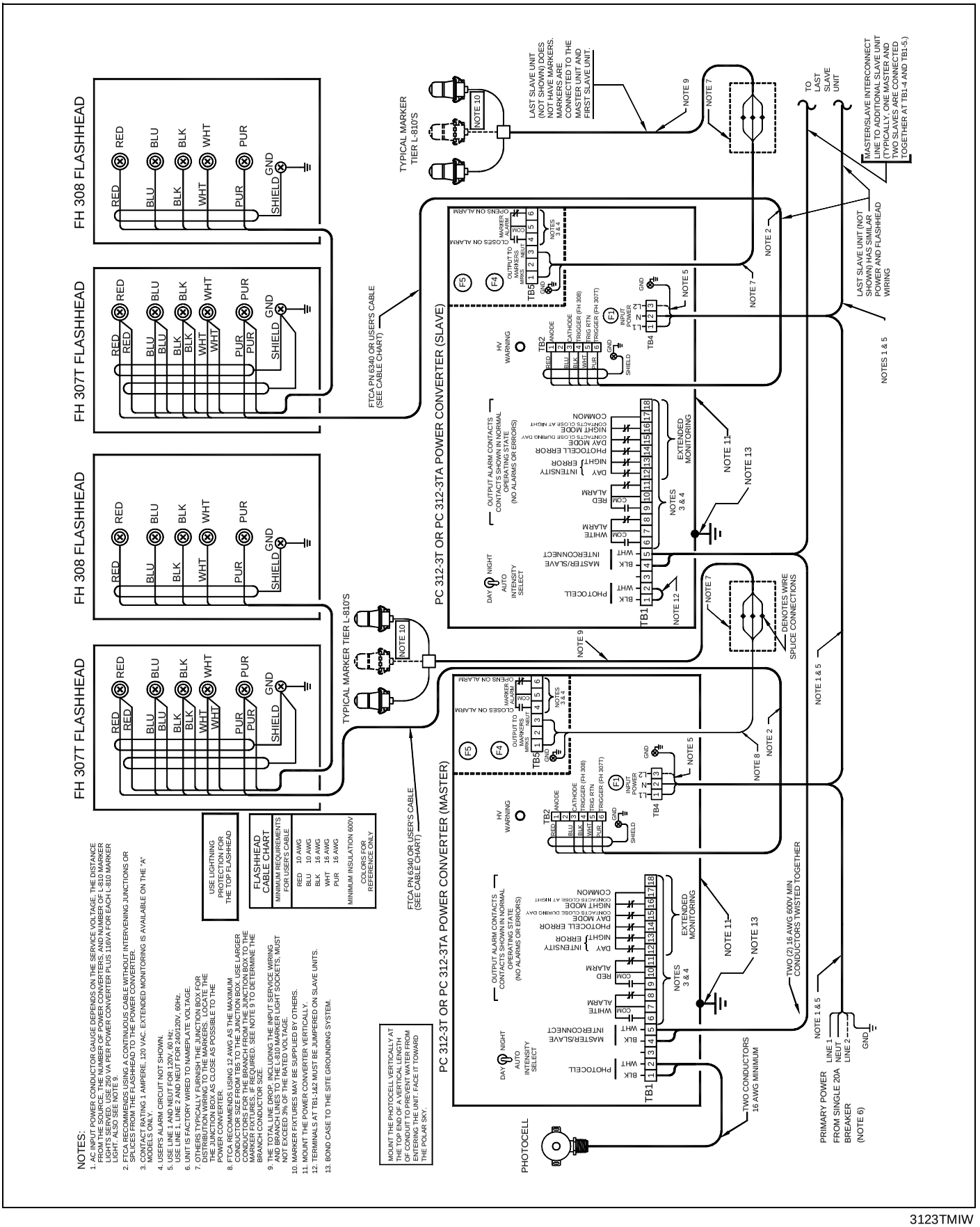
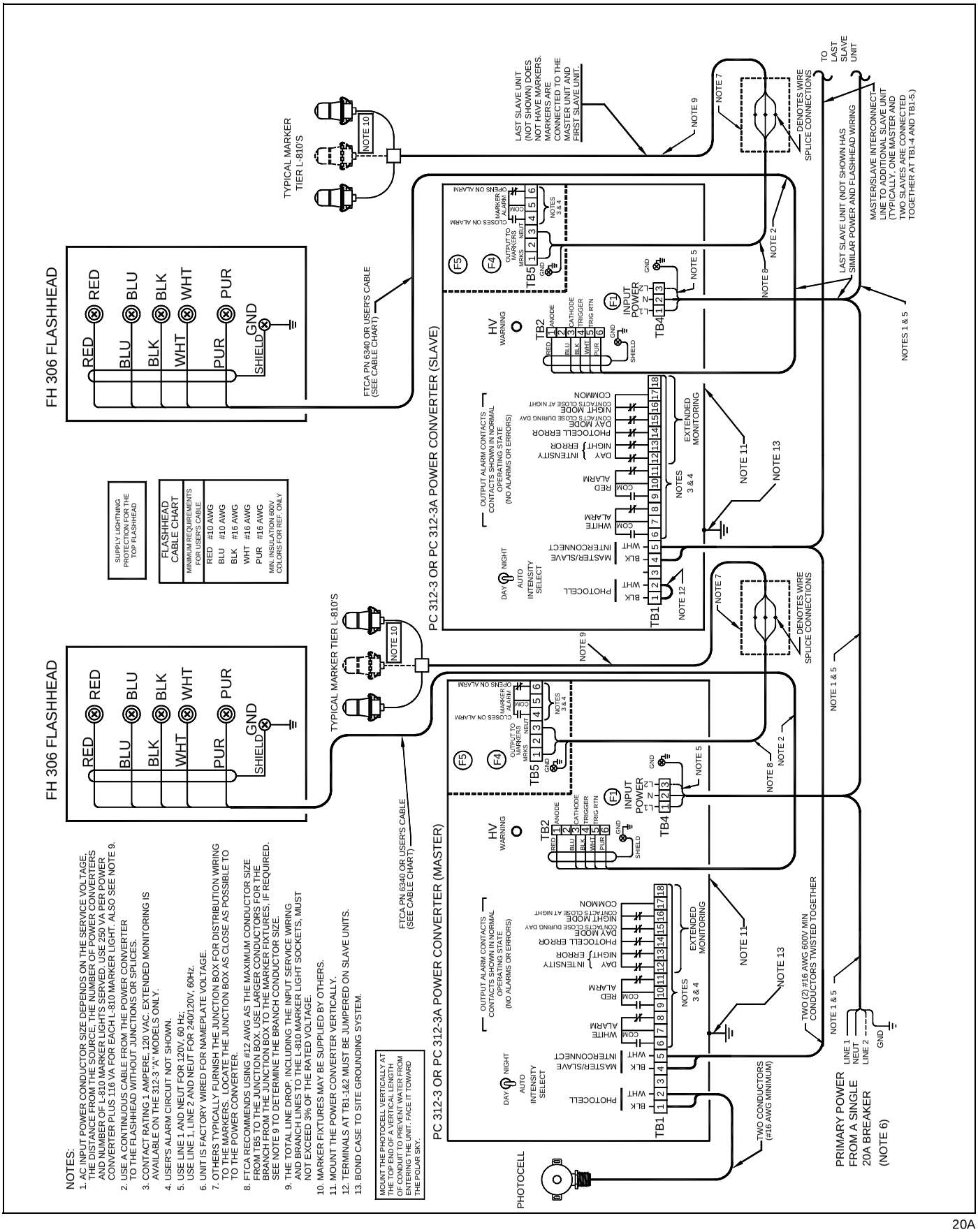


Figure 2-9 FTB 312-3AE Multiple Unit System Installation Wiring



3123TMIW

Figure 2-10 FTB 312-3T or FTB 312-3TA Multiple Unit System Installation Wiring



20A

Figure 2-11 FTB 312-3 or FTB 312-3A Multiple Unit System Installation Wiring

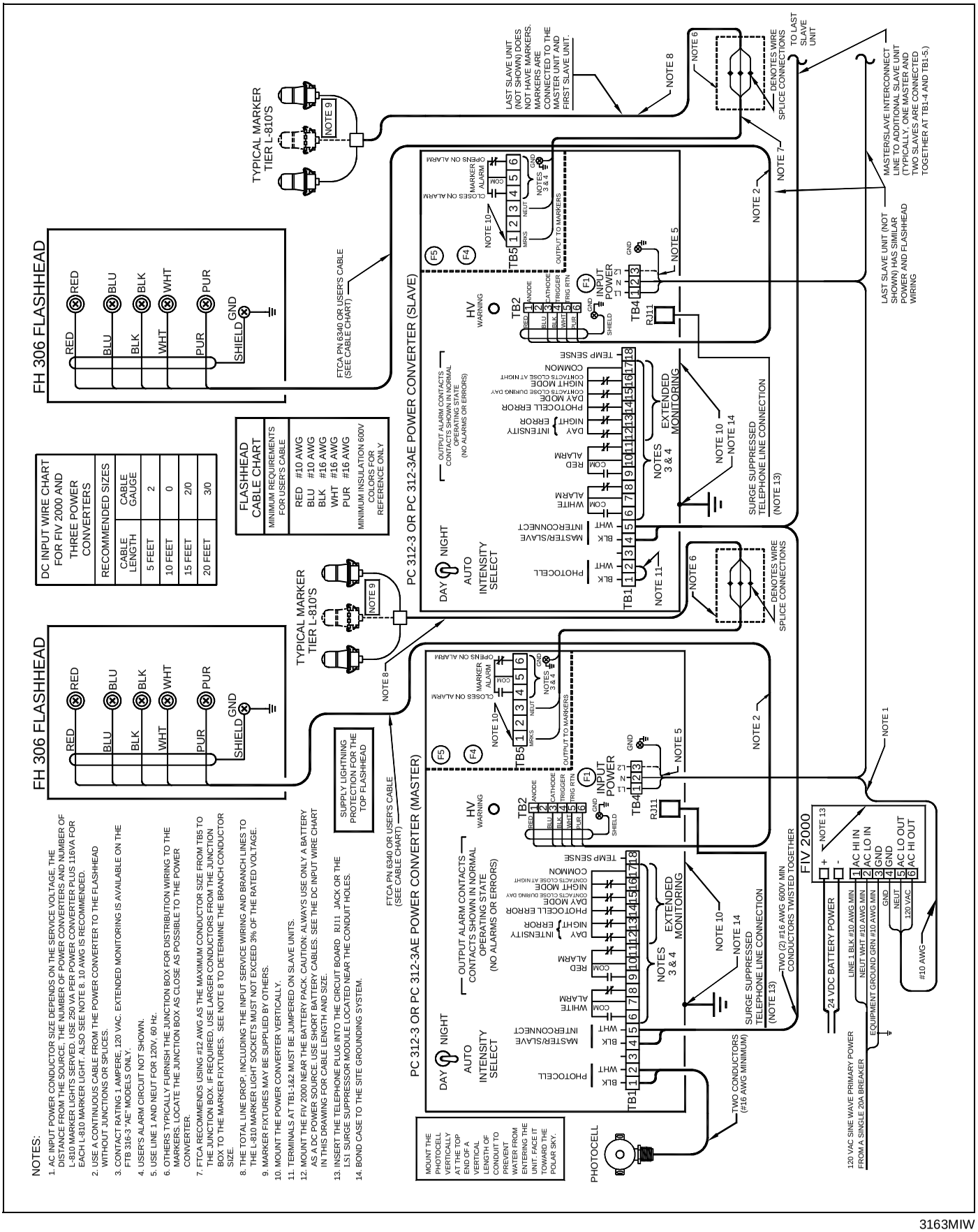
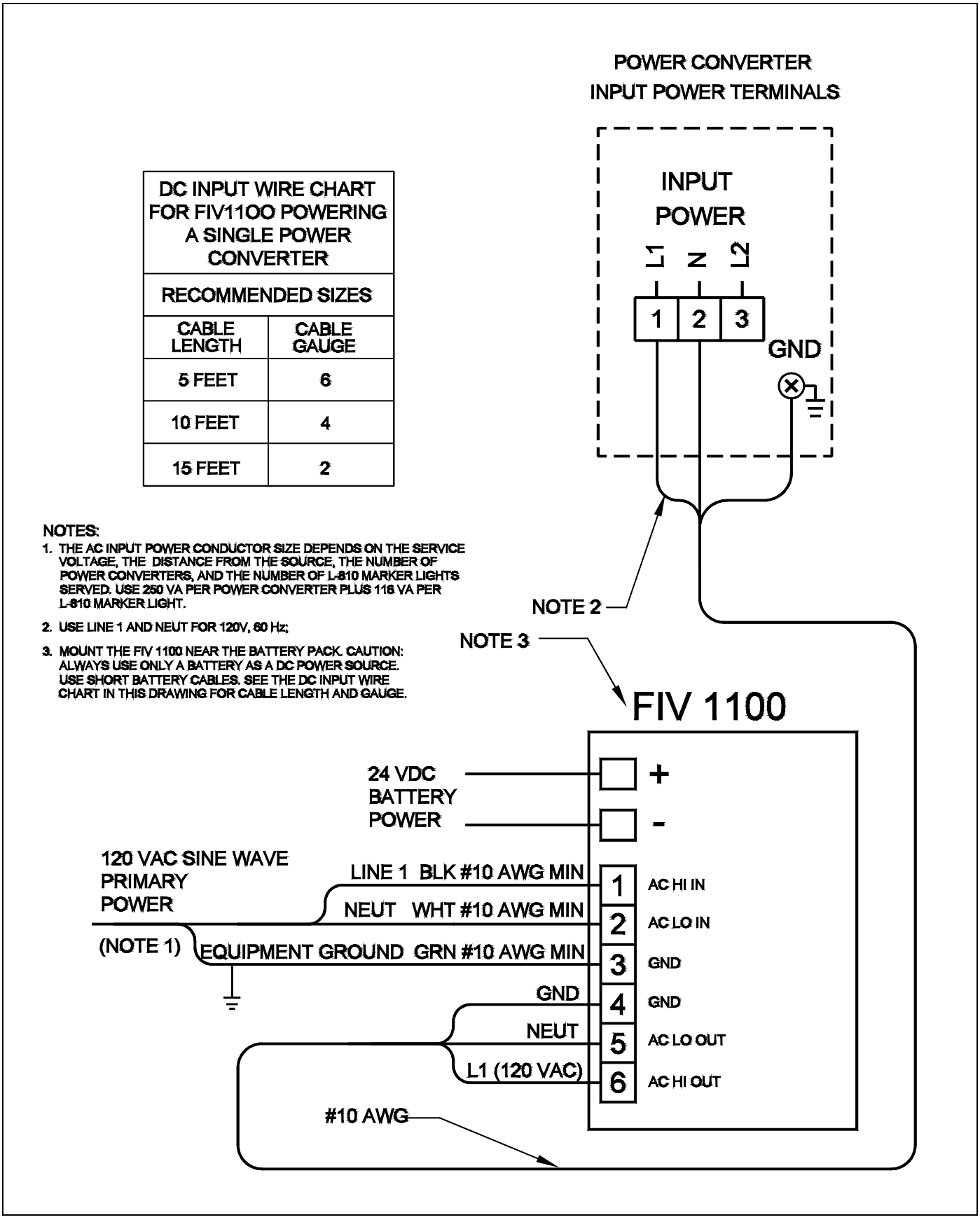
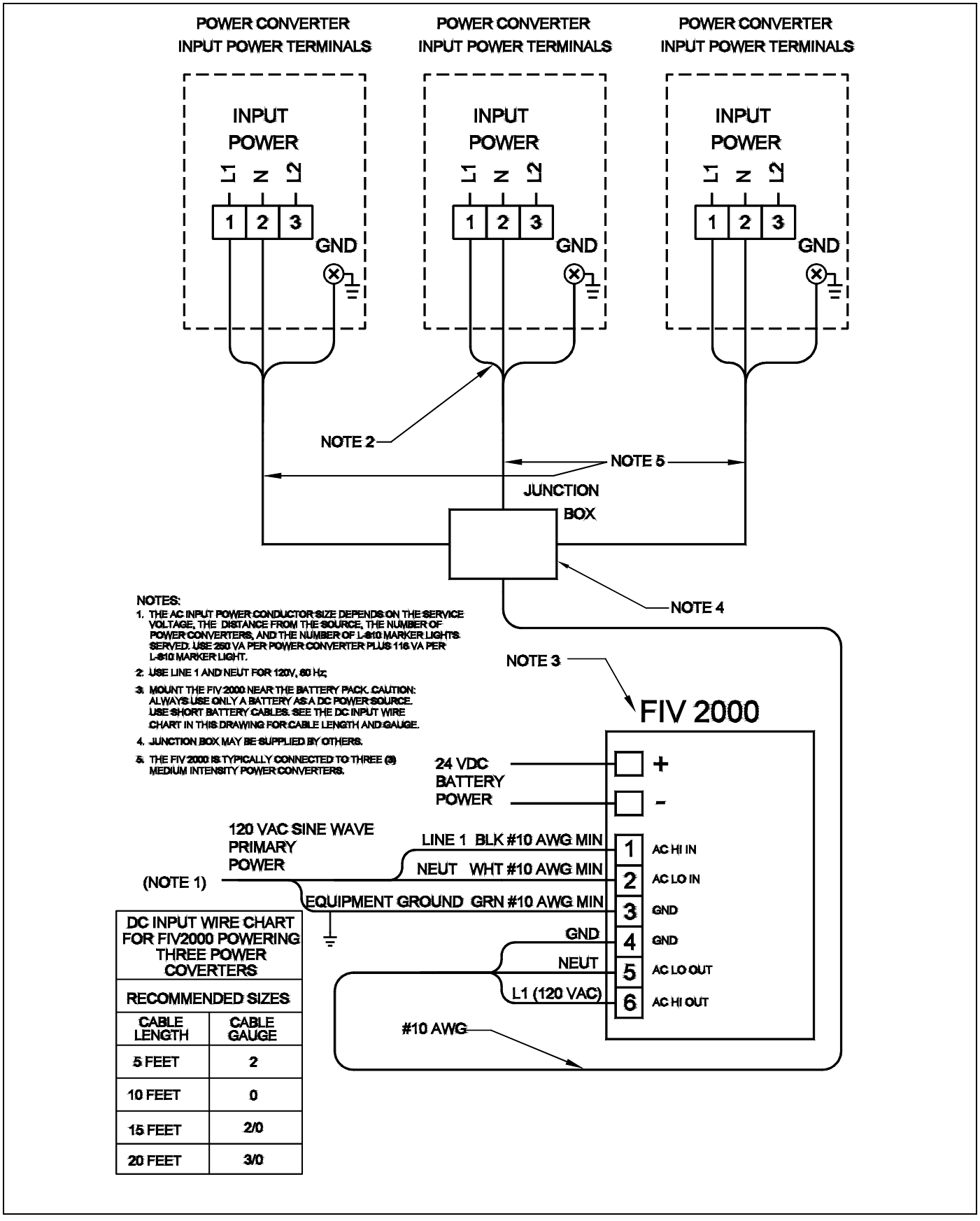


Figure 2-12 FTS 316-3 and FTS 316-3AE System Installation Wiring



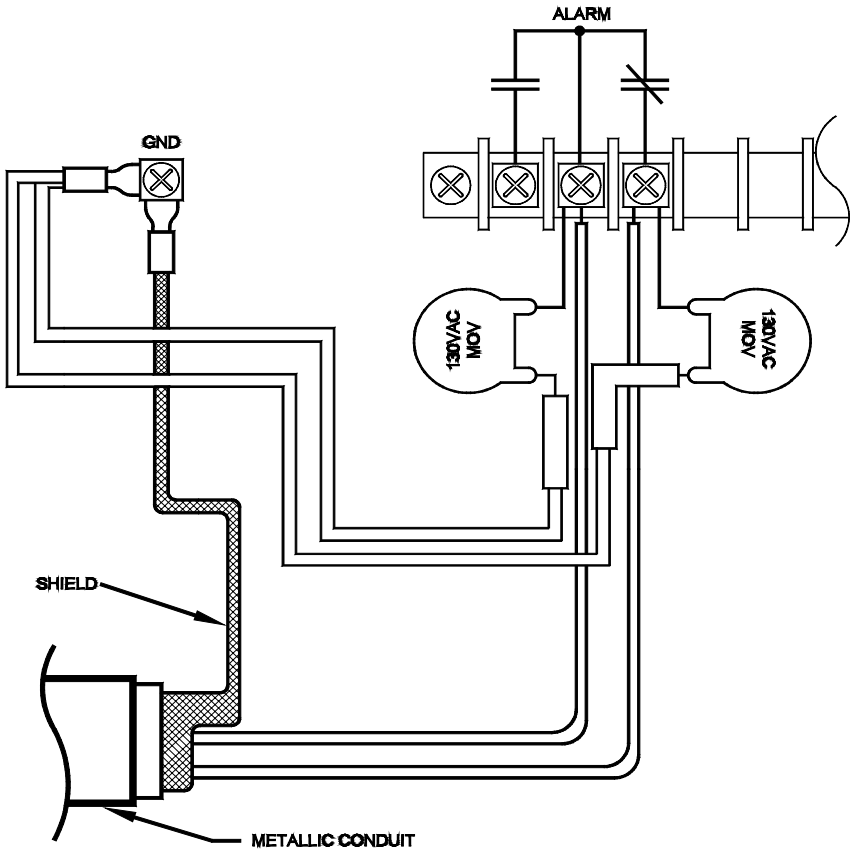
FIV1100IW

Figure 2-13 FIV 1100 Typical Installation Wiring



FIV2000IW

Figure 2-14 FIV 2000 Typical Installation Wiring



CUSTOMER CONNECTION TO ALARM RELAY CONTACTS

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.

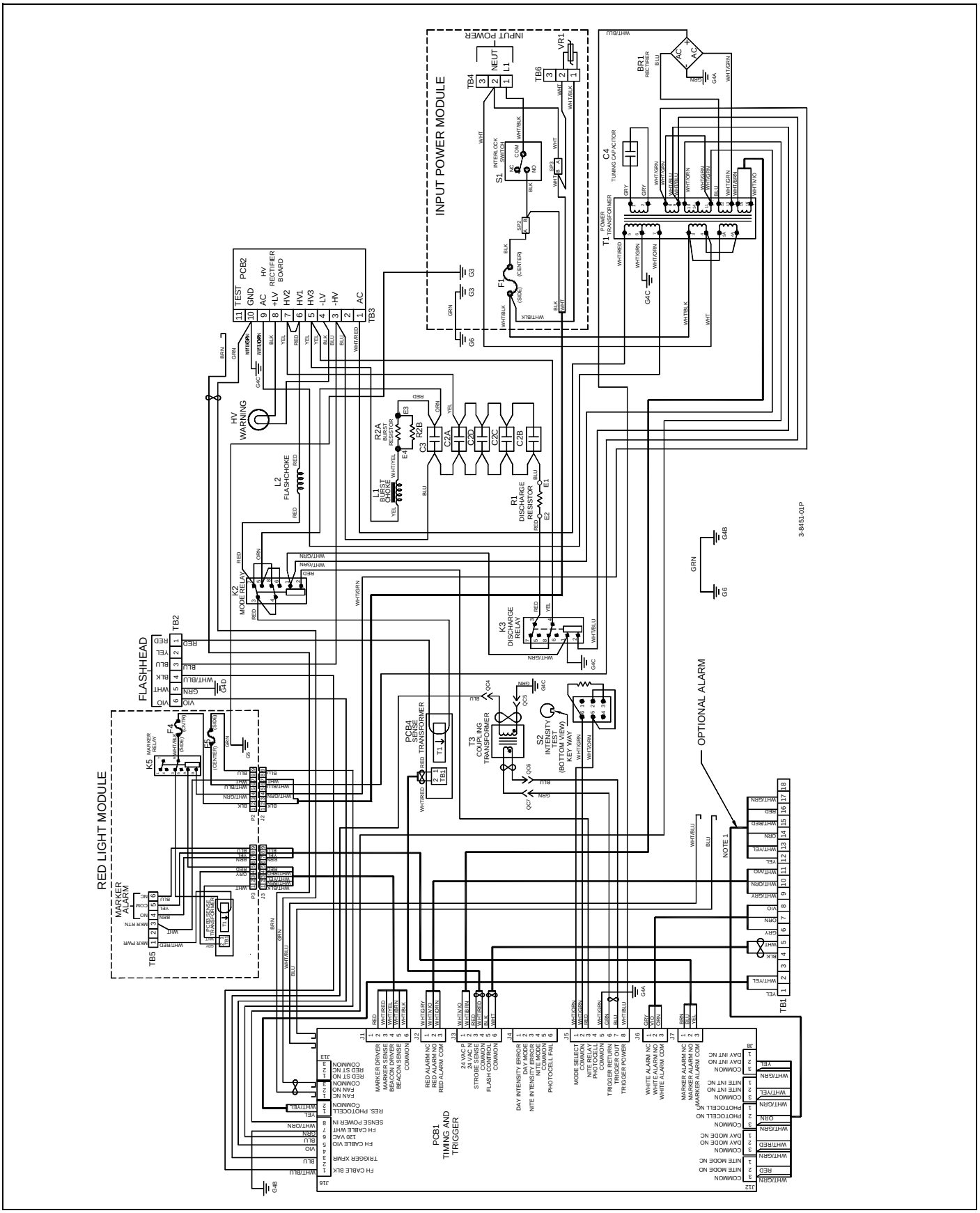
THE INSTALLER IS RESPONSIBLE FOR COMPLYING WITH ALL APPLICABLE ELECTRICAL CODES.

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.

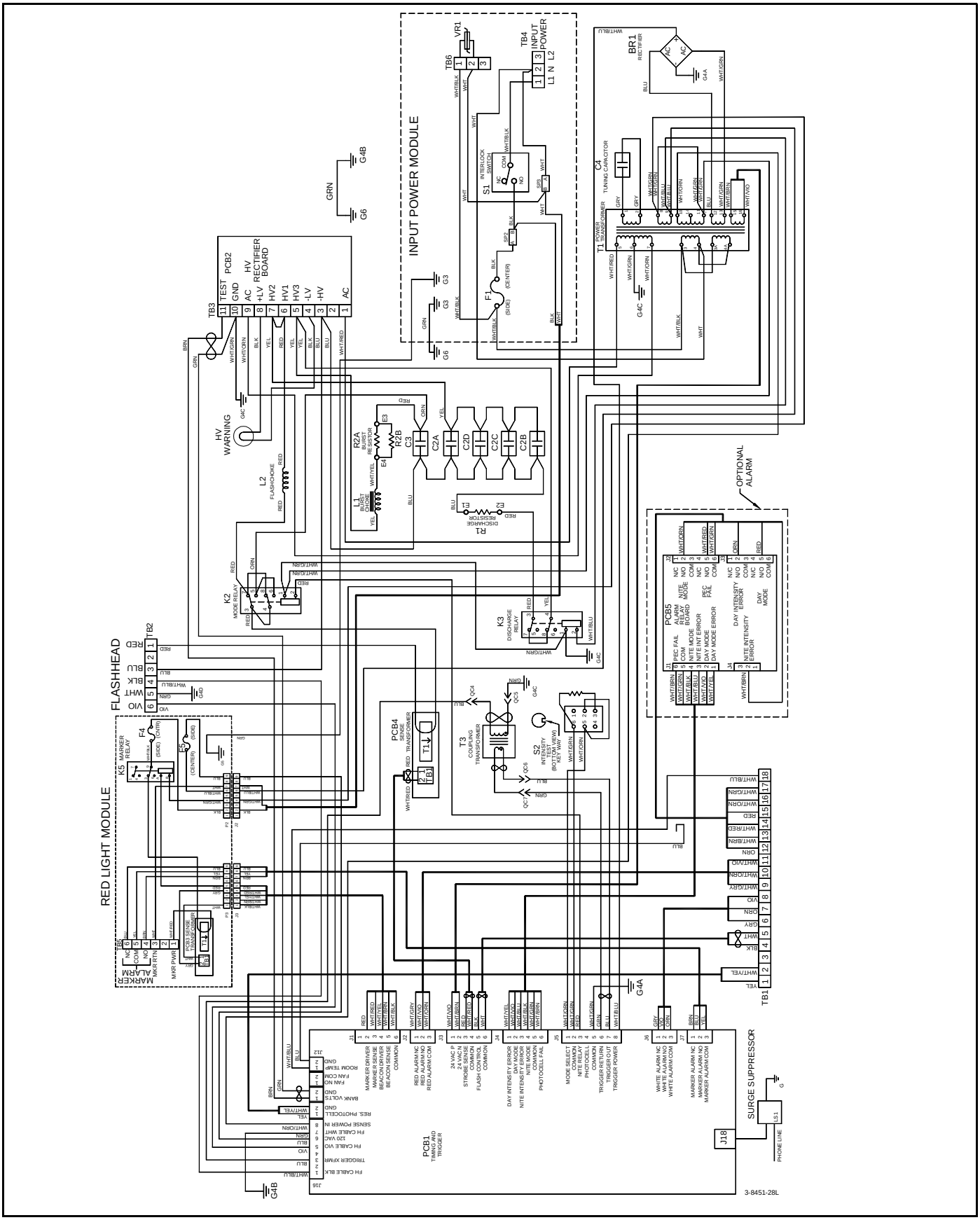
ALRM2

Figure 2-15 Recommended Alarm Relay Wiring Protection



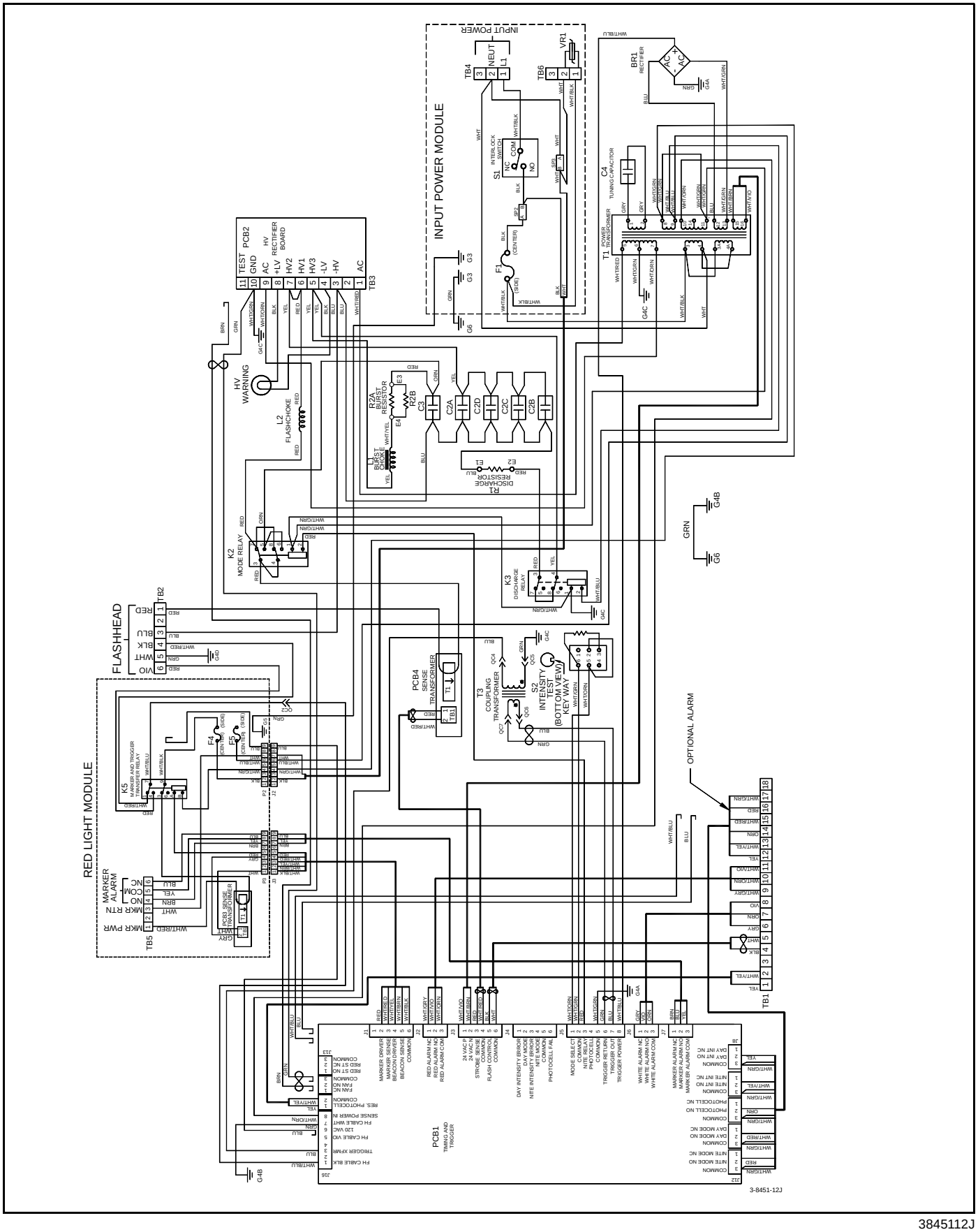
3845101P

Figure 2-16 PC 312-3 Power Converter Internal Wiring



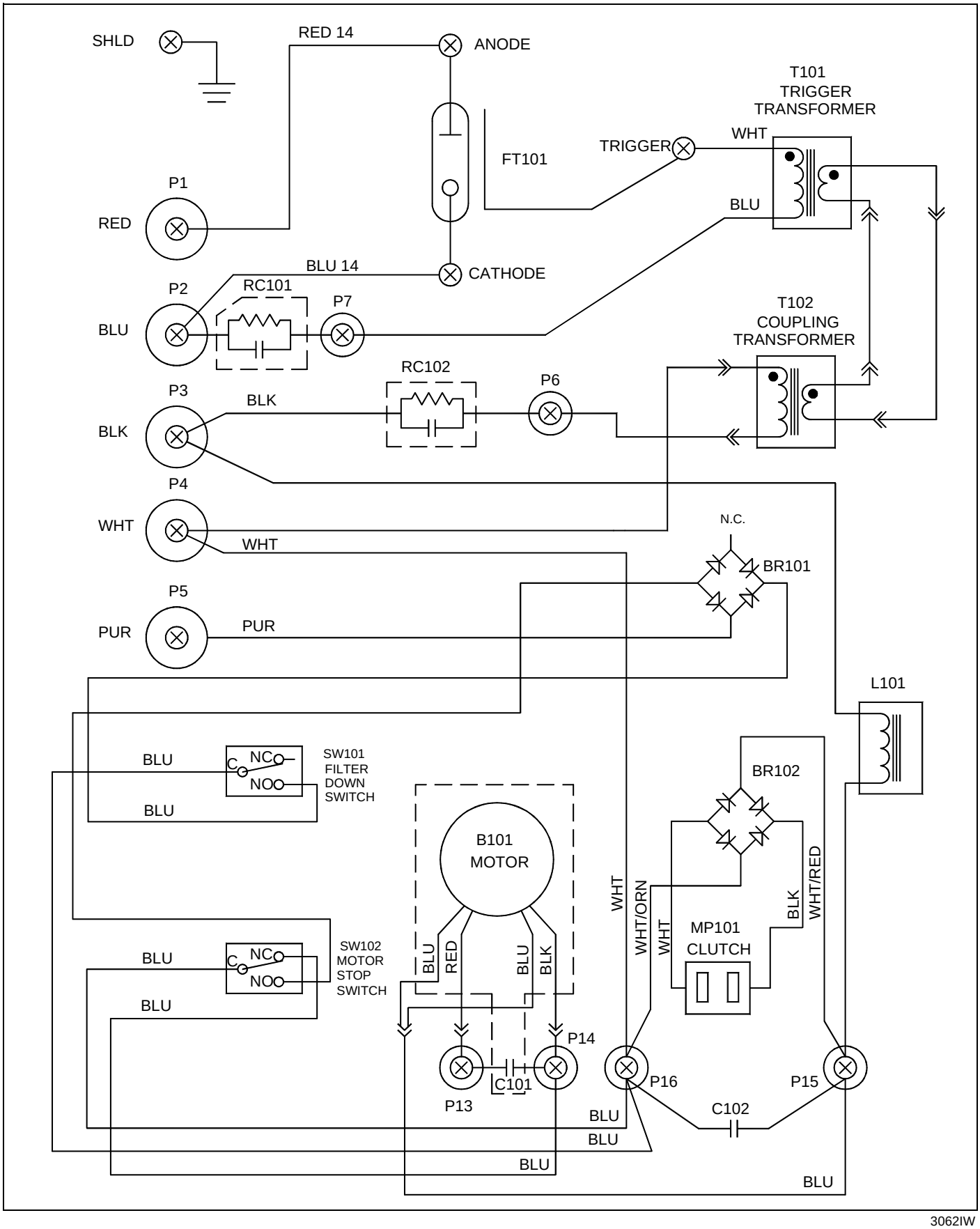
3845128L

Figure 2-17 PC 312-3AE Power Converter Internal Wiring



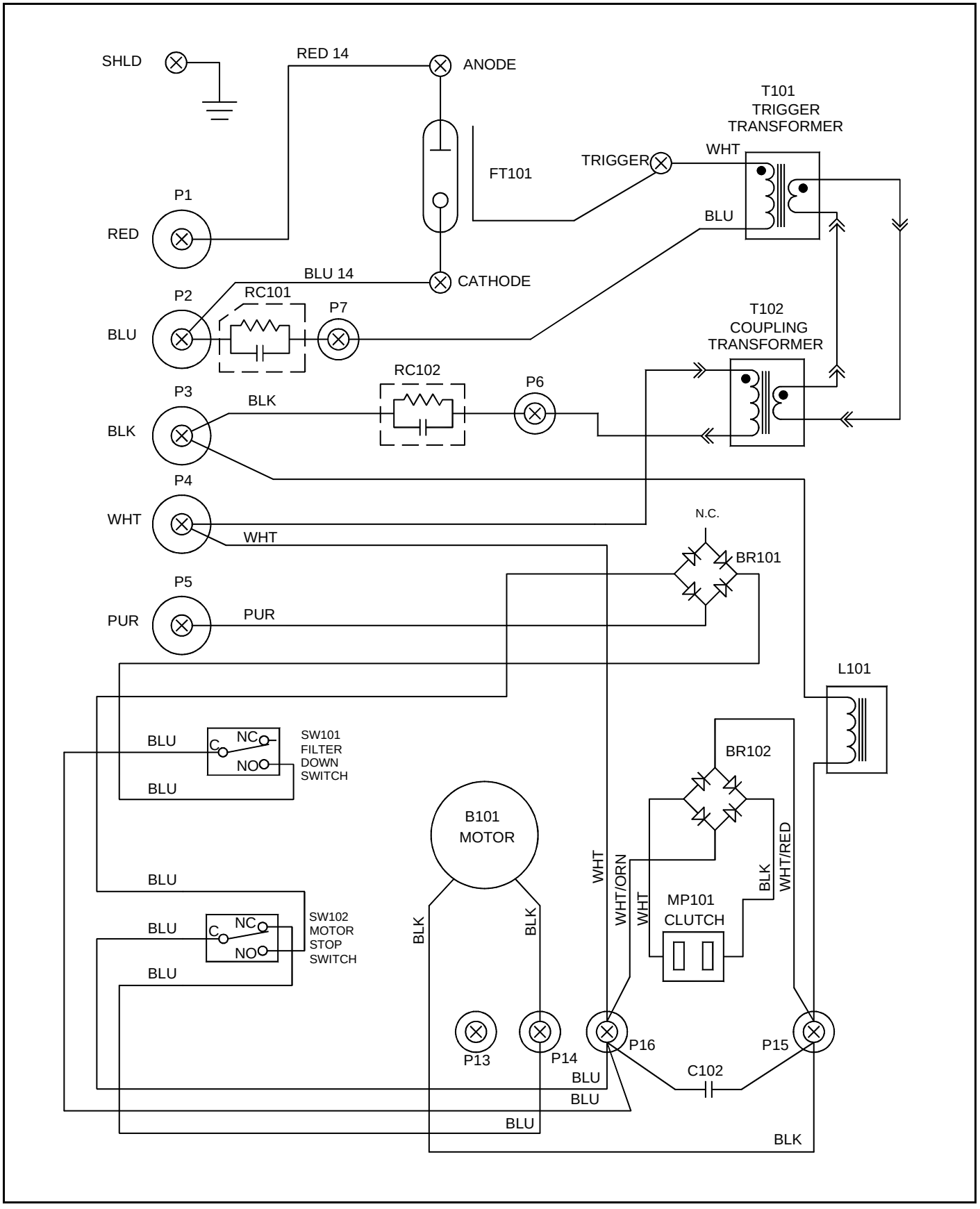
3845112J

Figure 2-18 PC 312-3T Power Converter Internal Wiring



3062IW

Figure 2-19 FH 306 Flashhead Internal Wiring



FH3062IWALT

Figure 2-20 FH 306 Flashhead Optional Internal Wiring

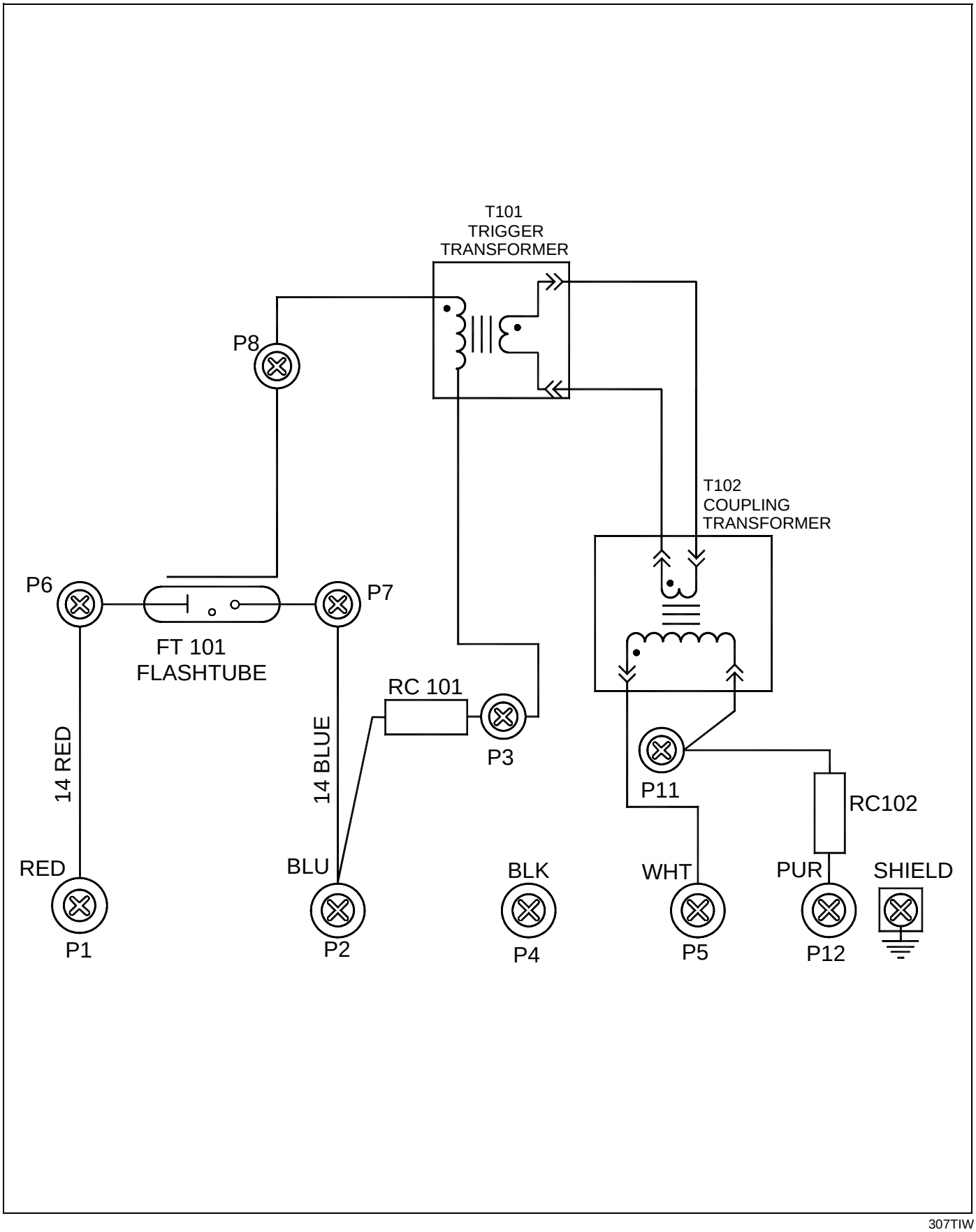


Figure 2-21 FH 307T Flashhead Internal Wiring

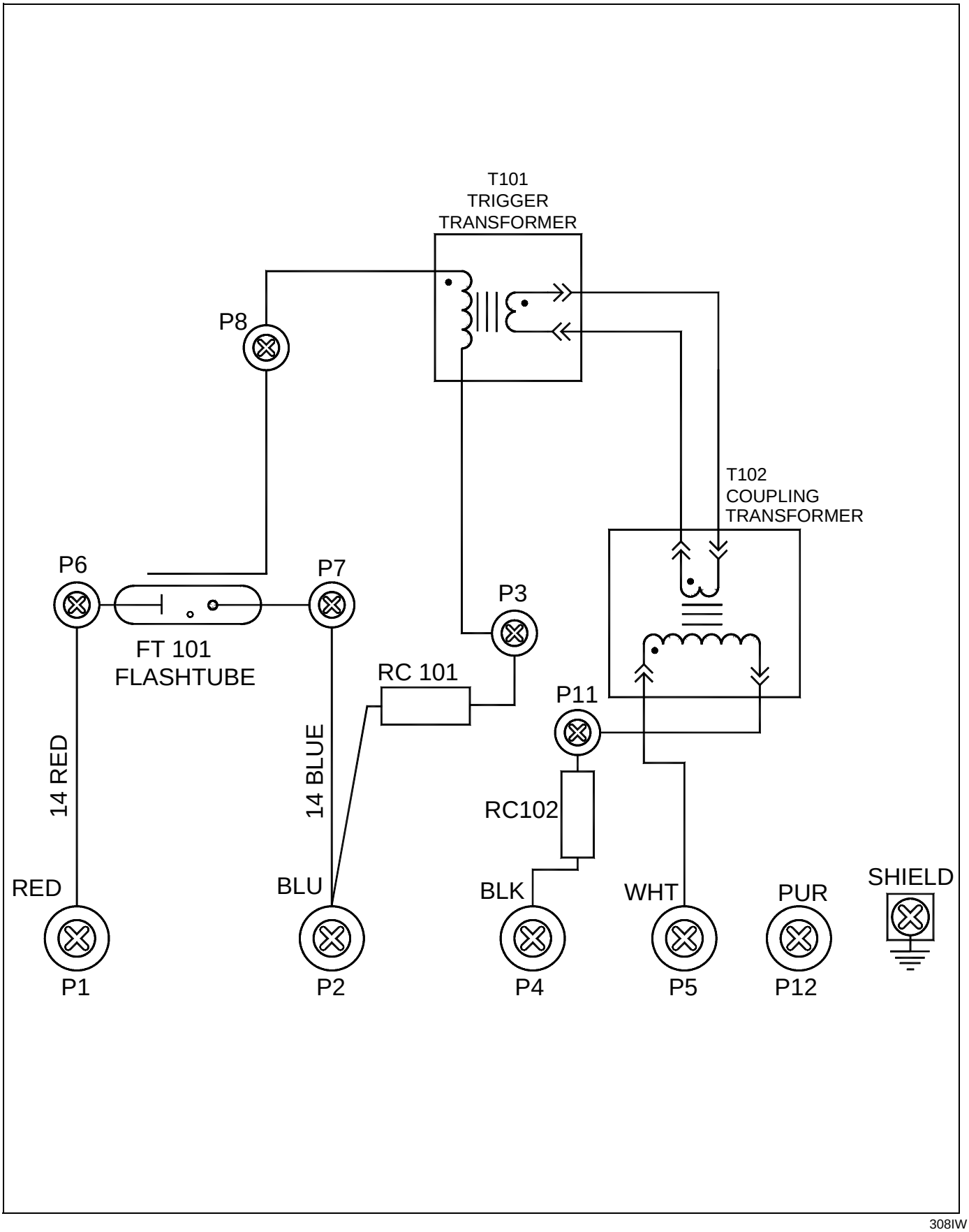


Figure 2-22 FH 308 Flashhead Internal Wiring

This page is intentionally blank.

Section 3 — Maintenance and Troubleshooting

Safety

WARNING

STOP: Before proceeding—read warning on Page iii.

Work safely as follows:

1. Remove rings and watches before opening the equipment.
2. Shut off the equipment.
3. Remove the component or connect the test instrument.
4. Replace the component.
5. Turn on the power and test the system.
6. Turn off the power and disconnect the test equipment.

Preventive Maintenance

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

1. Verify that moisture has not 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 evidence of corrosion and electrical arcing. Clean or replace any component that shows evidence of high-voltage damage.
4. Check flashtube connections for signs of pitting or arcing. Verify that anode and cathode connections are firmly tightened.
5. Check all electrical connections for tightness and verify the absence of corrosion or electrical arcing.
6. Clean the outside surface of the lens with liquid detergent and water. Wipe it gently with a soft cloth or paper towel.
7. Clean the inside surface of the lens with an FTCA-approved professional plastic cleaner. Wipe the lens with cheesecloth only. *Do not use regular cloth or paper towels.* A lens cleaning kit, Part Number 8630801, is available from FTCA.

Storage

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

Diagnostic Testing

This subsection describes procedures for basic functional testing. The only effective way to check out interconnected power converters is to disconnect the wire labeled *master/slave interconnect* that is connected to TB1-4 and check them as single units, as described in the subsection *Checkout Procedures*, described in subsequent text.

Sync Signal Evaluation

Refer to *Figure 2-11*. Note that, for each power converter, a master/slave interconnect line and its return line are connected to TB1-4 and TB1-5 respectively. All units place a sync pulse on the line; the first sync pulse on the line synchronizes the remaining lights to flash all the lights at the same time. PCB1 in each power converter generates a sync pulse. The width of the sync pulse controls the mode of operation.

The top light must be operated by the master power converter and the PEC must be connected to the master power converter. In the event of a top-most red light failure at night, the master 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 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. For example:

- RFI on primary power wires could cause errors in flash rate and intensity.
- RFI on the master/slave interconnecting wire could cause a light to switch to and remain in night intensity.
- RFI on the PEC line could switch a light to night intensity and force it to remain there. RFI would not normally cause a light to switch to day intensity.
- Strong RFI could burn out circuit board components.

While FTCA designed the circuits to reject or bypass RFI, FTCA cannot guarantee complete immunity beforehand. After installation, you may find it necessary to add external filters or use other methods to reduce RFI entering the equipment.

Component Testing

The following procedures describe how to check most of the unit's major electrical components. Always make resistance measurements with the primary power turned off. Before applying power for voltage measurements, connect test leads or circuit jumpers, or disconnect existing circuit connections, with the power turned off and storage capacitors discharged.

Wiring and Cabling

Wires or cables that move repeatedly will eventually 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 Component Testing

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.

Burst Choke (L1)

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

Relays

A malfunctioning relay may have faulty contacts, a sticky mechanism, a bad ground, 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.

Mode Relay (K2): 24 VDC; 290 ohm coil

Discharge Relay (K3): 120 VAC; 290 ohm coil

Timing and Trigger Board (PCB1)

Replace this board with one known to be in good condition. Note that the PCB1 board part numbers in this manual are either 24740xx or 24747xx. **Call Customer Service for technical assistance at 1-800-821-5825.**

PCB1 part numbers vary. Be certain that you have the number available, which is imprinted on your board.

HV Rectifier Board (PCB2)

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

Alarm Relay Board (PCB5) (PC 312-3AE)

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

Sense Module (PCB4)

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

Discharge Resistor (R1)

The measured resistance of this component should be 35,000 ohms.

Burst Resistor (R2)

The measured resistance of this component should be 250 ohms (two 500-ohm resistors in parallel)

Power Transformer (T1)

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

Table 3-1 T1 Transformer Voltages

Terminals	Voltage Range
TB3-1 to TB3-9	900-1050 volts AC*
PCB1 J5-8 to chassis	100-120 volts DC
PCB1 J3-1 to J3-2	22-26 volts AC

* If this AC voltage is substantially below the specified minimum value, check tuning capacitor C4.

Trigger Coupling Transformer (T3)

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

Red Light Module Components

Marker Relay (K5): 24 VDC; 450 ohm coil. Replace the entire Red Light Module to replace the relay.

Marker Sense Transformer (T1 on PCB3): The Marker Sense Transformer is mounted on PCB3. If you suspect the transformer, replace the entire Red Light Module.

Flashhead Component Testing

The following subsections describe component testing for the components in the 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 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 wire size. check with an ohmmeter at the wire terminals.

Photocell Testing

The PEC 510 Photocell is wired directly to the master power converter at TB1-1 and TB1-2.

1. Disconnect the photocell. The system should go to nighttime operation.
2. Disconnect the master/slave interconnect line on each power converter.
3. Operate the intensity control switch on each power converter in turn.
4. If each power converter operates correctly with the intensity control switch, the problem

is the photocell, or its wiring, or troubleshoot 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

Component location diagrams are provided in *Figure 4-1*, through *Figure 4-6* in *Section 4 — Recommended Spare and Replaceable Parts*. Internal electrical wiring diagrams are provided in *Section 2* and on the ***Information Card*** that is fastened inside the power converter cover.

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 conforms exactly to the wiring diagrams.

The general procedure for removing components is a logical one and is as follows:

1. Obtain access to the component in question:
   a. Disconnect completely or partially the wiring to components first that prevent clear access.
   b. 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, then the components that allowed you access. 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

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 accidental application of power if the interlock switch is inadvertently depressed.

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 on the Information Card. Wires must be replaced exactly as removed. In some instances, a quick-connect wire terminal does not seat properly if it is not placed on the terminal cluster exactly as it was before removal. This occurs by interference between the insulation on the wire terminal and the insulation surrounding their terminal cluster on the capacitor. FTCA recommends that you lightly squeeze the quick-connect wire terminals with pliers before reinstalling them over the capacitor terminal blades.

Input Power Module

Removal

1. Remove all accessible wires and cable connectors attached to the Input Power Module and to T1 located under the Input Power Module.
2. Loosen the truss-head screws in the base that fasten the Input Power Module to the base.
3. Remove the screw under the ground terminal to the left of TB4. This screw fastens the Input Power Module bracket to the Component Bracket.
4. Carefully slide the Input Power Module bracket to the right and lift it out. Ensure that connectors are not bent while doing so.
5. Remove any additional connections that you must to remove the Input Power Module bracket.

Replacement

1. Replace the Input Power Module in the reverse sequence to that of Removal.
2. Verify that wiring matches the ***Information Card*** and restore the wire routing to its original state.

K2 Mode Relay

You must first remove the Red Light Module and PCB1 as in *Section Red Light Module, Section Timing and Trigger Board (PCB1)*, and the Component Bracket for adequate access to the K2 Mode Relay.

Removal

1. Remove the Red Light Module.
2. Remove PCB1.
3. Loosen the four truss-head screws in the base that fasten the bracket to the base.
4. Loosen the screw that fastens the bracket to the Input Power Module.
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.
6. Carefully disconnect the wires from the terminals of the component and note their locations so that you may more easily replace them.
7. Remove the screws that hold the K2 relay to the base.
8. Remove the K2 relay.

Replacement

1. Replace the K2 relay in the reverse sequence of that of removal.
2. Verify that wiring matches the ***Information Card*** and restore the wire routing to its original state.

K3 Discharge Relay

Removal and replacement are similar to those in *Section K2 Mode Relay*.

K5 Marker Control Relay

To replace K5, replace the entire Red Light Module.

L1 Burst Choke

Removal and replacement are similar to those in *Section K2 Mode Relay*.

PCB1 Timing and Trigger Board

PCB1 is mounted on the left side of the power converter as you face the wall-mounted power converter.

Removal

1. Remove all connector plugs from PCB1 headers. On J15 Pins 1 & 2 remove the yellow and white/yellow wires.
2. Loosen (but do not remove) the four screws located near the corners of the board.
3. Slide the board so that it clears the four screws and remove it from the power converter.

Replacement

Reverse the removal procedure.

PCB2 HV Rectifier Board

The HV rectifier board is mounted on the right of the Component Bracket between the Component Bracket and the Red Light Module. You access it by first removing the Red Light Module and then the Component Bracket. Use the following procedure:

Removal

1. Remove the Red Light Module.
2. If you have a right-angle Phillips-head screwdriver available, it is not necessary to remove the Component Bracket before doing Step 3. Otherwise, remove the Component Bracket.

3. Loosen, but do not remove, the screws holding the HV rectifier board to the terminal block TB3. Slide the circuit board out from under the terminal block screws.

Replacement

1. Slide the circuit board under the terminal block screws and tighten them.
2. Replace the Red Light Module.
3. Verify that wiring matches the ***Information Card*** and restore the wire routing to its original state.

PCB4 Sense Module

Removal and replacement are similar to those in *Section K2 Mode Relay*.

Red Light Module

Removal

1. Remove the external wires connected to TB5.
2. Unplug all harness connections to the Red Light Module.
3. Loosen two screws in the base that fasten the Red Light Module to the base.
4. Remove the Red Light Module. Be careful of components and connectors.
5. Disconnect the ground wire from the back of the module.

Replacement

1. Replace the Red Light Module in the reverse sequence to that of Removal.
2. Verify that wiring matches the ***Information Card*** and restore the wire routing to its original state.

R2A and R2B Burst Resistors

Removal and replacement are similar to those in *Section K2 Mode Relay*.

T1 Power Transformer

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. Replace the power transformer in the reverse sequence to that of Removal.
2. Verify that wiring matches the ***Information Card*** and restore the wire routing to its original state.

T3 Trigger Coupling Transformer

Removal

1. Remove the Red Light Module.
2. Remove PCB1.
3. Loosen the four screws that hold the Component Bracket to the base.
4. Slide the Component Bracket up off the screws. Be careful of the cable and cable connectors. You may hang the Component Bracket over the edge of the connector panel to perform the remaining steps.
5. Pay special attention to the orientation of the wires on the transformer and their connections. *Replace them in the same orientation.*

Replacement

1. Replace T3 in the reverse sequence to that of Removal. Note the connections to T3 as in Step 5 of the Removal, and replace the wires to their connections in the same way.
2. Verify that wiring matches the ***Information Card*** and restore the wire routing to its original state.

Flashhead

FT101 Flashtube (FH 306)

Removal

1. Manually lift the red filter to allow access to the three screws under the flashtube that hold the flashtube assembly in place.
2. Using a flat-blade screwdriver, loosen the three screws (on screw lugs) directly under the flashtube, which hold the flashtube connector pins. Doing this enables you to disengage the flashtube. Carefully lift the flashtube upward from the assembly.

Replacement

1. Align the pins on the flashtube base with the clamps of the terminal screw lugs, making sure that the red dot on the flashtube base coincides with the red wire on the support column directly under it.
2. Insert the flashtube and settle it into place, making sure the ceramic base is resting directly on the tops of the screw lugs.

3. Ensure that the tube is vertical.
4. Tighten the three screws on the screw lugs to secure the flashtube.
5. Check the free rise and fall of the red filter by lifting and dropping the actuator arm.

Flashtube Mounting Plate Assembly (FH 306)

Components attached to the flashtube mounting plate (except the flashtube, the coupling transformer, and RC1 and RC2) require removing the entire mounting plate assembly and replacing it with a new one.

Removal

1. Remove the flashhead cable wires from the ceramic posts on the mounting plate assembly.
2. Remove the three mounting screws that hold the mounting plate assembly to the flashhead.
3. Lift the mounting plate clear of the flashhead base.

Replacement

1. Reverse the removal sequence.

Trigger Transformer, T101 (FH 307T, FH 308)

Refer to *Figure 4-5 FH 307T Flashhead Component Location* and *Figure 4-6 FH 308 Flashhead Component Location* .

Removal

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

Replacement

1. Reassemble the primary and secondary windings over the two halves of the core. Attach the core to the bracket using the two long screws.
2. Reattach the wires. Verify that wiring is in accordance with *Figure 2-21 FH 307T Flashhead Internal Wiring* or *Figure 2-22 FH 308 Flashhead Internal Wiring* .

Coupling Transformer, T102

Refer to the flashhead component locations diagram *Figure 4-4*, *Figure 4-5*, or *Figure 4-6* and internal wiring diagram *Figure 2-19*, *Figure 2-21*, or *Figure 2-22*.

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

Operational Checkout

Single-Unit System

During testing expose the photocell to normal outdoor daylight. Carefully perform the following steps and take the suggested action if any of the responses differ from the response described.

Multiple-Unit System

A system with more than one power converter unit is a multiple-unit system. Refer to any figure in *Section 2* that shows multiple-unit installation. You connect the first unit; the designated master unit, from terminals TB1-1 and TB1-2 directly to the photocell. The two other power converters each jumper together their terminals TB1-1 and TB1-2. Intensity information is supplied over the master/slave interconnect line to all power converters.

Each power converter, in the chain of power converters, sends a synchronization signal over the bidirectional wires at terminals TB1-4 and TB1-5 to flash all lights together. A master power converter sends a back-up signal at night if its topmost red light fails. Note that a lamp going out in a tier of red incandescent marker lights indicates a marker alarm but does not cause back-up night intensity operation.

Normal operation at night calls for monitoring a set of steadily burning markers installed at one structure level (tier). In configurations with more than one red flashhead at the same structure level (or tier), the additional flashhead does not

have associated markers. That is, this last flashhead connected to the last power converter in a multiple-unit installation does not have associated markers.

PCB1 can sense or ignore markers. It senses them by examining the marker current. It ignores them if the MRK0 and MRK1 jumpers on the 24740xx PCB1 are clipped (or switches SW1 and SW2 are *off*), or the internal programing of the 24747xx PCB1 is programmed for no markers. Therefore, before troubleshooting, you must verify correct marker installation wiring, programming, and operation.

Testing Each Unit

To test each unit in a multiple-unit system, use the following procedures:

1. Disconnect the wires labeled master/slave interconnect at TB1-4 and TB1-5.
2. Test this unit as described in *Section Single-Unit System*.

PEC Testing

The photocell is wired directly to the first (master) power converter at TB1-1 and TB1-2.

1. First, disconnect the photocell. The single unit, or multiple unit, system should revert to nighttime operation.
2. Disconnect TB1-4 and TB1-5 on each power converter.
3. Operate the intensity control switch on each power converter in turn.
4. If each power converter operates correctly with the intensity control switch, troubleshoot the PEC wiring or the circuits in the incorrectly operating power converter.
5. Reconnect all wires.

Checkout Procedures

Use instructions in *Table 3-2* and *Table 3-3* to checkout the equipment. To perform the procedures, you must open the cover of the power converter or converters. To check out multiple units, all units must be operating. Observe and confirm the operation for each power converter individually.

The procedures assume the photocell (PEC) is exposed to daytime sky conditions.

Set all intensity select switches to AUTO, which allows the photocell to control the intensity.

The steps in *Table 3-2* or *Table 3-3* are related to each other and should be performed together in the sequence given here. If a unit does not behave *exactly* as described, proceed to *Troubleshooting the System* in this section.

Table 3-2 Checkout of Power Converters with PCB1 24740xx Board

Setup to Check Normal Daytime Operation	Response — LEDs and Structure Lights	
PEC in daylight. 1) Intensity Select Switch in AUTO. 2) Apply power (pull out interlock switch plunger).	• HV Warning Light is ON • NITE ERR LED (I 1) is off. • DAY ERR LED (I 7) is off. • PEC ALM (I 2) is off. • WHT ALM LED (I 8) is off. • RED ALM LED (I 3) is off. • MKR ALM LED (I 9) is off. • FAN LED (I 4) not used. • SYNC LED (I 10) flashes on in a regular pattern. May be difficult to see. • CONF LED (I 5) “flashes” on after each strobe flash. May be difficult to see.	• DAY LED (I 11) is on. On during daylight. • NITE LED (I 6) is off. Off during daylight. • MKRS LED (I 12) is off during daylight. • NEON bulb (I 13) is on; trigger voltage is available; this bulb may flash. • White strobe is flashing at daylight high intensity. • Red markers are off.

Table 3-2 Checkout of Power Converters with PCB1 24740xx Board (Continued)

Setup to Check Normal Nighttime Operation	Response — LEDs and Structure Lights	
Place opaque cover over photocell (block all light). 1) Intensity Select Switch in AUTO. 2) Apply power (pull out interlock switch plunger).	• HV Warning Light is ON • NITE ERR LED (I 1) is off. • DAY ERR LED (I 7) is off. • PEC ALM (I 2) is off. • WHT ALM LED (I 8) is off. • RED ALM LED (I 3) is off. • MKR ALM LED (I 9) is off. • FAN LED (I 4) not used. • SYNC LED (I 10) flashes on in a regular pattern. May be difficult to see. • CONF LED (I 5) "flashes" on after each strobe flash. May be difficult to see.	• DAY LED (I 11) is off. Off at night. • NITE LED (I 6) is on. On at night. • MKRS LED (I 12) is on at night if markers are associated with the power converter being observed. • NEON bulb (I 13) is on; trigger voltage is available; this bulb may flash. • Red strobe (either FH 306 or FH 307T) is flashing at night intensity. • Associated red markers are on.
Setup to Check Default Night Operation	**Response — LEDs and Structure Lights**	
Perform this procedure for each power converter individually in a multi-unit system. 1) Place opaque cover over photocell (block all light). 2) Intensity Select Switch in AUTO. 3) Remove power. 4) Disconnect purple wire on TB2-6. This fails the red filter in the FH 306 and fails the FH 307T Flashhead. 5) Reapply power.	Responses after three flash cycles: • HV Warning Light is ON • NITE ERR LED (I 1) is off. • DAY ERR LED (I 7) is off. • PEC ALM (I 2) is off. • WHT ALM LED (I 8) is on. • RED ALM LED (I 3) is on. • MKR ALM LED (I 9) is off. Goes on initially but then goes off when structure enters white night back-up mode. • FAN LED (I 4) not used. • SYNC LED (I 10) flashes on in a regular pattern. May be difficult to see. • CONF LED (I 5) "flashes" on after each strobe flash. May be difficult to see.	• DAY LED (I 11) is off. Off at night. • NITE LED (I 6) is on. On at night. • MKRS LED (I 12) is off at night during white back-up operation. • NEON bulb (I 13) is on; trigger voltage is available; this bulb may flash. • White strobe is flashing at white back-up intensity. • Associated red markers are off. *Remove power.* *Restore all wires to their previous positions before disconnecting any new wires.* *Reconnect the purple wire on TB2-6.* *Reapply power.*
Setup to Check Marker Alarm	**Response — LEDs and Structure Lights**	
1) Place opaque cover over photocell (block all light). 2) Intensity Select Switch in AUTO. 3) Remove power. 4) Remove fuse F4. 5) Apply power.	Responses are the same as those for normal nighttime (previous) except for the following: • MKR ALM LED (I 9) is on. • MKRS LED (I 12) is on.	• Red strobe (either FH 306 or FH 307T) is flashing at night intensity. • Red markers are off. *Remove opaque cover over photocell.* *Remove power.* *Replace fuse F4.* *Reapply power.*
Setup to Check White Alarm for Day Operation	**Response — LEDs and Structure Lights**	
1) Remove opaque cover over photocell. 2) Intensity Select Switch in AUTO. 3) Remove power. 4) Disconnect black wire from TB2-4. 5) Reapply power.	Responses are the same as those for daylight (previous) except for the following: • DAY ERR LED (I 7) is on. • WHT ALM LED (I 8) is on. Turns on in three flash cycles after applying power.	• CONF LED (I 5) is off. • White strobe is off. *Remove power.* *Replace wire on TB2-4.* *Reapply power.*

Table 3-2 Checkout of Power Converters with PCB1 24740xx Board (Continued)

Setup to Check Red Alarm for Night Operation	Response — LEDs and Structure Lights	
1) Place opaque cover over photocell (block all light). 2) Intensity Select Switch in AUTO. 3) Remove power. 4) Disconnect black wire from TB2-4. 5) Apply power.	Responses are the same as those for normal nighttime (previous) except for the following: • NITE LED (I 6) is on. • WHT ALM LED (I 8) is off. • RED ALM LED (I 3) is on. Turns on in three flash cycles after applying power.	• CONF LED (I 5) is off. *If you leave the system on, it will next attempt to flash in white night backup (default).* *Remove power.* *Replace wire on TB2-4.* *Reapply power.*

Table 3-3 Checkout of Power Converters with PCB1 24747xx Board

Setup to Check Normal Daytime Operation	Response — LEDs and Structure Lights	
1) Apply power (pull out the interlock switch plungers to the service position). 2) Set the intensity select switch or switches to AUTO. 3) Verify that the responses occur at each power converter in the system.	Verify that the following responses occur at each power converter in the system: • The HV Warning Light is on. • The NITE ERR LED (I 15) is off. • The DAY ERR (I 9) is off. • The PEC ALM (I 14) is off. • The WHT ALM LED (I 8) is off. • The RED ALM LED (I 13) is off. • The MKR ALM LED (I 7) is off. • The FAN LED (I 12) is off. • The SYNC LED (I 6) "flicks" on regularly. May be difficult to see in bright daylight. • The CONF (confirm) LED (I 11) "flashes" on after each strobe flash. May be difficult to see in bright daylight.	• The DAY LED (I 5) is on. It is on during daylight. • The NITE LED (I 10) is off for daylight operation. • The MKRS (markers) LED (I 4) is off during daylight operation. • The clear NEON bulb (I 3) is on indicating the presence of trigger voltage for the flash tube. This bulb may flash. • The white light is flashing at the daytime high-intensity for this unit. • The associated red incandescent markers are off.
Setup to Check Normal Nighttime Operation	Response — LEDs and Structure Lights	
1) Place an opaque (blocks all light) cover over the photocell (PEC). Several seconds may pass before the PEC responds to the darkened condition after power is applied. 2) Set the intensity select switch or switches to AUTO. 3) Apply power (pull out the interlock switch plungers to the service position).	Verify that the responses occur as in Daytime (previous) except for those in the following list: • The DAY LED (I 5) is off. • The NITE LED (I 10) is on for night operation.	• The MKRS (markers) LED (I 4) is on if markers are associated with the power converter being observed. • The red light is flashing at the nighttime intensity for this unit. • The associated red incandescent markers are on.

Table 3-3 Checkout of Power Converters with PCB1 24747xx Board (Continued)

Setup to Check Normal Default Night Operation	Response — LEDs and Structure Lights	
Perform the following procedure for its power converter in a multiple-unit system. 1) Cover the PEC with an opaque (blocks all light) cover. 2) Set the intensity select switch or switches to AUTO. 3) Remove power. 4) Disconnect the purple wire on TB2-6. This fails filter operation in the FH 306 Flashhead, and fails the FH 307T Flashhead. 5) Reapply power.	Verify that the following responses occur as compared to those in Check Normal Daytime Operation, except for those in the following list (after three flash cycles): • The WHT ALM LED (I 8) is on. • The RED ALM LED (I 13) is on. • The DAY LED (I 5) is off. • The NITE LED (I 10) is on for night operation. • The MKRS (markers) LED (I 4) is off. It is off during white night backup mode.	• The system is flashing in white night back-up intensity. *Remove power.* *Reconnect the purple wire on TB2-6.* *Restore all wires to their previous connections before disconnecting any new wires.* *Reapply power.*
Setup to Check Marker Alarm Operation	**Response — LEDs and Structure Lights**	
1) Cover the PEC with an opaque (blocks all light) cover. 2) Set the intensity select switch or switches to AUTO. 3) Remove power. 4) Remove fuse F4. 5) Reapply power.	Verify that the following responses occur as compared to those in Check Normal Daytime Operation, except for those in the following list (after three flash cycles): • The DAY LED (I 5) is off. • The NITE MODE LED (I 10) is on. • The MKRS (I 4) LED is on indicating that markers should be on. • The MKR ALM (I 7) LED is on indicating a marker alarm. • The light is flashing in red mode (for the FH 306, the red filter is in place; or the FH 307T Flashhead is flashing).	• Remove power. • Replace F4 and recycle the unit with the Intensity Select Switch as done in Setup • Reapply power. • The unit should now be operating normally in night mode; that is: red light flashing, markers turned on, and no alarm. *Remove the temporary opaque cover placed over the PEC in Step 2.* *Set Intensity Select Switch to AUTO.* *Replace Fuse F4.*
Setup to Check White Alarm for Daytime Operation	**Response — LEDs and Structure Lights**	
1) Remove the opaque cover from the PEC. 2) Set the intensity select switch or switches to AUTO. 3) Remove power. 4) Disconnect the black wire from TB2-4. 5) Reapply power.	The following responses indicate a failure to flash in day mode. Verify that they occur as compared to those in Check Normal Daytime Operation, except for those in the following list (after three flash cycles): • The WHT ALM LED (I 8) is on. (The power converter executes 3 flash cycles internally after power application. The White Alarm turns on at the end of the three cycles.)	• The DAY ERR LED (I 7) is on. • The SYNC LED (I 6) flicks on regularly. • The CONF (flash confirm) LED (I 11) is off. *Remove power.* *Reconnect the black wire to TB2-4.* *Reapply power.* *Verify operation as in Daytime Operation.*

Table 3-3 Checkout of Power Converters with PCB1 24747xx Board (Continued)

Setup to Check Red Alarm for Night Operation	Response — LEDs and Structure Lights	
1) Place the opaque cover over the PEC. 2) Set the intensity select switch or switches to AUTO. 3) Remove power. 4) Disconnect the black wire from TB2-4. 5) Reapply power.	The following responses denote a light failure during normal nighttime operation. Verify that they occur as compared to those in Check Normal Daytime Operation, except for those in the following list (after three flash cycles): • The DAY MODE LED (I 5) is off. • The NITE MODE LED (I 10) is on. • The WHT ALM LED (I 8) is on. • The RED ALM LED (I 13) is on. (The power converter cycles executes 3 internal flash cycles before turning on the Red Alarm.) • The SYNC LED (I 6) flicks on regularly.	• The CONF (flash confirm) LED (I 11) is off. These denote a light failure during normal nighttime operation. *NOTE: If you leave the system on, it will next attempt to flash in white night backup mode(default).* *Remove power.* *Reconnect the black wire to TB2-4.* *Reapply power.* *Remove cover from photocell.* *Verify operation as in Daytime Operation.* *Reapply power.*

Troubleshooting the System

Effective troubleshooting begins with careful observations of operating behavior, often leading directly to the cause of a problem. Diagnostic procedures in this subsection are divided into two categories: *unit* level, originating in a single unit; and *system* level, problems affecting all units in a multiple-unit system in the same way. However, in a multiple-unit system some *unit-level* malfunctions could cause problems involving the entire system.

For example, if one light in a multiple-unit system fails to flash, *Table 3-4* directs you to *Table 3-5*, the troubleshooting guide for a unit-level problem (but not a system-level problem).

For each symptom, the troubleshooting guides list one or more probable causes in descending order of probability. Continuing with our example, assume that the light fails to flash during the day (No in column 1) and at night (No in column 2). High voltage is absent (No in column 3), but low voltage is present (OK in column 4). This condition is described in the fourth row of *Table 3-5*. The last column lists possible causes. The most probable cause is a shorted capacitor, the second most probable cause is a shorted flashhead cable, and so on.

When you trace a problem to a specific component, see *Section Power Converter Component Testing* and *Section Component Removal and Replacement*, in this Section.

Table 3-4 Selecting the Correct Troubleshooting Guide

	Single-Light System	Multiple-Unit System	
		Units Affected Differently, Usually Only One Failing Unit A Unit-Level Problem	All Units Affected the Same Way A System Level Problem
Troubleshooting Guide	*Table 3-5*	*Table 3-5*	*Table 3-6*

Table 3-5 Unit Troubleshooting Guide

Flash Conditions		Other Conditions			Probable Causes (All Units Unless Specifically Indicated)	
Day	Night	HV†	LV*			
No	No	OK†	OK		• FT101 Flashtube (FH 306) • Flashhead cable connections • T101 Transformer	• Flashtube Mounting Plate Assembly (FH 306)*** • T1 Transformer • T3 Transformer • BR1 Bridge • PCB1
No	No	No	No	Blows Fuse F1	• Varistor MOV	• T1 Transformer
No	No	No	No		• F1 Fuse • S1 Interlock	• T1 Transformer • Connections - main power
No	No	No	OK		• C2A-D, or C3 shorted	• Shorted FH Cable
No	No	OK	No	No indicators lit on PCB1	• PCB1 Board • T1 Power Transformer	• BR1 Bridge
OK	High Intensity	OK	OK	Red Alarm	• PCB1 Board • Photocell Circuit	• K2 Relay • Intensity select switch setting
OK	OK	OK	OK	All Markers Out	• F4 Fuse • K5 Marker Control Relay‡	• PCB1 Board
				Markers Stay On	• K5 Marker Control Relay‡	• PCB1 Board
OK	Backup Intensity	OK	OK		• Flashtube Mounting Plate Assembly*** (FH 306)	• K2 Relay • PCB1 Board
OK	OK	OK	OK	Marker Alarm	• One or more marker lamps out or incorrect wattage	• K5 Marker Control Relay‡ • PCB1 Board • PCB3
-	-	OK	OK	Incorrect Mode	• S2 Intensity Select Switch is not in AUTO position	• PEC or PEC wiring • PCB1
OK	No	OK	OK	Red Alarm	• Flashtube (FH 307T) • C3 Capacitor • Trigger Steering Relay	• FH 306 Flashhead Baseplate Assembly***
OK	Backup Intensity	OK	OK	Red Alarm	• Flashtube Mounting Plate Assembly*** (FH 306)	• F5
Red	OK	OK	OK		• FH 306 Flashtube Mounting Plate Assembly***	• PCB1 Board
Red or White	OK	OK	OK	White Alarm	• FH 306 Flashhead Baseplate Assembly***	
OK	No	OK	OK	Red Alarm	• PCB1 Board • K2 Relay • C3 Burst Capacitor Open	• L1 Burst Choke • R2 Burst Resistor
No	OK	OK	OK	White Alarm	• PCB1 Board • K2 Relay	• L2 Flash Choke • C2A-D Capacitors Open

† HV = High voltage. PCB2 or HV neon lamp lit confirms HV.

‡ Replace the entire red light module if any components therein fail.

* LV = Low voltage. Any PCB1 LEDs on confirms LV.

** See *Section Determining Filter Function from the Power Converter* in this Section.

*** Replace the entire Baseplate Assembly in the FH 306 Flashhead if the filter motion is defective. See *Section 4* for the part number.

Table 3-6 System Troubleshooting Guide

Flash Conditions		Other Conditions	Probable Causes	
Day	Night			
OK	Day Flash	Possible PEC Error	• PEC Photocell • PCB1 Board • Intensity Select Switch	• Jumper on TB1 & 2 on slave units missing
Red	OK	Possible PEC Error	• PEC Photocell	• Intensity Select Switch
-	-	Units mixed red and white	• PEC cable connected to TB1-1 and -3 (all units will be in night mode)	• Intensity Select Switch
OK	OK	Units not flashing together	• Master/slave interconnect cable connected to TB1-4 and TB1-5.	• PCB1 in one unit.
No	No	No lights	• Main power line	

Troubleshooting the FIV Power Inverter

First check:

- The 120 VAC power source is really off.
- The battery voltage under load with a battery tester.
- The AC output voltage of the FIV. With the AC power source off, and the battery OK, the FIV should produce 120 VAC at 60Hz.

See *Table 3-7*.

Table 3-7 FIV Inverter Troubleshooting Table

AC Power	Power Converter	Battery	FIV AC Out	Relay	Problem
OK	OK	OK	120 VAC 60Hz	Energized	None
OK	OK	Low	None	Energized	None with AC; DC power will not function
OK	Not operating	OK	None	Energized	Relay in FIV is defective
Off	OK	OK	120 VAC 60Hz	De-energized	None with DC; AC power does not operate power converter — FIV operating correctly
Off	Not operating	Low	None	De-energized	Battery
Off	Not operating	OK	None	De-energized	Relay or power inverter in FIV

Determining Filter Function from the Power Converter

Two voltages are present at TB2 in the Power Converter that allow you to determine correct functioning of the filter actuator in the FH 306 Flashhead.

See *Table 3-8*.

Table 3-8 Filter Function Voltage Check

VOTAGE	PROCEDURE
120-135 VAC between TB2-4 and TB2-5 at *night*	This voltage drives the filter actuator to the *up* position for night operation. The voltage should *not* be present in daylight. To test this voltage in daylight: 1) Turn the Intensity Select Switch to Manual Night Mode 2) Measure the voltage between TB2-4 and TB2-5. 3) The meter should read 120-135 VAC. 4) Switch the unit to Manual Day Mode 5) The meter should read approximately zero (0) volts. If the voltage is *not present* at night, or it *is present* during the day, the problem is most likely in the power converter.
13-17 VAC or 24-27 VAC between TB2-5 and TB2-6	Use the following procedure: 1) Place meter leads (0-50 VAC range) between main panel terminals TB2-5 and TB2-6. 2) Turn the Intensity Select Switch to Manual Day Mode. 3) The meter should read 13 to 17 VAC and -12 to -17 VDC. *If this voltage is not present, the problem is most likely in the power converter.* 4) Leaving the meter leads connected, turn the Intensity Select Switch to Manual Night Mode. The meter should read 24-27 VAC for about 6 seconds. If the voltage did not increase from 12-17 VAC to 24-27 VAC, the filter did not move. The problem is most likely in the power converter. After six (6) seconds, the voltage should drop to 13 to 17 VAC and read +12 to +17 VDC. If the voltage does not drop to 13 to 17 VAC and instead reads 24 to 27 VAC, or after 20 seconds a red alarm is indicated, and the light goes into white night backup mode, the red filter is not up.

Using the Intensity Select Switches — Finding the Failing Unit at Night

For normal operation, set the intensity select switches on each unit to AUTO. In AUTO, an intensity signal through the master/slave interconnect wires on TB1-4 and TB1-5 controls the day or night intensity level of all power converters and associated lights. Any power converter may send the sync signal on these wires, which flashes all lights at the same time. Normally, all units on a structure have backup enabled. Should a flashhead fail in AUTO night operation, the power converter with the failing flashhead sends a back-up signal to the other units on the interconnect wires. If the failing flashhead is the top-most and is correctly connected to the master, all strobes will go into white back-up mode.

You can switch any unit to day or night operation (manual operation) with its intensity select switch. In manual operation, the following conditions occur on the switched power converter:

In Night Mode:

- It does not send a back-up signal.
- It operates the red light only.
- It clears its red alarm (if it has one) and then re-establishes the alarm.
- It does not affect the other units.

In Day Mode:

- It ignores the master/slave interconnect line (sync and back-up signals).
- It operates the white light only.

When a topmost red light alarm occurs at night, the back-up signal from the failing master power converter switches all units to night intensity white operation. With the preceding information, you can determine master unit in the system is causing the entire system to run in white night intensity.

This page is intentionally blank.

Section 4 — Recommended Spare and Replaceable Parts

Customer Service

Customer Service 1-800-821-5825
FTCA Telephone: (615) 261-2000
Facsimile: (615) 261-2600
Internet Address:
http:\\www.flashtechnology.com
Shipping Address:
Flash Technology Corporation of America
332 Nichol Mill Lane
Franklin TN 37067

Ordering Parts

To order spare or replacement parts, contact FTCA customer service at 1-800-821-5825. Use the part numbers listed in Tables 4-1 to 4-3.

Power Converter Parts

Table 4-1 lists the major replaceable parts.

Flashhead Parts

Table 4-2 lists the major replaceable parts.

Photocell Parts

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

FIV 1100 and FIV 2000 Inverter Parts

Table 4-3 lists the major replaceable parts.

Returning Equipment

Before returning equipment to FTCA, contact Customer Service at 1-800-821-5825 for a Return Material Authorization (RMA) number.

Repackaging

Equipment must be returned in a container that provides maximum protection during shipping and handling. If the original cartons and packaging material are no longer available, package the power converter and flashhead *separately* as in the following subsections.

Power Converter

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

Flashhead

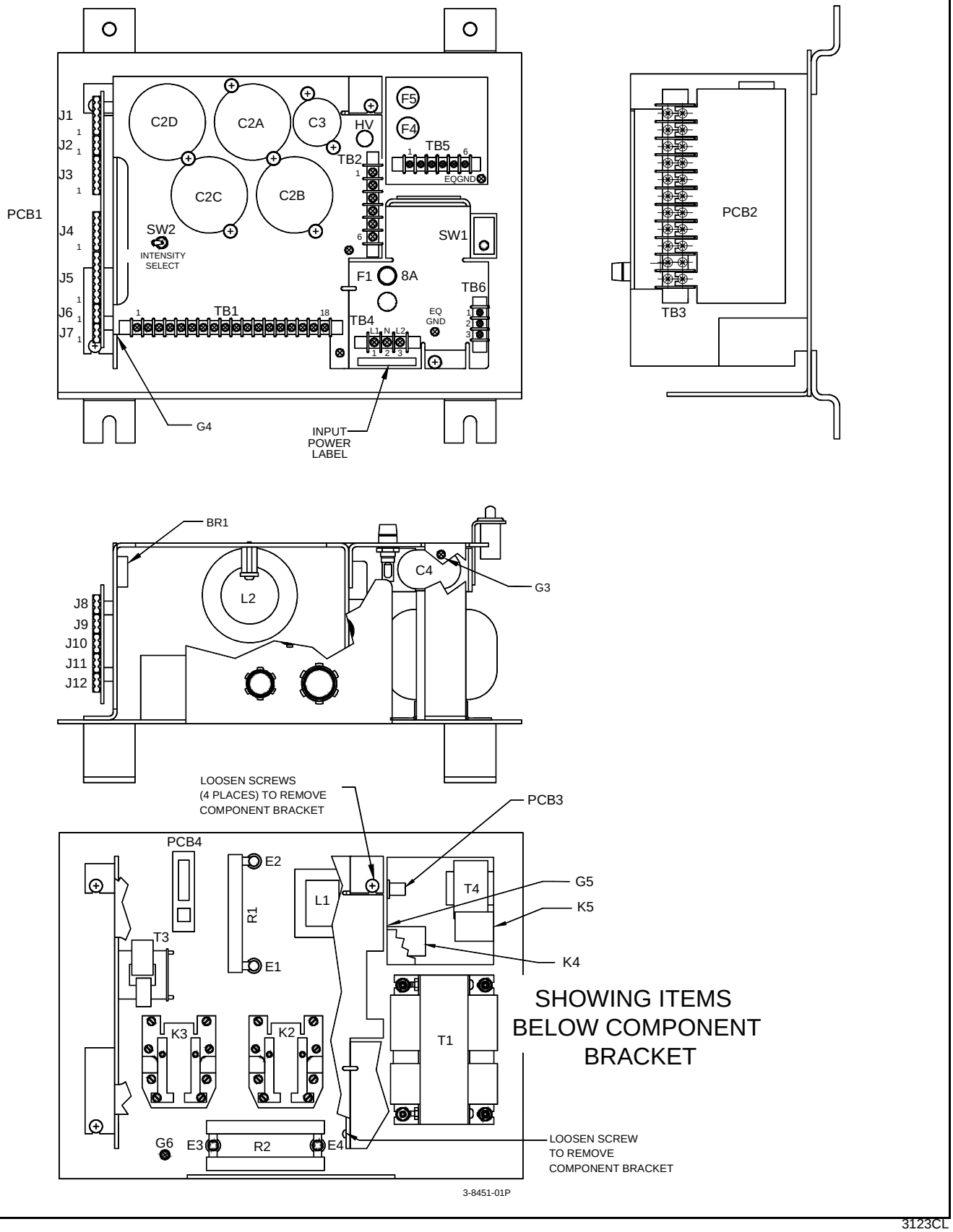
Package and ship the flashhead in an upright position. Box each flashhead separately and use adequate padding. Attach the flashhead base to a plate measuring 19 inches square (e.g., 3/8 inch plywood). Use a double thickness cardboard (or wood) container which is 19 inches square by about 25 inches high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

Table 4-1 Power Converter Major Replaceable Parts

Item	Description	Part Number
BR1	Diode Bridge	6902806
C2A, C, D	Capacitor, 70 mfd.	6720401
C2B	Capacitor, 40 mfd.	6386503
C3	Capacitor, 1 mfd.	6848202
C4	Capacitor, 3 mfd.	6577903
F1, F2	Fuse, Power, MDL8	*†4901931
F4	Fuse, Marker, MDL5	4900345
F5, F6	Fuse, MDL1	4900337
HV	Neon, High Voltage Light	4902317
K2	24V Relay, Mode	†8900494
K3	120V Relay, Discharge	†8900493
L1	Choke, Burst	4850601
L2	Choke, Flash	4175200
LS1	Line Surge Protector	2865301
M1 for PC 312-3H	Red Light Module	1811506
M1	Red Light Module	†1811502
MOV	Varistor	6901079
PCB1	Timing and Trigger Board — PC 312-3 non-“E” models	*†24740xx
PCB1	Timing and Trigger Board — PC 312-3 “E” models	*†24747xx
PCB2	HV Rectifier Board	*†2458005
PCB4	Sense Module	2811101
PCB5	Alarm Board — “AE” models	2805404
R1	Resistor, Discharge, 35K 50W	6900541
R2A & B	Resistor, Burst (two 500-ohm resistors of the indicated part number comprise one burst resistor)	6900532
S1	Switch, Interlock	4901220
S2	Switch, Toggle	†8799201
T1	Transformer, Power, 60 Hz	8841201
T1	Transformer, Power, 50 Hz	8842901
T3	Transformer, Coupling	8336701
TB1	Terminal Strip, 18 position	4901930
TB2, TB7	Terminal Strip, 6 position	4902257
TB3	Terminal Strip, 11 position	8721011
TB4, TB5	Terminal Strip, 3 position	4902134
TB5	Terminal Strip, 6 position	4902257
TB6, TB8	Terminal Strip, 3 position	4902157
VR1	Varistor, 130V	6901079
VR1	Varistor, 250V	6901081

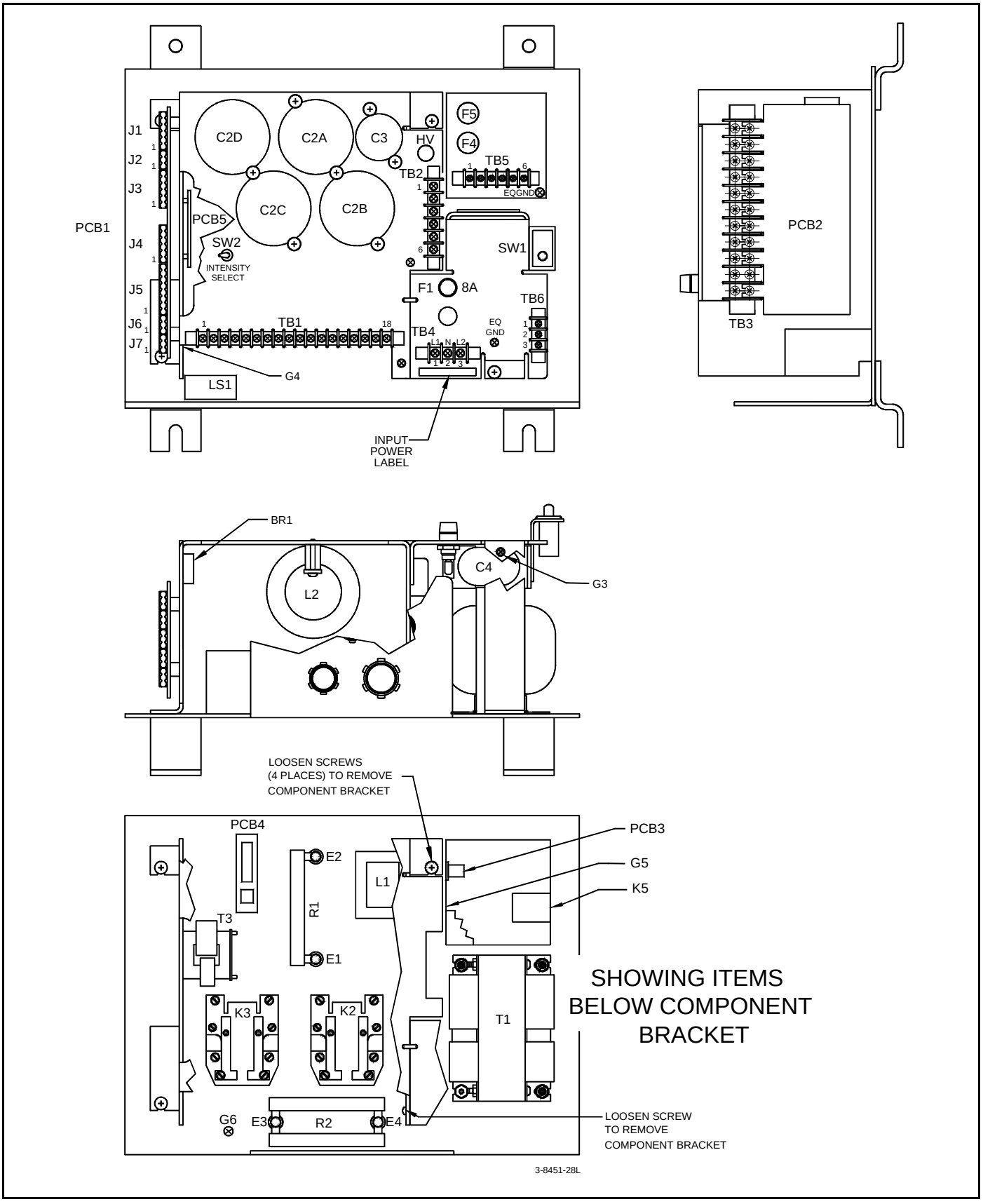
* This part number varies according to the specific equipment configuration and function. Be prepared to describe the system configuration when you call Customer Service for the correct PCB1 Timing and Trigger Board or fuse part number for your particular system. Have available the part number of your current PCB1 when you call.

† Recommended as a spare part.



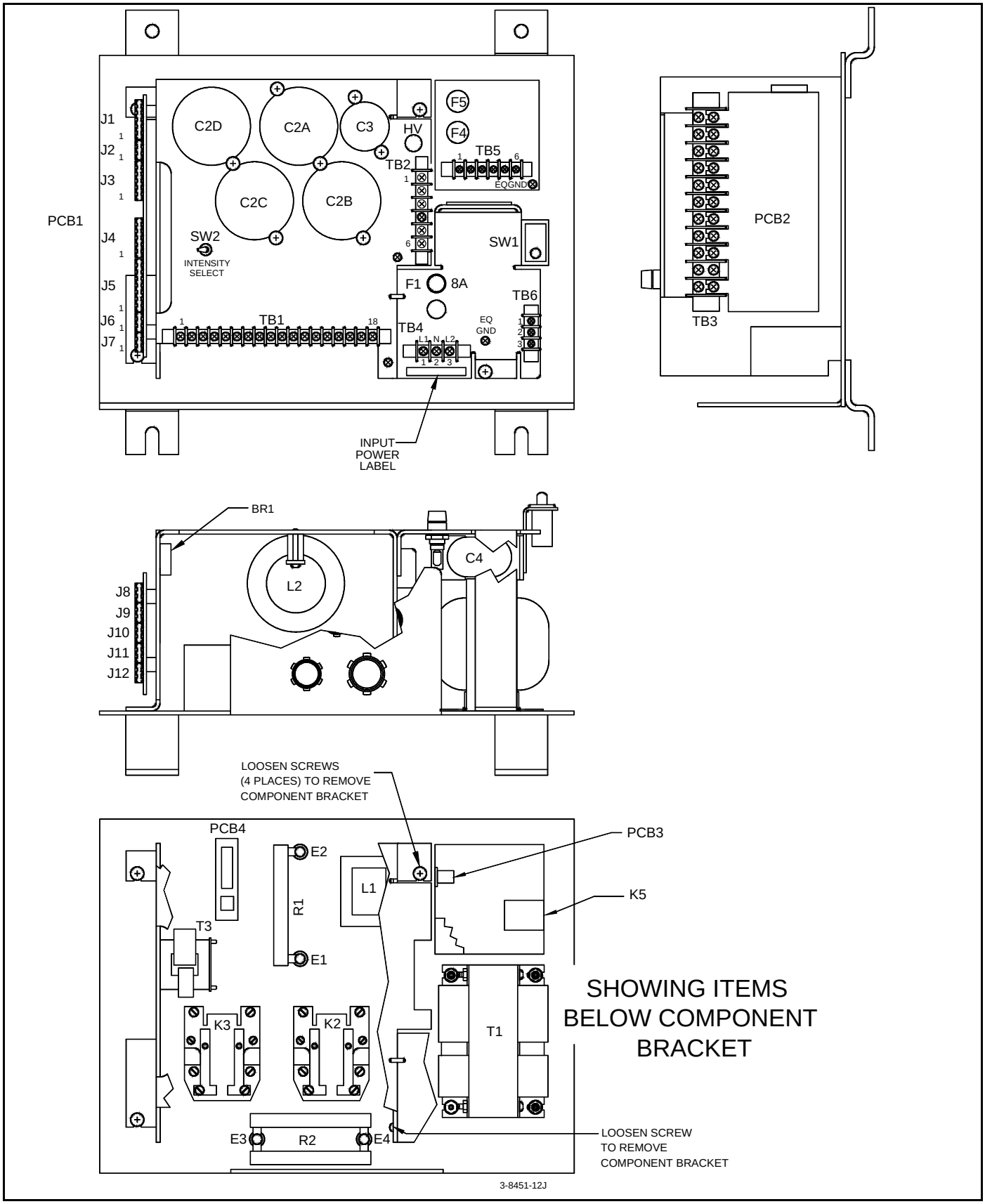
3123CL

Figure 4-1 PC 312-3 Power Converter Component Location



3123AECL

Figure 4-2 PC 312-3AE Power Converter Component Location

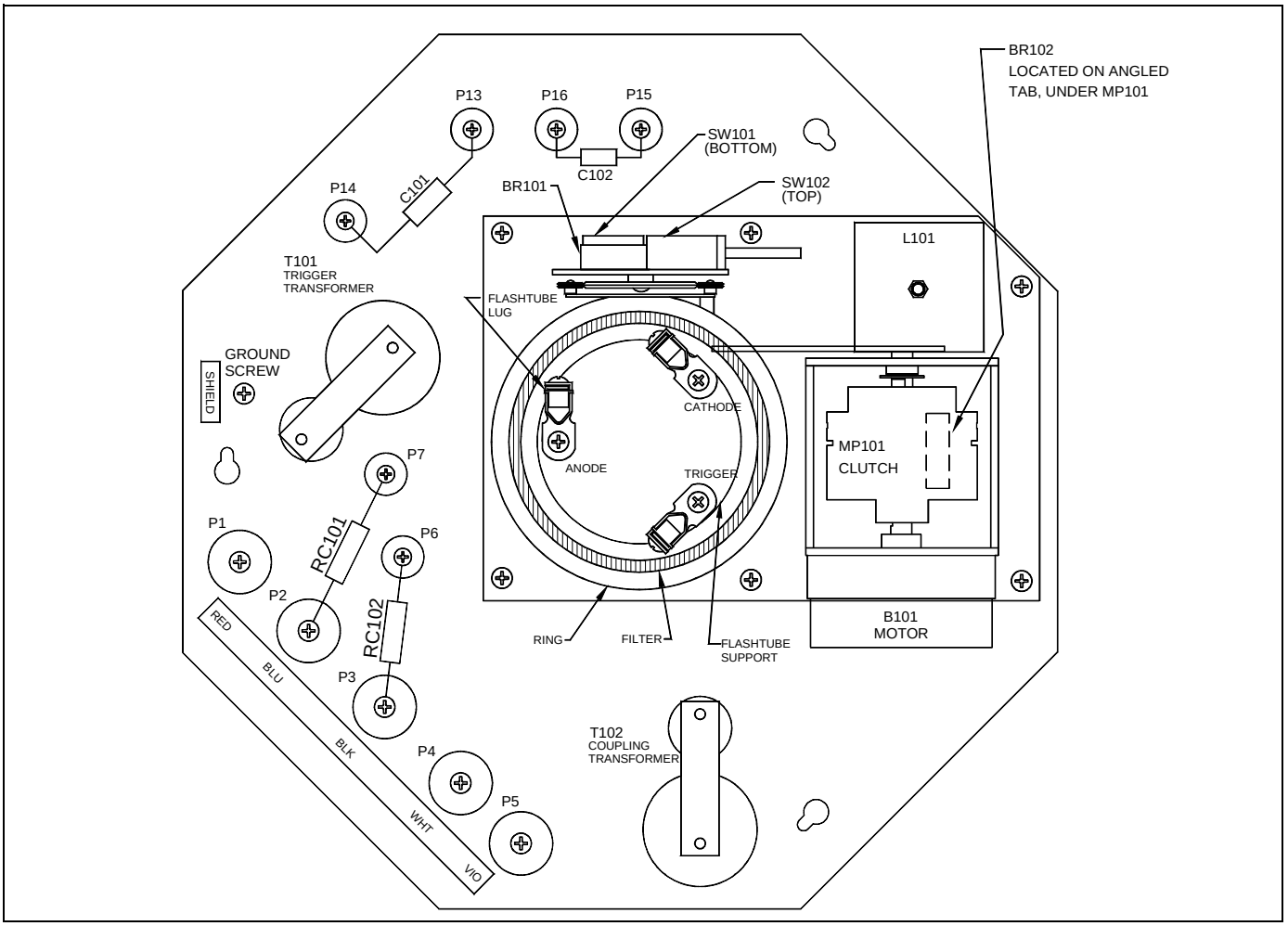


3123TCL

Figure 4-3 PC 312-3T Power Converter Component Location

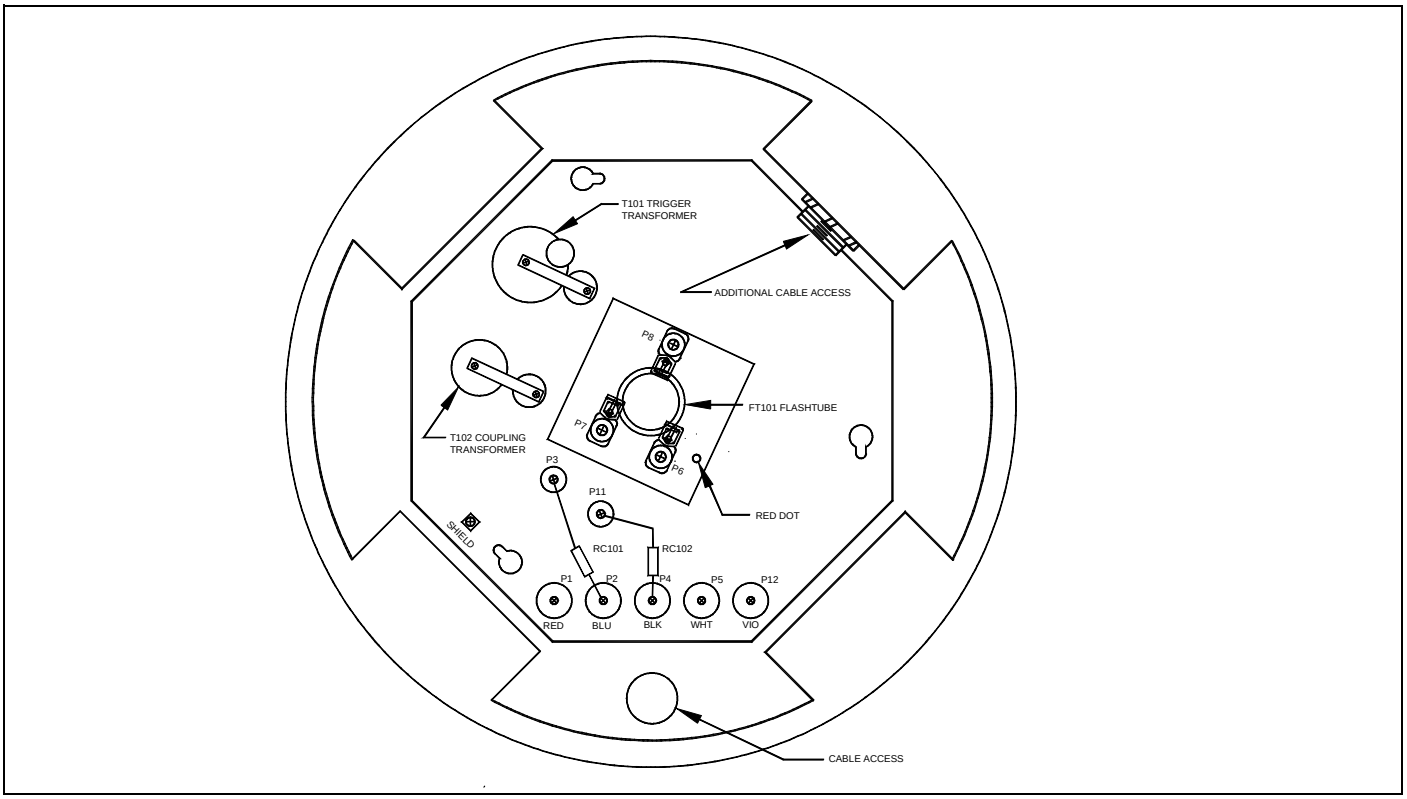
Table 4-2 Flashhead Major Replaceable Parts

Reference		Description	Part Number
Flashhead	Item		
FH 306	FT101	Flashtube	8384308
FH 307T	FT101	Flashtube	8384308
FH 308	FT101	Flashtube	8384329
FH 307T, 308	P1, P2, P4, P5, P12	Ceramic spacer, 3/4" diameter	5900844
FH 307T, 308	P3, P11	Ceramic spacer, 1/2" diameter, short	5900842
FH 307T, 308	P6, P7, P8	Ceramic spacer, 1/2" diameter, tall	5900843
FH 306	A101	Flashtube Mounting Plate Assembly	8812405
All	RC101	Resistor-capacitor network	1403411
All	RC102	Resistor-capacitor network	1403412
FH 307T, 308	T101	Transformer, Trigger	8288201
FH 306, 307T, 308	T102	Transformer, Coupling	8336701



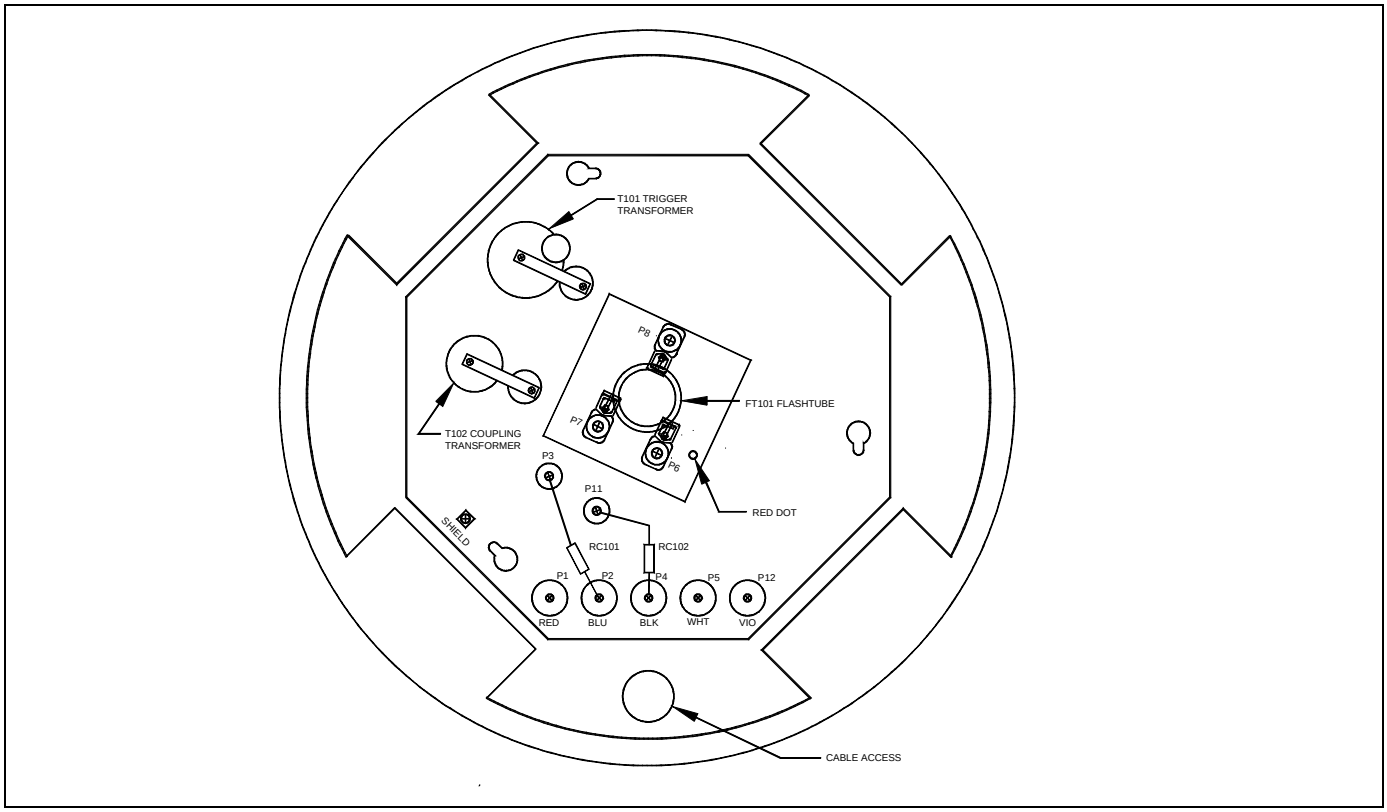
3062CL

Figure 4-4 FH 306 Flashhead Component Location



307TCL

Figure 4-5 FH 307T Flashhead Component Location



308CL

Figure 4-6 FH 308 Flashhead Component Location

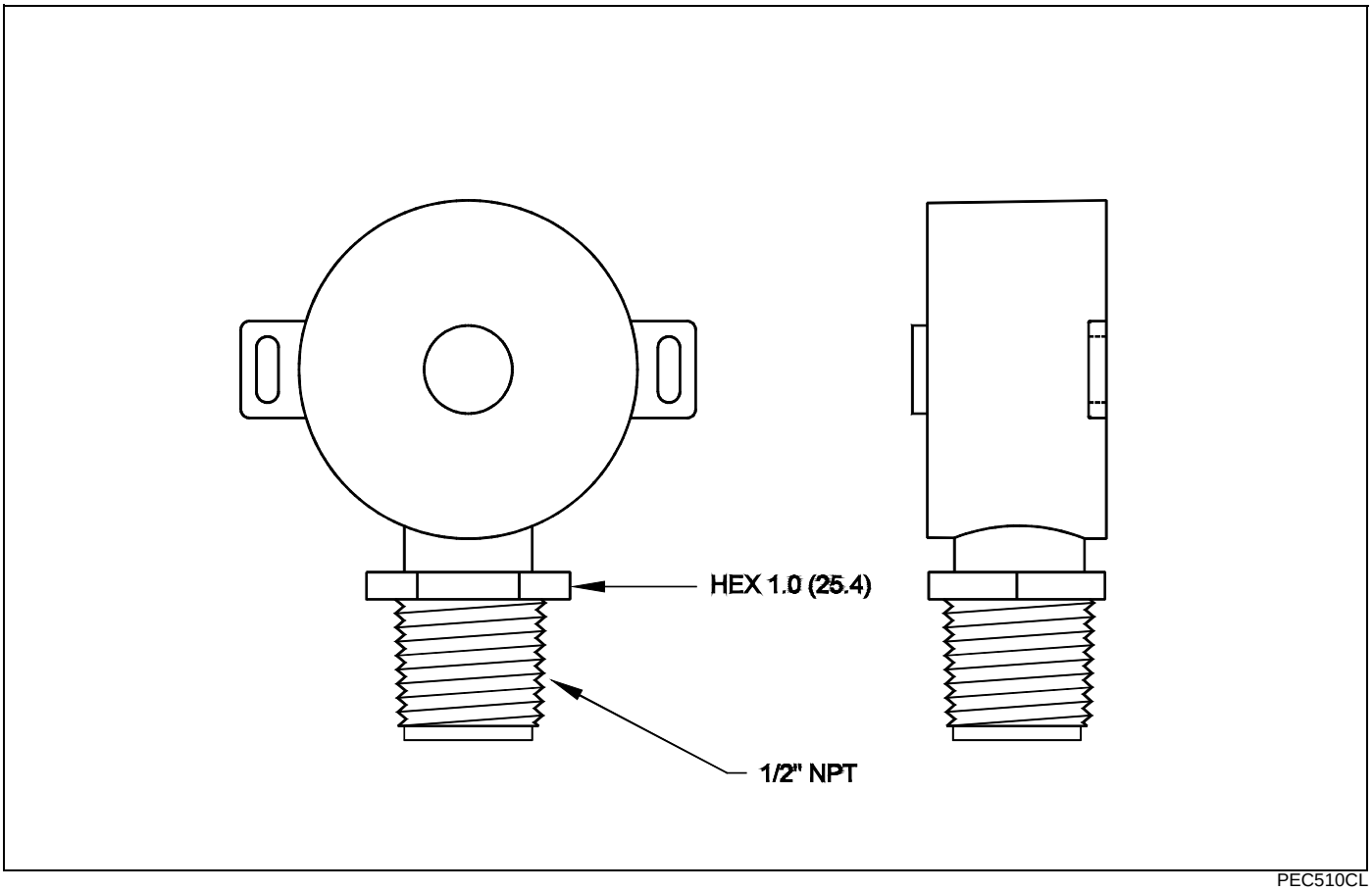
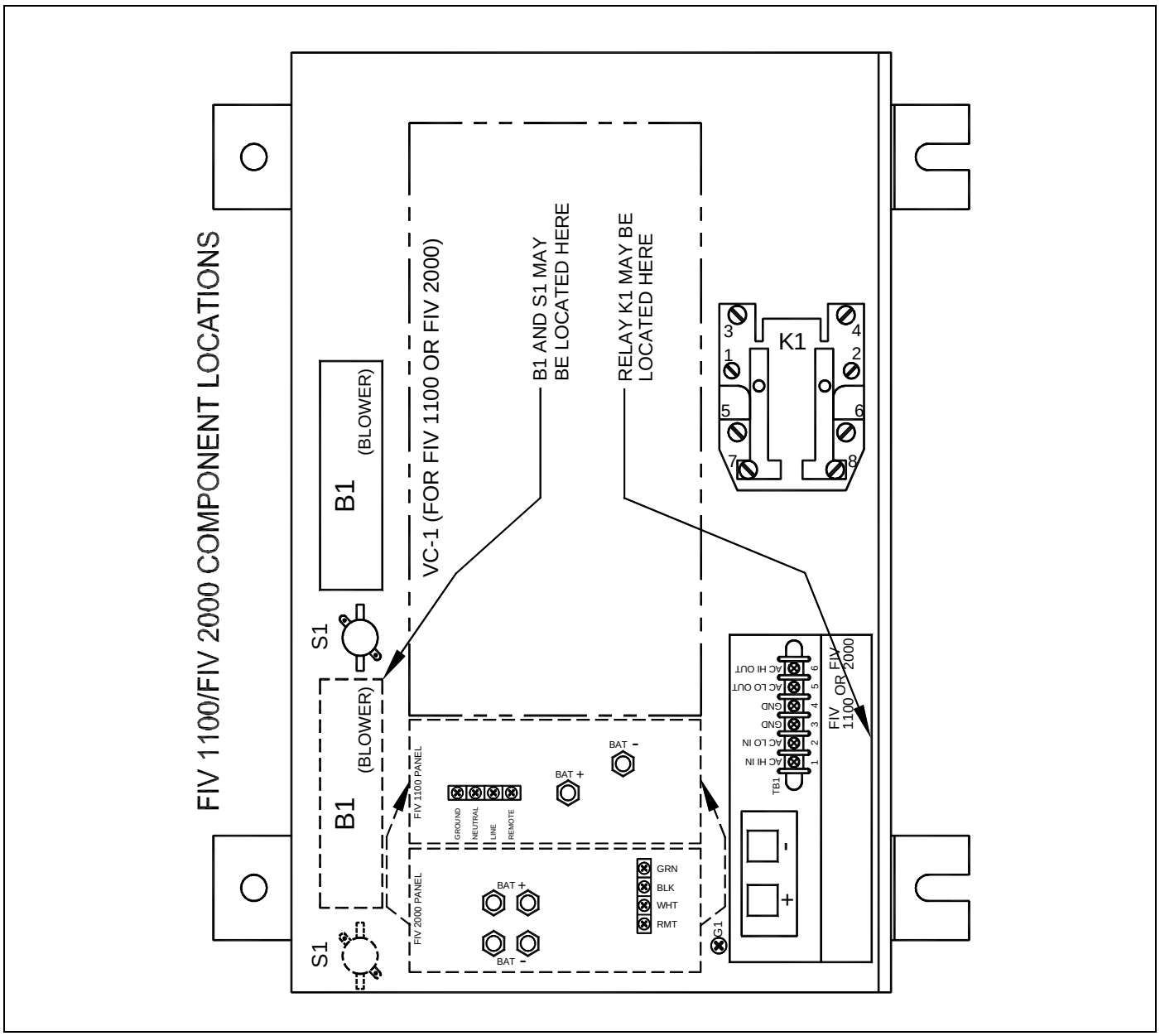


Figure 4-7 PEC 510 Photocell

Table 4-3 FIV 1100 and FIV 2000 Inverter Major Replaceable Parts

Unit	Description	Part Number
FIV 1100 & FIV 2000	Power Transfer Relay	4900493
FIV 1100 & FIV 2000	Thermostat	4902589
FIV 1100	DC to AC Inverter	4802583
FIV 2000	DC to AC Inverter	4802584
FIV 1100 & FIV 2000	TB1, Terminal Block, 6-position	4902257
FIV 1100 & FIV 2000	Blower	4902588



FV1100CL

Figure 4-8 FIV 1100/FIV 2000 Inverter Component Location

This page is intentionally blank.

INDEX

~~ End of Document ~~