



SN

FTC 161, FTC 163, FTC 165 Controller

Reference Manual

Front Matter

Abstract

This manual contains information and instructions for installing, operating and maintaining the FTC 161, FTC 162, and FTC 163 Controllers manufactured by Flash Technology Corporation of America® (FTCA).

Copyright

Copyright © 2003 Flash Technology Corporation of America®, Franklin, TN 37067, U.S.A.

All rights reserved. Reproduction or use of any portion of this manual is prohibited without express written permission from Flash Technology Corporation of America and/or its licensor.

Trademark Acknowledgments

Flash Technology Corporation of America® is a registered trademark name.

Flash™, ElectroFlash™, Flash Tech™, Flash Technology™, and FTCA™, are all trademarks of Flash Technology Corporation of America®.

All trademarks and product names mentioned are properties of their respective companies, and are recognized and acknowledged as such by Flash Technology Corporation of America.

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.

Parts Replacement

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

Warranty

All components are fully warranted, under normal operating conditions, for one year.

PERSONNEL HAZARD WARNING
DANGEROUS VOLTAGES

Dangerous line voltages reside in certain locations in this equipment. 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. There are no voltages significantly above the line voltage.

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.

Table of Contents

Section	Page
Section 1 — Introduction and Operation	1-1
FTC 160 Class Controllers	1-1
Specifications	1-1
FTC 160 Class Controller Types	1-1
Operation	1-1
Controller	1-1
Flashhead Connection	1-1
Normal LED Operation	1-2
Manual Override Operation	1-2
Checkout Procedure	1-5
Section 2 — Outline, Mounting, and Installation	2-1
Unpacking	2-1
Tools	2-1
Controller Access	2-1
Mounting	2-1
Location	2-1
Controller	2-1
Photocell and Temperature Sensor	2-1
Installation Wiring	2-1
Wiring	2-2
Temperature Sensor (Optional, for “E” Units Only)	2-2
Photocell	2-2
Lightning Protection	2-2
Installation Checklist	2-3
Section 3 — Maintenance and Troubleshooting	3-1
Maintenance	3-1
Troubleshooting	3-1
Failing to Switch State	3-1
Flashhead	3-1
Lamps	3-1
Electromechanical Relays	3-1
LED Displays	3-1
Component Removal and Replacement	3-1
PCB1 Monitor Board	3-2
PCB2 Flash Detection Board	3-2
PCB3 Current Sensor Board	3-3
PCB4 Surge Suppressor Board	3-3
Relays	3-3
K1 & K2 Relays	3-3
Section 4 — Major Replaceable Parts	4-1
Customer Service	4-1
Ordering Parts	4-1
Controller Parts	4-1
Photocell Parts	4-1
Returning Equipment	4-1
Repackaging the Controller	4-1
Index	I-1

List of Figures

	Page
Figure 1-1 — PCB1 Monitor Board	1-3
Figure 1-2 — PCB2 Flash Detection Board	1-3
Figure 1-3 — PCB3 Current Sense Board	1-4
Figure 1-4 — PCB4 Surge Suppressor Board	1-4
Figure 2-1 — FTC 160 Class Controller Mounting and Outline	2-4
Figure 2-2 — Photocell or Temperature Sensor Mounting and Outline	2-5
Figure 2-3 — FTC 161 and FTC 161E Controller Internal Wiring	2-6
Figure 2-4 — FTC 163 and FTC 163E Controller Internal Wiring	2-7
Figure 2-5 — FTC 165 and FTC 165E Controller Internal Wiring	2-8
Figure 2-6 — Front Panel Connections	2-9
Figure 2-7 — FTC 161 Controller Typical Installation Wiring	2-10
Figure 2-8 — FTC 163 Controller Typical Installation Wiring	2-11
Figure 2-9 — FTC 165 Controller Typical Installation Wiring	2-12
Figure 2-10 — Recommended Alarm Wiring	2-13
Figure 4-1 — FTC 160 Class Controller Component Location	4-3

List of Tables

	Page
Table 1-1 FTC 160 Class Controllers	1-1
Table 1-2 PCB1 Jumpers, Switches, Connectors, LEDs, and Test Points	1-2
Table 3-1 Major Troubleshooting Symptoms	3-2
Table 4-1 Major Replaceable Parts	4-2

This page is intentionally blank.

Section 1 — Introduction and Operation

FTC 160 Class Controllers

The FTC 160 Class Controller controls incandescent L-864 beacons, L-864 FH 309 Flashheads or L-864 LED beacons, and tiers of L-810 marker lights. The FTC 160 Class Controller directs beacon flashing, and reports light operating status. It allows photocell or manual override mode control.

FTC 160 Class Controllers that can communicate with a remote computer have an “E” suffix; for example, FTC 161E (“E” is for Eagle). These units contain a built-in modem and a PCB4 surge suppressor board. They also contain: a B1 Battery to allow the unit to communicate a power failure to the remote computer, and a K2 power transfer relay that connects the battery if power fails. The modem is built into the PCB1 Monitor Board in “E” units and the rest of the components for “E” units is shown in *Figure 2-3 to Figure 2-5*.

The enclosure of the controller allows it to be wall mounted. Latches fasten the cover allowing it to be removed to reveal the operating controls.

NOTE: Flashheads and marker tiers are numbered from top to bottom, the top flashhead designated Beacon 1 and the top marker tier designated Marker Tier 1.

The PEC 510 Photocell detects changes in ambient light conditions for the controller.

Specifications

Physical:

See outline drawings in Section 2 for mounting dimensions.

FTC 160 Class Controller (H x W x Depth, Wgt):

4.875 x 16.08 x 10.05 in., 15.5 lbs.
377.8 x 408.4 x 255.3 mm., 7.03 kg.

System Electrical: AC Voltage 120 VAC ± 10%
60 Hz ±5% single phase

FTC 160 Class Controller only: 11 Watts

Environmental: -50 to +55 degrees Centigrade

Alarm Relay: Isolated contacts, 120 VAC 1 amp rating.

FTC 160 Class Controller Types

Table 1-1 FTC 160 Class Controllers

Controller	Description of Example Lighting
FTC 161	One FH 309 Flashhead or L-864/LED beacon One L-810 side marker tier
FTC 163	Three FH 309 Flashheads or L-864 beacons or LED beacons Two L-810 side marker tiers
FTC 165	Five FH 309 Flashheads or L-864/LED beacons Three L-810 side marker tiers

Operation

Controller

The DAY/AUTO/NIGHT manual override mode switch, which controls day or night operation or automatic operation directed by the photocell, is located on the upper center of PCB1 Monitor Board. For normal operation, leave the switch in the AUTO position.

The controller begins operation as soon as power is turned on with the main power switch on the interior front panel.

Flashhead Connection

The flashheads are connected to the “beacon” connections on the controller at TB2, with the neutral wire connected to the neutral connection on TB3-4. All neutral wires must be returned to TB3-3 or TB3-4.

Tiers of marker lights are connected to the marker connections at TB2.

Normal LED Operation

The LEDs on the PCB1 Monitor Board should operate as described in the following list with the DAY/AUTO/NIGHT switch in AUTO:

- The ALARM LEDs are out.
- The DAY or NITE mode LED is glowing according to the sky lighting conditions.
- The AC LED should be flashing.

The DAY or NIGHT position of the switch overrides photocell control provided by the AUTO position.

Manual Override Operation

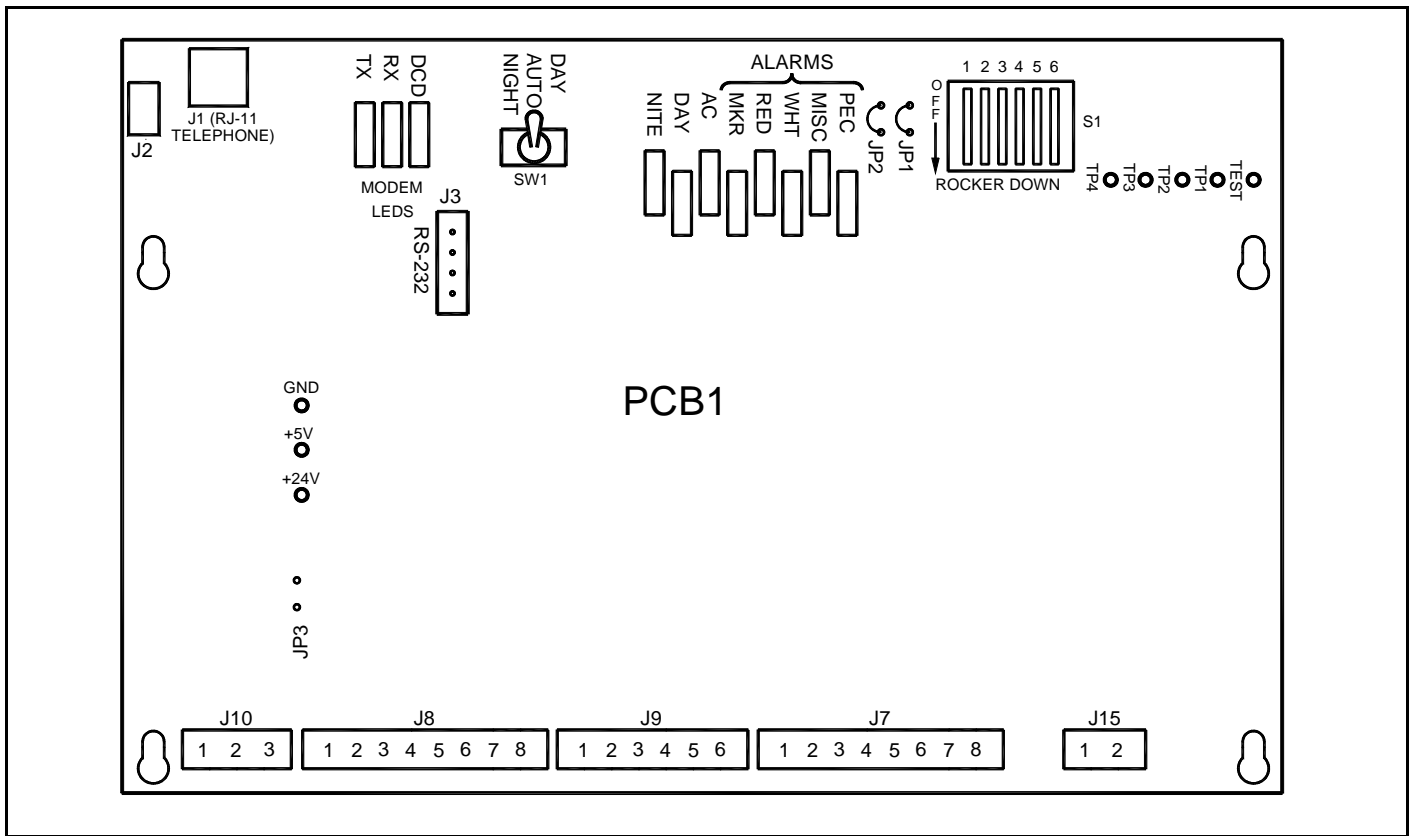
Select the desired mode of operation (DAY or NIGHT) by using the DAY/AUTO/NIGHT switch.

If the switch is left in DAY or NIGHT position for over 8 hours, the board reverts to AUTO mode.

PCB1 has jumpers, switches, connectors, LEDs, and test points whose functions are described in *Table 1-2*. *Figure 1-1* provides a pictorial of the PCB1 Monitor Board.

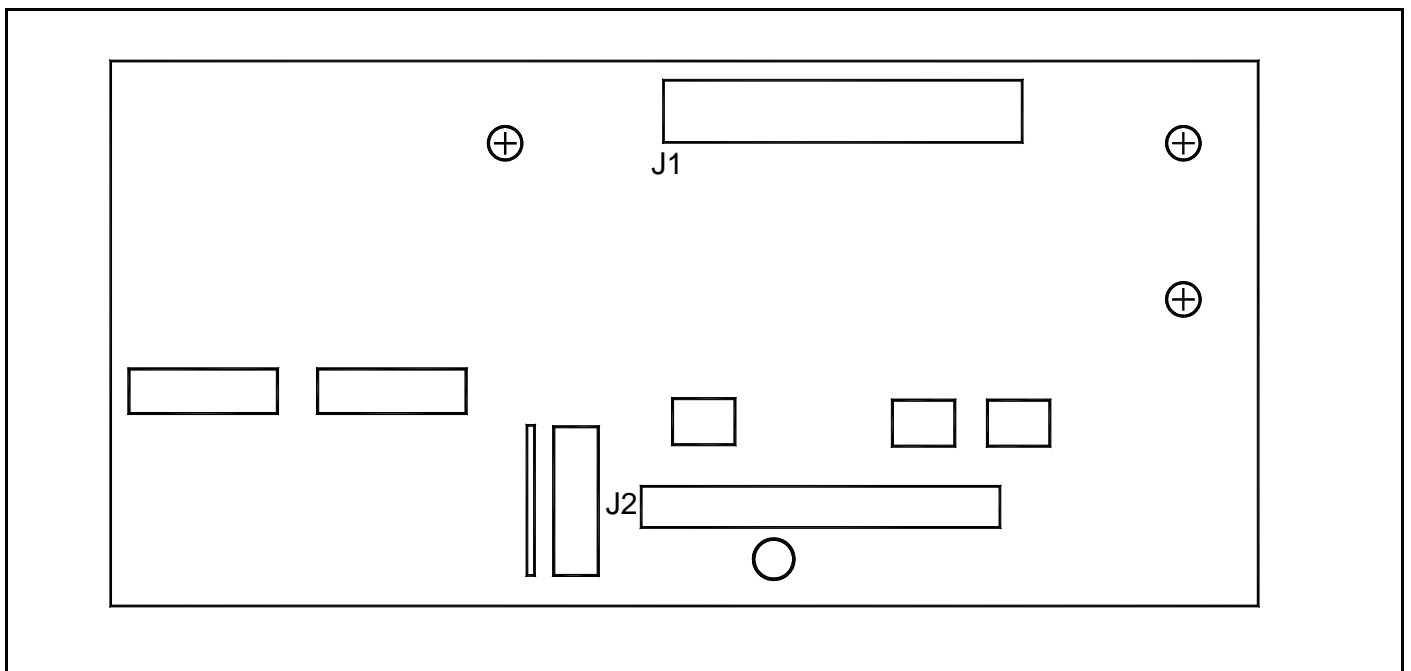
Table 1-2 PCB1 Jumpers, Switches, Connectors, LEDs, and Test Points

Jumper	Description
JP1	Cut when the FTC 160 is controlled by another system by attaching relay contacts to the photocell input.
JP2	Factory reserved.
JP3	Cut to enable use of a resistive photocell. This jumper is not installed.
DIP Switch S1	Factory reserved.
Manual Override Switch SW1	Auto: Normal operating position Day: Manual override to day mode; if in this position for over 8 hours, the board changes back to Auto mode. Night: Manual override to night mode; if in this position for over 8 hours, the board changes back to Auto mode.
J1	Phone line connector to PCB3 surge suppressor board. <i>Reserved for factory use.</i>
J3	Computer connector for board programming. <i>Reserved for factory use.</i>
LED I1	AC — Flashing = AC power present — Steady On = Unit on DC backup power — Steady Off = No power, unit not operating
LED I2	NITE — On = Night mode.
LED I3	DAY — On = Day mode.
LED I4	MKR — On = Marker alarm.
LED I5	RED — On = Red light alarm.
LED I6	WHT — On = White light alarm. (Does not apply to FTC 160. Applies only when PCB1 is used in FTM 130.)
LED I7	MISC — On = Future use.
LED I8	PEC (photocell) — On = Failure to change operating mode within a preprogrammed time; for example, 19 hours.
LED I11	TX — On = Modem transmit.
LED I12	RX — On = Modem receive.
LED I13	DCD — On = In modem initialization or calling state.
Test points: TP4, TP3, TP2, TP1, TEST.	Factory reserved.
Test points: GND, +5V, +24V	Voltage test points as indicated.



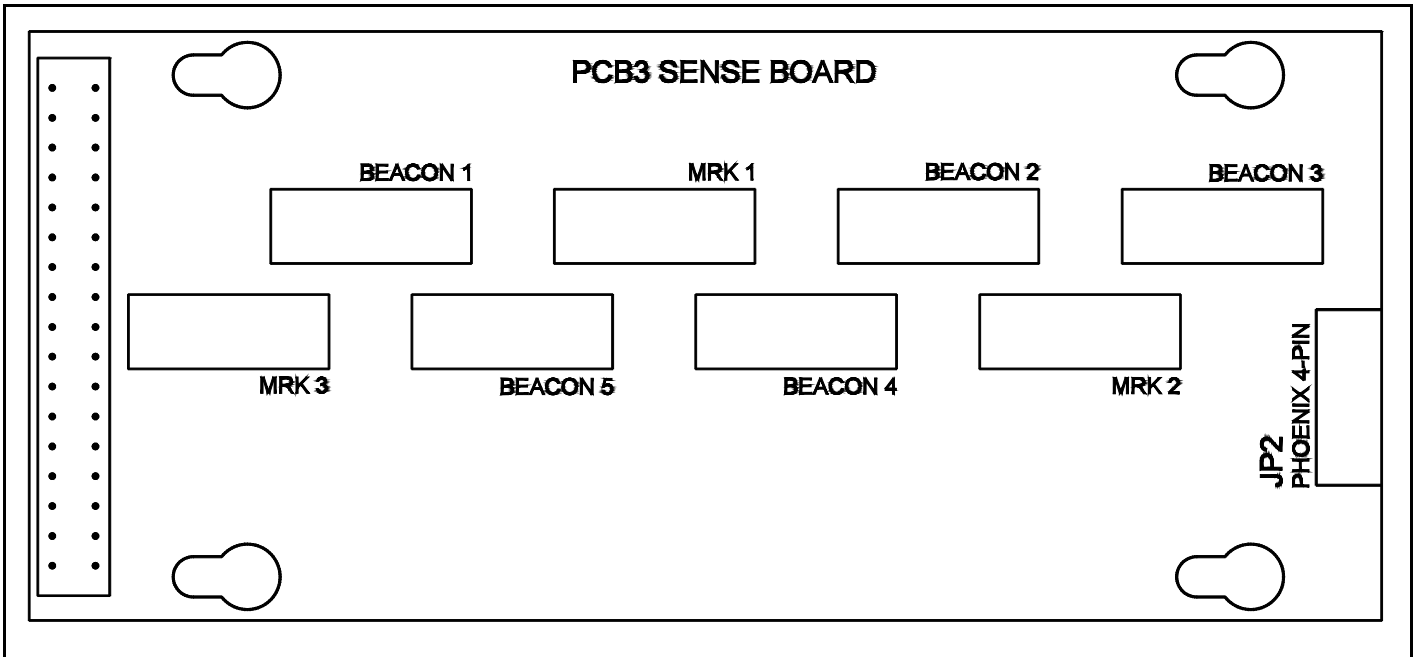
PCB1

Figure 1-1 — PCB1 Monitor Board



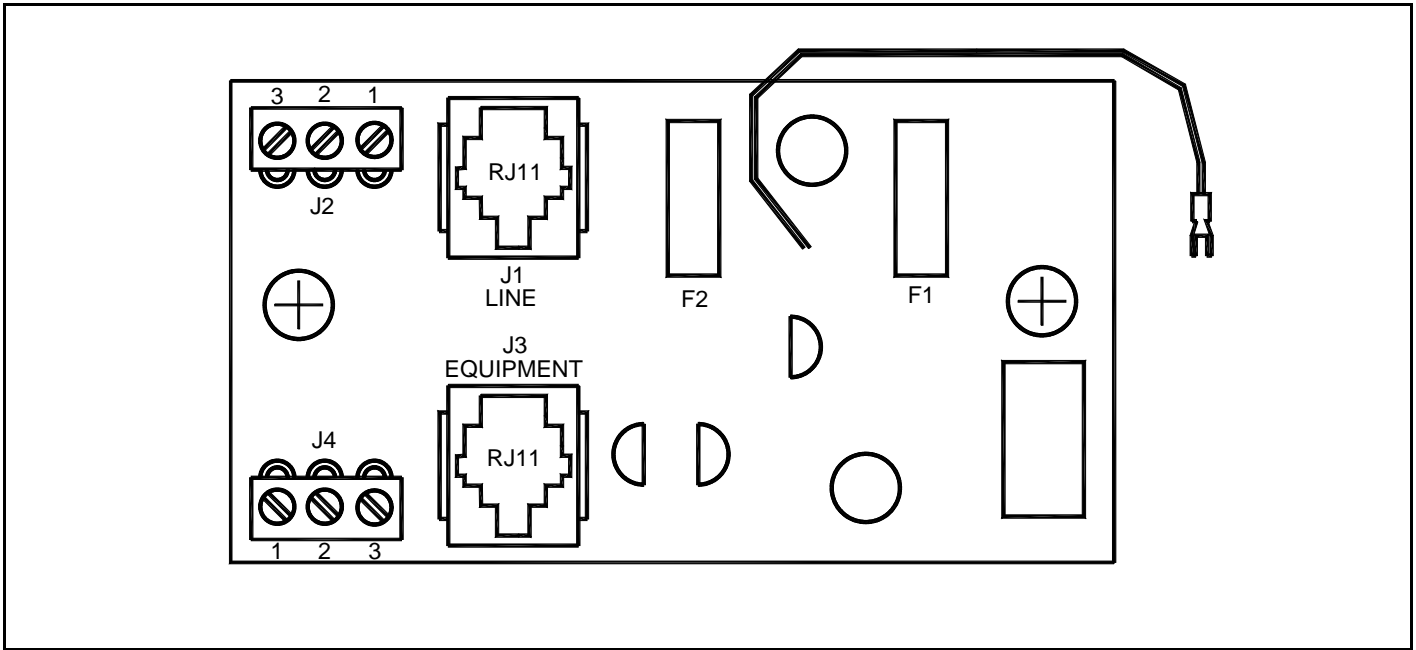
PCB2

Figure 1-2 — PCB2 Flash Detection Board



PCB3

Figure 1-3 — PCB3 Current Sense Board



PCB4

Figure 1-4 — PCB4 Surge Suppressor Board

Checkout Procedure

Using the Photocell

1. Turn the DAY/AUTO/NIGHT Switch to AUTO:

The system is now under photocell control.

Cover the photocell so as to block all light from it.

With no alarms or errors:

- The system is now in NIGHT mode.
- The beacons should be on and flashing.
- The markers should be on steadily.

Uncover the photocell so as to allow light to strike it, or shine a light on it. With no alarms or errors:

- The system is now in DAY mode.
- The beacons and markers should turn off.

Using the Mode Override Switch

1. Turn the DAY/AUTO/NIGHT Switch to DAY:

With no alarms or errors:

- The system is now in DAY mode.
- The beacons and markers should turn off.

2. Turn the DAY/AUTO/NIGHT Switch to AUTO:

With no alarms or errors:

- The system is now under photocell control.
- The beacons and markers should be off during daylight and on at night.

3. Turn the DAY/AUTO/NIGHT Switch to NIGHT:

With no alarms or errors:

- The system is now in NIGHT mode.
- The beacons should be on and flashing.
- The markers should be on steadily.

If the operation is not as described, go to *Troubleshooting* in Section 3.

This page is intentionally blank.

Section 2 — Outline, Mounting, and Installation

Unpacking

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

Tools

- Small flat blade (5/32") screwdriver
- #2 Phillips-head screwdriver with 10" shank

Controller Access

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

Mounting

Outline, mounting, and clearance dimensions for the controller are shown in *Figure 2-1* and those for the photocell are shown in *Figure 2-2*.

Location

Locate the FTC 160 Class Controller in an area with restricted access. You can place the controller anywhere within 2500 feet of the most distant light. Consult with the factory if a greater distance is necessary.

Controller

Use the following guidelines for mounting the controller:

- Ensure that adequate space exists around the equipment for access during installation, maintenance and servicing.
- Allow space for air flow around the controller.
- It is very important that you use a ground wire on the 10-32 bolt on the panel where the cables enter the unit. Connect the wire to the site grounding system.

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

Photocell and Temperature Sensor

Mounting and outline dimensions for the photocell are shown in *Figure 2-2*. These dimensions are the same for the Temperature Sensor.

Use the following guidelines for the photocell:

- Locate the photocell where it has an unobstructed view of the polar sky.
- It must not view direct or reflected artificial light.
- The photocell may be supported directly by electrical conduit.
- *Mount the photocell vertically on the top end of a vertical length of conduit to prevent water from entering and damaging the unit.*

Use the following guidelines for the Temperature Sensor:

- Locate the temperature sensor inside the tower building.

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 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.*

Follow all national and local electrical codes.

Wiring

NOTE

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

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

To wire the PEC 510 use #16 AWG stranded wire. The photocell is supplied with an attached cable.

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

Wire size for the lights on each wire run is calculated from the number of flashheads or beacons and marker lights, and the length of the wire on that run. Wire for the lights should be sized so that the voltage drop at the bulb sockets, FH 309 or LED should not exceed 3%. Total power required is the sum of all these and 11 watts additional for the FTC 160 Class Controller. Consult power requirements for each type of light in the *Specifications* in *Section 1*.

Use the supplied cable for the photocell wiring. The preferred telephone line connection to the PCB4 surge suppressor board is “Bell” wire connected to the J2 Phoenix connector on PCB4 at terminals 1 and 2.

Figure 2-7 shows the FTC 160 Class Controller wiring in a typical installation.

Make electrical connections at the following terminal blocks:

- **Alarm:** TB1-1 and TB1-2 (NO) or TB1-2 and TB1-3 (NC)
- **Photocell:** (control) TB1-4 and TB1-5
- **Temperature sensor:** (control) TB1-6 and TB1-7
- **Beacon 1 (TOP):** TB2-1 (power) and TB3-4 (neutral)
- **Beacon 2:** TB2-3 (power) and TB3-4 (neutral)
- **Beacon 3:** TB2-4 (power) and TB3-4 (neutral)
- **Beacon 4:** TB2-6 (power) and TB3-4 (neutral)
- **Beacon 5:** TB2-7 (power) and TB3-4 (neutral)
- **Marker 1:** TB2-2 (power) and TB3-4 (neutral)

- **Marker 2:** TB2-5 (power) and TB3-4 (neutral)
- **Marker 3:** TB2-8 (power) and TB3-4 (neutral)

Temperature Sensor (Optional, for “E” Units Only)

The temperature sensor is supplied with a 20-foot cable. One hundred feet is the maximum distance recommended if additional wires are spliced to it. Use #16 AWG wire.

The Temperature Sensor is a positive temperature coefficient thermistor; its resistance increases with temperature.

Connect the temperature sensor to the controller: the black wire to TB1-6 and the white wire to TB1-7.

Photocell

Connect the photocell to the controller: the black wire to TB1-4 and the white wire to TB1-5.

Ground the wire shield around the photocell wires, if one is present. Do not ground the shield to the photocell, but ground it at the Controller

Lightning Protection

All ElectroFlash equipment is designed to withstand severe transient over-voltages. However, a lightning arresting system should be installed to prevent eventual damage by lightning. Transient suppressors from line-to-line and line-to neutral are recommended at the primary power load center.

Installation Checklist

Use the following checklist when installing the system:

1. **Equipment Damage:**
Inspect all equipment for damage.
2. **Required Equipment:**
Verify the received equipment against the packing list to ensure completeness.
3. Consult site installation drawings for placement, mounting, wiring details, and power phasing.
4. Provide a power disconnect switch or a circuit breaker.
5. Check the lightning protection system.

6. Be sure that junction boxes will drain properly.
7. Position and mount the controller allowing adequate clearance for removing the cover.
 - Ensure that the unit is mounted upright.
 - Check the internal hardware to ensure that the chassis mounting screws are tight.
 - Ensure that no holes are punched or drilled on the top surface of the cover.
 - Ensure that air can flow around the enclosure.

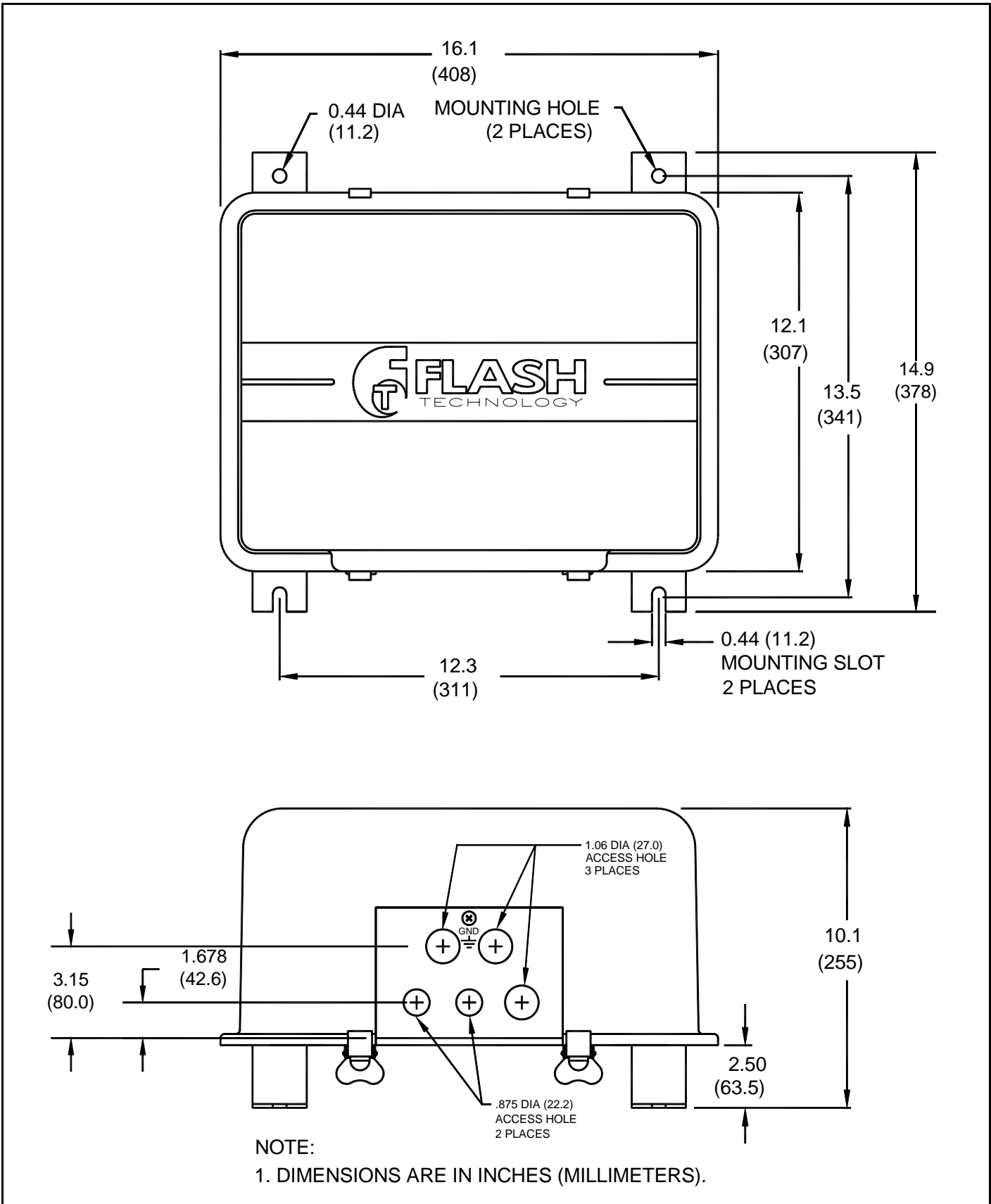
Complete the following steps before applying power:

8. Examine the installation drawings:
 - Check for proper incoming service voltage. Verify that primary power voltage is the value stated on the ID plate.
 - Wire each unit according to the instructions.
 - Check all electrical connections for tightness.
 - Check all terminal strip connections for tightness.
 - It is very important that you ground the controller to the site grounding system with a

wire fastened to the 10-32 screw provided on the panel where the cables enter the unit.

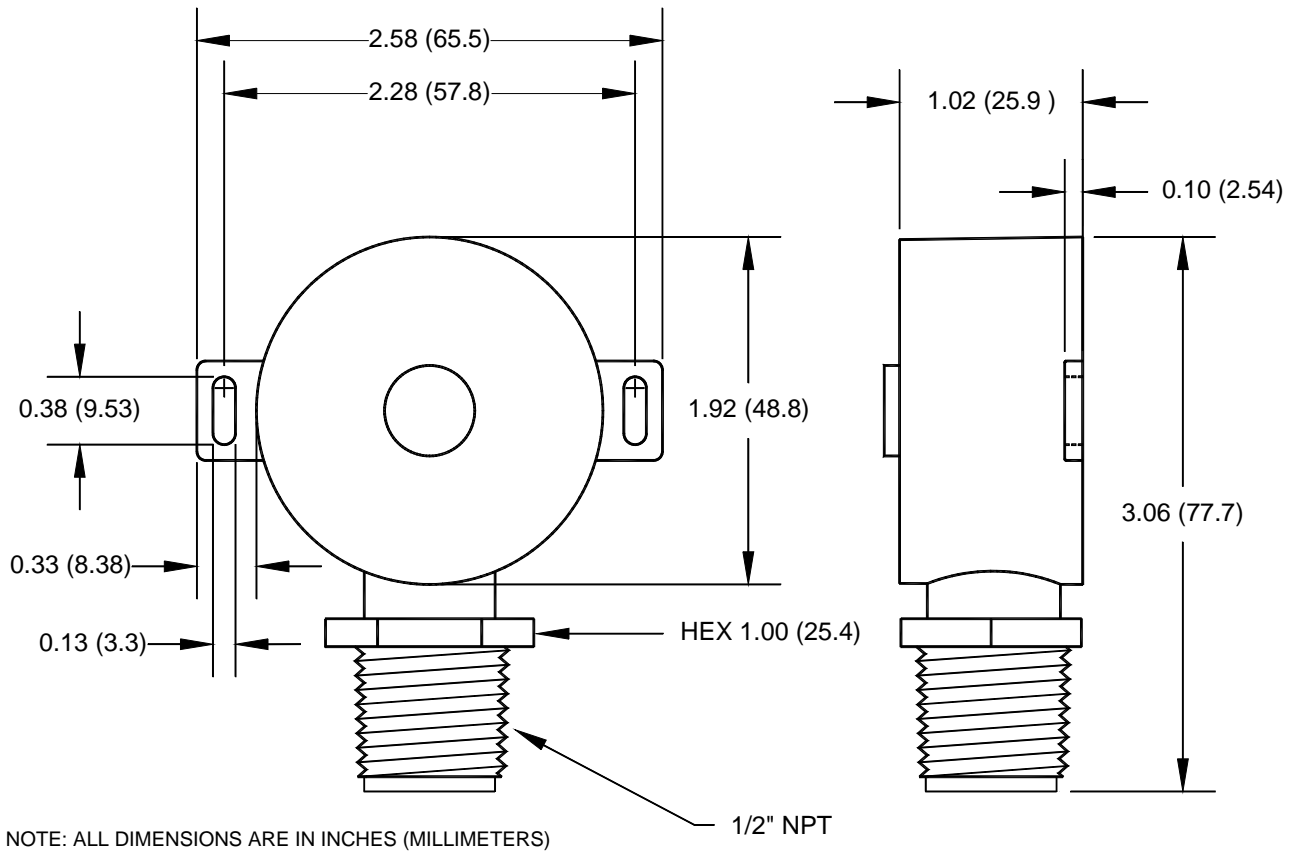
- If external alarm detection circuit responds to *closed* contacts, ensure that they are wired to the contacts on TB1-1 and TB1-2 that *close* on alarm.
- If external alarm detection circuit responds to *open* contacts, ensure that they are wired to the contacts on TB1-2 and TB1-3 that *open* on alarm.
- Protect alarm wiring by using shielded wires, grounding the shield, and placing wires in a conduit.
- Connect the photocell to the controller: the black wire to TB1-4 and the white wire to TB1-5. After running the photocell wires, check for continuity and shorts.
- Connect the temperature sensor to the controller: the black wire to TB1-6 and the white wire to TB1-7. After running the temperature sensor wires, check for continuity and shorts.

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



160MO

Figure 2-1 — FTC 160 Class Controller Mounting and Outline



PEC510MO

Figure 2-2 — Photocell or Temperature Sensor Mounting and Outline

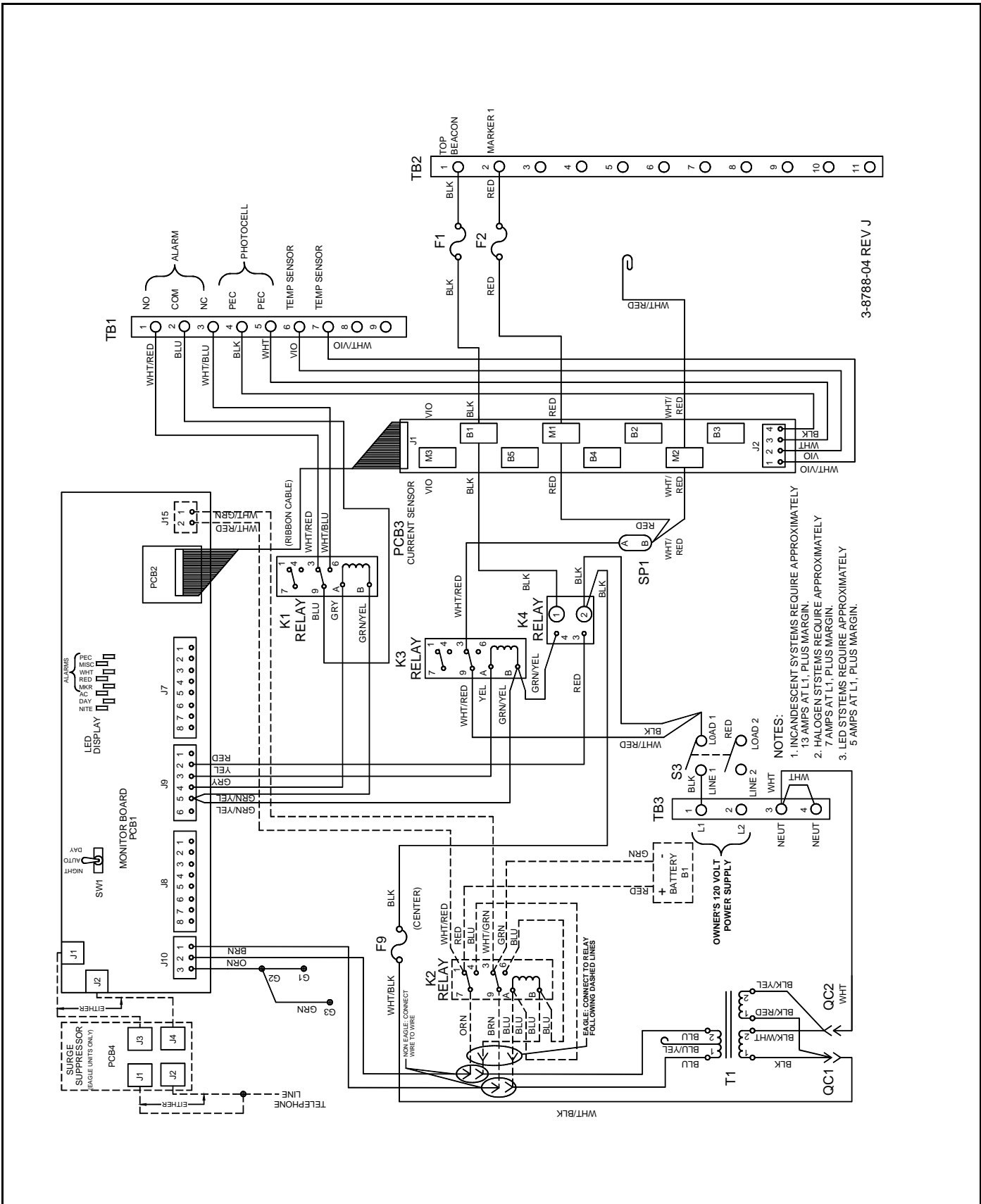
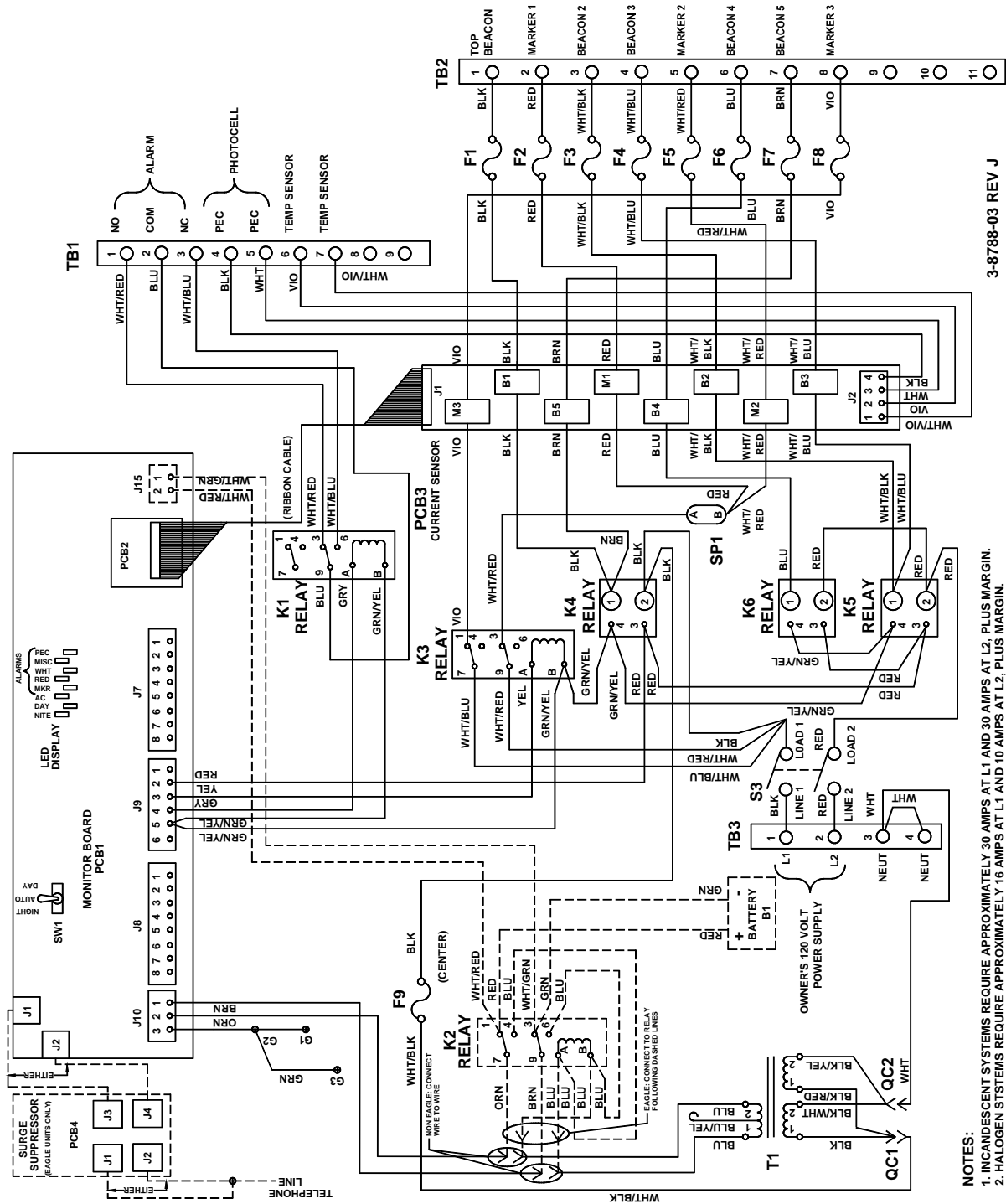


Figure 2-3 — FTC 161 and FTC 161E Controller Internal Wiring

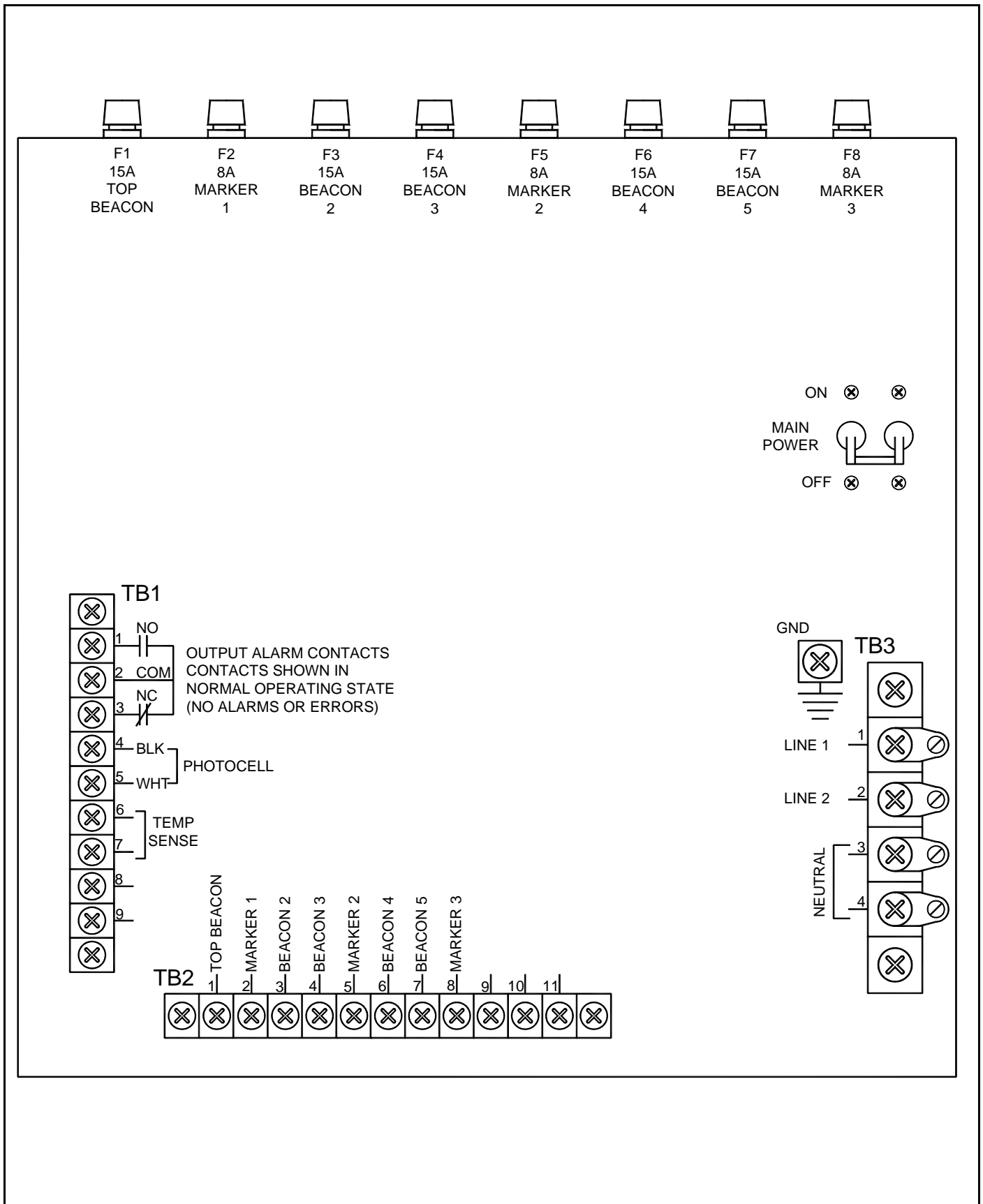
FTC161INTWRNG

Figure 2-5 — FTC 165 and FTC 165E Controller Internal Wiring



3-8788-03 REV J

- NOTES:**
1. INCANDESCENT SYSTEMS REQUIRE APPROXIMATELY 30 AMPS AT L1 AND 30 AMPS AT L2, PLUS MARGIN.
 2. HALOGEN SYSTEMS REQUIRE APPROXIMATELY 16 AMPS AT L1 AND 10 AMPS AT L2, PLUS MARGIN.
 3. IF ONLY ONE SUPPLY LINE OF POWER IS AVAILABLE, A JUMPER CAN BE USED ON TB3 BETWEEN L1 AND L2. THE TOTAL AMPS AVAILABLE MUST REMAIN THE SAME.
 4. LED SYSTEMS REQUIRE APPROXIMATELY 12 AMPS AT L1 AND 4 AMPS AT L2, PLUS MARGIN.



FRONTPANEL

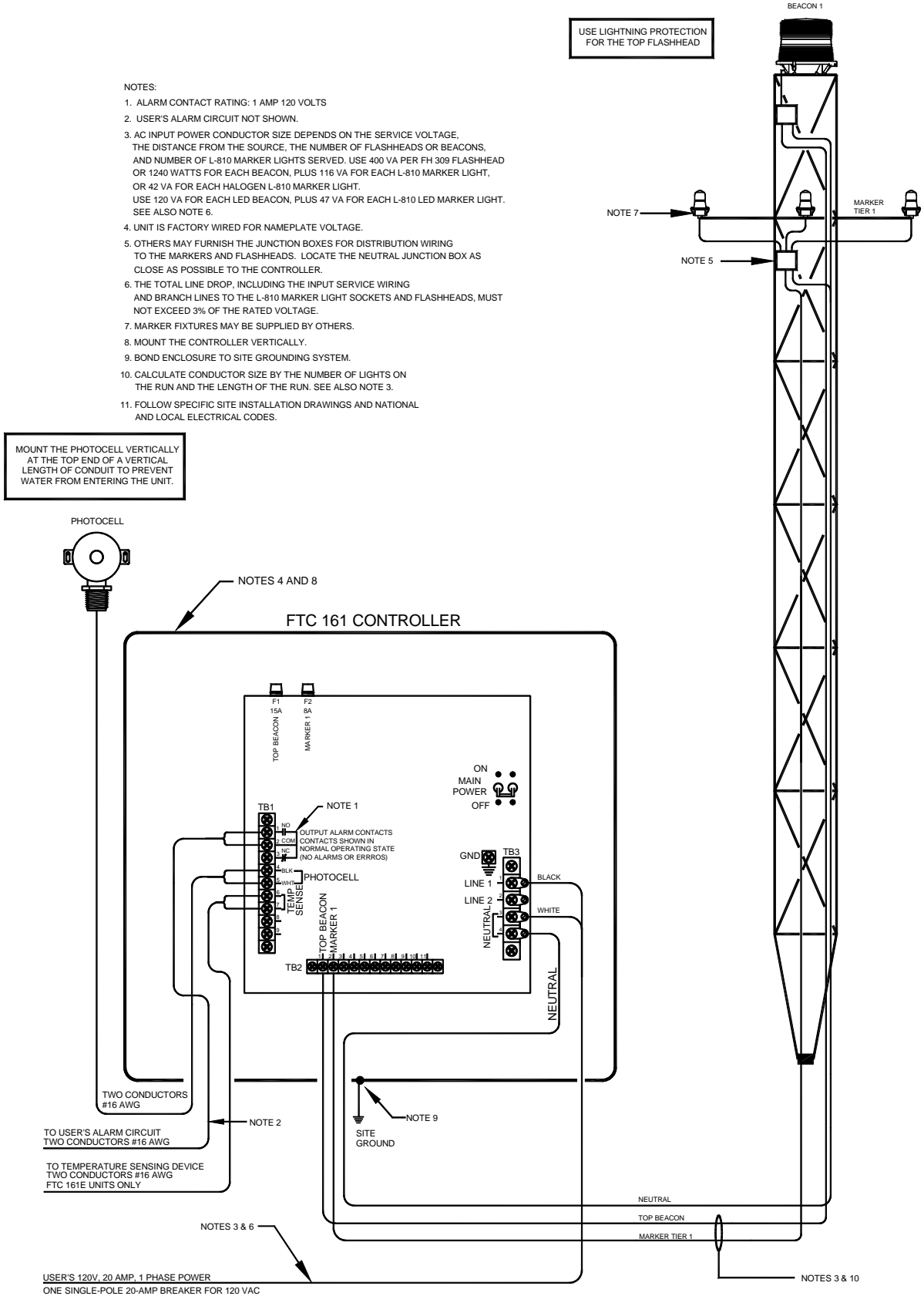
Figure 2-6 — Front Panel Connections

NOTES:

1. ALARM CONTACT RATING: 1 AMP 120 VOLTS
2. USER'S ALARM CIRCUIT NOT SHOWN.
3. AC INPUT POWER CONDUCTOR SIZE DEPENDS ON THE SERVICE VOLTAGE, THE DISTANCE FROM THE SOURCE, THE NUMBER OF FLASHHEADS OR BEACONS, AND NUMBER OF L-810 MARKER LIGHTS SERVED. USE 400 VA PER FH 309 FLASHHEAD OR 1240 WATTS FOR EACH BEACON, PLUS 116 VA FOR EACH L-810 MARKER LIGHT, OR 42 VA FOR EACH HALOGEN L-810 MARKER LIGHT, USE 120 VA FOR EACH LED BEACON, PLUS 47 VA FOR EACH L-810 LED MARKER LIGHT. SEE ALSO NOTE 6.
4. UNIT IS FACTORY WIRED FOR NAMEPLATE VOLTAGE.
5. OTHERS MAY FURNISH THE JUNCTION BOXES FOR DISTRIBUTION WIRING TO THE MARKERS AND FLASHHEADS. LOCATE THE NEUTRAL JUNCTION BOX AS CLOSE AS POSSIBLE TO THE CONTROLLER.
6. THE TOTAL LINE DROP, INCLUDING THE INPUT SERVICE WIRING AND BRANCH LINES TO THE L-810 MARKER LIGHT SOCKETS AND FLASHHEADS, MUST NOT EXCEED 3% OF THE RATED VOLTAGE.
7. MARKER FIXTURES MAY BE SUPPLIED BY OTHERS.
8. MOUNT THE CONTROLLER VERTICALLY.
9. BOND ENCLOSURE TO SITE GROUNDING SYSTEM.
10. CALCULATE CONDUCTOR SIZE BY THE NUMBER OF LIGHTS ON THE RUN AND THE LENGTH OF THE RUN. SEE ALSO NOTE 3.
11. FOLLOW SPECIFIC SITE INSTALLATION DRAWINGS AND NATIONAL AND LOCAL ELECTRICAL CODES.

MOUNT THE PHOTOCELL VERTICALLY AT THE TOP END OF A VERTICAL LENGTH OF CONDUIT TO PREVENT WATER FROM ENTERING THE UNIT.

USE LIGHTNING PROTECTION FOR THE TOP FLASHHEAD



INSTALLATION1

Figure 2-7 — FTC 161 Controller Typical Installation Wiring

NOTES:

1. ALARM CONTACT RATING: 1 AMP, 120 VOLTS
2. USER'S ALARM CIRCUIT NOT SHOWN.
3. AC INPUT POWER CONDUCTOR SIZE DEPENDS ON THE SERVICE VOLTAGE, THE DISTANCE FROM THE SOURCE, THE NUMBER OF FLASHHEADS OR BEACONS, AND NUMBER OF L-810 MARKER LIGHTS SERVED. USE 400 VA PER FH 309 FLASHHEAD OR 1240 WATTS FOR EACH BEACON, PLUS 116 VA FOR EACH L-810 MARKER LIGHT, OR 42 VA FOR EACH HALOGEN L-810 MARKER LIGHT, OR 120 VA FOR EACH LED BEACON, PLUS 47 VA FOR EACH L-810 LED MARKER LIGHT. SEE ALSO NOTE 6.
4. UNIT IS FACTORY WIRED FOR NAMEPLATE VOLTAGE.
5. OTHERS MAY FURNISH THE JUNCTION BOXES FOR DISTRIBUTION WIRING TO THE MARKERS AND FLASHHEADS. LOCATE THE NEUTRAL JUNCTION BOX AS CLOSE AS POSSIBLE TO THE CONTROLLER.
6. THE TOTAL LINE DROP, INCLUDING THE INPUT SERVICE WIRING AND BRANCH LINES TO THE L-810 MARKER LIGHT SOCKETS AND FLASHHEADS, MUST NOT EXCEED 3% OF THE RATED VOLTAGE.
7. MARKER FIXTURES MAY BE SUPPLIED BY OTHERS.
8. MOUNT THE CONTROLLER VERTICALLY.
9. BOND ENCLOSURE TO SITE GROUNDING SYSTEM.
10. CALCULATE CONDUCTOR SIZE BY THE NUMBER OF LIGHTS ON THE RUN AND THE LENGTH OF THE RUN. SEE ALSO NOTE 3.
11. FOLLOW SPECIFIC SITE INSTALLATION DRAWINGS AND NATIONAL AND LOCAL ELECTRICAL CODES.

MOUNT THE PHOTOCELL VERTICALLY AT THE TOP END OF A VERTICAL LENGTH OF CONDUIT TO PREVENT WATER FROM ENTERING THE UNIT.

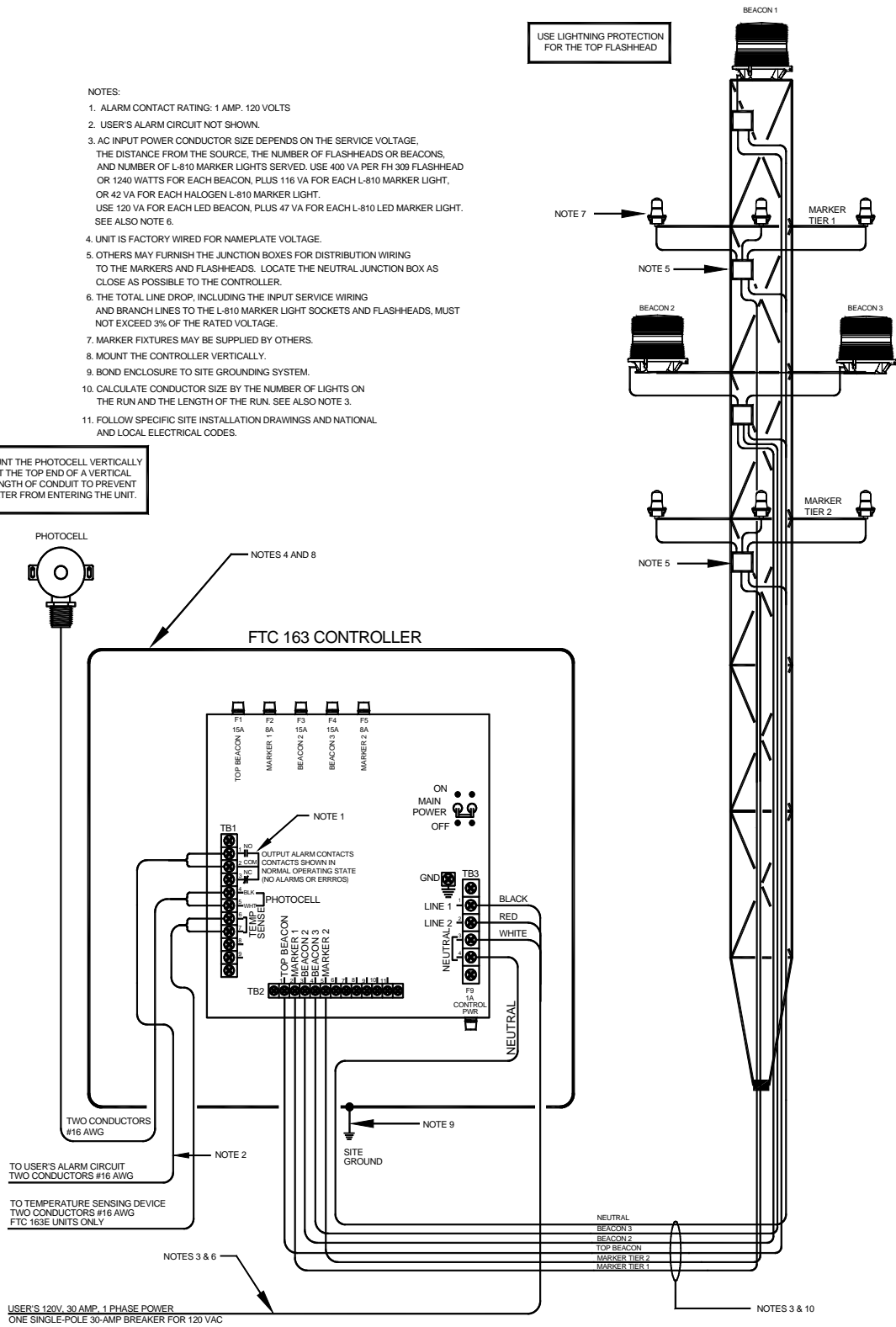


Figure 2-8 — FTC 163 Controller Typical Installation Wiring

- NOTES:
- ALARM CONTACT RATING: 1 AMP, 120 VOLTS
 - USER'S ALARM CIRCUIT NOT SHOWN.
 - AC INPUT POWER CONDUCTOR SIZE DEPENDS ON THE SERVICE VOLTAGE, THE DISTANCE FROM THE SOURCE, THE NUMBER OF FLASHHEADS OR BEACONS, AND NUMBER OF L-810 MARKER LIGHTS SERVED. USE 400 VA PER FH 309 FLASHHEAD OR 1240 WATTS FOR EACH BEACON, PLUS 116 VA FOR EACH L-810 MARKER LIGHT, OR 42 VA FOR EACH HALOGEN L-810 MARKER LIGHT. USE 120 VA FOR EACH LED BEACON, PLUS 47 VA FOR EACH L-810 LED MARKER LIGHT. SEE ALSO NOTE 6.
 - UNIT IS FACTORY WIRED FOR NAMEPLATE VOLTAGE.
 - OTHERS MAY FURNISH THE JUNCTION BOXES FOR DISTRIBUTION WIRING TO THE MARKERS AND FLASHHEADS. LOCATE THE NEUTRAL JUNCTION BOX AS CLOSE AS POSSIBLE TO THE CONTROLLER.
 - THE TOTAL LINE DROP, INCLUDING THE INPUT SERVICE WIRING AND BRANCH LINES TO THE L-810 MARKER LIGHT SOCKETS AND FLASHHEADS, MUST NOT EXCEED 3% OF THE RATED VOLTAGE.
 - MARKER FIXTURES MAY BE SUPPLIED BY OTHERS.
 - MOUNT THE CONTROLLER VERTICALLY.
 - BOND CASE TO SITE GROUNDING SYSTEM.
 - CALCULATE CONDUCTOR SIZE BY THE NUMBER OF LIGHTS ON THE RUN AND THE LENGTH OF THE RUN. SEE ALSO NOTE 3.
 - FOLLOW SPECIFIC SITE INSTALLATION DRAWINGS AND NATIONAL AND LOCAL ELECTRICAL CODES.

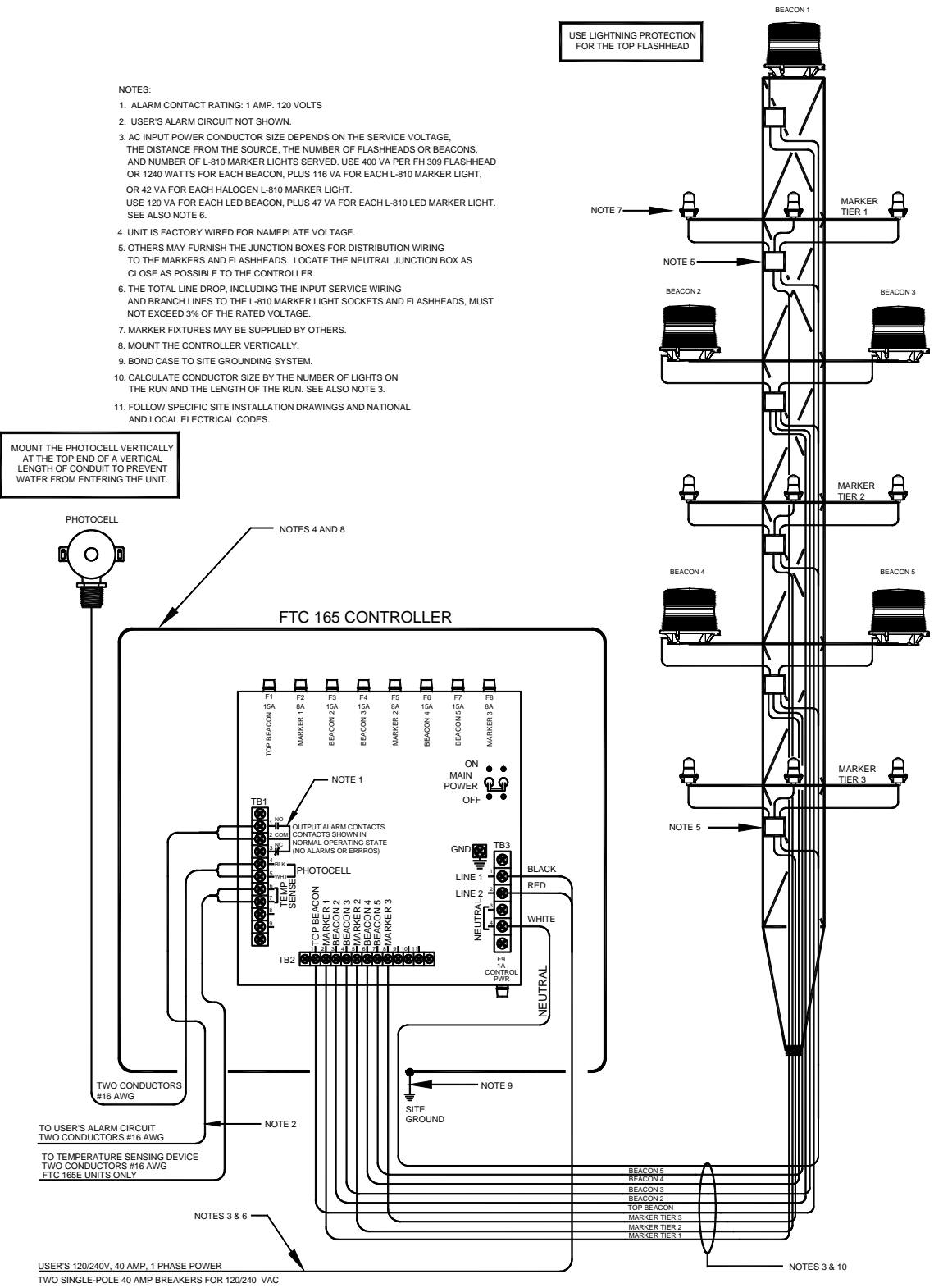
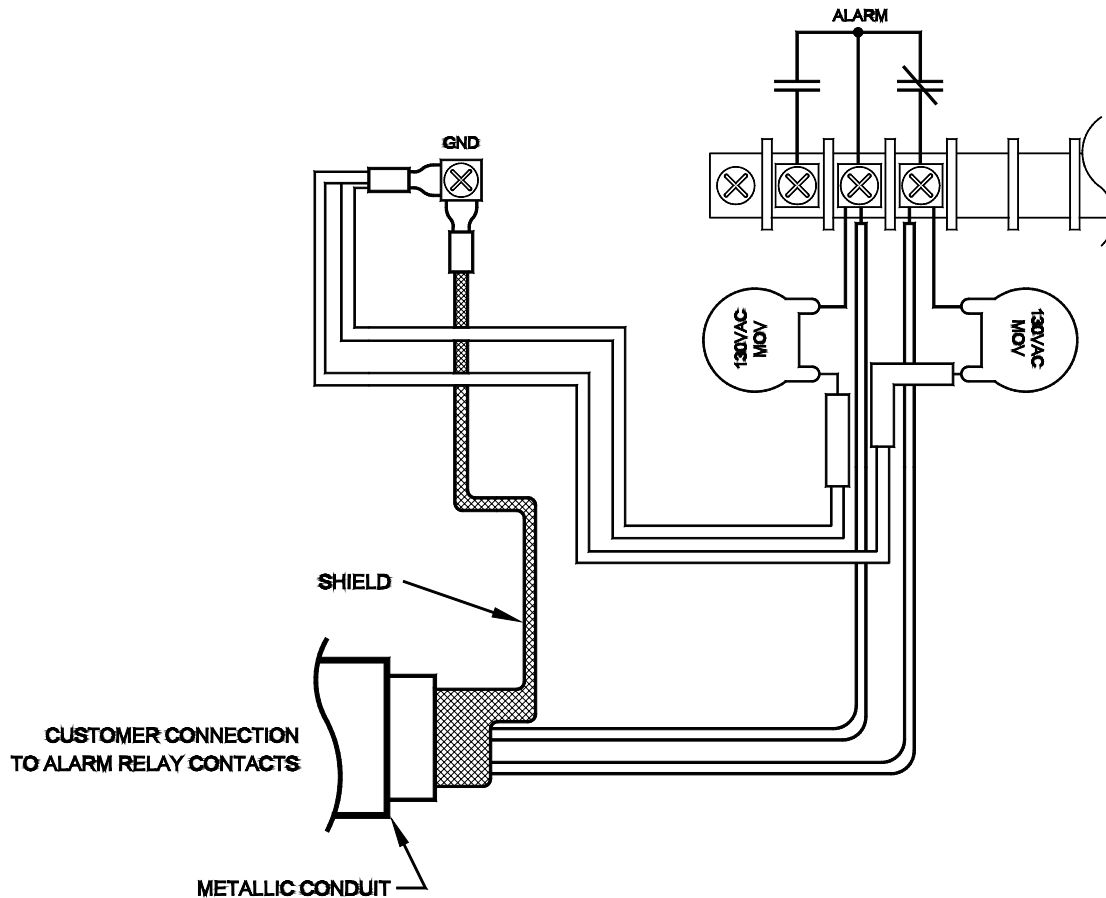


Figure 2-9 — FTC 165 Controller Typical Installation Wiring



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

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

NOTES:

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

ALRMWRNG

Figure 2-10 — Recommended Alarm Wiring

This page is intentionally blank.

Section 3 — Maintenance and Troubleshooting

Maintenance

The circuit boards should be kept free of accumulated dust. Brush and vacuum as necessary.

NOTE

Do not use compressed air to clean this equipment.

Troubleshooting

The most effective troubleshooting procedure begins with observing the behavior of the system. This often leads directly to a faulty component or other abnormal condition.

Table 3-1 contain information to help locate the cause of a problem.

Failing to Switch State

Switch the DAY/AUTO/NIGHT switch on the PCB1 Monitor Board through the modes and see if the lights follow the mode indicated by the switch position. The lights should be off in DAY mode, on in NIGHT mode, and in AUTO, flash according to the prevailing lighting conditions as determined by the photocell.

Note that some lights may be difficult to see in bright daylight.

Flashhead

If a flashhead is not flashing, first check the flashhead's lamp and then check the cable and its connections to that flashhead. PCB1 operates a relay that transfers power to the flashhead (beacon). If PCB1 control is absent, the flashheads default to always on, also the side markers turn on.

Check the voltage on the TB2 connections to the tower lights. Marker light connections should have a steady voltage. The flashhead (beacon) connections should show a voltage pulse rate of 20 flashes per minute.

Lamps

CAUTION: Ensure that the lamp in the FH 309 Flash-head is cool before replacing it. It can be very hot and

cause severe burns. Never handle lamps with bare skin whether hot or not. Do not handle lamps except with a clean cloth. Oils deposited from skin or other sources can greatly shorten the life of the halogen lamp.

Electromechanical Relays

Check continuity of the relay coil with an ohmmeter. Relay contacts may be pitted, corroded, or dirty, or all three; if so, try to determine a possible cause of the contact failure and correct the problem. If in doubt, replace the relay.

LED Displays

The DAY LED in the PCB1 Monitor Board should be lit during daylight and the NIGHT LED should be lit at night.

To determine the exact light or lights that are out, wait for a single red LED (RED or MKR) to light followed by a specific number of LEDs, which indicate the number of the beacon or marker tier that is out, respectively. This behavior repeats in 1-second intervals if additional beacons or marker tiers are out. For example:

RED LED	Turns on
Then Two LEDs	Turn on
	Beacon 2 is out

ONE SECOND INTERVAL PASSES...

RED MKR	Turns on
Then Three LEDs	Turn on
	A marker lamp is out in Tier 3

Component Removal and Replacement

Note the wiring connections and wire colors when you remove wires from their connections. These must be replaced exactly as they were. Use the wiring diagram in *Figure 2-5*. For locations, see *Figure 4-1*.

For all service that requires removal or replacement, *turn off the power or disconnect the power*.

Table 3-1 Major Troubleshooting Symptoms

Symptom	Possible Cause in Likely Order of Frequency
All lights fail	<ul style="list-style-type: none"> - Main power failure - External circuit breaker - PCB1 failure - T1 transformer
Single light fails	<ul style="list-style-type: none"> - Bulb or lamp - Check fuse for that line - Check wiring for short or open in that line - Beacon 1; check relay K4 - Beacon 2; check relay K5 - Beacon 3; check relay K5 - Beacon 4; check relay K6 - Beacon 5; check relay K4 - Marker Tier 1; check relay K3 - Marker Tier 2; check relay K3 - Marker Tier 3; check relay K3
Erratic operation	<ul style="list-style-type: none"> - Loose connections - PCB1
Alarm	<ul style="list-style-type: none"> - Normal if a light or tier is out
False alarm	<ul style="list-style-type: none"> - Check relay K1 - Check for correct alarm connections: normally open (NO) contacts close on alarm, normally closed (NC) contacts open on alarm - PCB1 - PCB3
AUTO switch position fails to switch system from day to night or night to day	<ul style="list-style-type: none"> - Photocell - PCB1
System status unavailable by telephone	<ul style="list-style-type: none"> - Relay K2 - Battery - PCB1 - PCB4

PCB1 Monitor Board

Removal

1. Remove PCB2.
2. Loosen four Phillips-head screws located near the corners of PCB1.
3. Lift the board so that the screws can clear the slots in which they reside and pass through the adjoining holes.
4. Disconnect cable connectors and wires. A small flat blade screwdriver is needed to loosen the small screws that hold some of the wires.

Replacement

1. Reverse the removal procedure.

PCB2 Flash Detection Board

Removal

1. Lift the board from the nylon spacer that fastens the board.
2. Use a see-saw motion to carefully pull the board away from the socket that connects it to PCB1. Avoid bending the pins.
3. Disconnect cable connections from PCB2.

Replacement

1. Reverse the removal procedure.

PCB3 Current Sensor Board

Removal

1. Remove external cable connections to the terminal blocks (beacons, markers, photocell, alarm, power).
2. Loosen four screws that hold the bracket that holds the terminal blocks and fuses.
3. Slide the bracket up and away from the four screws just loosened.
4. Turn the bracket over.
5. Remove the harness fuse connections. *Note the wire locations.*
6. Remove cable plug connections from the board.
7. Loosen four screws that hold the board. Note that a phenolic spacer is under each screw.
8. Lift the board out and support the board's coil for each wire in the next step.
9. Pull the wire that went to the fuse out from the coil on the board.

Replacement

1. Reverse the removal procedure.

PCB4 Surge Suppressor Board

Removal

1. Disconnect the telephone plugs.
2. Remove the two screws that hold the board. Note the phenolic spacer under each screw.

Replacement

1. Reverse the removal procedure.

Relays

Removal

1. Loosen four screws that hold the bracket that holds the terminal blocks and fuses.
2. Slide the bracket up and away from the four screws just loosened.
3. Remove wires connected to the relay; *note connections and colors.*
4. Remove the screw (or screws) that holds the relay.
5. Lift out the relay.

Replacement

1. Reverse the removal procedure.

K1 & K2 Relays

Removal

1. Remove PCB1 to access the relay mounting screws.
2. Remove wires connected to the relay; *note connections and colors.*
3. Remove the screw (or screws) that holds the relay.
4. Lift out the relay.

Replacement

1. Reverse the removal procedure.

This page is intentionally blank.

Section 4 — Major 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.

Controller Parts

Table 4-1 lists the major replaceable parts for the controller. Refer to *Figure 4-1* for component locations.

Photocell Parts

The part number for the PEC 510 Photocell is ***PN #1855001***. The photocell consists of only one component.

Returning Equipment

To return equipment to FTCA, call Customer Service at 1-800-821-5825 for a Return Material Authorization (RMA) number.

Repackaging the Controller

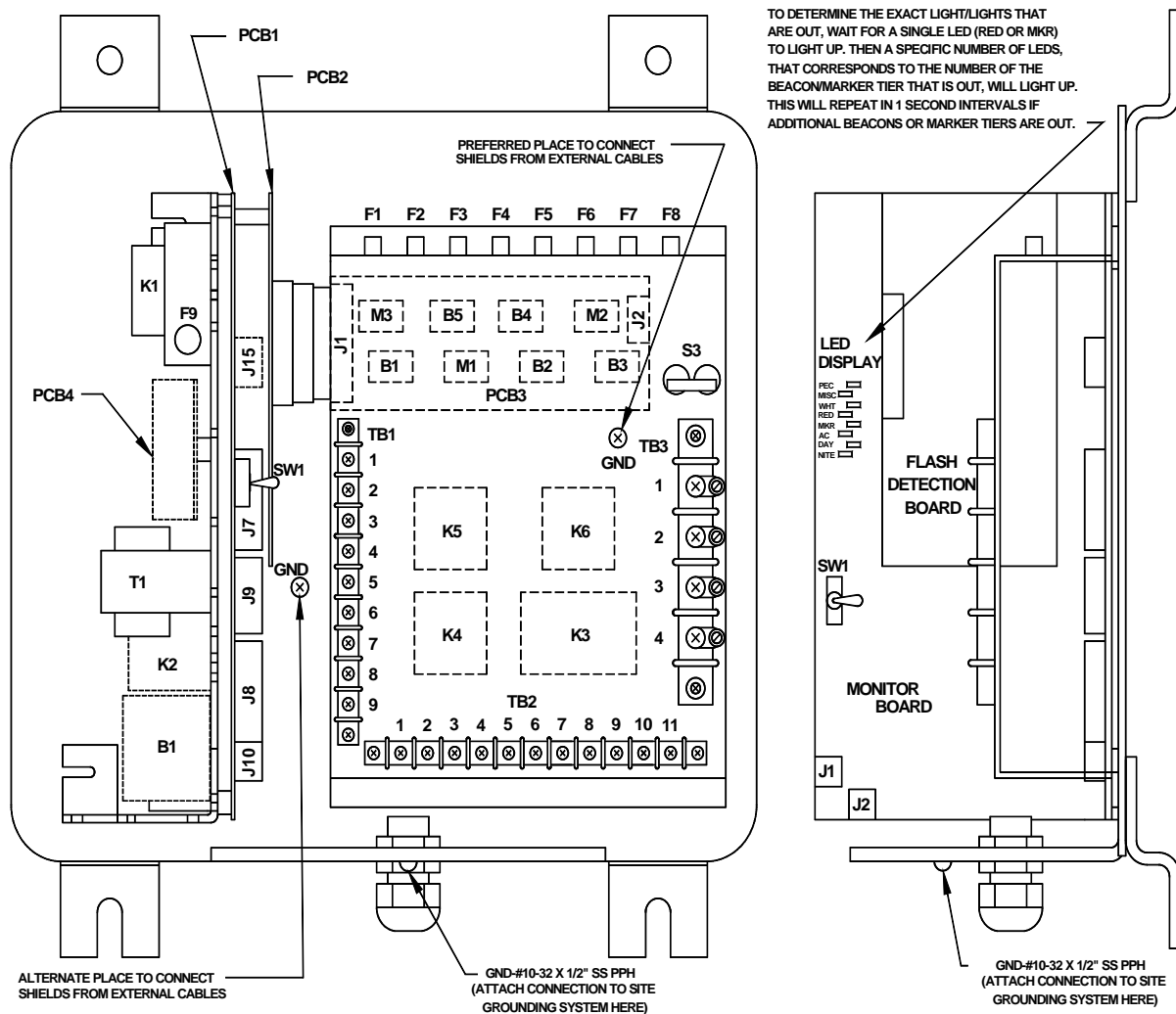
Equipment must be returned in a container that provides maximum protection during shipping and handling.

If the original cartons and packaging material are no longer available, package the Controller in a strong double corrugated carton using a double thickness cardboard container and adequate padding. Pad the Controller so that corners cannot penetrate the box during shipment. Do not drop. Use appropriate warning labels on the outside of the container.

Table 4-1 Major Replaceable Parts

Item	Description	Part Number
S3	Power Switch	4903190
F1, F3, F4, F6, F7	†Fuse, 15A	4903191
F2, F5, F8	†Fuse, 8A	4901931
F9	†Fuse, 1A	4900337
K1	†Relay,	4901233
K2, K3	†Relay,	4901266
K4, K5, K6	†Relay,	4903189
PCB1	Monitor Board	2480001
PCB2	Flash Detection Board	2481701
PCB3	Current Sense Board	2811201
PCB4	Surge Suppressor Board	2865301
TB1	Terminal Strip, 9-position	4902319
TB2	Terminal Strip, 11-position	4903195
TB3	Terminal Strip, 4-position	4903194
--	Temperature Sensor (optional, and for "E" units only)	1878901
T1	Transformer	4902971
B1	Battery	4991875

† Recommended as a spare part.



3-8788-03 REV J

Figure 4-1 — FTC 160 Class Controller Component Location

This page is intentionally blank.

INDEX

- A**
- Access
 - instructions 2-1
- Alarm wiring
 - figure 2-13
- C**
- Checkout procedure 1-5
- Component
 - removal 3-1
 - replacement 3-1
- Connections, front panel, figure 2-9
- Connectors 1-2
- Controller
 - internal wiring figure
 - FTC 161 2-6
 - FTC 163 2-7
 - FTC 165 2-8
 - introduction 1-1
 - location 2-1
 - mounting 2-1
 - mounting and outline figure 2-4
 - mounting check 2-3
 - operation 1-1
 - part location 4-3
 - types 1-1
- Current sensor board PCB3
 - removal and replacement 3-3
- Customer service 4-1
- E**
- Equipment
 - returning 4-1
- F**
- Flash detection board PCB2
 - removal and replacement 3-2
- Flashhead
 - connection 1-1
 - flashing errors 3-1
 - lamp replacement 3-1
 - troubleshooting 3-1
- Front panel, connections, figure 2-9
- I**
- Installation
 - checklist 2-3
 - wiring 2-1
 - site-specific 2-1
- Installation wiring
 - figure
 - alarm 2-13
 - typical
 - FTC 161 2-10
 - FTC 163 2-11
 - FTC 165 2-12
- Insulation, wiring 2-2
- Internal wiring
 - figure
 - FTC 161 2-6
 - FTC 163 2-7
 - FTC 165 2-8
- J**
- Jumpers 1-2
- L**
- Lamp, replacement, flashhead 3-1
- LED display, troubleshooting aid 3-1
- LED operation 1-2
- LEDs 1-2
- Lightning protection 2-2
- Location, controller 2-1
- M**
- Maintenance 3-1
- Manual operation 1-2
- Monitor board, PCB1
 - removal and replacement 3-2
- Mounting 2-1
 - controller 2-1
 - controller check 2-3
 - photocell 2-1
 - photocell check 2-1
- O**
- Operation
 - LED 1-2
 - manual 1-2
- Ordering parts 4-1
- P**
- Part
 - controller
 - location 4-3
 - major replaceable 4-1
 - ordering 4-1
 - photocell 4-1
- PCB1

monitor board pictorial 1-3
removal and replacement 3-2
PCB2
flash detection board pictorial 1-3
removal and replacement 3-2
PCB3
current sense board pictorial 1-4
removal and replacement 3-3
PCB4
removal and replacement 3-3
surge suppressor board pictorial 1-4
Photocell
mounting 2-1
mounting and outline figure 2-5
mounting check 2-1
part number 4-1

R

Relay, troubleshooting 3-1
Removal 3-1
Replaceable parts 4-1
Replacement 3-1
Returning equipment 4-1

S

Sensor, temperature 2-2
Shipping 4-1
Specifications 1-1
State switching failure 3-1
Surge suppressor board PCB4
removal and replacement 3-3
Switches 1-2
System
introduction 1-1
wiring

general 2-2

T

Temperature sensor 2-2
Test points 1-2
Tools needed 2-1
Troubleshooting 3-1
flashhead 3-1
relay 3-1
symptoms 3-2
Troubleshooting, aid
LED display 3-1

U

Unpacking 2-1

W

Wiring

alarm check 2-3
connections 2-2
controller check 2-3
figure
installation
alarm 2-13
typical
FTC 161 2-10
FTC 163 2-11
FTC 165 2-12
internal
FTC 161 2-6
FTC 163 2-7
FTC 165 2-8
general system 2-2
installation 2-1
insulation required 2-2

~~ END OF DOCUMENT ~~