



HUGHEY & PHILLIPS, LLC.

Installation and Operation Guide

UNIVERSAL HORIZON™ CONTROLLER

MEDIUM INTENSITY LED LIGHTING CONTROLLER

FAA TYPES A1, D1, & E1

MANUAL EPM-00000056-001

Revision 'A'

Hughey & Phillips, LLC.

240 W. Twain Ave.

Urbana, OH 43078

Telephone (937) 652-3500

Toll Free (877) 285-4466

Fax (937) 652-3508

www.hugheyandphillips.com

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Revisions

Rev	Date	ECO	Comment
-	10-3-16		Initial production release
A	12-6-16	561	Added -48VDC version information

Warranty Policy

*For current warranty policy,
please visit www.hugheyandphillips.com.*

Table of Standard Universal *HORIZON*[™] Controllers:

Model Number	Input Voltage	Output Voltage	Description
70-0015-001	110 . 240 VAC	110 . 240 VAC	Controller for 1 AC HORIZON Beacon with 0-4 AC Sidelights
70-0015-003	48 VDC	48 VDC	Controller for 1 DC HORIZON Beacon with 0-4 DC Sidelights
70-0015-005	110 . 240 VAC	48 VDC	Controller for 1 DC HORIZON Beacon with 0-4 DC Sidelights
70-0015-007	. 48 VDC	48 VDC	Controller for 1 DC HORIZON Beacon with 0-4 DC Sidelights

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1.0 General Information

The 70qSeries LED Lighting Controller is a microcontroller driven tower lighting control designed to meet or exceed FAA specifications and deliver reliable service with modular design, on-board diagnostics and one-touch alarm calibration, which simplifies set-up and troubleshooting. This controller is capable of controlling one **HORIZON** LED Medium Intensity beacon and up to four **HORIZON** LED L-810 sidelights. The features are as follows:

- Automatic photocontrol of the tower lights per FAA specification with easily replaceable photocell
- Button to override the automatic photocontrol with timer to return to automatic photocontrol mode
- Surge and lightning protection with replaceable fuse protection on inbound and outbound lines
- Alarm in the event of a power failure
- Alarm for failure of LED beacon as self-monitored by beacon
- Alarm for failure of LED beacon based on minimum power threshold determined by controller
- Alarm for failure of one or more sidelights per level (selectable)
- Contact signal indicating the present control mode (day/night)
- Option to latch alarms until mode change
- Option to flash sidelights in sync with beacon for avian safety programs
- Local status indicators for all alarms by means of LEDs and diagnostic flash codes
- Indoor/outdoor NEMA-4 housing
- Continuous microcontroller monitoring provides the best combination of fault detection without false alarms

This control is capable of operating in adverse climatic conditions. However, care should be taken during installation and servicing to avoid any physical damage to the unit that may impair operation. The following sections of this manual will review the installation of the control, setup of options, alarm threshold calibration, theory of operation, testing, and troubleshooting. Reviewing these sections before proceeding with the installation is highly recommended.

2.0 Safety Precautions

The following general safety precautions must be observed during all phases of operation, service, and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of this equipment. Hughey & Phillips assumes no liability for the customer's failure to comply with these requirements, as listed below.

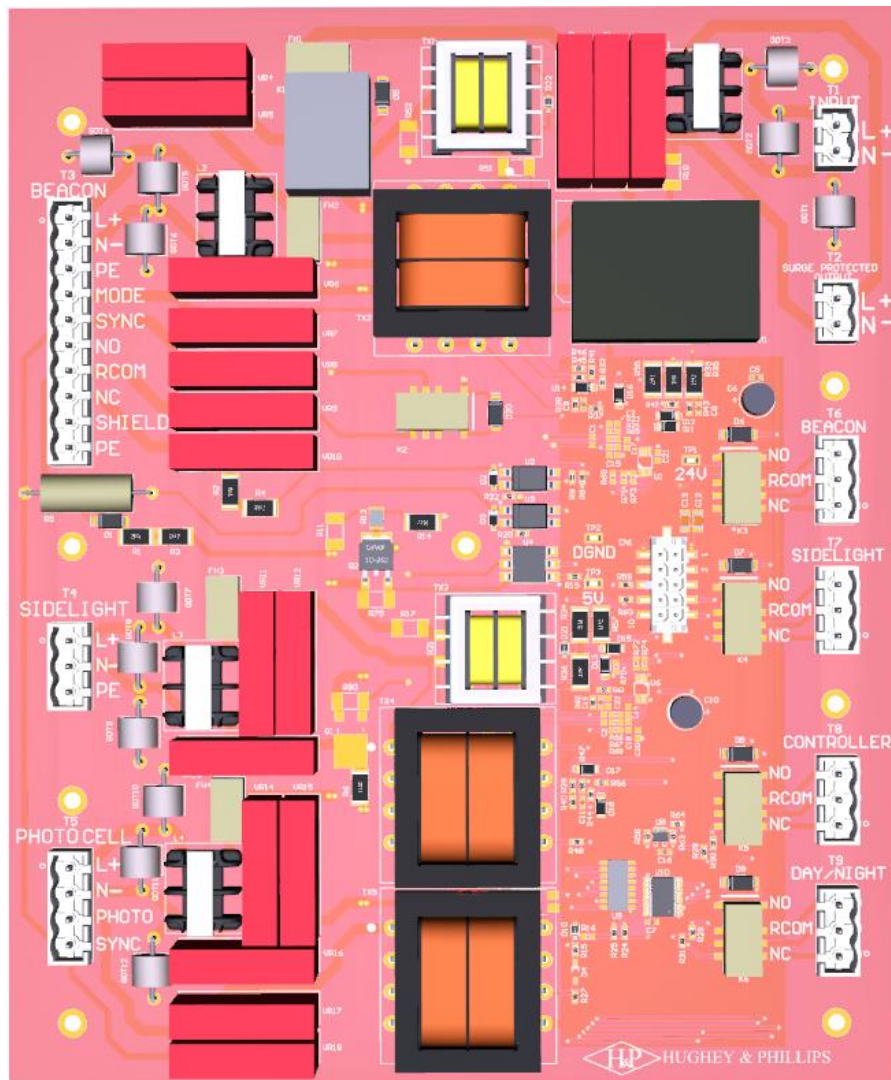
1. Any interruption of the protective grounding conductor (inside or outside the equipment) or disconnecting the protective earth ground terminal is likely to make this equipment dangerous.
2. Whenever it is likely that the ground protection has been impaired, the equipment must be made inoperative by removing input line power, and then shall be secured against any unintended operation.
3. Ensure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. Spare fuses are always available from Hughey & Phillips.
4. Electrical energy may result in personal injury if touched. Adjustment, maintenance, and repair of the equipment while power is applied shall be avoided as much as possible, however some maintenance described in this manual is performed with power supplied to the equipment while access doors or protective covers are removed. When repair with power applied is unavoidable, maintenance shall be carried out only by a skilled person who is aware of the hazard involved. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
5. Do not install substitute parts or perform any unauthorized modification to the equipment . doing so will void the warranty.

3.0 Controller Datasheet

Parameter	Value	Unit
Input Voltage		
70-0015-001	110 . 240 1Ø	VAC
70-0015-003	48 ± 10%	VDC
70-0015-005	110 . 240 1Ø Input	VAC
	48 Output	VDC
70-0015-007	-48 Input	VDC
	48 Output	VDC
System Power Requirement (1 Beacon, 4 Sidelights)		
70-0015-001	100	W
70-0015-003	80	W
70-0015-005	100	W
70-0015-007	80	W
Protective Earth Wire Size	12 or larger	AWG
Ambient Temperature Rating	-40 to 55	°C
	-40 to 131	°F
Max Non-Condensing Relative Humidity Inside Enclosure	95	%
Enclosure Environmental Rating	NEMA 4	

4.0 Installation Procedure

Installation of the 70 Series controller consists of the following steps: enclosure mounting, tower and input power wiring, photocell installation and wiring, and the alarm wiring to remote monitoring equipment.



4.1 Enclosure Installation

The controller may be mounted in any convenient location indoors or outdoors. Standard orientation is such that the enclosure door opens on the left side and the mounting feet or flange is bolted to a wall, pole, or tower structure.

While the enclosure and control equipment inside can endure a wide temperature range and all forms of precipitation, some locations may be better for service personnel in terms of sunlight or wind direction.

Conduit or cable entrance holes are recommended to be placed on the bottom of the enclosure through the cable gland plate. Sizes are to be determined at site by installer. When adding holes, the panel should be removed from the enclosure and the enclosure should be cleaned of all debris before replacing the panel. This will prevent the debris from harming any components.

4.2 Tower Wiring

The tower wires are connected to the terminal blocks **T3 BEACON** and **T4 SIDELIGHT** on the Controller Base Board using supplied removable screw clamp terminals. It is generally easier to install the stripped wires into the appropriate connectors and then install the connector to the control circuit board.

Make sure that wires are stripped approximately 1/4" and fully inserted into the connectors. A positive snap can be felt when the connector is fully inserted. Test screw terminals for tightness by tugging gently on wires after tightening screws.

Miswiring is the #1 cause of initial failures. Double check all wiring and, if in doubt, call the Hughey & Phillips service line for assistance prior to applying power.

For convenience, a system wiring diagram is placed on the inside of the controller door. The standard wire colors are shown for Hughey & Phillips supplied cables. Use caution when other wire colors are used. All cables should use **at least 18 AWG** wires.

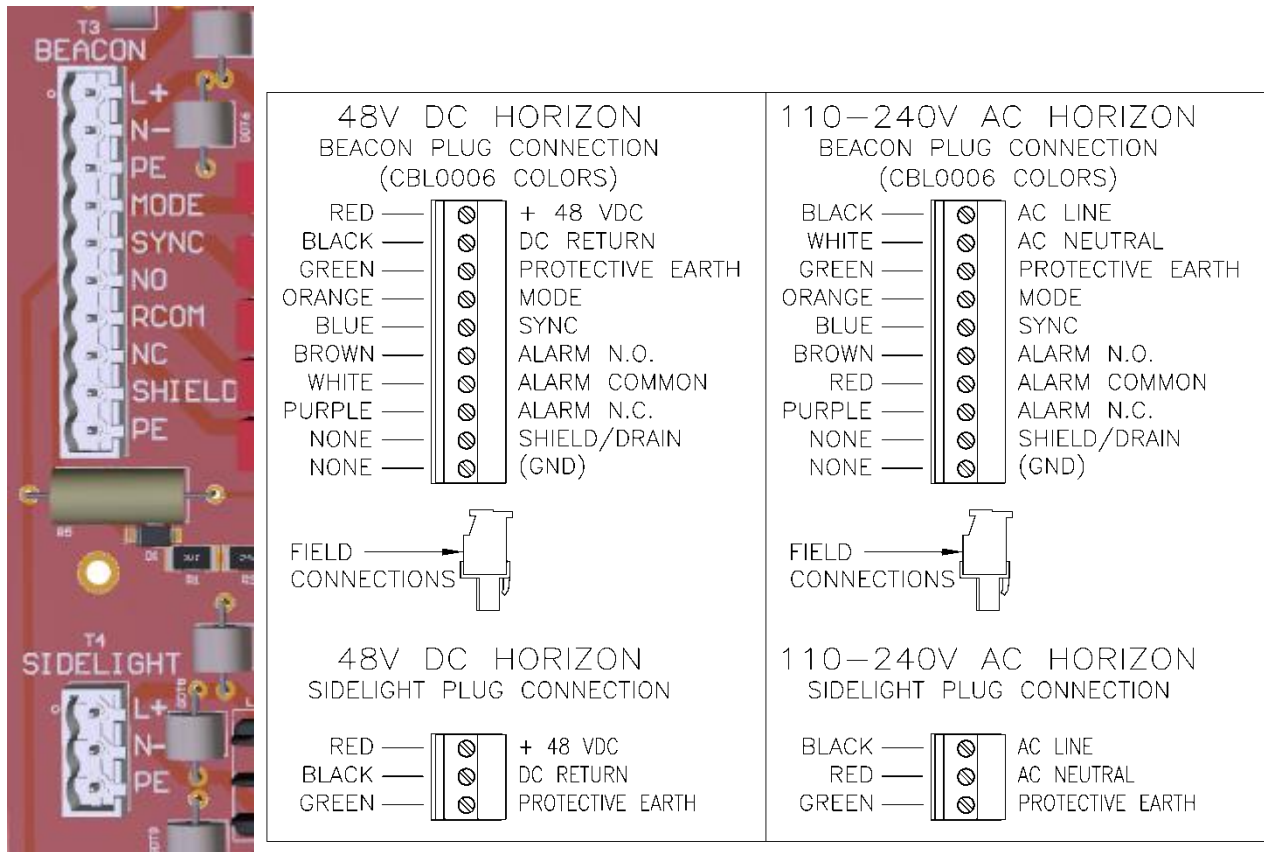


Figure 1 – Tower Wiring on Control PCB and Field Wiring Connector Plug

4.3 Input Power Wiring

The input power wires connect to the spring-loaded terminal block on the bottom right side of the panel as labeled on your controller type.

The incoming power fuse **FH1** is near the top left corner of the Controller Base Board.

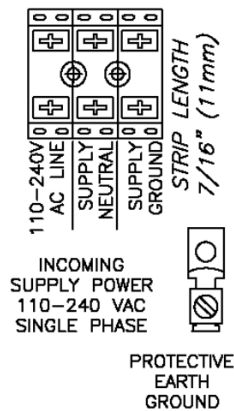


Figure 2 – Example Input Power Connections

4.4 Photocell

The photocell is a specialized twistlock photosensor optimized for this control system and application. It is pre-configured for the application to conform to the FAA regulations for light intensity control based on the type of system (white-only, dual, or red-only) and output power type (110-240 VAC or 48 VDC). The photosensors are made and tested to Hughey & Phillips standards and should be replaced only with approved parts purchased from Hughey & Phillips.

When installed, the photocell should have the threads down and be mounted so that the window of the photocell is pointing to the polar sky (north in northern hemisphere, south in southern hemisphere). Direct rays of sunlight should not be permitted to reach the face of the photocell, and exposure to artificial illumination (such as floodlights, street lights, headlights, etc.) of more than a few foot-candles must be avoided in order to prevent undesired mode change of the tower lights. The photocontrol circuitry has a delay built in to avoid changing modes in the event of a flash of light hitting the photocell. In addition to the photocell sensor delay, the controller adds an additional delay of 15 seconds.

4.5 Photocell Wiring

The photocell wiring connects to terminal block **T5 PHOTOCELL** as shown below.

Do not connect to the sync terminal block.

The photocell power connection is fused (FH3). Check the fuse for continuity in the event of photocell issues.

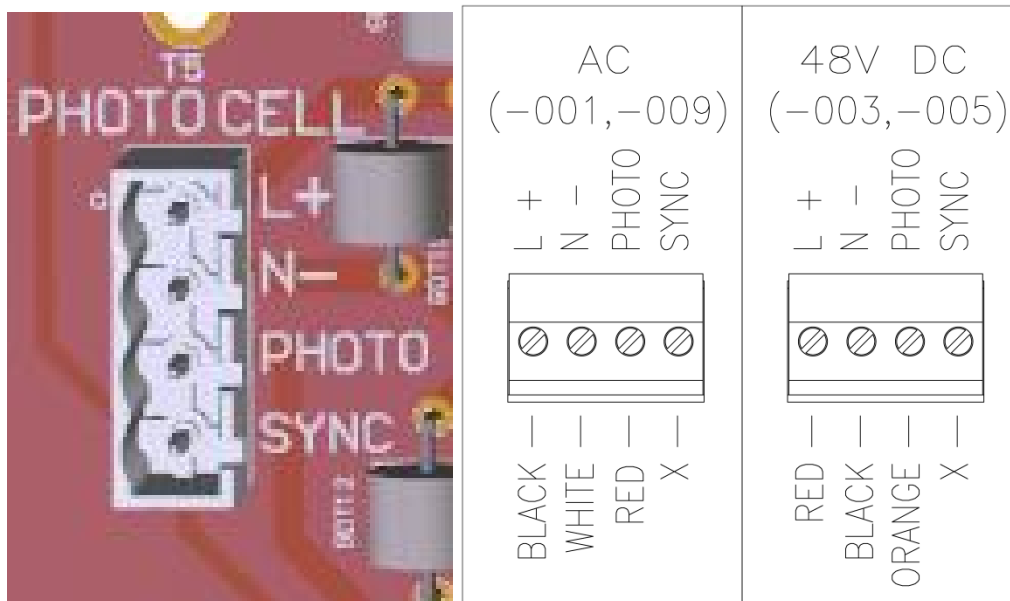


Figure 3 – Photocell Connection

4.6 Alarm Wiring

The alarm wiring connects to plug-in terminal blocks on the controller circuit board. Alarm wiring can be connected in various ways depending on the customer's choice or need.

If possible with the user's monitoring equipment, each contact should be monitored individually so the user can see which type of alarm they are receiving on their monitoring equipment.

If the user needs a single contact output to monitor all alarms, a jumper can be used to tie all alarm contacts together. For example, connecting several normally open contacts in parallel will result in a contact closure in the case of any alarm condition. Likewise, connecting several normally closed contacts in series will result in a contact opening in the case of any alarm condition. See examples in Figure 4 . Alarm Connections.

The normal condition is defined as proper operation with no problems. Under normal conditions, the alarm contact normally closed is closed.

For more information on alarms and their operation, please see section 0.

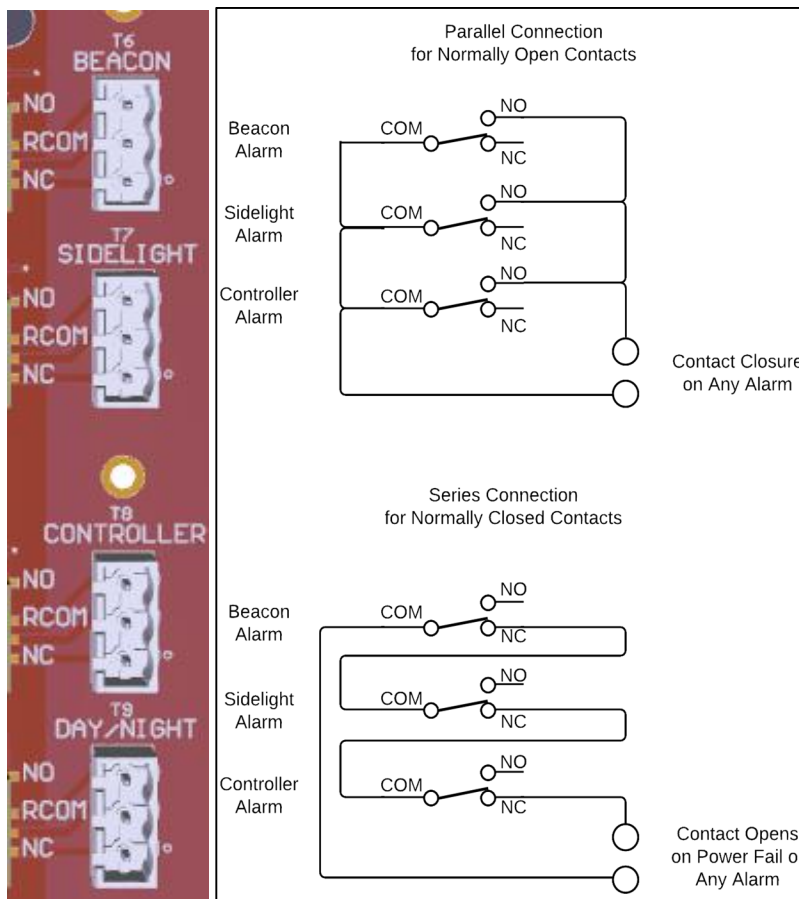


Figure 4 – Alarm Connections

4.7 Configuration

Confirm DIP switch settings are as desired.

Changes to any of the switches **will require** the system to be re-calibrated.

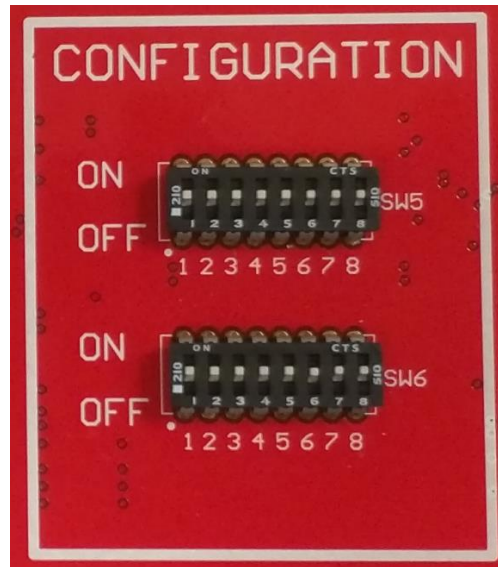


Figure 5 – Configuration DIP Switch

Switch Number	Default Position	Option	Description
SW5 1	ON	Constant-on sidelights	Switch ON keeps the sidelights on continuously at night. Switch OFF flashes in sync with the red night mode of the beacon
SW5 2	ON	Sidelight power alarm	Switch ON enables sidelight power level alarms. Switch OFF disables sidelight power level alarms
SW5 3	ON	Mode Automatic Timeout	Switch ON forces mode back to automatic after two hours. Switch OFF allows manual mode to hold indefinitely
SW5 4	ON	Latch alarm until mode change	Switch ON forces triggered alarms to latch until next mode change
SW5 5	ON	Calibration above freezing	Switch ON allows for calibration above freezing (32°F, 0°C). Switch OFF allows for calibration below freezing
SW5 6	ON	Beacon alarm monitoring	If switch ON, the remote beacon alarm contact will be used by the controller to control the local beacon alarm contact. If OFF, the local beacon alarm contact will be controlled based on remote beacon power levels only. See note 1
SW5 7	ON	Beacon power alarm	Switch ON will enable beacon power level alarm to be combined with remote beacon contact (if enabled). Switch OFF will not allow controller to alarm on beacon power levels only. See note 1
SW5 8	ON	Missing signal alarm	Switch ON will trigger local beacon alarm if missing beacon sync or photocell signal
SW6 1	ON	Sidelight Flash Rate	Both OFF = No flash 1 OFF and 2 ON = 24 FPM (flashes per minute)
SW6 2	ON	Sidelight Flash Rate	1 ON and 2 OFF = 60 FPM Both ON = 30 FPM
SW6 3	ON	TBD	
SW6 4	ON	TBD	
SW6 5	ON	TBD	
SW6 6	ON	TBD	
SW6 7	ON	TBD	
SW6 8	ON	TBD	

Table 1 – Configuration Switch Settings

Note 1: Either DIP Switch 6, 7, or both must be on. If both are off, the beacon alarm will trip to signify an unsafe condition.

5.0 Theory of Operation

The control unit consists of two to three major elements, the optional Power Module, the Controller Base Board, and the Controller UI Board.

5.1 Power Module Operation

Depending on the model of controller, this item can vary but its purpose remains the same. It is used to condition the input power and adjust it to a compatible voltage level and current type (AC vs. DC) for the rest of the system. A power module is used in the -005 and -007 versions.

5.2 Controller UI Board Operation

The Controller UI (user interface) Board provides all the controls needed to test, configure, and calibrate a control system all touch-safe voltage levels. There are also LED indicators for the systems mode and for the status of the beacon, sidelight, and controller alarms. In a properly connected and normally functioning system, there should be no need to access the other parts of the system which may contain dangerous voltages.

5.3 Controller Base Board Operation

The Controller Base Board provides connection points for all lighting, dry contact alarm, input power, and photocell connections. It converts these potentially dangerous signals to touch safe low voltage signals that are sent to the UI board for processing.

5.3.1 Alarm Operation



Figure 6 – Alarms

The controller provides dry contact alarms for various failures in the control or tower lights. These dry contacts, accessed through plug-in screw terminal blocks, are available from the alarm relays on the controller circuit board. **The alarm contacts are for remote monitoring equipment and are not intended to drive large loads.** Exceeding 1A is not recommended. The alarm terminal blocks are labeled on the board and have three connections available. The normal condition is when the equipment is functioning without errors or faults.

Under normal conditions, the NC contact is closed and the NO contact is open. COM is the common terminal to both contacts. During a beacon alarm condition, the NO contact is closed and the NO contact is open. The NC contact is open during a power failure.

The controller has contacts and LEDs to designate the following:

- Beacon Status (Normal / Failure) (Green / Red)
- Sidelight Status (Normal / Failure) (Green / Red)
- Controller Status (Normal / Failure) (Green / Red)
- Photocell Mode Status (Day / Night) (Yellow / Blue)

5.3.2 Beacon Alarm (Green Ok, Red Alarm)

The beacon failure alarm connections are located on the Controller Base Board at the terminal block **T7** labeled **BEACON** with connections labeled COM, NC, and NO.

The controller uses several sources of information to control the beacon alarm contact. First, the beacon alarm contact is monitored by the controller. The controller occasionally cycles power to the beacon in order to test the failsafe alarm NC contact relay is functioning. If the beacon alarm NC contact is not wired to controller, DIP switch 6 must be turned off to ignore the beacon contact.

Secondly, the controller measures the average and peak power used by the beacon in day/night modes and is capable of tripping an alarm condition should these power measurements indicate abnormal behavior. This option is enabled using DIP switch 7.

At least one beacon health measurement method must be used and it is recommended to use both methods for the added safety benefit. Failure to select a beacon health monitoring method using DIP switch 6 or 7 will force a beacon alarm.

Error flash codes can be used to assist the service personnel when troubleshooting problems. See section 7.1 in the troubleshooting section for error codes.

5.3.3 Sidelight Alarm (Green Ok, Red Alarm)

The sidelight failure alarm connections are located on the Controller Base Board at the terminal block **T6** labeled **SIDELIGHT** with connections labeled COM, NC, and NO.

The controller uses several sources of information to control the sidelight alarm contact. The sidelight voltage, current draw, and power consumption are measured. The power measurement is compared to the user set alarm threshold which was set during installation calibration. See calibration section 6.2.

Error flash codes can be used to assist the service personnel when troubleshooting problems. See section 7.1 in the troubleshooting section for error codes.

Options that are set using the DIP switch include latching alarms until mode change and sidelight flashing in sync with the beacon. See DIP switch options in section 4.7 for more details.

5.3.4 Controller Alarm (Green Ok, Red Alarm)

The controller failure alarm connections are located on the Controller Base Board at the terminal block **T8** labeled **CONTROLLER** with connections labeled COM, NC, and NO.

The controller uses several sources of information to control the controller alarm contact. An error that is not caused by the beacon or sidelights, such as a lack of calibration or photocell errors, will cause this alarm to be triggered.

Error flash codes can be used to assist the service personnel when troubleshooting problems. See 7.1 in troubleshooting section for error codes.

5.3.5 Photocell Mode Contact (Yellow Day / Blue Night)

The photo mode contact connections are located on the Controller Base Board at the terminal block **T9** labeled **DAY / NIGHT** with connections labeled COM, NC, and NO. During night mode, the Normally Closed (NC) terminals will have the closure to Common (COM). During day mode, the Normally Open (NO) terminals will have the closure to Common (COM).

Mode LEDs on the Controller UI Board will indicate the current day or night mode of operation. The DAY (Yellow) or NIGHT (Blue) LED will be lit to indicate the current mode of operation regardless of whether the controller is in manual or automatic photocontrol mode.

The pushbutton in the mode section, SW4, can be used to toggle between manual mode in day, automatic mode, and manual mode in night. The AUTO LED will be lit Green in automatic mode or Red in manual mode.

Unless overridden by a DIP switch setting (see Table 1 . Configuration Switch Settings), the controller will return to automatic mode two hours after there has been no activity so the controller is not accidentally left in manual mode.

5.4 Circuit Protection

5.4.1 Surge protection

Protecting the controller and system equipment from voltage line surges caused by lightning, generators, and power disturbances is accomplished by surge protection devices built into the equipment (beacons, sidelights, and controllers). In the event of a severe surge, a fuse or MOV may blow on the controller base board (see section below on fuses). If the surge protection has failed due to repeated surges, the damaged board will need to be replaced.

5.4.2 Short circuit protection

Short circuit protection is accomplished by fuses on tower connections, photocell connections, and input power lines.

In the event of a blown fuse on the input, an alarm will be signaled since the controller will detect a power failure. Other blown fuses will cause the loss of functionality of the beacon, sidelights, or photocell. These lost functions will be detected by the controller can be diagnosed with error flash codes (see error flash codes in troubleshooting section 7.1).

Spare fuses are available from Hughey & Phillips and are listed in section 8.0, Replacement Parts List.

Fuse	Function
FH1	Input Power
FH2	Beacon Power
FH3	Sidelight Tier Power
FH4	Photocell Power

Table 2 – Fuses

6.0 System Start-Up and Testing

Once the control enclosure is mounted, secured, and wired to the beacon and sidelights as described in section 4.0, the following start up procedure must be followed. It is important that the installer verify that the beacon and all sidelights are operational before calibration as this normal baseline power reading is used for some of the comparisons regarding system health and proper functioning. This procedure will allow the user to verify proper operation of the control's functions. The units undergo a vigorous factory test and burn-in procedure to ensure the highest quality. After testing, they are placed in a non-calibrated mode specifically to force the proper calibration to occur in the field during installation. **A unit installed from the factory will alarm until it is properly calibrated.** Assuming it is properly wired, the system (beacons, sidelights, photocell, and controller) will otherwise run as expected, and the obstruction lights will operate . even during an uncalibrated alarm condition. It is up to the installer to perform this important calibration step and wire the alarm contacts to monitoring equipment as required.

In the event a problem occurs, refer to section 7.0, Troubleshooting.

6.1 Verification of Operation

6.1.1 Day Mode Verification

The mode switch SW4 is used to manually force Day mode. The Mode LEDs on the Controller UI Board will now be yellow indicating day mode operation and red indicating manual control mode. The night LED will be off. The mode relay contact will now be in the day position (NO to COM is open, NC to COM is closed).

For FAA Type A-1 systems, all the tower lights should be OFF because A-1 systems only have red night activated lighting.

For FAA Type D-1 or E-1 systems, the white L-865 should be flashing in DAY mode (20,000 candela, white, high brightness) and the L-810 sidelights should be OFF, if present.

When the mode is changed, alarms are initially cleared but will reappear if data is collected to indicate a fault condition. The beacon self-monitoring alarms can take up to 45 minutes to appear (if enabled in the controller and wired to the beacon NC contact). The controller will typically flag a beacon fault condition sooner . within 15 minutes if this check is enabled. See DIP switch settings for enabling these features.

6.1.2 Night Mode Verification

The mode switch SW4 is used to toggle to Night mode. The Mode LEDs on the Controller UI Board will now be blue indicating night mode operation and red indicating manual control mode. The day LED will be off. The mode contact will now be in night position (NO to COM is closed, NC to COM is open).

For FAA Type A-1 or E-1 systems, the L-810 sidelights should be on and the L-864 beacon should be flashing red.

For FAA Type D-1, the white L-865 beacon should be ON, flashing in NIGHT Mode (2,000 candela, white, lower brightness).

When the mode is changed, alarms are initially cleared but will reappear if data is collected to indicate a fault condition. The beacon self-monitoring alarms can take up to 45 minutes to appear (if enabled in the controller and wired to the beacon NC contact). The controller will typically flag a beacon fault condition sooner . within 15 minutes if this check is enabled. See DIP switch settings for enabling these features.

Sidelight alarms will be signaled within 15 minutes by the controller.

6.1.3 Photocell Verification

- To test the photocell for proper operation, the control must be in the Auto mode. Use mode switch SW4 to advance to Auto mode.
 - The Auto mode LED will be green (steady).
 - The control will now turn the lights ON and OFF according to the light intensity hitting the photocell eye.
- Simulate night mode by covering the photocell so no light hits the sensor eye.
 - The control should go into night mode operation within 65 seconds.
 - Once in night mode, the mode Night LED will be blue and the mode contact will be closed (NO to COM is closed, NC to COM is open).
- Simulate day mode by allowing light to shine on the sensor eye.
 - The control should switch to day mode operation within 65 seconds.
 - If the control does not go to day mode, use a flashlight to force more light to hit the eye.
 - Once in day mode, the Mode Day LED will be yellow and the mode contact will be open (NO to Com is open, NC to Com is closed).
- Ensure that the photocell is mounted so that the eye will not be facing the direct sun. The eye should face the northern sky in the northern hemisphere or face the southern sky in the southern hemisphere.

	Auto LED	Day LED	Night LED
Manual Day	Red	Yellow	Off
Manual Night	Red	Off	Blue
Auto Day	Green	Yellow	Off
Auto Night	Green	Off	Blue

6.2 Sidelight and Beacon Alarm Calibration



Figure 7 – Alarm Calibration Inputs

1. Verify the beacon and all sidelights are illuminated by following section 6.1.
 - It is important that the sidelights are visually observed to be illuminated before a new calibration sequence is started as t/his power level will set the baseline for a properly functioning system.
2. Adjust the beacon alarm threshold rotary switch, SW2, to position 6 for normal operation.
3. Adjust the sidelight alarm threshold rotary switch, SW3, to the desired position based on Table 3.
 - The switch settings represent a percentage of normal sidelight power consumed divided by 10, with 0 used as a factory setting to always force a sidelight alarm
 - This percentage is used to set the alarm threshold.
 - For example, setting the switch to position 7, or 70%, will instruct the controller to alarm when 70% of the sidelights or less remain operational.

Number of Sidelights in System	Number of Sidelights Out to Trigger Alarm	SW3 Position
4	1 (75%)	9
	2 (50%)	6
	3 (25%)	4
	4 (0%)	1
3	1 (66%)	8
	2 (33%)	5
	3 (0%)	2
2	1 (50%)	7
	2 (0%)	3
1	1 (0%)	5

Table 3 – Example Sidelight Calibration Rotary Switch Settings

4. Press and hold the calibration button SW1 for 10 seconds.

5. Calibration is automatic and will take between 15 minutes and one hour and 15 minutes while the beacon and sidelights are cycled between modes and power measurements are taken.
 - Do not be concerned about controller LEDs, beacons, sidelights, and relays changing during this time. It is a normal part of the process.
 - The calibration LED flash rate will increase as calibration continues.

6. When calibration has completed successfully, the green Alarm Calibrated LED will be flashing.
 - If the LED is red, see section 7.10.
 - Changing the sidelight threshold rotary switch or some DIP switches (listed in section 4.7) during or after calibration will be flagged as an error.
 - If it is desired to change the sidelight alarm threshold, then the entire calibration sequence must be followed for the rotary switch position change to be recognized as a planned activity.

7.0 Troubleshooting

WARNING

1. Always turn off power when changing any component or printed circuit board.
2. The components and assemblies in this system were designed by HUGHEY & PHILLIPS. Use only factory authorized parts when servicing this unit.

7.1 Error Flash Sequence

If the calibration LED is flashing red instead of green, this indicates that the system is ready to display an error code. To display the error code, press the calibration button for **less than one second**. Once pressed, there will be a five second pause, then a series of red flashes followed by a series of green flashes. The number of each type of flash corresponds to an error in the table below.

Cal. LED Error Code	Description of Fault	Indication	Solution
Red: 1, Green: 1	No error or fault	None	None
Red: 1, Green: 2	Beacon is sending alarm to controller	Beacon Alarm Relay	Check beacon operation in manual EPM-00000043-005
Red: 1, Green: 3	Beacon power usage out of range in night mode	Beacon Alarm Relay	Check beacon operation in manual EPM-00000043-005
Red: 1, Green: 4	Beacon power usage out of range in day mode	Beacon Alarm Relay	Check beacon operation in manual EPM-00000043-005
Red: 1, Green: 5	Beacon mode relay failure on controller base board	Beacon Alarm Relay	Replace controller base board
Red: 1, Green: 6	Sync signal from beacon is not reaching controller	Beacon Alarm Relay	Check wiring and beacon operation
Red: 1, Green: 7	Sidelight power usage out of range	Sidelight Alarm Relay	Check for sidelight outage
Red: 1, Green: 8	BCD switch out of range	Controller Alarm Relay	Adjust BCD switch or replace controller UI board
Red: 1, Green: 9	Mode switch stuck	Controller Alarm Relay	Press switch again to dislodge. If unable to dislodge, replace controller board
Red: 2, Green: 1	Calibration switch stuck	Controller Alarm Relay	Press switch again to dislodge. If unable to dislodge, replace controller board
Red: 2, Green: 2	Beacon alarm relay failure	Controller Alarm Relay	Replace controller base board
Red: 2, Green: 3	Sidelight alarm relay failure	Controller Alarm Relay	Replace controller base board
Red: 2, Green: 4	Controller mode relay failure	Controller Alarm Relay	Replace controller base board
Red: 2, Green: 5	Temperature out of range	Controller Alarm Relay	Check temperature inside enclosure. System is rated for -40 to 55°C (-40 to 131°F)
Red: 2, Green: 6	Controller onboard power supply failure	Controller Alarm Relay	Replace controller module

Cal. LED Error Code	Description of Fault	Indication	Solution
Red: 2, Green: 7	Photocell failure	Controller Alarm Relay	Replace photocell
Red: 2, Green: 8	EEPROM checksum failure	Controller Alarm Relay, System Off	Replace controller UI board
Red: 2, Green: 9	Program checksum failure	Controller Alarm Relay, System Off	Replace controller UI board
Red: 3, Green: 1	No beacon alarm mode set	Controller Alarm Relay	Enable at least one type of beacon alarms via DIP switches. See section 4.7
Red: 3, Green: 2	Controller calibration needed	Controller Alarm Relay	Calibrate controller
Red: 3, Green: 3	Controller BCD switch changed since calibration	Controller Alarm Relay	Return BCD switch to calibrated position or recalibrate
Red: 3, Green: 4	Controller DIP switch changed since calibration	Controller Alarm Relay	Return DIP switch to calibrated position or recalibrate
Red: 3, Green: 5	No beacon monitoring	Controller Alarm Relay	Enable one form of beacon monitoring (See section 4.7)

7.2 Problem: Damage to Components

First, check to make sure fuses are intact.

Then, visually inspect all boards and wiring for signs of damage such as melted components, burn marks, swelling, or corrosion. If any component shows signs of damage, replace that board. See section 8.0, Replacement Parts List, for part numbers.

7.3 Problem: Beacon and Sidelights Not Flashing in Sync

First, check configuration DIP switch position 1 is set to enable flashing sidelights. See section 4.7 for more information.

Then, check sidelight voltage at the controller on terminal block **T4, SIDELIGHT**. Normal operation is voltage switching between 0VAC and 110 - 240VAC on every flash on the 70-0015-001 and 0VDC and 48VDC on every flash on the 70-0015-003, -005, and -007 versions.

7.4 Problem: Beacon Stuck in Day Mode

First, use mode switch SW4 to change mode to night. If the sidelights turn on and the beacon stays in day mode check beacon wiring or controller fault (Controller will show fault flash sequence).

Then, check photocell for proper wiring and operation. See sections 4.5 and 6.1.3.

Finally, check the beacon wiring (section 4.2), ensuring that the orange mode wire is connected from the controller to the beacon. The **PHOTO** line on **T5** should measure 110 - 240VAC or 48VDC in night mode and 0V in day mode.

7.5 Problem: Beacon Stuck in Night Mode

First, use mode switch SW4 to change the mode to day. If the sidelights go off and the beacon stays in night mode check beacon wiring or controller fault (Controller will show fault flash sequence).

Then, check photocell for proper wiring and operation. See sections 4.5 and 6.1.3.

Afterwards, proceed to the beacon wiring (section 4.2), ensuring that the orange mode wire is not shorted to the any other wires. The **PHOTO** line on **T5** should measure 110 - 240VAC or 48VDC in night mode and 0V in day mode.

7.6 Problem: Sidelights Will Not Turn On

First, check fuse F2 on the Controller Base Board. If the fuse is blown, it is likely that there is a short in the tower sidelight wiring or a severe voltage surge occurred. Check wiring to sidelights (section 4.2) for shorts before replacing fuse.

If the fuse is not open, the tower wiring should also be checked. It is most likely to be an open circuit that needs repair.

7.7 Problem: Sidelights Will Not Turn Off

Check wiring to ensure sidelights are being powered from the **SIDELIGHT** terminal block, **T4** and not directly from incoming power or beacon terminal block.

7.8 Problem: Beacon Will Not Turn On

First, check fuse F1. If the fuse is blown, it is likely that there is a short in the tower beacon wiring or a severe voltage surge occurred. Check wiring to beacon for shorts before replacing fuse. AC controller terminal block **T3** should measure 110 - 240VAC or 48VDC from **L/+** to **N/-** terminals.

If the fuse is not open, the tower wiring should also be checked. It is most likely to be an open circuit that needs repair.

If no faults are found with wiring, refer to beacon manual, EPM-00000043-005, for more troubleshooting information.

7.9 Problem: No LEDs Lit on Controller UI Board

First, check fuse F4. If the fuse is open, replace it. If the fuse is not open then proceed to the next paragraph.

Check incoming power to Controller Base Board. If 110 - 240VAC or 48VDC is read between **L/+** and **N/-** on the **Power Input** terminal block, **T1**, then replace Controller Base Board.

If 110 - 240VAC or 48VDC is not present on Controller Base Board, check input power to Power Module. If the proper input voltage is present on the Power Module, then replace fuse on the Power Module. If the proper input voltage is not present on the input, then check power source.

7.10 Problem: Calibration Failure

If the controller UI board's calibration LED does not turn green at the end of calibration, all wiring should be checked, the unit should be power cycled, and the calibration procedure should be repeated.

8.0 Replacement Parts List

The following lists include the Hughey & Phillips part numbers of components that are replaceable on the controller.

For AC Controllers 70-0015-001 and 70-0015-009 (AC w/ stainless steel housing):

H&P Part Number	Description
71-0054-001	Wire Harness UI Module to Base Module
71-0066-001	AC UI Module UHC
71-0067-001	AC Base Module UHC
FUS0006	Fuse 4A 250V (F1-F4)
71-0063-001	110 - 240VAC Early Turn-On Twistlock Photocell (A-1 Red)
71-0064-001	110 - 240VAC Twistlock Photocell (E-1 Dual or D-1 White)
71-0065-001	AC Twistlock Photocell Receptacle (Black/Red/White Wires)
MSC0049	AC Surge Block
ENC0052	Circuit Breaker
77-2644	Interlock Switch
CBL0006	Horizon Series MI Beacon Cable 18 AWG 8-Conductor Type TC-ER
EPM-00000043-001	AC Beacon Manual
EPM-00000056-001	Controller Manual

For DC, -DC and AC IN / DC OUT Controllers 70-0015-003, 70-0015-005 and 70-0015-007:

H&P Part Number	Description
71-0054-001	Wire Harness UI Module to Base Module
71-0066-003	DC UI Module UHC
71-0067-003	DC Base Module UHC
FUS0006	Fuse 4A 250V (F1-F4)

71-0031-001	48VDC Early Turn-On Twistlock Photocell (A-1 Red)
71-0032-001	48VDC Twistlock Photocell (E-1 Dual or D-1 White)
71-0033-001	48VDC Twistlock Photocell Receptacle (Black/Red/Orange Wires)
71-0072-001	Power Supply Module AC to 48VDC (-005 only)
MSC0049	AC Surge Block (-005 only)
71-0029-001	-48VDC Input Power Module (-007 only)
ENC0052	Circuit Breaker
77-2644	Interlock Switch
CBL0006	Horizon Series MI Beacon Cable 18 AWG 8-Conductor Type TC-ER
EPM-00000043-005	DC Beacon Manual
EPM-00000056-001	Controller Manual

9.0 Appendix of Drawings

71-0099-001_Rev-

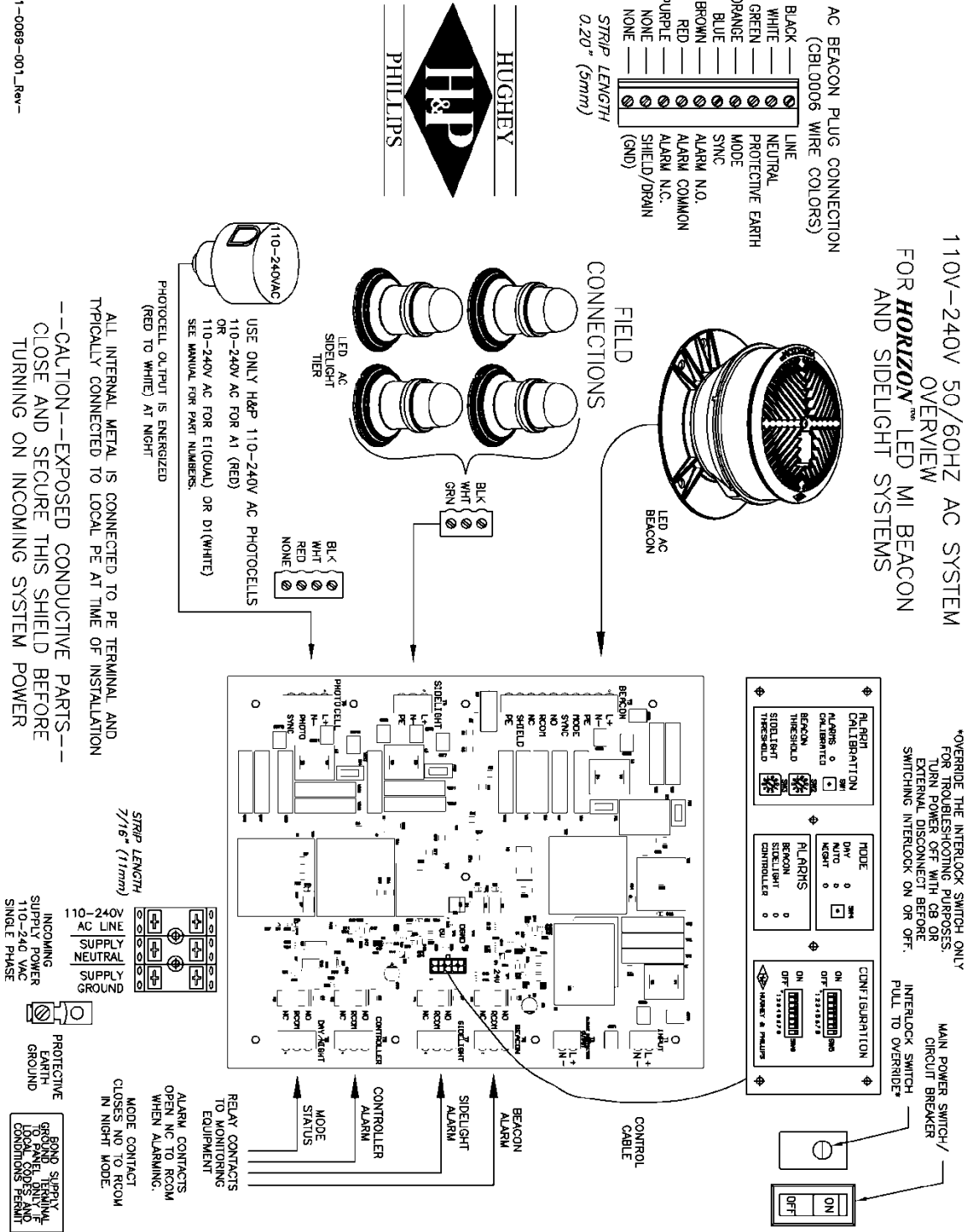


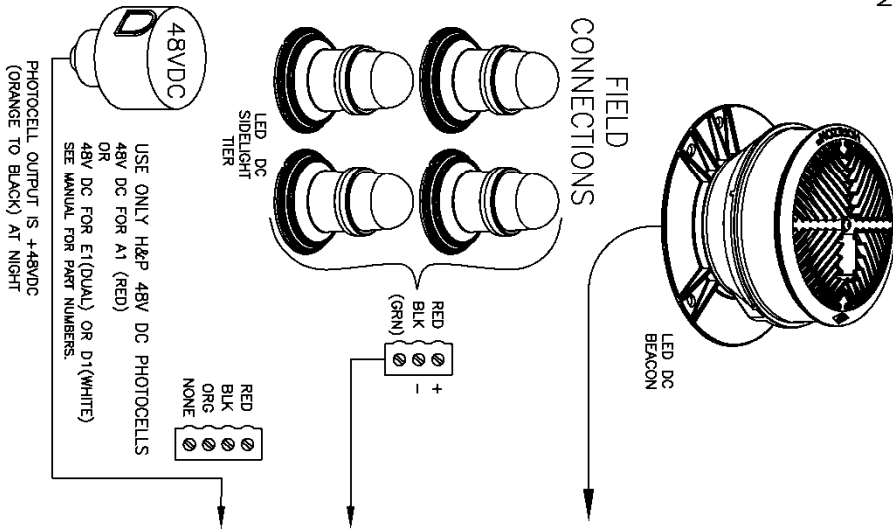
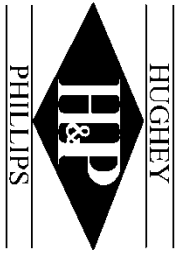
Figure 8a – Quick Start Guide -001 and -009

**+48 VOLT DC SYSTEM OVERVIEW
 FOR DC HORIZON™ LED MI BEACON
 AND SIDELIGHT SYSTEMS**

DC BEACON PLUG CONNECTION
 (CBL0006 WIRE COLORS)

RED	+ 48 VDC
BLACK	DC RETURN
GREEN	PROTECTIVE EARTH
ORANGE	MODE
BLUE	SYNC
BROWN	ALARM N.O.
WHITE	ALARM COMMON
PURPLE	ALARM N.C.
NONE	SHIELD/DRAIN
NONE	(GND)

STRIP LENGTH
 0.20" (5mm)

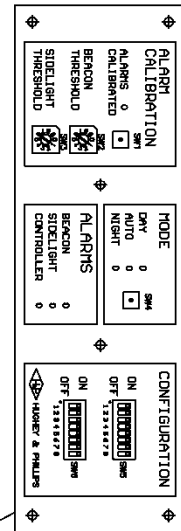
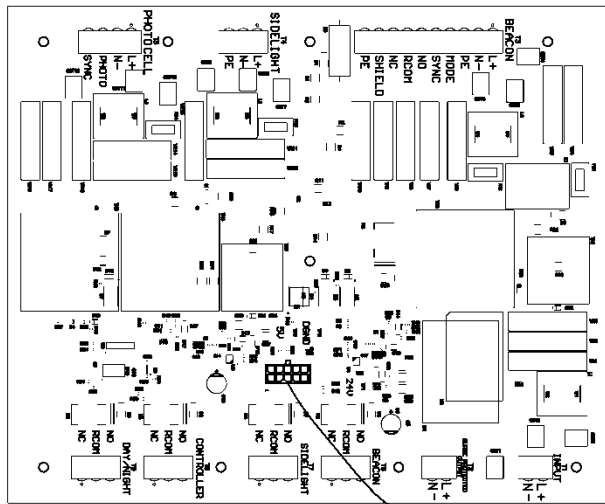


USE ONLY H&P 48V DC PHOTOCELLS
 48V DC FOR AT (RED)
 OR
 48V DC FOR ET (DUAL) OR D1 (WHITE)
 SEE MANUAL FOR PART NUMBERS.

PHOTOCELL OUTPUT IS +48VDC
 (ORANGE TO BLACK) AT NIGHT

ALL INTERNAL METAL IS CONNECTED TO PE TERMINAL AND
 TYPICALLY CONNECTED TO LOCAL PE AT TIME OF INSTALLATION

--CAUTION--EXPOSED CONDUCTIVE PARTS--
 CLOSE AND SECURE THIS SHIELD BEFORE
 TURNING ON INCOMING SYSTEM POWER



*OVERRIDE THE INTERLOCK SWITCH ONLY
 FOR TROUBLESHOOTING PURPOSES.
 TURN POWER OFF WITH CB OR
 EXTERNAL DISCONNECT BEFORE
 SWITCHING INTERLOCK ON OR OFF.

MAIN POWER SWITCH/
 CIRCUIT BREAKER
 INTERLOCK SWITCH
 PULL TO OVERRIDE*

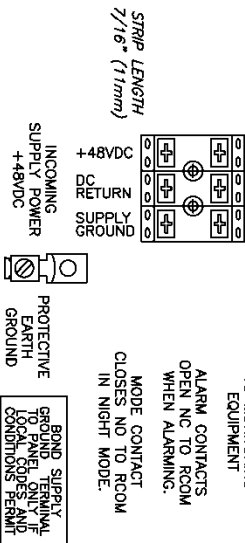
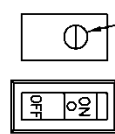


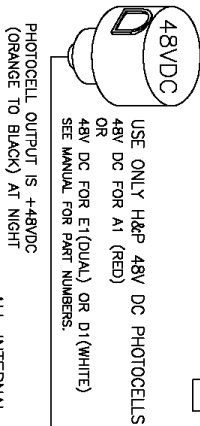
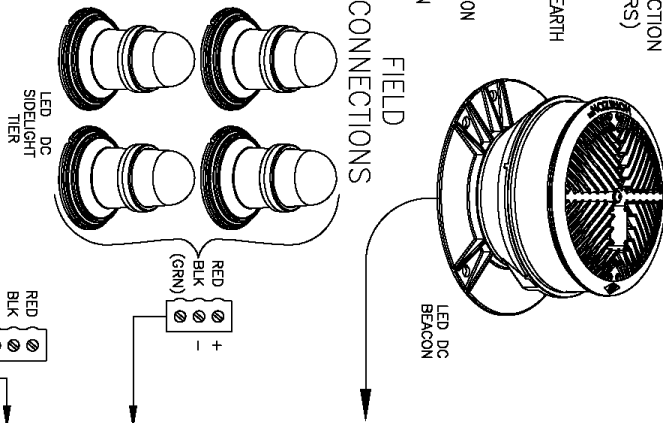
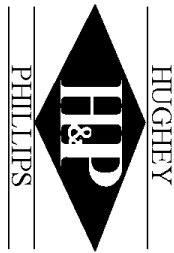
Figure 9b – Quick Start Guide -003

110V-240V 50/60HZ INPUT/
 48VDC OUTPUT SYSTEM OVERVIEW
 FOR **HORIZON™** LED MI BEACON
 AND SIDELIGHT SYSTEMS

DC BEACON PLUG CONNECTION
 (OBL0006 WIRE COLORS)

RED	+ 48 VDC
BLACK	DC RETURN
GREEN	PROTECTIVE EARTH
ORANGE	MODE
BLUE	SYNC
BROWN	ALARM N.O.
WHITE	ALARM COMMON
PURPLE	ALARM N.C.
NONE	SHIELD/DRAIN
NONE	(GND)

STRIP LENGTH
 0.20" (5mm)



ALL INTERNAL METAL IS CONNECTED TO PE TERMINAL AND TYPICALLY CONNECTED TO LOCAL PE AT TIME OF INSTALLATION

---CAUTION---EXPOSED CONDUCTIVE PARTS---
 CLOSE AND SECURE THIS SHIELD BEFORE TURNING
 ON INCOMING SYSTEM POWER

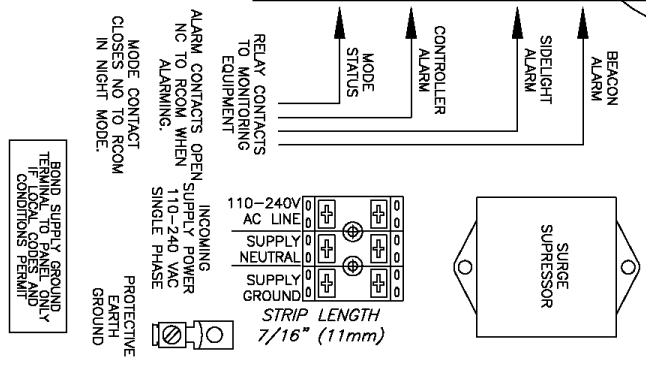
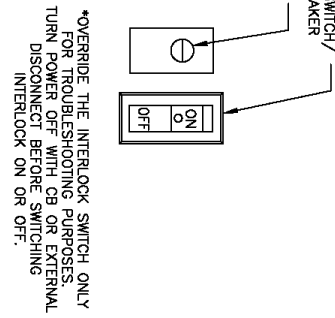
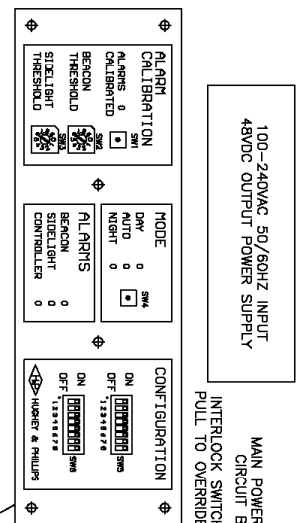
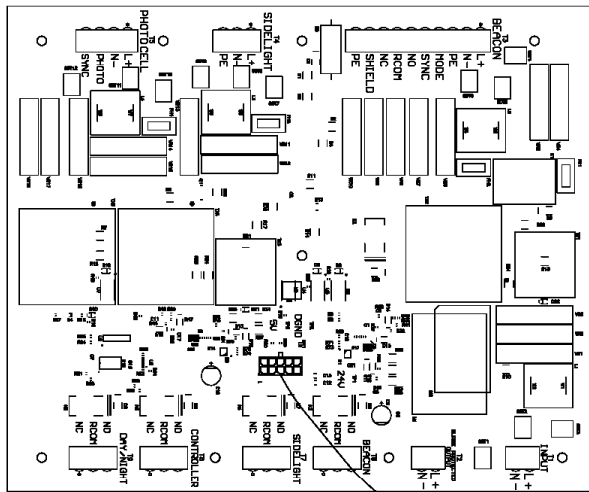


Figure 10c - Quick Start Guide -005

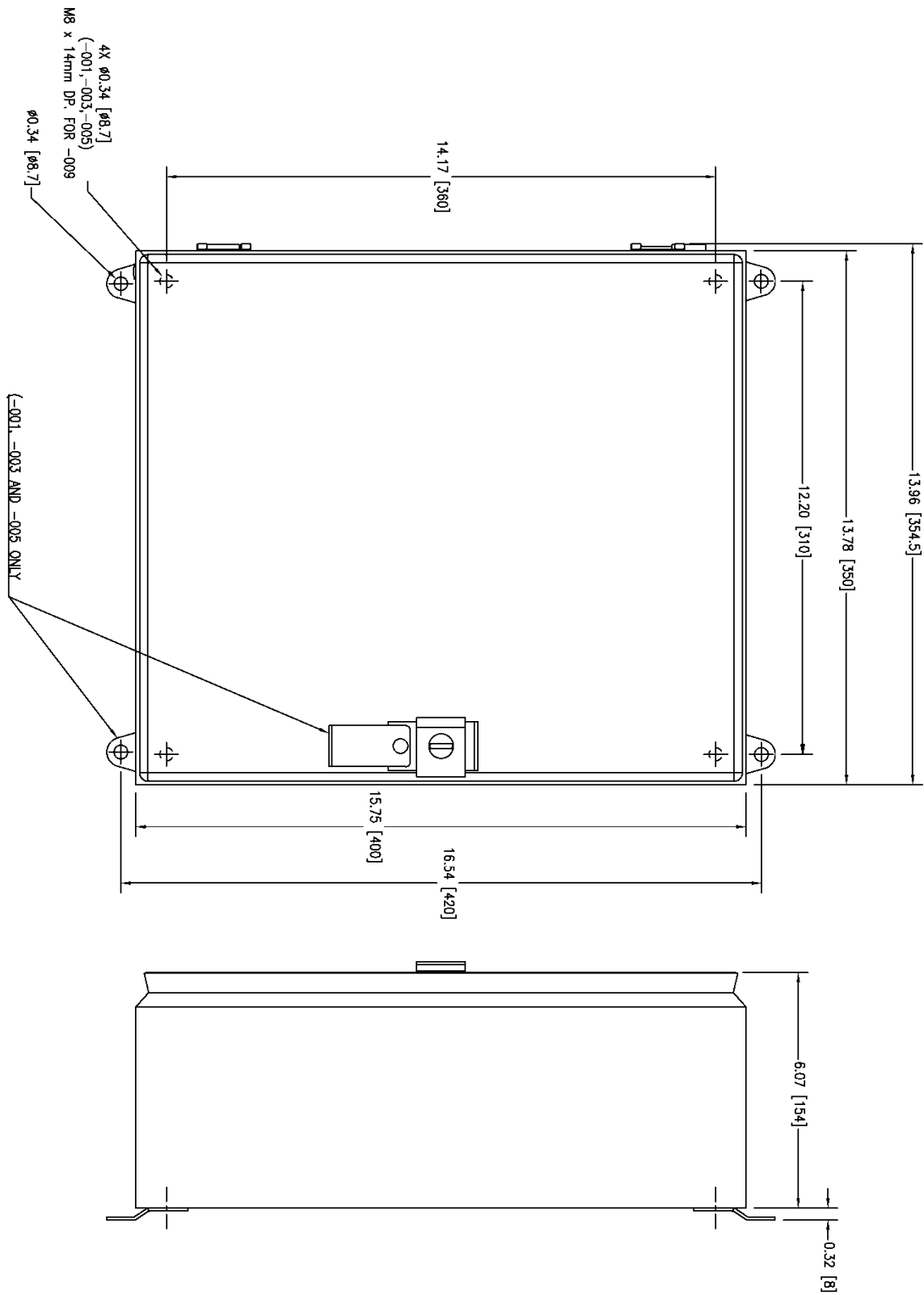


Figure 11 – Housing Dimensions