LED Precision Approach Path Indicator (AV-PAPI)
Model AV-PAPI-24

User Manual

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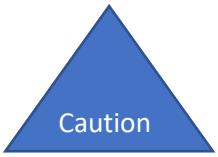
Contents

1 Warnings and Cautions

Warning indicates that serious bodily harm or death may result if precautions are not followed.



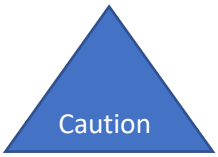
Caution indicates that damage to equipment may result if instructions are not followed.

1.1 Handling Light Emitting Diodes (LEDs)

Do not look into lenses that are actively emitting LED or infrared light. The PAPI can emit both visible and infrared lighting that is harmful to the eyes.

1.2 Handling Batteries

Use caution when handling the PAPI light. The PAPI can generate enormous short-circuit currents. Remove any bracelets, watches or rings before attempting to handle or remove batteries.



Periodically charge batteries to avoid permanent damage or reduced capacity.

Battery usage depends upon weather. Warmer weather causes the batteries to discharge more quickly than colder weather. A full battery charge is required for any lights that have been stored for long periods of time. To accurately assess battery health, ensure power is off, and store lights in a dark location for a minimum of 24 hours.

1.3 Handling Light Housing Assemblies (LHA)

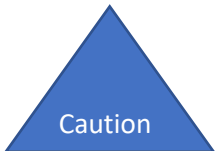
Always follow these instructions when handling the AV-PAPI:

- The LHAs contain glass components. **Do not drop!**
- The LHA is designed to be transported in the horizontal position.
- Do not store, carry or use the Battery Box Assembly (BBA) in any position other than top side up.
- Do not step on the top of the LHA, BBA, or Power Control Unit (PCU).
- When cleaning lenses, apply light pressure only. Grit on the lens is hard and sharp and will scratch the surface of the lenses.

1.4 Improper Cleaning Agents

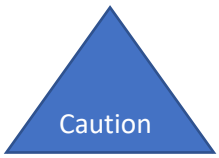
Improper cleaning methods and unauthorized cleaning agents can injure personnel and damage equipment. Do not use standard commercial glass window cleaners on the exit windows. While the lens itself is hard, the outer surface is coated and the cleaner may remove or scratch the coating. If necessary, use a standard lens cleaning fluid.

1.5 Inclinometer



Do not install battery backwards. To ensure accurate readings, calibrate the digital inclinometer before using. Refer to instructions included with the inclinometer.

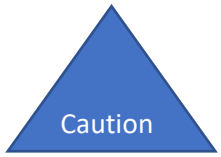
1.6 Power Sources



Do not connect the PCU directly to the DC output of a generator or any unregulated power source.

Ensure that the PCU Power switch on the PCU control panel is toggled to the **off** position before connecting power to the PCU. Failure to toggle the Power switch to **off** may result in damage to the power sources or the PCU.

1.7 Heated Lens



Heated lens option **required** for all PAPIs used in sub-zero or arctic conditions.

2 Product Configurations and Options

AV-PAPI-X-XX-XX-XX- X- X

Base Product
A – Abbreviated
2 – 2-Box
4 – 4-Box

Mounting
P0 – Permanent Installation
P1 – Portable Installation

Voltage
UM – 120-240 VAC
24 – 24 VDC
66 – 6.6 A Constant Current

Options
00 - None
01 - Radio Frequency (RF) Control
02 - Infrared (IR) Only
03 - IR and RF Control
04 - Heated Lens (HL)
05 - RF Control HL
06 - IR and HL
07 - IR, RF, and HL
08 - Tilt Switch (TS)
09 - RF and TS
10 - IR and TS
11 - IR, RF, and TS
12 - HL and TS
13 - RF, HL, and TS
14 - IR, HL, and TS
15 - IR, RF, HL, and TS
16 - Photocell Control (PC)
17 - RF and PC
18 - IR and PC
19 - IR, RF, and PC
20 - HL and PC
21 - RF, HL, and PC
22 - IR, HL, and PC
23 - IR, RF, HL, and PC
24 - TS and PC
25 - RF, TS, and PC
26 - IR, TS, and PC
27 - IR, RF, TS, and PC
28 - TS and PC
29 - RF, HL, TS, and PC
30 - IF, HL, TS, and PC
31 - IR, RF, HL, TS, and PC

Standard
A - ICAO Abbreviated PAPI 2- LHA
2 - FAA 2- LHA
4 - FAA/ICAO 4-LHA

Color
0 - FAA Orange
1 - ICAO Yellow

3 Tools and Equipment

Table 1: AV- PAPI Kit Contents		
Name	**Quantities**	
	4 Box	**2 Box**
Light Housing Assembly: Pre-wired with 6 ft. lengths of power and control cables	4	2
Power Control Unit	1	1
Photocell (optional)	1	1
PCU Column (Frangible EMT)	1	1
3/4 in. Liquidtite Flexible Conduit (50 ft.)	1	1
10 AWG Machine Tool Wire, Red (100 ft.)	1	1
10 AWG Machine Tool Wire, Black (100 ft.)	1	1
Alpha 1176C 6 conductor 22 AWG Wire (100 ft.)	1	1
Mounting Legs for LHA 12-3/4" Long with Frangible	4	2
Mounting Legs for LHA 14" Long with Frangible	8	4
2 in. Flanges	13	7
Weatherproof Junction Boxes with Lid	5	3
Ring Terminals, 22-18 AWG #8, Vinyl Insulated, Red;	100	100
Ring Terminals, 12-10 AWG #8, Vinyl Insulated, Yellow	50	50
Digital Inclinometer with Mounting Screws	1	1
Radio Remote Control Antennas	1	1

Table 2: AV-PAPI Solar Kit (4 Box)	
Name	**Quantity**
Solar Battery Boxes	1
Solar Combiner	1
Solar Panels	4
Solar Brackets	2
Frangible Bolts (4 per box)	3 Boxes
3 ft. Section EMT for Solar Combiner	1
2 in. Clamps for Solar Combiner	2
2 in. Threaded Floor Flanges	1
2 in. Threaded Frangible Compression Couplings	1

Table 3: AV-PAPI Tools (Not Supplied)	
Name	**Quantity**
3/4 in. Combination Wrench	1
3/16 in. Cabinet Tip Flat-Bladed Screw Driver	1
Crimper for insulated terminals	1
Wire Stripper	1
Electrical Tape	1
10 in. Tongue and Groove Pliers	1

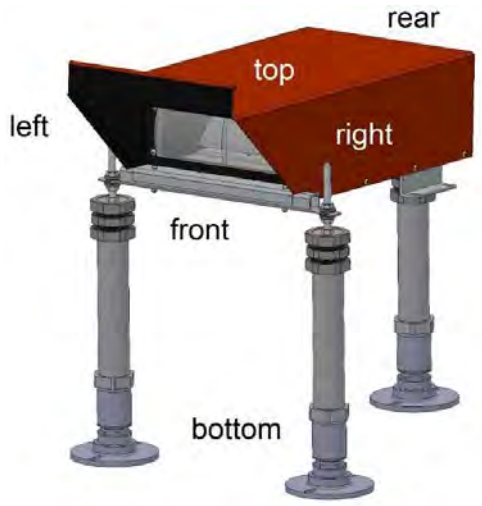
4 Acronyms and Abbreviations

Table 4: Acronyms and Abbreviations	
BBA	Battery Box Assembly
Cd	Candela
DC	Direct Current
EMT	Electrical Metallic Tubing
FAA	United States Federal Aviation Administration
ft.	foot
Hz	Hertz
ICAO	International Civil Aviation Organization
in.	inch
IR	Infrared
kg	kilogram
lb.	pound
LED	Light Emitting Diode
LHA	light housing assembly
mm	millimeter
PAPI	Precision Approach Path Indicator
nm	nanometer
NVE	Night Vision Equipment
NVG	Night Vision Goggle
OD	Outside Diameter
PCB	Printed Circuit Board
PCU	Power Control Unit
RCT	Remote Control Transmitter
RF	Radio Frequency
SFL	Sequence Flashing Lights
SHCS	Socket Head Cap Screw
SS	Stainless Steel
TDZ	Touchdown Zone
V	Volt
VAC	Volts, Alternating Current
VDC	Volts, Direct Current

5 Limitations of Scope

This manual provides information specific to solar assembly, installation, and operation. For information regarding DC, AC to DC, and Constant Current assembly, installation, and operation, a separate supplemental manual is supplied with purchased equipment.

6 Location References



Throughout this manual, the terms front, rear, top, bottom, left and right, are used as reference terms to describe specific locations on the Light Housing Assemblies (LHA). Glass lenses are located on the front panel. The power connector and manufacturer's labels are located on the rear panel. The right side is the side to the right when looking at the front of the LHA, and the left side is the side to the left when looking at the front of the LHA.

7 Disclaimer

The information in this manual is believed to be accurate and up to date, however, Avlite assumes no liability for damages or injuries that may result from errors or omissions, or from the use of information presented herein. Avlite reserves the right to modify this manual at its own discretion without notification to any person or organization. For questions regarding this disclaimer please contact Avlite at:

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8 Regulations

This manual is not a substitute for federal, state, and local regulations, including FAA and ICAO. Refer to and perform all actions/operations outlined in this manual in accordance with federal, state, and local regulations. The following FAA, UFC, and ICAO regulations were referenced while writing this manual:

- UFC 3-535-01
- AC 150/5340-30D
- FAA AC 150/5345-28G
- FAA AC 150/5340-30D

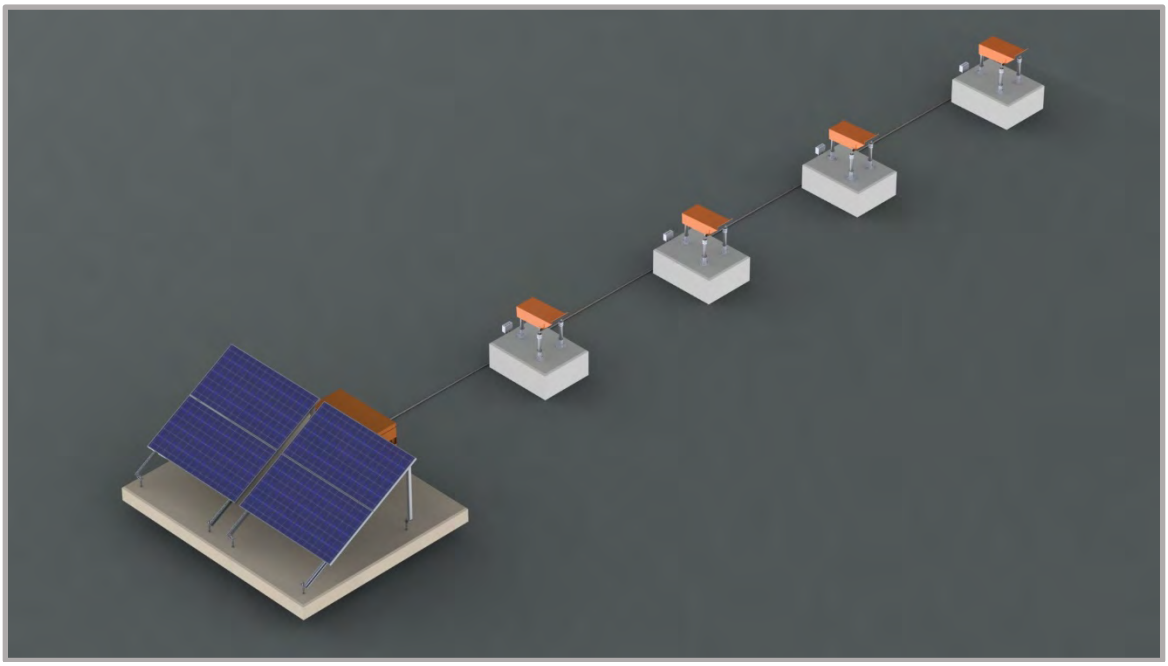
9 Scope

This manual contains installation, operation, and maintenance information for the LED Precision Approach Path Indicator (AV-PAPI), and Abbreviated Precision Approach Path Indicator (AV-APAPI).

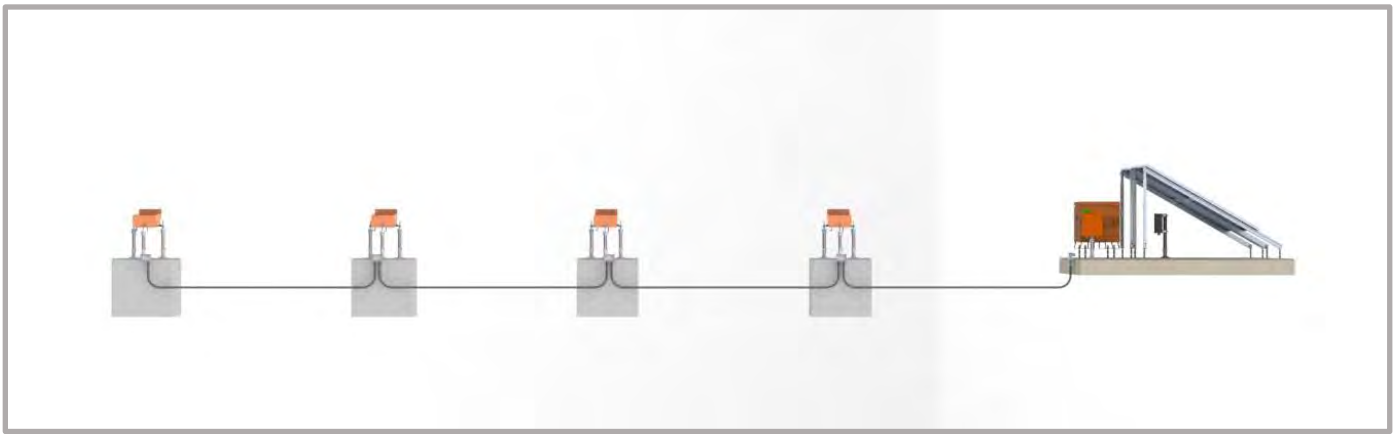
10 Equipment Overview

10.1 Equipment Characteristics, Capabilities, and Features

The AV-PAPI guides pilots on approach to landing by indicating an aircraft's vertical position with respect to proper glideslope. LEDs provide corridors of red and white lights emanating from a location off to the left of the landing zone. The AV-PAPI system includes one PCU and four LHAs. Each LHA projects beams of steady white and steady red light.



Fully Assembled AV- PAPI System - Overhead View



Fully Assembled AV-PAPI – Rear View

10.2 Major Components

The AV-PAPI is comprised of the following major components:

- 2 or 4 Light Housing Assemblies (LHA)
- Power Control Unit (PCU)

Also included are:

- Inclinometer
- Connection wire
- Flex conduit
- Junction boxes
- Frangible mounting system

Note:
Heated lens option **required** for all PAPIs used in sub-zero or arctic conditions.

10.2.1 Light Housing Assembly (LHA)

Please refer to **Section 10**, **Specifications**, in this manual for exact LHA dimensions.

Light Housing Assembly

10.2.2 Power Control Unit

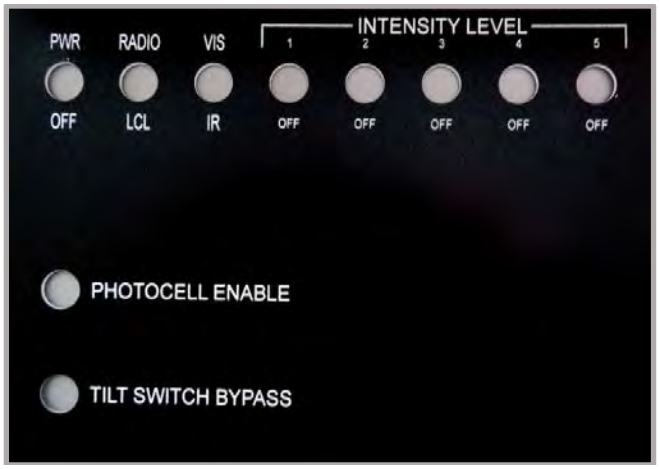
Please refer to **Section 10**, **Specifications**, in this manual for exact PCU dimensions.
The LHA are powered and controlled from the PCU. The PCU requires 24 VDC and uses 240 W of power when the four LHAs are set at the highest intensity (daytime) setting.

The PCU control panel includes switches for:

- System on-off control
- Radio remote or local operation
- Visible or infrared operation
- Five choices for intensity levels:

Table 5: Intensity Levels		
	ICAO	**FAA**
Intensity Step 5:	100%	
Intensity Step 4:	20%	
Intensity Step 3:	4%	100%
Intensity Step 2:	0.8%	20%
Intensity Step 1:	0.16%	5%

The PCU control panel also includes toggle switches for tilt switch bypass, and enabling photocell operation. If an optional feature, for example IR or Tilt Switch Bypass, is not installed, that opening on the control panel will be plugged, or is not present.



Power Control Unit (PCU) Control Panel

The PCU includes an input conduit attachment for power from a regulated 24 VDC source, and single input for 5 intensity levels on its lower right hand bottom as viewed from the front. Pre-wired 6 ft. lengths of wire are also included for power (red and black 10 gauge) and signal (6 x 22 gauge). The conduit fitting for the power and signal to the LHAs is located on the other side bottom panel. In all cases, the 10 gauge red wire is positive 24 volts, and the 10 gauge black wire is negative.

Note:
Heated lens option **required** for all PAPIs used in sub-zero or arctic conditions. Heated Lens option not shown.

10.2.3 Inclinometer

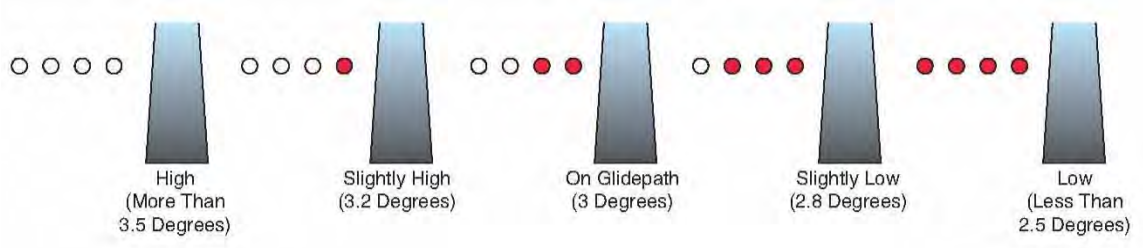
A digital inclinometer is included to set the side-to-side level and tilt angles for the LHA. Refer to the Owner's Manual included with the digital inclinometer for user instructions.

Digital Inclinometer

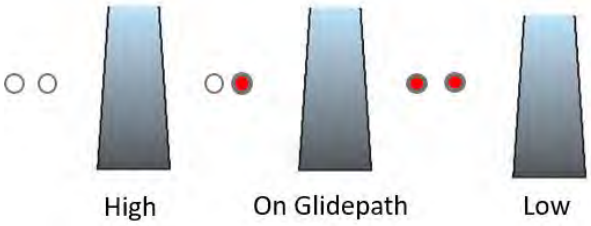
11 Theory of Operation

11.1.1 Light Housing Assemblies (LHAs)

LHAs use a row of high power LEDs to generate light of the required color: red for the bottom corridor, or white for the top corridor. The signal format seen by the pilot is illustrated in the figure below.



Signal format as seen by pilot on approach to landing for the 4-box configuration.



APAPI 2-box configuration

LEDs provide corridors of red and white lights emanating from a location off to the left side of the landing zone. Each LHA projects beams of steady white and steady red light. There are four different combinations of red and white lights used to indicate degree of glideslope:

- Two LHAs showing a red light, and the other two showing a white light, indicate **proper** glideslope on approach to landing.
- White lights for all four LHAs, indicate the aircraft is **well above** the proper glideslope.
- White lights from three LHAs, and a red light from one LHA, indicate the aircraft is **above** the proper glideslope.
- Red lights from three LHAs, and a white light from one LHA, indicate that the aircraft is **below** the proper glideslope.
- Red lights emanating from all four LHAs, indicate that the aircraft is **well below** the proper glideslope.

12 Specifications

Table 6: Specifications

Physical				
LHA	Dimensions:	14.2 in. W x 30.7 in. L X 6.6 in. H		
	Weight:	23 lbs.		
PCU	Dimensions:	9 3/4 in. W x 8 in. H x 1/8 in. T		
	Weight:	26 lbs.		
Operational				
	Voltage:	24 VDC		
	Power:	240 Watts		
	Intensity Levels:	Conform to FAA and ICAO requirements for intensity levels.		
			ICAO	**FAA**
		Step 5	100%	
		Step 4	20%	
		Step 3	4%	100%
		Step 2	0.8%	20%
		Step 1:	0.16%	5%
Photometrics and Chromaticity		Conform to FAA and ICAO photometric requirements.		
Beam Spread		Conform to FAA and ICAO photometric requirements.		

Note:
Heated lens option **required** for all PAPIs used in sub-zero or arctic conditions.

13 Compliance

FAA 150/5345-28G, and ICAO Annex 14, 5.3.4.10 – 5.3.4.2

14 Installation, Assembly, and Setup

Here is a list of high-level steps required for installing the AV-PAPI system:

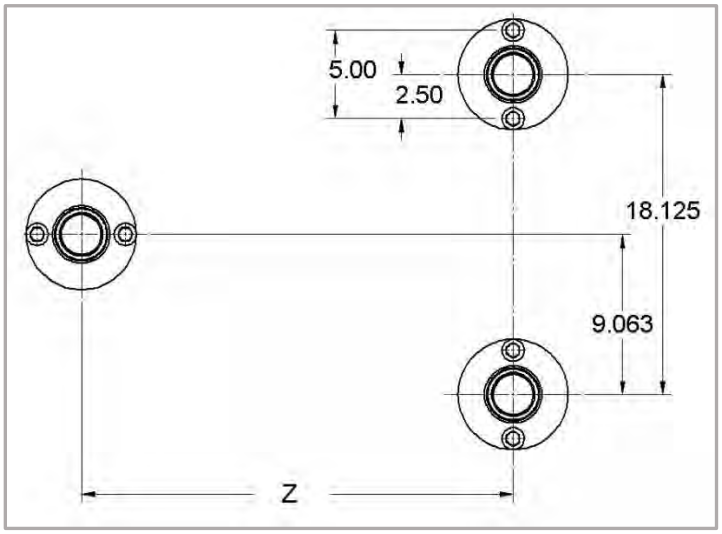
- ✓ Research federal, state, and local requirements for concrete pad, conduit and PAPI installation. Refer to *Section 8* of this manual for some, but not all, of the applicable regulations.
- ✓ Install electrical underground electrical conduit that will connect the LHAs to each other, the PCU, and the power supply.
- ✓ Pour concrete pads for the LHAs, PCU, and power supplies depending upon AV-PAPI configuration.
- ✓ Install PCU
- ✓ Install LHAs
- ✓ Install power
- ✓ Complete wiring

14.1 Site Requirements

In accordance with federal, state, and local regulations, pour concrete pads for permanent installation at each of the sites where an LHA, PCU, and solar power supply will be located. FAA requirements for concrete pads are found in FAA AC 150/5340-30D; however, please refer to state and local regulations as well.

Notes:
To comply with FAA regulations the concrete pad must extend 12 in. beyond the LHA weather cover.

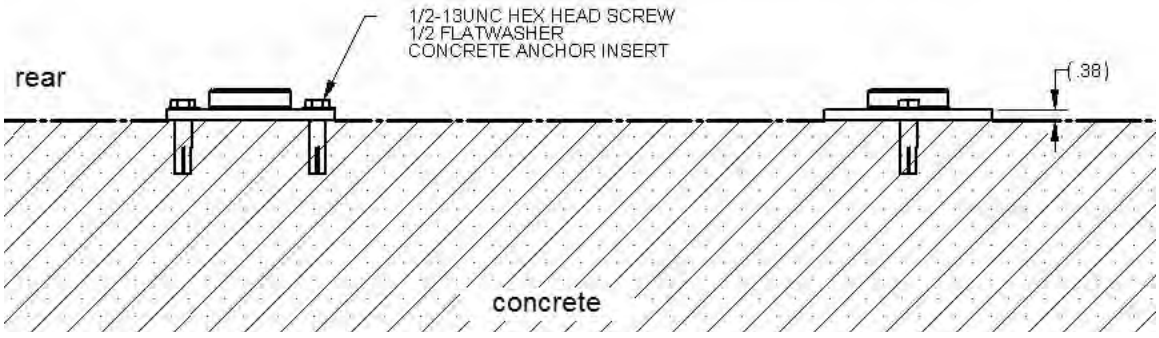
The distance between the front and back frangible fittings is provided in Table 7 and the distance between the two front supports is 18.125 in. Also note the concrete pad must be larger to extend a minimum of 12 in. beyond the LHA weather cover.



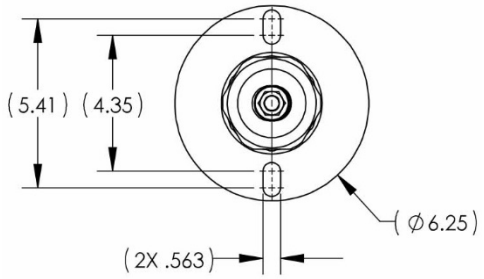
Above: Plan view indicating the distances between the three front legs of the LHA

Table 7: Front-to-Back Distance Between LHA Foot Flanges for 3 °, 3.5°, and 4° Glideslopes				
LHA Position	**Glideslope Angle (degree)**	**Offset Setting (arcmin)**	**Z (inches)**	**Z (mm)**
LHA-1	3	30	24.480	621.8
LHA-2	3	10	24.489	622.0
LHA-3	3	-10	24.496	622.2
LHA-4	3	-30	24.503	622.4
LHA-1	3.5	30	24.466	621.4
LHA-2	3.5	10	24.476	621.7
LHA-3	3.5	-10	24.485	621.9
LHA-4	3.5	-30	24.492	622.1
LHA-1	4	30	24.450	621.0
LHA-2	4	10	24.461	621.3
LHA-3	4	-10	24.471	621.6
LHA-4	4	-30	24.480	621.8

A side view of the flanges attached to the concrete pad is shown in the following images. Each hole in the three flanges is attached to the concrete pad with a ½ -13 UNC head screw and a ½ in. flat washer inserted into a concrete anchor insert. Note that the flanges have slots (dimensions also shown below) that permit slight adjustment for positioning of the legs. The rear flange includes slots aligned front-to-rear, and the front flanges contain slots aligned side-to-side.



Side View of Flanges Attached to Concrete Pad

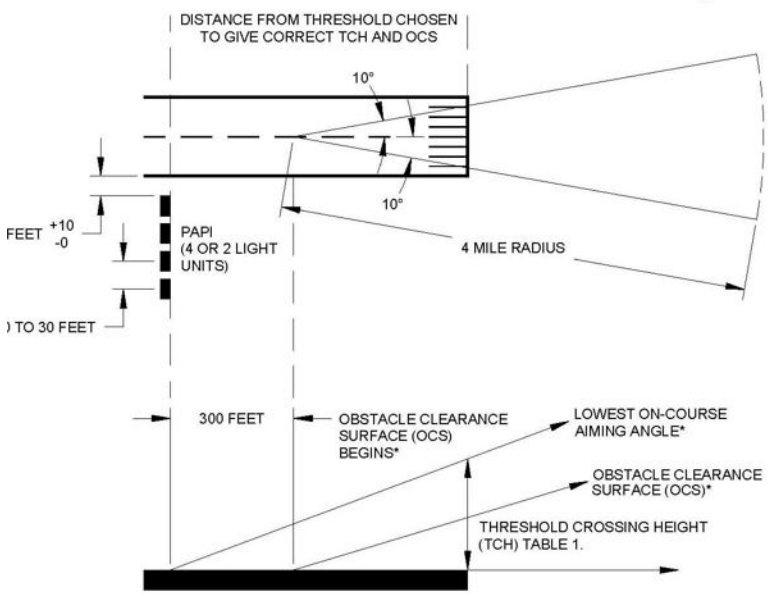


Plan View of Flanges. Dimensions Shown in Inches.

Position the AV- PAPI near the runway in accordance with specifications from either FAA or ICAO. Refer to *Section 14.2 Positioning the LHAs* for more information. An example of typical placement involves positioning the AV-PAPI to the left of the runway as seen by the approaching aircraft across from the touchdown zone. Location is determined based on:

- Aircraft type
- Runway grade
- Nominal glideslope angle
- LHA height above ground

Site requirements are more complex than shown in the following illustration. Aircraft type, grade of runway, and whether or not there is an Instrument Landing System (ILS) are just a few factors to consider. Additionally, there are different rules for general aviation runways used by non-jet aircraft.



The diagram above shows the Layout on the Runway for PAPI LHAs from FAA AC 150/5340-30d. This is an example only. **The installer is responsible for positioning the LHA in accordance with specifications from all appropriate regulatory agencies.**

Notes:

1. The visual glide path angle is the center of the on-course zone, and is a nominal 3 degrees when measured from the horizontal surface of the runway.

    A. For non-jet runways, the glide path may be raised to 4° maximum to provide obstacle clearance.

    B. If the PAPI glide path is changed to a higher angle from the nominal 3°, it must be communicated in a notice to airman (NOTAM) and published in the airport facility directory.

2. PAPI Obstacle Clearance Surface (OCS).

    A. The PAPI OCS provides the pilot with a minimum approach clearance.

    B. The PAPI must be positioned and aimed so no obstacles penetrate its surface.

        A. The OCS begins 300 ft. in front of the PAPI system.

        B. The OCS is projected into the approach zone one degree less than aiming angle of the third light unit from the runway for an L-800 system, or the outside light unit for an L-881 system.

14.2 Positioning the LHAs

Position the LHAs nearest the runway with the front facing toward the approach end of the runway (the approach end is the end from which the aircraft will be coming) and with the sides of the LHA parallel to the runway at a distance from the runway as specified by the appropriate regulatory agency. Ensure that the location of the first light housing assembly (LHA-1) and tolerances on the placement of LHA-1 comply with the appropriate regulatory agency. For example, the tolerance on azimuthal aiming in UFC 3-535-01 and AC 150/5340-30D is ±0.5 deg. Adjust the incline angle of LHA-1 with the procedure in *Section 14.4.1 Set the LHA Level and Tilt Angle*, except that for a standard FAA installation, the LHA nearest the runway is set at an incline that is 30 arcminutes (0.5°) above the glide path within ±3 arcmin (0.05 deg).

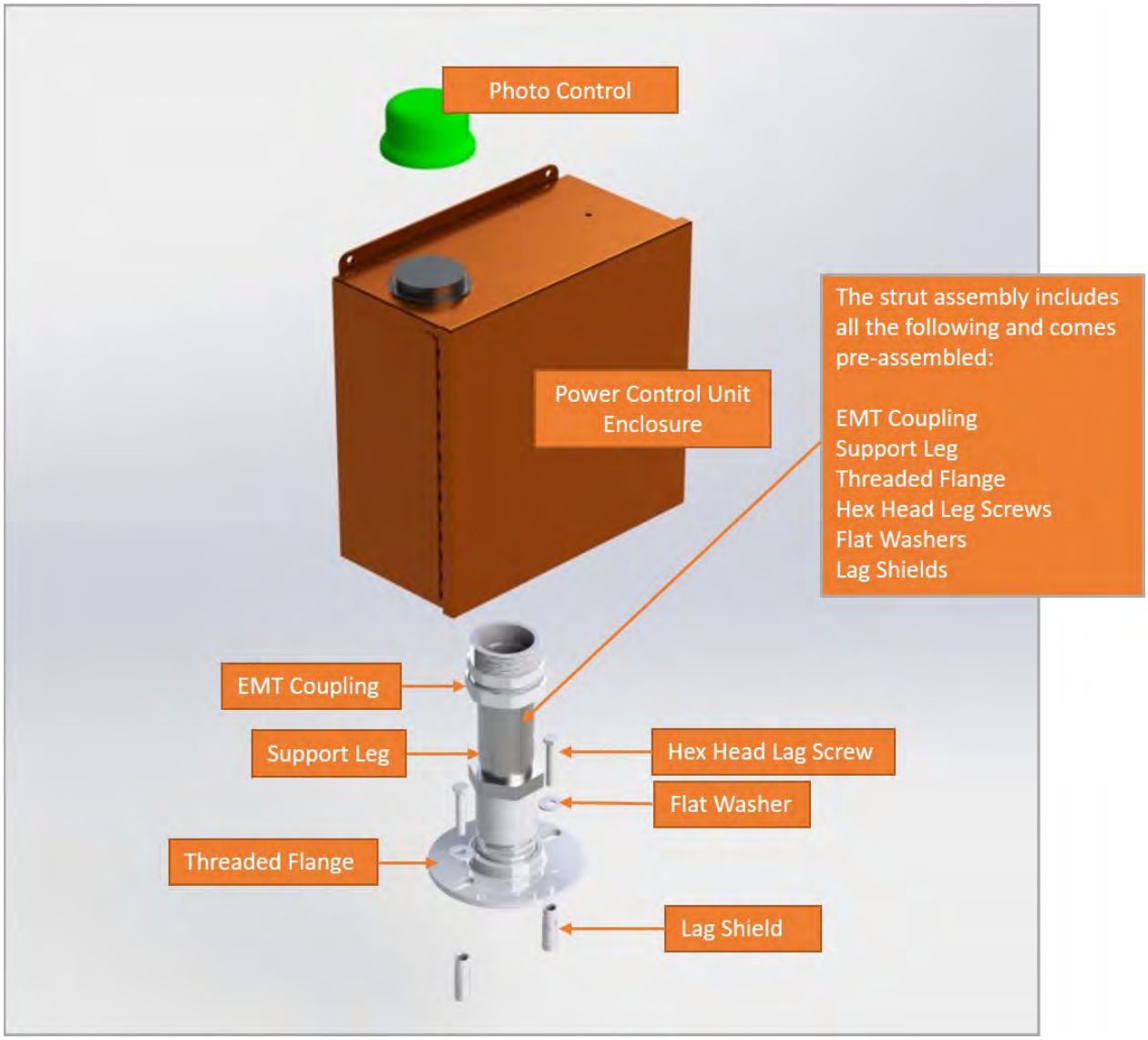
Place the second light housing assembly (LHA-2) further from the runway edge than the first LHA, with its front facing towards the approach end of the runway and with its sides

parallel to the runway at a distance from LHA-1 as specified by the appropriate regulatory agency. Ensure that the location and tolerances on the placement for LHA comply with appropriate regulatory agency regulations. For example, the tolerance on azimuthal aiming in UFC 3-535-01 and AC 150/5340-30D is ±0.5 deg and the beam centers for all of the LHA must be within ±1 inch of a horizontal plane. Adjust the incline angle of LHA-2 with the procedure in *Section 14.4.1 Set the LHA Level and Tilt Angle*, except that for a standard FAA installation, LHA-2 is set at an incline that is 10 arcminutes (0.17°) above the glide path within ±3 arcmin (0.05 deg).

Place the third and fourth light housing assemblies further from the runway adjacent to LHA-2 and spaced with the same distance as between LHA-1 and LHA-2. The locations for LHA-3 and LHA-4 and tolerances on their placement must comply with the appropriate regulatory agency regulations. For example, the tolerance on azimuthal aiming in UFC 3-535-01 and AC 150/5340-30D is ±0.5 deg and the beam centers of all of the LHA must be within ±1 inch of a horizontal plane. Adjust the incline angle of LHA-3 with the procedure in *Section 14.4.1 Set the LHA Level and Tilt Angle*, except that for a standard FAA installation, LHA-3 is set at an incline that is 10 arcminutes (0.17°) below the glide path within ±3 arcmin (0.05 deg). Adjust the incline angle of LHA-4 with the procedure in *Section 14.4.1 Set the LHA Level and Tilt Angle*, except that for a standard FAA installation, LHA-4 is set at an incline that is 30 arcminutes (0.5°) below the glide path within ±3 arcmin (0.05 deg).

There must not be any obstructions in front of (towards the approaching aircraft) the four LHA in order for the pilot to see both LHA on the approach to landing. Obstruction clearances must comply with the appropriate regulatory agency. The ICAO standards contain an obstacle protection surface 0.9° below the aim angle of the outer (lower) LHA.

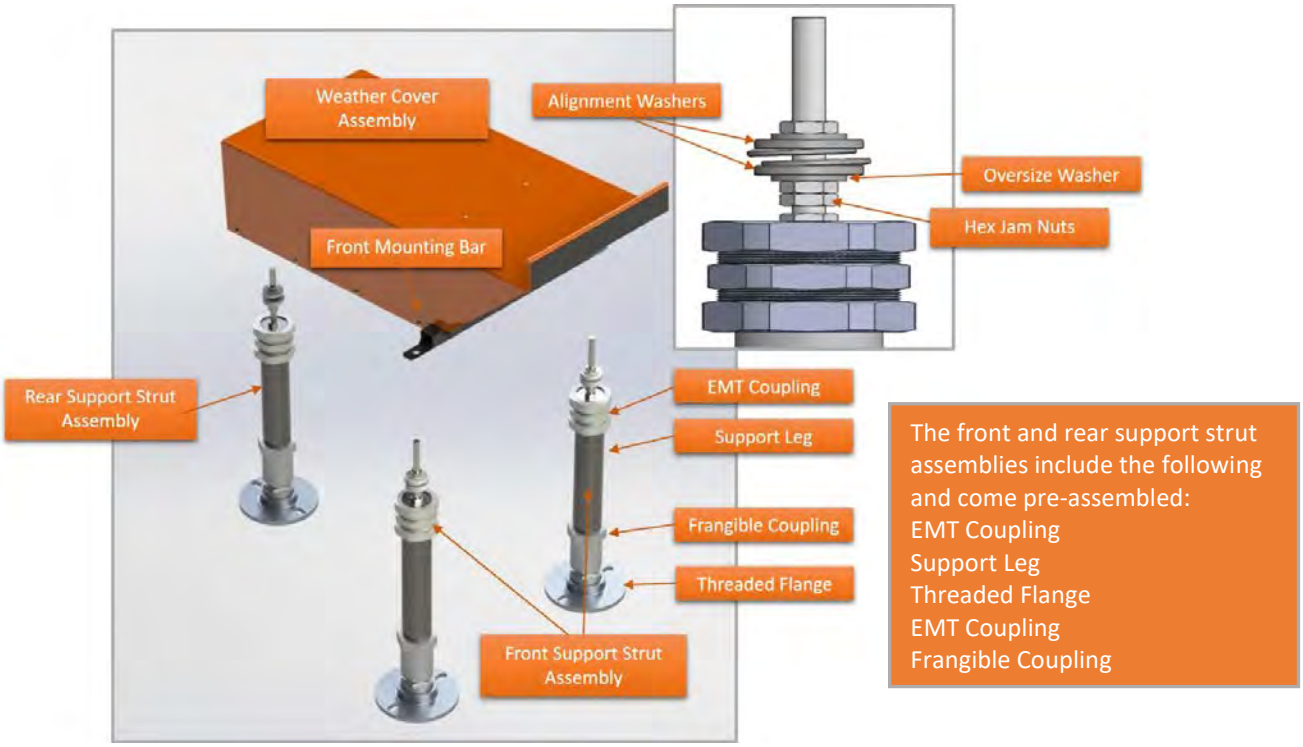
14.3 PCU Setup



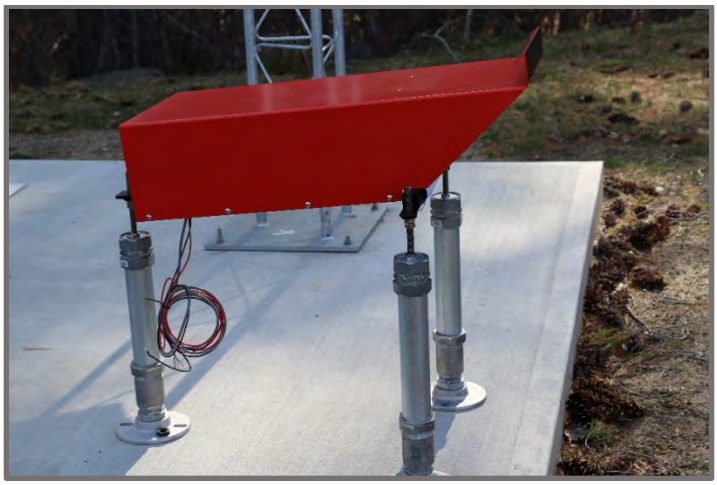
1. Thread the strut assembly onto the PCU.
2. Install the PCU on a cement pad in accordance with FAA and ICAO regulations.
3. Enclose the input (red and black cables) and output (red, black, and gray cables) cables in conduit.
4. Output from the PCU feeds to the junction box for the LHA positioned furthest from the runway. The wires from that LHA then feed to the next Junction box in the line.
5. Wire power and control in parallel.

14.4 Light Housing Assembly (LHA) Setup

For permanent installation, mount each of the three LHA legs on concrete pads using frangible couplings, tubing, and threaded rod. Position the shorter leg on the rear flange and the longer legs on the front flanges. Use the following diagram to assemble the LHAs.



1. Using a 3/4 in. wrench, remove the top hex jam nuts, oversize, and alignment washers on each of the legs.
2. Position the bottom hex jam nuts, oversize, and alignment washers on the threaded rod on all three legs of each LHA near the middle of their adjustment range.
3. Orient each LHA so that the front (the side with the glass lenses) faces the approach end of the runway.
4. Lower the LHA housing onto the three sets of bottom hex jam nuts, oversize, and alignment washers on the threaded rods of the legs.
5. Install three other sets of hex jam nuts, oversize, and alignment washers onto the threaded rods.



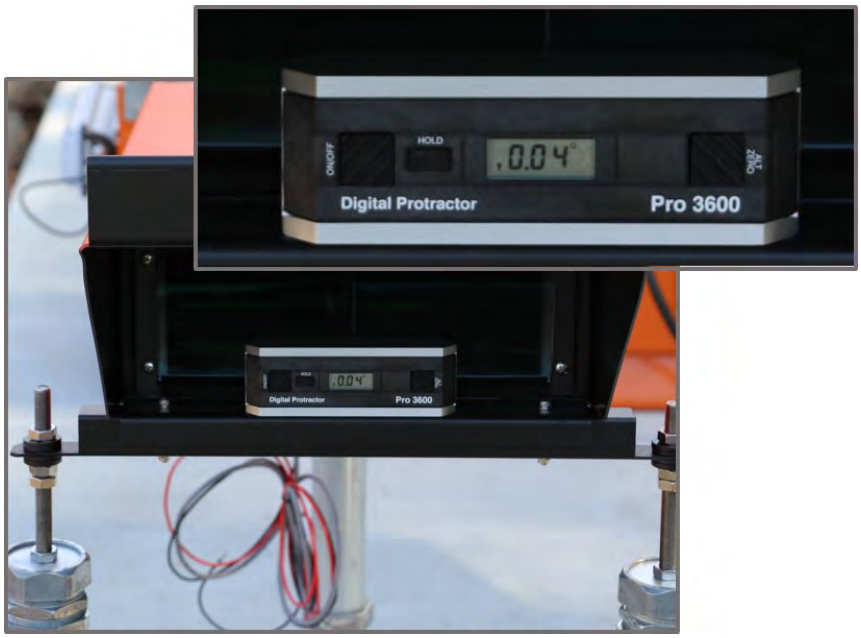
Above: Fully assembled LHA (photo for demonstration purposes only)

6. Position each LHA on a line perpendicular to the runway centerline within ±6 in.

14.4.1 Set the LHA Level and Tilt Angle

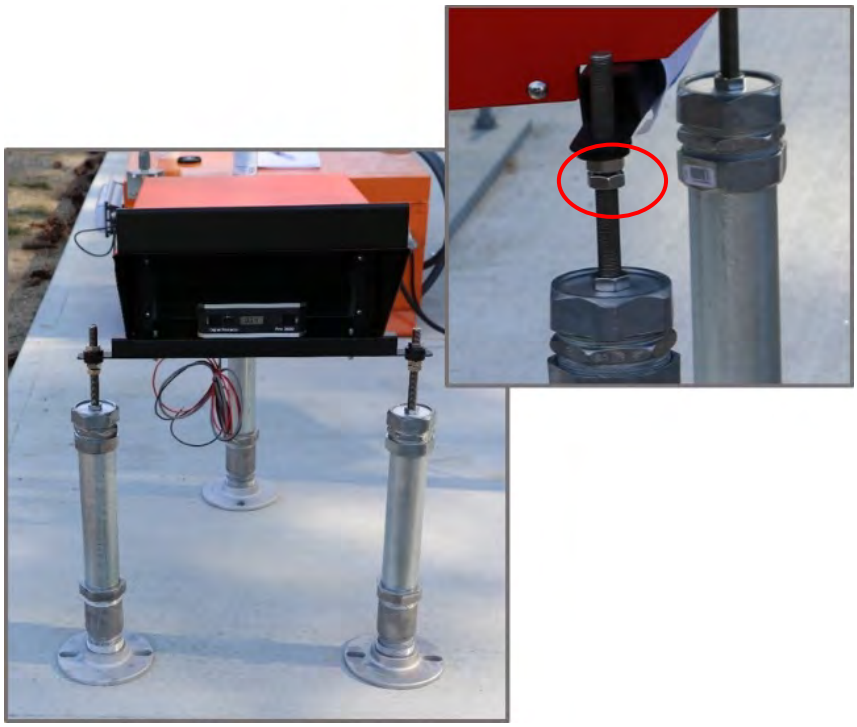
Follow these steps to set the LHA level side-to-side:

1. Center the inclinometer in the front of the base plate. If the optical head is dirty, clean the base plate in the spot where the inclinometer is placed.
2. Rotate the inclinometer so that it aligns with the front edge of the base plate, perpendicular to the runway direction.



Above: Inclinometer positioned in the middle of the front of the base plate

3. Adjust the incline angle by turning the lower jam nuts on the threaded rods of the legs.



4. Use a 3/4 in. wrench to adjust the position of the jam nuts. To do this:
    a. Loosen all of the upper jam nuts.
    b. Adjust the leg height by turning the lower jam nuts adjacent to the spherical washers.
    c. Use the upper jam nuts to lock the position after the adjustment is completed.
5. Adjust one front leg shorter, and the other front leg longer until the inclinometer indicates level within ± 0.05° (3 arcmin).
6. Clean the inclinometer bracket.
7. Place the inclinometer on the top of the inclinometer bracket and tighten the thumb screws.

Above: Inclinometer positioned on top of the inclinometer bracket.

8. Loosen the upper jam nut on the rear leg of the LHA.
9. Adjust the bottom jam nut on the rear leg of the LHA until the incline angle is proper according to the appropriate regulatory agency.
10. Set LHA -1 (nearest runway) to 3° 30 min.
11. Set LHA -2 (next adjacent) to 3° 10 min.
12. Set LHA -3 to 2° 50 min.
13. Set LHA -4 (outermost) to 2° 30 min.
14. Adjust until the inclinometer indicates the proper angle with ±0.05° (3 arcmin).

Table 8: Inclinometer Incline Angles and Tolerances

Position	Incline Angle	Tolerance
LHA-1	3° 30 min.	±0.05° (3 arcmin)
LHA-2	3° 10 min.	±0.05° (3 arcmin)
LHA-3	2° 50 min.	±0.05° (3 arcmin)
LHA-4	2° 30 min.	±0.05° (3 arcmin)

15. Move the inclinometer back to the position for measurement of the side-to-side level.
16. Repeat the level adjustment by moving one leg down and the other up an equal amount.
17. Move the inclinometer back to the inclinometer bracket.
18. If the incline angle has changed, repeat adjustment until it is properly set.
19. Continue adjustments until the incline angle and the side-to-side level are within tolerance.
20. Remove inclinometer from the optical head.

14.5 Connecting Power Cables

Each LHA includes a 6 ft. pigtail of wires located on the bottom rear of the LHA. Two of the wires are for prime power (24 VDC), and six provide intensity control. The wires are designed for connection to the output of the PCU, and should not be connected to other sources. A receptacle for the flexible conduit is installed on the bottom of the LHA. Conduit protects the wires from the environment and should terminate at the junction box. Mount junction boxes on rigid conduit (not included) that carry power and signal lines from the PCU to each LHA. The PCU also includes two sets of 6 ft. wire pigtails: one for power, and one for control. When viewing the PCU from the front, the input is on the left, and the output is on the right.

14.5.1 PCU Power Input

Follow these steps to connect cables from a power supply to the PCU:

1. Connect the positive 24 VDC prime power from a regulated 24 volt power source to the 10 gauge red wire at the PCU input.
2. Connect the negative of the 24 volt prime power source to the 10 gauge black wire of at the PCU input.

Note:
The power connections are distinguished by the larger diameter of the wire, and the fact that they are individual wires and not part of a cable bundle.

3. Connect the input remote signal to the signal input of the PCU. The signal input is a single cable with six (6) individual wires contained within it. These are all 22 gauge wires and they are color coded.

Table 9: Wiring Matrix

Function	Wire Color	Wire Gauge
Signal Ground	White	22
Level 1	Blue	22
Level 2	Orange	22
Level 3	Black	22
Level 4	Green	22
Level 5	Red	22

Table 10: Wiring Matrix IR Option

Function	Wire Color	Wire Gauge
Signal Ground	White	22
Level 1	Blue	22
Level 2	Orange	22
Level 3	Black	22
Level 4	Green	22
Level 5	Red	22
IR		

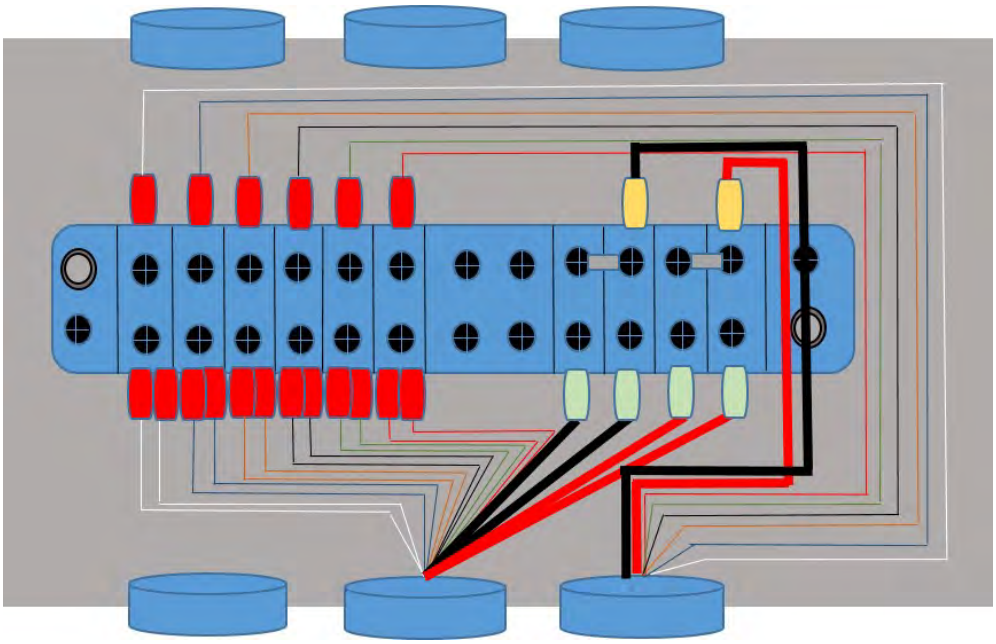
14.5.2 PCU Output to LHA

Follow these steps to connect cables from the PCU to the LHA:

1. Use exactly the same gauge and color coding for the output wires as the input wire bundle.
2. Use flexible conduit to enclose the output wire set and terminate it in the first junction box.

3. Mount the junction box on fixed conduit with the flex conduit terminated on one of the lower entrances to the junction box.

Note: Each junction box contains a terminal strip for connecting power and signal wires. Typically the signal wires are connected starting on the left side, and the power wires are connected starting on the right side. Refer to Table 8: Wiring Matrix for the color scheme.



Fully Wired Junction Box

4. Feed the 6 ft. pigtail through the flexible conduit and terminate it at the junction box.
5. For all but the last LHA in the train, double-tap the input power and signal to the junction box to provide signal and power to the next LHA. These terminate on the lower part of the terminal strip.
6. Terminate the wires from the LHA using the same color and gauge coding from below on the upper part of the strip.

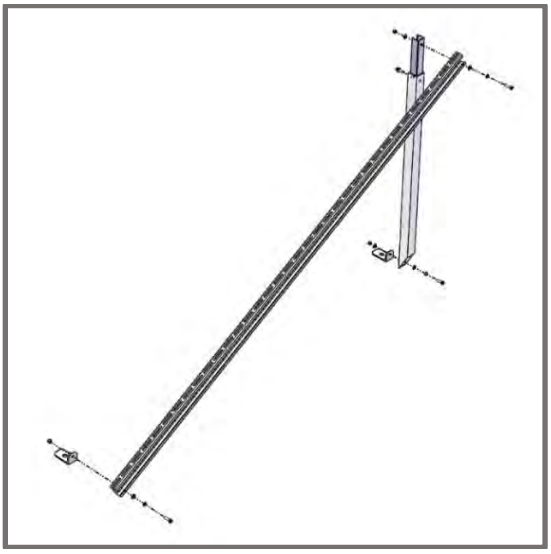
Example of an Installed LHA

14.6 Connecting to Solar Power

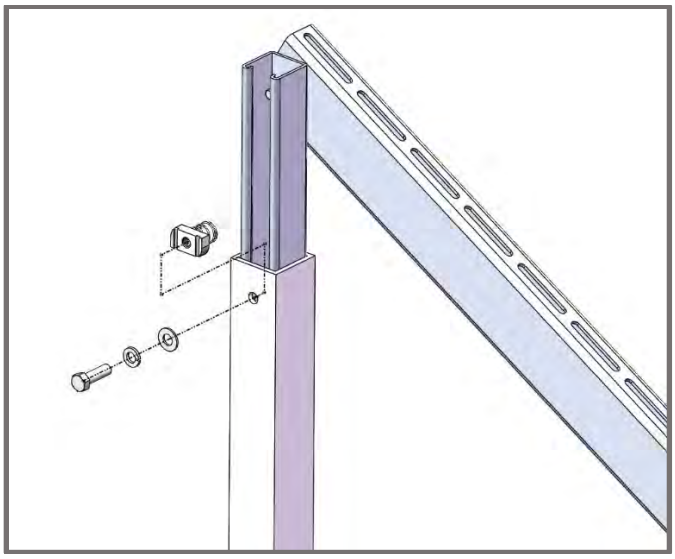
Orient the solar panels facing toward the equator.

Table 11: Inclination	
Site Latitude	**Near Optimum Solar Module Inclination Angle**
0-9°	15°
10-20°	Latitude + 5°
21-45°	Latitude + 10 °
45-55°	Latitude +15°

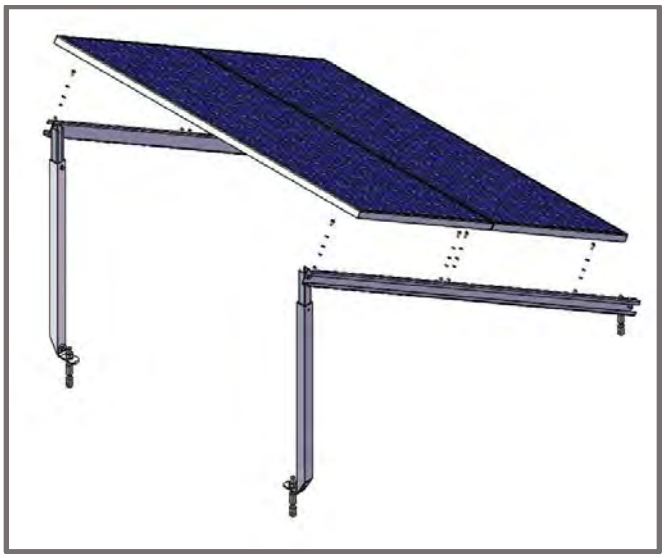
14.6.1 Assembling the Solar Panels



1. Assemble solar panel brackets according to the photo above, using a 1/2 in. and 9/16 in. combination wrench and sockets.

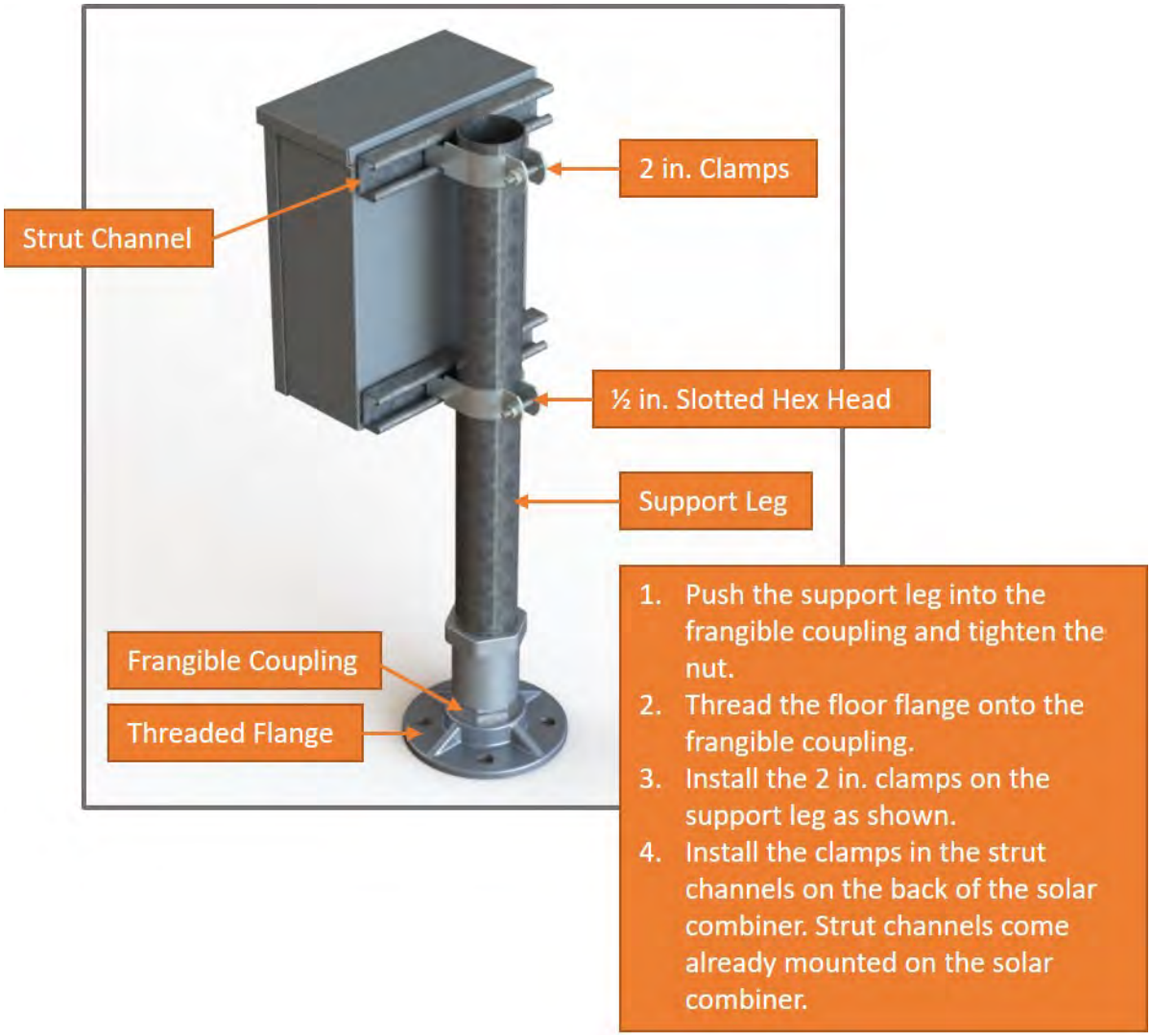


2. Insert the spring nut into the channel and rotate to lock in place.
3. Install fastener into spring nut.

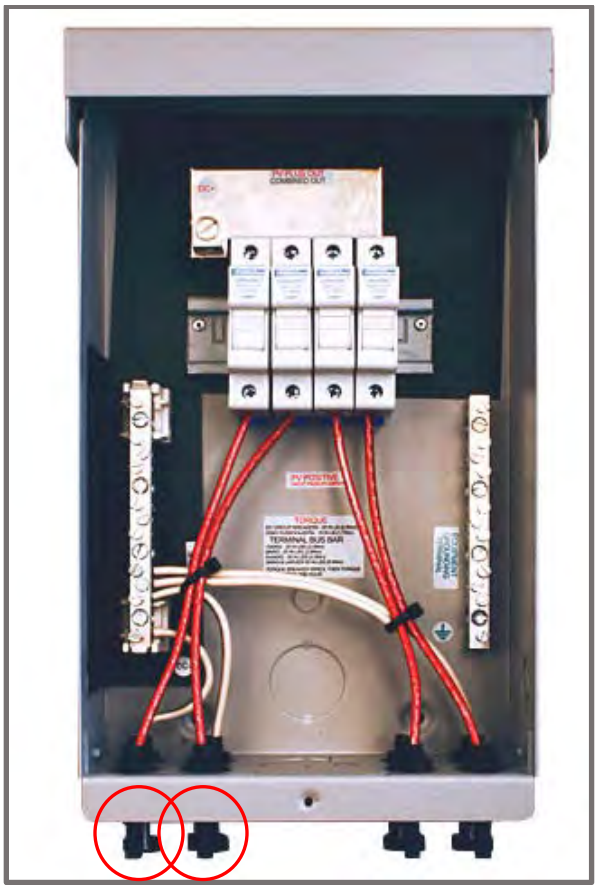


4. Mount solar panels on brackets.
5. Secure the solar panels to the concrete pad using supplied frangible bolts.

14.6.2 Assembling the Solar Combiner



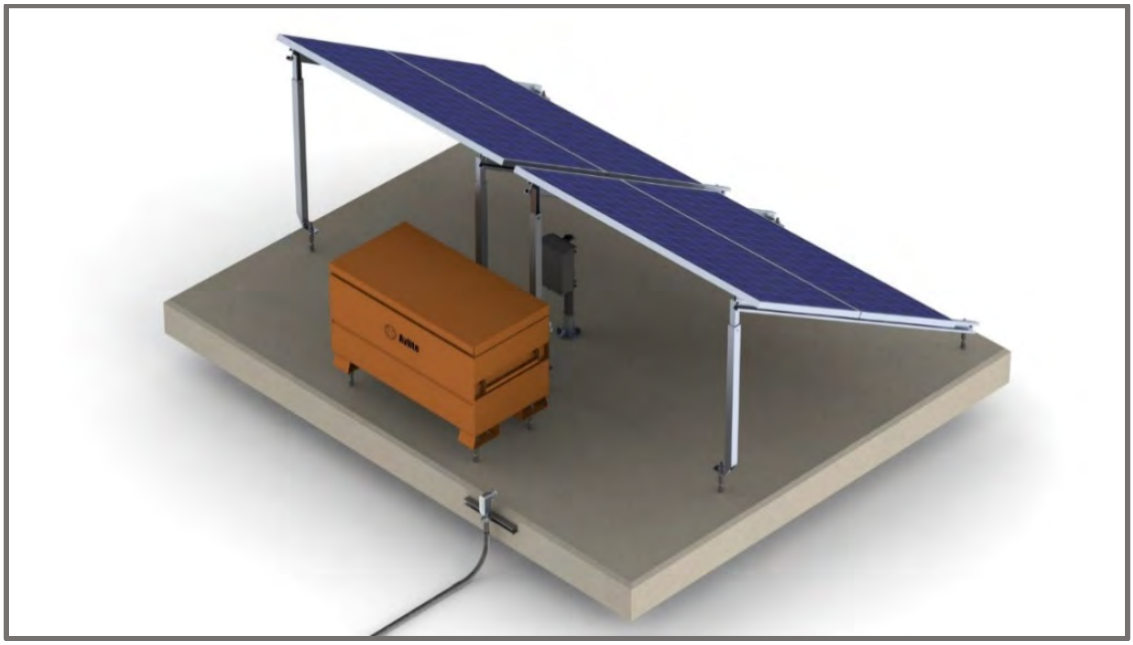
1. Assemble solar combiner according to the photo above using a large flat-bladed screw driver or a 1/2 in. wrench. The solar combiner comes pre-wired.
2. Use masonry screws to anchor the solar combiner to the cement pad.



3. Connect the MC 4 cables located on the back of the solar panels to the bottom of the solar combiner. The connectors are polarity protected i.e., negative will only connect to negative.
4. Feed the pigtail of wires hanging from the solar battery box into a piece of flexible conduit and connect it to the bottom of the solar combiner.
5. Feed the wiring from the last junction box into flexible conduit and connect it to the back of the solar battery box.
6. Flip the two battery breakers located in the right group first.

Above: PAPI Solar Battery Supply Comes Pre-wired with 6 ft. Pigtail.

7. Flip the other four breakers (three to the left, and the remaining one to the right).



Above: Completed solar power installation for 2 or 4 LHAs.

15 Operation

15.1 PCU Switches

The PCU control panel includes ten toggle switches. The three switches on the top left are for control. The next five toggle switches are used to select the intensity step. The toggle switch on the left side below the top row enables or disables autonomous photocell operation. The toggle switch on the bottom enables/disables the tilt switch. If an optional feature is not installed (e.g., IR or tilt switch) that opening in the control panel is plugged or does not appear.

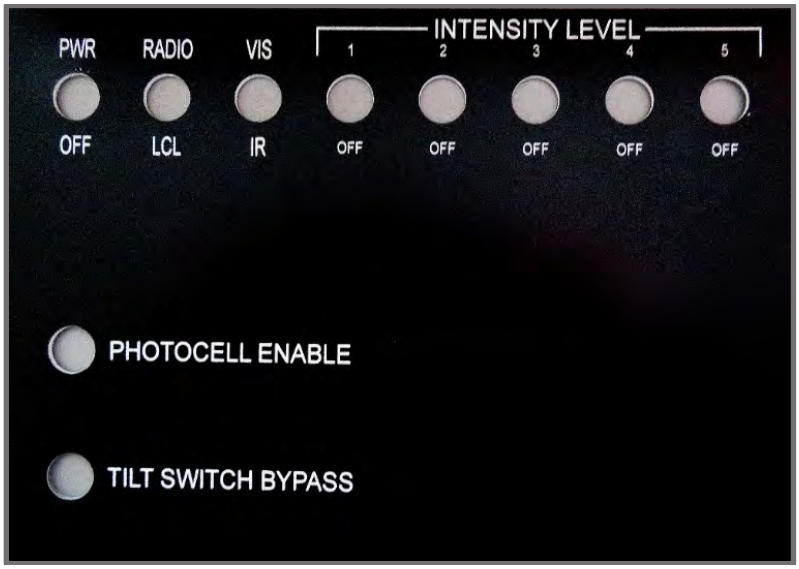


Table 12: Toggle Switches	
Name	**Description**
Power / Off	Turns the system On/Off. When toggled **off**, no power is supplied to the LHAs, and the PCU does not receive radio remote control signals.
Radio/Local	If toggled to the **Radio** position, the PCU is operated using the radio remote controller. If toggled to the **Local** position, the PCU is operated using the remaining switches on the control panel.
Visible/Infrared	If toggled to the **Infrared** position, the LHA is projecting infrared light and no visible light signals are projected.
Intensity 5	If the Radio/Local switch is toggled to **Local**, the Intensity 5 switch sets the LHA to High, 100% intensity.
Intensity 4	The Intensity 4 switch sets the LHA to 20% intensity in Local mode.
Intensity 3	The Intensity 3 switch sets the LHA to 4% intensity in Local mode.
Intensity 2	The Intensity 2 switch sets the LHA to 0.8% intensity in Local mode.

Intensity 1	The Intensity 1 switch sets the LHA to the lowest setting, or 0.16% in Local mode.
Photocell Enable	If the Photocell Enable switch is toggled **down**, the LHA intensity is set by the ambient light. 100% intensity level for day and 20% intensity level for night. When the photocell switch in the PCU is toggled **on**, the mode switches in the PCU are ignored.
Tilt Bypass Switch	When the Tilt switch Bypass is toggled **down**, the tilt switch is enabled. When the tilt switch is enabled, the PCU will turn **off** all power to both LHA if any LHA becomes misaligned at an incline angle greater than 0.5°.
Heated Lens	When the Heated Lens switch is toggled **down,** the heated lens is enabled, and is controlled by a thermostat located in each LHA. **Heated Lens option not shown.**

15.2 PCU Manual Operation

Toggle the Radio/Local switch to the **Local** position to manually operate the PCU.

Note:
If all of the intensity level switches are toggled to the **off** position, then no signal emanates from the LHA. If the Radio/Local switch toggled to the Radio position, the operating mode is selected from the optional radio remote control transmitter.

15.2.1 Operating the PCU

1. Before operating the PCU, verify that the power switch is toggled to the **off** position.
2. Toggle the Local/Radio switch to the Local position.
3. Toggle all of the intensity step switches to the **off** position.
4. Toggle the Power toggle switch to the **Power** position.
5. Toggle one of the intensity switches to the **up** position. If more than one of the intensity step toggle switches is in the **on** position, then the LHA will operate at the highest step that is switched to the **on** position.

15.3 Radio Operations

Toggle the Radio/Local switch into the **Radio** position. The PCU is controlled by the commands from the radio source.

15.4 Radio Remote Control

Refer to the AV-426-RF Radio-Controlled Solar Aviation Light Installation and Service manual to read about operating the radio controller used for the AV-PAPI system. Please note that the Avlite RF Radio Control Group Number must be specified when ordering the AV-PAPI. If using a hard wired control system configuration, instructions for operation will depend on the existing control system.

16 Functional System Tests

Follow these steps to perform a full functional system test on one LHA:

16.1 Prior to Installation

Follow these steps to verify that the system powers on as expected:

1. Move the LHA to a work area. If the LHAs are dirty, rinse them by spraying clean water and wiping off any debris with a cloth.
2. Set up the LHA and the PCU as explained in Section 14.4.1 *Set the LHA Level and Tilt Angle*.
3. Connect the PCU to power and verify the system powers on.

16.2 Manual Operation

Follow these steps to perform a functional system test:

1. On the PCU, toggle the Radio/Local switch to the **Local** position.
2. Toggle the Tilt Bypass Switch to the **up** position.
3. Toggle Intensity Level switch 5 to the **up** position to operate the system in full intensity mode.
4. Stand in front of an LHA and place a diffuse reflective surface in front of the weather cover to see the reflection of the beams. The surface can be a piece of paper, cardboard or clothing. Verify that white light is emitted from the top row and red light is emitted from the bottom row.
5. Observe the intensity of the light on the reflective surface. Toggle the Intensity Level switch 5 to the OFF position and the Intensity Level switch 4 to the **up** position. The intensity of the white and red beams should be at 20%.
6. Repeat these steps for each intensity level, confirming the remaining 4%, 0.8%, and 0.16% levels.
7. Repeat these steps to check the operation of each LHA in the same manner.

17 Maintenance

Clean the outer surfaces of the lenses and solar panels quarterly, or as necessary.

17.1.1 Cleaning LHA Lenses

- Access LHA lenses through the front, under the weather cover.
- Use a clean, soft lint-free cloth or lens tissue to clean the outer surfaces of the lenses. Reach in to clean the lenses.
- Wipe using a downward motion, lifting the cloth from the lens surface before repeating the wiping motion. This accumulates the dirt and debris at the bottom of the lens where it cannot effect the beam.
- Apply only **light** pressure when cleaning. Often grit on the lens is hard and sharp and will scratch lens surfaces.
- You can also spray clean water on the outer surfaces of the lenses. Use a clean, soft, lint-free cloth or lens tissue to clean the outer surfaces of the lenses and wipe the residual water off of the lenses.
- If the front surfaces of the lenses are very dirty, you can use lens cleaner fluid. Spray or pour a small amount of lens cleaning fluid on some clean lens tissue o or

piece or soft cloth, then wipe the lenses in a downward motion, as previously explained.

- Take another piece of clean, dry lens tissue or soft cloth and wipe the residual lens cleaner fluid off of the lenses with the same downward motion as previously discussed.

Note:
It is important not to scratch the outer surface of the lenses or leave residue that attracts dust or dirt.

18 Troubleshooting

Table 13: Troubleshooting

Problem	Possible Causes	Solutions
No light emitted from LHA	Local/Radio switch toggled to Radio position.	Verify that the Local/Radio switch is toggled to the Local position.
	Infrared/Visible switch toggled to Infrared position.	Verify that the Infrared/Visible switch is toggled to the Visible position.
	Intensity switches toggled off when the Local/Radio switch is in the Local position.	Verify that at least one intensity switch is toggled to the up position.
	Break in cabling between the PCU and the LHA.	Check cables using a multi-meter to verify 24 VDC at the input to the PCU.
	Break in cabling between the LHA and the junction box.	Check cables using a multi-meter to verify 24 VDC at each junction box.
		If there is still no light emitting from the LHAs, contact Sealite to speak to a Service technician.
No light emitted using solar power option	Batteries not charged.	1. Determine if the battery bank is charged by connecting the charging cord to the battery box and a known working source of AC power. 2. If the PAPI operates then the batteries were discharged. 3. Allow sufficient time for batteries to charge.
	No voltage	1. Disconnect the cable connecting the battery box to the PCU and use a multi-meter to check the voltage at the output connector for each battery box. It should be a nominal 24 VDC, which can be between 22 AND 28.8 VDC depending on the state of the charge.

		2. If the voltage is zero, open the top of the battery box and check the circuit breaker. 3. Reset the circuit breaker and verify that the switch is toggled **on**.
		1. Disconnect the battery box to PCU cable at the PCU and check the voltage at the end of each cable. The voltage should be nominal 25 VDC. 2. If there is voltage at the BBA and not at the end of the cable, the wrong cable end was connected to the battery box, the connector was not fastened properly, or the cable is defective and must be replaced.
		1. If cables work as expected, re-connect the battery box to PCU cable. 2. Operate the PCU in manual mode. Verify that the Radio/Local switch in the control panel is toggled to the Local position. 3. If none of the LHAs are functioning in any mode, disconnect the cable connecting the PCU to the LHA and check the voltage across pins A and B of the connector. 4. The voltage should be nominal 24 VDC. If there is no voltage from the PCU, verify that the cables are properly connected.
	Break in cabling between PCU and LHA.	1. Disconnect the PCU to LHA cables at the LHA. 2. Check the voltage across pins A and B. The voltage should be a nominal 24 VDC. If there is voltage at the PCU and not at the end of the cable, the wrong cable end was connected to the PCU or the cable is defective and must be replaced. 3. Reconnect the PCU to LHA cables.
One LHA Does not Emit Light	Bad cables	1. Toggle the Power switch on the control panel to the **off** position. 2. Disconnect the LHA cable at the PCU. 3. Remove the weather cover. Refer to Section 19.1 for instructions.

		4. Check all of the connections to the receptacles on the PCB enclosure and verify that they are not loose and that all of the screws are tight. 5. Remove the 8 SHCS and flat washers from the top of the aluminum enclosure that is mounted in the rear of the LHA base plate. 6. Remove the top cover of the box. 7. Store the screws, washers, and cover in a clean, dry place. 8. Use a multi-meter to check all of the connections to the LHA power control board. 9. Replace any defective cables.
	Bad connectors	If all of the connections are good, use the multi-meter to check the cable continuity.
	Bad LHA power control board	If the cable continuity is good, the most likely cause is LHA PCB failure. Replace the PCB in the non-functioning LHA.
Non-functioning LHA Does Not Emit White Light	Connector	1. Remove the weather cover. 2. Verify that the connector to the non-functioning white LED Array is properly connected.
	White LED Array PCB	If the connector is properly connected, and the issue still persists, replace the White LED Array PCB.
	LHA PCB	If the LHA still does not emit white light, replace any the LHA PCB.
White LED Array (One Side)	Connector	Check the connector to the non-functioning side and verify that it is properly connected.
	White LED Array PCB	If the cable is properly connected and the problem still persists, replace the White LED Array PCB.
	LHA PCB	If the issue still persists after replacing the White LED Array PCB, replace the LHA PCB.
White LED Modules do not Change Brightness when Switching Between the Intensity		Return PCU to Avlite for repair.

Levels, but Still Emit White Light		
Red LED Array	Connector	1. Remove the weather cover. 2. Verify that the connector to the non-functioning Red LED Array is properly connected.
	Red LED Array PCB	If the connector is properly connected, and the issue still persists, replace the Red LED Array PCB.
	LHA PCB	If the issue still persists after replacing the Red LED Array PCB, replace the LHA PCB.
Red LED Array (One Side)	Connector	Check the connector to the non-functioning side and verify that it is properly connected.
	Red LED Array PCB	If the cable is properly connected and the problem still persists, replace the Red LED Array PCB.
	LHA PCB	If the Red LED Array PCB has been replaced and the issue still persists, replace the LHA PCB.
Red LED Modules do not Change Brightness when Switching Between the Intensity Levels, but Still Emit Red Light		Return PCU to Avlite for repair.

19 Replacement Parts

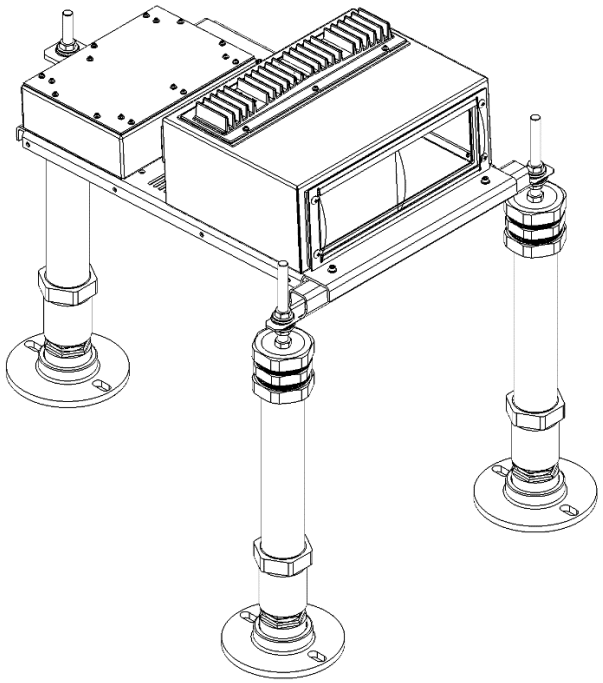
If replacement parts are required please call a local Avlite distributor. Perform parts replacement in a clean, dry environment whenever possible. However, if necessary part replacement can be performed while the PAPI-266F is deployed.

For greatest safety, it is recommended that all power to the PCU be disconnected along with the LHA cable. However, parts in an LHA can be replaced when the Power switch on the PCU control panel is toggled to the **off** position.

19.1 Removing the LHA Weather Cover

Follow these steps to remove the LHA weather cover:

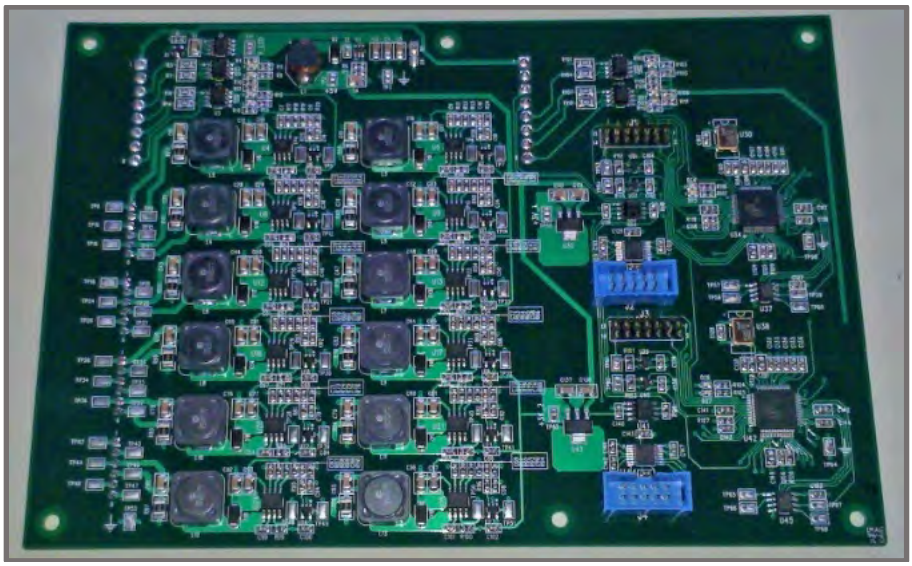
1. Use a #2 Phillips screwdriver to remove the four truss head machine screws along the bottom rear panel of the LHA weather cover.
2. Remove four truss head machine screws along the bottom of each side of the weather cover. Save these twelve screws in a clean, safe place.
3. Slide the weather cover back slightly, then lift the weather cover straight up until it clears the optical assembly. Set the weather cover away from the remainder of the LHA.



The illustration above shows the isometric wireframe drawing of the PAPI LHA with the weather cover removed. The front of the PAPI is on the right. The optical enclosure is towards the front. The power circuit board is located in the enclosure at the rear of the LHA.

19.2 Replacing the LHA Power Circuit Board

1. Toggle the Power switch on the PCU control panel to the **off** position.
2. Disconnect the LHA cable at the PCU.
3. Remove the LHA weather cover.
4. Remove the 8 SHCS and flat washers from the perimeter of the top of the aluminum enclosure that is mounted in the rear left side of the LHA base plate. Remove the top cover of the box. Store these eight socket head cap screws, eight flat washers, and the cover in a clean, dry place.
5. With a ¼-inch wrench, remove the 6 nylon insert locknuts that hold the PCB to the stand-offs.
6. Store the 6 locknuts in a clean, dry place.
7. Mark the Molex connectors to indicate the location and orientation relative to the PCB.
8. Carefully lift the circuit board and remove the Molex connectors from the PCB.
9. Obtain a replacement LHA power control board from Avlite.

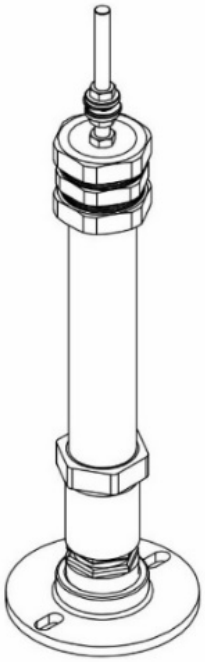


LHA PCB

10. Insert the Molex connectors in the same location and orientation on the PCB.
11. Verify that the Molex connectors are fully engaged to the PCB.
12. Carefully install the PCB onto the stand-offs and secure the PCB to the standoffs with the 6 nylon insert locknuts.
13. Install the cover of the box and secure with its SHCS and flat washers.
14. Re-install the weather cover.

19.3 Replacing Support Strut Assembly

1. Toggle the Power switch on the PCU control panel to the **off** position.
2. Disconnect the LHA cable at the PCU.
3. Loosen and remove the upper jam nuts and spherical washers on each of the 3 legs.
4. Place the jam nuts and spherical washers in a clean, dry location.
5. Remove the LHA from the legs by lifting upwards.
6. Observe the distance from the bottom of the lower jam nut to the top of the support column adapter.
7. Remove the damaged leg assembly by rotating the frangible coupling counterclockwise out of the flange using an adjustable wrench on the flats of the frangible coupling near the bottom of the assembly.
8. Replace the damaged leg with a new Support Strut Assembly by screwing the Support Strut Assembly into the flange using the adjustable wrench on the flats of the frangible coupling.



Above: Front Support Strut Assembly

9. Remove the upper jam nut and spherical washer from the new leg.
10. Set the bottom of the lower jam nut at the same distance from the top of the support column adapter as was measured before removing the damaged leg.
11. Install the LHA on the three legs.
12. Install the upper spherical washers and upper jam nuts on each of the legs.
13. Set the alignment of the LHA.

20 Warranty

20.1 Activating the Warranty

This product is covered under the below set of warranty terms and conditions from the date of shipment. Please contact a local Sealite representative with purchase details and serial numbers.

Avlite Systems will repair or replace your lantern in the event of electronic failure for a period of up to three years from the date of purchase. Avlite Systems will repair or replace any ancillary or accessory products in the event of failure for a period of up to one year from the date of purchase, as per the Terms and Conditions below. The unit must be returned to Avlite freight prepaid.

20.2 Terms and Conditions

20.2.1 Warranty Terms

1. Avlite Systems warrants that any Avlite aviation products fitted with telemetry equipment including but not limited to AIS, GSM, GPS, or RF ("Telemetry Products") will be free from defective materials and workmanship under normal and intended use, subject to the conditions hereinafter set forth, for a period of twelve (12) months from the date of purchase by the original purchaser.
2. Avlite Systems warrants that any rotationally-moulded products (Roto-Moulded Products) and accessory products (Accessory Products) will be free from defective materials and workmanship under normal and intended use, subject to the conditions hereinafter set forth, for a period of twelve (12) months from the date of purchase by the original purchaser.
3. Avlite Systems warrants that any Avlite aviation products other than the Telemetry Products, Roto-Moulded Products and Accessory Products (Avlite Products) will be free from defective materials and workmanship under normal and intended use, subject to the conditions hereinafter set forth, for a period of three (3) years from the date of purchase by the original purchaser.
4. Avlite Systems warrants that any Avlite obstruction products other than the Telemetry Products, Roto-Moulded Products and Accessory Products (Avlite Products) will be free from defective materials and workmanship under normal and intended use, subject to the conditions hereinafter set forth, for a period of five (5) years from the date of purchase by the original purchaser.
5. Avlite Systems will repair or replace, at Avlite's sole discretion, any Telemetry Products, Roto-Moulded Products, Accessory Products or Avlite Products found to be defective in material and workmanship in the relevant warranty period so long as the Warranty Conditions (set out below) are satisfied.
6. If any Telemetry Products or Avlite Products are fitted with a rechargeable battery, Avlite Systems warrants the battery will be free from defect for a period of one (1) year when used within original manufacturer's specifications and instructions.

20.2.2 Warranty Conditions

This Warranty is subject to the following conditions and limitations:

1. The warranty is applicable to lanterns manufactured from 1/1/2009.
2. The warranty is void and inapplicable if:
    a. the product has been used or handled other than in accordance with the instructions in the owner's manual and any other information or instructions provided to the customer by Avlite;
    b. the product has been deliberately abused, or misused, damaged by accident or neglect, or in being transported; or
    c. The defect is due to the product being repaired or tampered with by anyone other than Avlite or authorized Avlite repair personnel.
3. The customer must give Avlite Systems notice of any defect with the product within 30 days of the customer becoming aware of the defect.
4. Rechargeable batteries have a limited number of charge cycles and may eventually need to be replaced. Typical battery replacement period is 3-4 years. Long term exposure to high temperatures will shorten the battery life. Batteries used or stored in a manner inconsistent with the manufacturer's specifications and instructions shall not be covered by this warranty.
5. No modifications to the original specifications determined by Avlite shall be made without written approval of Avlite Systems.
6. Avlite lights can be fitted with 3rd party power supplies and accessories but are covered by the 3rd party warranty terms and conditions.
7. The product must be packed and returned to Avlite Systems by the customer at his or her sole expense. Avlite Systems will pay return freight of its choice. A returned product must be accompanied by a written description of the defect and a photocopy of the original purchase receipt. This receipt must clearly list model and serial number, the date of purchase, the name and address of the purchaser and authorized dealer and the price paid by the purchaser. On receipt of the product, Avlite Systems will assess the product and advise the customer as to whether the claimed defect is covered by this warranty.
8. Avlite Systems reserves the right to modify the design of any product without obligation to purchasers of previously manufactured products and to change the prices or specifications of any product without notice or obligation to any person.
9. Input voltage shall not exceed those recommended for the product.
10. Warranty does not cover damage caused by incorrect replacement of battery in solar lantern models.
11. This warranty does not cover any damage or defect caused to any product as a result of water flooding or any other acts of nature.
12. There are no representations or warranties of any kind by Avlite or any other person who is an agent, employee, or other representative or affiliate of Avlite, express or implied, with respect to condition of performance of any product, their merchantability, or fitness for a particular purpose, or with respect to any other matter relating to any products.

20.3 Limitation of Liability

To the extent permitted by acts and regulations applicable in the country of manufacture, the liability of Avlite Systems under this Warranty will be, at the option of Avlite Systems, limited to either the replacement or repair of any defective product covered by this Warranty. Avlite Systems will not be liable to Buyer for consequential damages resulting from any defect or deficiencies in accepted items.

20.4 Limited to Original Purchaser

This Warranty is for the sole benefit of the original purchaser of the covered product and shall not extend to any subsequent purchaser of the product.

20.5 Miscellaneous

Apart from the specific warranties provided under this warranty, all other express or implied warranties relating to the above product are hereby excluded to the fullest extent allowable under law. The warranty does not extend to any lost profits, loss of good will or any indirect, incidental or consequential costs or damages or losses incurred by the purchaser as a result of any defect with the covered product.

Warrantor

Avlite Systems has authorized distribution in many countries of the world. In each country, the authorized importing distributor has accepted the responsibility for warranty of products sold by distributor. Warranty service should normally be obtained from the importing distributor from whom you purchased your product. In the event of service required beyond the capability of the importer, Avlite Systems will fulfil the conditions of the warranty. Such product must be returned at the owner's expense to the Avlite Systems factory, together with a photocopy of the bill of sale for that product, a detailed description of the problem, and any information necessary for return shipment.

21 Customer Feedback

Thank you for your purchase.
We welcome your feedback and recommendations.
Please send your comments to:
Sealite USA t/a Avlite Systems
61 Business Park Drive
Tilton, New Hampshire 03276
USA
Email: usa@avlite.com
Telephone: 603-737-1311

22 Revision History

Revision	Author	Date	Description of Change