

Helicopter Approach Path Indicator (HAPI)

Quick-Start Guide

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Safety & Usage

The following symbols indicate important safety warnings and precautions throughout this manual:



WARNING indicates that serious bodily harm or death may result from failure to adhere to the precautions.



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



NOTE suggests optimal conditions and provides additional information.

1.1 Viewing Precautions



Do not view an actively emitting infrared or visible light from the side or top of the light (close to or on beam) from a range of less than 4 ft. (1.2 m). For infrared equipped products, the HAPI emits visible and infrared light energy that is harmful to the eye if viewed directly.

1.2 Wireless Precautions



If the HAPI is equipped for wireless control, keep the Handheld Controller at a distance of at least 3 ft. (1 m) from the antenna for the HAPI, other Carmanah wireless products, and other handheld controllers. It transmits a powerful radio signal that could damage sensitive receiver circuitry if operated at close range.

1.3 Warranty Disclaimer



This quick-start guide will familiarize you with the features and operating standards of the product. Failure to comply with the use, storage, maintenance, or installation instructions detailed in this guide could void the user warranty.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. Installation work must be done by a qualified person(s) in accordance with all applicable local codes and standards.

1.4 Recycling

This product may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. To avoid release of such substances into the environment, we encourage you to recycle the product in an appropriate way that will ensure most of the materials are reused or recycled. Check your local municipality for electronics recyclers.

1.5 Abbreviations

The following is a list of abbreviations used in the description of Airfield Lighting Systems. Some terms listed below may not be used in this document.

A	Ampere
AC	Alternating current
AGM	Absorbed glass mat
AH	Ampere-hour
APAPI	Abbreviated precision approach path indicator
BBA	Battery box assembly
cm	Centimeter
DC	Direct current
FAA	United States Federal Aviation Administration
ft.	Foot
Hz	Hertz
ICAO	International Civil Aviation Organization
ILS	Instrument landing system
in	Inch
IR	Infrared
kg	Kilogram
lb.	Pound (US)
LED	Light emitting diode
LHA	Light housing assembly
m	Meter
mm	Millimeter
MTBF	Mean time between failure
NATO	North Atlantic Treaty Organization
NSN	National stock number
NVE	Night vision equipment
NVG	Night vision goggle
PAPI	Precision approach path indicator
PCB	Printed circuit board
PCL	Pilot controlled lighting
PCU	Power control unit
RCT	Remote control transmitter
s	Second
SE	Solar engine
STANAG	(NATO) Standardization Agreement
TDZ	Touchdown zone
UFC	Unified facilities criteria
V	Volt
VAC	Volts, alternating current
VDC	Volts, direct current

1.6 Scope

The purpose of this document is to provide basic installation, setup, operation, and maintenance guidelines for the Carmanah Helicopter Approach Path Indicator (HAPI) system.

Limitations:

This quick-start guide is for general installation and operation of Carmanah HAPI systems and is not a replacement for local or national regulatory standards for installation and operation of aircraft navigational aids. Always consult the relevant authorities in all cases.

This quick-start guide pertains to equipment as provided, and does not cover civil, electrical, or mechanical design aspects not specifically related to the installation and operation of the HAPI system. This includes AC-power line service and equipment on the input side of the HAPI system (for AC-powered systems).

Please review the general warnings below.

1.7 WARNING SUMMARY

AIMING AND OPERATION



Efficacy of HAPI and other visual guidance systems and the subsequent safety of aircraft and personnel is contingent on the correct alignment of light-emitting fixtures and maintenance of the overall system.
Installation, setup, and maintenance of HAPI systems should only be performed by qualified personnel!

POWER SOURCES



AC-powered systems operate at high voltages: when performing installation or repair procedures, disconnect high-voltage at source and lock out access!



If using DC variant: DO NOT connect the Power Control Unit (PCU) directly to the DC output of a generator or any unregulated power source. Refer to Section 4.0, Electrical, for instructions.



DO NOT connect power to the Power Control Unit (PCU) while the control panel power switch is in the "PWR" position. Doing so may result in damage to the power source or the PCU. Refer to Section 5.0, Operation, of this quick-start guide.

VIEWING PRECAUTIONS



Do not view an actively emitting infrared or visible light from the side or top of the light (close to or on beam) from a range of less than 4 ft. (1.2 m).

HANDLING



HAPI light housing assemblies (LHA) contain glass components. Care should be taken to avoid unnecessary shock. Do not drop. The LHA is designed to be transported in the horizontal position.



DO NOT STEP on the top of the light housing assemblies (LHA), Battery Box Assemblies (BBA) (if equipped), or Power Control Unit (PCU).

IMPROPER CLEANING AGENTS



Improper cleaning methods and use of unauthorized cleaning agents can damage equipment. Refer to Section 5.3, Preventative Maintenance, of this document.

INCLINOMETER



DO NOT place battery in backwards. Refer to Section 6.0, Appendix.



DO NOT store inclinometer in a hot location. Extremely high temperatures will affect accuracy of the inclinometer and may cause permanent damage to the device.



The digital inclinometer must be calibrated before use to ensure accurate readings. To calibrate, perform the Superset instructions in Section 6.0, Appendix.

2.0 General Description

2.1 Overview:

The Carmanah HAPI is an approach path indicator that utilizes high-efficiency light emitting diode (LED) light sources to provide glideslope guidance to aircraft on final approach and landing. LEDs provide corridors of red and green light in a tightly controlled beam. The HAPI system is ground-mounted and located adjacent to the nominal aiming point.

Physical Arrangement:

The HAPI system consists of the following major components:

- Light housing assembly (LHA)
- Power control unit (PCU)

Power:

Carmanah HAPI systems are powered in one or more of the following manners:

- AC-powered: 95 to 250VAC, 50 or 60Hz
- 24VDC: Battery with external charging
- 24VDC: Battery with solar charging
- 24VDC: DC voltage supplied externally

NOTE

Power systems vary by product configuration. Not all options are available with each system as built.

Control:

The HAPI system can be controlled in the following manner:

- Manual (at the PCU)
- Photocell control (24-hour continuous operation with automatic night dimming)
- Wireless (via the Carmanah handheld controller)

NOTE

Control functionality varies by product configuration. Not all options are available with each system as supplied.

Compliance:

The Carmanah HAPI system is optically and physically compliant to the following standard:

- ICAO, Annex 14, Volume II – Heliports, 2013



Figure 1: LHA and PCU – PCU shown with photocell installed.

NOTE

Carmanah HAPI systems (LHA and control) operate at a constant internal voltage of 24 volts. Intensity control of the LEDs is achieved through pulse width modulation (PWM).

NOTE

Carmanah HAPI systems are not compatible with constant-current 6.6-amp systems or equipment.

NOTE

All externally and internally threaded fasteners are standard North American imperial system sizes.

NOTE

All electrical fittings threaded or otherwise are standard North American trade sizes.

2.2 Theory of Operation

Each light housing assembly (LHA) projects corridors of green and red light. The indication for proper glideslope is a LHA showing a steady green light. When the aircraft is above the proper glideslope, the pilot sees a flashing green light. When below the proper glideslope, the pilot sees a steady-on red light. When well below the proper glideslope, the pilot sees a flashing red light.

See the following excerpt from ICAO:

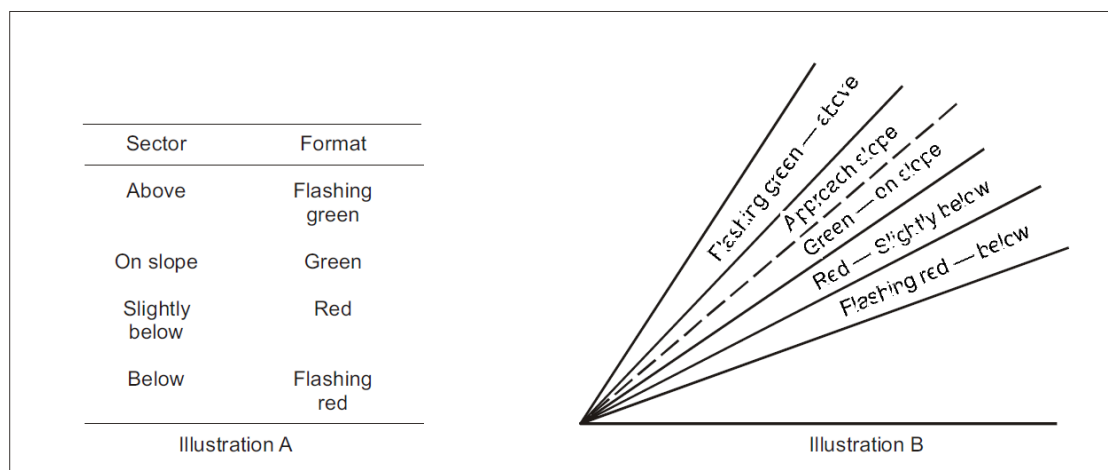


Figure 2: HAPI signal format

NOTE

This information is provided as a reference for installation and operation of aircraft navigational aids and is not a replacement for local or national regulatory standards. Always consult the relevant authorities.

3.0 Installation

3.1 LHA Installation



The stability of the LHA, once properly aligned, is critical to the efficacy of the system. The Federal Aviation Administration (FAA) provides guidelines for sizing of concrete footings for PAPI systems and other navigational aids. See reference document: AC 150/5340-30D

The LHA needs to be mounted securely to a stable surface. The HAPI system mounting kit contains base flanges and concrete anchor bolts for mounting.

If the LHA or PCU need to be relocated, Carmanah recommends using concrete anchors as opposed to studs cast into the concrete to improve dimensional accuracy and flexibility.

Below is a detail view of the LHA and base flanges:

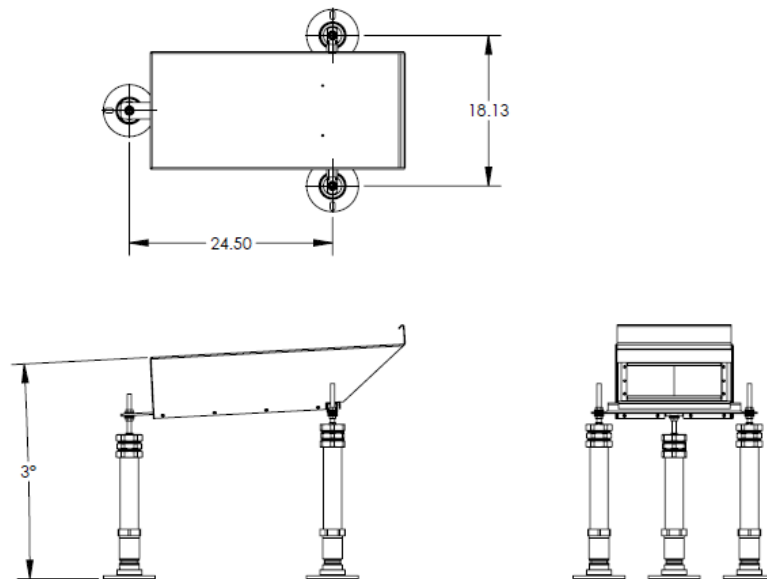


Figure 3: LHA detail (dimensions in inches)

NOTE

The LHA hollow tube portion of each mounting leg assembly can be cut to length to suit individual site requirements.

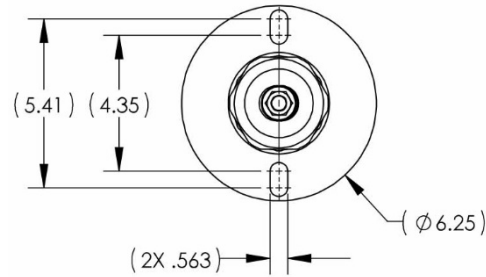


Figure 4: Mounting leg and mounting flange (dimensions in inches)

Mounting flanges have slotted holes that allow for some adjustments before the LHA is secured in place. The following diagram shows the flange orientation that provides the most tolerance for variance in front anchor placement:

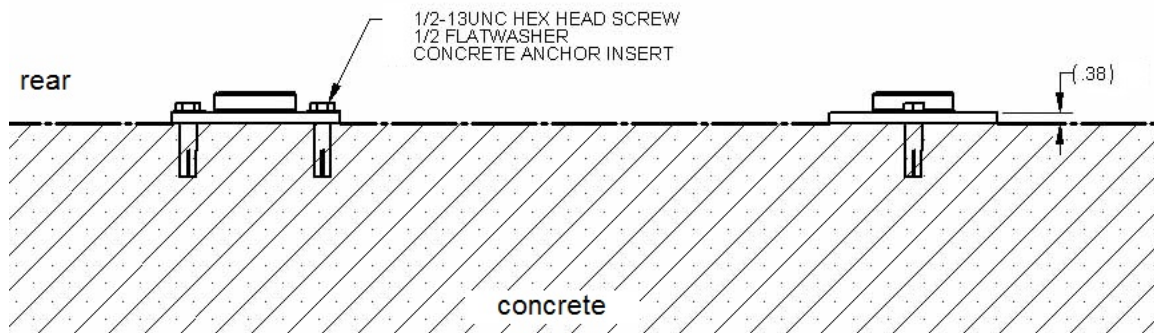


Figure 5: Flange orientation for adjustments

3.2 PCU Installation

Like the LHA, the PCU should be mounted securely to a stable surface; however, the position and stability are less critical. The PCU can be located at a distance away from the LHA and can be mounted inside a building or control room if required.

The HAPI system comes with 15 ft. (4.6 m) of cable and flexible conduit to connect the LHA to the PCU (see next section).

NOTE

The hollow tube portion of the single mounting leg can be cut to length to suit site requirements.

Below is a detail view of the PCU:

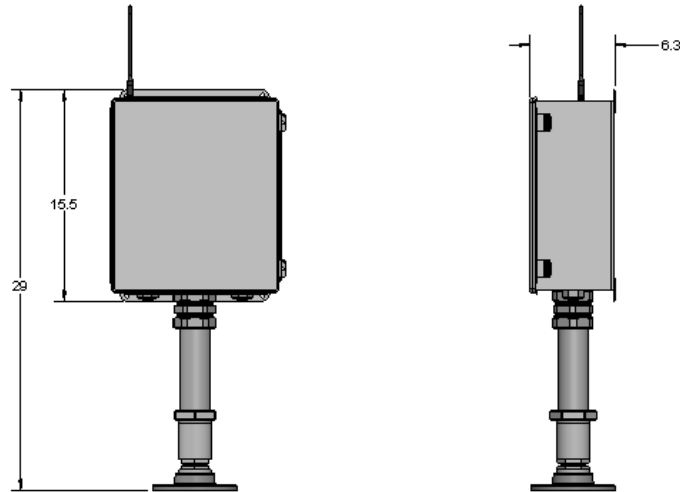


Figure 6: PCU – wireless version without photocell shown (dimensions in inches)

NOTE

If the PCU is equipped with a photocell, the photocell aperture must face north in northern hemispheres and must face south in southern hemispheres.

3.3 Cable Routing

NOTE

This section provides an overview of cable routing options for the HAPI system. Electrical connection diagrams and instructions are in Section 4.0, Electrical.

The HAPI system comes with 15 ft. (4.6 m) of cable and flexible conduit and junction boxes. Cables can run either directly between the LHA and PCU in flexible conduit above ground or in rigid conduit below ground.

NOTE

Rigid conduit is not supplied. If installing AC-powered systems, note that conduit, junction boxes, and electrical components related to the AC supply circuit are not supplied.

The diagrams below depict both above- and below-ground cable routing between the LHA and PCU:

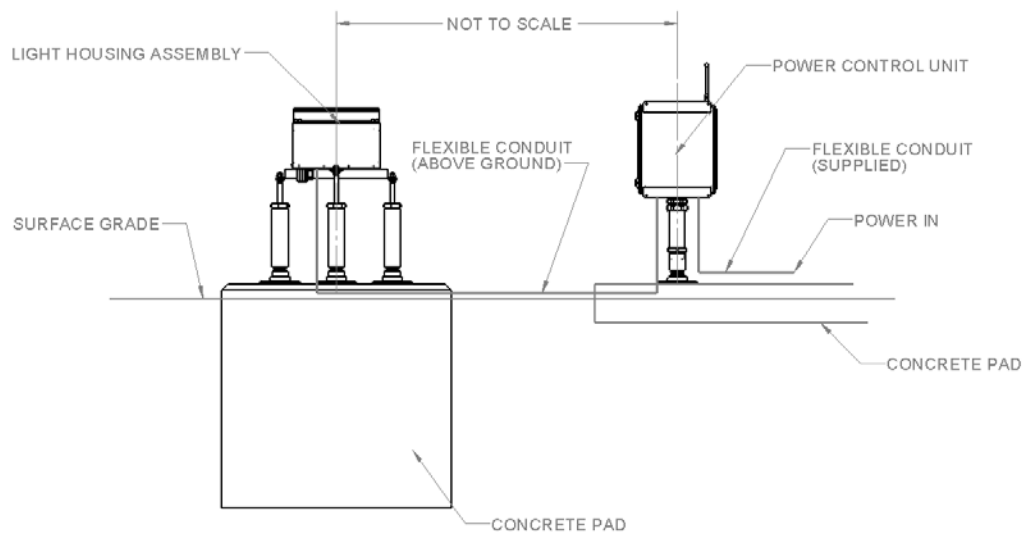


Figure 7: Above-ground cable routing (flexible conduit)

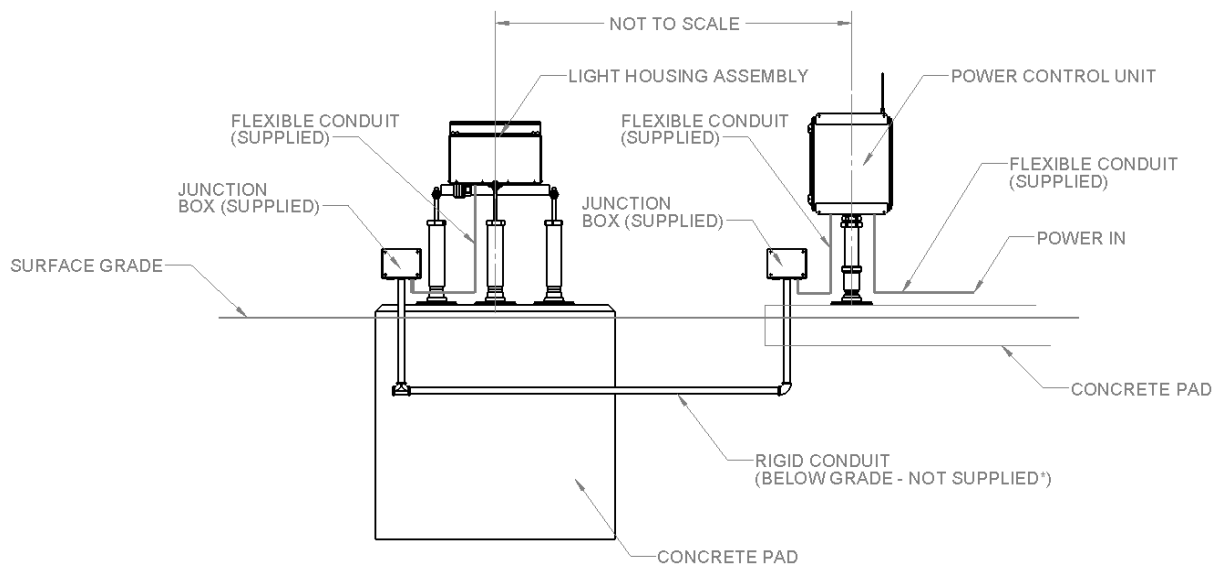


Figure 8: Below-ground cable routing (rigid conduit)

NOTE

For rigid conduit cable routing, a short length of flexible conduit is used between the LHA and junction box and PCU and junction box. Both the LHA and PCU have compression fittings on the underside for securing the flexible conduit.

The figure below shows the inside of one of the supplied junction boxes:

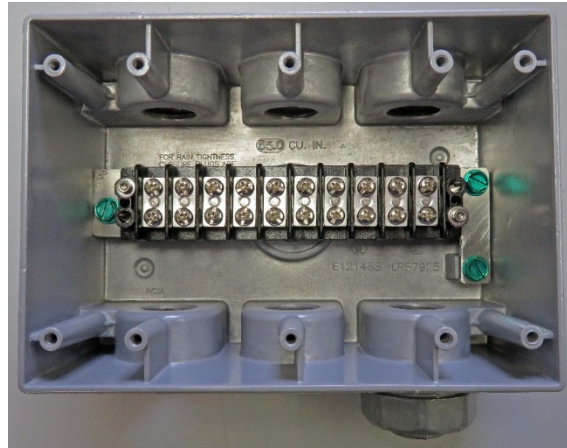


Figure 9: Junction box with terminal block (compression fitting shown on bottom)

NOTE

All junction boxes and fittings supplied with the HAPI system are standard North American trades sizes.

NOTE

If junction boxes are not used and the PCU is wired directly to the LHA, care must be taken to ensure that the correct wire assignments are maintained, both at the PCU and LHA.

4.0 Electrical

This section describes the electrical connections between the LHA and PCU. All connections are color-coded.



Ensure that all connections are made with the corresponding matching colors.



AC-powered systems operate at high voltages: when performing installation or repair procedures, disconnect high-voltage at source and lock out access!



DO NOT connect power to the Power Control Unit (PCU) while the control panel power switch is in the "PWR" position. Doing so may result in damage to the power sources or the PCU. Refer to Section 5.0, Operation, of this quick-start guide.

4.1 Cables

AC Power

For AC-powered configurations, two lengths of red and black #12 AWG wire are prewired to the power converter within the PCU.

LHA Power

Two #12 AWG (RED and BLACK) single conductor wires are prewired to the PCU. These conductors provide 24VDC to the LHA.

Control Lines

A six-conductor cable is prewired to the PCU. This cable provides the intensity control signals to the LHA.

The following table shows the control line colors and functions:

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

Tilt Switches

For systems with a tilt switch installed, the PCU is prewired with a separate two-conductor #22 AWG cable (RED and BLACK).

Figure 10 below shows the PCU with all the above cables:



Figure 10: PCU with pre-wired connections (note: shown with a photocell and antenna)

Figure 11 below shows the power and control line connections made within the junction box:

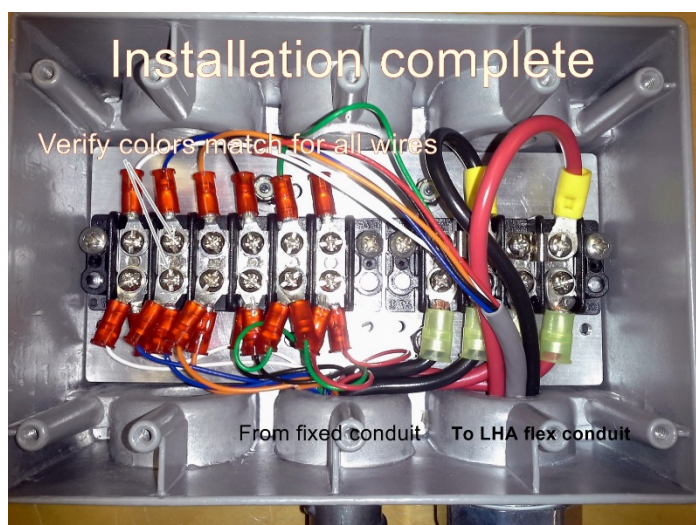


Figure 11: Junction box with final connections (note: tilt switch connections not shown)

NOTE

Image above depicts the wiring arrangement for a (2) LHA system. A single LHA system will only have one group of connections on the bottom row.

4.2 Aiming

The following section provides guidance on adjusting and setting the LHA ascension angle and adjustment of the tilt switch (if installed).

Aiming the LHA



Efficacy of HAPI and other visual guidance systems and the subsequent safety of aircraft and personnel is contingent on the correct alignment of light-emitting fixtures and maintenance of the overall system. Installation, setup, and maintenance of HAPI systems should only be performed by qualified personnel!

The LHA legs are fitted with threaded rods and nut and washer sets for adjusting and securing both the level of the LHA (side-to-side) and the correct ascension angle for approaching aircraft to view.

This diagram of the LHA shows the adjustment points:

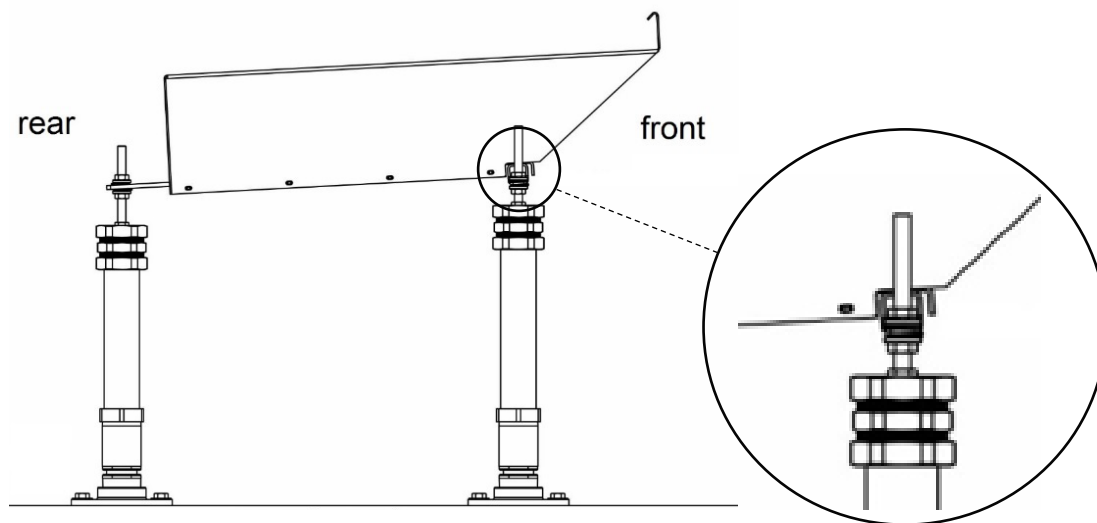


Figure 12: LHA with adjustment points (front and rear)

4.2.1 Adjusting the LHA side-to-side

To adjust the side-to-side level of the LHA, loosen the locking nuts on the front legs. Place the inclinometer inside the weather cover of the LHA close to the outer lens. Adjust the nut and washer assembly either up or down to level the LHA. Do not tighten the upper lock nuts on the front legs at this time.

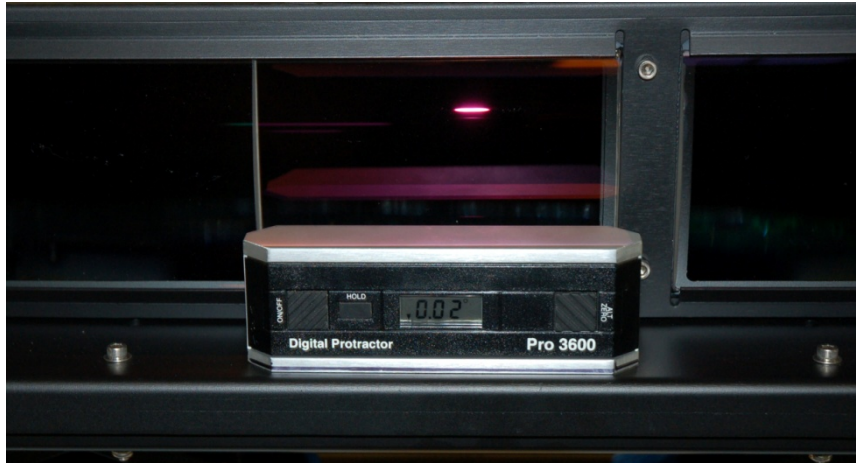


Figure 13: LHA with the digital inclinometer in place

4.2.2 Adjusting the LHA ascension angle (upward tilt)



Efficacy of HAPI and other visual guidance systems and the subsequent safety of aircraft and personnel is contingent on the correct alignment of light-emitting fixtures and maintenance of the overall system. Installation, setup, and maintenance of HAPI systems should only be performed by qualified personnel!



The digital inclinometer must be calibrated before each use to ensure accurate readings. To calibrate, perform the Superset instructions in Section 6.0, Appendix.



Before inserting the inclinometer into the mounting bracket on the underside of the LHA, ensure that the bracket is free from dust or debris. Once inclinometer is inserted into the bracket, tighten the two thumb screws. The image below shows the inclinometer placed in the bracket:



Figure 14: Inclinometer inserted in mounting bracket on the bottom of the LHA

To set the correct ascension angle (upward tilt), adjust the single nut and washer set on the rear leg. Once the correct angle has been achieved, recheck the side-to-side tilt and adjust as necessary. Check the ascension angle again. Readjust if necessary. Tighten the upper lock nuts on the adjustment assembly. With the lock nuts tightened, recheck the alignment of the LHA again using the inclinometer. If the angle has changed, loosen the upper lock nuts and begin the alignment procedure again.



DO NOT store inclinometer in a hot location. Extremely high temperatures will affect efficacy of the inclinometer and may cause permanent damage to the device.



Ascension angle of the LHA should be checked at regular intervals to ensure compliance with desired aircraft approach angle.

4.2.3 Setting the tilt switch:

If the HAPI system is fitted with a tilt switch, perform the following steps:

- A) The tilt switch is located on the back of the inclinometer bracket.

NOTE

For the tilt switch to function, it must be set to “level” and locked securely in place.

- B) To set the tilt switch to a level position, loosen both screws that secure the switch in place. Loosen the screws only enough to allow movement.
- C) Place the inclinometer against the bottom of the tilt switch bracket and rotate the tilt switch bracket into position, rotating it slightly about the non-slotted end of bracket (see Figure 14 below):



Figure 15: Tilt switch bracket detail

- D) Once the bracket has been set to level, carefully re-tighten both screws, securing the bracket in place.

NOTE

The tilt switch contains mercury, which is resistant to movement. During the adjustment process, move past the level position and then return to level to ensure that the mercury is settled correctly.

NOTE

The tilt switch contact-closed range is 0.5 degrees up and 0.25 degrees down.

WARNING

The tilt switch contains mercury enclosed in a glass container. If damaged or broken, place in a sealed container and dispose of appropriately.

5.0 Operation



Prior to operating the HAPI system, confirm that all the electrical connections are correct and secure.



DO NOT connect power to the Power Control Unit (PCU) while the control panel power switch is in the "PWR" position. Doing so may result in damage to the power sources or the PCU.



Do not view an actively emitting infrared or visible light from the side or top of the light (close to or on beam) from a range of less than 4 ft. (1.2 m).



Safety of the aircraft and occupants is contingent on this equipment being operated by knowledgeable and qualified individuals only.

PCU Control Panel:

The main control panel is located within the PCU. The following image depicts the switches on the control panel:

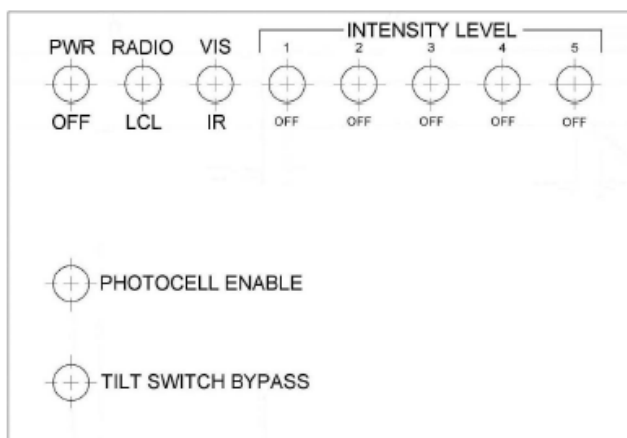


Figure 16: PCU control panel (note: not all switch locations may be populated)

Main operational modes:

- Local (via toggle switches at PCU)
- Photocell control (when equipped)
- Wireless (when equipped)

NOTE

For systems equipped with photocells, the photocell aperture should face north in northern hemispheres and south in southern hemispheres.

Toggle switch positions and functions:

OFF

- PCU and LHA are not receiving power through the PCU power input.

PWR

- PCU and LHA are being powered.

LCL

- System can be controlled locally only. For wireless equipped units, system will not respond to radio commands.

RADIO

- System is in remote wireless control mode. Intensity control toggle switch positions are ignored when in wireless mode (if equipped).

NOTE

When the RADIO switch is in the up position (when equipped), the system will only respond to wireless commands—both manual and photocell control are overridden.

VIS

- System is in visible light output mode.

IR

- System is in infrared output mode (if equipped).

PHOTOCELL ENABLE

- System will operate 24-hours per day continuously at 100% intensity during daylight hours and at 20% intensity at night (when equipped with photocell).

NOTE

When the PHOTOCELL ENABLE switch is in the up position, manual control is overridden.

TILT SWITCH BYPASS

- Tilt switch is bypassed (when equipped) and will not interrupt regular system function.

NOTE

Tilt switches are not bypassed during normal operation.

GROUP SELECT (push button)

- Used to assign wireless control groups or channels. Note: this button is only present on models with wireless control capability.

NOTE

To operate systems equipped with wireless control capability, please refer to the following document, which is also applicable for the HAPI: *67674 Handheld Controller User Manual – PAPI*.

Intensity Levels:

The following table provides the intensity levels and resulting percent of output:

Switch Number	Position	Output	Fixture Intensity- RED (cd)	Fixture Intensity- GREEN (cd)
1	UP	0.16%	14	14
2	UP	0.8%	72	72
3	UP	5%	450	450
4	UP	20%	1800	1800
5	UP	100%	9000	9000

NOTE

If more than one of the toggle switches for setting intensity is in the “up” position at one time, the system will operate at the highest intensity selected.

NOTE

Peak output intensity for visible light systems is: 9000 Candela (cd)

5.1 Operations in Adverse Conditions

- A) Below freezing temperatures
 - 1) If required, wipe the lenses with a clean, soft cloth to clear frost.
 - 2) Recalibrate the digital inclinometer before checking ascension angle.
- B) Soft ground and with optional rapid deployment legs
 - 1) Check the level, angle, and proper alignment of the LHA daily.
- C) Snow
 - 1) Clear snow away from the front of the LHA and PCU. Wipe the exit aperture lenses with a clean, soft cloth.
- D) Heavy rain
 - 1) Wipe the exit aperture lenses with a clean, soft cloth to clear residual water drops.
- E) Dust storm
 - 1) Wipe the exit aperture lenses with water spray and then wipe with a clean, soft cloth.

5.2 Emergency Procedures

- 1) Move the PWR toggle switch on the Power Control Unit (PCU) control panel to the "OFF" position.
- 2) Turn off the power from the power source.

5.3 Preventative Maintenance



Ascension angle of the LHA should be checked at regular intervals to ensure compliance with desired aircraft approach angle.

Once installed, the only required maintenance under normal operating conditions is a weekly cleaning of the outer surfaces of the lenses of each of the Light Housing Assemblies (LHA). The lenses should also be cleaned after a storm.

Cleaning the lenses

Supplies needed:

- Clean, soft lint-free cloth or lens tissue
- Clean water
- Lens cleaning fluid (not commercial glass cleaner)

Access the front surfaces of the lenses of a light housing assembly (LHA) through the front, under the weather cover. Reach in to wipe the lenses using a downward motion, lifting the cloth from the lens surface after each downward stroke. This allows dirt and debris to accumulate at the bottom of the lens where it has no effect on the beam. Apply only light pressure to avoid scratching the lens.

If the front surfaces of the lenses are very dirty, use lens cleaner fluid or water. Spray or pour a small amount on a clean cloth or lens tissue, then wipe the lenses as described above. Use a dry cloth or lens tissue to wipe the residual lens cleaner fluid off the lenses with the same downward motion.



Do not to scratch the outer surface of the lenses or leave residue that attracts dust or dirt.



Apply only light pressure, as the grit on the lens may be hard and sharp and will scratch the lens surface.



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.

6.0 Appendix

See Pro 3600 Digital Protractor Owner's Manual, provided by the original equipment manufacturer, on the following pages.

7.0 Product Support

This product is covered by the Laser Guidance warranty. Visit laserguidance.com for additional information.

Before contacting Carmanah's customer service department, please be ready with:

- The serial number of your product
- A brief description of the problem
- All details of the installation and recharging efforts (if applicable)

For additional information regarding HAPI systems or any other specialized Carmanah products, please contact Customer Service or Sales Engineering – Signals Division.

Customer Service:

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