

Helicopter Approach Path Indicator (HAPI) Quick-Start Guide

Portable System

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Contents

Safety & Usage	3
1.1 Viewing Precautions.....	3
1.2 Wireless Precautions	3
1.3 Warranty Disclaimer	3
1.4 Recycling.....	3
1.5 Abbreviations.....	4
1.6 Scope	5
1.7 WARNING SUMMARY	5
2.0 General Description	7
2.1 Overview:	7
2.2 Theory of Operation	9
3.0 Installation	10
3.1 LHA Installation	10
3.1.1 Unfolding and Preparing the Legs.....	11
3.1.2 Adjusting the LHA side-to-side.....	12
3.1.3 Adjusting the LHA ascension angle (upward tilt)	13
3.1.4 Securing the LHA	14
3.1.5 Setting the tilt switch:	16
4.0 Operation.....	18
4.1 Operations in Adverse Conditions.....	20
4.2 Emergency Procedures.....	20
4.3 Preventative Maintenance.....	20
5.0 Appendix	22
6.0 Product Support	29

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

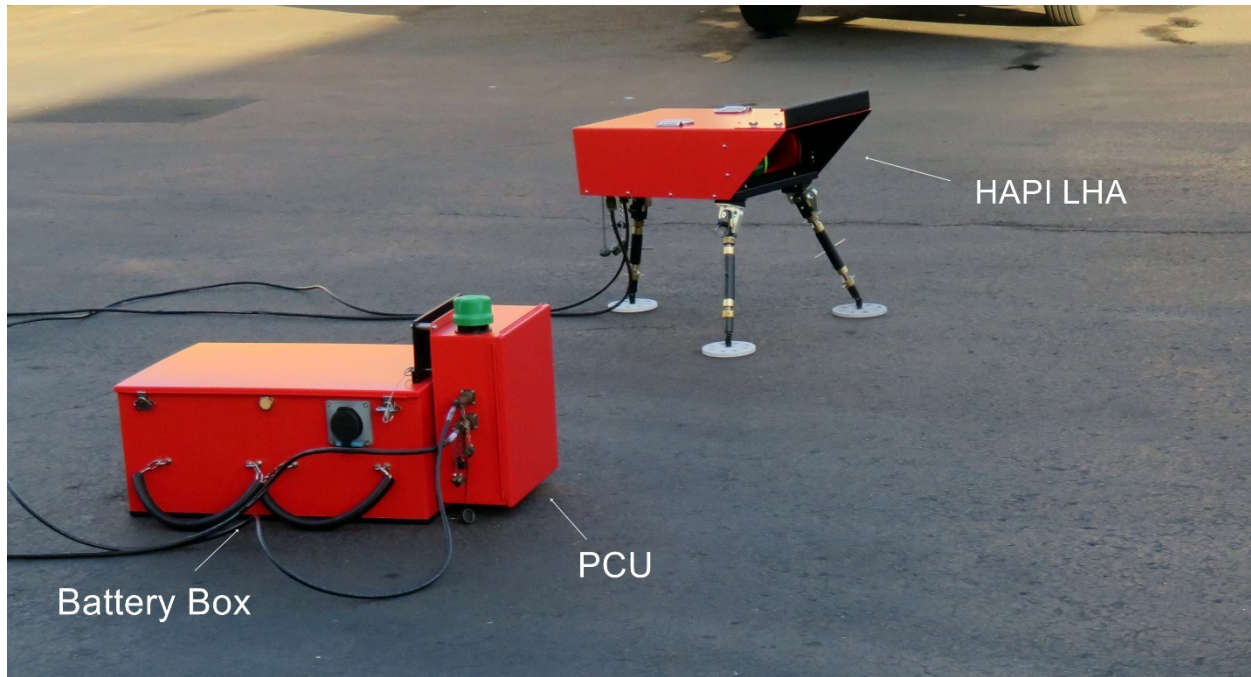
Control functionality varies by product configuration. Not all options are available with each system as supplied.

Compliance:

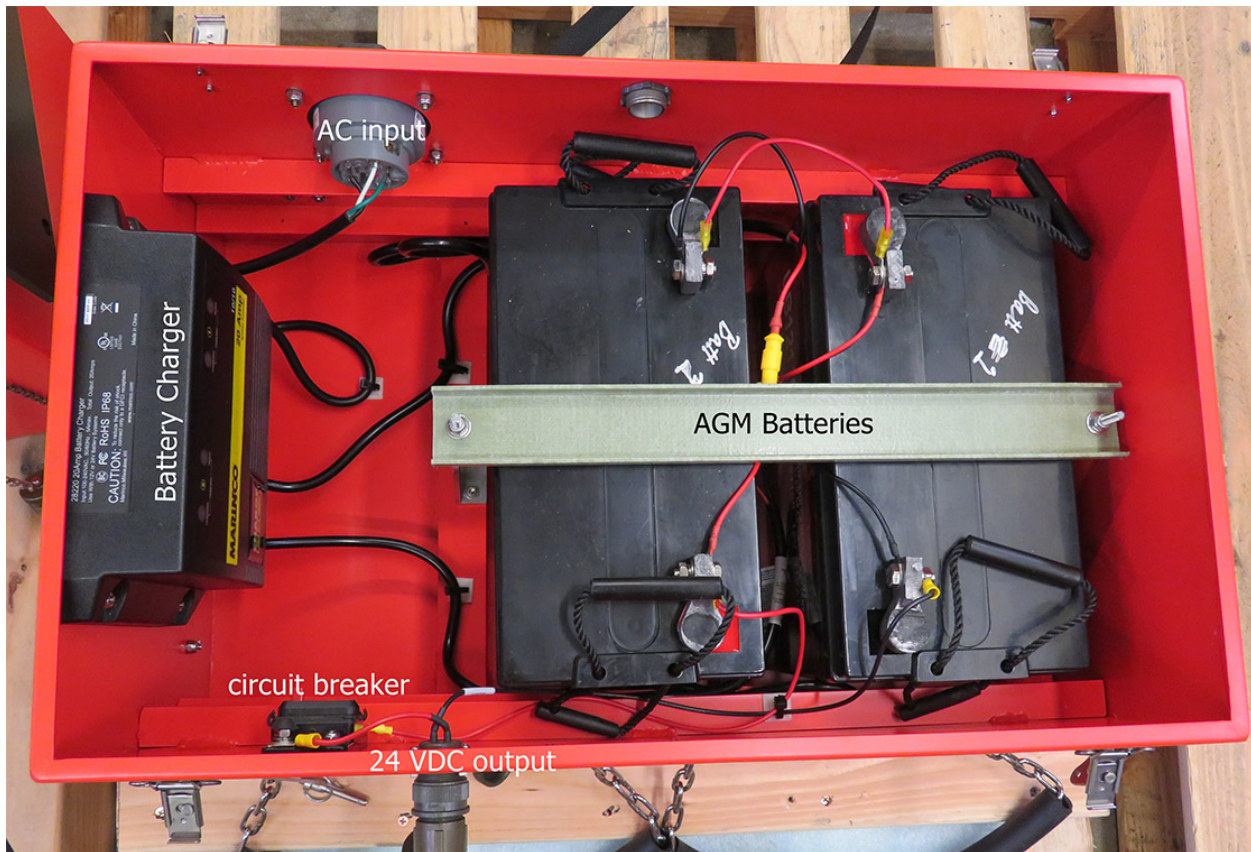
The Carmanah HAPI system is optically and physically compliant to the following standard:

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

Portable System Overview:



LHA and PCU – PCU shown with photocell installed.



Battery Box interior.

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.

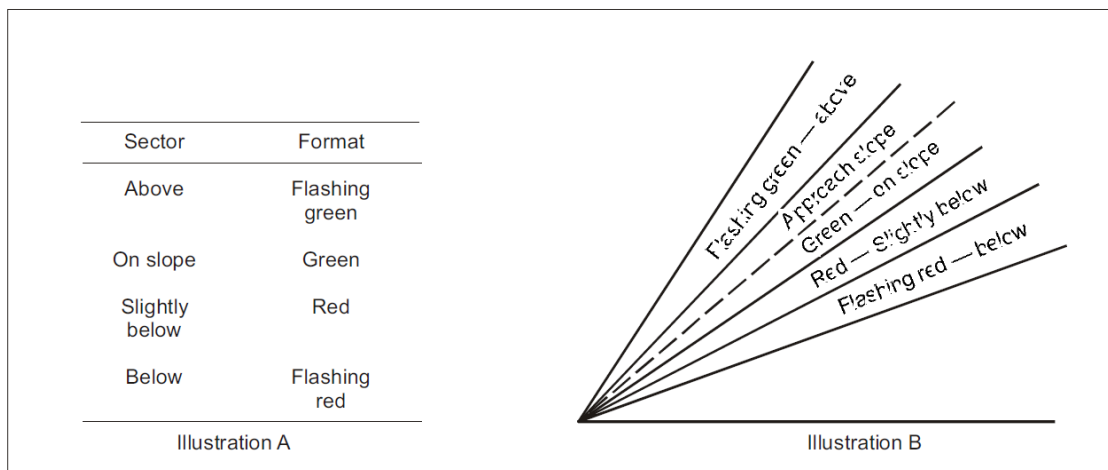
NOTE All externally and internally threaded fasteners are standard North American imperial system sizes.

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

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:



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

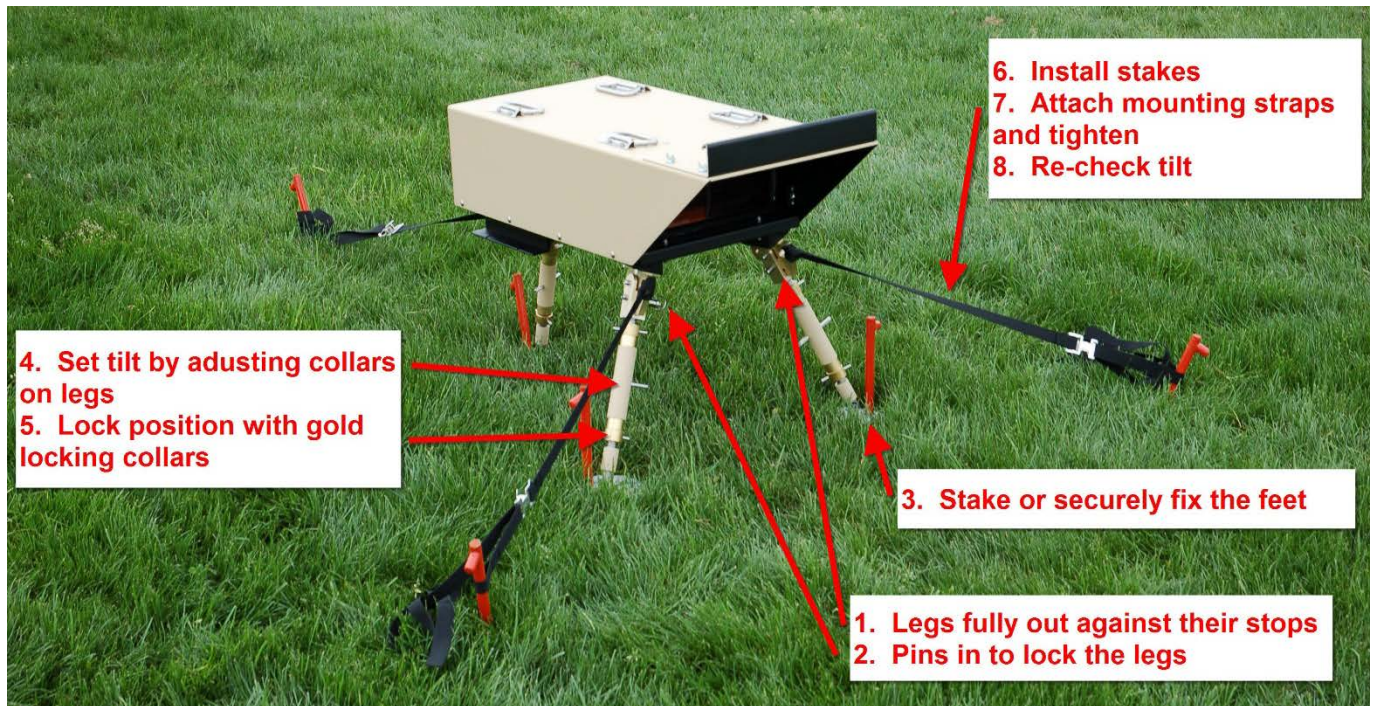
3.1 LHA Installation



The stability of the LHA, once properly aligned, is critical to the efficacy of the system.

The LHA needs to be mounted securely to a stable surface.

LHA Installation - Overview



Fully deployed LHA with Ground Straps and Pegs

**Note stakes are not fully in place for illustration purposes only*

3.1.1 Unfolding and Preparing the Legs



The LHA contains glass lenses. Take precautions to not drop the LHA during the installation process. The following procedure is best performed with two people.

Remove the locking pin from one of the front legs by pushing on the center knob on the pin then pulling the pin outwards. Let down the leg, and then pull the foot away from the LHA until it reaches its stop. Secure the leg into its extended position with its locking pin.

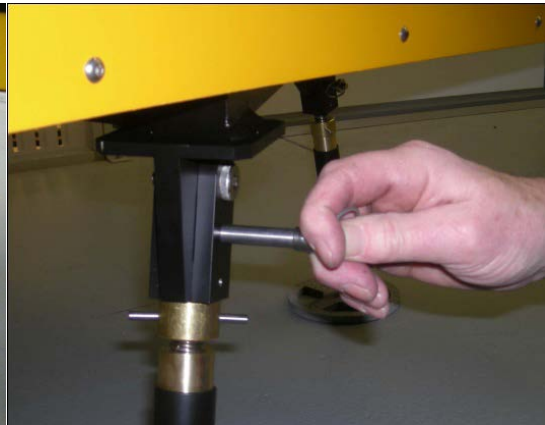
Repeat this procedure for the second front leg and rear leg.



Leg in fully retracted position

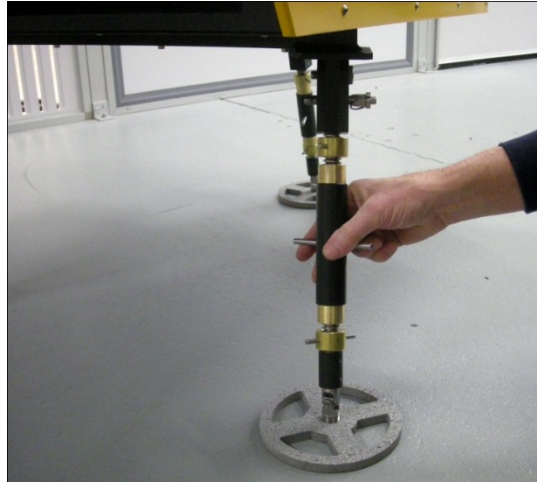


Leg fully extended



Replacement of locking pin on fully extended leg

To prepare the LHA legs for final adjustments, set the central turnbuckles on all three legs so that they are near the middle of their adjustment range. Rotate the turnbuckle using the pins that protrude from the sides. The brass locking collars may have to be backed away from the turnbuckle.



Leg assembly with turnbuckle at midpoint of adjustment

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!

For effective glideslope indication, the LHA must be oriented parallel to the approach path of the aircraft. Instructions for correctly levelling the LHA and adjusting the glideslope (ascension angle) are in the following sections:

3.1.2 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 turnbuckle assembly either up or down to level the LHA. Do not tighten the upper and lower locking collars on the front legs at this time.



LHA with the digital inclinometer in place

3.1.3 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:



Inclinometer inserted in mounting bracket on the bottom of the LHA

To set the correct ascension angle (upward tilt), adjust the turnbuckle 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 and lower locking collars on the adjustment assembly. With the collars tightened, recheck the alignment of the LHA again using the inclinometer. If the angle has changed, loosen the upper and lower collars 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.

3.1.4 Securing the LHA



Fully secured LHA with ground stakes and straps

Secure the three feet with the stakes provided, or, secure the LHA with stakes and straps as shown above and below.



LHA leg staked in place

Strap Installation

Thread the end of a strap through the hole on the rear leg. Secure the strap in a loop using the buckle end of the strap. Hammer in a ground stake directly behind the LHA at a distance so that the strap will reach. Loop the strap onto the ground stake and tighten.



Thread the looped end of the strap through the hole on one of the side legs. Feed the end of the strap through. Insert a ground stake at an angle in the horizontal of about 120 degrees from the strap in the rear. Loop the strap onto the ground stake and tighten. Repeat for the other side leg.



Re-check for the proper ascension angle and side-to-side level of the LHA. Adjust as required

NOTE

Once the LHA position has been finalized, remove the inclinometer from the LHA and store it in a safe place free from excessive heat or moisture.

3.1.5 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 image below):



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.

4.0 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).



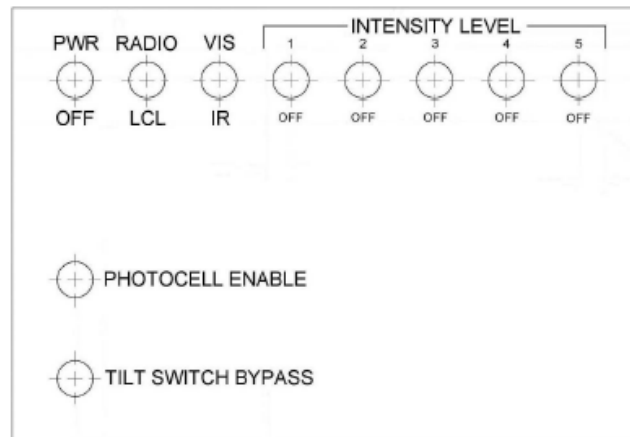
Safety of the aircraft and occupants is contingent on this equipment being operated by knowledgeable and qualified individuals only.



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

PCU Control Panel:

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



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)

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 PHOTOCCELL 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)

4.1 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.

4.2 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.

4.3 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.

5.0 Appendix

See the Battery and Battery Charger specification sheets on the following pages.



Sealed Lead-Acid Battery

UPG No. 45824

UB121100

Maintenance-Free

Absorbant Glass Mat (AGM) technology for superior performance. Valve regulated, spill proof construction allows safe operation in any position. Approved for transport by air. D.O.T., I.A.T.A., F.A.A. and C.A.B. certified. U.L. recognized under file number MH 20567.

Specification

Nominal Voltage	12 volts		
Nominal Capacity	77° F (25° C)		
20-hr. (5.50A)	110 Ah		
10-hr. (10.23A)	102.3 Ah		
5-hr. (18.70A)	93.5 Ah		
1-hr. (66.00A)	66.0 Ah		
Approximate Weight	62.7lbs (28.44 kgs)		
Internal Resistance (approx.)	4mΩ		
Shelf Life (% of normal capacity at 77° F (25° C))			
3 Months	6 Months	12 Months	
91%	82%	64%	
Temperature Dependency of Capacity	(20 hour rate)		
104° F	77° F	32° F	5° F
102%	100%	85%	65%



Charge Method (Constant Voltage)

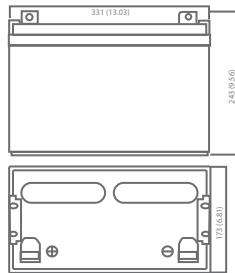
Cycle Use (Repeating Use)

Initial Current	40 A or smaller
Control Voltage	14.4 - 14.9 V

Float Use

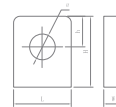
Control Voltage	13.5 - 13.8 V
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Physical Dimensions: in (mm)



L: 13.03in (331 mm)
W: 6.91in (176 mm)
TH: 9.56in (243 mm)
 Tolerances are +/- 0.04 in. (+/- 1mm) and +/- 0.08 in. (+/- 2mm) for height dimensions. All data subject to change without notice.

Terminals



L Series (L Type Terminal)

Dimension Type	L	W	H	h	φ
L3	25.5	7.0	22.0	10.5	8.5

Constant Current Discharge Characteristics Unit:A (25°C, 77°F)

F.V/Time	5MIN	10MIN	15MIN	30MIN	1HR	2HR	3HR	4HR	5HR	8HR	10HR	20HR
9.60V	361.1	269.3	189.5	114.7	59.9	34.9	25.6	20.0	16.5	11.6	10.5	5.7
10.20V	325.2	245.4	169.6	108.7	56.3	33.3	24.9	19.5	16.2	11.4	10.2	5.5
10.50V	313.2	233.4	159.6	105.7	54.9	32.5	24.3	19.2	16.0	11.3	10.0	5.5
10.80V	301.2	221.4	149.6	102.7	52.9	31.7	23.7	18.9	15.6	11.0	10.0	5.4
11.10V	289.3	209.5	139.7	99.8	50.9	30.9	22.9	18.3	15.2	10.7	9.5	5.1

Constant Power Discharge Characteristics Unit:W (25°C, 77°F)

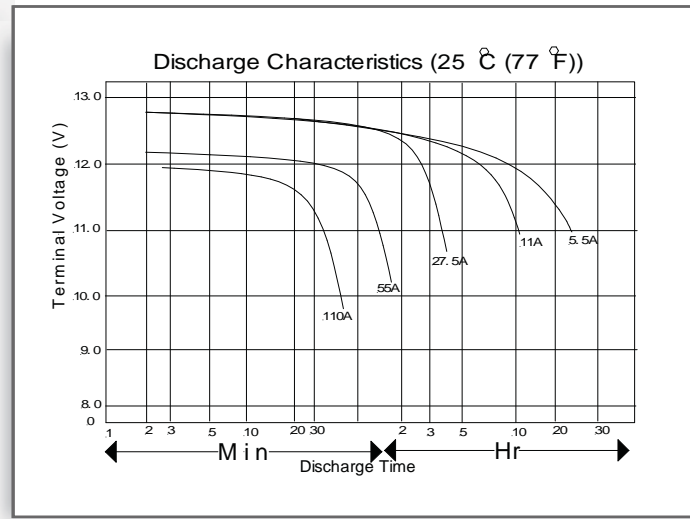
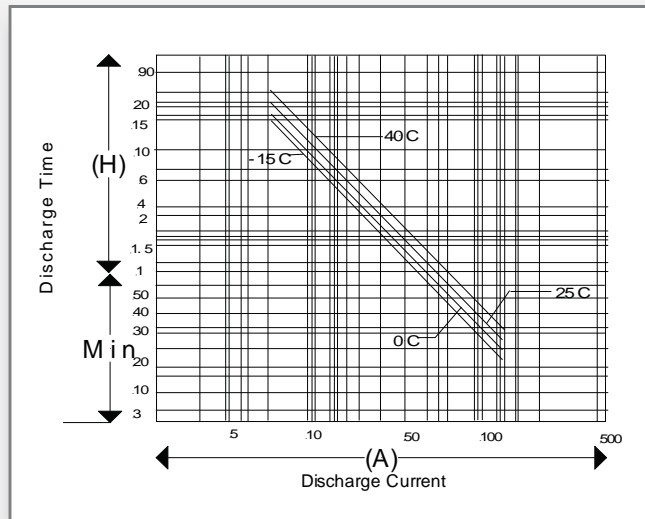
F.V/Time	5MIN	10MIN	15MIN	30MIN	1HR	2HR	3HR	4HR	5HR	8HR	10HR	20HR
9.60V	3919.2	2959.6	2013.0	1217.9	693.3	404.0	297.3	231.4	190.5	134.7	121.7	65.5
10.20V	3610.0	2724.2	1882.3	1207.0	651.4	386.0	289.3	225.4	149.7	131.7	118.7	63.8
10.50V	3552.1	2647.4	1809.5	1199.0	630.4	377.1	282.3	221.4	184.5	130.7	116.7	63.0
10.80V	3506.2	2577.5	1741.6	1196.0	613.5	369.1	276.3	217.5	181.5	127.7	115.7	62.7
11.10V	3442.4	2492.8	1661.8	1187.0	605.5	368.1	273.3	216.5	180.5	126.7	112.7	60.8



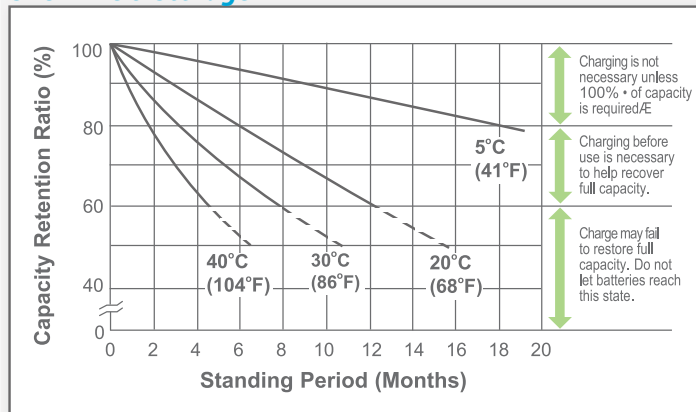
UB121100

Maintenance-Free

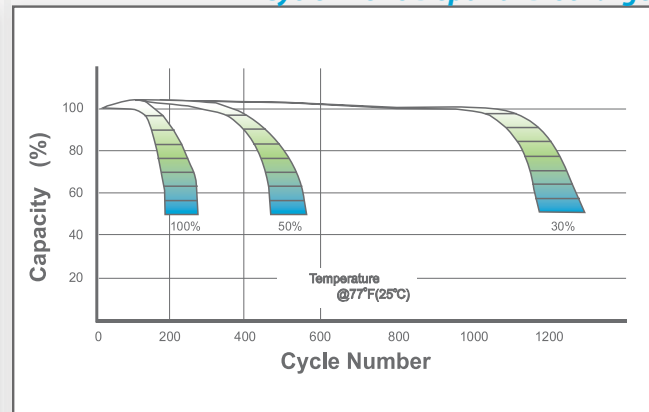
Temperature Discharge Current & Discharge Duration Time Discharge Characteristics



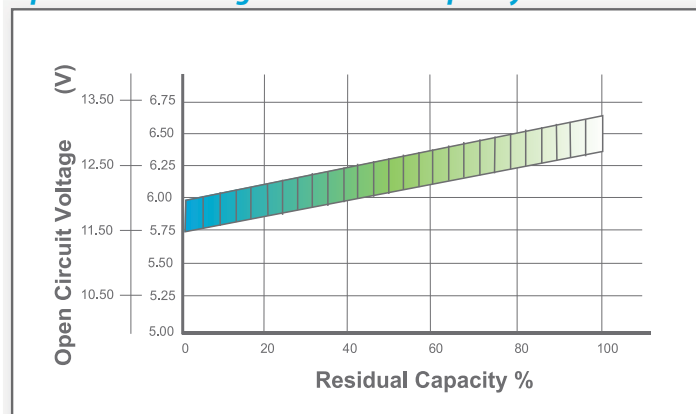
Shelf Life & Storage



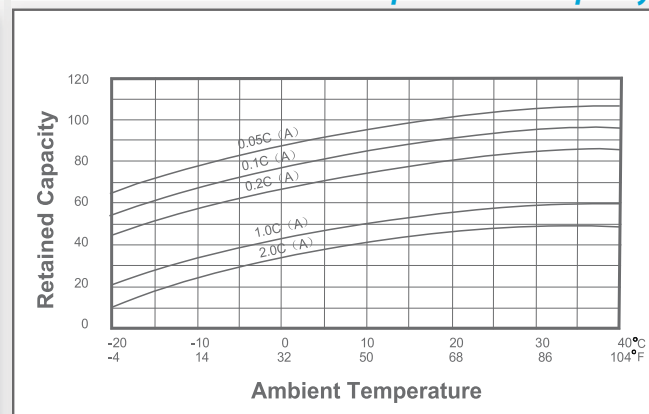
Cycle Life vs Depth of Discharge



Open Circuit Voltage vs Residual Capacity



Effect of Temperature on Capacity



Charge Current & Final Discharge Voltage

Application	Charge Voltage(V/Cell)			Max.Charge Current	Final Discharge Voltage V/Cell	Discharge Current(A)	1.75	1.70	1.60	1.30
	Temperature	Set Point	Allowable Range							
Cycle Use	25°C(77°F)	2.45	2.40-2.50	0.35C	Discharge	0.2C<(A)	0.2C<(A)<0.5C	0.5C<(A)<1.0C	(A)>1.0C	
Standby	25°C(77°F)	2.325	2.30-2.35							



Let UPG Power Your Life.

www.upgi.com

PRODUCT NUMBER: 28220 - Marinco On-Board Battery Charger

This 28220 model is a 2 bank, 20 amp, 12/24V DC output charger with wide input voltage range (100-240V AC), is microprocessor controlled and has a maintenance mode that will keep the charger fully charged. The Marinco 28220 meets the CEC (California Energy Commission), FCC Class B, is RoHS compliant and has UL and CSA listings (cULus). The 28220 has the same mounting dimensions as the 2620A and will replace this model.

1. DESCRIPTION

1.1. Dimensions Reference only

Height 7.0 inches 17.8 cm	Width 9.6 inches 24.4 cm	Depth 2.9 inches 7.4 cm
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1.2. Mounting Bulkhead mount (vertical at wall)

Hole diameter is .295 inches / .750 cm or clearance for #12 screw
Left to Right Center to Center = 8.5 inches / 21.6 cm
Top to Bottom Center to Center = 4.5 inches / 11.4 cm

1.3. Weight (reference)

Approximately 8.0 lbs. (3.6 kg)

1.4. Connection

1.4.1. AC

6' (1.8 m) AC Cable with NEMA L5-15P AC Plug. Cable consists of 16/3 SJTOW cord with one BLACK (HOT), one WHITE (NEUTRAL) and one GREEN (GROUND)

1.4.2. DC

6' (1.2 m) DC output cable, 14 gauge wires, SJTOW with ring terminal connection

2. FEATURES

2.1. Waterproof

The Marinco 28220 has an IP68 rating. This rating is described as dust tight and protected against the effects of immersion in water under pressure for long periods.

2.2. Charge Indicators

Unit has 2 LEDS per bank, one Red and one Green in color. The following table should be used as indicator of the charger status.

	Red	Green
Soft start	On	Off
Bulk	On	Off
Absorption	On	On
Float	Off	On

2.3. Protection

Ignition Protection
Over Current
Over charge
Reverse Polarity
Thermal Protection
Short Circuit

2.4. Temperature Characteristics

Ambient Operating Temp Full Power -40 °C to 50 °C
Storage Range -40 °C to 70 °C

3. ELECTRICAL CHARACTERISTICS

3.1. Battery Recommendations

Battery size: Group 24 through 31 (up to 120 Amp-Hr)
Battery Type: 12V lead acid (FLOODED and AGM)
Maximum Recharger time: 12 hours

3.2. Input rating

Input Voltage Range: 100 to 240V AC 50/60 HZ
 Input Current rating: 5.0 Amps maximum

3.3. Voltages / Current

	Output Voltage	Output Current
Bulk	14.3VDC	5.5 – 6.5 Amps
Absorption	14.3VDC	3 – 6.5 Amps
Float	13.3VDC	0 – 3 Amps

3.3.1. Soft Start - “Soft Start” slowly charges the battery with 14.25V (10% of rated current). As soon as the max Soft Start timer (starts immediately when entering “Soft Start”) of 6 hours is reached or when the battery reaches 10V for 30 seconds the charger switches to the “Bulk stage”.

3.3.2. Bulk - “Bulk” charges the battery with 14.3V (100% of rated current) until the battery reaches 13.25V. As soon as the battery reaches 13.25V the Bulk timer will start counting after which it can charge the battery up to 12 hours until the voltage reaches 14.25V. As soon as the max Bulk timer (starts when voltage level is above 13.25V while in “Bulk”) of 12 hours is reached or when the battery reaches 14.25V for 30 seconds the charger switches to the “Absorption stage”.

3.3.3. Absorption - “Absorption” charges the battery with 14.25V. As soon as the Absorption timer (starts immediately when entering “Absorption”) reaches 14 hours or when the charge current drops below 10% of the rated current for 30 seconds the charger switches to the “Float stage”.

3.3.4. Float - “Float” keeps the charger on a specific voltage level of 13.25V (100% of rated current) for a period and then will switch to the “Maintenance stage”

3.3.5. Maintenance - As soon as the re-cycle timer reaches 14 days (336 hours) or when the voltage drops below 12.8V for 30 seconds the charger switches back to “Bulk stage”

4. AGENCY CERIFICATIONS

cULus	ANSI/UL 1236 "Battery Chargers for Charging Engine-Starter Batteries" E227501
ABYC	American Boat & Yacht Council = UL 1236 marine section A20 (Battery Chargers), E8 (AC Systems on Boats), E9 (DC Systems on Boats)
CEC	CB Mark for 120V
FCC	Labeled, FCC Part 15 Class B EN 55022
RoHS	Compliant

5. WARRANTY

This product has a 2 year warranty.

6. REVISION HISTORY

Revision	Product Specification Change Summary	Initials	Effective Date
A	Initial Release	<i>Mgt</i>	Dec. 2014
B	Removed CE	SH	July 2015
C	Added cULus	SH	Aug 2015

Originator: Mark Thomson Approved by: Erik Zwollo	Position: Technical Services Position:
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6.0 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:

Mail: Carmanah Technologies Corp.
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