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1.0 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). The PAPI is capable of emitting visible and infrared light energy that is harmful to the eye if viewed directly.

1.2 Wireless Precautions



Keep the Handheld Controller at a distance of at least 3 ft. (1 m) from the antennas of lights or 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 manual 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 manual 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 application 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. In order 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.

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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

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1.6 Limitations of scope

- This manual supplement provides an overview of Carmanah Precision Approach Path Indicator - tilt switch setup and calibration for **permanently-mounted system only**.
- This manual is supplemental to the general user manual and is not intended as a replacement. Consult the general user manual for all other aspects of setup, commissioning and troubleshooting of PAPI systems.
- This manual supplement pertains to both portable and permanently-mounted systems.
- This manual is not specific to either solar or AC-powered systems, nor is it specific to system configurations within those categorizations. Supplemental information specific to each Precision Approach Path Indicator configuration is supplied with the purchased equipment under separate cover.

2.0 Theory of operation

The efficacy of PAPI systems is contingent on all the beams of LHAs angled correctly with respect to one another and with respect to the desired glide slope.

If a PAPI's angle is incorrect, it could provide an incorrect glide slope indication to the aviator, so PAPIs are designed to operate in a "fail safe" manner. By using electromechanical tilt switches to detect a PAPI's angle, the system will only emit light if *all* LHAs are in the correct angular position as per the prescribed system configuration and set up. Each LHA is equipped with a single tilt switch, and all LHA tilt switches are wired in series to form an electrical loop. If any one LHA deviates from its angular set position or if any tilt switch fails, the power to all LHAs will be disconnected. This type of "fail safe" protection can be used with 2-LHA and 4-LHA systems.



Efficacy of PAPI systems and the 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 PAPI systems should only be performed by qualified personnel.

3.0 Tilt Switch Connectivity

Wiring the PAPI tilt switches:



The following procedure can only be performed successfully once the correct angle for each LHA has been determined and set in accordance to the desired glideslope angle.

Depending on the configuration, the PAPI system comes with a tilt switch on each of the LHAs. The tilt switch is used to extinguish the LEDs in the event that any of the PAPI LHAs is disturbed after being set in position.

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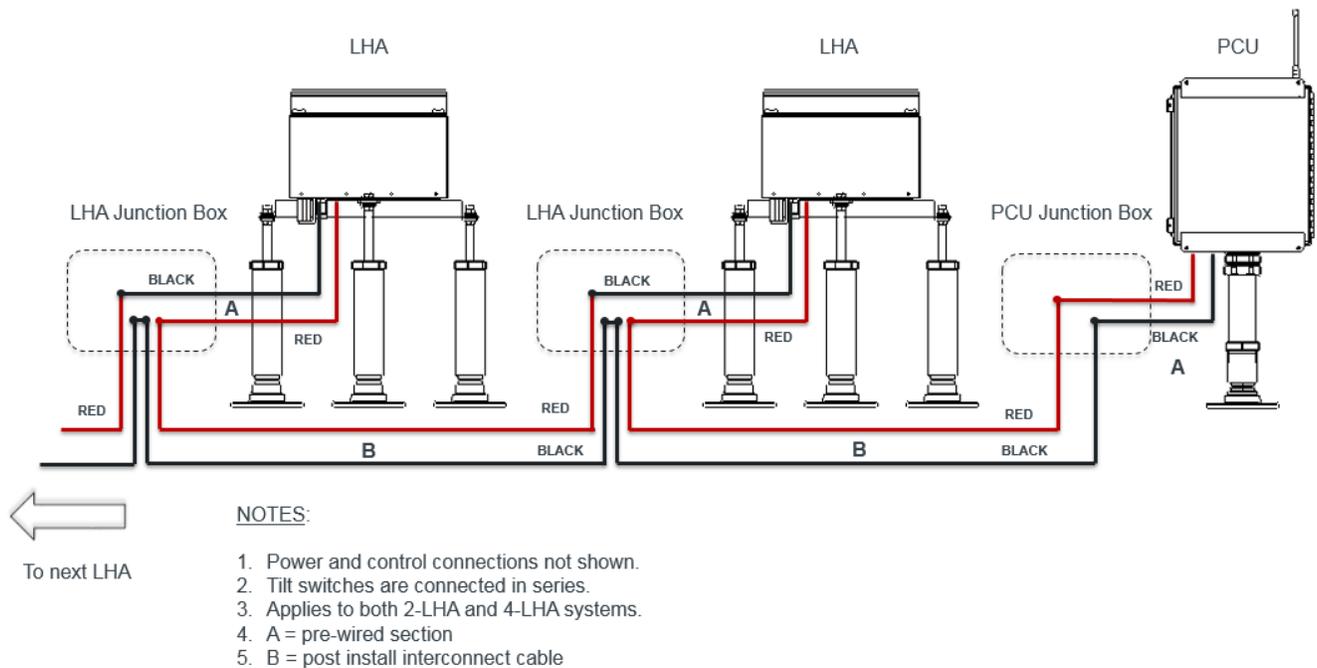
On the PCU there is a switch labeled “Tilt Switch Bypass”. When the PCU arrives, this switch will have been taped in the “up” position. This switch should remain in the “up” position while setting up the PAPI LHAs; this allows the system to function regardless of position of the tilt switch sensors.

The PCU and the LHAs each have pre-wired lengths of wire exiting them. The 10-gauge red and black wires are for 24 VDC power, the six-conductor 22-gauge cable provides the intensity control signals, and the 2-conductor cables are used to wire the tilt switches.

NOTE

While the other wires are connected color-to-color, the tilt switch are wired in **series** – forming a loop through the PCU and all of the LHAs. The layout of this loop is shown in the diagram below:

Tilt Switch Connectivity – Overview:



The PAPI system also comes with a length of two-conductor cable for the runs between the PCU and the LHAs.



Do not confuse the power wires with the tilt switch wires. All references to the red and black conductors within this supplement are for the small two-conductor tilt switch cables, not the larger gauge power conductors from the PCU junction box that are spliced red to red and black to black.

4.0 Setup and Calibration

Setting the PAPI tilt switches:

On the PAPI control panel is a switch labeled “Tilt Switch Bypass”. When this switch is in the up position, the tilt switches are bypassed and the PAPI will function regardless of the position of the tilt switches. When the tilt bypass switch is in the down position, the PAPI will not function unless the tilt switches are all set at the correct angle. Use the up position of the tilt bypass switch to either set up the PAPI angle or allow the PAPI to continue to function in the event that there is an issue with one or more of the tilt switches.

Tilt switches are adjusted after the LHAs have been set for the correct angles. The tilt switches are located on the back of the bracket that holds the inclinometer when positioning the PAPI LHAs. The switch is located on an adjustable bracket. Loosen both of the screws that hold the bracket just enough to allow the tilt switch assembly to move.

Place the digital inclinometer against the bottom of the tilt switch as shown in the photo below. (Ensure that both surfaces are clean and free of debris, otherwise the angle could be affected):



The bracket can then be rotated around the left hand screw through an angular range permitted by the slot on the right hand side.

NOTE

Due to the viscosity of the mercury and resistance to movement within the switch, it may be necessary to start the adjustment process by biasing the switch more on one side of “level” (approximately 1.0 degree or more), and then moving back toward level, slowly move past level about 0.1 degrees prior to returning to level.

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Finally move the switch to level (0 degrees) and tighten the screws as shown in the photo below:



The “closed” range of the tilt switch is within the angular range of +0.5 degrees and -0.25 degrees. A small deviation within this range will not affect functionality.

NOTE

It may be necessary to tap the switch a few times when set in the final position to settle the contact mercury, then recheck the angle to verify that the position is correct.

Once the tilt switches in all the LHAs have been set in place, flip the “Tilt Switch Bypass” switch on the controller to the “down” position. The tilt switch circuit can now disable the PAPI if one or more LHAs deviate from the correct angle.



The tilt switches contain mercury in glass enclosures which are sealed inside the aluminum structure. If broken, place in sealed container and dispose of appropriately.

5.0 Inclinometer Instructions

Introduction

The Pro 3600 Digital Protractor is a revolutionary measuring tool that provides an immediate, digital reading of all angles in a 360° circle. The machined aluminum frame is a rigid, light weight, ultra-precise platform that allows the state-of-the-art sensor and its microprocessor circuit to provide unsurpassed accuracy throughout the Protractor's 360° range.



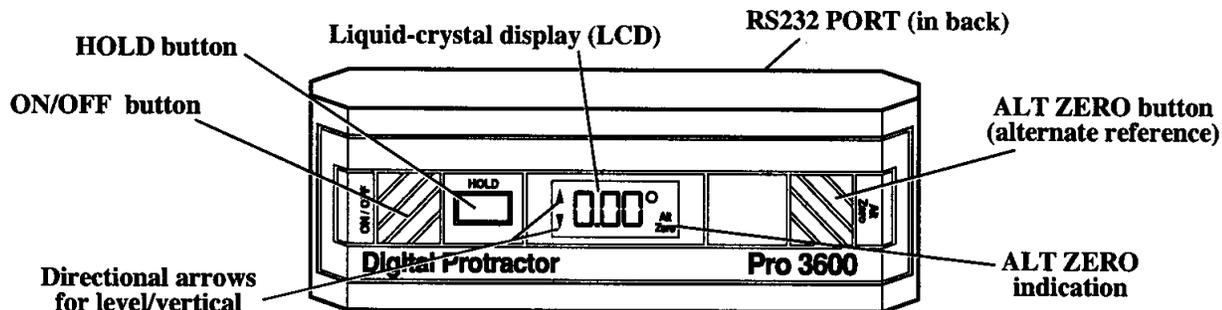
The Pro 3600 uses an innovative liquid filled angle sensor. As the protractor is moved, the liquid seeks a new position, resulting in changes in the electrical properties of the sensor. A microprocessor analyzes the changes and calculates the numbers seen on the display. The Pro 3600 also has an RS-232 compatible digital output which will interface with computers, data loggers and printers. This feature, along with the improved accuracy, high resolution and simple operation, makes the Pro 3600 a benchmark tool for years to come.

Feature Overview

The Pro 3600 operates normally in a standard reference mode where *level* is displayed as 0.00°. However, a new reference point for 0.00° can easily be established by pushing the ALT ZERO button. You can also "freeze" any displayed angle on the LCD by pushing the HOLD button.

The 360° range of the unit is organized into four 90° quadrants for display purposes. Display resolution is 0.01° near level (0.00° to 9.99°) and 0.1° at all other angles (10.0° to 90.0°).

And the Pro 3600 does not need to be returned to the manufacturer or dealer for recalibration. By following the Superset® instructions in this booklet, you can test and recalibrate the Pro 3600 in just a couple of minutes on site and without any special fixtures.

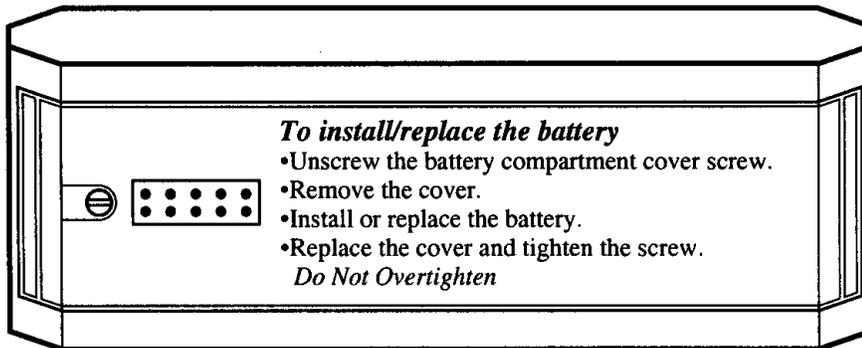


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Operating Instructions - Battery

The Pro 3600 is powered by a 9-volt battery. A new alkaline battery will provide 500 hours of use. A 9-volt lithium battery can be used for even longer life.

To extend battery life, the Pro 3600 shuts off automatically when left undisturbed for five minutes (to reactivate, push the ON/OFF button) unless there is activity on the serial port. Note: Hooking serial port pin 5 (REQ) to pin 9 (BATT+) disables the auto-power shutoff.. The Pro 3600 also indicates when the battery is low. Change the battery when the display alternately flashes "LO bAt" with angle measurements. (**NOTE:** The Pro 3600 does not display inaccurate angles due to a weak battery.)



Operating Instructions - Angle Measuring

First, you must make sure your unit is reading accurately by using the test on pages 9-10. If the unit fails this simple test, you must recalibrate it using Superset® (pages 11-14).

To operate your Pro 3600, simply push the ON/OFF button; it will begin displaying angle readings immediately. Set the Pro 3600 on the surface to be measured and read the angle. (To get the most accurate reading, allow the unit to settle for 5 seconds before noting the angle.) The resolution will be one hundredths of a degree for $\pm 10^\circ$ of level. The resolution will automatically change to tenths of a degree beyond these points.

When the unit is first turned on, the displayed angles will be in *standard reference mode* - level (true horizontal) is displayed as 0.00° and plumb (true vertical) is displayed as 90.0° . (An *alternate reference* point can be set easily if desired - see ALT ZERO.)

An arrow on the left side of the display will indicate which way to move the Pro 3600 to achieve level or plumb.

Between 0° and 44.9° , the arrow will point toward level. Between 45° and 89.9° , the arrow will point toward vertical (plumb).



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HOLD (temporarily "freezing" a reading on the display)

If you need to take a measurement with the Pro 3600 in an unreadable position, or if you need to temporarily lock in a reading while you record it, simply press the Hold button while measuring the angle. (Make sure the unit has been in position and still for 5 seconds.)

The readout will freeze and the decimal point, degree sign and an arrow on the left side of the LCD will flash.

To release, press the Hold button again.

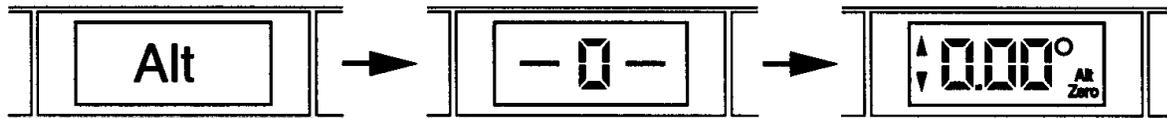
Note: The Pro 3600 cannot be recalibrated (Superset®) nor can a new reference point be established (ALT ZERO) when the HOLD feature is engaged. The HOLD feature is disengaged automatically when the unit shuts off or is turned off.



ALT ZERO (Setting an alternate reference point)

ALT ZERO allows you to set any angle as a 0.00° reference point from which to take measurements.

To set an alternate reference point, place the Pro 3600 on the new surface and wait 5 seconds. Press the ALT ZERO button once. "Alt" will appear on the display, followed by "-0-". The Pro 3600 will then display angles using the new reference. ALT ZERO will appear in the lower right hand corner of the display as long as the Pro 3600 is in ALT ZERO mode.



Press ALT ZERO again to return to standard reference mode. The Pro 3600 also returns to standard reference when it is turned off or shuts off automatically.

NOTE: You cannot activate the ALT ZERO button when the Pro 3600 display is in HOLD.

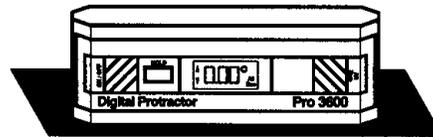
Recalibration

Like all measurement instruments the Pro 3600 must periodically be monitored for accuracy. The Pro 3600 should be tested daily with the simple procedure outlined below. If it is found to be out of calibration, it is easily recalibrated on site using Superset® - an eight-step procedure that realigns the unit through its entire 360° range and takes just a couple of minutes to perform. And Superset® doesn't require any special fixtures, tools, or expertise.

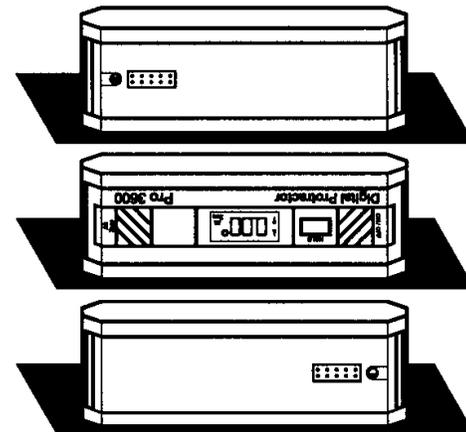
Accuracy Test

Perform this simple test each day before using the Pro 3600. Also perform it anytime the Pro 3600 has been dropped or is being used in an environment that varies more than 5° C (9° F) from the environment in which it was last calibrated. If your Pro 3600 fails this test, you must recalibrate it using Superset® before using the unit further to measure angles.

- Position the Pro 3600 with the display facing you on a clean, flat horizontal surface. It doesn't have to be exactly level. Wait 10 seconds so the unit is completely settled and note the angle on the display.



- Rotate the unit end-for-end so the display is facing away from you. Be sure to set the Pro 3600 in exactly the same spot, and wait 10 seconds before reading the angle that's displayed.
- Now roll the unit toward you so that the display is facing you, but the lettering on the face of the unit is upside down. Wait 10 seconds, and note the angle on the display.
- Finally, rotate the unit end-for-end so the display is facing away from you (the lettering should still be upside-down). Wait 10 seconds and note the angle on the display.



- **If any of the four measurements varies from any other by more than 0.1°, you must recalibrate (Superset®) your unit before using it further.**

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Superset®

Superset® recalibrates the Pro 3600 through its entire 360° range by electronically recording four horizontal and four vertical settings. It should be performed whenever the accuracy test shows a discrepancy of 0.1° or more.

How to Perform Superset®

Turn on the Pro 3600 and place it on a flat surface. You can use any horizontal surface within 10° of level and any vertical surface within 10° of plumb to perform Superset®. You must use the same surfaces throughout the entire process.

Note: Each time you reposition the Pro 3600 during Superset®, wait a minimum of 10 seconds before pressing the HOLD button to advance to the next step.

Starting Superset®

- Press and hold the HOLD and ALT ZERO buttons simultaneously. Keep them depressed for approximately three seconds.
- Release the buttons when the symbol "SUP" appears. A "0" within flashing brackets will then appear. These brackets are composed of four horizontal and four vertical segments.

Note that as you proceed through the eight steps of Superset®, a new segment will hold steady after you complete each step.



"0" within flashing brackets

Superset® - Horizontal Settings

[1]

- Unit faces you and white lettering on face is right-side up.
- Align with an edge or line - wait 10 seconds.
- Press HOLD button until [1] appears.

[2]

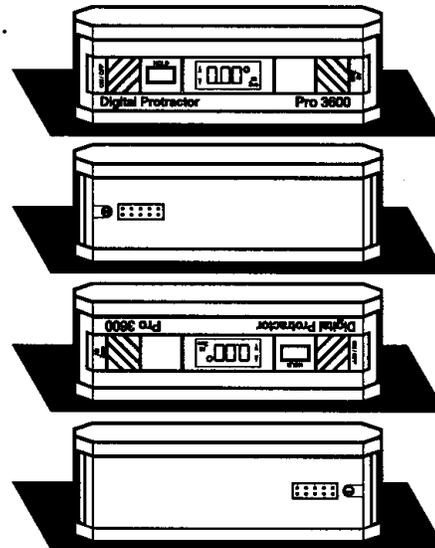
- Rotate unit so it faces away from you, the lettering should still be right-side up.
- Align with same edge or line - wait 10 seconds.
- Press HOLD button until [2] appears.

[3]

- Roll unit so it faces you, the lettering should now be upside-down.
- Align with same edge or line - wait 10 seconds.
- Press HOLD button until [3] appears.

[4]

- Rotate unit so it faces away from you, the lettering should still be upside-down.
- Align with same edge or line - wait 10 seconds.
- Press HOLD button until [4] appears.



You have completed one half of Superset® (continued on next page)

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Superset® - Vertical Settings

[5]

- Place unit against vertical surface so it faces you, the lettering on the face ("Pro 3600, etc.") should read from bottom to top.
- Align with an edge or line - wait 10 seconds.
- Press HOLD button until [5] appears.

[6]

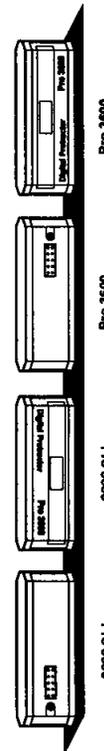
- Roll the unit so it faces away from you, the lettering should still read from bottom to top
- Align with same edge or line - wait 10 seconds
- Press HOLD button until [6] appears.

[7]

- Rotate unit end-for-end so it faces you, the lettering should now read top to bottom.
- Align with same edge or line - wait 10 seconds
- Press HOLD button until [7] appears.

[8]

- Roll the unit so it faces away from you, the lettering should still read top to bottom.
- Align with same edge or line - wait 10 seconds
- Press HOLD button. [8] will very briefly appear, followed immediately by regular angle measuring.



Your Pro 3600 has been Superset® back to manufacturer's spec's.

Canceling Superset®

You may cancel Superset® at any time during the process by turning the unit off.

Maintenance

The Pro 3600 is designed to stand up to the rigors of industrial use. The following tips will ensure a long service life:

- Use the "end-for-end" accuracy test daily to make sure the unit is in calibration. If it is not, recalibrate it immediately with Superset®.
- Clean the Pro 3600 with mild liquid soap and a damp cloth. Never immerse in water.
- Do not use solvents directly on any of the Pro 3600 plastic surfaces.
- Store the Pro 3600 away from extreme temperature: Never below -20°C (-4°F) or above 65°C (149°F).

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Pro 3600 Specifications

Range360° (90° x 4)
Resolution0.01° (0° to 9.99°)
 0.10° (10° to 90°)
Accuracy±0.05° (0° to 10°)
 ±0.10° (80° to 90°)
 ±0.20° (10° to 80°)
Repeatability±0.05°
Cross Axis Error ..Minimal

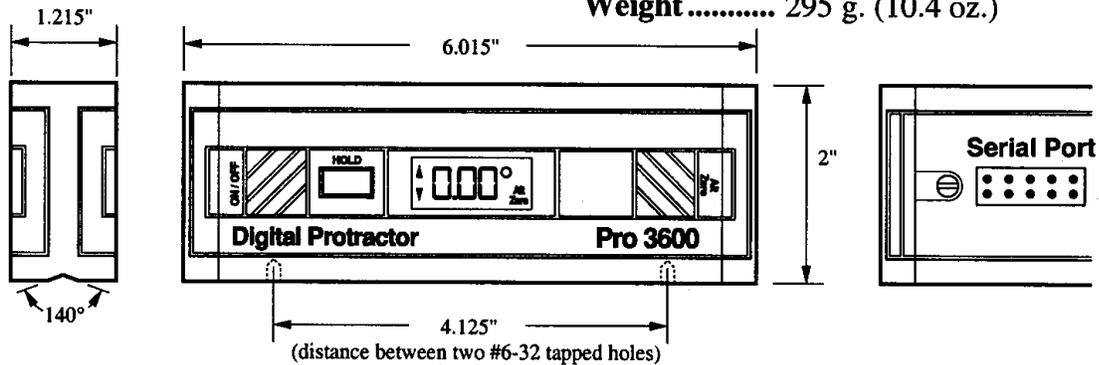
Serial Port

Type RS-232 Compatible
Connector 10-pin, Rectangular
Supply Voltage 9 V. Alkaline Battery
Battery Life 500 hours typical
Temperature

Operating .. -5°C to 50°C (23°F to 122°F)

Storage -20°C to 65°C
 (-4°F to 149°F)

Weight 295 g. (10.4 oz.)



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6.0 Warranty

This product is covered by the Carmanah warranty. Visit carmanah.com for additional information.

Before contacting Carmanah's customer service department, please have the serial number of your light available, a brief description of the problem, as well as all details of the installation and recharging efforts.

To contact Customer Service:

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