

# Instruction Manual

## Aero-Almen Gage



**Electronics Inc.**  
*Shot Peening Control*



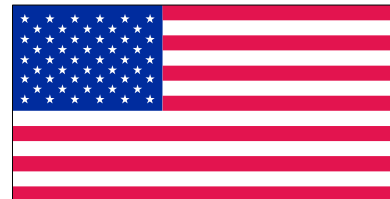
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Made in the USA

# Instruction Manual Model Aero-Almen Gage

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## Instruction Manual Model Aero-Almen Gage

### Description

The Aero-Almen Gage\* is a precision device used to measure the blast intensity of aircraft paint stripping with abrasive media. This process must be carefully controlled to preclude damage to the thin aircraft skin. A test measures the blast intensity of the paint stripping process using an Aero-Almen strip—a test coupon made of aluminum. The test strip is blasted with the abrasive media and examined for curvature on the Aero-Almen Gage. Any excess curvature, usually over .005", is an indication the blasting intensity may be detrimental to the aircraft skin and should be avoided.

Treated properly, the Aero-Almen Gage will provide many years of trouble-free service. The gage should be calibrated annually or more frequently if conditions warrant. The gage has an automatic shut-off function, to prolong battery life—the Almen Gage automatically shuts off after approximately fifteen (15) minutes of inactivity. The unit may be turned on again by pressing the ZERO/ON button. The gage comes with two (2) batteries with a life expectancy of at least one (1) year. The batteries can be easily replaced without loss of calibration.

The Aero-Almen Gage is similar in construction to the #2 Almen gage; however, the Aero-Almen Gage is fitted with a hold-down ballast with four spring-fingers to secure the aluminum strip to the measurement platform. (The standard Almen gage uses magnets to hold the steel test strips in place). For additional information on construction specifications of the standard #2 Almen gage, see SAE J442 ***Test Strip, Holder and Gage for Shot Peening***.

For additional information on use of Aluminum strips for aircraft paint stripping, see AFSC Design Handbook DH-1-13, February 1992 (Available from Electronics Inc.)

\*US Patent 5,877,405

### Environment

The indicator is built to withstand severe use. The gasket case, window lens, and durable stem assembly will resist encroachment of most dusts and fluids. The gage should never be immersed in liquid, as this will damage the unit. The seals and boots should be regularly inspected to prevent contamination. The dust cap for the electronic 4-pin connector should always be in place whenever an output cable is not attached. This will prevent damage to the connector. Please respect the recommended temperature ranges shown below.

|            | Temperature Range |                |
|------------|-------------------|----------------|
| Storage:   | 4° - 140° F       | -15.5° - 60° C |
| Operation: | 60° - 90° F       | 15.5° - 32° C  |

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### Control Features

The three red control buttons perform these functions:

- **ZERO/ON** - This button is used to turn on the gage. It can also be used to set the True Spindle position. See the “Trouble Shooting the Aero-Almen Gage” section for more information on this feature.
- **M/OFF** - This button, when pushed and held for three (3) seconds turns the unit off.
- **Inch/mm** - This button allows selection of the display in inches or millimeters.



### Quick Switch (Millimeters to Inches)

Pressing the inch/mm button to change measurement units from millimeters to inches results in a five (5) digit display (0.00000 inch), with a resolution of 0.00005 inch.

If a display of only four (4) digits (0.0000) in inches is preferred, use the following steps to reprogram the indicator.

1. Turn on the Aero-Almen Gage by pressing ZERO/ON.
2. Press inch/mm to change the scale to inches.
3. Press the M/OFF and inch/mm buttons at the same time (M1 will appear on the bottom left of the display).
4. Press M/OFF four (4) times.
5. Press inch/mm six (6) times until the display shows 0.0001.
6. Press M/OFF to exit the programming mode.

### Factory Default Settings

**Indicator Polarity** – The indicator should be in the Reverse Measurement Direction mode as indicated by “R” at the bottom of the display. This allows positive numbers to be shown on the display as the indicator extends into the concave arc of the Aero-Almen strip. If the “R” is not shown, see the Trouble Shooting section to return to the Reverse Measurement Direction Mode.

**Resolution** – The indicator is factory set to the Metric mode and the resolution is three (3) decimal places (for example, 0.600 mm). If the English mode is required, the resolution will be set at five (5) decimal places (for example, 0.00240 inch) by default. To change the resolution to four (4) decimal places see “Quick Switch mm to inch – with Resolution to 0.0001 inch.”

### Flat Check Block

A Flat Check Block is supplied with the Aero-Almen gage. The flat side is precision lapped to a flatness of 2 HLB (2 Helium Light Bands) or better and is used to zero the gage.

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## How to Use the Aero-Almen Gage

### Strip Qualification

The flatness of an Aero-Almen strip is an important contributor to an accurate blast intensity measurement; therefore, the flatness of an Aero-Almen strip must be measured before blasting. To measure an Aero-Almen strip's flatness, insert an unused strip onto the measurement platform, and lower the ballast until the spring fingers pinch the strip. Make sure that the ballast is securely resting at the bottom of travel of the four guideposts. This assures that the spring-loaded fingers are in proper alignment for accurate readings. Read the value in the display. If the value is greater than .0015 inch, do not use that strip. If the strip value is less than .0015 inch, the strip can be used.



### Measuring the Blast Intensity

The blasting technique for the test strip should be the same as will be used on the aircraft, keeping the stand-off distance, stroking time, media feed rate and air pressure fixed. Remove the strip from the holder after it has been blasted and place it onto the measurement platform of the Aero-Almen Gage. Lower the ballast until the spring-fingers pinch the strip. Make sure that the ballast is securely resting at the bottom of travel of the four guideposts. This assures that the spring-fingers are in proper alignment for accurate readings.

Read and record the value on the blasted Aero-Almen strip with a permanent marker on the non-blasted side. Consult practice requirements guide to determine if the blast intensity is within acceptable limits (usually less than .005" is acceptable). If the intensity is too high, increase the standoff distance, decrease the air pressure, or do both. If the intensity is too low, decrease the standoff distance, increase the air pressure, or do both.

Verify the validity of the measurement by removing and replacing the strip into the gage. The indicator reading should repeat within .0001". If it does not repeat the reading as expected, continue to take readings to ascertain the actual value. If problems persist, place the Flat Check Block on the gage and zero.

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## Maintenance

### Replacing the Battery

A warning message appears in the gage's display when the batteries need to be replaced (Figure 1). The Aero-Almen Gage has a battery tray that holds two (2) CR2450 lithium batteries.

To change the batteries:

1. Using a small flat-blade screwdriver, carefully slide the blade into the opening and release the battery holder from its locked position (Figure 2).
2. Once the battery holder is unlocked, grasp it with your fingers and pull the battery holder out (Figure 3).
3. The batteries are on the underside of the tray (Figure 4).
4. Remove the expired batteries and place the new batteries positive side up in the tray (Figure 5). The current Almen gage set-up and calibration information are retained while the batteries are replaced.
5. Place the battery holder in the battery compartment and push it in until it locks into position.



**Figure 1.** Battery Low



**Figure 2.** Open tray carefully with a flat blade screwdriver.



**Figure 3.** Grasp and pull the battery tray.



**Figure 4.** The batteries are held on the underside of the tray.



**Figure 5.** Batteries are placed with positive side up

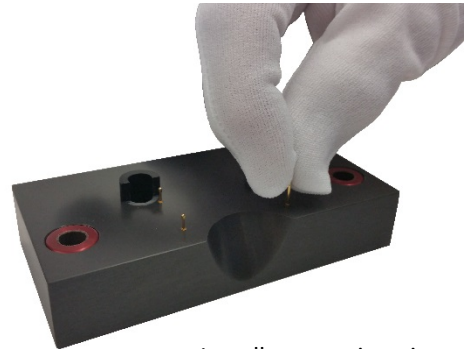
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### Replacing the Spring-Fingers

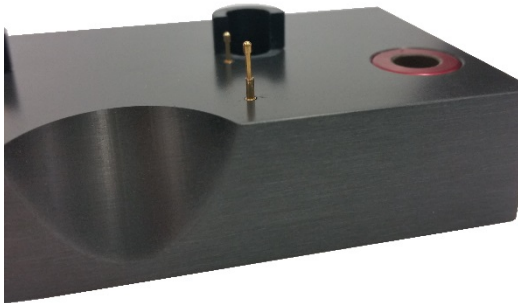
Check each spring-finger for freedom of movement by gently pushing on it. It should retract and extend freely. If a spring-finger is damaged it should be replaced. Extra spring-fingers are included with the purchase of the Aero-Almen gage. Additional spring-fingers may be ordered from Electronics Inc. Fingers are sold in quantities of ten (10) springs per package (part number 999206).



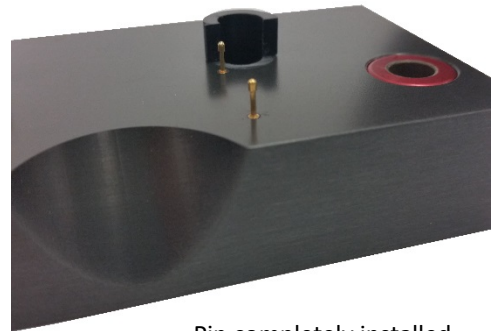
Remove defective spring pin



Install new spring pin



Pin partially installed



Pin completely installed

## Calibration

Periodic calibration of the Aero-Almen Gage is important to assure process repeatability and accuracy. The gage should be calibrated annually or sooner if it appears to be damaged or inaccurate. Return the gage to Electronics Incorporated or an Authorized Distributor for calibration.

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### Optional Equipment

Entering multiple measurements is quick and easy with the Computer Interface Device.

The device plugs into a computer's USB port and pulls the value displayed on the Aero-Almen Gage directly into a computer program (Excel, Word, or similar software).

The Computer Interface Device eliminates data entry errors and accelerates the measurement process. A push-button or foot switch controls the device. There are no power requirements as the device is powered from the USB port and there are no drivers to load.

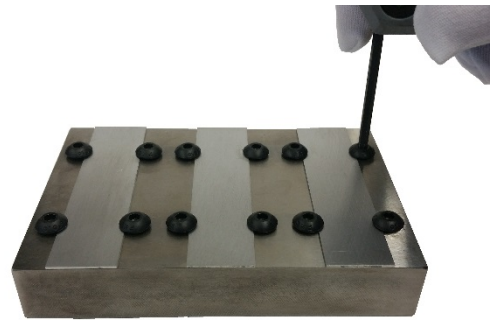
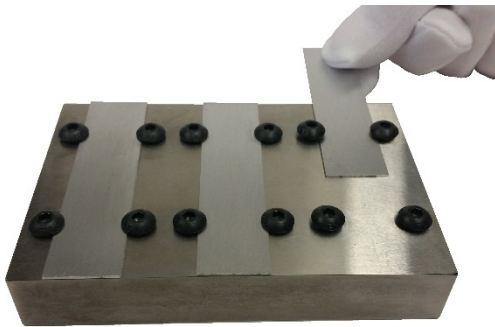
See [www.electronics-inc.com](http://www.electronics-inc.com) for more information.



Computer Interface EI# 999144

### Aero-Almen Strip Holder

The Aero-Almen strip holder is a convenient and secure way to expose strips to the blast stream. All holders are hardened to minimum HRc 58 so the surface can be re-finished to maintain surface flatness requirements. Screws for strip attachment are supplied with each block. To order, ask for part number 999114.





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### Replacement Parts

Replacement parts may be ordered from Electronics Incorporated. Please specify the part number and the Almen gage serial number when ordering.

| Part Number | Description  |
|-------------|--|
| 980105      | Replacement gage head with extra label             |
| 999155      | μMaxμm II Digital Indicator                        |
| 999206      | Replacement Pins, Spring S-1-D-3.8-G D/C (10 pack) |
| 999156      | Replacement Bushing                                |
| 999144      | μMaxμm II Interface System for Digital Data Output |
| 999150      | CR2450 Battery – two (2) required                  |
| 999152      | Indicator Tip                                      |
| 970187      | Adaptor Collar                                     |
| 999272      | Flat Check Block                                   |

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### Trouble Shooting the Aero-Almen Gage

If the Aero-Almen gage indicator is flashing, the gage will not zero, or the resolution needs to be changed, the following instructions will return the gage back to its factory default settings and remedy these conditions.

**Perform every step—one through six—in sequence until the problem is resolved.** If more assistance is needed, please call Electronics Incorporated Customer Service Department at 1-800-832-5653 (USA and Canada) or (574) 256-5001.

#### Step One

- Press M/OFF and the inch/mm button at the same time. "M1" will appear on the screen.
- If the "R" is not on the bottom left side of the screen, press ZERO/ON button until the "R" is on the screen.
- If the "X1" is not on the bottom center of the screen, press the inch/mm button until "X1" is selected.

#### Step Two

Press M/OFF button. "M2" will appear on the screen and it should read **000.0000**.

- If "-" precedes the digits, press the ZERO/ON button to remove it.
- Press the inch/mm button to move the cursor over to the first non-zero digit to be changed.
- Press the ZERO/ON button repeatedly to toggle through numbers until "0" is displayed. Repeat for other digits not at "0."

#### Step Three

Press M/OFF button. "M12" will appear on the screen and it should read **000.0000**.

- If "-" precedes the digits, press the ZERO/ON button to remove it.
- Press the inch/mm button to move a cursor over to the first non-zero digit to be changed.
- Press the ZERO/ON button repeatedly to toggle through numbers until "0" is displayed. Repeat for other digits not at "0."

#### Step Four

Press M/OFF button. "M23" will appear on the screen and it should read **000.0000**.

- If "-" precedes the digits, press the ZERO/ON to remove it.
- Press the inch/mm button to move a cursor over to the first non-zero digit to be changed.
- Press the ZERO/ON button repeatedly to toggle through numbers until "0" is displayed. Repeat for other digits not at "0."

#### Step Five

- Press M/OFF button. "M13" will appear on the screen. This is the Digital Resolution Mode screen
- When using the mm mode – press the inch/mm button repeatedly to select **0.001**.
- When using the inch mode – press the inch/mm button repeatedly to select **0.0001**.

#### Step Six

- Press M/OFF button - the gage will be in run mode.
- Place the flat side of the curved check block on top of gage and press the ZERO/ON button.
- The indicator will read 0.000 mm if in metric mode or 0.0000 if in English mode.
- The bottom of the screen will read "R X1 mm" or "R X1 in".

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### **Check or Set the Spindle Starting Position**

To evaluate the Spindle Starting Position, you must first enter the True Spindle Mode. Press the ZERO/ON button for three (3) seconds (the "X1" will disappear when in True Spindle Mode). The value of the Spindle Starting Position should be set to 0.0000 inch + 0.0010 inch (0.000 mm + 0.025 mm). If the Spindle Starting Position is out of tolerance, reposition the indicator on the frame using the instructions below or call Electronics Incorporated or an Authorized Distributor for assistance.

#### **Instructions:**

Loosen the 8 mm gland nut holding the indicator and adjust the indicator placement on the frame until the Spindle Starting Position is within tolerance. Carefully tighten the gland nut and be sure the indicator is secure (does not move or rotate and the Spindle Starting Position does not change as the gland nut is tightened. Place a dab of proof lacquer at the gland nut and stem as a tamper-proof seal.

## **Instruction Manual Model Aero-Almen Gage**

### **Limited Warranty**

The warranty obligations of Electronics Inc. for this product are limited to the terms set forth below.

#### **Length of Warranty Period**

This limited warranty lasts one (1) year from the shipping date of this product from Electronics Inc. or an Authorized Distributor.

#### **What is Covered**

This limited warranty covers defects in materials and workmanship in this product.

#### **What is Not Covered?**

This limited warranty does not cover any damage or deterioration of this product resulting from any alteration or modification, improper or unreasonable use or maintenance, or improper handling or storage.

#### **How to Obtain a Remedy Under This Limited Warranty**

To obtain a remedy under this limited warranty, contact Electronics Inc. or an Authorized Distributor from whom this product was purchased. If it is determined that this product must be returned under this limited warranty, then a Returned Goods number (RG), obtained from Electronics Inc., will be required. This product should be properly packed, preferably in the original carton, for shipping. Cartons not bearing an RG number will require additional processing time. Shipping and insurance charges must be prepaid; Electronics Inc. is not responsible for these expenses.

#### **What Electronics Inc. Will Do Under This Limited Warranty**

Electronics Inc. will, at its sole discretion, provide one of the following two remedies to whatever extent it shall deem necessary to satisfy a proper claim under this limited warranty:

- Repair the product. Electronics Inc. will pay the shipping costs necessary to return this product to the customer once the repair is complete.
- Replace this product with a comparable current model. Electronics Inc. will pay the shipping costs necessary to replace this product.

#### **Limitation on Liability**

The maximum liability of Electronics Inc. under this limited warranty shall not exceed the actual purchase price paid for the product. Electronics Inc. is not responsible for direct, special, incidental or consequential damages resulting from any breach of warranty or condition, or under any other legal theory to the maximum extent permitted by law.

#### **Exclusive Remedy**

To the maximum extent permitted by law, this limited warranty and the remedies set forth above are exclusive and in lieu of all other warranties, remedies and conditions, whether oral or written, express or implied to the maximum extent permitted by law, Electronics Inc. specifically disclaims any and all implied warranties, including, without limitation, warranties of merchantability and fitness for a particular purpose. If Electronics Inc. cannot lawfully disclaim or exclude implied warranties under applicable law, then all implied warranties covering this product, including warranties of merchantability and fitness for a particular purpose, shall apply to this product as provided under applicable law.

#### **Rights under State Law**

This warranty defines specific legal rights about these products provided by Electronics Inc. Legal rights may also vary from state to state.