

Instruction Manual

Model TSP-3 #2 Almen Gage



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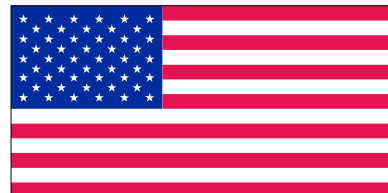
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Electronics Inc.

Shot Peening Control



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Contents

1. Description	3
2. General Information	3
3. Environment	4
4. Control Features	4
5. Quick Switch mm to inch – with Resolution 0.0001 inch	4
6. Factory Default Settings	5
7. Curved Check Block	5
8. Measure Pre-bow of a New (Unpeened) Almen Strip	6
9. Measure a Peened Almen Strip	6
10. Battery	7
11. Calibration	8
12. TSP-3 Computer Interface Device	8
13. Data Collection Curved Check Block Weekly Readings	9
14. Trouble Shooting Model TSP-3	10
15. Limited Warranty	12

Instruction Manual Model TSP-3 #2 Almen Gage

1. Description

- 1.1. The model TSP-3 #2 Almen Gage is manufactured to the specifications of SAE J442 **Test Strip, Holder and Gage for Shot Peening**. It is a precision device used for measuring the curvature of a metal test coupon called an Almen strip. It has a calibrated electronic digital indicator with a low-force spindle spring to provide highly accurate and repeatable measurements. This gage will provide many years of trouble-free service if properly maintained.
- 1.2. A Curved Check Block is supplied with each gage for checking the condition of the gage weekly.
- 1.3. The gage should be calibrated (both indicator performance and inspection for ball wear) annually or more frequently if conditions warrant.
- 1.4. 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.

2. General Information

2.1. Viewing angle

- 2.1.1. The gage is normally used when the operator is in a sitting position with the gage oriented as shown in Figure 1.
- 2.1.2. The operator may use the gage while standing by rotating the indicator bezel 180° and then placing the gage into the inverted position (Figure 2).



Figure 1. Gage shown when in sitting position with Curved Check Block in measuring position (Display in inch mode).



Figure 2. Gage shown when in standing position with Curved Check Block in measuring position (Display in inch mode).

Instruction Manual Model TSP-3 #2 Almen Gage

3. Environment

The indicator is built to withstand severe use. It has a gasket sealed case, hard crystal display window and durable stem assembly to resist most dust and fluids. The gage should never be immersed in liquid as this will cause damage to 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

4. Control Features

Three red control buttons on the display perform various user functions (Figure 3).

- 4.1. **ZERO/ON:** This button is used to turn the unit “ON”. It can also be used to set the True Spindle position. See Trouble Shooting Section 14.7 for more information on this feature.
- 4.2. **M/OFF:** This button, when pushed and held for three (3) seconds turns the unit “OFF”.
- 4.3. **inch/mm:** This button allows selection of the display in inches or millimeters.



Figure 3. Red Control buttons

5. Quick Switch mm to inch – with Resolution 0.0001 inch.

SAE J442 requires Almen gage indicators to have a resolution of 0.001 mm; therefore, the TSP-3 #2 Almen gage is factory set to display 0.000 mm, with a 0.001 mm resolution.

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.

- 5.1. Turn on the TSP-3 by pressing ZERO/ON.
- 5.2. Press inch/mm to change the scale to inches.
- 5.3. Press the M/OFF and inch/mm buttons at the same time (M1 will appear on the bottom left of the display).
- 5.4. Press M/OFF four (4) times.
- 5.5. Press inch/mm six (6) times until the display shows 0.0001.
- 5.6. Press M/OFF to exit the programming mode.

Instruction Manual Model TSP-3 #2 Almen Gage

6. Factory Default Settings

6.1. Indicator Polarity

6.1.1. The indicator should be in the Reverse Measurement Direction mode as indicated by “R” at the bottom of the display. This allows for positive numbers to be shown on the display as the indicator extends into the concave arc of the Almen strip. If the “R” is not shown, see Section 14 to return to the Reverse Measurement Direction Mode.

6.2. Resolution

6.2.1. Metric mode resolution is factory set to three (3) decimal places (e.g. 0.600 mm).

6.2.2. “If English mode is required, the resolution will be set at five (5) places (e.g., 0.00240 inch) by default.”

6.2.3. See Section 5 to change the resolution to only four (4) places.

7. Curved Check Block

The Curved Check Block should be used weekly to check the repeatability of the gage. It is important to make initial “first-time use” readings of the check block as a comparison for the weekly readings. Any changes in the weekly average readings may require service or calibration. Follow the instructions in Section 13, Data Collection Curved Check Block Readings.

7.1. The flat side of the Curved Check Block is certified flat to set relative zero (Figure 4).

7.2. The curved side of the Curved Check Block is for weekly inspections to check the repeatability of the Almen gage (Figure 5). The curved side is NOT certified or calibrated. It is for reference only.



Figure 4. Place flat side of the Curved Check Block on the gage



Figure 5. Place the curved side of the Curved Check Block on the gage

Instruction Manual Model TSP-3 #2 Almen Gage

8. Measure Pre-bow of a New (Unpeened) Almen Strip

- 8.1. Push the ZERO/ON button to turn the gage "ON".
- 8.2. Place the flat side of the Curved Check Block on the gage with the indicator tip touching the flat side. Push the ZERO/ON button to achieve 0.000 in the display (Figure 4).
- 8.3. Place a new (unpeened) Almen strip onto the measurement position (Figure 6). Be sure the strip touches the back posts and is centered between the end posts. Read and record the pre-bow (also called flatness). Turn the strip over and measure the opposite side. If the reading from either side exceeds the specification value, then discard the strip. (See Table 1 for common examples of acceptable pre-bow).

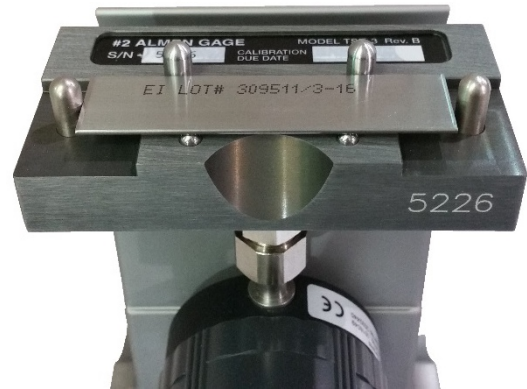


Figure 6. Unpeened Almen Strip

Table 1. Examples of common industry Almen strip requirements for maximum pre-bow			
Specification	Grade	mm	Inch
AMS2432, Shot Peening, Computer Monitored	A1-S, N1-S	±0.013	±0.0005
AMS2430, Shot Peening	A-1, N-1	±0.025	±0.001
J442, Test Strip, Holder and Gage for Shot Peening	A-1, N-1	±0.025	±0.001
MIL-S-13165 Shot Peening of Metals (Canceled)	A-2, N-2	±0.038	±0.0015

9. Measure a Peened Almen Strip

- 9.1. Push the ZERO/ON button to turn the gage "ON".
- 9.2. Always zero the gage before measurement of a strip by placing the flat side of the Curved Check Block on the gage with the indicator tip touching the flat side. Push the ZERO/ON button to achieve 0.000 in the display.
- 9.3. Place the peened Almen strip onto the measurement position with the indicator tip touching the non-peened side (concave side) of the strip (Figure 7). Read the value of the arc height shown in the display.
 - 9.3.1. Remove the strip and place it once again on the gage. Do this three (3) times to assure you have an accurate reading.
- 9.4. When finished push the M/OFF button for three (3) seconds to turn the gage "OFF".
 - 9.4.1. The gage automatically turns "OFF" if it is not active for 15 minutes.



Figure 7. Place strip onto gage with indicator tip touching the non-peened side of strip

Instruction Manual Model TSP-3 #2 Almen Gage

10. Battery

- 10.1. A warning message appears in the gage's display when the batteries need to be replaced (Figure 8).
- 10.2. The Almen gage has a battery tray that holds two (2) CR2450 lithium batteries.
- 10.3. To change the batteries:
 - 10.3.1. Do NOT remove indicator from the frame. See images below.
 - 10.3.2. Using a small flat-blade screwdriver, carefully slide the blade into the opening and release the battery holder from its locked position (Figure 9).
 - 10.3.3. Once the battery holder is unlocked, grasp it with your fingers and pull the battery holder out (Figure 10).
 - 10.3.4. The batteries are on the underside of the tray (Figure 11).
 - 10.3.5. Remove the expired batteries and place the new batteries positive side up in the tray (Figure 12). The current Almen gage set-up and calibration information are retained while the batteries are replaced.
 - 10.3.6. Place the battery holder in the battery compartment and push it in until it locks into position.
- 10.4. The gage automatically turns off after 15 minutes of no activity.



Figure 8. Battery Low



Figure 9. Open tray carefully with a flat blade screwdriver.



Figure 10. Grasp and pull the battery tray.



Figure 11. The batteries are held on the underside of the tray.



Figure 12. Batteries are placed with positive side up.

Instruction Manual Model TSP-3 #2 Almen Gage

11. Calibration

Periodic calibration of the 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.

An Almen Gage Calibration Kit is available for purchase from Electronics Incorporated or an Authorized Distributor. The kit contains an instruction manual and all of the equipment needed to inspect and qualify the gage (Figure 13).

To perform an in-house calibration, refer to SAE J442 Test Strip, Holder and Gage for Shot Peening for industrial applications and SAE AMS 2432 Shot Peening, Computer Monitored for aerospace applications.

Refer to the Mahr Federal Incorporated Digital Indicator Manual P/N 2249001 Rev C included with the gage for additional information.



Figure 13. Almen Gage Calibration Kit
EI # 999430

12. TSP-3 Computer Interface Device

Entering multiple measurements is quick and easy with the TSP-3 Computer Interface Device. The device plugs into a computer's USB port and pulls the value displayed on the Electronics Incorporated #2 Almen Gage directly into a computer program (Excel, Word, or similar software). The TSP-3 Computer Interface Device eliminates data entry errors and accelerates the measurement process. The device is controlled by a push-button or foot switch. There are no power requirements as the device is powered from the USB port and there are no drivers to load (Figure 14).

See www.electronics-inc.com for more information.



Figure 14. Computer Interface EI# 999144

Instruction Manual Model TSP-3 #2 Almen Gage

13. Data Collection Curved Check Block Weekly Readings

- Instructions:**
1. Zero the Almen gage with the certified flat side of the Curved Check Block, then push the ZERO/ON button.
 2. Measure the check block five (5) times with the indicator tip touching the **curved side** of the check block and record below.
 3. Calculate the average of the five (5) readings and place average value in the Average column.
 4. Make a weekly comparison of the calculated average reading to the initial first use average reading.
 5. Continue using the gage if the new average is within ± 0.005 mm of the first-use average.
 6. STOP using the Almen gage if the new average is greater than ± 0.006 mm from the first use average value.
 7. Return the Almen gage to Electronics Incorporated or an Authorized Distributor.

Date	Collected By	1	2	3	4	5	Average

Instruction Manual Model TSP-3 #2 Almen Gage

14. Trouble Shooting Model TSP-3

If the TSP-3 #2 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**".

Instruction Manual Model TSP-3 #2 Almen Gage

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 **0.000 mm ± 0.025 mm** (0.000 inch ± 0.001 inch). 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 TSP-3 #2 Almen Gage

15. 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.