

# TSP-3 Almen Gage



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

## Electronics Inc.

56790 Magnetic Drive

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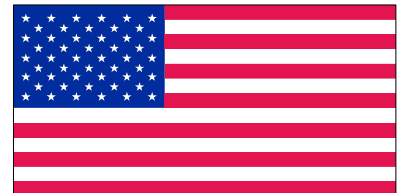
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## 1. Description

The TSP-3 Almen Gage is a precision device used for measuring the deflection or curvature of a metal test coupon called an Almen strip. It is fitted with a calibrated high accuracy electronic digital indicator with a low-force spindle spring to provide highly accurate and repeatable measurements.

Treated properly, this gage will give many years of trouble-free service. A curved “Check Block” is supplied with each gage to allow the owner to check the condition of the gage weekly. The gage should be re-calibrated (both indicator performance and ball wear) annually or more frequently if conditions warrant. The gage comes with 2 batteries installed and an expected battery life of greater than one year. The batteries are easily replaced without loss of calibration.

The digital indicator has an accuracy exceeding 0.005 mm (over a range of 0 – 0.600mm). For additional information see:

Use of Almen Gage	U.S. Patent 2,350,440
Construction of Gage	SAE J442
Use of Gage	SAE J443
Shot Peening Practice	SAE HS-84
Digital Data Output	A-274 rev.A Mahr Federal Inc.

## 2. Quick Start

- A. To turn the unit on, push the **ZERO/ON** button.
- B. Place the flat side of the “Check Block” onto the gage with the indicator tip touching the flat side.
- C. Push the **ZERO/ON** button to zero the display.
- D. Place the “Check Block” onto the gage with the indicator touching the curved side. The reading should be in the range of  $0.600 \pm 0.050\text{mm}$ .
- E. Refer to the “Weekly Check Block Log” (sample on page 11) for the expected value. If the average value is within 0.005mm of the initial average, continue using the gage. If the average value is 0.006mm or greater, return the gage to Electronics Incorporated for service.
- F. Select a new Almen strip and place it on the gage to check its flatness. Be sure to measure both sides of the strip to determine the pre-bow (flatness) on the display. The larger number, regardless of positive or negative sign, is used as the flatness value.  
**Note:** *Because of Almen strip thickness and twist variations, the flatness values may not be the same from one side of the strip to the other.*

**Note:** *Because of production tolerances, the actual value of the check block is not known with NIST certainty. However, the actual value is not important. The check block readings that are taken and then compared on a weekly basis are what are important. This procedure allows detection of a change in the gage condition in your shop that warrants attention.*

Common flatness limits are listed below:

Mil-S-13165	0.038mm or 0.0015"	Grade 3 or 2 Almen strip
SAE J 442	0.0254mm or 0.001"	Grade A1 Almen strip
SAE AMS 2432	0.0127mm or 0.0005"	Grade A1-S Almen strip

If the strip flatness is within (the appropriate) specification, thenpeen the strip.

### 3. General Information

#### A. Gage Viewing Angle

The Almen gage indicator face can be easily rotated to change the viewing angle, and can be used while the operator is sitting or standing at a bench.



#### B. Automatic shut-off

To conserve battery power and prolong battery life the Almen Gage uses an automatic power-down routine to turn itself "off" after approximately 15 minutes of no activity. The unit may be turned "on" again by momentarily pressing the **ZERO/ON** button.

#### C. Blanking of last (5th) digit (English units mode only, not metric mode)

The following procedure is used to select these options.

1. Press and hold **M/OFF** - then press and release the **inch/mm** for the M1 icon.
2. Press and release the **M/OFF** button 4x's for "M1 3".
3. Press **ZERO/ON** until desired resolution (in inch read .0001 metric .001).
4. Press and release the **M/OFF** button until the gage returns to the gauging mode (no "m" icon is displayed).

#### D. Environment

The indicator is built to withstand severe use. The gasketed case, hard crystal display window lens and durable stem assembly resist encroachment of most dusts and fluids, however, the Almen Gage should never be immersed in any liquid as this will damage the unit. Regularly inspect the unit's seals and boots to guard against the possibility of contamination. The dust cap for the electronic 7-pin SPC output port connector should always be in place whenever an output cable is not attached in order to prevent damage to the connector.

#### E. SPC Data Port

	Temperature Range
Storage:	4° - 140° F
Operation:	60° - 90° F

For additional information on the use of the SPC Data Port output, see the Mahr Federal Inc. document, A-274rev.A included with the Almen Gage.



Figure 2: Indicator Face

### 4. Description of Control Buttons

#### A. ZERO/ON

This control button performs several different functions.

##### 1. ON

The primary function of the **ZERO/ON** button is to turn the indicator “on”. If the unit is “off” (nothing shown in the display window), push the **ZERO/ON** button momentarily to turn the indicator “on”. When any digits or symbols are shown in the indicator display window the unit is “on”.

##### 2. ZERO

The second function of the **ZERO/ON** button, when power is already on, is to set the digital display to zero. This mode is sometimes referred to as “Relative” mode. Readings displayed after this mode is selected are “Relative” to this zero setting at the sur-

face of the flat side of the “Check Block”. If the unit is “on”, push the **ZERO/ON** button momentarily and the indicator will function in the “Relative” mode.

3. True Spindle Mode

The third function of the **ZERO/ON** button, when power is already on, is to set the indicator into “True Spindle Position” mode. Readings displayed after this mode is selected are “Absolute”, i.e. they indicate the actual physical position of the spindle relative to the mechanical center of the spindle travel. Use a certified flat surface if the unit is “on”, push and hold the **ZERO/ON** button for approximately one (1) second.

4. Cycle values in the Access Setup Mode.

The final function of the **ZERO/ON** button is to change values on the display during set up and calibration.

B. M/OFF

1. The primary function of this button is to turn the unit “off”. The **M/OFF** button must be pushed and held for approximately two (2) seconds in order to turn the unit “off”. This prevents accidental turn off. When the unit is “off” no digits or symbols will be shown in the indicator display window.

2. Access Setup Mode

The secondary function of the **M/OFF** button is to place the unit into one of six setup modes. These modes are:

I. Measurement direction / analog scale magnification (M1)

a) Measurement direction - The #2 Almen gage must read positive numbers for the extension of the indicator stem (spindle) and therefore the indicator must be in the “R” or “reversed mode” direction. Press and hold the **M/OFF** button and then press and release the **inch/mm** button (mode M1). Press and release the **ZERO/ON** button. The “R” icon will appear in the display to indicate reversed mode operation. This is the correct mode for the TSP-3 Almen gage.

Press the **M/OFF** button (5) times to exit this calibration mode.

You should now see “R” “x1” “in” at the bottom of the display window.

b) Analog Scale Magnification – This setting determines the amount of the full-scale range represented by the bar-graph display. The choices are blank, x1, x5, x10, x50. Push the **inch/mm** button to obtain the “x1” icon for Almen gage applications.

I. Press the **M/OFF** button (5) times to exit this calibration mode.

You should now see “R” “x1” “in” at the bottom of the display window.

II. Pre-set value setting (M2)

Not used for Almen gage readings.

III. Limit #1 tolerance entry (M12)

Not used for Almen gage readings.

IV. Limit #2 tolerance entry (M23)

Not used for Almen gage readings.

V. Resolution (M1 3)

Press and hold the **M/OFF** button and then press and release the **inch/mm** button (mode M1). Press and release **M/OFF** button until “M1 3” appears.

a) English- Indicator display should read .0001 or press **ZERO/ON** button for desired resolution (ex. .00005, .0001, .0002, .0005 and .001). Press the **M/OFF** button (1) times to exit this calibration mode. You should now see “R” “x1” “in” at the bottom of the display window.

b) Metric- Indicator display should read .001 or press **ZERO/ON** button for desired resolution (ex. .001, .002, .005, .01 and .02). Press the **M/OFF** button (1) times to exit this calibration mode. You should now see “R” “x1” “in” at the bottom of

the display window.

#### VI. Calibration (M 3)

Press and hold the **M/OFF** button and then press and release the **inch/mm** button (mode M1). Must have a certified flat block on the gage. On “M1 3” screen press and hold **M/OFF** button for 2 seconds. The M 3 screen will appear. Calibrate using master calibrator or gage block. Press the **M/OFF** button (1) times to exit this calibration mode. Put back into reverse mode. (see 4.2.2 A1) You should now see “R” “x1” “in” at the bottom of the display window.

#### C. **inch/mm**

The primary function of this button is to select the inch or metric display option. When the unit is “on” momentarily push the **inch/mm** button and the function will alternate from inch to metric or from metric to inch. Push the **inch/mm** button momentarily again to revert to the opposite mode.

#### D. Access Misc. Functions - not used for #2 Almen gage.

### 5. Battery Power Management

To conserve battery power and prolong its life the  $\mu$ Max $\mu$ m indicator should be turned “off” when not in use. The operator can do this manually or it will be done automatically by a built-in sensing circuit.

#### A. Manual Power Off

Pushing and holding the **M/OFF** button for two (2) seconds achieve manual power off.

#### B. Automatic Power Off

Automatic power off is performed by the  $\mu$ Max $\mu$ m after fifteen (15) minutes of inactivity. (i.e. no spindle movement, no buttons pushed and no “data output” request via the SPC data port).

#### C. Restore Power

To restore power to the unit push the **ZERO/ON** button momentarily, or apply a “Data Request” signal via the SPC data port.

### 6. Battery Low Signal



*Figure 6-1 Battery Low Indication*

A. A battery low is indicated when the indicator displays “bALo” . The indicator will not function until new batteries (2) are installed. Use (2) CR2450 cells.

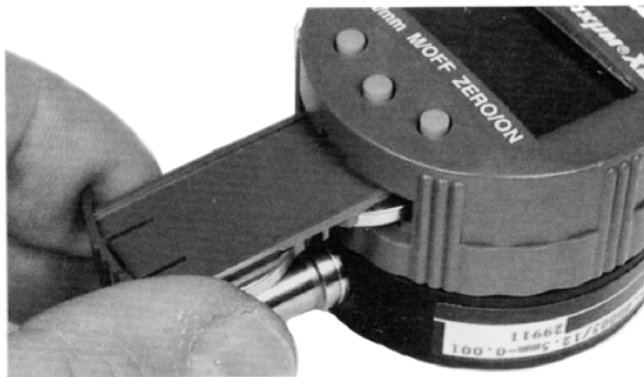
#### B. Changing the Battery

The Almen gage incorporates a battery tray, which holds the two batteries in position. To change the batteries:



*Figure 6-2a Changing The battery*

1. Using a small screwdriver (see figure 6-2a) carefully slide the blade into the opening and release the battery holder from its locked position.



*Figure 6-2b Changing the Battery*

2. Once the battery holder is unlocked (see figure 6-2b) grasp it with your fingers and pull the battery holder out.



*Figure 6-2c Changing the Battery*

3. The battery holder contains two CR2450 style batteries. Remove the two expired batteries and replace them with new ones with the larger diameter into the holder. The current set-up and calibration are retained when battery power is removed.
4. Place the battery holder in the battery compartment and slide it in until it locks into position. (See figure 6-2c).



## 7. Using the Almen Gage

- A. With a properly zeroed gage, place an Almen strip onto the measurement head, firmly seated on the 4-balls, and read the value of the Almen strip. Next, turn the strip over and read the value of the opposite side. Record the reading of the highest magnitude (either plus or minus).



- B. Place the Almen strip onto a proper Almen holder (see SAE J442, SAE J443). Expose the Almen strip to the blast stream, remove it from the holder and place it onto the Almen gage. A negative reading indicates that the strip is placed *upside-down*, on the gage. This occurs when the indicator tip is touching the peened side of the Almen strip. This should be avoided because of the inaccuracy caused by the tip touching the peening indentations. All peening specifications require measurement based upon the concave curvature (indicator tip touching the non-peened side of the Almen strip).
- C. Confirm the accuracy of the measurement by repeating the procedure using the same strip. (*Do not turn the strip upside-down*). The indicator reading should repeat within .001mm. If it does not repeat the reading then check the gage for shot sticking to the magnetic balls. Also check that there are no grooves or imperfections in the round posts that might prevent the strip from sitting properly on the 4-balls. If problems persist, repeat the zero and check-block procedure.

## 8. Using Check Block

The Almen gage should be checked each week for proper operation. After the zero has been established, place the curved side of the check block into measurement position ten times and take the average of those ten readings. The average reading should be recorded each week in the “*Almen Gage Log*”. If the average reading of the check block shows 0.006mm or greater variation from previous readings then the gage should be rejected and returned to Electronics Incorporated for service.

## 9. Digital Data Output

An electrical connection is provided for digital data output. The protective cover should be kept in place when this feature is not in use. For more information on digital data output, request the TSP -3 Interface System document from Electronics Incorporated. The TSP-3 Interface System makes entering multiple measurements quick and accurate. The Interface plugs into an available USB port and inputs the value displayed on the Almen Gage directly into the program (excel, word, etc.) used to store the collected data. The TSP-3 Interface System can be used by pushing the button on the box or by tapping the footpad. This will eliminate typing errors and speed up the measurement process. There are no power requirements, as the Interface is powered from the USB port.

## 10. Maintenance

No regular maintenance, other than cleaning with a dry cloth, is recommended. The Almen gage should be calibrated annually. The customer can perform battery replacement and it is recommended as soon as the indicator displays “bALo”. Use (2) type CR2450 batteries. If the gage shows any signs of obvious abuse or misuse or fails to perform the weekly check-block test, then it should be returned to the Electronics Incorporated for service.

### **DO NOT APPLY ANY OIL OR OTHER LUBRICANTS TO THE INDICATOR.**

**Note:** The indicator should be repositioned on the gage using the standard zero position as outlined in the Federal  $\mu$ Max $\mu$ mâ instruction manual. The attachment of the digital indicator onto the gage is done with a precision factory procedure, which accurately sets the “mechanical zero” to 0.000mm  $\pm$ .001mm position offset. Failure to follow this practice can seriously affect the Almen gage accuracy and performance.

The spindle spring force should be less than 50 gram (force) to prevent distortion of “N” thickness Almen strips. The spindle spring force can be as high as 300 gram (force) when used only with “A” thickness Almen strips.

## 11. 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
980107	Replacement gage head w/ extra label
999155	Digital Indicator for TSP-3B
999156	Replacement Bushing, threaded
999153	Plug & Cable for signal output
999150	Battery (2) required
999152	Contact Point .375 in. diameter, stem, 0.25 long, radiused tip, 4-48 thread.
970187	Adaptor Collar
999271	Curved Check Block, 0.600mm or 0.024” nominal arc height (NOT calibrated)
972000	Calibrated Curved Check Block, 0.600mm or 0.024” arc height (actual value shown on certificate)
972030	Calibrated Step Block Kits set of 5 blocks (metric)
972001	Calibrated Step Block Kits set of 5 blocks (inch)

## **12. Warranty**

The #2 Almen gage is warranted to be free from defects and materials for a period of one (1) year from date of shipment from Electronics Incorporated. Any problems, other than customer abuse or normal wear will be corrected free of charge. Send the gage with freight pre-paid to:

Electronics Incorporated  
56790 Magnetic Drive  
Mishawaka, In 46545 USA

Your repaired gage will be returned freight prepaid via United Parcel Service (UPS) unless specified otherwise (additional cost). Non-warranty work is chargeable and will be quoted in advance. Loaner gages are available in advance. Contact the factory for assistance.

# Almen Gage Log

For Almen Gage Model:	Almen Gage Serial Number:
Check Block Model:	Check Block Serial Number:

Date	by	1	2	3	4	5	6	7	8	9	10	avg.

Instructions: (see owner's instruction manual IM0060 for more information)  
 Zero the Almen gage  
 Measure Checking Block ten times and record the average value  
 Acceptable: if average is .005mm" or less variation from your initial average value  
 Not-Acceptable: if average is .006mm" or greater variation from your initial average, return Almen