

# AOA System

## Owner's Manual



© 2014 Garmin Ltd. or its subsidiaries. All rights reserved.

This manual reflects the operation of System Software version 2.10 for the GI 260, or later. Some differences in operation may be observed when Comparing the information in this manual to later software versions.

Garmin International, Inc., 1200 East 151st Street, Olathe, KS 66062, U.S.A.

Tel: 913/397.8200

Fax: 913/397.8282

Garmin AT, Inc., 2345 Turner Road SE, Salem, OR 97302, U.S.A.

Tel: 503/391.3411

Fax 503/364.2138

Garmin (Europe) Ltd., Liberty House, Bulls Copse Road, Hounslow Business Park, Southampton, SO40 9RB, U.K.

Tel. +44 (0) 870 850 1243

Fax +44 (0) 238 052 4004

Garmin Corporation, No. 68, Zhangshu 2nd Road, Xizhi Dist., New Taipei City 221, Taiwan (R.O.C.)

Tel: 886/02.2642.9199

Fax: 886/02.2642.9099

[www.garmin.com](http://www.garmin.com)

<https://fly.garmin.com/fly-garmin>

Except as expressly provided herein, no part of this manual may be reproduced, copied, transmitted, disseminated, downloaded or stored in any storage medium, for any purpose without the express written permission of Garmin. Garmin hereby grants permission to download a single copy of this manual and of any revision to this manual onto a hard drive or other electronic storage medium to be viewed for personal use, provided that such electronic or printed copy of this manual or revision must contain the Complete text of this copyright notice and provided further that any unauthorized commercial distribution of this manual or any revision hereto is strictly prohibited.

Garmin® is a registered trademarks of Garmin Ltd. or its subsidiaries. These trademarks may not be used without the express permission of Garmin.



## LIMITED WARRANTY

All Garmin avionics products are warranted to be free from defects in materials or workmanship for: two years from the date of purchase for new Remote-Mount and Panel-Mount products; one year from the date of purchase for new portable products and any purchased newly-overhauled products; six months for newly-overhauled products exchanged through a Garmin Authorized Service Center; and 90 days for factory repaired or newly-overhauled products exchanged at Garmin in lieu of repair. Within the applicable period, Garmin will, at its sole option, repair or replace any Components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost. This warranty does not apply to: (i) cosmetic damage, such as scratches, nicks and dents; (ii) consumable parts, such as batteries, unless product damage has occurred due to a defect in materials or workmanship; (iii) damage caused by accident, abuse, misuse, water, flood, fire, or other acts of nature or external causes; (iv) damage caused by service performed by anyone who is not an authorized service provider of Garmin; or (v) damage to a product that has been modified or altered without the written permission of Garmin. In addition, Garmin reserves the right to refuse warranty claims against products or services that are obtained and/or used in contravention of the laws of any country.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL GARMIN BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE OR INABILITY TO USE THE PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

Garmin retains the exclusive right to repair or replace (with a new or newly-overhauled replacement product) the product or software or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

**Online Auction Purchases:** Products purchased through online auctions are not eligible for warranty coverage. Online auction confirmations are not accepted for warranty verification. To obtain warranty service, an original or copy of the sales receipt from the original retailer is required. Garmin will not replace missing Components from any package purchased through an online auction.

**International Purchases:** A separate warranty may be provided by international distributors for devices purchased outside the United States depending on the country. If applicable, this warranty is provided by the local in-country distributor and this distributor provides local service for your device. Distributor warranties are only valid in the area of intended distribution. Devices purchased in the United States or Canada must be returned to the Garmin service center in the United Kingdom, the United States, Canada, or Taiwan for service.

To obtain warranty service, contact your local Garmin Authorized Service Center. For assistance in locating a Service Center near you, visit the Garmin web site at <http://www.garmin.com> or contact Garmin Customer Service at 866-739-5687.



**WARNING:** For safety reasons, this AOA System's operational procedures must be learned on the ground.

---



**CAUTION:** This AOA System does not contain any user-serviceable parts. Repairs should only be made by an authorized Garmin service center. Unauthorized repairs or modifications could void both the warranty and the pilot's authority to operate this device under FAA regulations.

---



**NOTE:** All visual depictions contained within this document, including screen images of the GI 260 displays, are subject to change and may not reflect the most current GI 260 software. Depictions of equipment may differ slightly from the actual equipment.

---



**NOTE:** This product, its packaging, and its Components contain chemicals known to the State of California to cause cancer, birth defects, or reproductive harm. This notice is being provided in accordance with California's Proposition 65. If you have any questions or would like additional information, please refer to our web site at [www.garmin.com/prop65](http://www.garmin.com/prop65).

---



**NOTE:** This AOA System is non-required and is to be used only as supplemental information to the pilot. This AOA System is not to be used or substituted for a certified stall warning system. No operational credit may be taken for reduced approach speed and shorted landing distances.

---



**NOTE:** The approved Pilot's Operating Handbook (POH) or Airplane Flight Manual (AFM) always supersedes this Owner's Manual.

---



**NOTE:** Refer to the AOA System Installation Manual for calibration instructions.

---



**NOTE:** This AOA system is designed to be accurate in the calibrated aerodynamic configuration. When the aircraft experiences changes in the airfoil shape (e.g., flap extension or icing accumulation), the AOA indicator may no longer accurately represent the angle of attack.

---

## Record of Revisions

<b>Part Number</b>	<b>Revision</b>	<b>Date</b>	<b>Description</b>
190-01773-00	A	09/2014	Initial release

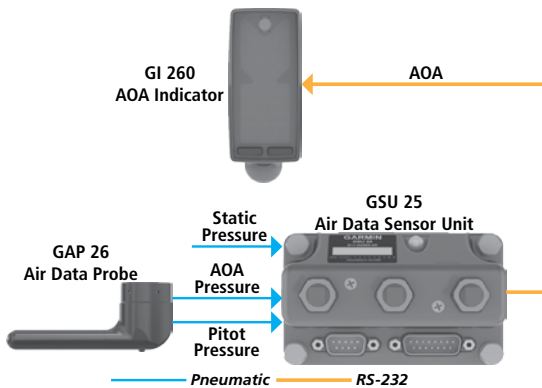
# OVERVIEW

The Garmin AOA (Angle of Attack) System is designed to improve the pilot's awareness of the approximate available remaining lift of the aircraft's wings. The system calculates the approximate AOA (acute angle between the wing chord line and the relative wind) using pitot, AOA, and static air pressure inputs.

When correctly calibrated, the system provides a visual approach AOA reference, as well as increasing caution and warning annunciations as the AOA approaches the wing's maximum coefficient of lift (CL<sub>max</sub>).

# SYSTEM DESCRIPTION

The Garmin AOA System is comprised of three components; the GI 260 Indicator, the GAP 26 Probe, and the GSU 25 Air Data Computer. The GAP 26 sends pitot and AOA air pressure to the GSU 25. The GSU 25 measures the air pressure inputs from the probe and from an independent static source. The GSU 25 then calculates the AOA information and sends it to the GI 260. The GI 260 displays the AOA information to the pilot via ten color-coded LED annunciators. When calibrated correctly (refer to the AOA System Installation Manual for calibration instructions), the system indicates AOA during critical phases of flight. The system also provides awareness of AOA trends toward the target AOA for an approach, as well as visual alerting of critical AOA. When connected to an audio panel or compatible audio system, the GI 260 issues aural alerts of increasing frequency when the system approaches the critical angle of attack.



## AOA System

## GI 260 CONTROLS



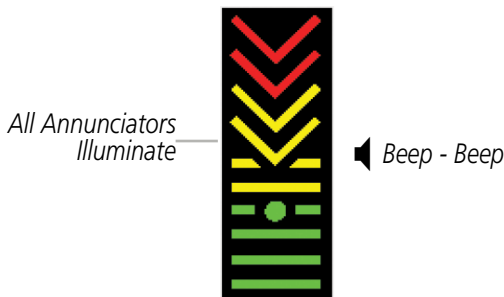
**NOTE:** The **TEST** and **MUTE** functions of the GI 260 are described in this manual. Refer to the AOA System Installation Manual for information on the **CAL** (calibration) and **SET** (alert volume) functions of the GI 260.



GI 260 Controls

### SELF TEST

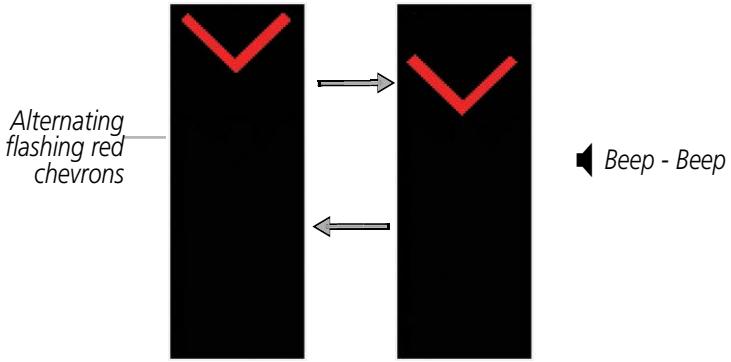
Press the **TEST** (CAL) button at any time to perform a self test of the GI 260. Upon successful completion of the self test, all annunciators illuminate and a “Beep - Beep” audible alert is played.



GI 260 Self Test (Pass)



A failure is indicated by alternating flashing red chevrons and a “Beep - Beep” audible alert.



**GI 260 Self Test (Fail)**

## **MUTE**

### **START-UP**

The system is muted by default upon start-up. The system remains muted until 15 seconds has elapsed since start-up and the Angle of Attack reaches the upper yellow chevron. The first slow audible “Beep-Beep” alert is heard when the upper yellow chevron annunciator illuminates.

### **NORMAL OPERATION**

Press the **MUTE** (SET) button to mute the GI 260 audible alert. When muted manually during normal operation, the audio alert is muted for at least 15 seconds and remains muted until the upper green bar illuminates for at least five seconds.

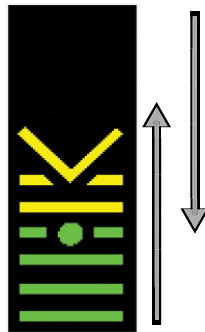
## NORMAL OPERATION



**NOTE:** Refer to the approved Pilot's Operating Handbook (POH) or Airplane Flight Manual (AFM) for recommended operational procedures.

## POWER-UP

The AOA system is ON by default during power-up. During power-up, the unit cycles its annunciators from bottom to top and back to the bottom. For the unit to cycle its annunciators it must receive valid AOA data from the GSU 25, determine it has a valid calibration, and pass the unit self test.



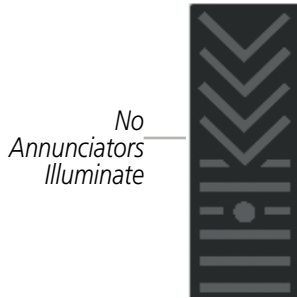
GI 260 Power-Up

## ARMING OF THE AOA SYSTEM

The AOA system arms automatically when the indicated airspeed exceeds 50 knots. Visual annunciations occur immediately upon arming (if applicable). Aural annunciations are delayed for 15 seconds after the system is armed.

## CRUISE CONFIGURATION ANNUNCIATIONS

During flight at low angles of attack (cruise configuration), typically 0-1 annunciators may be illuminated.

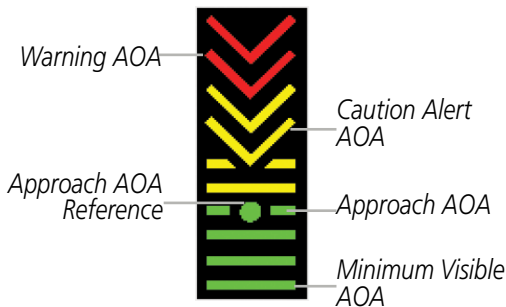


GI 260 (Cruise Configuration)

## APPROACH CONFIGURATION ANNUNCIATIONS

As the angle of attack increases beyond the cruise configuration, the Approach AOA Reference (green circle) annunciator and the green bar annunciators begin to illuminate. The Approach AOA is reached when the green bar annunciators adjacent to the Approach AOA Reference illuminate.

The first slow audible “Beep-Beep” alert is heard when the upper yellow chevron annunciator illuminates. A fast audible “Beep-Beep” alert is heard when the red Warning AOA annunciator illuminates.



GI 260 Display

## APPROACH AOA REFERENCE



**NOTE:** For information on calibrating the Approach AOA, refer to the calibration instructions in Appendix C of the AOA System Installation Manual.

The Approach AOA Reference (green circle) and the adjacent green bar annunciators should be calibrated to coincide with the published approach speed (if provided), or the speed upon crossing the runway threshold that is required in order to achieve calculated (or desired) aircraft landing performance. This speed is typically equal to or greater than 1.3 times the published stall speed in the landing configuration ( $V_{so}$ )

## LOW AOA WITH APPROACH AOA REFERENCE

A low AOA approach is indicated by the illumination of less than four green bar annunciators and the Approach AOA Reference (green circle) annunciator.

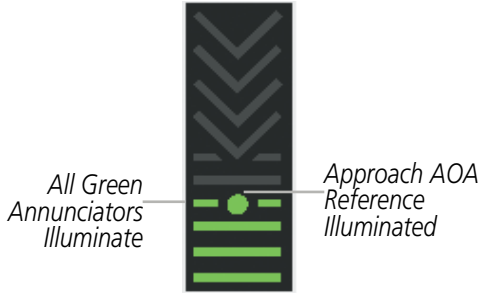


GI 260 (Low AOA with Approach AOA Reference)

## APPROACH AOA

The Approach AOA is intended to align with the landing reference speed or threshold crossing speed. In some aircraft the Approach AOA may be consistent with  $V_{ref}$  and equal to  $1.3 \times V_{so}$  (stall speed in the landing configuration).

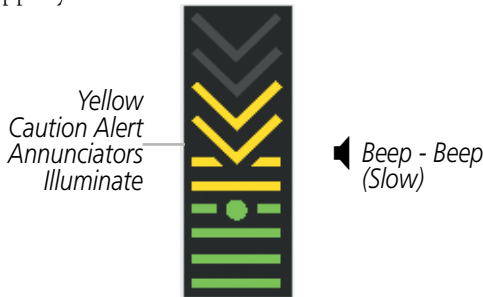
The Approach AOA is indicated by the illumination of all green bar annunciators and the Approach AOA Reference (green circle) annunciator.



**GI 260 (Approach AOA)**

## HIGH AOA WITH AUDIBLE ALERT

A high AOA approach is indicated by the illumination of the yellow Caution Alert AOA bar/chevron annunciators. A slow audible “Beep-Beep” alert coincides with illumination of the upper yellow chevron.



**GI 260 (High AOA)**

## WARNING AOA WITH AUDIBLE ALERT



**NOTE:** For information on calibrating the Warning AOA, refer to the calibration instructions in Appendix C of the AOA System Installation Manual.

The first Warning AOA chevron is intended to coincide with the calibrated flap configuration (typically the landing configuration).

The Warning AOA is indicated by the illumination of the red Warning AOA annunciators and a fast audible “Beep-Beep” alert.



**NOTE:** During the landing flare, the AOA and stall warning may not coincide precisely due to ground effect, mounting of probe, etc.

Warning AOA  
Annunciators  
Illuminate



Beep - Beep  
(Fast)

GI 260 (Warning AOA)

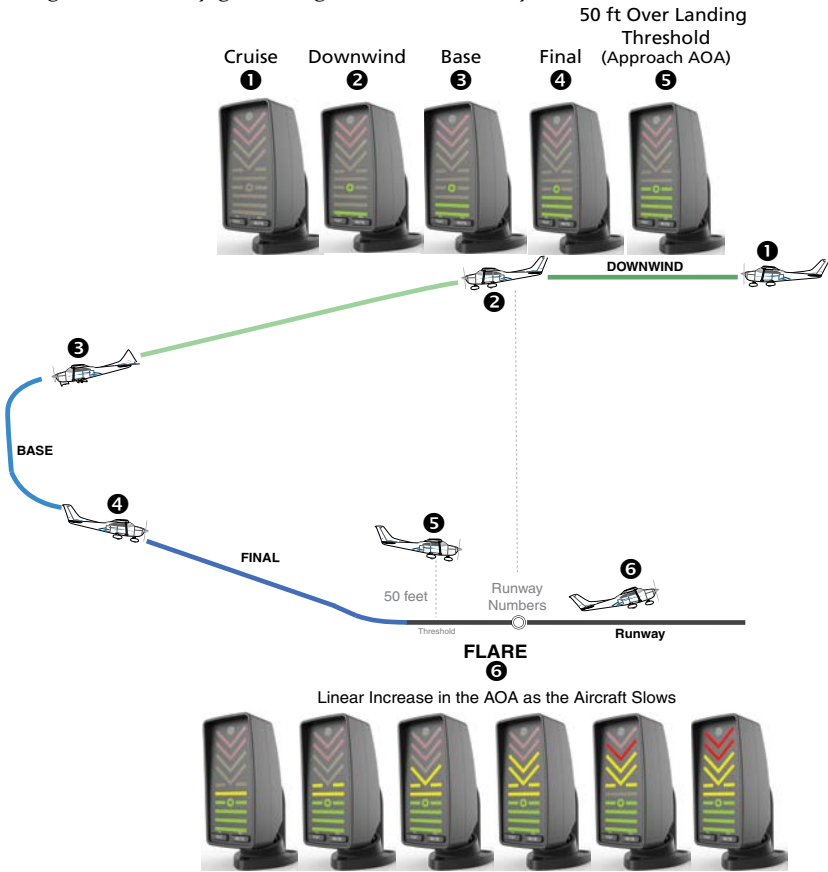
## EXAMPLE APPROACH



**WARNING:** This AOA System is non-required and is to be used only as supplemental information to the pilot, and may not be used as a substitution for the certified aircraft stall warning system.

A correctly calibrated AOA System will provide a linear increase in the AOA indication as the aircraft slows. The bottom red Warning AOA chevron is intended to coincide with the calibrated flap configuration (typically the landing configuration). It is recommended to simulate an approach to landing at a safe altitude to ensure that the lower Warning AOA chevron illuminates concurrently or prior to the first indication of the certified stall warning horn in the landing configuration.

The Approach AOA should be calibrated (refer to Appendix C of the AOA System Installation Manual) at an acceptable margin above CL<sub>max</sub> to fly an approach. As a starting point, use the aircraft manual to determine the stall speed of the aircraft at the **actual gross weight** in the landing configuration. Multiply the calibrated airspeed by 1.3, then convert from calibrated airspeed to indicated airspeed (if necessary). Once the AOA angles have been calibrated, they will be accurate in the calibrated flap configuration, at any gross weight or altitude, every time.



**Example Indications for a Typical Decelerating Approach and Flare**

# ABNORMAL OPERATION

## AOA SYSTEM FAILURE

---

In the event that the GI 260 or the AOA system is malfunctioning, the unit can be powered-down by pulling the associated circuit breaker.

## NUISANCE ALERTS

---

In the event that the AOA System is providing nuisance alerts, press the **MUTE** (SET) button to mute the GI 260 audible alerts. The audio remains muted for at least 15 seconds and remains muted until the upper green bar illuminates for at least five seconds.





Garmin International, Inc.  
1200 East 151st Street  
Olathe, KS 66062, U.S.A.  
Toll free: 800.800.1020 or  
866.739.5687  
p: 913.397.8200  
f: 913.397.8282

Garmin AT, Inc.  
2345 Turner Road SE  
Salem, OR 97302, U.S.A.  
Toll free: 800.525.6726  
p: 503.391.3411  
f: 503.364.2138

Garmin (Europe) Ltd  
Liberty House, Bulls Copse Road  
Hounslow Business Park  
Southampton, SO40 9RB, U.K.  
Toll free (within U.K.) 0808.2380000  
p: 44/0870.8501241  
f: 44/0870.8501251

Garmin Corporation  
No. 68, Jangshu 2nd Road  
Shijr, Taipei County, Taiwan  
p: 886/2.2642.9199  
f: 886/2.2642.9099

[www.garmin.com](http://www.garmin.com)