SANDIA aerospace

SI 205
Radar Altimeter Indicator

Installation Manual

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Record of Revisions

Revision	Date	Description	Approval
IR	10/4/2024	DRN 575	A. Tangen

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Section 1 General Description

1.1 Introduction

This manual describes the installation of the SANDIA aerospace SI 205 Radar Altimeter Indicator, Sandia Part Number 306273-XX. It is intended for use by FAA certified repair stations to install the SI 205 Radar Altimeter Indicator and includes both mechanical and electrical installation information. System configuration and checkout procedures are included. The installer should ensure that all functions are operating according to their intended purpose in their particular installation.

1.2 Radar Altimeter Indicator Product Description

The SI 205 is 1/2 3ATI indicator designed to operate with Garmin Radar Altimeters. It provides the pilot with a means of entering Decision Height. The SI 205 displays Radar Altitude from the Garmin 55/5500 Radar Altimeter and sounds an audible alert and displays a visual alert when Decision Height has been crossed. The SI205 is equivalent to and plug compatible with the Garmin GI 205.

1.3 Technical Characteristics

1.3.1 Physical Characteristics

1.3.1.1 SI 205

1/2 3ATI Panel Cut Out

Behind Panel Dimensions 1.78”H x 3.5”W x 1.87”L (4.52cm x 8.89cm x 4.75cm)

Weight: 0.5 Lbs. (.23 kg)

1.3.2 Electrical

1.3.2.1 Operational Voltage: 11-32Vdc

1.3.2.2 Current: Maximum Brightness and Audio
14Vdc 120 mA
28Vdc 60 mA

1.3.2.3 Display

128x64 Dot Matrix OLED
Altitude Display Range: -40 to 2500 Ft
Unrounded Altitude Display Resolution: 1 Ft throughout the range

Fixed Wing Setting		Rotorcraft Setting	
Range (Ft)	Resolution (Ft)	Range (Ft)	Resolution (Ft)
0 to 200	5	0 to 50	1
200 to 1500	10	50 to 200	5
1500 to 2500	50	200 to 2500	10

Figure 1-1
Rounded Altitude Display Resolution

1.3.2.3 Display (Con't)

Decision Height Setting Range: 0 to 2500 Ft
Decision Height Setting Resolution:

Decision Height Range (Ft)	Decision Height Resolution (Ft)
0 to 200	10
200 to 500	50
500 to 2500	100

Figure 1-2
Decision Height Setting Resolution

Altitude Trend Indicator Scale:
Full scale selectable between 300, 600, 900, 1200 or 1500 Ft/Min
Display Format:

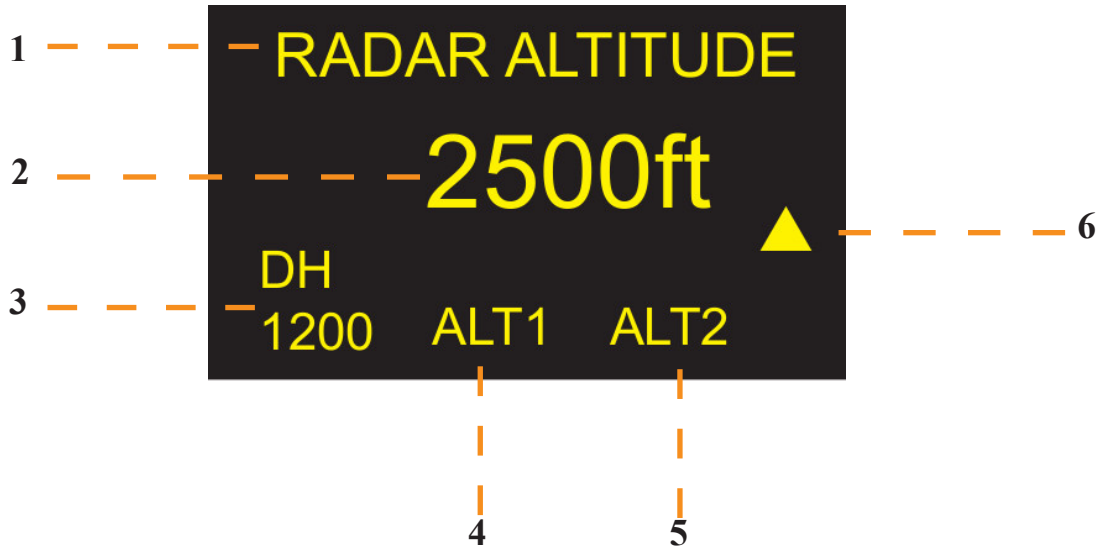


Figure 1-3
Display Format

Section 1 is the Displayed Data Description
Section 2 is the Current Altitude
Section 3 is the Decision Height
Section 4 is the GRA 1 Altitude Alert discrete input if triggered
Section 5 is the GRA 2 Altitude Alert discrete input if triggered
Section 6 is the Altitude Trend Indicator.

1.3.2.4 Interfaces

Audio Alerts: Selectable between 1Khz tone, Male “Minimums” or Female “Minimums”
Audio Power: 80mW into 600 Ohms at Maximum volume. Balanced
Audio Range: 40dB. Muted at minimum volume setting
ARINC 429 Receive: Label 164. High speed and Low speed selectable
Decision Height Discrete Output: Active Low (RA Altitude <DH)
<0.5V@200mA
Inhibit DH Iput: Normally not connected. Connect to ground to remove decision height function
GRA Altitude Alert Discrete Inputs: 1V threshold@1mA

1.4 Certification

TSO: C87a (incomplete)
Software: DO-178C Level C
Environmental: DO-160G
[(A3)(F2)X]BAB[(SBM)(U2)]XXXXXXZZAZ[ZC][RR]H[A2B2(J2L2)]XXAX

1.4.1 The SI-205 meets the display requirements for a Radio Altimeter per the standards contained in TSO-87a and ED-30. The SI-205 meets the following standards:

ED-30 paragraph 2.1 - Controls
ED-30 paragraph 2.4 - Surveillance
ED-30 paragraph 2.5 - Failure Warning
ED-30 paragraph 2.6 - Warm-up
ED-30 paragraph 2.8 - Radio Altimeter
ED-30 paragraph 2.9 - Decision Height
ED-30 paragraph 2.11 - No Available Data Indication
ED-30 paragraph 3.2.1.1 - Accuracy height information output, category A1
ED-30 paragraph 3.3.1 - Altitude range, category A

“This article meets the minimum performance and quality control standards required by a technical order (TSO). Installation of this article requires separate approval”

1.5 Radar Altimeter Data

The SI 205 obtains radar altitude data via the ARINC 429 data bus (Label 164). It does not require data from the Garmin High Speed Data Bus (HSDB).

Both the GARMIN GRA Altimeter and the SI 205 must have their ARINC 429 bus configured for the same speed, either both High or both Low.

1.6 Radar Altimeter Self Test

When the selector knob is pressed momentarily (5 seconds or less), the Self Test Out discrete line triggers the GRA to perform a self test. While the GRA is in self test, the SI 205 will display the self test altitude of 40 feet, sent from the GRA. In certain modes of operation, the GRA will inhibit the self test. This condition will be indicated by a “Test Inhibited” flag on the display data description.

Environmental Qualification Form

NOMENCLATURE: Radar Altimeter Display
TYPE/MODEL/PART No.: SI 205/306273-[XX]
MANUFACTURER'S SPECIFICATION AND/OR OTHER APPLICABLE SPECIFICATION:
MANUFACTURER: SANDIA AEROSPACE
ADDRESS: 3700 OSUNA RD NE, SUITE 711, ALBUQUERQUE, NM 87109
REVISION & CHANGE NUMBER OF DO-160 : REV G
DATE OF TESTS: 2014

Conditions	Section	Description of Tests Conducted	Notes
Temperature and Altitude	4.0	Tested to Category [A3F2]	
Low Temperature	4.5.1 4.5.2		-55 Ground/-55 Short -55 Operating
High Temperature	4.5.3 4.5.4		+85 Ground/+85 Short +70 Operating
Loss of Cooling	4.5.5	Not applicable	
Altitude Decompression Overpressure	4.6.1 4.6.2 4.6.3		55,000 Feet 55,000 Feet -15,000 Feet
Temperature Variation	5.0	Tested to Category B	5 deg/min
Humidity	6.0	Tested to Category A	48 Hours / 2 Cycles
Operational Shock and Crash Safety Sustained Crash Safety	7.0 7.3.2	Tested to Category B Aircraft Type 5 Test Type F	Helicopter and All Fixed-wing in fixed orientation (panel mounting)
Vibration	8.0	Tested to Category S curves B and M. Tested to Category U2 curve F & F1	
Explosion	9.0	Equipment identified as Category X, no test performed	
Waterproffness	10.0	Equipment identified as Category X, no test performed	
Fluids Suseptibility	11.0	Equipment identified as Category X, o test performed	
Sand and Dust	12.0	Equipment identified as Category X,no test performed	
Fungus	13.0	Equipment identified as Category X, no test performed	
Salt Spray	14.0	Equipment identified as Category X, not test performed	
Magnetic Effect	15.0	Tested to Category Z	Less than 0.3m deflection
Power Input	16.0	Tested to Category Z	Tested to Category Z for 28V Acft. Note 1 for 14V Acft.
Voltage Spike	17.0	Tested to Category A	
Audio Frequency Suseptibility	18.0	Tested to Category Z	
Induced Signal Suseptibility	19.0	Tested to Ctegory [ZC]	
Radio Frequency Suseptibility	20.0	Tested to Category [RR]	
Radio Frequency Emission	21.0	Tested to Category H	
Lightning Induce Transient Susceptibility	22.0	Tested to Category [A2B2J2]	
Lightning Direct Effects	23.0	Equipment identified as Category X, no test performed	
Icing	24.0	Equipment identified as Category X, no test performed	
Electrostatic Discharge	25.0	Equipment identified as Category A	
Fire, Flammability	26.0	Equipment identified as Category X, no test performend	

Note 1. The indicator is tested to Category Z with the exception that for momentary power interruption at 14Vdc operation, the system meets the Category A requirements of 200mS interruptions.

Section 2 Installation Considerations

2.1 MOUNTING CONSIDERATIONS

The SI 205 is designed to be rear mounted in a 1/2 3ATI cutout. The ATI (Airline Transport Indicator) form factor is used in most corporate and commercial aircraft. It provides a professional look while keeping space requirements to a minimum. The SI 205 is attached to the aircraft panel with four supplied 6-32 machine screws. The length of the mounting screw should be the thickness of the aircraft panel plus 0.15 inches (extension into the SI 205 bezel). A template is provided with the SI 205 to aid in panel cutout.

SANDIA aerospace also has a panel punch available for use in installing the SI 205. Contact the factory at 505.341.2930 regarding use of the panel punch.

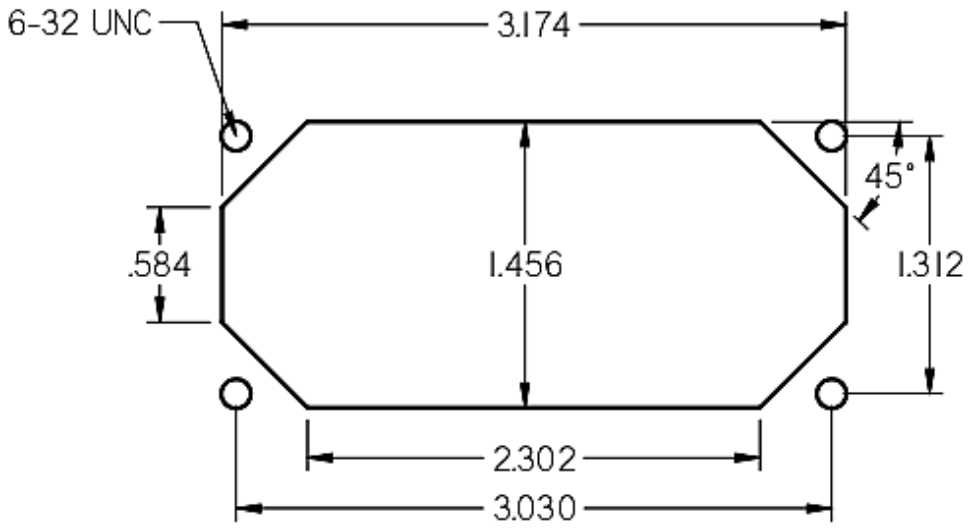


Figure 2-1
Panel Cut Out Dimensions

Section 3 Installation Procedures

3.1 General

The SI 205 uses a 25 pin D-sub with crimp connectors. Failure to observe proper installation techniques could result in a failure of a connection and cause intermittent or non operation of the SI 205.

3.2 Equipment Required

3.2.1 Supplied

SI 205 System 706273-10

SI 205 Control Head P/N 306273-10
Installation Kit P/N 306533-00
CONN, DSUB, RECP, 25 POS, W/CRIMP SKTS, P/N 305720
CLAMP, DSUB 25P SIZE, METAL, P/N 306529
4 each 6-32 x 1/4" pan head screws P/N 306282-03
Panel cutout dimensions template P/N 306099

3.3 Electrical Considerations

The SI 205 operates on 11-32Vdc. Power can be supplied from the same breaker that is used for the Garmin Radar Altimeter or it can be powered through it's own 1 Amp circuit breaker. If powered using the Radar Altimeter breaker, the breaker size should be increased to accommodate the SI 205.

The SI 205 uses a single 25 pin D-Sub connector for all power and interface functions.

Power and ground wires are 20 AWG. All other wires are 22 AWG unless otherwise noted.

Installation to be in accordance with FAA AC 43.13-1B

3.4 Backshell Assembly

The SI 205 connector kit includes a backshell with strain relief assembly(s).

3.5 Post Installation Configuration

If the INHIBIT DECISION HEIGHT pin (P1-12) is connected to ground, the decision height selector functions are removed from the display and only Radar Altimeter altitude and altitude alerts from the GRA are issued.

All other configurations are performed through the display and knob.

There are two configuration menus. The User Configuration Menus and the full Installation Configuration Menus. To enter the Installation Configuration Menus, select 1300 ft Decision Height (or 390 Meters) and hold the knob in for more than 5 seconds. To enter the User Configuration Menus, select a Decision Height other than 1300 feet and hold in the knob for more than 5 seconds.

Title	Installation	User	Description	Default
MIN BRIGHTNESS	X	X	Allows the user to limit the minimum brightness of the display.	50%
VOLUME	X	X	Set the volume level of the aural alert.	50%
ALTITUDE UNIT	X	X	Feet or Meters.	Feet
ALT ROUNDING	X		Fixed wing, Rotorcraft or None.	Rotorcraft
ALT FILTER TIME CONSTANT	X		Response time of the altitude display	0.7 seconds
ALTITUDE TREND	X	X	Enable or Disable the Altitude Trend display.	Enable
MAX TREND SCALE	X		The maximum scale for the trend indicator can be set to either 300, 600, 900, 1200, and 1500 feet/minute.	900 feet/minute
TREND FILTER TIME CONSTANT	X		Response time of the altitude trend indicator.	5.0 seconds
DH DISPLAY NAME	X		The Decision Height display name can be displayed as “DH” or “MIN”.	“DH”
DH VISUAL ALERT	X		The Decision Height Visual Alert can be selected to be annunciated either in the DH display field or in the Current Altitude diplay field.	DH Field
DH AURAL ALERT	X		The audible alert can be configured as either a male voice, female voice or a 1KHz tone.	Female
DH SET DEFAULT	X		The default Decision height can set to either “PREVIOUS”, “200 FEET” or “50 FEET”.	“PREVIOUS”
ARINC 429 SPEED	X		The Arinc 429 speed can be set to either “HIGH” (100 kbps) or “LOW” (12.5 kbps).	“HIGH”

Figure 3-1
Post Installation Configuration Settings

3.6 Pin Functions

The rear 25 pin D-sub connector pin functions are listed below. All other pins are not connected for aircraft installations.

Pin	Pin Name	I/O
P1-1	Aircraft Power 1	In
P1-14	Aircraft Power 2	In
P1-6	Audio Out High	Out
P1-8	Audio Out Low	Out
P1-2	Power Ground	--
P1-7	Ground	--
P1-18	Ground	--
P1-22	Ground	--
P1-24	ARINC 429 Receive In A	In
P1-25	ARINC 429 Receive In B	In
P1-11	Decision Height Visual Alert Out	Out
P1-4	Self Test Out	Out
P1-9	GRA Altitude Alert In 1	In
P1-13	GRA Altitude Alert In 2	In
P1-12	Inhibit Decision Height Func	In

Figure 3-2
P1 Pin Functions

3.7 Continued Airworthiness

Continued Airworthiness of the SI 205 Radar Altimeter Indicator is on condition only.

APPENDIX A - Outline Drawings

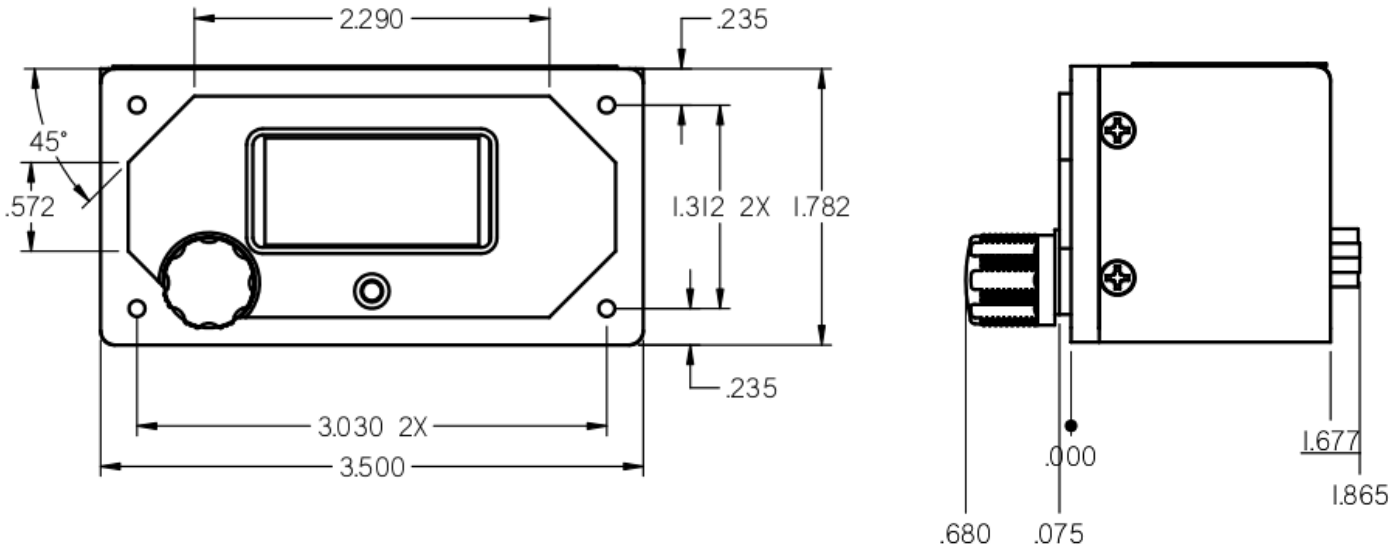
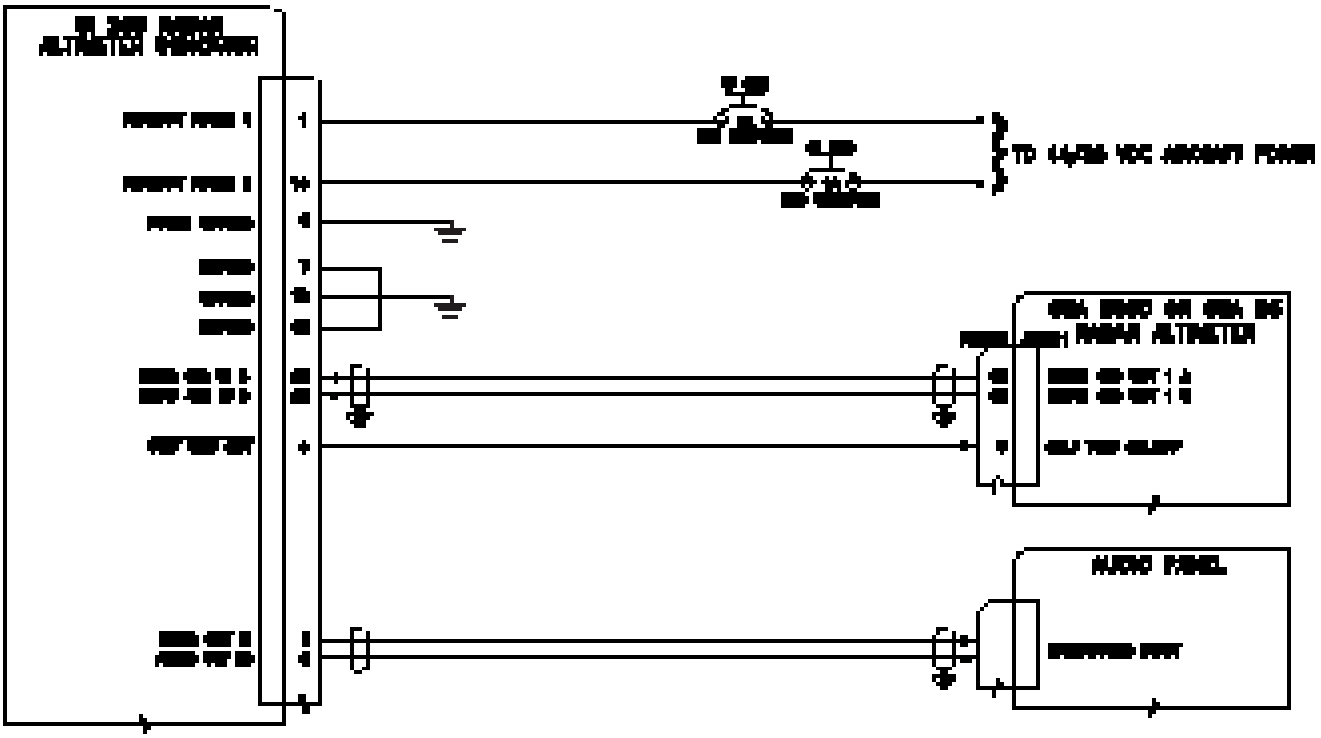


Figure A-1
Outline Dimensions

APPENDIX B - SUGGESTED INTERCONNECTS



Notes:
1. UNLESS OTHERWISE NOTED, ALL STRANDED WIRE MUST CONFORM TO MIL-W-27759/16
2. UNLESS OTHERWISE NOTED, ALL SHIELDED WIRE MUST CONFORM TO MIL-C-27522 OR EQUIVALENT
3. UNLESS OTHERWISE NOTED, ALL POWER AND GROUND WIRES ARE 20 GAUGE MINIMUM, AND ALL OTHER WIRES ARE 22 GAUGE MINIMUM
4. SYMBOL DESIGNATIONS

Figure B-1
Typical Installation