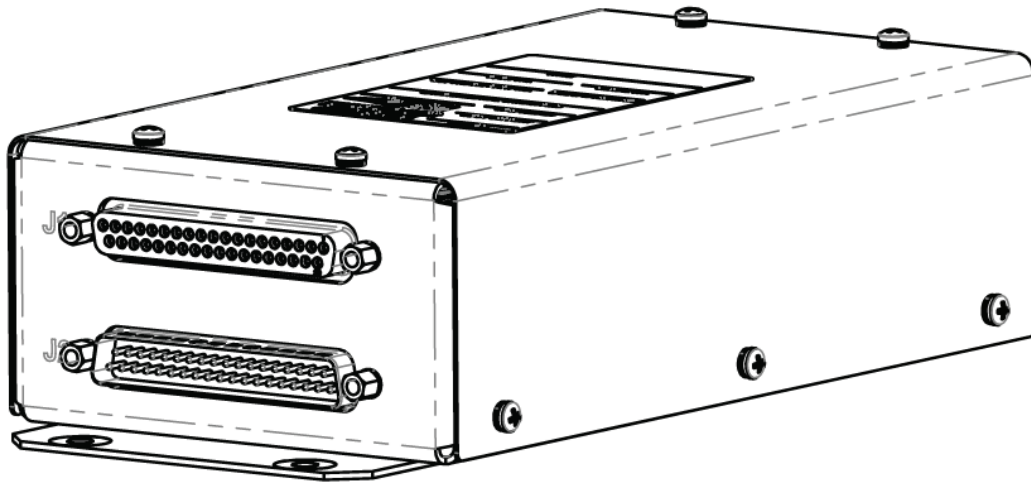




DIGITAL TO ANALOG RADAR ALTIMETER

P/N: 833832-00



INSTALLATION MANUAL MANUAL P/N: M833832-00 REV B

SHADIN AVIONICS
7555 Market Place Drive
Eden Prairie, MN 55344

Customer Service: 952-927-6500

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Control SC1	INSTALLATION MANUAL	
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REVISION LOG

Rev	Date	ERN	DESCRIPTION
B	10 DEC 2024	2412/007	Updated TSO statement in section 2.6.
A	27 AUG 2024	2408/018	Updated upper limit of the power supply voltage range in section 2.2 to 32VDC.
-	08 JUL 2024	2407/003	Initial Issue

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1 OVERVIEW

The information in this manual is subject to change without notification.

1.1 SCOPE

This manual is intended to guide the proper installation of Digital to Analog Radar Altimeter (DARALT) converter. Installation instructions should be read and followed.

1.2 DEFINITIONS AND ABBREVIATIONS

BCD	Binary Coded Decimal
BNR	Binary
DAL	Design Assurance Level
DARALT	Digital to Analog Radio Altimeter
EQF	Environmental Qualification Form
GND	Ground
HS	High speed
LS	Low speed
ms	Milliseconds
MTBF	Mean Time Between Failures
NCD	No Computed Data
PWR	Power
RTN	Return
SSM	Sign/Status Matrix
TSO	Technical Standard Order
XCVR	Transceiver

1.3 PRODUCT DESCRIPTION

Aircraft are being equipped with a new generation of Radio Altimeters that do not fully integrate into the existing aircraft systems. Aircraft still require analog height conversion and altitude trip discrete outputs for other on-board systems (e.g., autopilot or mission systems) that the new generation Radio Altimeter does not provide. The Digital to Analog Radio Altimeter (DARALT) converts ARINC 429 data (provided from the new generation Radio Altimeter) to analog voltages and discrete output signals for altitude trip setting.

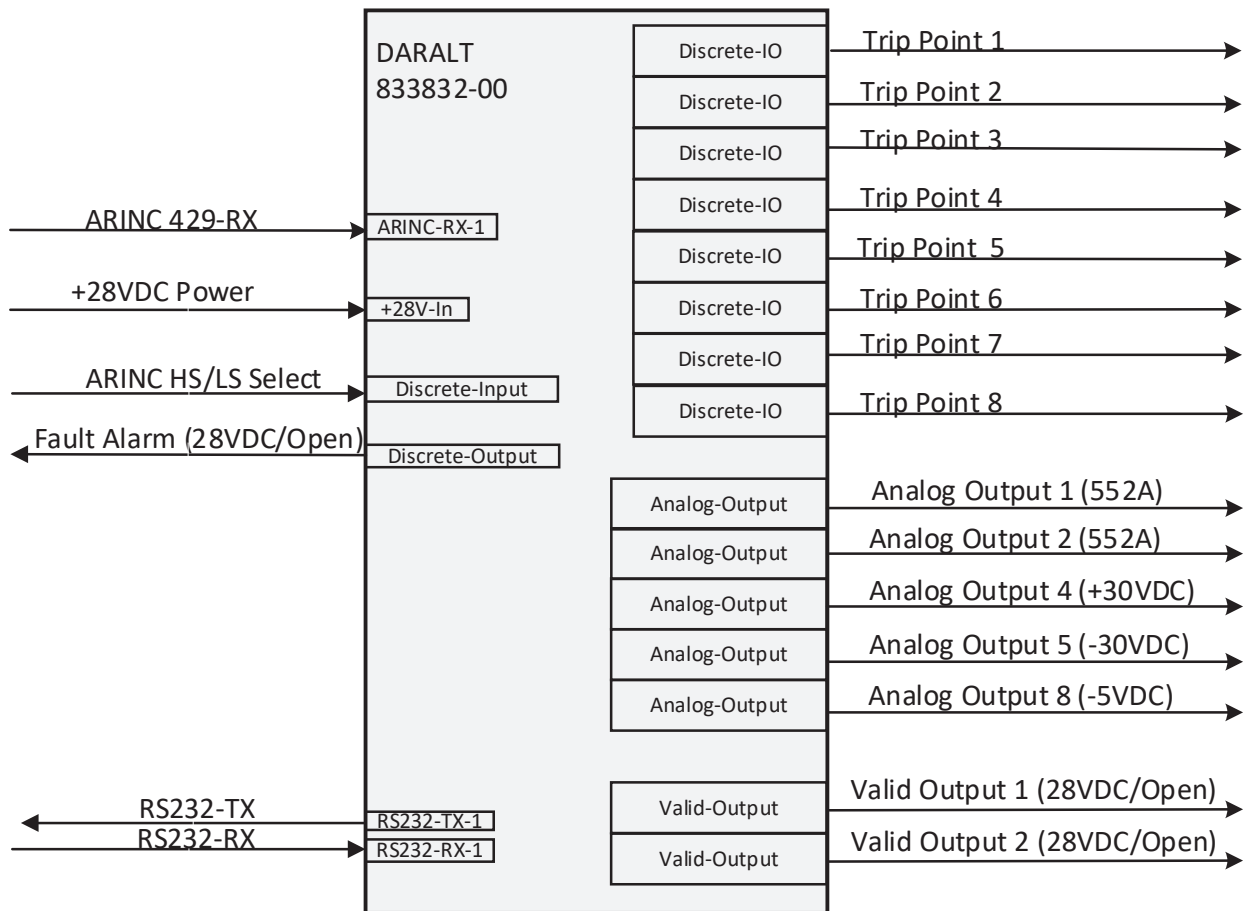


Figure 1-1: System Overview

The block diagram above in Figure 1-1 depicts the intended use of the unit installed in the aircraft.

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2 SPECIFICATIONS

For a complete listing of product qualifications please review the Environmental Qualification Form (EQF) found in Section 4.

2.1 PHYSICAL

Nominal Dimensions:	8.50"L x 4.21"W x 2.25"H
Weight:	1.2 pounds (lbs.)
Mounting:	Screw Size # 8
Mounting Locations:	8.00"L x 2.00"W

2.2 ELECTRICAL

Power Supply Voltage:	+18VDC to +32VDC
Supply Current:	Max: 500mA, Typical: 100mA at +28VDC
Protection:	Not internally fused

2.3 FUNCTIONAL

2.3.1 *INPUTS:*

ARINC 429:	High Speed or Low Speed, strap selectable
Discrete Input:	High/Low ARINC 429 Speed Select
Serial Communication:	RS-232

2.3.2 *OUTPUTS:*

Height Outputs:	2x Analog Outputs in ARINC 552A Format
+30 VDC (indicator power)	Power Output
-30 VDC (indicator power)	Power Output
-5 VDC	Power Output
Valid Output:	2x Valid Discrete Outputs
Discrete Trip Points	8x Altitude Trip Points 1-8
Serial Communication:	RS-232
Flag Alarm	28VDC when operating normally, Open when fault is detected

2.4 ENVIRONMENTAL

RTCA/DO-160G

Operating Temperature	-55°C to +70°C
Storage Temperature	-55°C to +85°C

Equipment can run indefinitely within stated environmental range with no external cooling. See section 4 for complete environmental qualification data.

2.5 SOFTWARE CERTIFICATION

This product was developed in accordance with RTCA/DO-178C Design Assurance Level B.

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2.6 REGULATORY CERTIFICATION

This product meets the requirements of TSO-C87a.

The conditions and tests for required for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards which include any accepted integrated non-TSO functions. TSO articles and any accepted integrated non-TSO function(s) must have separate approval for installation in an aircraft. The article may be installed only according to 14 CFR part 43 or the applicable airworthiness requirements. This is an incomplete system intended to provide the following functions with the accuracy requirement from EUROCAE ED-30 Section 3.2.1:

- Convert ARINC-429 height above ground into ARINC 552A analog outputs.
- Provide altitude trip point discrete output.”

2.7 RELIABILITY

MTBF (Mean Time Between Failures) Estimated to be greater than 15,000 hours

2.8 REPAIR

Units needing repair or that have failed should be returned to Shadin Avionics. Contact technical support for assistance by phone at (952) 927-6500, or email at service@shadin.com

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3 INSTALLATION PROCEDURE

3.1 LIMITATIONS

This equipment is developed to Design Assurance Level B (DAL B). It is the responsibility of those installing this article to determine if it meets the needs set forth in the System Safety Assessment. The installer must substantiate the interoperability when showing compliance to the applicable airworthiness.

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

The DARALT converter is compliant to TSO-C87a as an incomplete system and is designed to be used in conjunction with a radio altimeter receiver/transmitter that outputs height above ground data in ARINC 429 format.

3.2 MOUNTING

The unit may be mounted in any orientation in environments specified in the environmental categories, Section 4.

The unit should be mounted according to Installation Drawing, P/N D833832-00

3.3 BONDING

The primary bonding is achieved through metal-to-metal contact of the mounting feet. The two mounting feet (2.4 x 3.2 inches) are unpainted, chemical conversion coated per MIL-DTL-5541F Type II, Class 3. Additionally, the top of the four mounting holes are unpainted to a diameter of roughly 0.45 inches. The aircraft's mating surface should be free of paint or any anodizing primer or finish which would prevent solid grounding contact between the aircraft and the unit.

3.4 ELECTRICAL CONNECTION

Table 1 lists the connector and pin number (i.e. J1:3), signal name, and signal description of the electrical connections for the unit.

Table 1: Electrical Connection

Connector & Pin Number	Signal Name	Signal Description
Connection to Power Supply		
J2:1 and J1:9	CHASSIS-GND	Chassis Ground
J2:2,21	POWER-GND-IN	Power Return
J2:3,22	+28V-IN	28 VDC Power Positive
Inputs		
J2:5	Speed	ARINC 429 Speed Select: (open=high, grounded=low)
J2:27	ARINC-429-RXA-1	ARINC-429 Input #1 (Line A)
J2:28	ARINC-429-RXB-1	ARINC-429 Input #1 (Line B)
Outputs		
J1:16	Trip 1	Default to 30' ascending / 10' descending
J1:17	Trip 2	Default to 70' ascending / 50' descending
J1:18	Trip 3	Default to 220' ascending / 200' descending
J1:19	Trip 4	Default to 320' ascending / 300' descending
J1:34	Trip 5	Default to 520' ascending / 500' descending
J1:35	Trip 6	Default to 1250' ascending / 1200' descending

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Connector & Pin Number	Signal Name	Signal Description
J1:36	Trip 7	Default to 1550' ascending / 1500' descending
J1:37	Trip 8	Default to 2550' ascending / 2500' descending
J1:23	552A-1	Analog Output 1 (ARINC 552A)
J1:24	552A-2	Analog Output 2(ARINC 552A)
J1:11	P_30V	Power Output Positive 30VDC
J1:12	N_30V	Power Output Negative 30VDC
J1:13	N_5V	Power Output Negative 5VDC
J1:10	Valid 1	Valid Output: +28VDC when Valid, float when Invalid
J1:28	Valid 2	Valid Output: +28VDC when Valid, float when Invalid
J2:6	Flag Alarm	Flag Alarm Output: +28VDC when good, float when alarmed
Signal Grounds		
J1:8	Ground	Signal Ground
J1:27	Ground	Signal Ground
Diagnostic		
J1:13	RS232-TX-1	RS232-TX-1
J1:14	RS232-RX-1	RS232-RX-1

Notes:

The two valid discrete outputs and the flag alarm output will float under the following conditions:

- Invalid ARINC 429 input message from radio altimeter R/T with an SSM of NCD or Fail
- ARINC 429 input times out (300 ms).
- Internal fault detected
- Altitude received on ARINC-429 input is below -20 ft or above 2500 ft

The DARALT will attempt to use ARINC 429 input label 164 (Radar Altitude, BNR) first, and will automatically switch to ARINC input label 165 (Radar Altitude, BCD) if label 164 is not present or usable before timing out. The DARALT will automatically switch back to received label 164 if it becomes usable.

3.4.1 TYPICAL INSTALLATION WIRING

Figure 3-1 is typical installations wiring diagram.

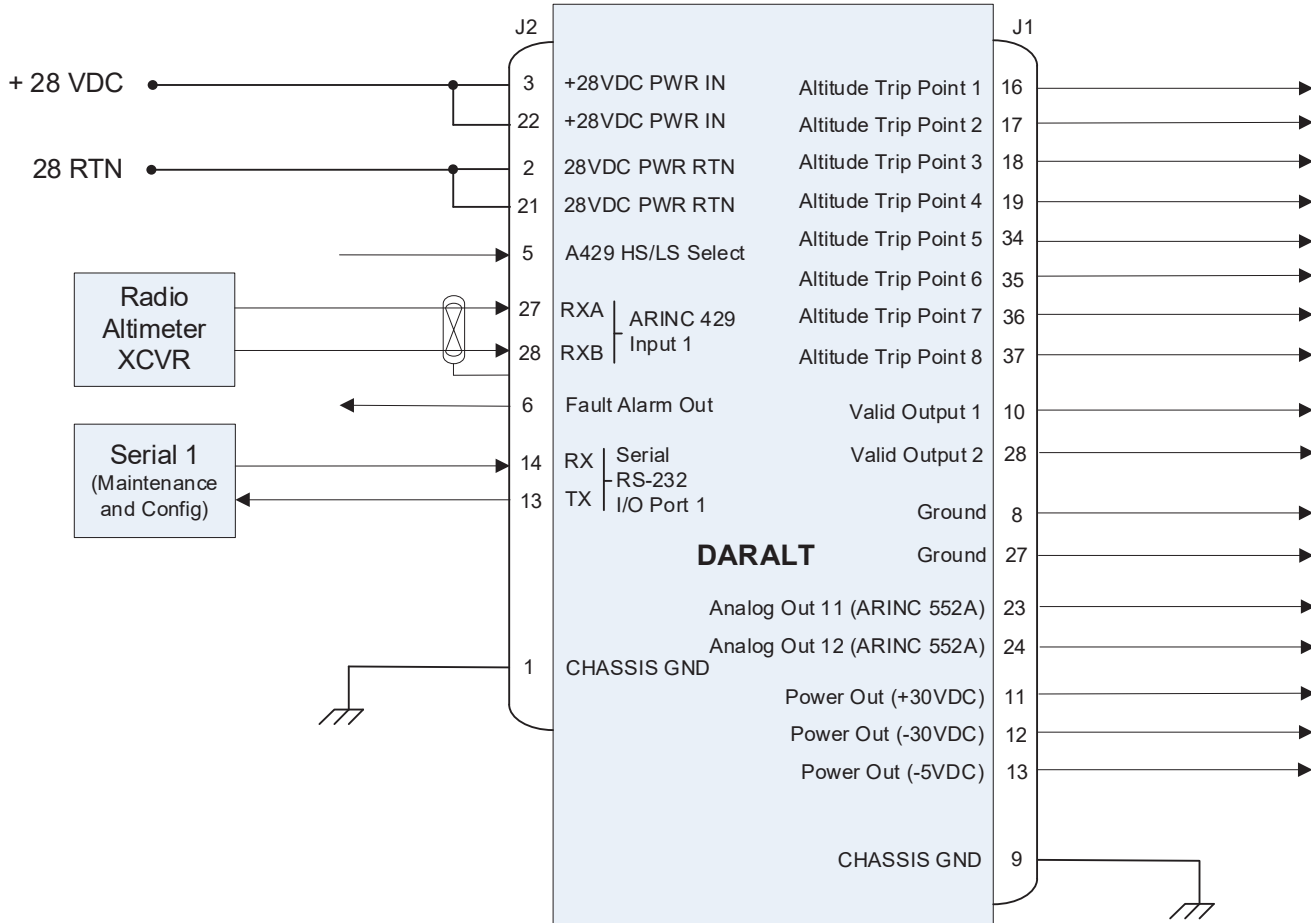


Figure 3-1: Wiring Diagram

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4 ENVIRONMENTAL QUALIFICATION FORM (EQF)

The DARALT hardware was environmentally tested with all functions active to RTCA/DO-160G and is documented in Shadin Qualification Testing Report SD-240010.

NOMENCLATURE: Digital To Analog Radar Altimeter

TYPE/MODEL/PART NO: 833832-00 **CERTIFICATION:** TSO C87a

MANUFACTURER'S SPECIFICATION AND/OR OTHER APPLICABLE SPECIFICATION: RTCA/DO-160G

MANUFACTURER: Shadin Avionics

ADDRESS: 7555 Market Place Drive Eden Prairie, MN 55344

Items listed with an "X" for test conducted will be identified as not being tested. Any other description indicates either a test category or a modification to a test.

Table 2: DO-160G Qualification Testing

CONDITIONS	SECTION	DESCRIPTION OF TESTS CONDUCTED
Temperature and Altitude	4	D2
Low Temperature (Operating)	4	-55°C
High Temperature (Operating)		+70°C
Altitude		50,000ft
Decompression		55,000ft
Temperature Variation	5	B (10°C/min)
Humidity	6	A
Operational Shock and Crash Safety	7	B
Vibration	8	R(B,B1) and U(F,F1)
Explosion	9	X
Waterproofness	10	X
Fluids Susceptibility	11	X
Sand and Dust	12	X
Fungus	13	X
Salt Spray	14	X
Magnetic Effect	15	Z
Power Input	16	AXX
Voltage Spike	17	A
Audio Frequency Susceptibility	18	Z
Induced Signal Susceptibility	19	CC
Radio Frequency Susceptibility	20	RR
Radio Frequency Emission	21	H
Lightning Induced Transient Susceptibility	22	A3J3L3
Lightning Direct Effects	23	X
Icing	24	X
Electrostatic Discharge	25	A
Fire, Flammability	26	C

5 SETUP AND USE

This product can be configured to set Altitude Trip Points 1-8 to a desired height trip point in feet (ft). Altitude Trip Points 1-8 are set to an Active State (Ground (GND)) when the altitude reported over ARINC-429 is at or below the selected Altitude Trip Point and set to an Inactive state (Open (Float)) when the altitude reported over ARINC-429 is above the selected Altitude Trip Point.

Altitude Trip Points are not field configurable and must be set up by Shadin Avionics.

5.1 INITIAL SETUP

This product leaves the factory configured for default trip points with set hysteresis on Altitude Trip Points 1-8. The default settings of Altitude Trip Points 1-8 are defined in **Table 3** below.

Table 3: Default Altitude Trip Points

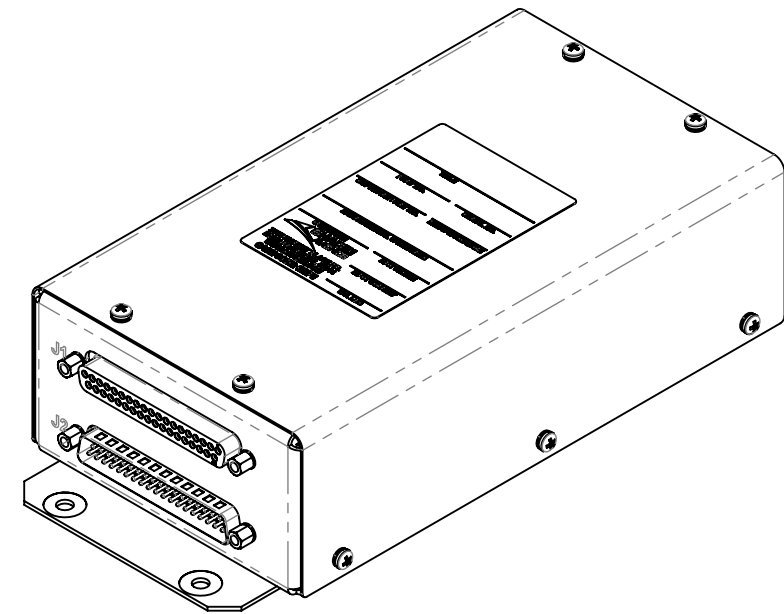
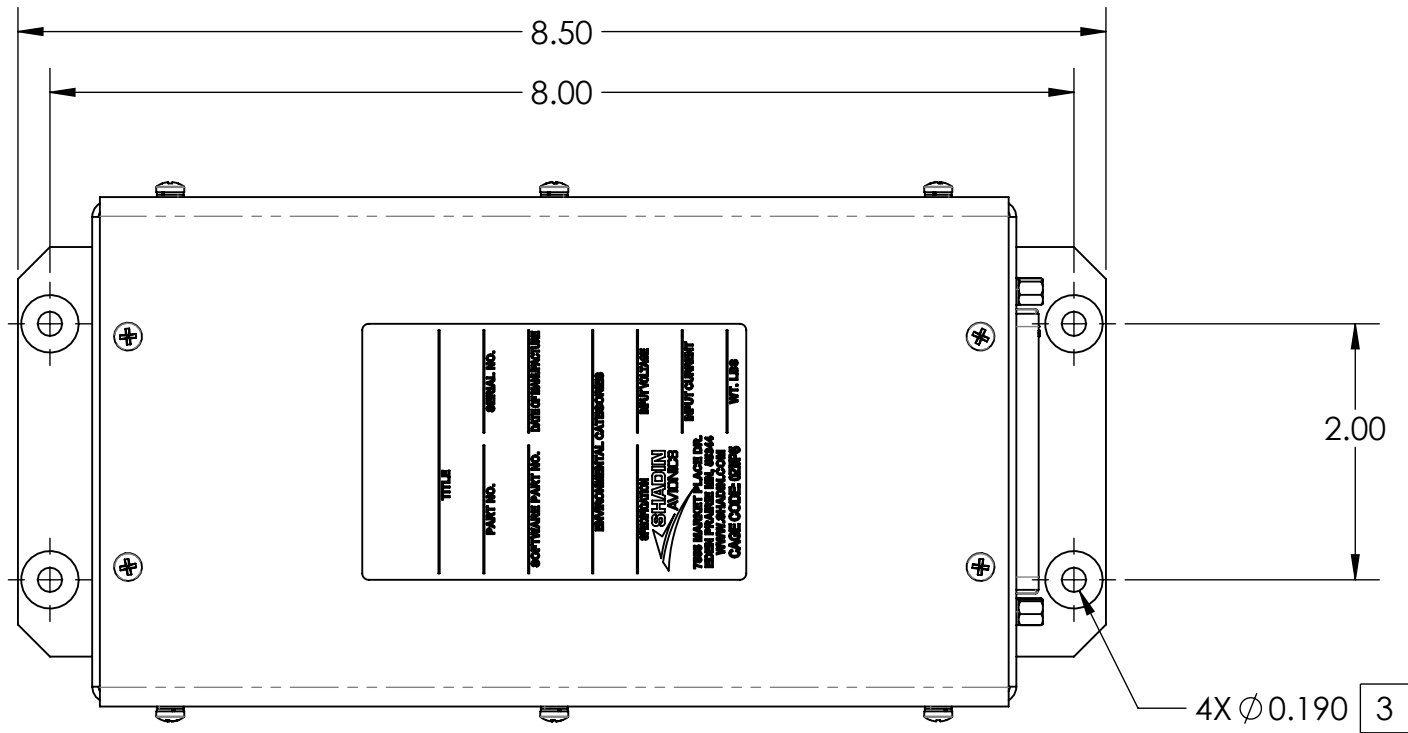
Default Trip Points	Default Hysteresis
Altitude Trip Point 1= 10 ft	Descending= 0 ft Ascending= 20 ft
Altitude Trip Point 2= 50 ft	Descending= 0 ft Ascending= 20 ft
Altitude Trip Point 3= 200 ft	Descending= 0 ft Ascending= 20 ft
Altitude Trip Point 4= 300 ft	Descending= 0 ft Ascending= 20 ft
Altitude Trip Point 5= 500 ft	Descending= 0 ft Ascending= 20 ft
Altitude Trip Point 6= 1200 ft	Descending= 0 ft Ascending= 50 ft
Altitude Trip Point 7= 1500 ft	Descending= 0 ft Ascending= 50 ft
Altitude Trip Point 8= 2500 ft	Descending= 0 ft Ascending= 50 ft

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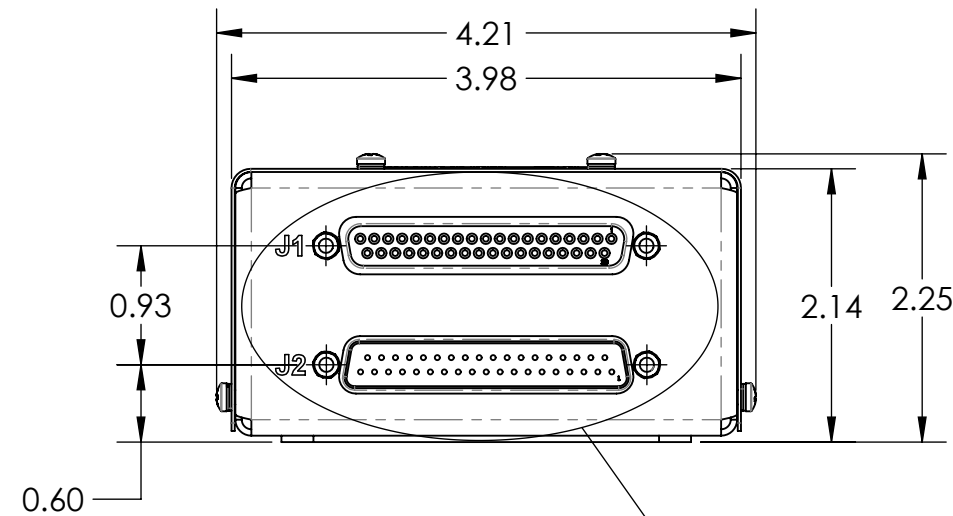
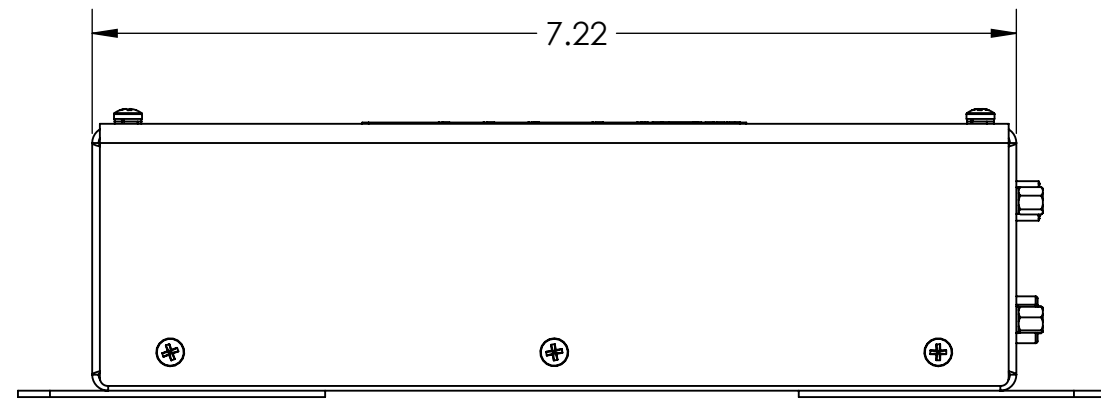
6 APPENDIX A: INSTALLATION DRAWING

Installation drawing D833832-00 can be found on the following pages.

REVISIONS					
ERN #	REV.	DATE	BY	APP'D	DESCRIPTION
2407/003	-	7/3/2024	SRJ	JW	BASELINE RELEASE.
2408/018	A	8/27/2024	SRJ	DB	UPDATED WEIGHT IN NOTE 2



PICTORIAL VIEW



SEE DETAIL A
SHEET 2

NOTES:

- DIMENSIONS ARE FOR REFERENCE ONLY
- WEIGHT: 1.2 LBS
- MOUNTING SCREW SIZE: NO. 8
- J1 CONNECTOR: 37 PIN D-SUB, FEMALE
- J2 CONNECTOR: 37 PIN D-SUB, MALE
- MATING CONNECTORS:
J1 37 PIN D-SUB, MALE
J2 37 PIN D-SUB, FEMALE
- WIRE TYPE "SINGLE" IS A SINGLE WIRE.
WIRE TYPE "SSW" IS A SINGLE SHIELDED WIRE.
WIRE TYPE "STP" IS A SHIELDED TWISTED PAIR.
-WIRE SHIELDS SHOULD BE TIED TO MATING CONNECTOR SHELL OR TO PINS CONNECTED TO CHASSIS GROUND.

UNLESS OTHERWISE SPECIFIED: DRAWN PER ASME Y14.5M-2009 DIMENSIONS ARE IN INCHES	
THIRD ANGLE PROJECTION	TOLERANCES: X/X±1/64 X°±1° X.X±0.1 X.XX±0.01 X.XXX±0.005
FINISH	N/A
MATERIAL	N/A

SHADIN AVIONICS		
DRAWN	SRJ	2/9/2024
CHECKED	DB	2/9/2024
ENG APPR.	DB	2/9/2024
SIZE	CAGE CODE: OZ5P5	
B	F/N D833832-00.SLDDRW	
SCALE: N/A	SHEET 1 OF 2	

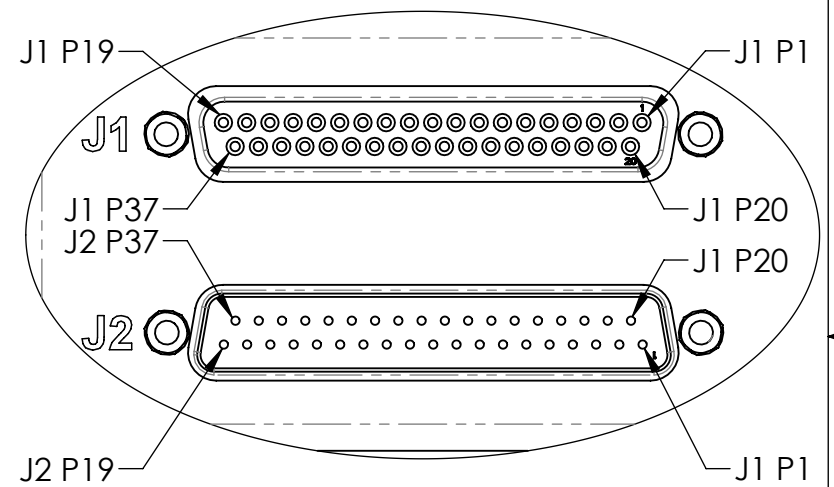
INSTALLATION DWG, P/N 833832-00	
DWG. NO. D833832-00	REV A

4

5

J1 CONNECTOR (313831-XX) PINOUT				
PIN	SIGNAL NAME	DESCRIPTION	TYP (REF)	PAIR (REF)
1	RESERVED	RESERVED	N/A	N/A
2	RESERVED	RESERVED	N/A	N/A
3	RESERVED	RESERVED	N/A	N/A
4	RESERVED	RESERVED	N/A	N/A
5	RESERVED	RESERVED	N/A	N/A
6	RESERVED	RESERVED	N/A	N/A
7	RESERVED	RESERVED	N/A	N/A
8	SIGNAL-GND	SIGNAL GROUND	SINGLE	N/A
9	CHASSIS-GND	CHASSIS GROUND	SINGLE	N/A
10	VALID 1	VALID OUTPUT: 28VDC WHEN VALID, FLOAT WHEN INVALID	SINGLE	N/A
11	P_30V	+30VDC 50mA	SINGLE	N/A
12	N_30V	-30VDC 50mA	SINGLE	N/A
13	N_5V	-5VDC 200mA	SINGLE	N/A
14	RESERVED	RESERVED	N/A	N/A
15	RESERVED	RESERVED	N/A	N/A
16	TRIP 1	DEFAULT TO 30' ASCENDING / 10' DESCENDING	SINGLE	N/A
17	TRIP 2	DEFAULT TO 70' ASCENDING / 50' DESCENDING	SINGLE	N/A
18	TRIP 3	DEFAULT TO 220' ASCENDING / 200' DESCENDING	SINGLE	N/A
19	TRIP 4	DEFAULT TO 320' ASCENDING / 300' DESCENDING	SINGLE	N/A
20	RESERVED	RESERVED	N/A	N/A
21	RESERVED	RESERVED	N/A	N/A
22	RESERVED	RESERVED	N/A	N/A
23	552A-1	ARINC-552A OUTPUT -20 to +2500 FEET	SSW	N/A
24	552A-2	ARINC-552A OUTPUT -20 to +2500 FEET	SSW	N/A
25	RESERVED	RESERVED	N/A	N/A
26	RESERVED	RESERVED	N/A	N/A
27	SIGNAL-GND	SIGNAL GROUND	SINGLE	N/A
28	VALID 2	VALID OUTPUT: 28VDC WHEN VALID, FLOAT WHEN INVALID	SINGLE	N/A
29	RESERVED	RESERVED	N/A	N/A
30	RESERVED	RESERVED	N/A	N/A
31	RESERVED	RESERVED	N/A	N/A
32	RESERVED	RESERVED	N/A	N/A
33	RESERVED	RESERVED	N/A	N/A
34	TRIP 5	DEFAULT TO 520' ASCENDING / 500' DESCENDING	SINGLE	N/A
35	TRIP 6	DEFAULT TO 1250' ASCENDING / 1200' DESCENDING	SINGLE	N/A
36	TRIP 7	DEFAULT TO 1550' ASCENDING / 1500' DESCENDING	SINGLE	N/A
37	TRIP 8	DEFAULT TO 2550' ASCENDING / 2500' DESCENDING	SINGLE	N/A

J2 CONNECTOR (313662-XX) PINOUT				
PIN	SIGNAL NAME	DESCRIPTION	TYP (REF)	PAIR (REF)
1	CHASSIS-GND	CHASSIS GROUND	SINGLE	N/A
2	POWER-GND-IN	POWER RETURN	SINGLE	N/A
3	+28V-IN	28VDC POWER POSITIVE	SINGLE	N/A
4	RESERVED	RESERVED	N/A	N/A
5	SPEED	ARINC HS (OPEN) / LS (GND)	SINGLE	N/A
6	FLAG ALARM	FLAG ALARM OUTPUT: 28VDC WHEN GOOD, FLOAT WHEN ALARMED	SINGLE	N/A
7	RESERVED	RESERVED	N/A	N/A
8	RESERVED	RESERVED	N/A	N/A
9	RESERVED	RESERVED	N/A	N/A
10	RESERVED	RESERVED	N/A	N/A
11	RESERVED	RESERVED	N/A	N/A
12	RESERVED	RESERVED	N/A	N/A
13	SER-1TX	RS232-TX	N/A	N/A
14	SER-1-RX	RS232-RX	N/A	N/A
15	RESERVED	RESERVED	N/A	N/A
16	RESERVED	RESERVED	N/A	N/A
17	RESERVED	RESERVED	N/A	N/A
18	RESERVED	RESERVED	N/A	N/A
19	RESERVED	RESERVED	N/A	N/A
20	RESERVED	RESERVED	N/A	N/A
21	POWER-GND-IN	POWER RETURN	SINGLE	N/A
22	+28V-IN	28VDC POWER POSITIVE	SINGLE	N/A
23	RESERVED	RESERVED	N/A	N/A
24	RESERVED	RESERVED	N/A	N/A
25	RESERVED	RESERVED	N/A	N/A
26	RESERVED	RESERVED	N/A	N/A
27	ARINC-429-RX	ARINC 429 INPUT	STP	28
28	ARINC-429-RX	ARINC 429 INPUT	STP	27
29	RESERVED	RESERVED	N/A	N/A
30	RESERVED	RESERVED	N/A	N/A
31	RESERVED	RESERVED	N/A	N/A
32	RESERVED	RESERVED	N/A	N/A
33	RESERVED	RESERVED	N/A	N/A
34	RESERVED	RESERVED	N/A	N/A
35	RESERVED	RESERVED	N/A	N/A
36	RESERVED	RESERVED	N/A	N/A
37	RESERVED	RESERVED	N/A	N/A



DETAIL A
ENLARGED