AIS-450 SYNCHRO CONVERTER

P/N: 834510-00

INSTALLATION MANUAL

REV D

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MANUAL P/N: IM834510-00

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AIS-450 SYNCHRO CONVERTER
Rev: D **P/N 834510-00**

PAGE CONTROL CHART

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REVISION LOG

REV.	DATE	APP'D	CHANGE
–	02-25-2011	DSE	Baseline Release
A	03-24-2011	DSE	Updated per SCR #450 and #456.
B	03-25-2013	ZK	Updated per SCR #662 (ERN#1303/005)
C	10-14-2014	MET	Updated per SCR #978 (ERN#1410/007)
D	01-19-2015	ZK	Added Software Certification and Reliability to Section 1.3

The information in this manual is subject to change without notification. To ensure complete and current updates, note the Revision Log above and call Technical Assistance for updated information.

1. OVERVIEW

1.1 THE MANUAL

This manual is intended to guide the proper installation of the AIS-450 Synchro Converter. Installation instructions should be read and followed.

1.2 PRODUCT DESCRIPTION

The AIS-450 is a digital to synchro based converter that receives angular data (Heading, Pitch, and Roll) on two ARINC 429 inputs and converts it to three ARINC 407 synchro outputs (3-wire). The two ARINC 429 inputs are high speed (H/S) and accept only angular ARINC 429 labels for Heading, Pitch, and Roll (ARINC Labels 314, 320, 324, and 325). The ARINC 429 outputs are high speed (H/S) and pass through only the valid angular ARINC 429 labels received on the inputs. The AIS-450 has three ARINC 407 outputs that are configured as 3-wire synchro. The first output is mapped to the True or Magnetic Heading ARINC 429 label (314 or 320) depending on the state of the Heading Select Discrete Input. A High/Open state maps the output to Magnetic Heading and a Low/Ground state maps the output to True Heading. The second output is mapped to the Pitch ARINC 429 label (324). The third output is mapped to the Roll ARINC label (325). The Synchro Validity Discrete Outputs indicate whether each of the ARINC 407 outputs is valid. The ARINC 429 Input 1 takes priority over the ARINC 429 Input 2. Valid Pitch and Roll labels must be received on the same ARINC Input to enable the Pitch and Roll Validity Discrete Outputs.

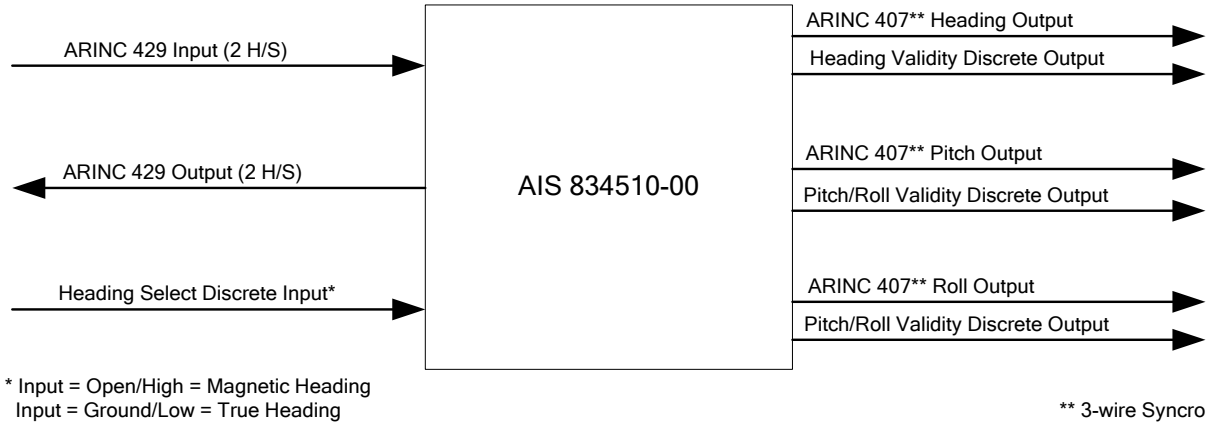


Figure 1 - System Overview

Using the alternate wiring shown in Figure 3, the pitch and roll outputs can provide the 200mV/Deg inputs to an autopilot system.

1.3 SPECIFICATIONS

Physical Specifications

Dimensions:	8.5”L x 4.0”W x 2.5”H (excluding screw heads)
Weight:	1.7 lbs
Mounting:	Screw size #8
Mounting Locations:	8.00”L x 2.00”W

Electrical and Functional

Power Supply Voltage:	+18VDC to +33 VDC
Supply Current:	520 mA Max (745 mA Max including external loads)
Protection:	Active current limiting to 2.0 Amps

Inputs:

ARINC 429	High Speed, 100 Kbps ± 1%
26 VAC Reference CH1 and CH3	24.7 VAC to 27.3 VAC[1]
Discrete Input (ARINC 763-3)	Active: Low / Ground Signal V < 3.5 VDC with I < 20 mA sink or R < 10 Ω Inactive: High / Open Signal 18.5 VDC < V < 36.0 VDC or R > 100 K Ω

Outputs:

ARINC 429	High Speed, 100 Kbps ± 1%
Synchro-X, Y, and Z (ARINC 407) (Heading, Pitch and Roll)	0 to 11.8 VAC Typical, 12.4 VAC Max 0.209 VA into 500 Ω each channel
Synchro Angle Accuracy	Input Angle ± 0.5°
Synchro-Valid-CH1, CH2, and CH3	+28VDC(Valid) / Open(Invalid) Discrete, 75mA Max Short Circuit Protected
Or Alternate 2-wire Synchro (ARINC 561) (Pitch and Roll)	200mV/Deg

1. Input Voltage in excess of 27.3 VAC may result in Synchro output voltage greater than 12.5 VAC.

Environmental

RTCA/DO-160F Categories: F1-BAB[R(B, B1)]XXXXXXZ[AXX]AR[CC][WW]M[XXXXX]XXAX

Operating Temperature:	-40°C to +70°C
Storage Temperature:	-55°C to +85°C
Operating Altitude:	Up to 55,000ft
In-Flight loss of Cooling:	Equipment can run indefinitely with no cooling
Certification:	TSO-C4c, TSO-C5f, TSO-C6e "Incomplete System"

Software Certification

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

Reliability

MTBF (Mean Time Between Failures) 24,000 hours [Airborne Inhabited Cargo (AIC), 30°C]

The reliability predictions were performed using the general methodology of MIL-HDBK-217F. The component failure rate calculation models presented in MIL-HDBK-217F were used as a guide to determine each component's initially assigned predicted failure rate.

2. INSTALLATION PROCEDURE

2.1 INSTALLATION LIMITATION

The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only if performed under 14 CFR part 43 or the applicable airworthiness requirements.

2.2 MOUNTING

The AIS-450 Synchro Converter (P/N 834510-00) should be mounted in a partially temperature controlled location. Non-pressurized or pressurized locations are acceptable.

The converter should be mounted according to the AIS 834510-00 Installation Dwg, P/N ID834510-00.

2.3 ELECTRICAL CONNECTIONS

The electrical connections are defined in the AIS 834510-00 Installation Dwg, P/N ID834510-00. The mating connectors are standard female 25 and 37 pin D-Sub connectors (Included in installation kit are shell P/Ns Amphenol 205165-1 and 205167-1 and contacts P/N Positronic M39029/63-368). All interface wires should be 20 AWG. All wire shielding for STP (Shielded Twisted Pair) and STT (Shielded Twisted Triple) wires should be tied to the mating connector backshell.

2.4 MAINTENANCE

There is no periodic maintenance or calibration required for the AIS-450. All product repairs will be completed at Shadin Avionics.

2.5 EXAMPLE INSTALLATION DIAGRAMS

The diagram (Figure 2) shows an Example of System Installation.

The installation drawing shows ARINC 429 Input 2 connections as optional. The ARINC 429 Input 1 takes priority over the ARINC 429 Input 2. Valid Pitch and Roll labels (ARINC 429 labels 324 and 325) must be received on the same ARINC Input to enable the Pitch and Roll Validity Discrete Output.

The installation drawing shows the Discrete Input tied to Low/Ground which maps Synchro Output 1 to True Heading (ARINC 429 label 314). The Discrete Input can also be left in a High/Open state which maps the output to Magnetic Heading (ARINC 429 label 320).

External Synchro Z to C signal connection for each channel is required if it does not already exist within the interface LRU. All AIS-450 pins not shown on the installation diagram should be left unconnected.

The diagram (Figure 3) shows an Autopilot 200mV/Deg Input Installation.

Pitch and Roll connections are 2-wire Synchro (ARINC 561).

The Table below shows the voltage to angular relationship for this wiring.

Angle Set (°)	**Angle Measured (°)**	**X/C/GND to Y (Vrms)**	**Ratio (Vrms/°)**
0	0.000	0.0066	
1	0.950	0.1975	0.2079
2	1.912	0.3955	0.2069
3	2.966	0.6112	0.2061
4	3.933	0.8089	0.2057
5	4.900	1.0064	0.2054
10	9.921	2.0252	0.2041
15	14.941	3.0280	0.2027
20	19.951	4.0073	0.2009
25	24.961	4.9559	0.1985
30	29.971	5.8670	0.1958
-1	-1.038	0.2168	0.2089
-2	-2.005	0.4145	0.2067
-3	-3.054	0.6300	0.2063
-4	-4.021	0.8275	0.2058
-5	-4.988	1.0248	0.2055
-10	-10.014	2.0422	0.2039
-15	-15.029	3.0438	0.2025
-20	-20.039	4.0217	0.2007
-25	-25.043	4.9691	0.1984
-30	-30.053	5.8790	0.1956

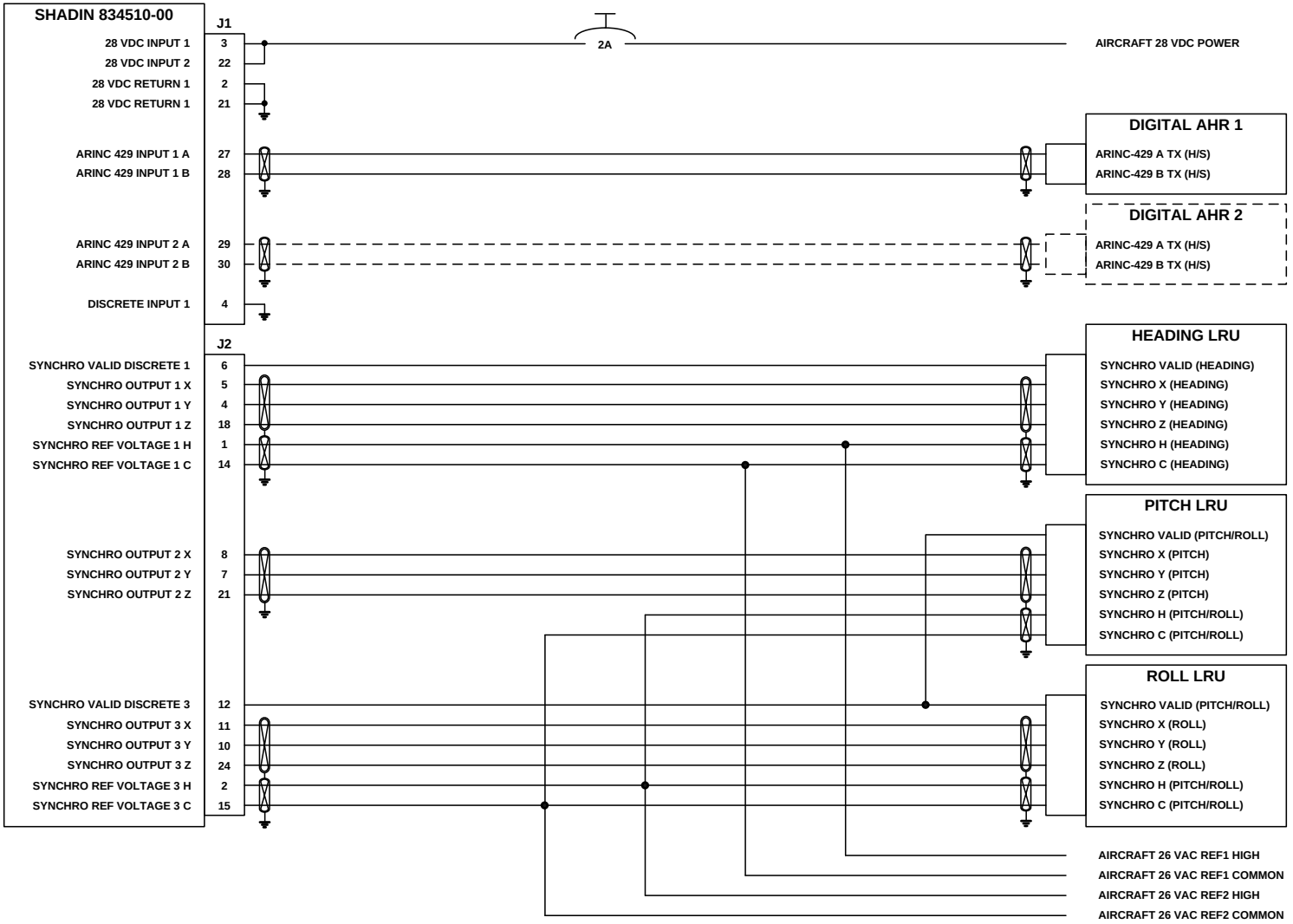


Figure 2 - Example of System Installation Diagram

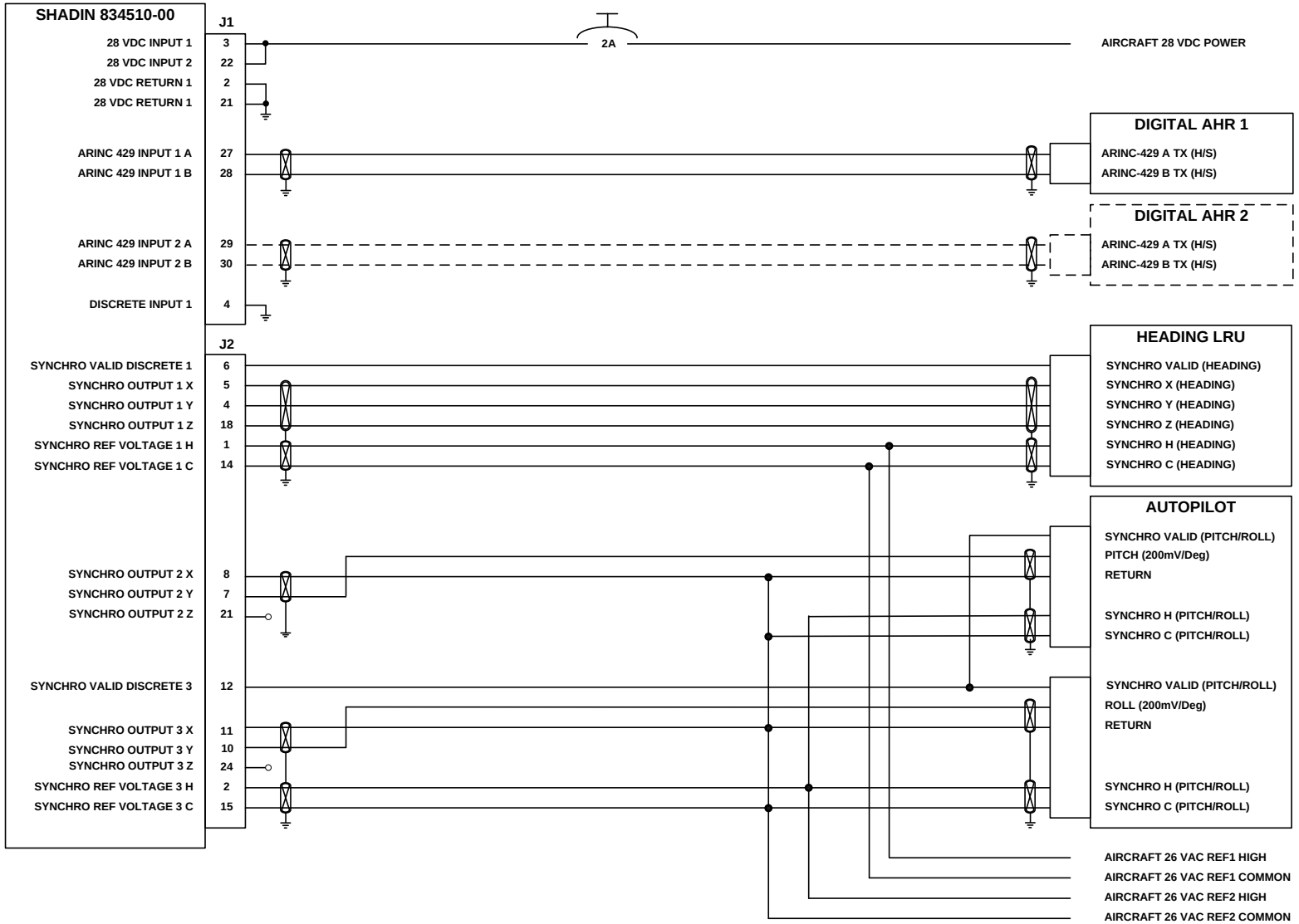


Figure 3 – Autopilot 200mV/Deg Input Installation Diagram

3.0 ENVIRONMENTAL QUALIFICATION FORM (EQF)

NOMENCLATURE: AIS-450 SYNCHRO CONVERTER
TYPE/MODEL/PART NO: 834510-00 **TSO NUMBER: TSO-C4c, -C5f, -C6e "Incomplete System"**
MANUFACTURER'S SPECIFICATION AND/OR OTHER APPLICABLE SPECIFICATION:
RTCA/DO-160F
MANUFACTURER: Shadin Avionics
ADDRESS: 6831 Oxford Street, St. Louis Park, Minnesota 55426-4412

CONDITIONS	**SECTION**	**DESCRIPTION OF TESTS CONDUCTED**
Temperature and Altitude	4.0	Tested to Category F1.
Low Temperature High Temperature		-40˚C +70˚C
Altitude Decompression Overpressure		55,000ft 55,000ft -15,000ft
Temperature Variation	5.0	Tested to Category B.
Humidity	6.0	Tested to Category A.
Operational Shock and Crash Safety	7.0	Tested to Category B.
Vibration	8.0	Tested to Category R (B, B1).
Explosion	9.0	Identified as Category X. Not tested.
Waterproofness	10.0	Identified as Category X. Not tested.
Fluids Susceptibility	11.0	Identified as Category X. Not tested.

ENIRONMENTAL QUALIFICATION FORM (Cont.)

CONDITIONS	**SECTION**	**DESCRIPTION OF TESTS CONDUCTED**
Sand and Dust	12.0	Identified as Category X. Not tested.
Fungus	13.0	Identified as Category X. Not tested.
Salt Spray	14.0	Identified as Category X. Not tested.
Magnetic Effect	15.0	Tested to Category Z.
Power Input	16.0	Tested to Category AXX and Engine Starting Undervoltage.
Voltage Spike	17.0	Tested to Category A.
Audio Frequency Susceptibility	18.0	Tested to Category R.
Induced Signal Susceptibility	19.0	Tested to Category CC.
Radio Frequency Susceptibility	20.0	Tested to Category WW.
Radio Frequency Emission	21.0	Tested to Category M.
Lightning Induced Transient Susceptibility	22.0	Identified as Category XXXXX. Not tested.
Lightning Direct Effects	23.0	Identified as Category X. Not tested.
Icing	24.0	Identified as Category X. Not tested.
Electrostatic Discharge	25.0	Tested to Category A.
Fire, Flammability	26.0	Identified as Category X. Not tested.

SECTION 4.0

INSTALLATION DRAWINGS AND INSTALL KIT PARTS LISTS

The following drawings are arranged in the sequence specified on page i of the Page Control Chart.

NOTES:

1. DIMENSIONS ARE FOR REFERENCE ONLY.

2. PHYSICAL SIZE, EXCLUDING SCREW HEADS:
   - 8.5" (L) X 4.0" (W) X 2.50" (H).

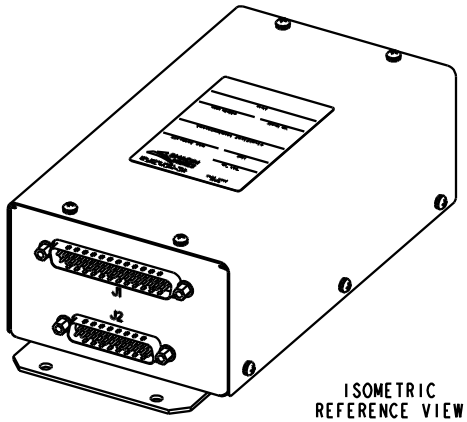
3. WEIGHT = 1.7 LBS

[4] MOUNTING SCREW SIZE IS NO. 8.

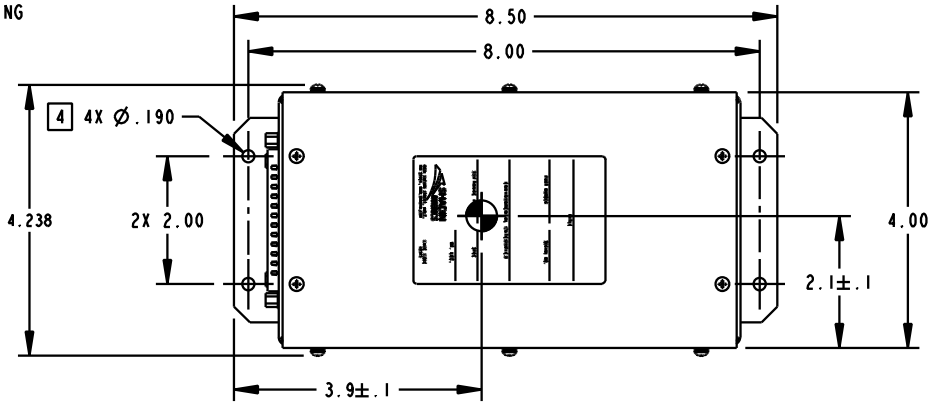
[5] J1 CONNECTOR
- 37 PIN D-SUB, MALE
- WIRE TYPE "STP" IS SHIELDED TWISTED PAIR

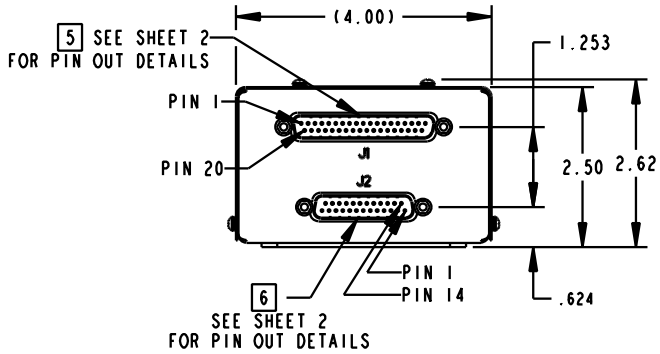
[6] J2 CONNECTOR
- 25 PIN D-SUB, MALE
- WIRE TYPE "STP" IS SHIELDED TWISTED PAIR
- WIRE TYPE "STT" IS SHIELDED TWISTED TRIPLE PAIR

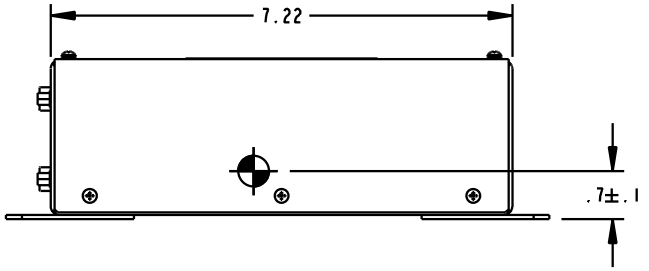
7. MATING CONNECTORS ARE STANDARD 25 & 37 PIN FEMALE D-SUB.
   - STP & STT WIRE SHIELDS SHOULD BE TIED TO MATING CONNECTOR SHELL.

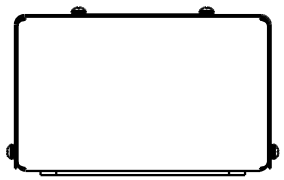


ISOMETRIC
REFERENCE VIEW









1303/005	A	03/20/13	CAL	ZK	ADDED CHASSIS GND TO J1:1 ON PAGE 2.
1010/011	—	01/20/11	HWL	DSE	BASELINE RELEASE
ERN #	REV.	DATE	BY	APP'D	DESCRIPTION

DRAWING DATE 2010-08-23
DRAFTER HWL
APPROVED DSE
FILE NAME 1D834510-00A.PDF
DIRECTORY 834510-00
SHEET 1 OF 2

SHADIN AVIONICS
MINNEAPOLIS, MN 55426

INSTALLATION DWG,
AIS 834510-00

CAGE CODE 0Z5P5 | SIZE A | P/N 1D834510-00 | REV A

[5] J1 CONNECTOR PIN OUT

PIN	SIGNAL NAME	DESCRIPTION	TYPE (REF)	PAIR (REF)
1	CHASSIS GND	CHASSIS GROUND	SINGLE	N/A
2	POWER-GND-IN	POWER RETURN	SINGLE	N/A
3	+28V-IN	28 VDC POWER POSITIVE	SINGLE	N/A
4	DISCRETE-INPUT-1	DISCRETE INPUT #1 (ACTIVE LOW)	SINGLE	N/A
5	RESERVED	N/A	N/A	N/A
6	RESERVED	N/A	N/A	N/A
7	RESERVED	N/A	N/A	N/A
8	ARINC-429-TXA-1	ARINC 429 OUTPUT #1 (LINE A)	STP	PIN 9
9	ARINC-429-TXB-1	ARINC 429 OUTPUT #1 (LINE B)	STP	PIN 8
10	ARINC-429-TXA-2	ARINC 429 OUTPUT #2 (LINE A)	STP	PIN 11
11	ARINC-429-TXB-2	ARINC 429 OUTPUT #2 (LINE B)	STP	PIN 10
12	RESERVED	N/A	N/A	N/A
13	RESERVED	N/A	N/A	N/A
14	RESERVED	N/A	N/A	N/A
15	RESERVED	N/A	N/A	N/A
16	RESERVED	N/A	N/A	N/A
17	RESERVED	N/A	N/A	N/A
18	RESERVED	N/A	N/A	N/A
19	RESERVED	N/A	N/A	N/A
20	SPARE1	UNUSED PIN	NA	N/A
21	POWER-GND-IN	POWER RETURN	SINGLE	N/A
22	+28V-IN	28 VDC POWER POSITIVE	SINGLE	N/A
23	RESERVED	N/A	N/A	N/A
24	RESERVED	N/A	N/A	N/A
25	RESERVED	N/A	N/A	N/A
26	RESERVED	N/A	N/A	N/A
27	ARINC-429-RXA-1	ARINC 429 INPUT #1 (LINE A)	STP	PIN 28
28	ARINC-429-RXB-1	ARINC 429 INPUT #1 (LINE B)	STP	PIN 27
29	ARINC-429-RXA-2	ARINC 429 INPUT #2 (LINE A)	STP	PIN 30
30	ARINC-429-RXB-2	ARINC 429 INPUT #2 (LINE B)	STP	PIN 29
31	RESERVED	N/A	N/A	N/A
32	RESERVED	N/A	N/A	N/A
33	RESERVED	N/A	N/A	N/A
34	RESERVED	N/A	N/A	N/A
35	RESERVED	N/A	N/A	N/A
36	RESERVED	N/A	N/A	N/A
37	RESERVED	N/A	N/A	N/A

[6] J2 CONNECTOR PIN OUT

PIN	SIGNAL NAME	DESCRIPTION	TYPE (REF)	PAIR (REF)
1	+26-VAC-REFERENCE-H-CH1	SYNCHRO REFERENCE VOLTAGE HIGH - CHANNEL 1	STP	PIN 14
2	+26-VAC-REFERENCE-H-CH3	SYNCHRO REFERENCE VOLTAGE HIGH - CHANNEL 3	STP	PIN 15
3	SPARE1	UNUSED PIN	N/A	N/A
4	SYNCHRO-Y-CH1	SYNCHRO OUTPUT Y - CHANNEL 1	STT	PINS 5 & 18
5	SYNCHRO-X-CH1	SYNCHRO OUTPUT X - CHANNEL 1	STT	PINS 4 & 18
6	SYNCHRO-VALID-CH1	SYNCHRO VALIDITY DISCRETE - CHANNEL 1	SINGLE	N/A
7	SYNCHRO-Y-CH2	SYNCHRO OUTPUT Y - CHANNEL 2	STT	PINS 8 & 21
8	SYNCHRO-X-CH2	SYNCHRO OUTPUT X - CHANNEL 2	STT	PINS 7 & 21
9	SYNCHRO-VALID-CH2	SYNCHRO VALIDITY DISCRETE - CHANNEL 2	SINGLE	N/A
10	SYNCHRO-Y-CH3	SYNCHRO OUTPUT Y - CHANNEL 3	STT	PINS 11 & 24
11	SYNCHRO-X-CH3	SYNCHRO OUTPUT X - CHANNEL 3	STT	PINS 11 & 24
12	SYNCHRO-VALID-CH3	SYNCHRO VALIDITY DISCRETE - CHANNEL 3	SINGLE	N/A
13	SPARE2	UNUSED PIN	N/A	N/A
14	+26-VAC-REFERENCE-C-CH1	SYNCHRO REFERENCE VOLTAGE COMMON - CHANNEL 1	STP	PIN 1
15	+26-VAC-REFERENCE-C-CH3	SYNCHRO REFERENCE VOLTAGE COMMON - CHANNEL 3	STP	PIN 2
16	SPARE3	UNUSED PIN	N/A	N/A
17	RESERVED	RESERVED PIN	N/A	N/A
18	SYNCHRO-Z-CH1	SYNCHRO OUTPUT Z - CHANNEL 1	STT	PINS 4 & 5
19	SPARE4	UNUSED PIN	N/A	N/A
20	RESERVED	RESERVED PIN	N/A	N/A
21	SYNCHRO-Z-CH2	SYNCHRO OUTPUT Z - CHANNEL 2	STT	PINS 7 & 8
22	SPARE5	UNUSED PIN	N/A	N/A
23	RESERVED	RESERVED PIN	N/A	N/A
24	SYNCHRO-Z-CH3	SYNCHRO OUTPUT Z - CHANNEL 3	STT	PINS 10 & 11
25	SPARE6	UNUSED PIN	N/A	N/A

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ECO #: 1102/014
Release Date: 2/24/2011
Approved: HWL

PARTS LIST

Drawing #s: NA

Part #: **IK834510**
Description: **INSTALL KIT, P/N 834510**

FN	P/N	QTY.	DESCRIPTION	MFG.	MFG.#	DESIGNATION	COMMENTS
5	230055	36	CONTACT, Crimp D-Sub, Fem, 20-24, M39029/63-368	POS	M39029/63-368 (FC6020D)		29 pcs needed, 7 pcs are spares.
10	230082	1	CONN HOOD, 37 Pin D-Sub ST	CIN	DC-24660		
15	230088	1	CONN SHELL, 25 Pin D Sub Fem Crimp Type	AMP	205165-1		
20	230089	1	HOOD, 25 Pin D-Sub, ST	CIN	DB-24659		
25	232002	1	CONN SHELL, 37 Pin D-Sub, Fem Crimp	AMP	205167-1		
30	239001	1	TOOL, Insertion/Extraction	DAN	M81969/1-02		
35	512101	4	RETAINER CLIP, "Bow Tie" Style	KEY	2061K		
40	753217	1	Thermal Label, 4"x 1"	ULI	S-8601		
45	PK1001	2	BAG, 2.5 x 3, 4 MIL Zip Lock				
50	PK1007	1	BAG, 6 x 8, 4 MIL				

49 items