



ARINC-MANCHESTER CONVERTER (AMC)

P/N: 833520-01

INSTALLATION MANUAL

MANUAL P/N: M833520-01

REV -

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REVISION LOG

Rev	Date	ERN	DESCRIPTION
-	30 Nov 2018	1811/014	Baseline Release

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1 REFERENCES

1.1 INDUSTRY DOCUMENTS

RTCA/DO-178C	Software Considerations in Airborne Systems and Equipment Certification
RTCA/DO-160G	Environmental Conditions and Test Procedures for Airborne Equipment
ARINC 429	Aeronautical Radio, Inc.
TSO C112e	Technical Standard Order, ATCRBS/Mode S Airborne Equipment

1.2 ACRONYMS

ADS-B	Automatic Dependent Surveillance-Broadcast
AMC	ARINC – Manchester Converter
DME	Distance Measuring Equipment
RCZ	Radio Communications – ‘integrated communications unit’
RMU	Radio Management Unit
RSB	Radio System Bus

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2 OVERVIEW

Shadin Avionics utilizes a development process in accordance with AS-9100C, following practices stated in RTCA/DO-178C.

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

2.1 SCOPE

This manual describes the interface to the 833520-01 ARINC MANCHESTER CONVERTER (AMC). It also provides information to guide the proper installation of the AMC. Installation instructions should be read and followed.

2.2 PRODUCT DESCRIPTION

Aircraft such as the Cessna Citation utilize a Honeywell Primus II Remote Radio System which integrates Communications, Navigation, Air Traffic Control (ATC) and Automatic Direction Finder (ADF) equipment. The AMC allows installation of an ADS-B compatible transponder to meet the coming regulatory introduction of ADS-B Out by 2020.

The AMC is intended to intercept and inject messages between the Radio Management Unit (RMU) and the RCZ-800/850 integrated communications unit as shown in Figure 1. The AMC acts as the controller for the ADS-B compliant transponder via an A-429 bus (red), in place of the existing Honeywell XS-850 transponder module which is a sub-unit of the RCZ-850. Messages from the RMU BUS (blue) are forwarded to the COM BUS (orange) while return status messages from the transponder, combined with COM BUS data, are transmitted on the RMU BUS.

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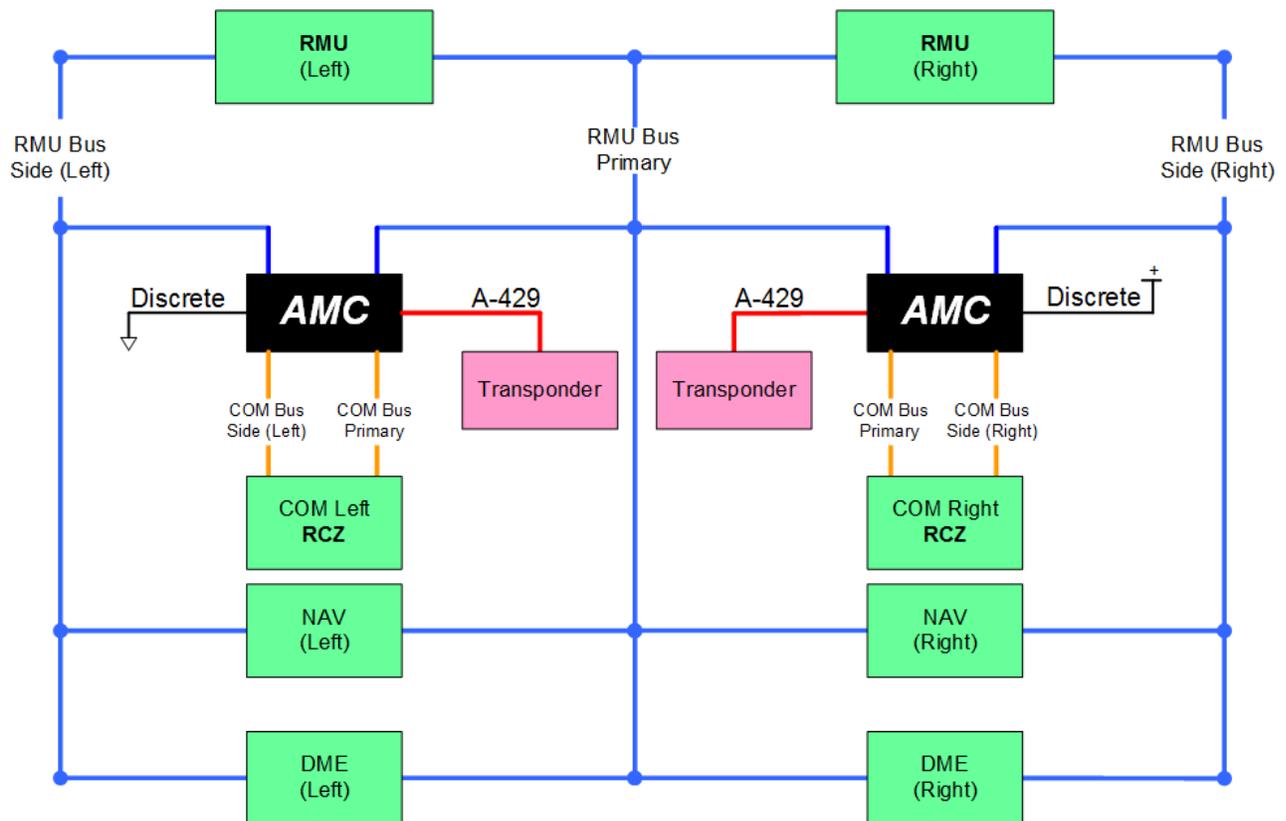


Figure 1: Aircraft Integration Diagram

As shown in Figure 1 each side of the aircraft (right and left) has its own transponder (pink) and Manchester bus devices (green). An AMC is allocated to each side of the aircraft to handle the data conversion required for that side. The message timing protocol for all devices on the aircraft is strictly timer based where each device is assigned a time slot within a repeating 192 millisecond frame where it is allowed to transmit its data. Any time a device transmits data on the Manchester bus the resulting message is broadcasted to all devices on that bus, therefore data transmitted on the Primary Bus is received and processed by devices on both sides of the aircraft (data transmitted by a device to an opposite side device is called “cross-talk” and is a built in redundancy feature of the system) whereas data transmitted on either Side Bus is received and processed only by devices on that side. In order to maintain cross-talk capability, each AMC will accept all data received on the primary bus regardless of which side it came from. Each AMC will also accept all data received on its respective side bus.

For each side, the AMC will transmit bus messages within the time slot originally assigned to the RCZ radio unit. Because the message transmission time slot varies based on device side, the AMC will be assigned as the left or right side unit via a discrete input strap. As shown in Figure 1, the AMC strapped to ground is assigned to left side while the AMC strapped open is assigned to right side.

Each AMC controls the transponder that is connected to it. The AMC maintains internal Transponder/TCAS control registers which it updates when valid bus commands are received. Most messages contain status data (versus command data). Bus commands are identified by a “command” or “update” bit flag being set in the message for the associated data.

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2.3 SPECIFICATIONS

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

PHYSICAL

Product Part Number	833520-01 revision –
Nominal Dimensions:	6.9”L x 4.2”W x 2.2”H
Weight:	0.9 pounds
Mounting:	4 Screws (See Installation Drawing D833520-01 in Appendix A)
Mounting Locations:	6.25”L x 2.00”W
Enclosure:	Aluminum alloy with chemical conversion coating, painted black

ELECTRICAL

Power Supply Voltage:	+18VDC to +33VDC
Supply Current:	200mA at +28VDC
Thermal Dissipation:	8.0 watts typical

ENVIRONMENTAL

Tested:	RTCA/DO-160G
Categories:	[D2X]BBB[R(B,B1)]XXXXXXXXZ[BXX]AZ[CC][RR]M[XXJ3L3]XXAX
Operating Temperature:	-55°C to +70°C
Operating Altitude:	Up to 50,000 feet
Storage Temperature:	-55°C to +85°C
In-Flight Loss of Cooling:	Equipment can run indefinitely with no cooling

See Section 4 for the Environmental Qualification Form

RELIABILITY

MIL-HDBK-217F MTBF:	> 20,000 hours (estimate)	[Airborne Inhabited Cargo (AIC), 30°C]
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CERTIFICATION

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

There are no programmable logic devices in this product; hence RTCA/DO-254 does not apply.

Failure of the function per TSO-C112c could result in a Major failure condition, resulting in misleading data.

REGULATORY

TSO-C112e “INCOMPLETE SYSTEM”

SOFTWARE

403520-01	Software for Main Processor, DAL C
403521-00	Software for Bus Processors, DAL C

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2.4 ALLOCATED INPUTS AND OUTPUTS:

- 4 Manchester II (Bi-Phase Level) bus ports
- 1 ARINC 429 receiver
- 1 ARINC 429 transmitter
- 1 discrete input

Unused Inputs and Outputs:

- 1 ARINC 429 receiver
- 1 ARINC 429 transmitter
- 3 discrete I/O interfaces
- 2 high side discrete output
- 2 serial ports, RS-232
- 2 serial ports, configurable as RS-232, RS-422 or RS-485
- 2 pulse / frequency inputs

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3 INSTALLATION

3.1 LIMITATIONS

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

3.2 MOUNTING

The AMC should be mounted using four (4) number 8 size screws in a dry location (number 6 screws are acceptable). Installation Drawing D833520-01, included at the end of this document, provide the physical dimensions of the mounting holes.

3.3 ELECTRICAL CONNECTION

Connector and pin number, signal name, and signal description of the electrical connections for the unit are provided in this section. Signals denoted with a ‘n/c’ are not connected in the AMC application.

J1 main connector is a 44 pin male D-Subminiature. Mate with cabled 44 pin female D-Subminiature connector. The Installation Drawing in Appendix A provides the full list of pin functions.

Table 1: AMC J1 Electrical Connections

Pin (Note 1)	Signal	Description	Comments
1	POWER-RETURN	28 VDC Power Negative input	(Note 2)
2	+28V-POWER	28 VDC Power Positive input	(Note 2)
10	ARINC-429-TX1-B	ARINC 429 Output #1 (Line B)	to Transponder
16	POWER-RETURN	28 VDC Power Negative input	(Note 2)
17	+28V-POWER	28 VDC Power Positive input	(Note 2)
19	SER-1-RX	Serial RS-232 Receive	RESERVED - diagnostic
23	DISCRETE-IO-4	Side Select	Ground = Left // High/Open = Right
25	ARINC-429-TX1-A	ARINC 429 Output #1 (Line A)	to Transponder
30	GROUND	Signal ground	I/O and Serial reference
34	SER-1-TX	Serial RS-232 Transmit	RESERVED - diagnostic
37	CHASSIS-GND	Chassis Ground	
40	ARINC-429-RX1-A	ARINC 429 Input #1 (Line A)	from Transponder
41	ARINC-429-RX1-B	ARINC 429 Input #1 (Line B)	from Transponder
43	DISCRETE-OUT-6	Fail Discrete Output	RESERVED - diagnostic

Note 1: Pin numbers not shown are not used

Note 2: Two pins for 28V-IN and POWER-GND-IN are internally connected but not diode isolated - only one of each is required

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J2 connector is a 25 pin male D-Subminiature. Mate with cabled 25 pin female D-Subminiature connector. The Installation Drawing in Appendix A provides the full list of pin functions.

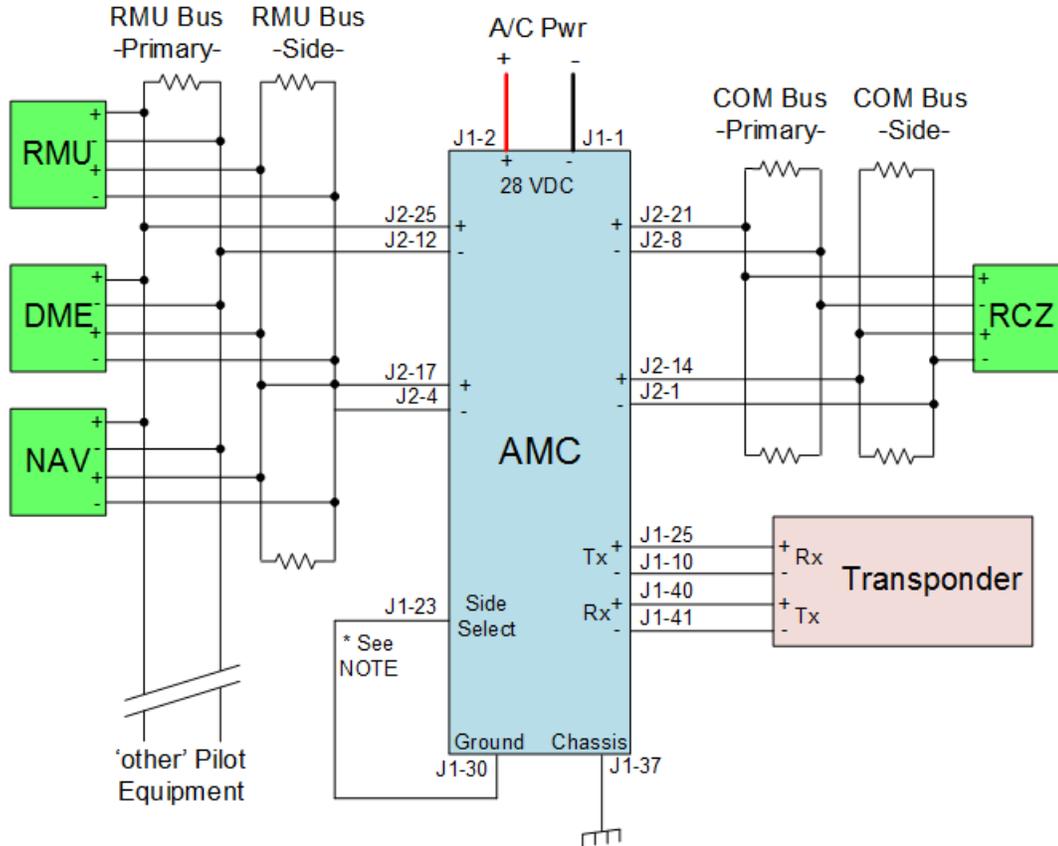
Table 2: AMC J2 Electrical Connections

Pin (Note 1)	Signal	Description	Comments
1	SIDE-RCZ-LO	Side data to RCZ	
4	SIDE-BUS-LO	Side data from RMU	
6	GROUND	Signal ground	RESERVED - Serial reference
8	PRIMARY-RCZ-LO	Primary data to RCZ	
10	RS232-RX-SIDE	Side RS-232 Input	RESERVED - diagnostic
11	RS232-TX-SIDE	Side RS-232 Output	RESERVED - diagnostic
12	PRIMARY-BUS-LO	Primary data from RMU	
14	SIDE-RCZ-HI	Side data to RCZ	
17	SIDE-BUS-HI	Side data from RMU	
19	GROUND	Signal ground	RESERVED - Serial reference
21	PRIMARY-RCZ-HI	Primary data to RCZ	
23	RS232-RX-PRIMARY	Primary RS-232 Input	RESERVED - diagnostic
24	RS232-TX-PRIMARY	Primary RS-232 Output	RESERVED - diagnostic
25	PRIMARY-BUS-HI	Primary data from RMU	

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3.4 WIRING DIAGRAM

An example wiring diagram is provided below. The 'Side Select' discrete input is shown connected to ground for Left side operation. Wiring the Side Select discrete to 28v or leaving the input open will configure the AMC for Right side operation.



Note: Diagram shows AMC strapped for Left operation

Figure 2: Wiring Diagram

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4 ENVIRONMENTAL QUALIFICATION FORM (EQF)

The base AMC 833520-00 hardware was environmentally tested with all functions active to RTCA/DO-160G and is documented in Shadin Qualification Testing Report SD-160084. The 833520-01 AMC hardware is equivalent to the 833520-00 AMC hardware and therefore is environmentally qualified by similarity.

NOMENCATURE: ARINC-MANCHESTER CONVERTER

TYPE/MODEL/PART NO: 833520-01 **CERTIFICATION:** TSO-C112e "INCOMPLETE SYSTEM"

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

MANUFACTURER: Shadin Avionics

ADDRESS: 6831 Oxford Street, St. Louis Park, Minnesota 55426

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 3: Environmental Qualification

CONDITIONS	SECTION	DESCRIPTION OF TESTS CONDUCTED
Temperature and Altitude Low Temperature (Operating) High Temperature (Operating) Altitude Decompression Overpressure	4.0	Category D2 -55°C +70°C +50,000 ft +50,000 ft -15,000ft
Temperature Variation	5.0	Category B
Humidity	6.0	Category B
Operational Shock and Crash Safety	7.0	Category B
Vibration	8.0	Category R(B, B1)
Explosion	9.0	X – not tested
Waterproofness	10.0	X – not tested
Fluids Susceptibility	11.0	X – not tested
Sand and Dust	12.0	X – not tested
Fungus	13.0	X – not tested
Salt Spray	14.0	X – not tested
Magnetic Effect	15.0	Category Z
Power Input	16.0	Category BXX
Voltage Spike	17.0	Category A
Audio Frequency Conducted Susceptibility	18.0	Category Z
Induced Signal Susceptibility	19.0	Category CC
Radio Frequency Susceptibility (CS/RS)	20.0	Category RR
Radio Frequency Emission (CE/RE)	21.0	Category M
Lightning Induced Transient Susceptibility	22.0	Category XXJ3L3
Lightning Direct Effects	23.0	X – not tested
Icing	24.0	X – not tested
Electrostatic Discharge	25.0	Category A
Fire, Flammability	26.0	X – not tested

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5 SETUP AND USE

5.1 INITIAL SETUP

There is no initial setup procedure for this unit. The unit becomes active and ready when power is applied to its power pins.

5.2 CONFIGURATION

This unit is not field configurable.

This unit leaves the factory configured as described in the functional description of this Installation Manual.

5.3 MAINTAINABILITY

No maintenance is required for this unit.

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6 APPENDIX A: INSTALLATION DRAWINGS

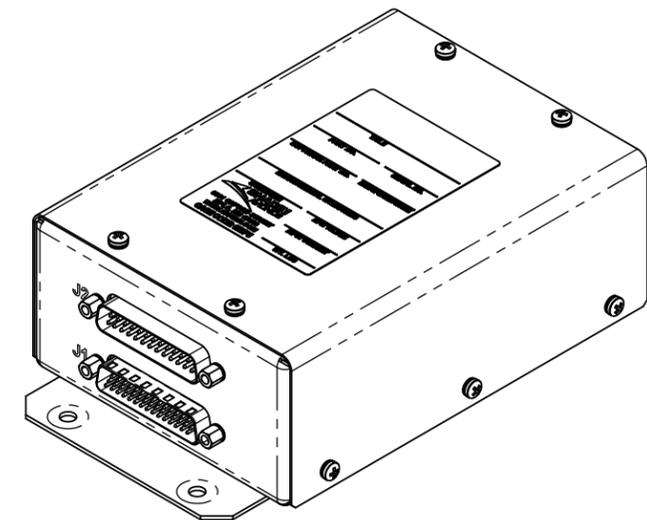
The following pages provide mechanical and electrical connection details for the 833520-01.

NOTE: Pin assignments are provided in Table 1 and Table 2.

REVISIONS					
ERN #	REV.	DATE	BY	APP'D	DESCRIPTION
1811/014	-	11/30/2018	EG	MET	BASELINE RELEASE

4 J1 CONNECTOR PIN OUT

PIN	SIGNAL NAME	DESCRIPTION	TYPE(REF)	PAIR(REF)	PIN	SIGNAL NAME	DESCRIPTION	TYPE(REF)	PAIR(REF)
1	PWR_GND	POWER RETURN	SINGLE	N/A	23	DISCRETE-IO-4	DISCRETE INPUT/OUTPUT #4	SINGLE	N/A
2	+28V_PWR	28 VDC POWER POSITIVE	SINGLE	N/A	24	FREQ-1	FREQ/PULSE INPUT #1	STT	PIN 28
3	DC_IN_2_NEG	DC INPUT #2 NEGATIVE	STP	4	25	ARINC-429-TX1-A	ARINC 429 OUTPUT #1 (LINE A)	STP	PIN 10
4	DC_IN_2_POS	DC INPUT #2 POSITIVE	STP	3	26	ARINC-429-TX2-A	ARINC 429 OUTPUT #2 (LINE A)	STP	PIN 11
5	DISCRETE-IO-1	DISCRETE INPUT/OUTPUT #1	SINGLE	N/A	27	ARINC-429-RX2-A	ARINC 429 INPUT #2 (LINE A)	STP	PIN 12
6	DISCRETE-IO-3	DISCRETE INPUT/OUTPUT #3	SINGLE	N/A	28	FF-PWR-RTN-1	FUEL FLOW POWER RETURN #1	STT	PIN 14, 24
7	SER-3-RX	SERIAL 3 RECEIVE POSITIVE	STP	PIN 8	29	DISCRETE-OUT-5	DISCRETE OUTPUT #5	SINGLE	N/A
8	SER-3-RX-NEG	SERIAL 3 RECEIVE NEGATIVE	STP	PIN 7	30	SIGNAL_GND	SIGNAL GROUND	SINGLE	N/A
9	DC_IN_1_POS	DC INPUT #1 POSITIVE	STP	15	31	SER-3-TX	SERIAL 3 TRANSMIT POSITIVE	STP	PIN 32
10	ARINC-429-TX1-B	ARINC 429 OUTPUT #1 (LINE B)	STP	PIN 25	32	SER-3-TX-NEG	SERIAL 3 TRANSMIT NEGATIVE	STP	PIN 31
11	ARINC-429-TX2-B	ARINC 429 OUTPUT #2 (LINE B)	STP	PIN 26	33	SER-4-TX	SERIAL 4 TRANSMIT POSITIVE	STP	PIN 18
12	ARINC-429-RX2-B	ARINC 429 INPUT #2 (LINE B)	STP	PIN 27	34	SER-1-TX	SERIAL 1 TRANSMIT	STP	PIN 19
13	FF-PWR-POS-2	FUEL FLOW POWER POSITIVE #2	STT	PIN 42	35	SER-4-RX	SERIAL 4 RECEIVE POSITIVE	STP	PIN 36
14	FF-PWR-POS-1	FUEL FLOW POWER POSITIVE #1	STT	PIN 28	36	SER-4-RX-NEG	SERIAL 4 RECEIVE NEGATIVE	STP	PIN 35
15	DC_IN_1_NEG	DC INPUT #1 NEGATIVE	STP	9	37	CHASSIS-GND	CHASSIS GROUND	SINGLE	N/A
16	PWR_GND	POWER RETURN	SINGLE	N/A	38	DOWNLOAD-ENABLE	DOWNLOAD ENABLE INPUT (ACTIVE LOW)	SINGLE	N/A
17	+28V_PWR	28 VDC POWER POSITIVE	SINGLE	N/A	39	FREQ-2	FREQ/PULSE INPUT #2	STT	PIN 42
18	SER-4-TX-NEG	SERIAL 4 TRANSMIT NEGATIVE	STP	PIN 33	40	ARINC-429-RX1-A	ARINC 429 INPUT #1 (LINE A)	STP	PIN 41
19	SER-1-RX	SERIAL 1 RECEIVE	STP	PIN 34	41	ARINC-429-RX1-B	ARINC 429 INPUT #1 (LINE B)	STP	PIN 40
20	SER-2-TX	SERIAL 2 TRANSMIT	STP	PIN 21	42	FF-PWR-RTN-2	FUEL FLOW POWER RETURN #2	STT	PIN 13, 39
21	SER-2-RX	SERIAL 2 RECEIVE	STP	PIN 20	43	DISCRETE-OUT-6	DISCRETE OUTPUT #6	SINGLE	N/A
22	DISCRETE-IO-2	DISCRETE INPUT/OUTPUT #2	SINGLE	N/A	44	+5V	+5 VDC	SINGLE	N/A



PICTORIAL VIEW

5 J2 CONNECTOR PIN OUT

PIN	SIGNAL NAME	DESCRIPTION	TYPE(REF)	PAIR(REF)
1	SIDE-RCZ-LO		STP	14
2	DISCRETE-INPUT-FILTERED		SINGLE	N/A
3	NC	NOT CONNECTED	N/A	N/A
4	SIDE-BUS-LO		STP	17
5	DOWNLOAD-ENABLE-FILTERED-SIDE		SINGLE	N/A
6	GROUND		SINGLE	N/A
7	NC	NOT CONNECTED	N/A	N/A
8	PRIMARY-RCZ-LO		STP	21
9	NC	NOT CONNECTED	N/A	N/A
10	RS-232-RX-FILTERED-SIDE		SINGLE	N/A
11	RS-232-TX-FILTERED-SIDE		SINGLE	N/A
12	PRIMARY-BUS-LO		STP	25
13	NC	NOT CONNECTED	N/A	N/A
14	SIDE-RCZ-HI		STP	1
15	NC	NOT CONNECTED	N/A	N/A
16	NC	NOT CONNECTED	N/A	N/A
17	SIDE-BUS-HI		STP	4
18	DOWNLOAD-ENABLE-FILTERED-PRIMARY		SINGLE	N/A
19	GROUND		SINGLE	N/A
20	NC	NOT CONNECTED	N/A	N/A
21	PRIMARY-RCZ-HI		STP	8
22	NC	NOT CONNECTED	N/A	N/A
23	RS-232-RX-FILTERED-PRIMARY		SINGLE	N/A
24	RS-232-TX-FILTERED-PRIMARY		SINGLE	N/A
25	PRIMARY-BUS-HI		STP	12

NOTES:

- ALL DIMENSIONS ARE FOR REFERENCE ONLY.
- MOUNTING SCREW SIZE: NO. 8
- WEIGHT: 0.9 LBS
- CONNECTOR J1 IS A 44 PIN HD D-SUB, MALE. WIRE TYPE "SINGLE" IS A SINGLE WIRE. WIRE TYPE "STP" IS A SHIELDED TWISTED PAIR. WIRE TYPE "STT" IS SHIELDED TWISTED TRIPLE.
 - A. MATING CONNECTOR IS A HIGH DENSITY 44 PIN FEMALE D-SUB. STP WIRE SHIELDS SHOULD BE TIED TO MATING CONNECTOR SHELL.
- CONNECTOR J2 IS A 25 PIN STANDARD D-SUB, MALE. WIRE TYPE "SINGLE" IS A SINGLE WIRE. WIRE TYPE "STP" IS A SHIELDED TWISTED PAIR.
 - A. MATING CONNECTOR IS A STANDARD 25 PIN FEMALE D-SUB.

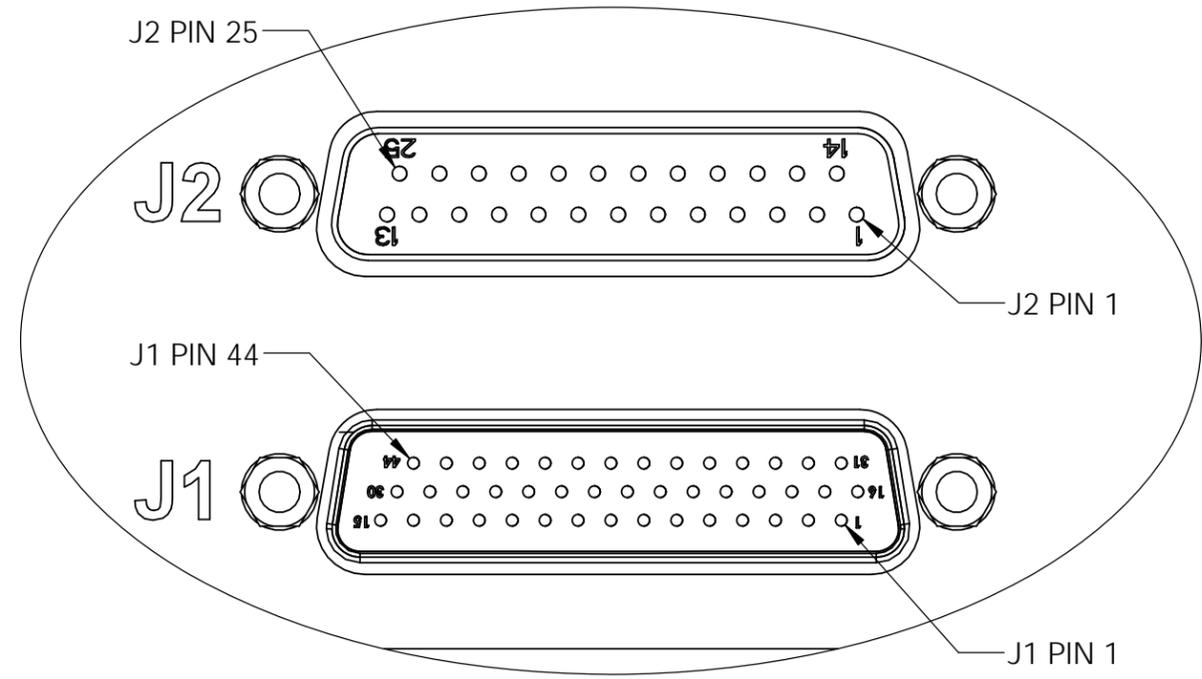
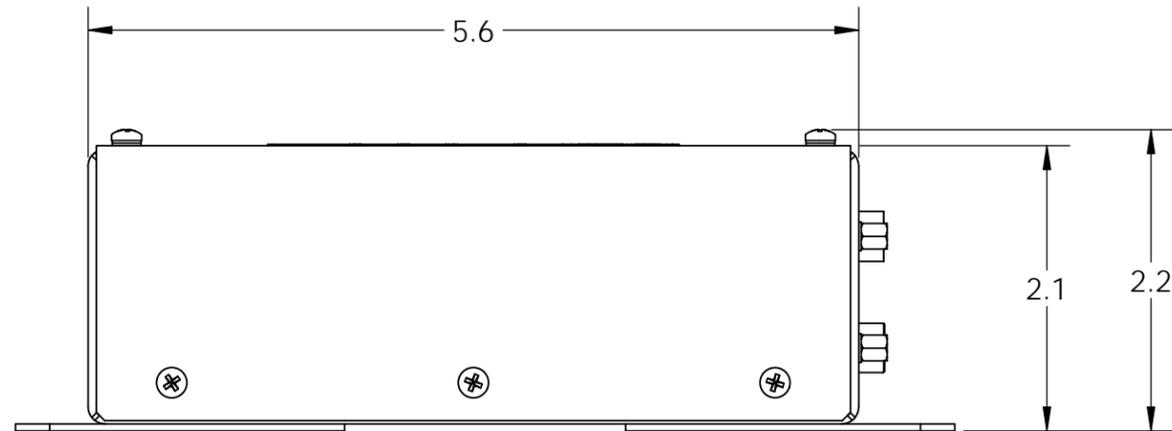
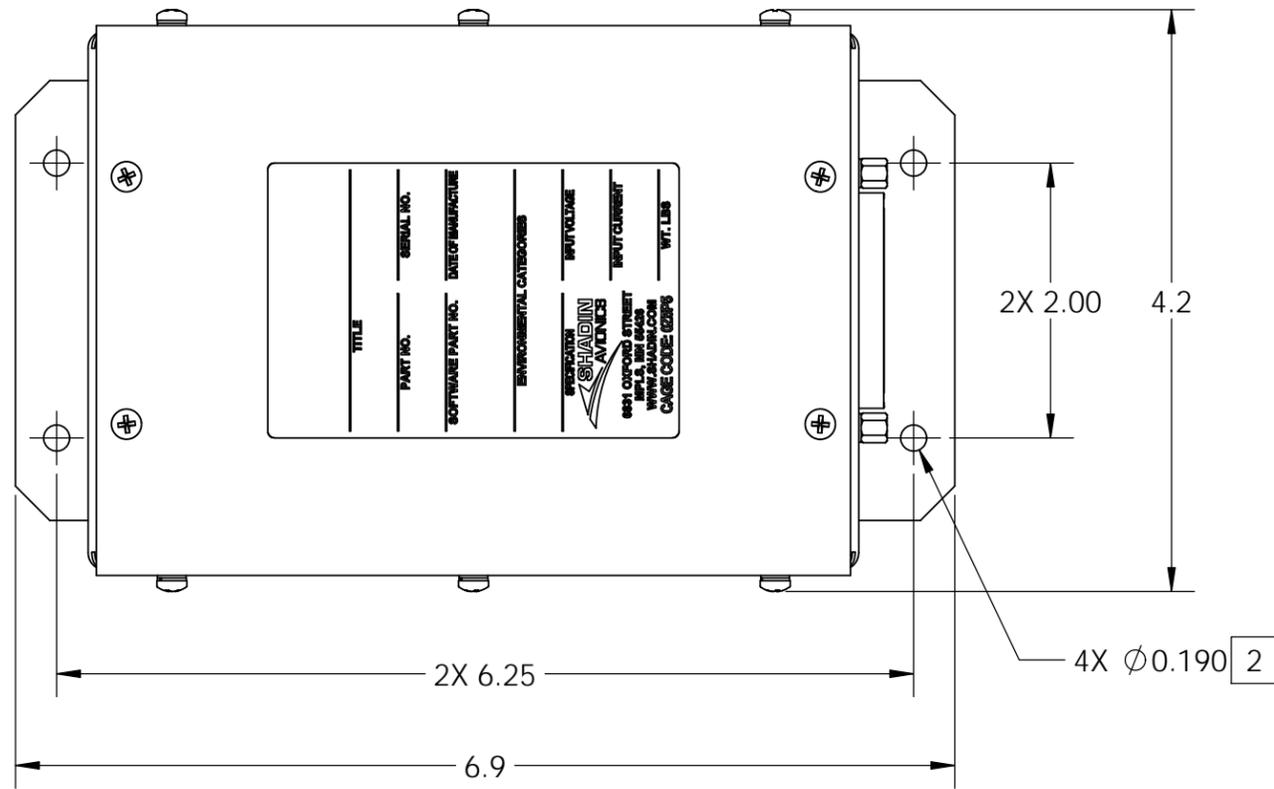
UNLESS OTHERWISE SPECIFIED: DRAWN PER ASME Y14.5M-2009 DIMENSIONS ARE IN INCHES		ST. LOUIS PARK, MN 55426	INSTALLATION DWG, P/N 833520-01	
THIRD ANGLE PROJECTION	TOLERANCES: X/±1/64 X°±1° X.X±0.1 X.XX±0.01 X.XXX±0.005			
FINISH	N/A	DRAWN	EG	11/30/2018
MATERIAL	N/A	CHECKED	GM	11/30/2018
		ENG APPR.	MET	11/30/2018
SIZE	N/A	CAGE CODE:	OZ5P5	
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P/N			D833520-01	
REV			-	

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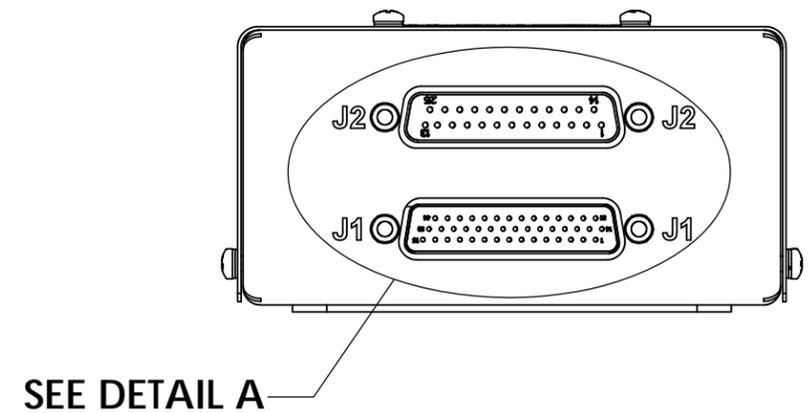
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A



DETAIL A
ENLARGED



SIZE	CAGE CODE: 0Z5P5	P/N	REV
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	SCALE: N/A	SHEET 2 OF 2	