

Trans-Cal Industries, Inc.

Model IA-RS232C-S  
Interface Adapter (Serializer)  
Owner/Installation Manual  
TSO-C88a Approved

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### What's in the Box:

Qty.	Part Number	Description
1 ea.	IA-RS232C-S	Interface Adapter
1 ea.	950000	Owner/Installation Manual
1 ea.	DA-15S	15 Pin D-Subminiature Mating Receptacle
1 ea.	DA-15P	15 Pin D-Subminiature Plug
2 ea.	600016	15 Pin Connector Back Shell
1 ea.	DE-9P	9 Pin D-Subminiature Mating Plug
1 ea.	600017	9 Pin Connector Back Shell

### History of Revision

Revision	Date	Description
A	17 Apr. 2001	Revised in entirety.
B	4 Apr. 2002	Added Tables I thru VII.
C	18 Mar. 2004	Added Rev. A of 930003.
D	25 Aug. 2004	Updated Manual
E	25 Aug. 2006	Changed warranty from 40 to 42 month
F	19 July 2012	Corrected protocol listing, corrected connection diagram.
G	19 May 2015	Added Limitations, Deviations & Compliance §1.3.1 DO-178 Cat. Updated reproduction notice.

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### Abbreviations, Acronyms and Symbols

<b>A</b>	Amperes
<b>AC</b>	Advisory Circular
<b>ARINC</b>	Aeronautical Radio Incorporated
<b>ASCII</b>	American Standard for Coded Information Interchange
<b>ATCRBS</b>	Air Traffic Control Radar Beacon System
<b>bps</b>	Bits per second.
<b>CFR</b>	Code of Federal Regulation
<b>C<sub>R</sub></b>	Carriage Return
<b>EASA</b>	European Aviation Safety Agency
<b>EEPROM</b>	Electrically Erasable Read Only Memory
<b>EIA</b>	Electronic Industries Association
<b>ETSO</b>	European Technical Standard Order
<b>FAA</b>	Federal Aviation Administration
<b>FAR</b>	Federal Aviation Regulation
<b>ft.</b>	Distance in feet.
<b>GPS</b>	Global Positioning System
<b>H/W</b>	Hardware
<b>Hz</b>	Hertz
<b>ICAO</b>	International Civil Aviation Organization
<b>I.F.F.</b>	Identification Friend or Foe
<b>In. Hg.</b>	Pressure in Inches of Mercury
<b>k</b>	Thousand
<b>Kbps</b>	Kilobits per Second
<b>KHz</b>	Kilohertz
<b>L<sub>F</sub></b>	Line Feed
<b>LSB</b>	Least Significant Bit
<b>mA</b>	Milliamperes
<b>max.</b>	Maximum
<b>MB</b>	Millibar
<b>MHz</b>	Megahertz
<b>MFD</b>	Multi-Function Display
<b>MSL</b>	Mean Sea Level
<b>min.</b>	Minimum
<b>ms</b>	Time in milliseconds.
<b>MSB</b>	Most Significant Bit
<b>mW</b>	Milliwatt
<b>NIST</b>	National Institute of Standards and Technology
<b>oz</b>	Ounce
<b>P/N</b>	Part number
<b>psi</b>	Pounds per Square Inch
<b>RAM</b>	Random Access Memory
<b>RS</b>	Recommended Standard
<b>RTCA</b>	Radio Technical Commission for Aeronautics
<b>SAE</b>	Society of Automotive Engineers
<b>sec.</b>	Time in seconds.
<b>SSR</b>	Secondary Surveillance Radar
<b>S/W</b>	Software
<b>TCI</b>	Trans-Cal Industries, Inc.
<b>TIA</b>	Telecommunication Industries Association
<b>TSO</b>	Technical Standard Order
<b>Vdc</b>	Volts Direct Current
<b>VSI</b>	Vertical Speed Indicator
<b>W</b>	Watt
<b>Ω</b>	Electrical resistance measured in Ohms.
<b>°C</b>	Temperature in degrees Celsius.
<b>±</b>	Plus or minus.
<b>§</b>	Section

## **Section 1.0 General**

### **1.1 Scope**

This manual provides detailed installation, and operating instructions for the Model IA-RS232C-S Interface Adapter (Serializer.). This manual assumes use by competent, qualified avionics professionals utilizing installation methods in accordance with 14CFR and other industry accepted installation practices.

### **1.2 Equipment Description**

Approved under F.A.A. TSO-C88a the Model IA-RS232C-S is an all solid-state microprocessor-based device that converts parallel altitude data (ICAO Altitude Transmission Code) received from pressure altitude reporting equipment, into serialized data conforming to the TIA/EIA RS232C standard, as well as repeating the ICAO Altitude Code on an output port.

The input parallel digital altitude data is repeated on (1) one output port. The protocol is set forth in the (ICAO) International Standard for Pressure Altitude Transmission. This data format is in accordance with U.S. National Standards for Common System Component Characteristics for the I.F.F. Mark X (SIF)/Air Traffic Control Radar Beacon System SIF/ATCRBS.

The serial altitude data is provided on (2) two asynchronous RS232C output ports and may be used to provide pressure altitude data to GPS or other on board navigation devices. The serial data protocol is selectable see §1.8.

### **1.3 General Specifications**

#### **1.3.1 Limitations, Deviations & Compliance**

##### **NOTE**

The conditions and tests 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. TSO articles must have separate approval for installation in an aircraft. This article is to be installed in accordance with 14 CFR part 43 or the applicable airworthiness requirements.

##### **NOTE**

DO-160E lightning induced transient susceptibility tests were not conducted on this device and it is the responsibility of the installing agency to substantiate compliance with FAR25.1316. Advisory Circular AC20-136B provides guidance related to the protection of aircraft electrical systems from the effects of lightning.

##### **Deviation:**

TSO-C88a specifies RTCA/DO-160A for environmental testing. TCI utilized RTCA/DO-160B in testing this device. DO-160B provides an equivalent level of safety and meets or exceeds the standard environmental test condition requirements of TSO-C88a and DO-160A.

**TSO/RTCA Compliance Table**

<b>FAA TSO</b>	C88a
<b>RTCA DO-178 Software</b>	Non-Essential Category H/W - S/W P/N: 881053-SrB-700006rC
<b>RTCA DO-160B Environmental*</b>	E1BA/JKLMNOP/XXXXXXXXZBBBBB

\*See Environmental Qualification form for specifics.

**1.3.2 Operating Voltage:**

+12 to +30Vdc.

**1.3.3 Operating Current:**

0.090 Amperes. (90mA)

**1.3.4 Operating Temperature:**

-20° to +85°C.

**1.3.5 Storage Temperature:**

-55° to +85°C.

**1.3.6 Warm-up Time:**

No warm-up required.

**1.3.7 Weight:**

12 oz.

**1.3.8 Operating Altitude:**

-1000 to +62,700 feet. (Dependant on input device range.)

**1.3.9 Accuracy:**

This device repeats the data from the source altitude reporting device with 100% accuracy.

**1.3.10 Mechanical Characteristics:**

See outline drawing.

**1.4 Parallel Altitude Data Input Port Specification (DA-15S Connector)**

The IA-RS232C-S will accept altitude data inputs from (1) one source. Pin 6 (strobe) is internally grounded on the interface adapter to continuously enable altitude data transmission. If the altitude data being sent to the Interface Adapter is interrupted, or strobed, then the serial altitude data will be disabled.

**Input Code Format:** In accordance with U.S. National Standard for Common System Component Characteristics for the I.F.F. Mark X (SIF) Air Traffic Control Radar Beacon System, SIF/ATCRBS.

**Receiver Description:** The parallel altitude data input takes the form of an “uncommitted collector” and is “pulled up” through a resistive load by the interface adapter.

**Interface Adapter Pull-Up Voltage:** +5 VDC.

**Maximum Sink Current:** 1 mA.

### **1.5 Parallel Altitude Data Output Port Specification ( DA-15P Connector)**

Code Format: In accordance with U.S. National Standard for Common System Component Characteristics for the I.F.F. Mark X (SIF) Air Traffic Control Radar Beacon System, SIF/ATCRBS.

Driver Description: The parallel altitude data output is provided by the “uncommitted” collectors of a transistor array and must be “pulled-up” through a resistive load by the transponder, or other receiving device.

Pull-Up Voltage: +3 to 50Vdc.

Maximum Sink Current: 50 mA.

Maximum Cable Length: 50 feet. (15.24 meters)

Input Signal Requirement: pin 6 (strobe or signal common) must be either grounded or connected to the transponder.

### **1.6 Serial Altitude Data Output Port Specification (DE-9S Connector)**

Electrical Format: Conforming to the TIA/EIA RS232E standard.

Logic Levels: “0” +9 volts. Logic “1” –9 volts.

Driver Output Maximum Voltage: ±25 VDC.

Driver Load Impedance: 3kΩ typ.

Maximum Cable Length: 50 Feet. (15.24 meters)

Code Format: ASCII

Communication Method: Asynchronous

Transmission Rate: Selectable, 1200 bps to 9600 bps.

Update Rate: 1/second.

### **1.7 Serial Communication Format**

Model IA-RS232C-S carries out serial communication asynchronously with the “start/stop” system. The specifics of the format i.e. the number of data bits, baud rate, etc., are determined by the protocol selected.

### **1.8 Serial Communication Protocol**

The serial data protocol is selectable by grounding or leaving open pins 6 or 7 of the 9 pin D-Subminiature DE-9S connector. The selected protocol is transmitted on both serial ports simultaneously.

Leaving Pin 6 and 7 of the DE-9S connector open results in the default protocol compatible with UPS Aviation Technologies' (IIMorrow) Navigation devices. At a baud rate of 1200 bps the Interface Adapter sends a seventeen-byte message as follows:

Message	Definition
#AL+00800T+25D8 <sup>C</sup> <sub>R</sub>	Altitude 800 feet.

Grounding Pin 7 of the DE-9S connector results in a protocol compatible with some navigation devices manufactured by Trimble and Garmin. At a baud rate of 9600 bps the Interface Adapter will send a ten-byte message as follows:

Message	Definition
ALT 10500 <sup>C</sup> <sub>R</sub>	Altitude 10,500 feet.
ALT 99900 <sup>C</sup> <sub>R</sub>	Digitizer disabled.



## **Section 2.0 Operation**

### **2.1 General**

The IA-RS232C-S Interface Adapter is designed to be mounted within a pressurized or non-pressurized, but temperature controlled area of aircraft operating up to 62,000 feet MSL. Remotely located, the Interface Adapter is fully automatic in operation. The Interface Adapter will begin transmitting parallel and serial data upon power up and the receipt of valid altitude data. The parallel data output is controlled by the transponder, while the serial data is transmitted asynchronously.

### **2.2 Operating Instructions**

#### Parallel Data:

Apply power to the Interface Adapter and to the device(s) connected to the Interface Adapter. The parallel data will assume the value of the present pressure altitude being received from the altitude data source. If the parallel output data of the Interface Adapter is connected to a transponder it may, or may not control the data by an enable/disable signal on the strobe or signal common (pin 6) of the Interface Adapter DA-15P connector. To continuously enable the parallel output data pin 6 *MUST* be grounded on the 15 Pin DA-15P connector.

#### Serial Data:

Serial communication is fully automatic and transmission begins after the Interface Adapter receives valid altitude data messages. Strobing the parallel output data will not affect the serial data transmission.

## **Section 3.0 Installation and Calibration**

Unpack the unit and make a visual inspection of the interface adapter for evidence of damage incurred during shipment. If a claim for damage is to be made, save the shipping container to substantiate the claim.

### **3.1 Mechanical Installation**

The IA-RS232C-S Interface Adapter may be mounted in any attitude within the internal structure of the aircraft. The mounting position should allow ample room for a service loop on the interconnecting cabling. No cooling is required.

Avoid mounting the interface adapter near any equipment operating with high pulse currents or high power outputs such as strobe power supplies, radar and satellite communications equipment.

The adapter should be installed in a manner consistent with good workmanship and engineering practices and in accordance with the instructions given in this publication. To verify the installation has been properly and safely installed, the installer should perform a visual inspection and conduct an overall operational check of the system prior to flight.

### **3.2 Electrical Installation**

**NOTE**, proper solder or crimp techniques should be observed when attaching wires to the mating connectors. Failure to do so could result in damage, intermittent operation or non-operation of the interface adapter. Shielded cable is recommended for both serial and parallel data wiring harnesses. Wire and harnesses should be installed in such a way that the weight of the cable bundle does not exert a force on the connector pins. Harnesses must be fully supported to prevent movement and should be protected against chaffing.

**CAUTION – AFTER INSTALLING THE WIRING HARNESSSES AND BEFORE INSTALLATION OF THE INTERFACE ADAPTER, A CONTINUITY CHECK OF ALL WIRES IN THE HARNESSSES SHOULD BE MADE TO VERIFY THE HARNESS CONSTRUCTION. THEN A CHECK SHOULD BE MADE WITH THE AIRCRAFT POWER SUPPLIED TO THE ADAPTER’S CONNECTOR TO VERIFY POWER AND GROUND ARE ROUTED TO THE CORRECT PINS AS DETAILED IN THE FIGURE 1 INSTALLATION EXAMPLE AND THE OUTLINE DRAWING. REMOVE POWER BEFORE INSTALLING THE INTERFACE ADAPTER.**

The Interface Adapter is designed to operate with either a +14 or 28 Vdc power source. This voltage can be A+ switched power provided by a transponder or provided by the avionics buss. If using the avionics buss, protect the circuit with a ½ amp circuit breaker or fuse. Power should be provided on either 15 pin connector. A+ on pin 8 or 14. DO NOT provide power on more than one connector! The power applied to the DA-15P output connector will be routed internally to the DA-15S data input connectors.

#### **Parallel Data Output Connection (DA-15P)**

The outline drawing provides the electrical connector pin/function information. Use this data when connecting the interface adapter to the transponder or other receiving device. See installation example **Figure 1** and the outline drawing.

#### **Parallel Data Input Connection (DA-15S)**

The outline drawing provides the electrical connector pin/function information. Use this data when connecting the digitizer to the parallel altitude data source. See installation example **950003** and outline drawing.

**Serial Data Connection (DE-9S)**

**Table VI** lists the pin assignments for the serial data connector.

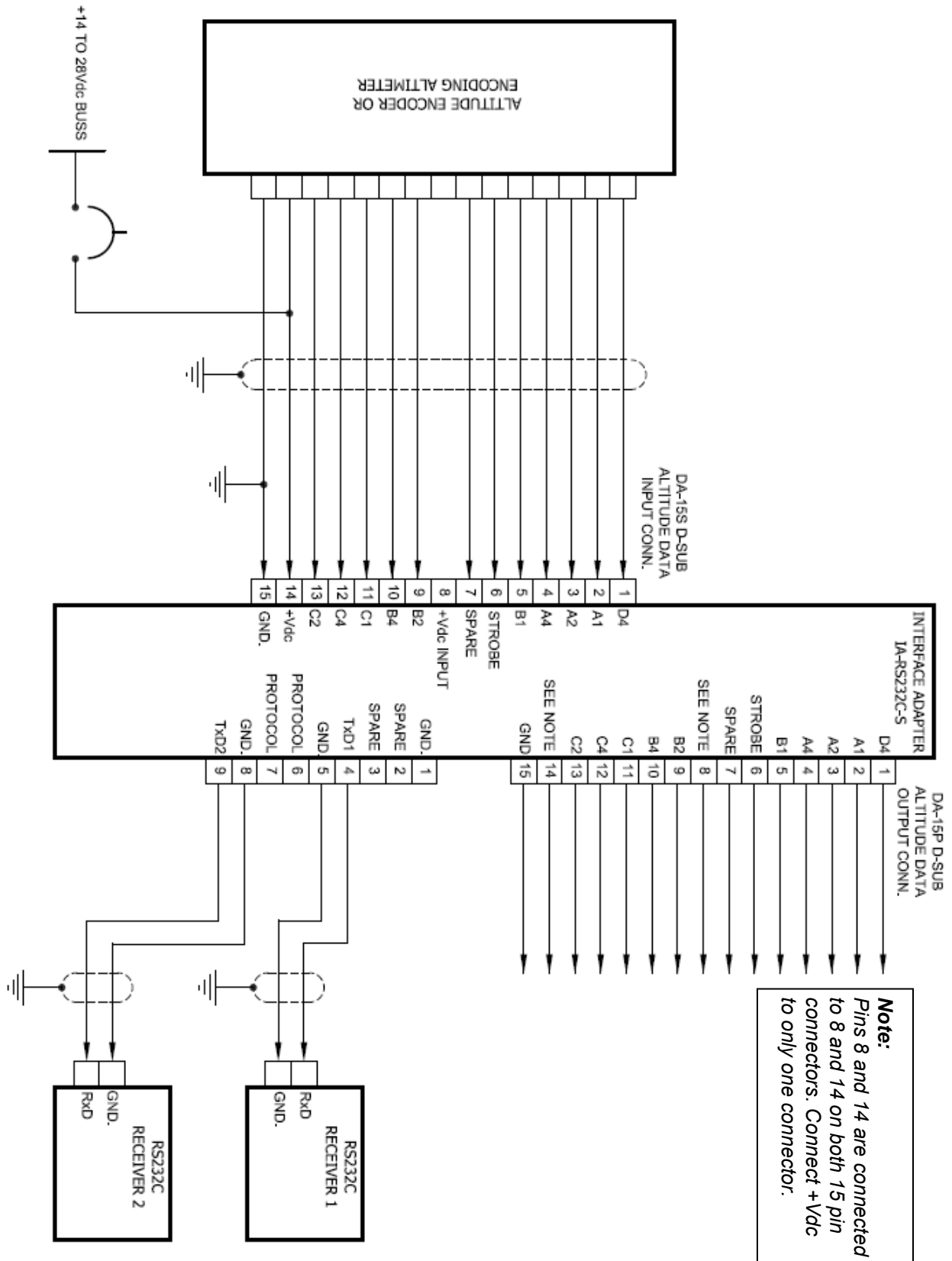
Connect **TxD1** or **TxD2** (transmit data) from the Interface Adapter to the **RxD** (receive data) port on the GPS or other navigation device. All grounds on the DA-9S serial data connector are internally connected to ground and may be used to ground protocol pins, as well as provide serial data grounds to the receiving RS232 device.

**3.3 Calibration**

The interface adapter is an all solid-state device that requires no calibration.

**NOTE: To ensure correspondence with all on-board pressure altitude systems, altitude digitizers connected to the interface adapter that are not providing information to the ATC transponder should be tested to ensure correspondence to the primary flight altimeter, as per FAA AC43-6C.**

Figure 1 Installation Example



**Note:**  
 Pins 8 and 14 are connected to 8 and 14 on both 15 pin connectors. Connect +Vdc to only one connector.

### **3.4 Serial Data Port Test Equipment**

The output of the serial port may, or may not be displayed by the RS232 receiving device. There are several ways to test the output of the serial port:

a) Use a TCI Model ATS-400 Test Set or ECP-100 Programmer to display the serial altitude data.

b) Connect to an open serial port on a personal computer using serial data capture software such as PROCOMM™, VERSATERM™, SOFTWARE WEDGE™, TERMINAL (Windows® 3.x) or HYPERTERMINAL (Windows® 95, 98, 2000 or XP.)

c) Use a dedicated serial data test box such as the BLACK BOX™ RS232 Monitor.

d) Test for serial output using an oscilloscope to view the 9 Vdc square wave group transmitted about twice a second.

### **3.5 Parallel Altitude Data Port Test Equipment**

The output of the parallel altitude data may be monitored by any number of transponder ramp test sets that allow display of the altitude digitizer/encoder code. Alternatively, the Trans-Cal Industries, ATS-400 may be used to display the parallel and serial data.

## **Section 4.0 Instructions for Continued Airworthiness**

The IA-RS232C-S *is an all solid-state device and requires no periodic maintenance to maintain its airworthiness.* The interface adapter is to be tested during the aircraft biennial transponder and pitot-static system test as required by current Federal Aviation Regulations. If the interface adapter fails to report data at any altitude, then the unit is to be repaired or replaced. Contact Trans-Cal Industries for further information.

**Section 5.0 Tables I through XII Digitizer Interconnection**

The following digitizer interconnections are provided as a quick reference only, and though they are correct to the best of our knowledge, always consult the latest installation, operation, and service bulletins from the equipment manufacturer.

**Table I Bendix/King**

IA- RS232C-S DA-15P	Function	Bendix/King KT73 Pin Number	Bendix/King KT76/78 Pin Number	Bendix/King KT76A/78A Pin Number	Bendix/King KXP Pin Number	Bendix/King KXP 755 Pin Number
1	D4	8	*1	*4	V	X
2	A1	M	6	M	G	A
3	A2	K	7	K	H	D
4	A4	J	9	J	J	k
5	B1	E	4	E	K	f
9	B2	C	1	C	L	g
10	B4	B	2	B	M	Y
11	C1	D	3	D	P	U
13	C2	L	8	L	R	T
12	C4	H	10	H	S	W
6	Output Enable	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.
8 or 14 *2	14 to 28Vdc Input.	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.
15	Ground	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.

<sup>1</sup> Data for this connection is not available at this time.

<sup>2</sup> Pins 8 and 14 are connected internally.

**Table II Cessna, Narco, Microair**

RS232C-S DA-15P IA-	Function	Cessna RT359A, RT459A, RT859A Pin Number	Narco AT-150 AT-50, AT-50A Pin Number	Narco AT-6A AT-5, AT-6 Pin Number	Microair T2000
1	D4	10	*3	*6	21
2	A1	14	7	2	9
3	A2	13	6	4	10
4	A4	15	8	8	11
5	B1	19	12	9	12
9	B2	17	10	10	13
10	B4	16	9	11	17
11	C1	21	14	1	18
13	C2	18	11	3	19
12	C4	20	13	5	20
6	Output Enable	11	5	12	Connect to aircraft ground.
8 or 14 *4	14 to 28Vdc Input	9	18	13	2
15	Ground	Connect to aircraft ground.	Connect to aircraft ground.	14	Connect to aircraft ground.

**Narco AT-50 and AT-50A Installations**

Please note! The Narco AT-50 and earlier transponder models require a modification before they will function correctly with any altitude encoder. This modification is outlined in Narco Service Bulletin AT-50A-5.

<sup>3</sup> Data for this connection is not available at this time.

<sup>4</sup> Pins 8 and 14 are connected internally.

**Table III Garmin**

IA- RS232C-S DA-15P	Function	Garmin GTX 327 Pin Number	Garmin GTX 330 & 330D Pin Number	Garmin GNC 300 Pin Number	This column left blank intentionally.
1	D4	18	11	N/C <sup>5</sup>	
2	A1	3	2	15	
3	A2	5	4	16	
4	A4	6	5	17	
5	B1	9	7	18	
9	B2	11	9	19	
10	B4	12	10	20	
11	C1	10	8	21	
13	C2	4	3	22	
12	C4	7	6	23	
6	Output Enable	13 or 25 or aircraft ground	50	Connect to aircraft ground	
8 or 14 * <sup>6</sup>	14 to 28Vdc Input	14 to 28VDC Input	Pin 62 through a 3 amp 50V reverse rated diode.	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.	
15	Ground	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.	

<sup>5</sup> Data for this connection not available at this time.

<sup>6</sup> Pins 8 and 14 are connected internally.



**Table IV Garmin**

## Serial Data Connection for the Garmin GTX327 Transponder

<b>IA-RS232C-S 9 Pin Connector</b>	<b>Function</b>	<b>GTX327 25 Pin Connector</b>
4 or 9	TxD to RxD	19
1 or 5 or 8	Data Ground	13 or 25
Protocol: connect pin 7 to ground.		

## Serial Data Connection for the Garmin GTX330 and 330D Transponder

<b>IA-RS232C-S 9 Pin Connector</b>	<b>Function</b>	<b>GTX330 62 Pin Connector</b>
4 or 9	TxD to RxD	24 (RS232 In 2)
1 or 5 or 8	Data Ground	DataGround
Protocol: connect pin 7 to ground.		

To allow the **Garmin GTX 327, 330 and 330D** transponders to communicate with the IA-RS232C-S go to the **Setup Page** and set the **Altitude Source (ALT SRC)** to receive data in the **Icarus RS232 format**.

**Table V Edo-Air, Genave, Collins, Radair**

IA- RS232C-S DA-15P	Function	Edo-Air RT-777 Pin Number	Genave Beta 5000 Pin Number	Collins TDR 950 Pin Number	Radair 250 Pin Number
1	D4	15	0	3	15
2	A1	7	4	12	7
3	A2	5	5	10	6
4	A4	3	6	7	13
5	B1	12	7	6	9
9	B2	13	8	5	10
10	B4	14	9	4	11
11	C1	8	10	8	14
13	C2	6	11	11	16
12	C4	4	12	9	12
6	Output Enable	2	3	Connect to aircraft ground.	19
8 or 14 * <sup>7</sup>	14 to 28Vdc Input	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.	2	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.	22
15	Ground	2	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.

<sup>7</sup> Pins 8 and 14 are connected together internally.

**Table VI Bendix, Wilcox, UPS AT**

IA-RS232C-S DA-15P	Function	Bendix TPR-2060 Pin Number	Bendix TR641A/B Pin Number	Wilcox 1014A Pin Number	UPS AT Apollo SL70 Pin Number
1	D4	*8	N	C	35
2	A1	4	A	k	13
3	A2	6	B	c	31
4	A4	8	C	W	12
5	B1	9	D	T	33
9	B2	10	E	L	14
10	B4	11	F	D	32
11	C1	3	H	P	16
13	C2	5	J	f	34
12	C4	7	K	Z	15
6	Output Enable	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.
8 or 14 *9	14 to 28Vdc Input	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.
15	Ground	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.

Serial Altitude Data Connection for the Apollo SL70 Transponder

IA-RS232C-S 9 Pin Conn.	Function	UPS AT SL70
4 or 9	TxD to RxD	4
1 or 5 or 8	Ground	3

To allow the **UPS AT SL70** transponder to accept serial data from the IA-RS232C-S go to the **Test Mode** on the **SL70 Conf** page and set the **Altitude Source (ASrc)** to receive **Serial (Ser)** data. On the **BAUD** page select **1200**.

\*8 Data for this connection is not available at this time.  
 \*9 Pins 8 and 14 are connected internally.

**Serial Data Connector and Protocol Tables**

**Table VI**  
Serial Port Connector, 9 Pin D-Subminiature DE-9S

Pin	Function
1	Ground <sup>10</sup>
2	Spare
3	Spare
4	TxD1
5	Ground <sup>10</sup>
6	Protocol
7	Protocol
8	Ground <sup>10</sup>
9	TxD2

**Table VII**

Protocol Selection: DE-9S D-Subminiature Connector Function Table

Protocol Selection	Pin 6	Pin 7
<b>UPS AT 100' resolution, 1200bps.</b>	Open	Open
<b>Trimble/Garmin, 100' resolution, 9600bps.</b>	Open	Gnd.

<sup>10</sup> Pins 1 and 5 and 8 are internal grounds provided for protocol selection and serial data ground.

**GPS Connection Data**

*Given the speed with which new GPS units are entering the market, it is impossible to provide data on every device. The following digitizer/GPS interconnections are provided as a quick reference only, and though they are correct to the best of our knowledge, always consult the latest installation, operation, and service bulletins from the GPS manufacturer.*

**UPS Aviation Technologies (IIMorrow)**

**Apollo Model GX50, GX60, GX65**

Apollo GX50, GX60, GX65 Signal	Apollo 37 Pin D-Sub Connector	IA-RS232C-S Serial Port Connector DE-9S
RxD2	21	4 or 9
Ground	20	1 or 5 or 8

**Apollo GX50, GX60, GX65 Software Configuration**

In test mode, rotate the **Large** knob to select serial port configuration **RX**. Press **SEL**, rotate the large knob to select the **RxD2** port, rotate the small knob to select **AltEnc** input.

**Apollo Model MX20 Multi Function Display**

Apollo MX20 Signal	Apollo 37 Pin D-Sub Connector	IA-RS232C-S Serial Port Connector DE-9S
RxD2	21	4 or 9
Ground	3	1 or 5 or 8

**Apollo MX20 Software Configuration**

Under External Data Source set altitude source to **Port 2**.

Trimble**Trimble 2101 Approach Plus GPS Receiver**

Trimble Signal	Trimble 2101 Port 1	Trimble 2101 Port 2	IA-RS232C-S Serial Port Connector DE-9S
RxD+	7	24	1 or 5 or 8
RxD-	8	36	4 or 9
Ground	3 or 20	3 or 20	1 or 5 or 8
			Protocol assignment, jumper pin 7 to ground on pins 1 or 5 or 8

**Trimble 2101 Approach Plus GPS Receiver Software Configuration - Installation Setup**

Access the 2101 installation setup submenu and go to the SERIAL I/O SETUP. Select the GPS serial port which is to receive the pressure altitude data,

**SERIAL-1 IN** or **SERIAL-2 IN**.  
Set data format to **ENCODER**.

**2101 I/O Approach Plus GPS Receiver**

Trimble Signal	Trimble 2101 I/O Serial Port 1	Trimble 2101 I/O Serial Port 2	IA-RS232C-S Serial Port Connector DE-9S
RxD+	J1-7	J1-24	1 or 5 or 8
RxD-	J1-8	J1-36	4 or 9
Ground	J1 - 3 or 20	J1 - 3 or 20	1 or 5 or 8
			Protocol assignment, jumper pin 7 to ground on pins 1 or 5 or 8

**2101 I/O Approach Plus GPS Receiver Software Configuration - Installation Setup**

Access the 2101 installation setup submenu and go to the SERIAL I/O SETUP. Select the GPS serial port which is to receive the pressure altitude data,

**SERIAL-1 IN** or **SERIAL-2 IN**.  
Set data format to **ENCODER**.

**Garmin International****Garmin 400 Series GPS Devices**

<b>Garmin 78 Pin Conn. (P4001)</b>	<b>Function</b>	<b>IA-RS232C-S Serial Port Connector DE-9S</b>
<b>57</b>	TxD	4 or 9
<b>77 or 78</b>	Ground	1 or 5 or 8
		Protocol, jumper pin 7 to ground.

**Garmin 400 series GPS software configuration**

To allow the **Garmin 400 series GPS** to communicate with the IA-RS232C-S go to the **Main RS232 Config** page and set channel 1 input to **Icarus-alt**.

**Environmental Qualification Form**

Nomenclature: Interface Adapter

Model No.: IA-RS232C-S

FAA TSO-C88a

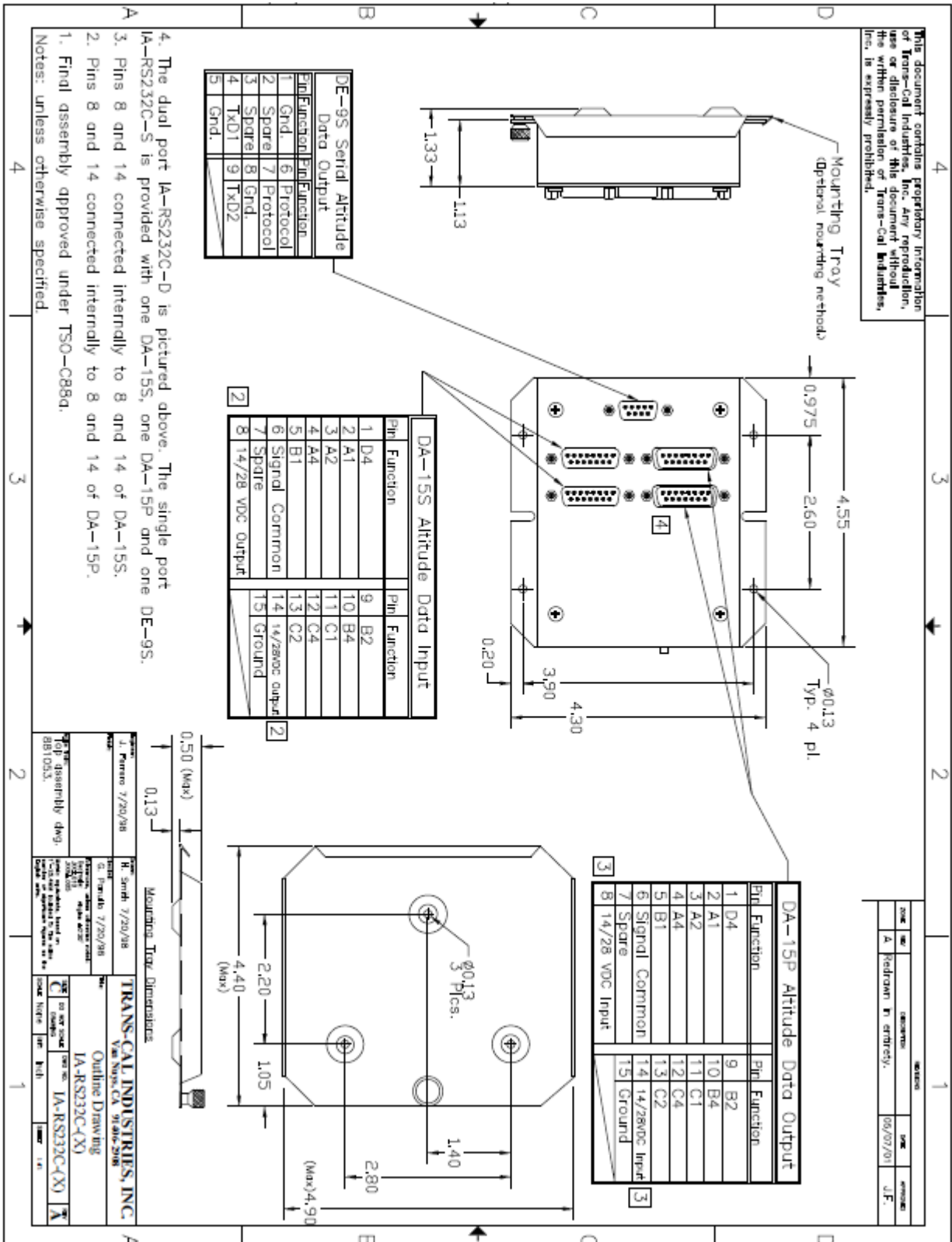
Manufacturer: Trans-Cal Industries, Inc., 16141 Cohasset St. Van Nuys, CA 91406

DO-160B Testing Completed: Oct. 1994

Conditions	Section	Description of Tests Conducted
<b>Temp. and Altitude</b>	<b>§4.0</b>	Tested to Category E1.
<b>Low Temperature</b>	<b>§4.5.1</b>	-20°C
<b>High Temperature</b>	<b>§4.5.2 &amp; 4.5.3</b>	+55°C
<b>In-Flight Loss of Cooling</b>	<b>§4.5.4</b>	No cooling required.
<b>Altitude</b>	<b>§4.6.1</b>	30,700 Feet
<b>Decompression</b>	<b>§4.6.2</b>	
<b>Overpressure</b>	<b>§4.6.3</b>	
<b>Temp. Variation</b>	<b>§5.0</b>	Tested to Category B.
<b>Humidity</b>	<b>§6.0</b>	Tested to Category A.
<b>Operational Shock and Crash Safety</b>	<b>§7.0</b>	Tested to Category B.
<b>Vibration</b>	<b>§8.0</b>	Tested to Categories JKLMNOP
<b>Explosive Atmosphere</b>	<b>§9.0</b>	Identified as Category X, no test performed.
<b>Waterproofness</b>	<b>§10.0</b>	Identified as Category X, no test performed.
<b>Fluids Susceptibility</b>	<b>§11.0</b>	Identified as Category X, no test performed.
<b>Sand and Dust</b>	<b>§12.0</b>	Identified as Category X, no test performed.
<b>Fungus Resistance</b>	<b>§13.0</b>	Identified as Category X, no test performed.
<b>Salt Spray</b>	<b>§14.0</b>	Identified as Category X, no test performed.
<b>Magnetic Effect</b>	<b>§15.0</b>	Tested to Category Z.
<b>Power Input</b>	<b>§16.0</b>	Tested to Category B.
<b>Voltage Spike</b>	<b>§17.0</b>	Tested to Category B.
<b>Audio Frequency Conducted Susceptibility – Power Inputs</b>	<b>§18.0</b>	Tested to Category B.
<b>Induced Signal Susceptibility</b>	<b>§19.0</b>	Tested to Category BC.
<b>RF Susceptibility (Radiated and Conducted)</b>	<b>§20.0</b>	Tested to Category T for Radiated Susceptibility and Category T for Radiated Susceptibility.
<b>Emission of RF</b>	<b>§21.0</b>	Tested to Category B.
<b>Lightning Induced Transient Susceptibility</b>	<b>§22.0</b>	Identified as Category X, no test performed.



**Outline Drawing**



**Trans-Cal Industries, Inc.  
Solid State Altitude Digitizer  
Part Number Ordering Information**

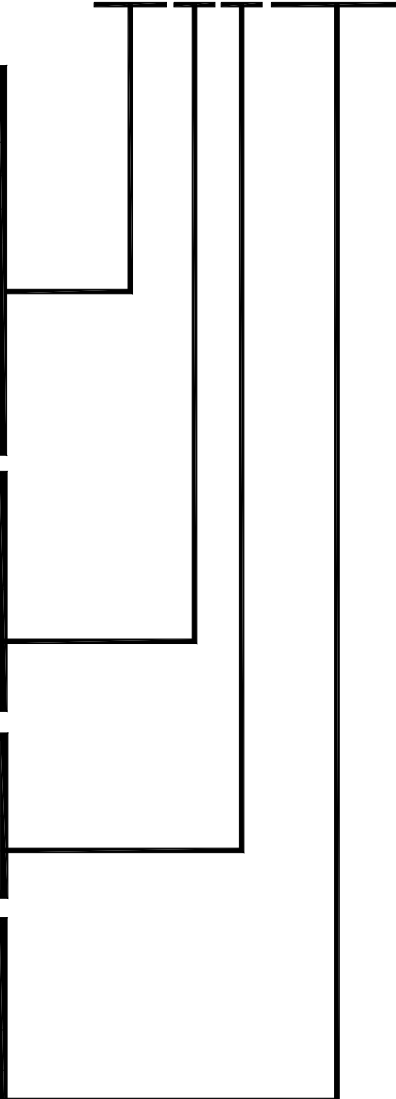
**SSD120-XX X X-XXXX**

Max. Operating Altitude (Feet)	
30,000	-30
35,000	-35
42,000	-42
50,000	-50
62,000	-62
65,000	-65
80,000	-80
85,000	-85
100,000	-100

Model Nomenclature	Identifier
Encoder / Digitizer	A
Modular Encoder	M
Servo Module	SM

Operating Temperature Range	
Blank	-20° to +70°C
E	-55° to +70°C

Additional Ports and Features	
-RS232	Dual RS232 Ports
-RS	RS485 and Dual RS232 Ports
-RS1	RS485 and 1' Resolution on Tx/D2



**Part Number Example: SSD120-42AE-RS232**  
**Note: On models operating at 50,000 to 100,000 feet, dual RS232 ports are included as a standard feature.**

**WARRANTY REGISTRATION**

Trans-Cal Industries warrants each Model IA-RS232C-S Solid State digitizer / serializer to be free of defects in workmanship and materials for a period of 40 months after purchase. This warranty applies to the original purchaser of the instrument.

Trans-Cal's obligation under this warranty is limited to repairing or replacing any unit returned to Trans-Cal during the life of this warranty provided:

- (1) The defective unit is returned to us, **transportation pre-paid.**
- (2) Prior approval is obtained from Trans-Cal.
- (3) The unit has not been damaged by misuse, neglect, improper operation, accident alteration or improper installation.

Trans-Cal **DOES NOT** reimburse labor costs on warranty repairs. Trans-Cal Industries will be the sole judge as to the cause of the malfunction and wherein the responsibility lies. No other obligation or liability is expressed or implied.

For the above warranty to become effective, the attached registration card **must** be completed and returned to Trans-Cal Industries, properly filled out and signed by the dealer selling or installing this equipment.

Mail to: Trans-Cal Ind., Inc., 16141 Cohasset St., Van Nuys, CA 91406

----- cut here -----

**MODEL: IA-RS232C-S**                      **SERIAL NO: IA-** \_\_\_\_\_

**AIRCRAFT:** \_\_\_\_\_ **NUMBER:** \_\_\_\_\_

**OWNER:** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

**CITY:** \_\_\_\_\_ **STATE:** \_\_\_\_\_ **ZIP:** \_\_\_\_\_

**DEALER:** \_\_\_\_\_

**INSTALLED BY:** \_\_\_\_\_

**LICENSE NO:** \_\_\_\_\_

**INSTALLATION DATE:** \_\_\_\_\_

**I hereby certify the above instrument was installed in accordance with the instructions of Trans-Cal Industries, and the installation was done to industry standards. I further certify the instrument was properly working on the above date.**

**SIGNED:** \_\_\_\_\_

**PRINT NAME:** \_\_\_\_\_