

Trans-Cal Industries, Inc.

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

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Rev. D

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Please Note:

It is the responsibility of the installer of this equipment, within a specific type or class of aircraft, to determine that the aircraft operating conditions are within TSO standards.

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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

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Section 1.0 General

1.1 Scope

This manual provides detailed installation, and operating instructions for the Model IA-RS232C-S Interface Adapter (Serializer.)

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 parallel digital altitude data is provided 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 Operating Voltage:

+12 to +30 VDC.

1.3.2 Operating Current:

0.090 Amperes. (90mA)

1.3.3 Operating Temperature:

-20° to +85°C.

1.3.4 Storage Temperature:

-55° to +85°C.

1.3.5 Warm-up Time:

0

1.3.6 Weight:

12 oz.

1.3.7 Operating Altitude:

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

1.3.8 Accuracy:

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

1.3.9 Mechanical Characteristics:

See outline drawing.

1.3.10 Environmental:

All model IA-RS232C-S Interface Adapters are designed and tested to meet or exceed the requirements of TSO-C88a, in accordance with RTCA Document DO-160b, dated July 1984. Category E1BA/JKLMNOP/XXXXXXXXZBBBBB

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 Milliampere.

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 Milliamperes.

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 ^{C_R}	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 ^{C_R}	Altitude 10,500 feet.
ALT 99900 ^{C_R}	Digitizer disabled.

Grounding Pin 6 of the DE-9S connector results in a protocol compatible with some navigation devices manufactured by Northstar and Garmin. At a baud rate of 2400 bps the Interface adapter will send a ten-byte message as follows:

Message	Definition
ALT 10500 ^{C_R}	Altitude 10,500 feet.
ALT -2500 ^{C_R}	Digitizer disabled.

Grounding both Pin 6 and 7 of the DE-9S connector results in a protocol compatible with some navigation devices manufactured by Magellan. At a baud rate of 1200 bps the Interface adapter will send a seventeen-byte message as follows:

Message	Definition
\$MGL+02500T+25D6 ^{C_R}	Altitude 2,500 feet.

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

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.

3.2 Electrical Installation

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 **950003** and 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 GPS or other navigation device.

3.3 Serial Data Port Test Equipment

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

- A. Connect to an open serial port on a personal computer using serial data capture software such as PROCOMM™, SOFTWARE WEDGE™, TERMINAL (Windows® 3.x) or HYPERTERMINAL (Windows® 95, 98, 2000 and ME.)
- B. Use a dedicated serial data test box such as the BLACK BOX™ RS232 Monitor.
- C. Test for serial output using an oscilloscope to view the 9 VDC square wave group transmitted about 5 times a second.

3.4 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-200 may be used to display the parallel data.

Digitizer / Transponder Interconnections

The following digitizer/transponder 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 transponder manufacturer.

Table I

IA-RS 232C-S DA-15 P	Function	KT76/78 Pin Number	King KT76A/78A Pin Number	King KXP Pin Number
1	D4	* ¹	* ¹	V
2	A1	6	M	G
3	A2	7	K	H
4	A4	9	J	J
5	B1	4	E	K
9	B2	1	C	L
10	B4	2	B	M
11	C1	3	D	P
13	C2	8	L	R
12	C4	10	H	S
6	Output Enable	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.
15	Ground	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.

¹ Data for this connection is not available at this time.

² A pin 8 of the DA-15P is connected to Pin 8 of the DA-15S. Pin 14 of the DA-15P is connected to pin 14 of the DA-15S.

Table II

IA-RS 232C-S DA-15 P	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	Garmin GTX 327 Pin Number
1	D4	10	* ³	* ³	18
2	A1	14	7	2	3
3	A2	13	6	4	5
4	A4	15	8	8	6
5	B1	19	12	9	9
9	B2	17	10	10	11
10	B4	16	9	11	12
11	C1	21	14	1	10
13	C2	18	11	3	4
12	C4	20	13	5	7
6	Output Enable	11	5	12	13 or 25 or aircraft ground
8 or 14 * ⁴	14 to 28VDC Input	9	18	13	14 to 28VDC Input
15	Ground	Connect to aircraft ground.	Connect to aircraft ground.	14	Connect to aircraft ground.

Serial Data Connection for the Garmin GTX327 Transponder

IA-RS232C-S Serial I/O Connector DE-9S	Function	GTX 327 25 Pin Conn.
4 or 9	TxD to RxD	19
1 or 5 or 8	Ground	13 or 25
Protocol, Connect pin 7 to ground.		

To allow the **Garmin GTX 327** transponder 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.

³ Data for this connection not available at this time.

⁴ Pin 8 of the DA-15P is connected to Pin 8 of the DA-15S. Pin 14 of the DA-15P is connected to pin 14 of the DA-15S.

Table III

IA-RS 232C-S DA-15 P	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 * ⁵	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.

⁵ Pin 8 of the DA-15P is connected to Pin 8 of the DA-15S. Pin 14 of the DA-15P is connected to pin 14 of the DA-15S.

Table IV

IA-RS 232C-S DA-15 P	Function	Bendix TPR-2060 Pin Number	Bendix TR641A/B Pin Number	Wilcox 1014A Pin Number	UPS AT Apollo SL70 Pin Number
1	D4	* ⁶	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 * ⁷	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 Serial I/O Connector DE-9S	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-D go to the **Test Mode** on the **SL79 Conf** page and set the **Altitude Source (ASrc)** to receive **Serial (Ser)** data. On the **BAUD** page select **1200**.

⁶ Data for this connection is not available at this time.

⁷ Pin 8 of the DA-15P is connected to Pin 8 of the DA-15S. Pin 14 of the DA-15P is connected to pin 14 of the DA-15S.

Table V

IA-RS 232C-S DA-15 P	Function	Becker Avionic Systems ATC3401 ATC2000	This column left blank intentionally.	This column left blank intentionally.	This column left blank intentionally.
1	D4	23			
2	A1	16			
3	A2	15			
4	A4	14			
5	B1	17			
9	B2	19			
10	B4	18			
11	C1	22			
13	C2	21			
12	C4	20			
6	Output Enable	24			
8 or 14 * ⁸	14 to 28VDC Input	6			
15	Ground	24			

⁸ Pin 8 of the DA-15P is connected to Pin 8 of the DA-15S. Pin 14 of the DA-15P is connected to pin 14 of the DA-15S.

Serial Data Connector and Protocol Tables

Table VI

Serial Port Connector, 9 Pin D-Subminiature DE-9S

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

Table VII

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

Protocol Selection	Pin 6	Pin 7
UPS AT 100' resolution, 1200bps.	Open	Open
Trimble/Garmin, 100' resolution, 9600bps.	Open	Gnd.
Northstar/Garmin, 100' resolution, 2400bps.	Gnd.	Open
Magellan, 100' resolution, 1200bps.	Gnd.	Gnd.

⁹ Pins 1 and 5 and 8 are internal grounds provided for protocol selection and serial data ground.

¹⁰ TxD1 and TxD2 are two (2) separate RS232 outputs that will transmit the protocol selected by grounding the pins above, See §1.8.

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

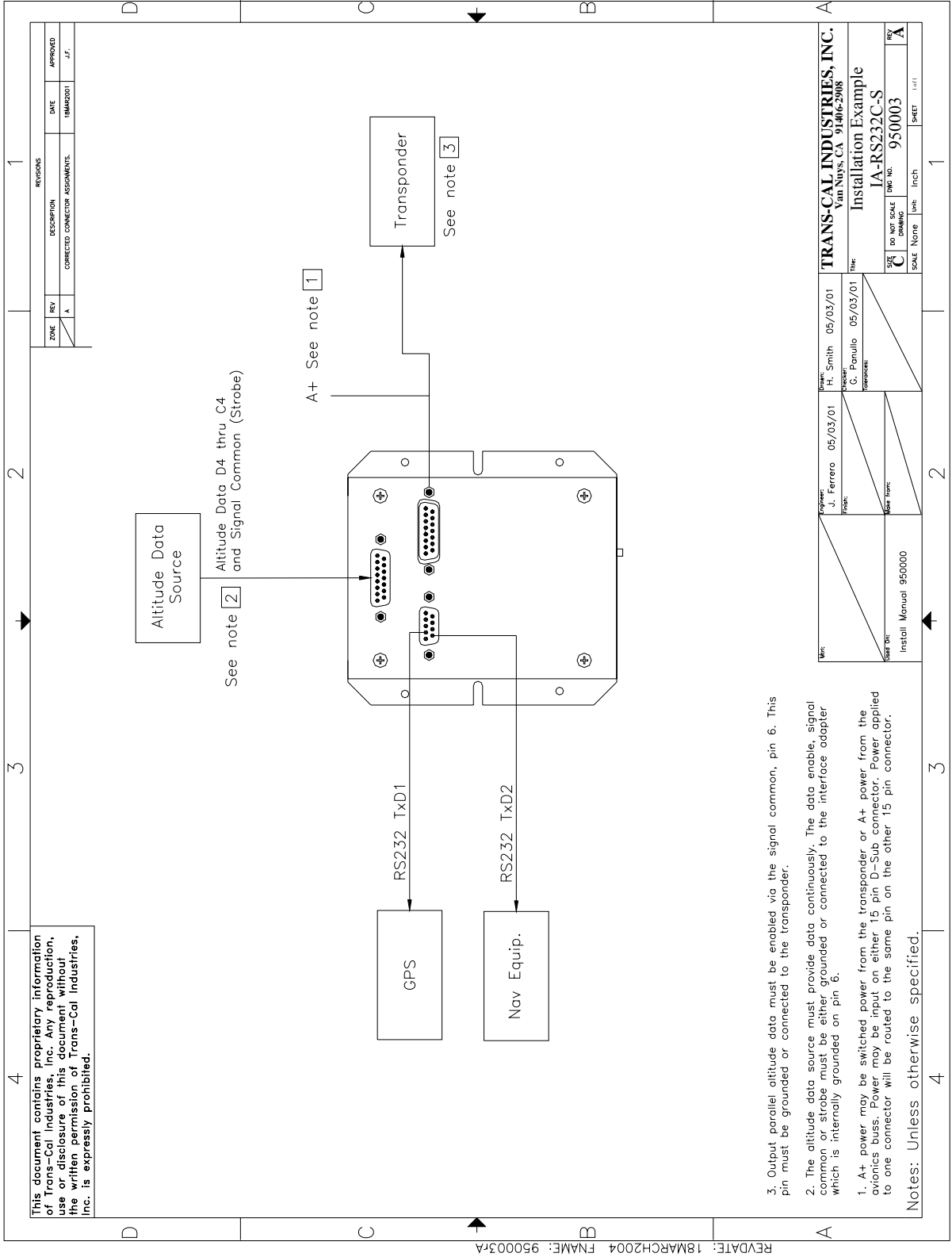
Garmin 400 Series GPS Devices

Garmin 78 Pin Conn. (P4001)	Function	IA-RS232C-S Serial Port Connector DE-9S
57	TxD	4 or 9
77 or 78	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**.

Installation Example IA-RS232C-S



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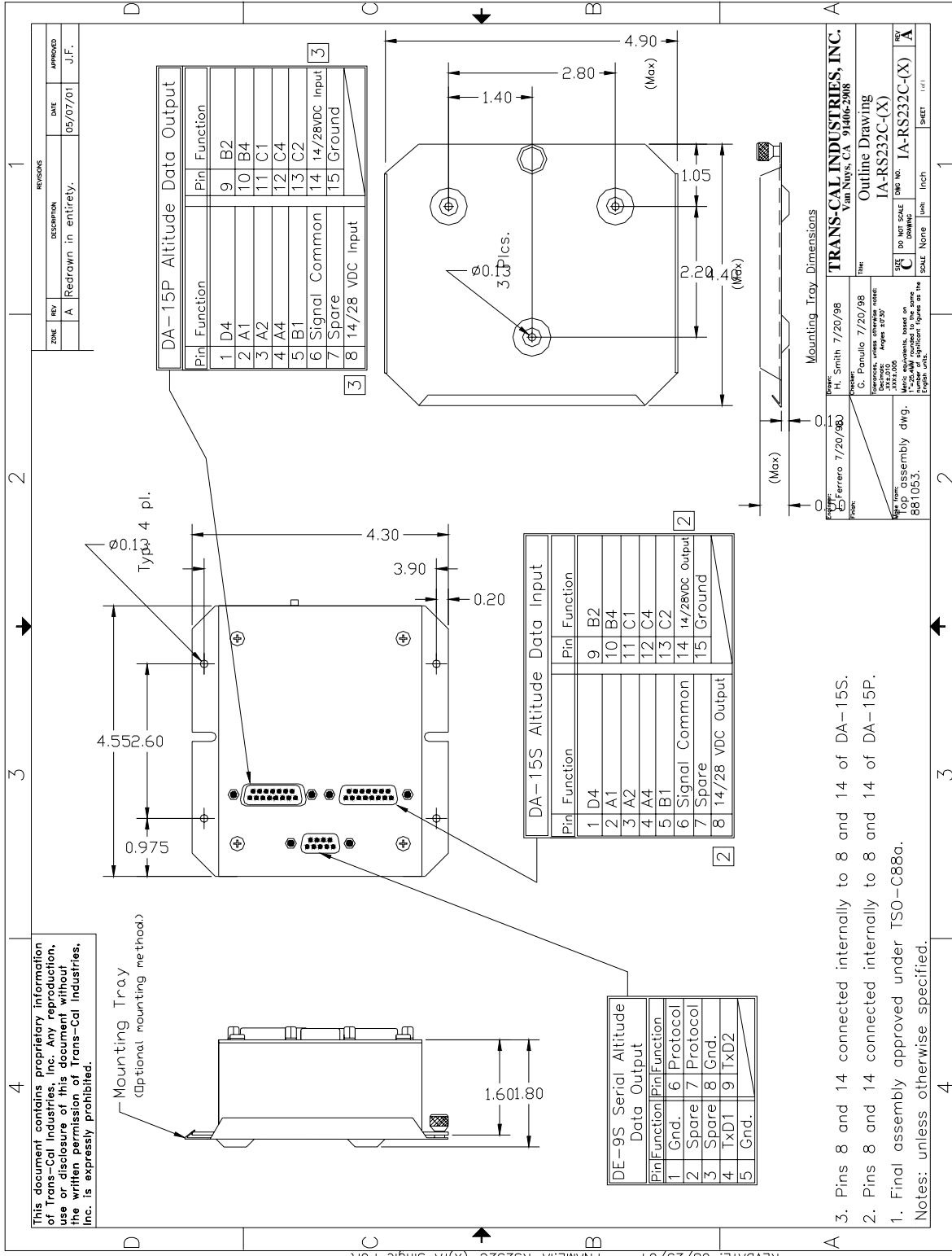
3. Output parallel altitude data must be enabled via the signal common, pin 6. This pin must be grounded or connected to the transponder.
 2. The altitude data source must provide data continuously. The data enable, signal common or strobe must be either grounded or connected to the interface adapter which is internally grounded on pin 6.
 1. A+ power may be switched power from the transponder or A+ power from the avionics buss. Power may be input on either 15 pin D-Sub connector. Power applied to one connector will be routed to the same pin on the other 15 pin connector.
- Notes: Unless otherwise specified.

ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	CORRECTED CONNECTOR ASSIGNMENTS.	18MARCH2004	J.F.

TRANS-CAL INDUSTRIES, INC. Van Nuys, CA 91406-2908		Project: H. Smith 05/03/01 Checked by: C. Ponzillo 05/03/01 Drawn by:	Title: Installation Example IA-RS232C-S
User pin: Install Manual 950000	Scale: None	Sheet: 1 of 1	Rev: A

REVDATE: 18MARCH2004 FNAME: 950003.rfa

Outline Drawing



Part Number Ordering Form

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

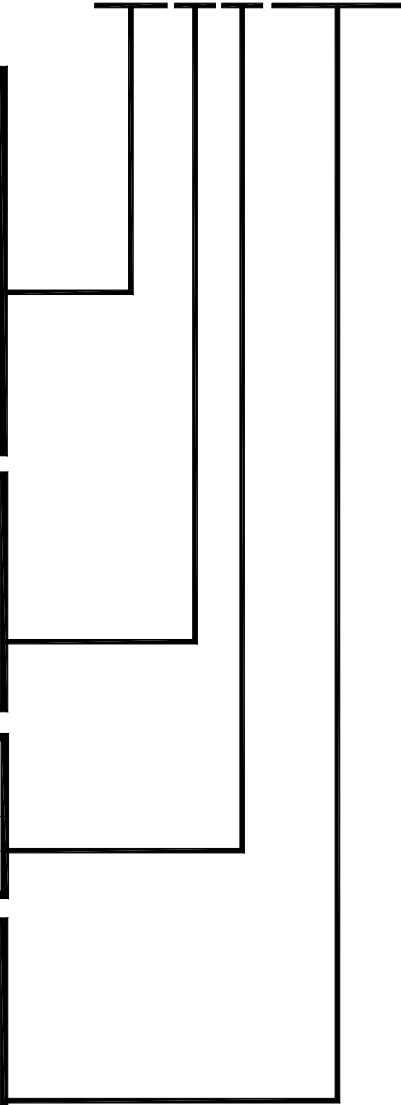
SSD120-XX X X-XXXX

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 SSD120-(XX)A(E)-RS1 Solid State digitizer / serializer to be free of defects in workmanship and materials for a period of eighteen (18) 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: SSD120-()A(E)-RS1 **SERIAL NO:** RS-_____

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:_____