

Trans-Cal Industries, Inc.

Model SSD120-(XX)A
&
Model SSD120-(XX)AE
(Includes Mod. 1 Data)

All Solid State
Altitude Encoder/Digitizer

Owner/Installation Manual

FAA TSO-C88a Approved

Trans-Cal Industries, Inc.
Van Nuys Airport
16141 Cohasset Street
Van Nuys, CA 91406-8916
(818) 787-1221 FAX(818)787-8916
www.trans-cal.com

Copyright Notice: This document may not be reproduced, transmitted, or copied in any form without the prior written consent of Trans-Cal Industries, Inc. The data contained herein is subject to change without notice. Trans-Cal Industries hereby grants permission to download one copy of this manual and any subsequent revision, provided that electronic or printed copy contains this complete copyright notice. Trans-Cal Industries explicitly prohibits any unauthorized commercial distribution of this manual or any revision thereto.

© 2015 by Trans-Cal Industries, Inc.
16141 Cohasset Street
Van Nuys, CA 91406

CAGE Code 57323

818/787-1221
FAX 818/787-8916
E-Mail: support@trans-cal.com
www.trans-cal.com

What's in the Box:

Qty.	Part Number	Description
1 ea.	SSD120-(XX)A	Altitude Digitizer
1 ea.	881000	Owner/Installation Manual
1 ea.	DA-15S	15 Pin D-Subminiature Mating Connector
1 ea.	600016	15 Pin Connector Back Shell
1 ea.	600019	1/8 NPT Nylon tube elbow fitting
1 ea.	600020	1/4" Tube Polypropylene tee fitting

History of Revision

Revision	Date	Description
N/C	07/98	Production release.
A	10/99	Added SL70 transponder data pg. XX.
B	12/01	Added GTX 327 transponder pg. 13. Corrected current pg. 3. Clarified calibration '3.3.3 added diagram.
C	08/04	Updated Manual in entirety.
D	08/06	Updated warranty from 40 to 42 months.
E	06/2015	Revised in entirety. Added limitations, deviations & compliance §1.3.2.

Table of Contents

Abbreviations, Acronyms and Symbols 4

Section 1.0 Introduction 5

 1.1 Scope 5

 1.2 Equipment Description 5

 1.3 General Specifications 5

 1.3.1 Operating Altitude 5

 1.3.2 Limitations, Deviations and Compliance 6

 TSO/ETSO/RTCA Certification & Compliance Table 6

 1.3.3 Accuracy 6

 1.3.4 Mechanical Characteristics 6

 1.3.5 Over Range 6

 1.4 Parallel ICAO Altitude Data Port Specifications 6

Section 2.0 Operation 7

 2.1 General 7

 2.2 Operating Instructions 7

Section 3.0 Installation 8

 3.1 Mechanical Installation 8

 3.2 Electrical Installation 8

 3.3 Parallel ICAO Altitude Data Port Test Equipment 9

Section 4.0 Calibration and Configuration 10

 4.1 Calibration Overview 10

 4.2 Required Equipment Span Adjust 10

 4.3 Span Adjust Procedure 11

 Figure 1 Altitude Digitizer Correspondence 12

Section 5.0 Tables I through VII Digitizer Interconnection 13

 Figure 2 SSD120-(XX)A 15 Pin D-Sub Connector Front View 13

Section 6.0 Instructions for Continued Airworthiness 20

Section 7.0 Frequently Asked Questions 20

Section 9.0 Known Compatibility Issues 22

 9.1 Narco AT5A, AT6A, AT-50 and AT-50A Installations and SSD120-(XX)A Mod.1 22

 9.2 "Mod. 1" Installations 22

 9.3 King KT-75 22

 9.4 S-Tec (Collins) TDR950 22

 9.5 Trans-Cal SSD120-(XX)A Backwards Compatibility 22

 9.6 SSD120-(XX)A Compatibility to Competitor's Products 23

 Figure 3 Temperature vs. Warm-up Time 24

Outline Drawing 25

Environmental Qualification Form 26

Part Number Builder 27

Manufacturer Direct Warranty 28

Abbreviations, Acronyms and Symbols

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

Section 1.0 Introduction

1.1 Scope

This manual provides detailed installation, calibration and operating instructions for Trans-Cal Industries' Model SSD120-(XX)A and SSD120-(XX)AE¹ series of altitude encoder/digitizer, and applies to units with operating ceilings of 30,000 to 42,000 feet. 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 FAA TSO-C88a, the Model SSD120-(XX)A and SSD120-(XX)AE is an all solid-state electronic device which, when connected to an aircraft static and electrical system, converts pressure altitude information into parallel digital data.

The parallel digital altitude data protocol is set forth in the ICAO International Standard for SSR Pressure Altitude Transmission. 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.

1.3 General Specifications

This equipment has been tested and will utilize power in accordance with MIL-STD-704E for 28 Vdc systems.

Operating Voltage: Model SSD120-(XX)A Model SSD120-(XX)AE ²	+12 to 30 Vdc +12 to 30 Vdc
Operating Current all models:	0.25 Amps at 14Vdc 0.27 Amps at 28Vdc
Operating Temperature: Model SSD120-(XX)A Model SSD120-(XX)AE	-20° to +70°C (-4° to +158°F) -55° to +70°C (-67° to +158°F)
Storage Temperature (non-operating) all models:	-65° to +85°C (-85° to +185°F)
Warm-up time:	0 Seconds at 20°C (68°F). See Figure 2 for low temperature warm-up times.
Weight:	10 oz.

1.3.1 Operating Altitude

Model	Operating Altitude
SSD120-30A()	-1000 to +30,000 feet.
SSD120-35A()	-1000 to +35,000 feet.
SSD120-42A()	-1000 to +42,000 feet.

¹ SSD120-(XX)AE Extended operating temperature range: -55° to +70°C.

² Longer warm-up times will be experienced when operated at +12 Vdc.

1.3.2 Limitations, Deviations and Compliance

NOTE:

This article may be installed only in accordance with 14 CFR part 43 or the applicable airworthiness requirements. 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.

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-160E in testing this device. DO-160E provides an equivalent level of safety and meets or exceeds the standard environmental test condition requirements of TSO-C88a and DO-160A.

TSO/ETSO/RTCA Certification & Compliance Table

FAA TSO	C88a
RTCA DO-178 Software	Non-Essential Category H/W - S/W P/N: 881200rA-700001rC
RTCA DO-160E Environmental*	D1BAB[(SM)(UF)]XXXXXXXXZBBB(BC)TTBXXXAX

*See Environmental Qualification form for specific data.

1.3.3 Accuracy

Digitizer accuracy is ± 50 feet from -1000 to +30,000 feet, and ± 75 feet from 30,100 to +42,000 feet, when measured from the altitude transition points of the ICAO code and referenced to 29.92 In. Hg. (1013 MB.) See **Figure 1** and **§4.0**.

1.3.4 Mechanical Characteristics

Model Number	Dimensions	Weight
Model SSD120-30A()	See Outline Drawing	10 oz.
Model SSD120-35A()	See Outline Drawing	10 oz.
Model SSD120-42A()	See Outline Drawing	10 oz.

Mounting tray adds 1 oz. To the weights listed above

1.3.5 Over Range

The SSD120-(XX)A() series of altitude digitizers will not be damaged when operated beyond their specified maximum altitude up to 100,000 feet MSL, (0.1581psi) or over pressured to -5721 feet (18psi) maximum.

1.4 Parallel ICAO Altitude Data Port Specifications

Code Format: In accordance with U.S. National Standard for Common System Component Characteristics for the IFF 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.

Pull-Up Voltage: +3 to 40Vdc.

Maximum Sink Current: 35 mA.

Maximum Cable Length: 4000 ft. (1219 meters)

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

Section 2.0 Operation

2.1 General

The SSD-120(XX)A() series of altitude digitizers are designed to be mounted within a pressurized or non-pressurized, but temperature controlled area within aircraft operating up to 42,000 feet MSL. Usually remotely located, the digitizer is fully automatic in operation. The parallel ICAO altitude data output is controlled by the transponder.

2.2 Operating Instructions

Place the transponder in mode “C”, altitude-reporting mode. Apply power to the transponder and to the digitizer. In some installations the digitizer will automatically be supplied power when the transponder is energized; in others, power to the digitizer may be through a separate circuit breaker. If power to the digitizer is provided directly from the aircraft’s avionics buss, follow the power-up procedures recommended by the transponder manufacturer. All ICAO altitude parallel outputs will be pulled low for a self test at power up, then assume the value for the present input pressure. In some installations, the transponder controls the digitizer by enabling and disabling its output. In other installations, the digitizer’s output is not controlled by the transponder and is continuously enabled, (Digitizer pin 6 is grounded.)

Section 3.0 Installation

3.1 Mechanical Installation

The SSD120-(XX)A should be installed in a manner consistent with the requirements of 14 CFR Part 43. Good workmanship and installation practices in accordance with the instructions given in this publication are to be observed. To verify the digitizer 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.

The SSD120-(XX)A() series of digitizer may be mounted in any attitude within the internal structure of the aircraft. DO NOT mount the digitizer in the direct air stream of either hot or cold air ducts. The mounting position should allow for a short static pressure line from the digitizer to the altimeter, access to the digitizer's adjustments, and ample room for a service loop for the interconnecting cabling to the transponder. The SSD120-(XX)A is provided with one 1/8-27NPT static port inlet to connect the Digitizer to the aircraft static system. Apply pipe sealant (not included) or equal to the static system fitting threads. Exercise care to prevent excess sealant from plugging the inlet to the pressure sensor.

On SSD120-(XX)AE devices operating below -20°C, use metal fittings on all static line connections. The coefficient of thermal expansion for nylon is roughly three times that of aluminum. Nylon and plastic fittings will leak at low temperatures due to thermal contraction.

To prevent the accumulation of condensation in the digitizer pressure sensor, locate this device away from the lowest section of the static system, and ensure a proper condensation trap and system drain is installed and functional, reference FAR 23.1325. Verify that moisture resulting from condensation will run away from the digitizer electrical connections.

Use #4-40 or #6-32 machine screws, sheet metal screws, or rivets to attach the digitizer or the mounting tray to the airframe. Secure mating connectors to the digitizer housing using the #4-40 screws provided. Refer to the outline drawing for mechanical dimensions.

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 digitizer. Shielded cable is recommended for the wiring harness. Wire and harnesses should be installed in such a way that the weight of the cable 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 HARNESS AND BEFORE INSTALLATION OF THE DIGITIZER, A CONTINUITY CHECK OF ALL WIRES IN THE HARNESS SHOULD BE MADE TO VERIFY HARNESS CONSTRUCTION. A TEST SHOULD THEN BE MADE WITH THE AIRCRAFT POWER SUPPLIED TO THE DIGITIZER'S CONNECTOR TO VERIFY POWER, GROUND AND DATA ARE ROUTED TO THE CORRECT PINS AS DETAILED IN THE OUTLINE DRAWING. REMOVE POWER BEFORE INSTALLING THE DIGITIZER.

The digitizer is designed to operate with either a +14 or +28 Vdc power source. These voltages may be A+ switched power provided by the transponder or can be provided by the avionics buss. If using the avionics buss, protect the circuit with a ½ amp fuse or circuit breaker.

Parallel ICAO Altitude Data Connection

The outline drawing provides electrical connector pin/function information. Use this data when connecting the digitizer to the transponder or other navigation device. In some installations where older transponders are used, the transponder may not provide an “altitude disable” function. In this case, an instrument panel mounted switch for this function may be required.

3.3 Parallel ICAO Altitude Data Port Test Equipment

The output of the parallel ICAO altitude data may be monitored by any number of transponder ramp test sets, which allow display of the ICAO altitude digitizer/encoder code. The IFR Model ATC-600A Portable Transponder Test Set is one example. Alternatively, the Trans-Cal Industries’ ATS-400 may be used to display the parallel data.

Section 4.0 Calibration and Configuration

4.1 Calibration Overview

**Reference: FAR 91.217; FAA Advisory Circular 43-6C
FAR 91.411; FAR 43-Appendix E and F
FAA TSO-C88a, SAE AS8003**

NOTE: To ensure correspondence with all on-board pressure altitude systems, altitude digitizers 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.

This procedure will allow adjustment to the calibration curve of the SSD120-(XX)A or SSD120-(XX)AE as an aide in matching the digitizer output to a primary flight altimeter or NIST traceable pressure standard.

The maximum allowed error between the primary flight altimeter and the altitude digitizer is ± 125 feet as required by TSO-C88a. All Trans-Cal digitizers are calibrated to within ± 50 feet of a NIST traceable pressure standard; however, the error allowed on altimeters at higher altitudes could lead to a combined error in excess of ± 125 feet. When the altitude digitizer is installed in an aircraft for use as the transponder's source of mode "C" information the digitizer must be recalibrated for correspondence to the aircraft's primary flight altimeter, as required by FAR 91.217 and 91.411. Model SSD120-(XX)A and SSD120-(XX)AE are designed to be field calibrated to meet this requirement, as per the procedure described in **§4.3** of this manual.

The correspondence required for altitude digitizers is fully addressed in SAE Aerospace Standard AS8003 §3.11. The correspondence described by the SAE standard requires the digitizer to report altitude within ± 125 feet of the primary flight altimeter's reading when the pressure datum is set to 29.92 In. Hg., (1013 MB) absolute. The SAE standard also requires a transition accuracy of ± 75 feet of the nominal transition point for that altitude. A transition is defined as the point at which the digitizer changes from one altitude to the next, either increasing or decreasing altitude. The nominal transition point of the ICAO code occurs 50 feet prior to the altitude in question. See **Figure 1**.

4.2 Required Equipment Span Adjust

1. Primary Flight Altimeter.
2. +12 or 28VDC power supply.
3. A pitot-static test set, capable of exercising the altimeter and digitizer over a range of -1000 feet to the maximum altitude of the digitizer.
4. A ramp checker or test set capable of interrogating the transponder.
Optional: ATS-400 or equal device which will allow the display of the 100-foot resolution parallel altitude data.

4.3 Span Adjust Procedure

CAUTION

ALWAYS DETERMINE THE DESIGN LIMITS OF THE INSTRUMENTS ATTACHED TO THE STATIC SYSTEM. LOCATE AND IDENTIFY ALL INSTRUMENTS ATTACHED TO THE SYSTEM AND REFER TO THE MANUFACTURER'S DATA FOR MAXIMUM RATE OF CLIMB OR DESCENT, AND ANY SPECIAL TEST CONDITIONS WHICH MUST BE COMPLIED WITH TO PREVENT DAMAGE.

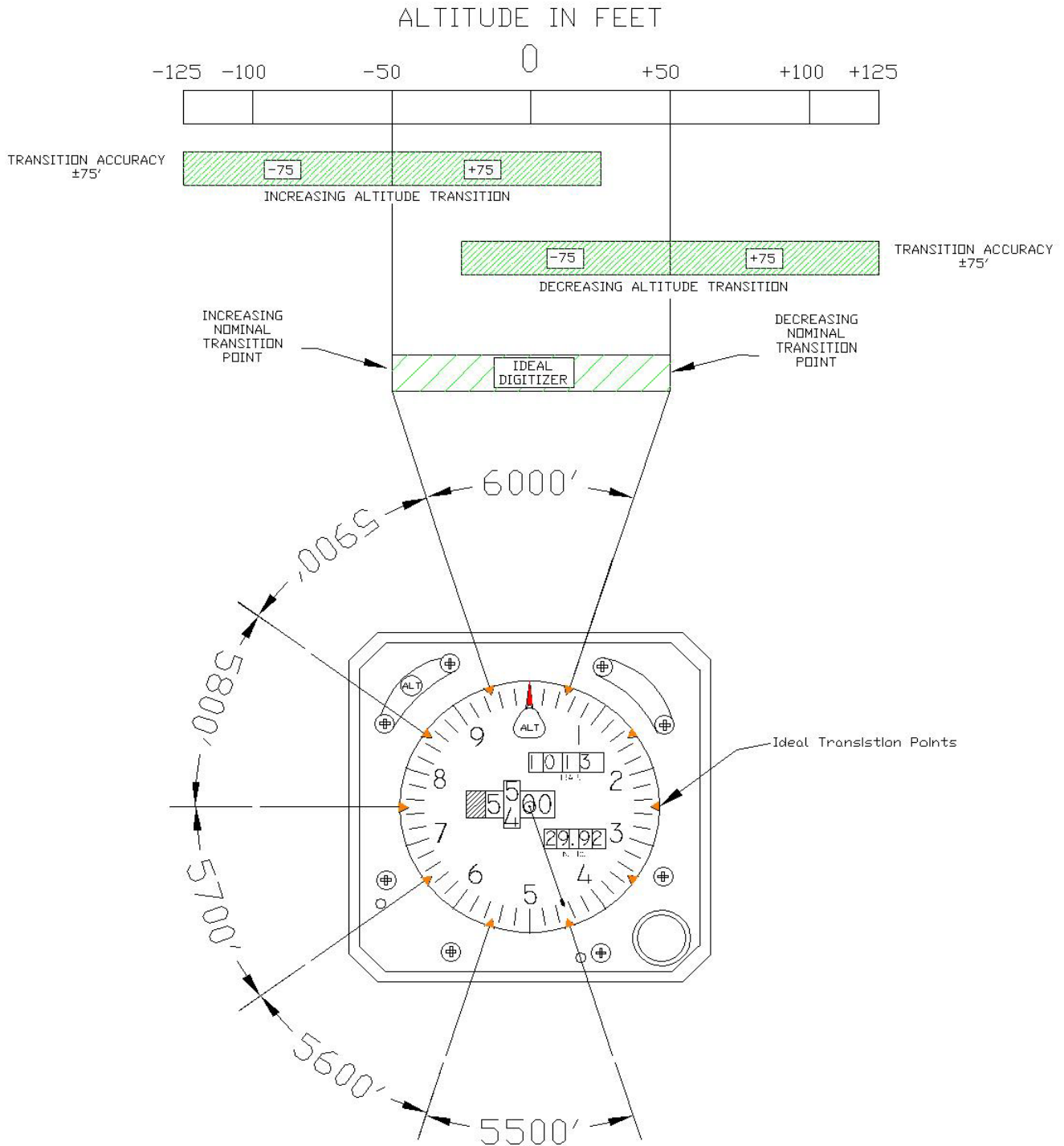
1. Connect the pitot-static test equipment to the aircraft's static line, and connect the transponder test set as per the manufacturer's recommendations. The digitizer's two altitude adjustment potentiometers are identified as L and H, representing low and high altitude.

Note: Changing either potentiometer will affect the other. An adjustment made to correct the low transition point, will move the high transition point, and require an adjustment of the high potentiometer.

2. Apply power to the altitude digitizer/transponder.
3. Set the primary flight altimeter barometric pressure to 29.92 In. Hg. (1013 MB).
4. Interrogate the transponder with the ramp tester, while observing the digitizer ICAO altitude code, decrease pressure to the point where the altitude code just makes a transition to the maximum altitude encoded. Verify that the digitizer is within ± 125 feet of the primary flight altimeter's reading. If not, adjust the high potentiometer until the digitizer transition point is within ± 30 feet of the nominal transition point. (i.e. while ascending, the digitizer should transition from 29,900 feet to 30,000 feet at 29,950 feet nominally.)
5. Increase pressure until the digitizer's output just makes the transition from 100 feet to 0 feet. Verify that the altitude digitizer reports within ± 125 feet of the primary flight altimeter. If not, adjust the low potentiometer until the transition point is within ± 30 feet of the nominal transition point. (i.e. while descending, the digitizer should transition from +100 to 0 feet at +50 feet nominally.)
6. Repeat steps (4) and (5) until the ± 125 foot tolerance is achieved for both the maximum calibration altitude and the minimum calibration altitude.
7. Exercise the aircraft's static system over the operating range of the altitude digitizer and, with increasing and decreasing pressure, verify at a minimum of ten test points that the altitude digitizer and primary flight altimeter correspond within the ± 125 foot tolerance. Lightly tap the altimeter before each reading to eliminate friction. If correspondence is not achieved at any test point, the altimeter may require calibration.
8. Verify that the digitizer's output is disabled when the transponder is not in mode "C", or when the "Altitude Disable" switch is in the off position.

Figure 1 Altitude Digitizer Correspondence

Altitude Digitizer to Primary Flight Altimeter Correspondence Reference TSO-C88a and SAE AS8003



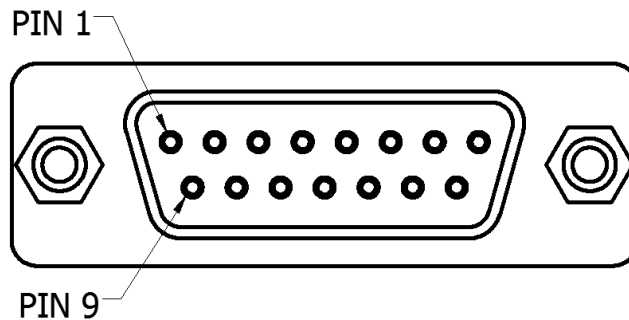
Section 5.0 Tables I through VII Digitizer Interconnection

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

SSD120 15 Pin Conn.	Function	Bendix/King KT73 Pin Number	Bendix/King KT76/78 Pin Number	Bendix/King KT76A/78A Pin Number	Bendix/King KXP Pin Number
1	D4	8	*3	*3	V
2	A1	M	6	M	G
3	A2	K	7	K	H
4	A4	J	9	J	J
5	B1	E	4	E	K
9	B2	C	1	C	L
10	B4	B	2	B	M
11	C1	D	3	D	P
13	C2	L	8	L	R
12	C4	H	10	H	S
6	Output Enable	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.
8 or 14 *4	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.

Figure 2 SSD120-(XX)A 15 Pin D-Sub Connector Front View



³ Data for this connection is not available at this time.

⁴ Pins 8 and 14 are connected internally.

Table II

SSD120 15 Pin Conn.	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	*5	*5	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 *6	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

The Narco AT-5A, AT-6A, AT-50 or AT-50A transponder will not accept data from the SSD120-(XX)A() Altitude Digitizer. A modification to remove the output decoupling capacitors is required. The unit may be ordered from the factory with this modification. Order Model Number SSD120-(XX)A() with Mod 1.

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.

⁵ Data for this connection is not available at this time.

⁶ Pins 8 and 14 are connected internally.

Table III

SSD120 15 Pin Conn.	Function	Garmin GTX 327 Pin Number	Garmin GTX 330 & 330D Pin Number	This column left blank intentionally.	This column left blank intentionally.
1	D4	18	11		
2	A1	3	2		
3	A2	5	4		
4	A4	6	5		
5	B1	9	7		
9	B2	11	9		
10	B4	12	10		
11	C1	10	8		
13	C2	4	3		
12	C4	7	6		
6	Output Enable	13 or 25 or aircraft ground	50		
8 or 14 *7	14 to 28Vdc Input	14 to 28VDC Input	Pin 62 through a 3 amp 50V reverse rated diode.		
15	Ground	Connect to aircraft ground.	Connect to aircraft ground.		

⁷ Pins 8 and 14 are connected internally.

Table IV

SSD120 15 Pin Conn.	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 * ⁸	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.

⁸ Pins 8 and 14 are connected together internally.

Table V

SSD120 15 pin Conn.	Function	Bendix TPR-2060 Pin Number	Bendix TR641A/B Pin Number	Wilcox 1014A Pin Number	UPS AT Apollo SL70 Pin Number
1	D4	*9	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 *10	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.

⁹ Data for this connection is not available at this time.

¹⁰ Pins 8 and 14 are connected internally.

Table VI

SSD120 15 pin Conn.	Function	Becker Avionic Systems ATC3401 ATC2000	Becker Avionic Systems ATC4401	Terra TRT-250 TRT-250D	This column left blank intentionally.
1	D4	23	20	9	
2	A1	16	1	5	
3	A2	15	2	17	
4	A4	14	3	16	
5	B1	17	14	15	
9	B2	19	15	2	
10	B4	18	16	14	
11	C1	22	17	3	
13	C2	21	18	4	
12	C4	20	19	18	
6	Output Enable	24	25	12	
8 or 14^{*11}	+14 to 28Vdc	6	6	20	
15	Ground	24	25	Connect to aircraft ground	

¹¹ Pins 8 and 14 are connected internally.

Table VII

SSD120 15 pin Conn.	Function	Bendix/King 560EGPWS & MK-XXI EGPWS	Bendix/King KMH 870 IHAS Processor	This column left blank intentionally.
1	D4	No connection	18	
2	A1	12	11	
3	A2	52	10	
4	A4	33	9	
5	B1	14	14	
9	B2	34	13	
10	B4	73	12	
11	C1	32	17	
13	C2	13	16	
12	C4	72	15	
6	Output Enable	Connect to aircraft ground	Connect to aircraft ground	
8 or 14¹²	+14 to 28Vdc	Connect to avionics buss via circuit breaker	Connect to avionics buss via circuit breaker	
15	Ground	Connect to aircraft ground	Connect to aircraft ground	

¹² Pins 8 and 14 are connected internally.

Section 6.0 Instructions for Continued Airworthiness

The SSD120-(XX)A is an all solid-state device and requires no periodic maintenance to maintain its airworthiness. The altitude encoder is to be tested during the aircraft biennial transponder and pitot-static system test as required by Federal Aviation Regulations. If the altitude encoder reports an error in excess of ±125 feet compared to the primary flight altimeter, than recalibration as per §4.0 of this manual is required. If the error cannot be corrected through this procedure, then the unit is to be repaired or replaced. Contact Trans-Cal Industries for further information.

Section 7.0 Frequently Asked Questions

1. *How often must the Altitude Digitizer be calibrated; is there periodic maintenance required?*

There is no periodic maintenance required. The Digitizer is tested and calibrated, if required, during the aircraft’s biennial certification of the transponder and static system.

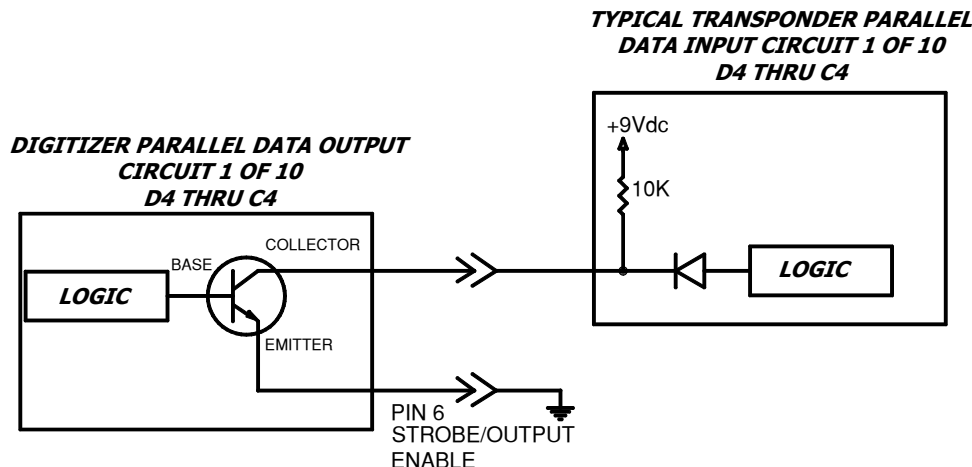
2. *How many devices may be driven off of the parallel ICAO Altitude data port?*

The number of devices that may be connected to the Digitizer ICAO altitude output is a function of the current and power required. The Digitizer parallel data outputs are “uncommitted” collectors of a transistor array which are “pulled-up” through a resistive load by the transponder (or other device) to some positive voltage. This voltage may range from about +3 to +40Vdc. Each Digitizer data output line (i.e. D4, A1, A2, A4 etc.) is capable of providing 35 mA (0.035 Amperes) with a not to exceed power rating of 100mW (0.1 Watts), when it is “sinking” current in the “on” position. Typical modern applications require about 1 milliampere or less per data line, per device.

In the circuit illustrated below, the current is calculated as 0.9mA at 8.1mW. At this current and power rating, a total of 12 identical devices could be connected to the digitizer. *Given the wide variety of input circuits capable of interfacing with the Digitizer and the possibility of crosstalk, careful planning of the electrical loads acting upon the Digitizer output is advised.*

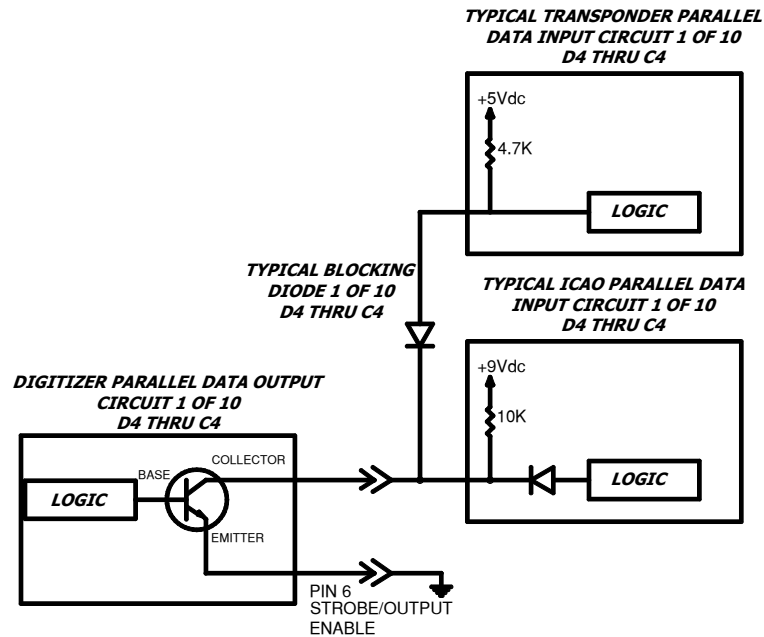
$$V/R = I \quad 9Vdc / 10000Ohms = 0.0009 Amps$$

$$V(I) = P \quad 9Vdc \times 0.0009 Amps = 0.0081Watts$$



3. Why do altitude encoding errors occur when connecting a second or third device to the altitude encoder, but not when only one device is connected?

This is a symptom of “Cross-Talk.” This condition typically occurs when the devices connected to the altitude encoder are “pulling-up” to different voltages without diode isolation. When the altitude encoder is in the “off” state the data line electrical current may flow in undesired directions due to this pull-up voltage imbalance. Most modern avionics devices are diode isolated; but in applications where older equipment is mixed with new devices, blocking diodes may be required to isolate the older device. Germanium or Schottky blocking diodes are the preferred devices to install due to the low forward voltage drop across the diode. Connect as detailed in the illustration below. Use of general purpose silicon diodes are *NOT* recommended, as the larger voltage drop may interfere with the logic threshold detection in the equipment.



4. My transponder does not have a D2 or D4 input. What do I do with these signals from the Digitizer?

Leave unused data bits unconnected or connect to circuit ground.

5. What is the **Strobe** or **Signal Common** or **Output Enable** function on the ICAO altitude data port?

This is a control signal for the ICAO parallel altitude data. On devices manufactured by Trans-Cal this function is always on pin 6 of the ICAO altitude port. A “high” or “open” on this pin will disable the ICAO altitude data. A “low” or “ground” on this line will enable the altitude data. Some interconnecting devices may use this signal to control the flow of data from the Digitizer. Be aware that when using this signal and connecting multiple devices to the Digitizer, interruptions of the ICAO data will occur when the controlling device “strokes” the Digitizer.

Section 9.0 Known Compatibility Issues

9.1 Narco AT5A, AT6A, AT-50 and AT-50A Installations and SSD120-(XX)A Mod.1

The Narco AT-5A, AT-6A, AT-50 or AT-50A transponder will not accept data from the SSD120-(XX)A Altitude Digitizer. A modification to remove the output decoupling capacitors is required. The unit may be ordered from the factory with this modification. Order Model Number SSD120-(XX)A with Mod. 1. **Please note! This modification may NOT be performed in the field.** **Please also 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.

9.2 “Mod. 1” Installations

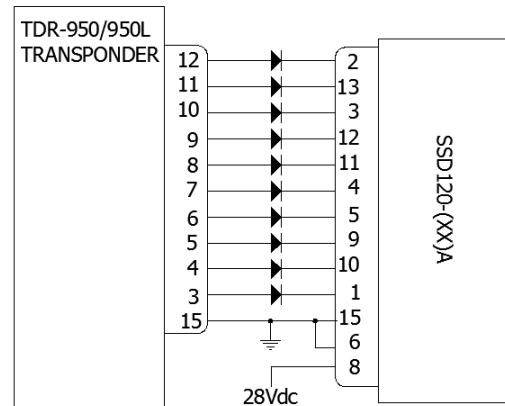
SSD120-(XX)A Mod.1 Altitude digitizers lack decoupling capacitors on the data line outputs to enable operation with older Narco transponders. When installing a Mod. 1 unit in an aircraft, and **particularly when installing in composite structured aircraft**, great care should be taken to insure that the digitizer is located away from RF emitting devices and fields. The interconnecting data harness must be shielded and properly grounded. Additional shielding around the digitizer may be required to prevent stray RFI from disrupting the digitizer’s analog signal sensing electronics.

9.3 King KT-75

The King KT-75/75R uses the old RTL (resistor transistor logic) pulling up to about 3 volts; consequently the open collectors of the SSD120-(XX)A will not pull the signal past the KT-75 logic threshold.

9.4 S-Tec (Collins) TDR950

The TDR950 must be powered-up first, or the SSD120-(XX)A must be diode isolated to prevent the TDR 950 from invalidating the encoder data. All diodes 1N4454 (CPN 353-3741-010).



9.5 Trans-Cal SSD120-(XX)A Backwards Compatibility

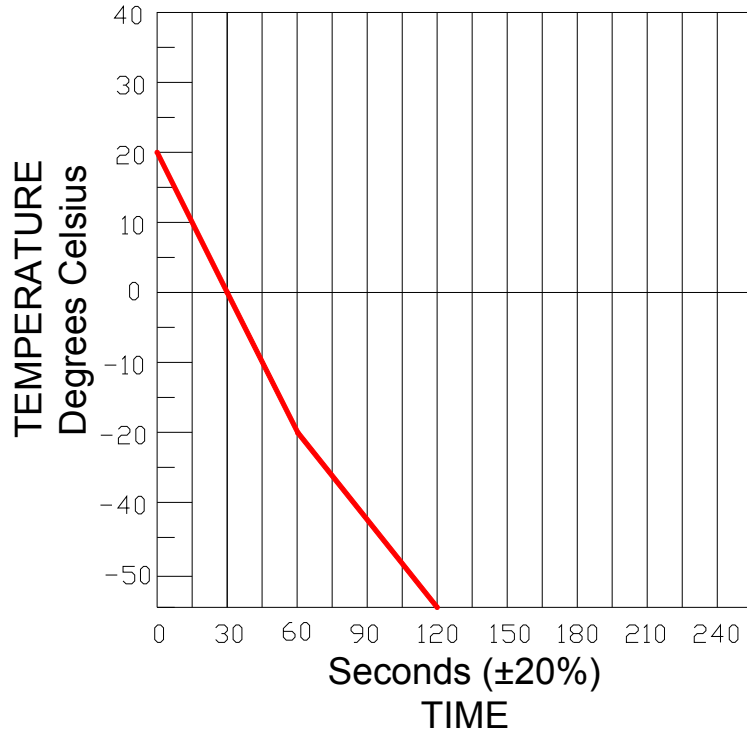
All Model SSD120-(XX)A are pin-for-pin replacements for all Model SSD120-(XX) and D120-P2-T, with ONE exception. The older SSD120-(XX) utilized a 28V heater ground on pin 1 of the D-Subminiature connector. Pin 1 is the D4 data bit on the SSD120-(XX)A models. Rewire the harness appropriately, if D4 is an active bit. No action is required if D4 is unused. All Model SSD120-(XX)N-XXXX are pin-for-pin replacements for all Model SSD120-(XX)A-XXXX.

9.6 SSD120-(XX)A Compatibility to Competitor’s Products

Manufacturer	Compatibility with Model SSD120-(XX)A
ACK Technologies	Model A-30 Pin-for-pin compatible.
Ameri-King Corp.	Model AK-350 Pin-for-pin compatible.
Becker Avionic Systems	Model BE6400-01-(XX) Utilizes an RS422 interface and in <i>NOT</i> compatible with Trans-Cal Encoders
Narco	Model AR-850 Pin-for-pin compatible.
Narco	Model AR-500 Uses a 25 Pin D-Sub connector and must be rewired to use SSD120-(XX)A.
Rocky Mountain Instrument	Model μ Encoder no display function and requires rewiring the harness to use SSD120-(XX)A.
Shadin	See chart below.
Sandia	Model SAE5-35 ICAO data is pin-for-pin compatible.
Terra	Model AT3000 is pin-for-pin compatible.

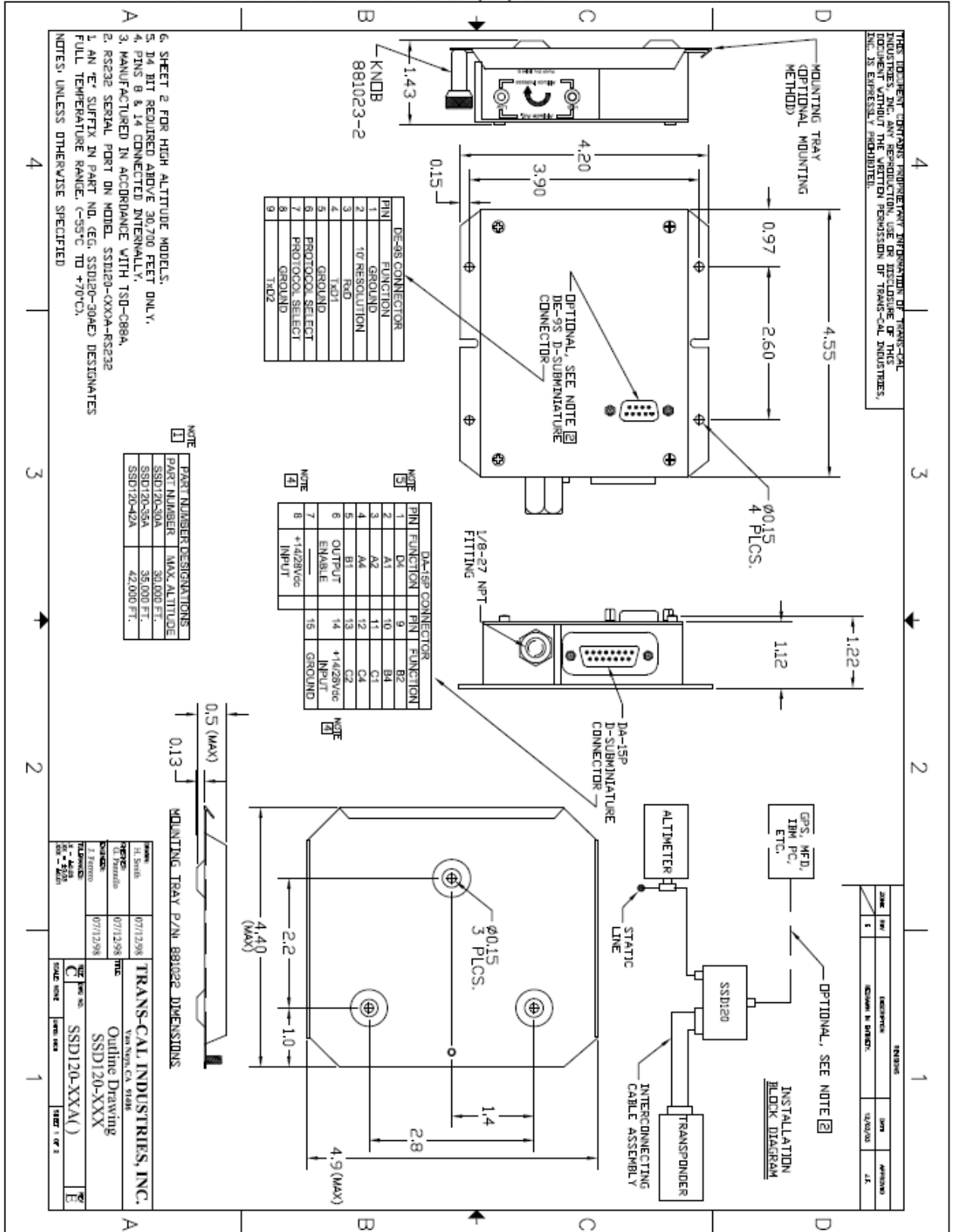
Manufacturer	Compatibility with Model SSD120-(XX)N
Shadin Model 8800M	ICAO data is pin-for-pin compatible, RS232 data is output on pin 7. Requires use of TCI model SSD120-(XX)A-RS232 and rewire to use TCI 9 pin D-Sub connector. Configure for UPS AT serial data message.
Shadin Model 8800G	ICAO data is pin-for-pin compatible, RS232 data is output on pin 7. Requires use of TCI model SSD120-(XX)A-RS232 and rewire to use TCI 9 pin D-Sub connector. Configure for Magellan serial data message.
Shadin Model 8800T	ICAO data is pin-for-pin compatible, RS232 data is output on pin 7. Requires use of TCI model SSD120-(XX)A-RS232 and rewire to use TCI 9 pin D-Sub connector. Configure for Trimble serial data message.
Shadin Model 8800A	ICAO data is pin-for-pin compatible, RS232 data is output on pin 7. Requires use of TCI model SSD120-(XX)A-RS232 and rewire to use TCI 9 pin D-Sub connector. Configure for ARNAV serial data message.

Figure 3 Temperature vs. Warm-up Time



Outline Drawing

REVDATE: 30DECEMBER2003 FNAME: SSD120-(XXX) Outline rE



Environmental Qualification Form

Nomenclature: Altitude Digitizer

Model No.: SSD120 – 42A

FAA TSO-C88a

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

DO-160B Testing Completed: May 1988

Conditions	Section	Description of Tests Conducted
Temp. and Altitude	§4.0	Tested to Category B1.
Low Temperature	§4.5.1	-20°C
High Temperature	§4.5.2 & 4.5.3	+55°C
In-Flight Loss of Cooling	§4.5.4	No cooling required.
Altitude	§4.6.1	30,700 Feet
Decompression	§4.6.2	
Overpressure	§4.6.3	
Temp. 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 Categories JKLMNOP
Explosive Atmosphere	§9.0	Identified as Category X, no test performed.
Waterproofness	§10.0	Identified as Category X, no test performed.
Fluids Susceptibility	§11.0	Identified as Category X, no test performed.
Sand and Dust	§12.0	Identified as Category X, no test performed.
Fungus Resistance	§13.0	Identified as Category X, no test performed.
Salt Spray	§14.0	Identified as Category X, no test performed.
Magnetic Effect	§15.0	Tested to Category Z.
Power Input	§16.0	Tested to Category B.
Voltage Spike	§17.0	Tested to Category B.
Audio Frequency Conducted Susceptibility – Power Inputs	§18.0	Tested to Category B.
Induced Signal Susceptibility	§19.0	Tested to Category BC.
RF Susceptibility (Radiated and Conducted)	§20.0	Tested to Category T for Radiated Susceptibility and Category T for Radiated Susceptibility.
Emission of RF	§21.0	Tested to Category B.
Lightning Induced Transient Susceptibility	§22.0	Identified as Category X, no test performed.

Part Number Builder

SSD120-XX X X X-XXXX

Max. Operating Altitude (ft.) Dash Number	
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	
Encoder/Digitizer	A
2" Dia. Module	M
Servo Module	SM
Nano Encoder Series	N

Operating Environment	
Standard -20° to +70°C	Blank
Extended -55° to +70°C	E
Extended Hermetic -55° to +70°C	EH

Static Port Connection	
Dual Female 1/8-27NPT	Blank
.125" Dia Swivel	1

Additional Ports/Features	
Dual RS232 Ports	-RS232
Dual RS232 Ports and One RS485 Port	-RS
Dual RS232 Ports with 1' resolution data on TxD2 and one RS485 Port	-RS1

Model Number Example: SSD120-30NE-RS232
 Solid State Altitude Digitizer -1000 to +30,000 ft., Nano Style, Extended Temperature Range, 1/8-27NPT Female Static Port, Dual RS232 Ports.

**Manufacturer Direct Warranty
Do Not Return to Place of Purchase**

Trans-Cal Industries warrants each Model SSD120-(XX)A() Solid State altitude digitizer to be free of defects in workmanship and materials for a period of 42 months after purchase. **Do NOT send this unit to a distributor or retailer for repair.** Contact the factory directly if you experience problems (818) 787-1221 x400.

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 Trans-Cal, **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() **SERIAL NO:** A-_____

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:_____