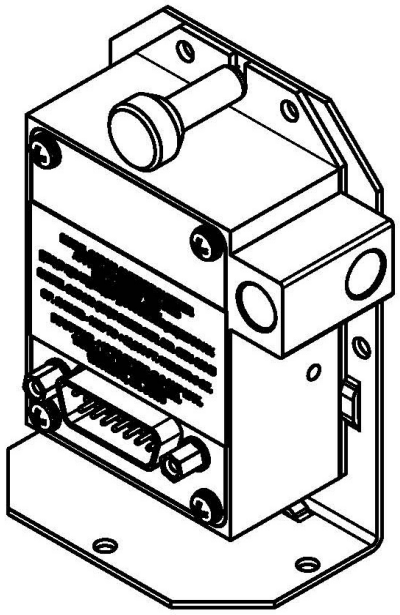
Trans-Cal Industries, Inc.

Model SSD120-(XX)N
&
Model SSD120-(XX)NE
(Includes Mod. 1 Data)

All Solid-State
Altitude Encoder/Digitizer

Owner/Installation Manual

FAA TSO-C88a Approved
EASA ETSO-C88a Approved



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Please Note:
It is the responsibility of the installer of this equipment, within a specified type or class of aircraft, to determine that the aircraft operating conditions are within TSO or ETSO standards. 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 AC20-136A provides guidance related to the protection of aircraft electrical systems from the effects of lightning.

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What's in the Box:

Qty.	Part Number	Description
1 ea.	SSD120-(XX)N	Altitude Digitizer
1 ea.	882188	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 fitting
1 ea.	600020	¼" Tube Polypropylene tee fitting
1 ea.	103024	1/8-27NPT Nylon Plug

History of Revision

Revision	Date	Description
N/C	10/2007	Production release.
A	03/2008	Added §3.1 Static plug reference, §6.0 FAQ; §7.0 Known Compatibility Issues, §8.0 Inst. for Continued Airworthiness.
B	07/2008	Added ETSO reference, adapter plate reference and ordering info, updated outline drawing to rev.C. Added MK XXI EGPWS to Table VII
C	12/2008	Added Mod. 1 installation references §9.2. and TDR950 graphic to §9.4.

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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.
$^{C}_{R}$	Carriage Return
EASA	European Aviation Safety Agency
EEPROM	Electronically 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
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
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
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.
ºC	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)N and SSD120-(XX)NE[1] series of altitude encoder/digitizer.

1.2 Equipment Description

Approved under FAA TSO-C88a and EASA ETSO-C88a, the Model SSD120-(XX)N and SSD120-(XX)NE 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)N Model SSD120-(XX)NE[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)N Model SSD120-(XX)NE	 -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:	5.1 oz. (6.1 oz. with tray)

1.3.1 Operating Altitude

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

[1] SSD120-(XX)NE Extended operating temperature range: -55° to +70°C.
[2] Longer warm-up times will be experienced when operated at +12 Vdc.

1.3.2 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**.

1.3.3 Mechanical Characteristics

Model Number	Dimensions	Weight
Model SSD120-30N( )	*See Outline Drawing*	5.1 oz.
Model SSD120-35N( )	*See Outline Drawing*	5.1 oz.
Model SSD120-42N( )	*See Outline Drawing*	5.1 oz.

Mounting tray adds 1 oz. To the weights listed above

1.3.4 Environmental

All model SSD120-(XX)N( ) digitizers have been designed and tested to meet the requirements of TSO-C88a and ETSO-C88a. This unit has been tested in accordance with RTCA Document DO160E, dated December 2004 Environmental Category: D1BAB[(SM)(UF)]XXXXXXZBBB(BC)TTBXXXAX. See Environmental Qualification form for specifics.

1.3.5 Over Range

The SSD120-(XX)N( ) 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: 50 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)N( ) series of altitude digitizer's 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, and 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)N( ) 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)N is provided with two static port inlets, either or both may be used to connect the Digitizer to the aircraft static system. If only one static port is used, install the 1/8-27NPT plug included with the connector kit into the unused static port. 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)NE devices operating below -20ºC, 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, 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.

Use #4-40 or #6-32 machine screws, sheet metal screws, or pop 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.

Adapter plates are available to convert older Trans-Cal and competing digitizer installations for use with the SSD120-(XX)N series of altitude digitizers. See adapter plate ordering information **§7.0**.

3.2 Electrical Installation

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 43-6B
FAR 91.411; FAR 43-Appendix E and F
FAA TSO-C88a, EASA ETSO-C88a SAE AS8003

This procedure will allow adjustment to the calibration curve of the SSD120-(XX)N or SSD120-(XX)NE 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 and ETSO-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)N and SSD120-(XX)NE are designed to be field calibrated to meet this requirement, as per the procedure described in **§4.3**. 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**.

The digitizer is adjusted using two potentiometers, which affect the span and reference of the pressure transducer. The **Span Adjust** calibration **(§4.3)** is normally used in applications where the only a slight modification is required to bring the altitude digitizer curve up or down.

4.2 Required Equipment Span Adjust

(See span adjust block diagram.)

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

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

(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.)

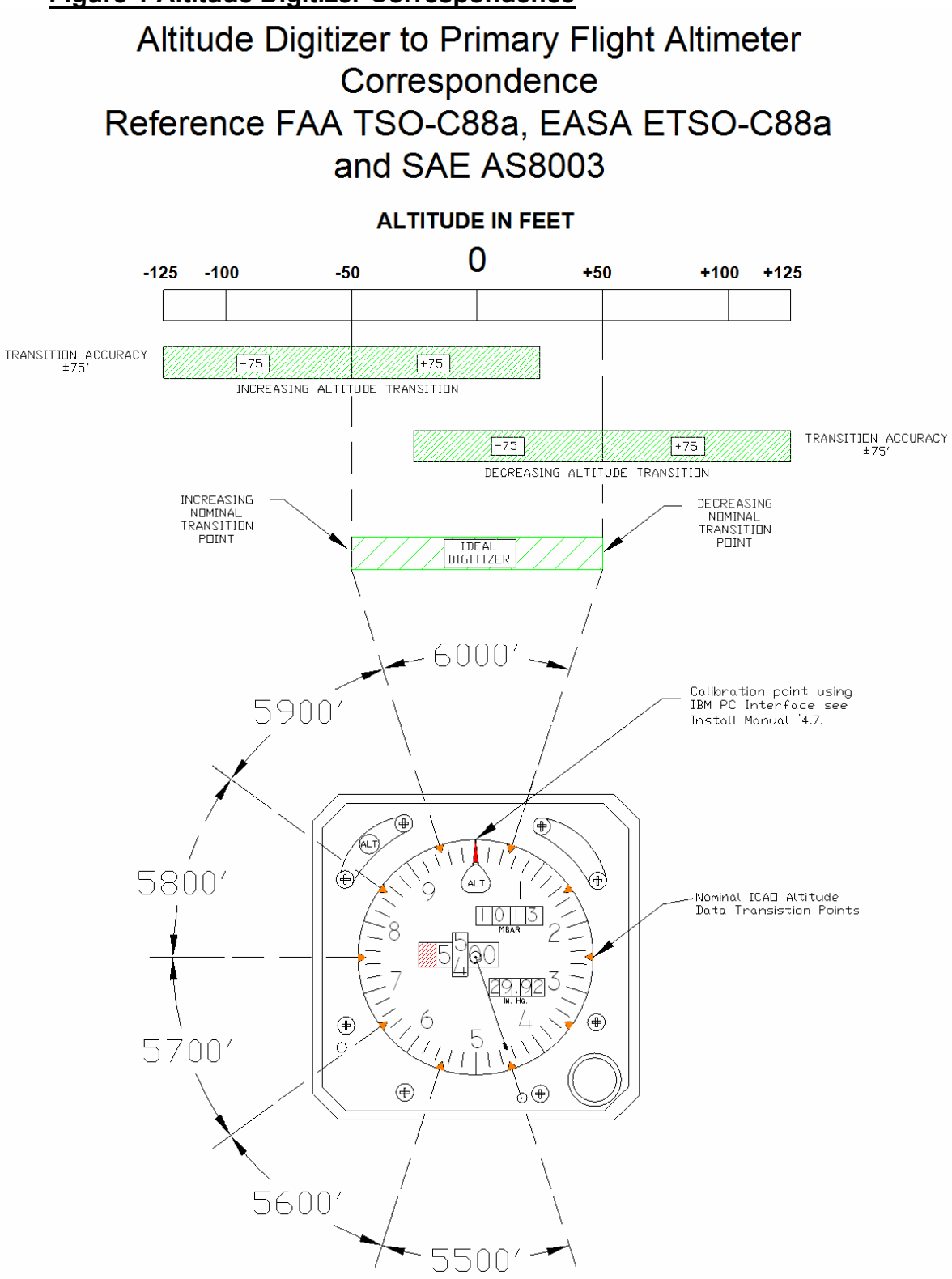
6. Repeat steps (4) and (5) until the ±125 foot tolerance is achieved for both the maximum calibration altitude and the minimum calibration altitude.

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.

CAUTION: Always refer to the altimeter and VSI manufacturer's data for maximum rate of climb or descent, and any special test conditions which must be complied with.

Figure 1 Altitude Digitizer Correspondence



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]	*[4]	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.

[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]	*[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 *[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)N( ) Altitude Digitizer. A modification to remove the output decoupling capacitors is required and the unit may be ordered from the factory with this modification. Order Model Number SSD120-(XX)N( ) 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 14*[12]	+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

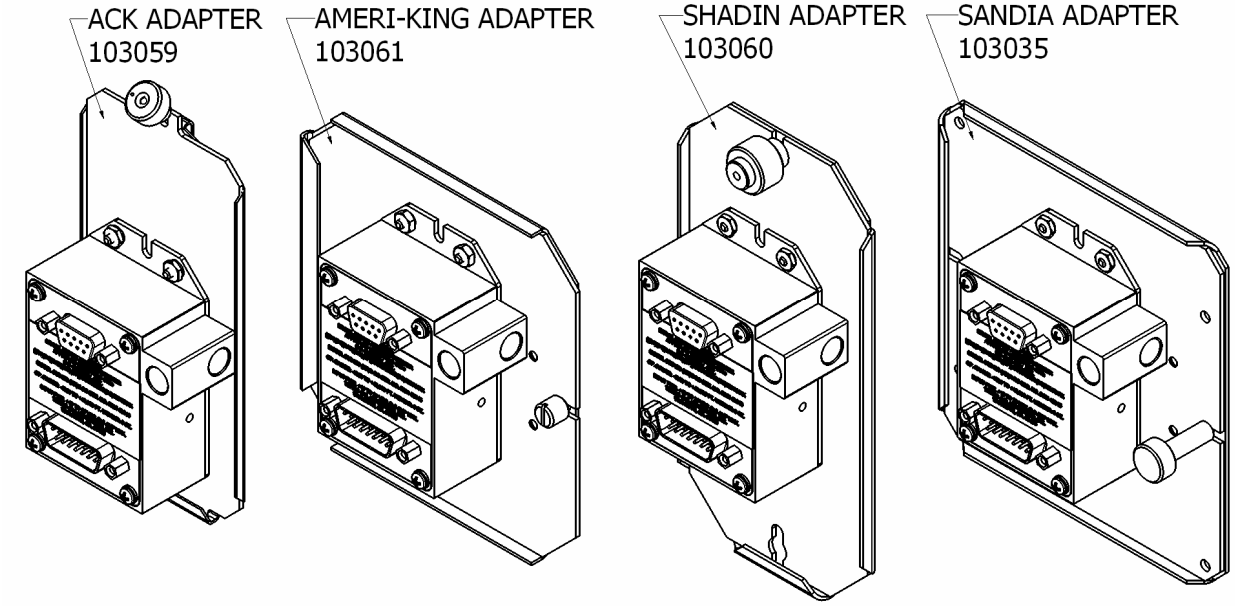
The SSD120-(XX)N is an all solid-state device and requires no periodic maintenance to maintain its airworthiness. The altitude encoder is to be tested during the aircraft biennial transponder and pitot-static system test as required by Federal Aviation Regulations. If the altitude encoder reports an 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 Adapter Plate Ordering Information

The adapter plates listed below will allow the use of competing digitizer manufacturer's and older Trans-Cal quick release mounting trays with the SSD120-(XX)N. These adapter plates are designed to allow quick replacement of altitude encoders. Use the following Trans-Cal part numbers to order adapter plates.

Manufacturer Model	TCI Adapter Plate Part Number
ACK Model A-30	103059
Ameri-King Model AK350 Series	103061
Narco Model AR-850	No adapter required.
Shadin Model 8800-X Series	103060
Sandia Model SAE5-35	103035
Trans-Cal Model D120-P2-T	103036
Trans-Cal Model SSD120-(XX)A	103038

Pictured below is the SSD120-(XX)N-RS232 mounted on adapter plates and quick release mounting trays for Ameri-King and ACK devices. Quick release mounting trays are NOT included with the adapter plates.



Section 8.0 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.

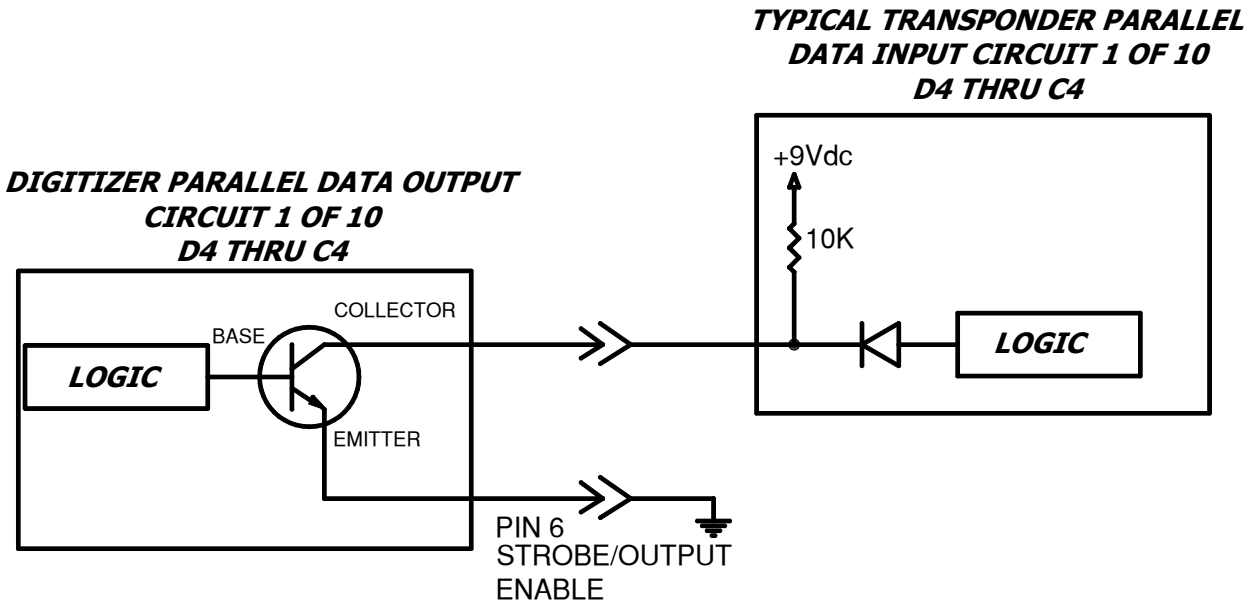
2. *How many devices may be driven off of the parallel ICAO Altitude data port?*

   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.*

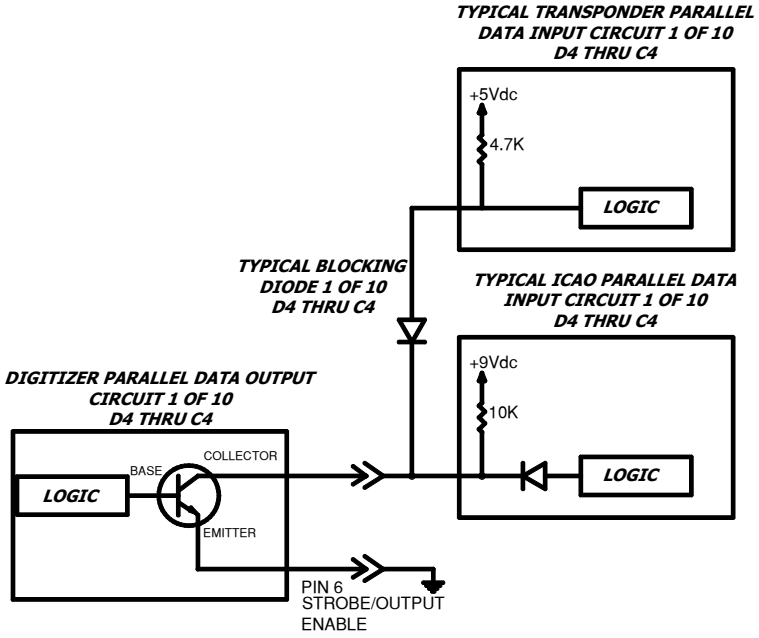
$$V/R = I \qquad 9Vdc/10000Ohms = 0.0009Amps$$

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



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 “*strobes*” the Digitizer.

Section 9.0 Known Compatibility Issues

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

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

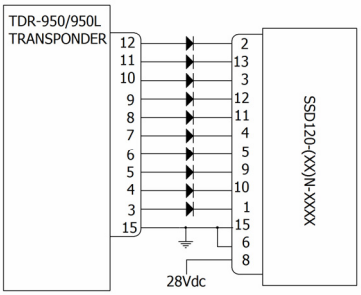
SSD120-(XX)N Mod.1 Altitude digitizers lack decoupling capacitors on the data line outputs to enable operation with older Narco transponders. When installing a Mod. 1 unit in an aircraft, and **particularly when installing in composite structured aircraft,** great care should be taken to insure that 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)N 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)N 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)N Backwards Compatibility

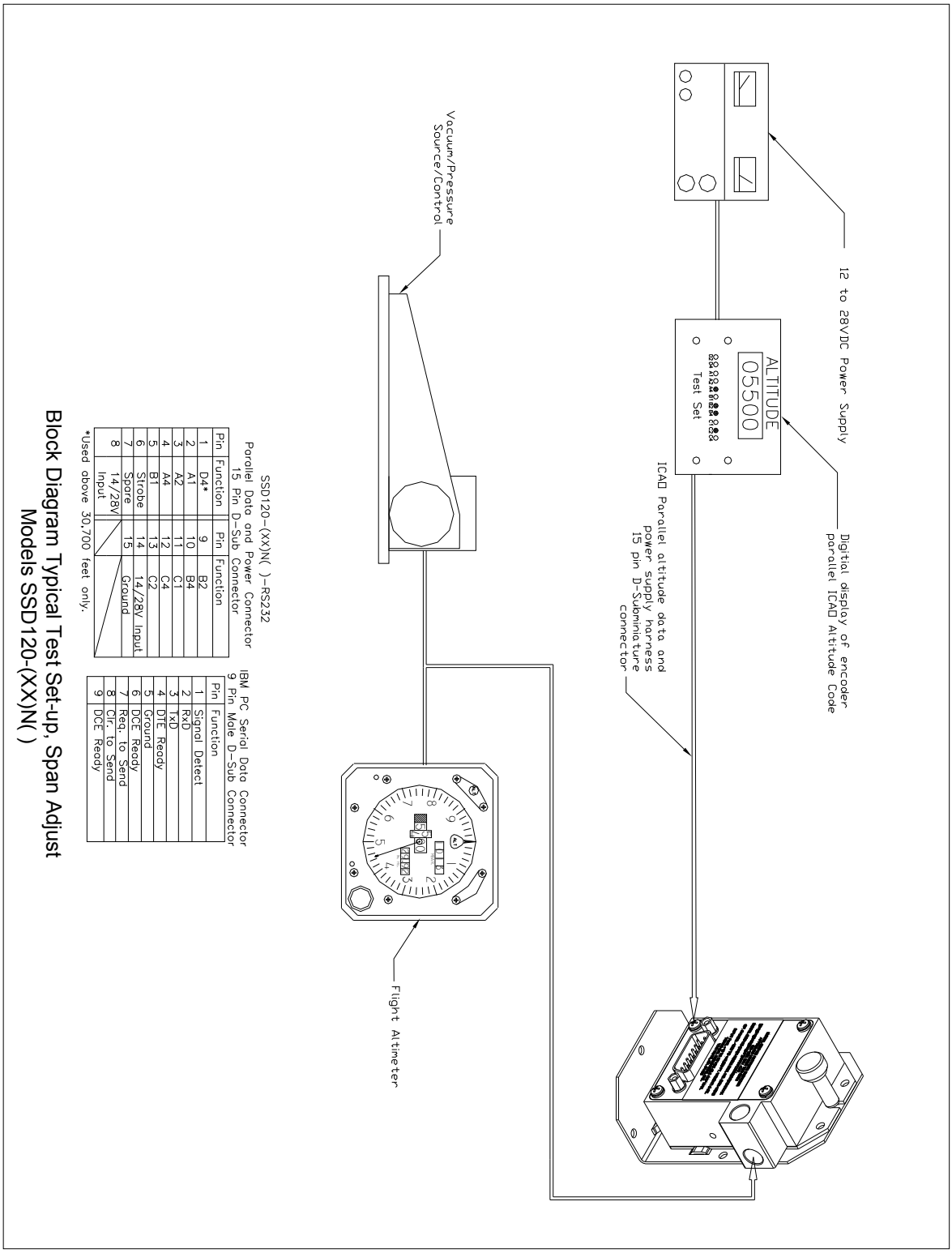
All Model SSD120-(XX)N-XXXX are pin-for-pin replacements for all Model SSD120-(XX) and D120-P2-T, with ONE exception. The older SSD120-(XX) utilized a 28V heater ground on pin 1 of the D-Subminiature connector. Pin 1 is the D4 data bit on the SSD120-(XX)N models. Rewire the harness appropriately, if 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)N Compatibility to Competitor's Products

Manufacturer	Compatibility with Model SSD120-(XX)N
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 *NOT* 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)N.
Rocky Mountain Instrument	Model µEncoder no display function and requires rewiring the harness to use SSD120-(XX)N.
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)N-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)N-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)N-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)N-RS232 and rewire to use TCI 9 pin D-Sub connector. Configure for ARNAV serial data message.
Shadin Model 9200T	ICAO data is pin-for-pin compatible, RS232 data is output on pin 7. For use with the Shadin AMS2000 Requires use of TCI Model SSD120-(XX)N-RS1. Rewire to use the 9 pin D-Sub connector 1-foot resolution data is transmitted on TxD2.

Span Adjust Block Diagram



SSD120-(XX)N( )-RS232
Parallel Data and Power Connector
15 Pin D-Sub Connector

Pin	Function
1	D4*
2	A1
3	A2
4	A4
5	B1
6	Strobe
7	Spare
8	14/28V Input
9	B2
10	B4
11	C1
12	C4
13	C2
14	14/28V Input
15	Ground

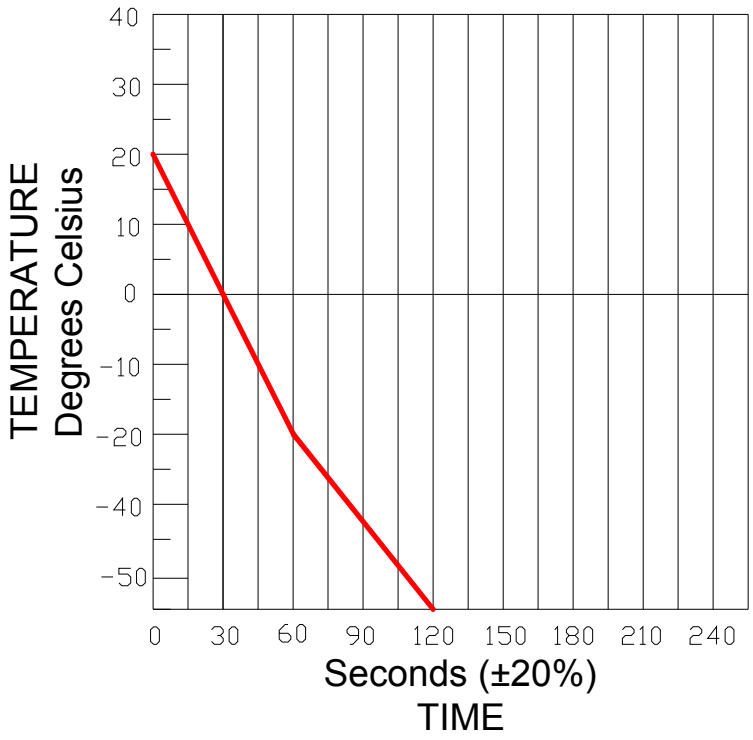
*Used above 30,700 feet only.

IBM PC Serial Data Connector
9 Pin Male D-Sub Connector

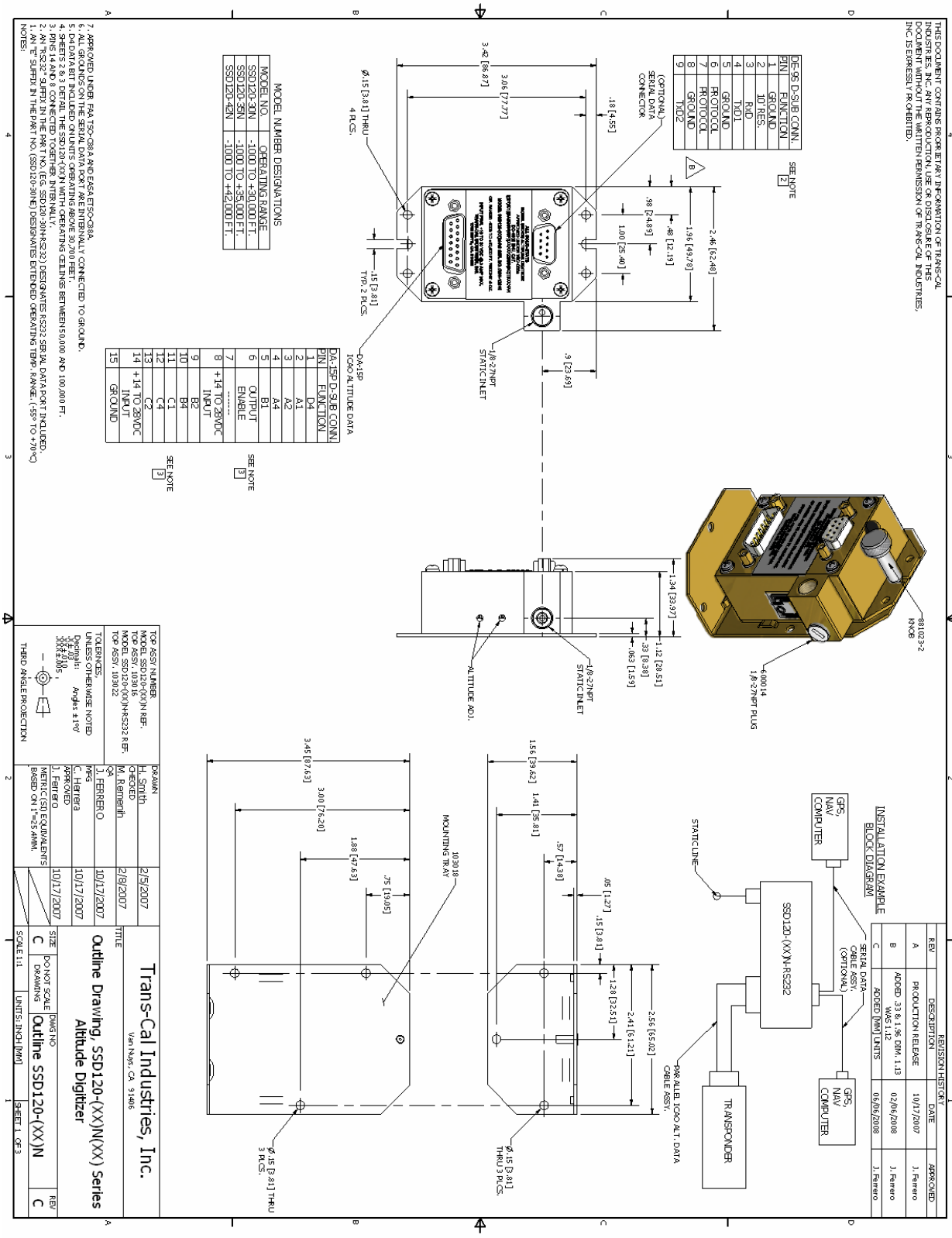
Pin	Function
1	Signal Detect
2	RxD
3	TxD
4	DTE Ready
5	Ground
6	DCE Ready
7	Req. to Send
8	Clr. to Send
9	DCE Ready

Block Diagram Typical Test Set-up, Span Adjust
Models SSD120-(XX)N( )

Figure 2 Temperature vs. Warm-up Time



Outline Drawing



Environmental Qualification Form

Nomenclature: Altitude Digitizer
Model No.: SSD120-42NE FAA TSO-C88a and EASA ETSO-C88a
Manufacturer: Trans-Cal Industries, Inc., 16141 Cohasset St. Van Nuys, CA 91406
DO-160E Testing Completed: October 2007

Conditions	Section	Description of Tests Conducted
Temp. and Altitude	**§4.0**	Tested to Category D1.
Low Temperature	**§4.5.1**	
High Temperature	**§4.5.2 & 4.5.3**	
In-Flight Loss of Cooling	**§4.5.4**	No cooling required.
Altitude	**§4.6.1**	
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 Category S Fixed Wing Zone 1, 2, 3 & 5 Curve M and Tested to Category U Helicopter Zone 1 & 2 Curve F & F1.
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.
Lightning Direct Effects	**§23.0**	Identified as Category X, no test performed.
Icing	**§24.0**	Identified as Category X, no test performed.
Electrostatic Discharge	**§25.0**	Tested to Category A.
Fire, Flammability	***§26.0***	Identified as Category X, no test performed.

Remarks:

During power input tests, the device was subjected to subparagraph 16.6.1.4b, requirement for devices with digital circuits.

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	
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)N( ) 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.

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-( )N( ) SERIAL NO: N-_____

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:_____