Trans-Cal Industries, Inc.

Model SSD120-(XX)A
&
Model SSD120-(XX)AE

All Solid State Altitude Encoder/Digitizer
Owner/Installation Manual
Operating Ceilings from 30,000 to 42,000 Feet.

T.S.O. C88a Approved

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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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Ordering Information:

To receive additional copies of this publication, order Trans-Cal Industries part number **881000 rev. C**.

History of Revision

Revision	Date	Description
--	07/98	Production release.
A	10/99	Added SL70 transponder data pg. 15.
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.

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Section 1.0 Introduction & Specifications

1.1 Scope

This manual provides detailed installation, calibration and operating instructions for the Trans-Cal Industries' Model SSD120-(XX)A and SSD120-(XX)AE* (see note 1) series of altitude encoders.

1.2 Equipment Description

This device is approved under F.A.A. T.S.O. C88a. The SSD120-(XX)A and SSD120-(XX)AE series of altitude encoders are self contained solid state electronic devices which, when connected to an aircraft static and electrical system, converts pressure altitude into the digital data set forth in the International (ICAO) 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.

In operation, with the encoder connected to the aircraft's transponder in mode "C" operation and interrogated by an air traffic control station, the transponder will utilize the encoder data to reply with the aircraft's altitude referenced to 29.92 In. Hg. (1013 MB.)

1.3 Equipment Specifications

1.3.1 Warm-Up Time:

SSD120-(XX)A	+20°C to +70°C	No warm-up time.
	-20°C to +20°C	See figure 1.
SSD120-(XX)AE	-55°C to -20°C	See figure 1.

1.3.2 Operating Altitude:

Model SSD120-30A	or	SSD120-30AE	-1000 to +30,000 feet.
Model SSD120-35A	or	SSD120-35AE	-1000 to +35,000 feet.
Model SSD120-42A	or	SSD120-42AE	-1000 to +42,000 feet.

See High Altitude Series manual for the units listed below:

Model SSD120-50A	or	SSD120-50AE	-1000 to +50,000 feet.
Model SSD120-62A	or	SSD120-62AE	-1000 to +62,000 feet.
Model SSD120-65A	or	SSD120-65AE	-1000 to +65,000 feet.
Model SSD120-80A	or	SSD120-80AE	-1000 to +80,000 feet.

***** Note 1: (E) Extended operating temperature range: -55°C to +70°C.

1.3 Equipment Specifications (continued)

1.3.3 Code Output.

The encoder's digitized output code is in accordance with the U.S. National Standard for Common System Component Characteristics for the IFF Mark X (SIF) Air Traffic Control Radar Beacon System, SIF/ATCRBS, as amended 8 March 1971.

1.3.4 Accuracy.

The encoder accuracy is ±50 feet from -1000 to 30,000 feet and ±75 feet from 30,000 feet to 42,000 feet, when measured from the altitude transition points of the digital code and referenced to 29.92 In. Hg. (1013 MB.)

1.3.5 Mechanical Characteristics.

Weight: 10 oz. **Dimensional:** See outline drawing.

1.3.6 Input Power Requirement.

The SSD120-(XX)A or SSD120-(XX)AE models operating up to 42,000 feet will operate on either 14 or 28 VDC at 0.600 Amps.

1.3.7 Output Signal Characteristics.

The encoder's output is provided by the "uncommitted" collectors of a transistor array and must be "pulled-up", through a resistive load by the transponder. The pull-up voltage may be 3 to 50 VDC at 50 ma sink current.

1.3.8 Input Signal Requirements.

Pin 6 of the altitude encoder must be either grounded or connected to the transponder strobe (output enable.)

1.3 Equipment Specifications (continued)

1.3.9 Environmental.

All SSD120-(XX)A and SSD120-(XX)AE encoders have been designed, tested and approved to meet the requirements of TSO-C88a, in accordance with RTCA Document DO-160b, dated July 1984 (specifics provided upon request.)

Operating Temperature:	SSD120-(XX)A	-20° to +70°C.
	SSD120-(XX)AE	-55° to +70°C.

Storage Temperature (non-operational): -60° to +85°C.

1.3.10 Over Range.

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

Section 2.0 Operation

2.1 General

The SSD120-(XX)A and SSD120-(XX)AE series of altitude encoders are designed to be mounted within a pressurized or non-pressurized, but temperature controlled location within aircraft operated up to 42,000 feet MSL. Usually remotely located, the encoder is fully automatic in operation and normally controlled by the transponder.

2.2 Operating Instructions

Place the transponder in mode “C”, altitude reporting mode, and apply power to the encoder. In some installations the encoder will automatically be supplied power when the transponder is energized; in others, power to the encoder may be supplied through a separate circuit breaker. If power to the encoder is provided directly from the avionics buss, follow the power-up procedures recommended by the transponder manufacturer.

In some installations, the transponder controls the encoder by enabling and disabling the encoder outputs. In still other installations, the encoder's output is not controlled by the transponder and is continually enabled, (pin 6 of the altitude encoder is grounded.)

Section 3.0 Installation and Calibration

3.1 Mechanical Installation

The SSD120-(XX)A and SSD120-(XX)AE series of altitude encod ers may be mounted in any attitude within the internal structure of the aircraft. *DO NOT* mount the encoder in the direct airstream or either hot or cold air ducts. The mounting position should allow for a short pressure line from the encoder to the altimeter, and allow access to the encoder's adjustments.

Use #4-40 machine screws, sheet metal screws, or pop rivets to attach the encoder or the mounting tray to the airframe. Secure the mating connector to the encoder housing using the captive #4-40 screwlock assembly provided. Refer to the outline drawing for mechanical dimensions and the installation block diagram.

3.2 Electrical Installation

The altitude encoder is designed to operate on either 14 or 28 VDC power source. These voltages can 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 1 Amp fuse or circuit breaker. Ground, pin 15, should be connected to aircraft ground (A-).

The encoder label and the outline drawing provide electrical connector/function information. Use this data when connecting the altitude encoder to the transponder.

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 Calibration

3.3.1 General
Ref: FAR 91.217; FAA Advisory Circular 43-6A
FAR 91.413; FAR 43-Appendix E and F.

Each altitude encoder is calibrated to an NIST traceable pressure datum; however, when the unit is installed in an aircraft for use as the transponder's mode "C" altitude encoder, it must be recalibrated for correspondence to the aircraft's primary flight altimeter as required by FAR 91.217 and 91.413.

Model SSD120-(XX)A and SSD120-(XX)AE altitude digitizers are designed to be field calibrated to meet this requirement, as per the procedure described in §3.3.3. The correspondence required for digitizers is fully addressed in SAE Aerospace Standard AS8003 §3.11. This correspondence standard requires altitude digitizer's to report 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 standard further 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. This nominal transition point occurs 50 feet prior to the altitude in question. See figure 1.

3.3.2 Calibration Equipment Required.

A pitot-static test set capable of exercising the altimeter and the altitude encoder over a range of -1000 feet to the maximum altitude of the encoder, and a test set (ramp tester) capable of interrogating the transponder are required.

3.3.3 Calibration Procedures.

1. Connect the pitot-static test equipment to the aircraft's static line, and the transponder test set per the manufacturer's recommendations. The encoder's two adjustment potentiometers are identified as L and H, meaning 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 the low potentiometer, correcting the low transition point, will move the high transition point, and require an adjustment of the high potentiometer.)

2. Apply power to the altitude encoder/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 altitude code, decrease pressure to the point where the altitude code just makes the transition to the maximum altitude encoded. Verify that the digitizer is within ±125 feet of the altimeter's reading. If not, adjust the high potentiometer until the digitizer's transition point is within ±30 feet of the nominal transition point; 29,950 feet for a 30,000 foot digitizer.

5. Increase pressure until the digitizer's output just makes the transition from 100 feet to 0 feet. Verify that the altitude digitizer reads within ±125 feet of the altimeter. If not, adjust the digitizer's low potentiometer until the digitizer's transition point is within ±30 feet of the nominal transition point (+50 feet) as read on the altimeter.

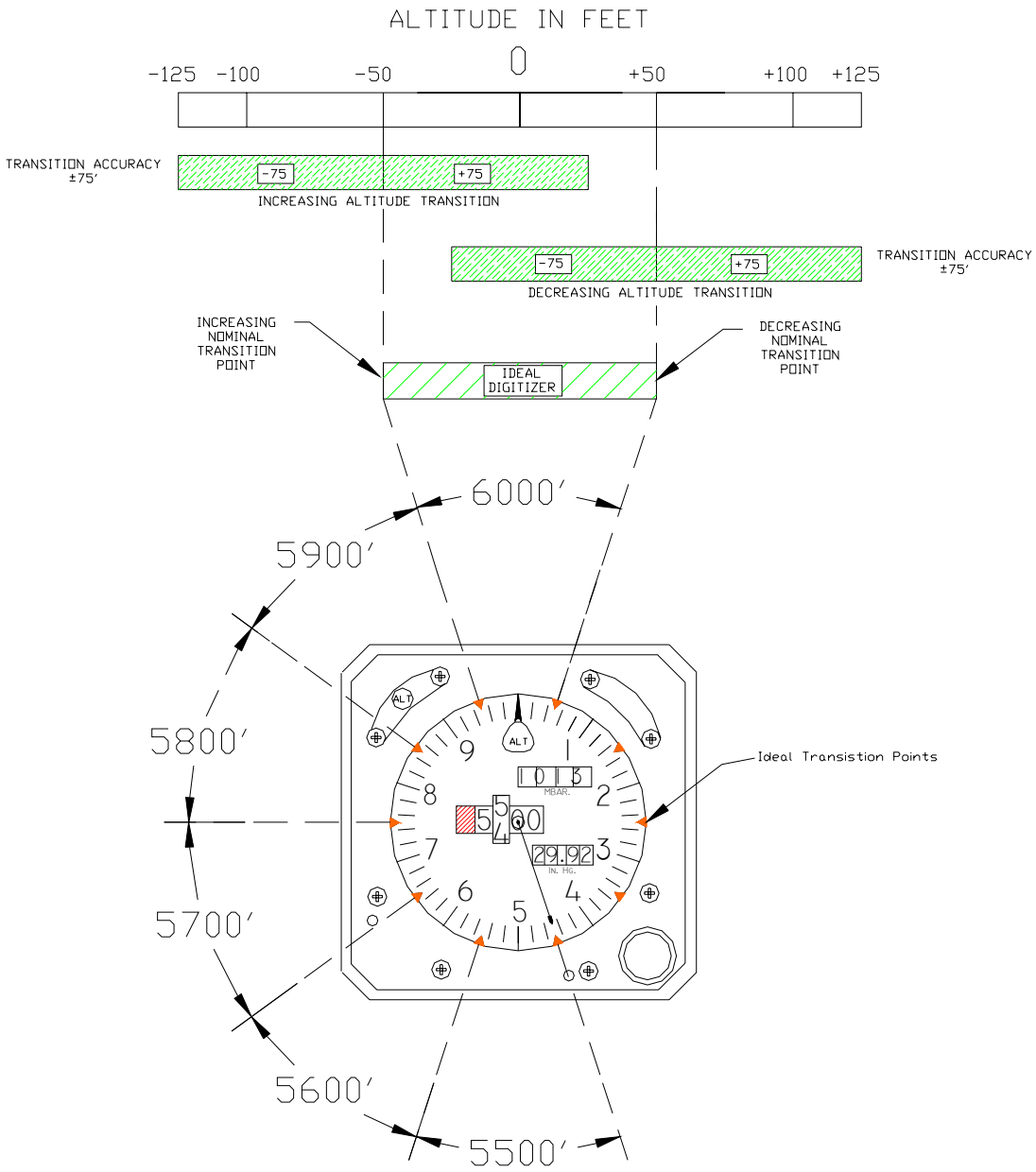
6. Repeat steps (D) and (E) until the ±125 tolerance is achieved for the maximum calibration altitude and the minimum calibration altitude.

7. Exercise the aircraft's static system over the operating range of the altitude encoder and, with increasing and decreasing pressure, verify at a minimum of ten test points that the altitude digitizer and primary flight altimeter is within the ±125 foot tolerance. If correspondence is not achieved at any test point the altimeter may need calibration.

8. Verify that the altitude digitizer's output is disabled when the transponder is not in mode "C", or when the "Altitude Disable" switch is in the disable position.

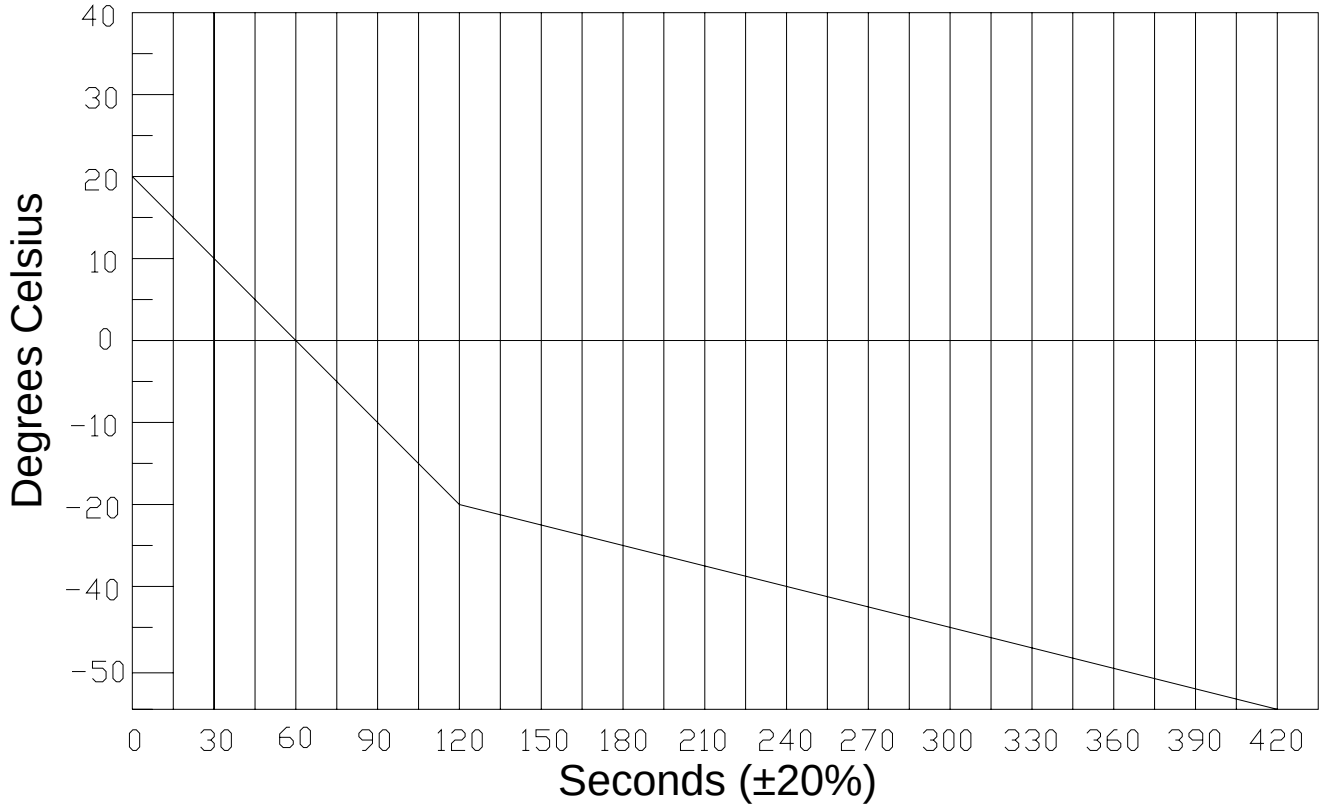
Altitude Digitizer to Primary Flight Altimeter

Figure 1
Altitude Digitizer to Primary Flight Altimeter Correspondence
Reference TSO-C88a and SAE AS8003

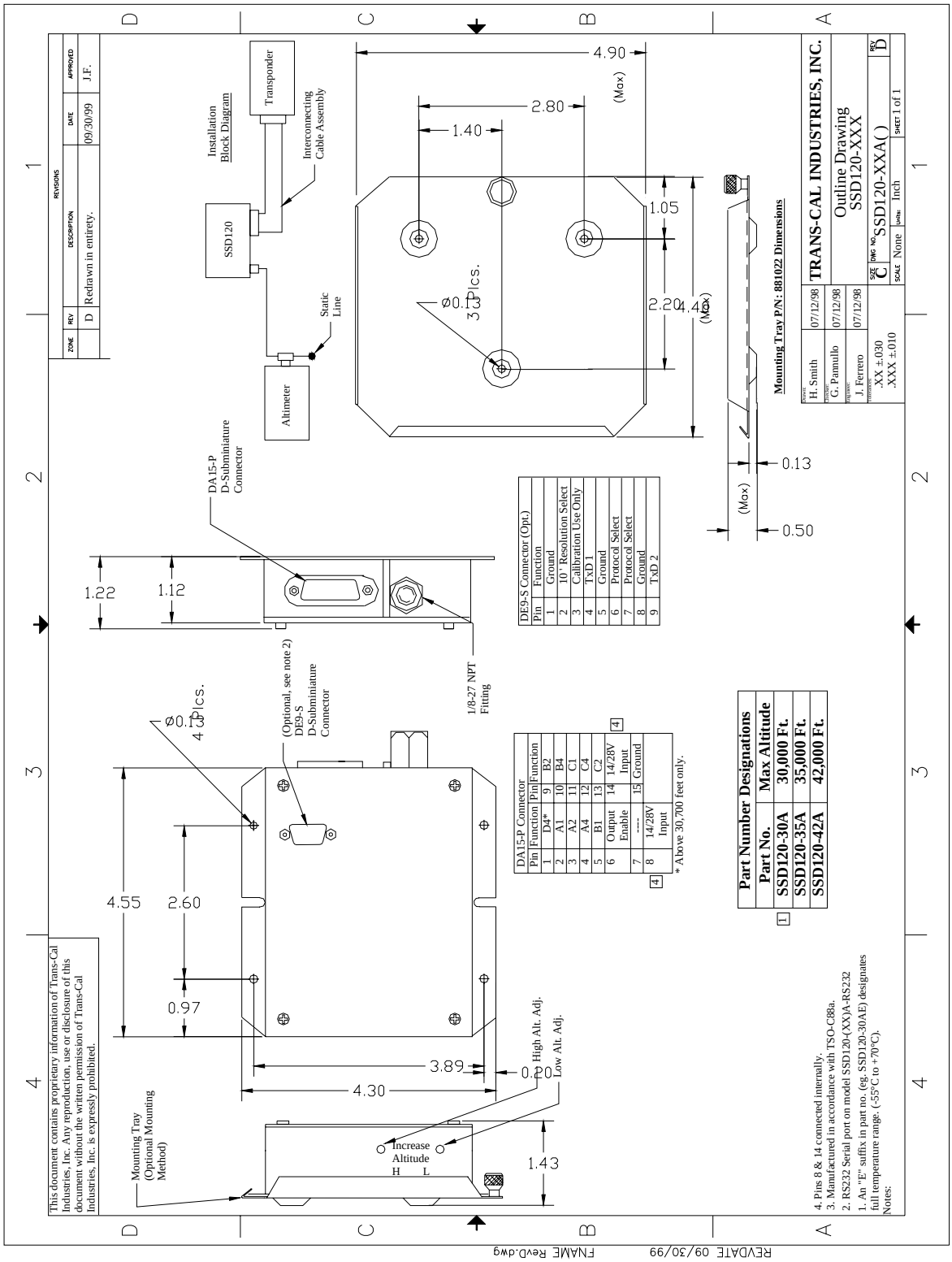


Temperature vs. Warm-up Time:

Figure 3
Temperature vs. Warm-up Time



Outline Drawing



Narco AT-50 and AT-50A Installations

The Narco AT-50 or AT-50A transponder will not accept data from the Trans-Cal SSD120-(XX)A until the following modifications have been completed:

1. The strobe modification as outlined in Narco service bulletin no. AT-50A-5 dated 19 February 1975 has been performed on the transponder.

2. A modification to the Trans-Cal SSD120-(XX)A removing the data line decoupling capacitor network.

The SSD120-(XX)A may be ordered from the factory with Mod. 1 completed, or the altitude digitizer may be modified in the field as outlined below.

Instructions for field modification:

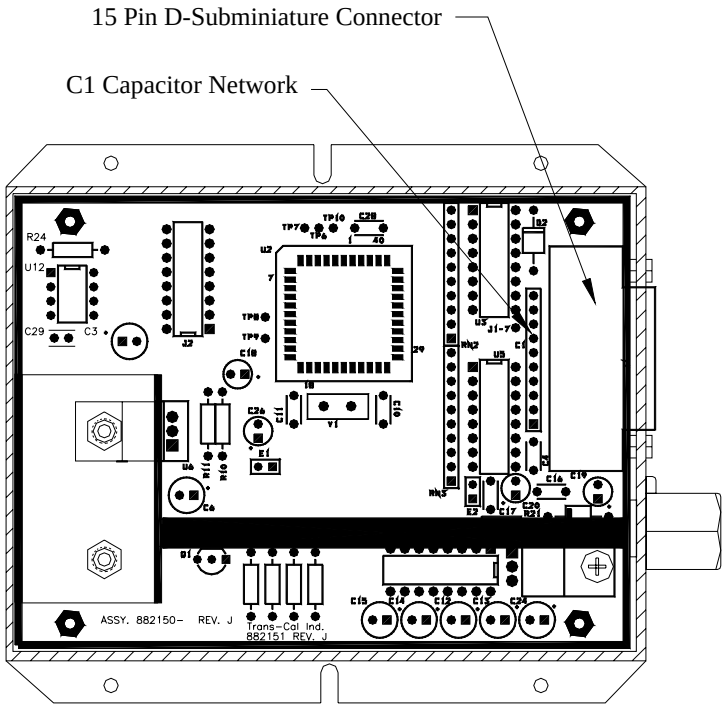
1. Remove the 4 screws, lockwashers and cover plate. Do not remove the D-Sub serial data connector.

2. Remove and discard the C1 capacitor network (refer to figure 1 below.) The network may be removed using a pair of pliers to slowly rock the network back and forth until it breaks away.

3. Replace the cover plate, 4 lockwashers and screws.

4. A modification label is located on the side of the altitude digitizer. Using an indelible ink pen, place an "X" in the box identifying modification 1 as complete.

Figure 1



Encoder Interconnections

The following encoder/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 equipment manufacturer.

Table I

SSD120 15 pin conn.	SSD120 Function	KT76/78 Pin Number	King KT-76A/78A Pin Number	King KXP Pin Number
1	D4	**	**	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*	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.

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

Table II

SSD120 15 pin Conn.	Function	Cessna RT359A, RT459A, RT859A Pin Number	Narco AT-150 AT-50, AT-50A Pin Number	Narco AT6A AT-5 AT-6 Pin Number	Garmin GTX 327 Pin Number
1	D4	10	**	**	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**	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.

*Pins 8 and 14 are connected together internally.
**Data for this connection is not available at this time.
***Narco transponders see page 12 for modification requirements.

Table III

SSD120 15 Pin Conn.	Function	Edo-Air RT-777 Pin Number	Genave Beta 5000 Pin Number	Radair 250 Pin Number	Becker Avionic Systems ATC3401 ATC2000
1	D4	15	0	15	23
2	A1	7	4	7	16
3	A2	5	5	6	15
4	A4	3	6	13	14
5	B1	12	7	9	17
9	B2	13	8	10	19
10	B4	14	9	11	18
11	C1	8	10	14	22
13	C2	6	11	16	21
12	C4	4	12	12	20
6	Output Enable	2	3	19	24
8 or 14 *	14 to 28VDC Input	Connect to aircraft's avionics buss protected by a fuse or circuit breaker.	2	22	6
15	Ground	2	Connect to aircraft ground.	Connect to aircraft ground.	24

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

Table IV

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	**	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 *	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.

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

Table V

SSD120 15 Pin Conn.	Function	Bendix/King KGP 560 EGPWS	Bendix/King KMH 870 IHAS Processor	This column left blank intentionally.	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 *	14 to 28VDC Input	Connect to avionics buss via circuit breaker.	Connect to avionics buss via circuit breaker.		
15	Ground	Connect to aircraft ground.	Connect to aircraft ground.		

***Pins 8 and 14 are connected together internally.**

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:_____