Trans-Cal Industries, Inc.

Installation and Calibration Manual

(Patent Pending)

Model SSD120-(XX)M
Modular Altitude Encoder / Digitizer Series
TSO-C88a Approved

Please Note:

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

History of Revision

Revision	Date	Description
	07/00	Production release.
A	08/00	Removed protocol jumper info., added prgm. pin Y data. Added baro set pin and external wire data.
B	09/00	Changed outline drawing to revision C.
C	06/05	Updated document layout, added wiring diagram 101802.dwg

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Section 1.0 Introduction

This manual provides detailed installation, calibration and operating instructions for Trans-Cal Industries' Modular Altitude Encoder/Digitizer Model SSD120-(XX)M.

1.1 Equipment Description

Approved under F.A.A. TSO-C88a, the Model SSD120-(XX)M is an all solid state electronic device which, when installed within a flight altimeter and connected to the aircraft's electrical system, converts pressure altitude information into parallel and serial digital data.

The parallel digital data 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.

The serial altitude data is provided on (2) two asynchronous RS232 output ports. The serial data protocol is individually selectable for each port (refer to **Table V,** and **§4.4**)

This unit is also designed to be programmed to match the flight altimeter error curve utilizing an IBM compatible PC with an available serial port.

1.2 General Specifications

Operating voltage: Model SSD120-(XX)M   +9 to 30 VDC.

Operating current: Model SSD120-(XX)M   0.1 Amperes Max.

Operating temperature/warm-up time:

Model SSD120-(XX)M: -30° to +70°C No warm-up time required.

Storage temperature all models (non-operating): -55° to +85°C.

Weight: 3.82 oz. (108.2 grams)

1.2.1 Operating Altitude

Model SSD120-50M	-1000 to +50,000 feet.
Model SSD120-62M	-1000 to +62,000 feet.
Model SSD120-65M	-1000 to +65,000 feet.
Model SSD120-80M	-1000 to +80,000 feet.

1.2.2 Accuracy

Accuracy throughout operating temperature range -30° to +70°C.
-1000 to +42,000 feet ±50 feet.
+42,100 to maximum altitude ±75 feet.

1.2.3 Serial Port Data Resolution

The resolution of the serial port altitude data is selectable in 100 foot or 10 foot increments. The default resolution of the altitude digitizer serial data is 100 feet. To enable 10 foot resolution configure the SSD120-(XX)M via software see **§4.4**.

1.2.4 Mechanical Characteristics

Model Number	Dimensions	Weight
All models.	See outline drawing.	3.8 oz. (107.648g)

1.2.5 Environmental

All Model SSD120-(XX)M series of altitude encoder/digitizer have been designed and tested to meet the requirements of TSO-C88a, in accordance with RTCA Document DO160b, dated July 1984 (specifics provided upon request).

1.2.6 Over Range

The SSD120-(XX)M series of altitude encoder/digitizer will not be damaged when operated beyond its specified maximum altitude and may be exposed to a pressure equivalent to 100,000 feet, or over pressured to 18 psi max.

1.3 Parallel Altitude Data Port Specifications

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

Driver Description:
> The parallel altitude data output is provided by the "uncommitted" collectors of a transistor array and must be "pulled-up" through a resistive load by the transponder.

Pull-Up Voltage: +3 to 50VDC.

Maximum Sink Current: 50 milliamperes.

Maximum Cable Length: 4000 feet.(1219 meters)

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

1.4 Serial Altitude Data Port Specifications

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

Logic levels: '0', +9 volts. Logic '1', -9 volts.

Driver output maximum voltage: ±25 VDC.

Driver load impedance: 3KΩ typ.

One receiver allowed per serial port.

Maximum cable length: 50 feet. (15 Meters)

Code format: ASCII.

Communication system: simplex (talk only).

Transmission Method: asynchronous.

Transmission rate: selectable, 1200 bps to 9600 bps.

Update rate: 10/sec.

1.5 Serial Communication Format

Model SSD120-(XX)M and carries out serial communication asynchronously with the "Start/Stop" system. This system puts a start bit at the head of a character, and then in turn adds data bits, a parity bit, and a stop bit. The specifics of the protocol are determined by user selection, see **§4.4**, and **Table V.**

1.6 Serial Communication Protocol

The serial data protocol is user selectable via software see **§4.4**. If the installation calls for two separate protocols to be transmitted on the serial data ports the second protocol may be software assigned. The following list of protocols is referred to in **§4.4**.

Protocol 1 which is compatible with UPS Aviation Technologies' Apollo (IIMorrow) Navigation devices. At a baud rate of 1200 bps the encoder sends a seventeen byte message beginning with # AL, then a space followed by five altitude bytes ; the letter "T" and the number "25"; two checksum bytes and a carriage return.

An example of a serial message for UPS AT Apollo devices:

Message:	Definition:
#AL +00800T+25D8⌐R	Altitude 800 feet

Protocol 2 is compatible with some navigation devices manufactured by Trimble and Garmin. At a baud rate of 9600 bps the encoder sends a ten byte message. The message begins with ALT followed by a space and five altitude bytes; concluding with a carriage return. Examples of serial messages for Trimble or Garmin devices:

Message:	Definition:
ALT 10500 ⌐R	Altitude 10,500 feet

1.6 Serial Communication Protocol (continued)

Protocol 3 is compatible with some navigation devices manufactured by Northstar and Garmin. At a baud rate of 2400 bps the encoder sends a 10 byte message. The message begins with ALT followed by a space and five altitude bytes; concluding with a carriage return. Examples of serial messages for these devices:

Message: **Definition:**
ALT 02500 ⌐R   Altitude 2500 feet

Protocol 4 is compatible with some navigation devices manufactured by Magellan. At a baud rate of 1200 bps the encoder sends a seventeen byte message beginning with $MGL, followed by a +/- sign and five altitude digits, then T+25, a checksum and concludes with a carriage return. Examples of serial messages for Magellan devices:

Message   **Definition:**
$MGL+02500T+25D6 ⌐R   Altitude 2500 feet.

Protocol 5 is compatible with some navigation devices manufactured by ARNAV Systems. At a baud rate of 9600 bps the encoder sends a twenty two byte message beginning with $PASHS, followed by ALT; a +/- sign and five altitude digits, then a* as delimiter, a checksum and concludes with a carriage return/line feed. Examples of serial messages forARNAV devices:

Message   **Definition:**
$PASHS,ALT,+00033*1B⌐R⌐F   Altitude 33 meters.

Section 2.0 Operation

2.1 General

The SSD120-(XX)M series of altitude encoder/digitizer's are designed to be mounted within the body of a flight altimeter operated up to 80,000 MSL. The encoder/digitizer is fully automatic in operation. The parallel data output is controlled by the transponder while the serial data is transmitted asynchronously.

2.2 Operating Instructions

2.2.1 Parallel Altitude Data

Place the transponder in Mode 'C', altitude reporting mode, and apply power to the transponder and the encoder/digitizer. In some installations, the encoder/digitizer will be automatically supplied power when the transponder is energized; in others, power to the encoder/digitizer 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/digitizer by enabling and disabling its outputs. In other installations, the encoder/digitizer's output is not controlled by the transponder and is continuously enabled, (encoder/digitizer pin A is grounded.)

2.2.2 Serial Altitude Data

The serial data communication is fully automatic and transmission begins immediately upon power up to the encoder/digitizer. The serial communication is not affected by the strobe function on the parallel data.

Section 3.0 Installation and Calibration

3.1 Mechanical Installation

The SSD120-(XX)M series altitude encoder/digitizer may be mounted in any attitude within the body of the altimeter, but should be mounted to insure no interference with the altimeter mechanism, and no obstruction of the SSD120-(XX)M static pressure inlet. The mounting position should insure that the 26 pin mating connector does not interfere with the altimeter static port connection or other electrical or mechanical connections required for the altimeter's operation.

Manufacture an opening in the altimeter case per the outline drawing for the **Connector Panel Cutout 881667**. Be sure to provide a flat surface to which the connector O-Ring can seal. Secure the encoder/digitizer to the altimeter case using the 1⅛-18 nut provided. Refer to the outline drawing for mechanical dimensions and the sample installation diagram.

3.2 Electrical Installation

The encoder/digitizer is designed to operate with a +9 to +28VDC power source. This voltage can be A+ switched power provided by the transponder or can be provided by the avionics buss, protected with the appropriate fuse or circuit breaker.

3.2.1 Parallel Altitude Data Connection

The outline drawing provides electrical connector pin/function data. Use this information when connecting the encoder/digitizer to the transponder. In some installations where older transponders are in use, the transponder may not provide an "altitude disable" function. In this case a panel mounted switch may be required.

3.2.2 Serial Altitude Data Connection

Connect the TxD (transmit data) pin X (TxD1) or pin U (TxD2) from the connector to the receive data RxD port on the GPS or other navigation device. See connection **Table V** as well as the **GPS Connection Data.** Be sure to connect a ground from the encoder/digitizer to the receiving GPS unit to ensure good data transmission. Shielded cable is recommended for both serial and parallel data wiring assemblies.

3.3 Serial Data Port Test Equipment

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

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

B.   Use a dedicated serial data test box such as BLACK BOX™ RS232 Monitor.

C.   Test for serial output using an oscilloscope to view the 9 VDC square wave, transmitted once a second.

3.4 Parallel Data Port Test Equipment

The output of the parallel port may be displayed on any number of ramp test sets capable of interrogating the transponder and displaying the altitude code from the encoder/digitizer. Or the Trans-Cal ATS-200 test set may be used to display the encoder/digitizer output.

Section 4.0 **Configuration and Calibration**

4.1 Configuration and Calibration Procedure

Overview:

This procedure will allow configuration of the serial ports on the SSD120-(XX)M to transmit the desired protocol, format and altitude data resolution.

This procedure will also allow adjustment to the calibration curve of the SSD120-(XX)M to match the encoder/digitizer output to a 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 SSD120-(XX)M digitizers are calibrated to NIST traceable pressure standards; however, the error allowed on altimeters at altitudes above 30,000 feet, can lead to a combined error in excess of ±125 feet between the two instruments. The SSD120-(XX)M utilizes an externally addressable EEPROM which is configured to accept an alternate error table communicated to the encoder/digitizer via an IBM compatible PC.

This procedure assumes the SSD120-(XX)M is installed within an altimeter referenced to 29.92 In.Hg.(1013.25MB) The technician must be capable of adjusting the input pressure to run the encoder/digitizer and altimeter to a stable pressure altitude, and then enter this altitude into an IBM compatible computer which will transmit the correction to the digitizer's error table.

4.2 Required Equipment for Calibration:

(See Calibration Block Diagram 881669.)

1. SSD120-(XX)M installed within a flight altimeter.

2. +12 to 28VDC power supply.

3. IBM compatible computer with an available serial port.
   Software requirement: **Windows 98®** using **Hyper Terminal** Ver. 5.0 by Hilgraeve.
   (Available as a free download at http://www.hilgraeve.com)(Software Note: The
   Hyper Terminal program which is shipped with **Windows 98®** will not function
   correctly. You must download version 5.0 or better to use this calibration program.)

4. Digitizer/PC interface cable. (See wiring harness diagram or order 881668 from
   Trans-Cal Industries.)

5. Vacuum/pressure source and control capable of exercising the digitizer/altimeter, pressure standard over the digitizer's operating range. (Optional: ATS-200 or equal device which will allow the display of the parallel 100 foot altitude data.)

4.3 Hyper Terminal Software Set-Up on the IBM Compatible PC

Boot up the computer and start the **Hyper Terminal** program. **Hyper Terminal** may be located in the **Programs Section** or in the **Accessories Section** under **Communications** .

Under the **New Connection** window. (Identifies the new connection.) - Choose an icon then select an identifying title such as "Test." Select **OK** after you have made your choices.

Under the **Connect to** window (Selects the Com port to use.) -Choose **Connect Using Com 1** or whatever **Com** port you have chosen to use. After your selection click on **OK.**

Under the **Com ? Properties**, (Sets communication properties.) Under the **Port Settings** tab, set the following:

Bits per second:	**9600**
Data bits:	**8**
Parity:	**None**
Stop Bits:	**1**
Flow Control:	**None**

Select **OK**

In the **Hyper Terminal** window select **File** then click on **Properties**.

Under the **Com ? Properties** window click on the **Settings** tab. Set the following:

Function, arrow, ctrl keys to act as **Terminal Keys.** Emulation to **Auto Detect**

Under **ASCII Setup** Set the following:

Echo off.
Wrap lines that exceed terminal width.

Select **OK.**

The software is now configured for operation.

4.4 SSD120-(XX)M Serial Port Software Configuration

This device incorporates two separate RS232E compatible outputs which may be configured via software to transmit 2 different altitude data protocols simultaneously.

1. Construct a wiring harness per the **Wiring Harness Diagram 881668**. (This harness may be ordered directly from Trans-Cal Industries. Please specify 9 pin or 25 pin connector.)

2. Connect the digitizer to an IBM compatible computer running Hyperterminal as described in **§ 4.3** and as shown in the **Calibration Block Diagram 881669.** Assign the serial port protocols as follows:

Apply power to the digitizer and after the data appears on the PC screen type the following:

Type   <enter>   The Digitizer will return "?> current altitude"

Type ADJ   <enter>   Access the digitizer adjustment program.
The Digitizer will return   A=

Type   P   <enter>   To identify the current serial port settings.

The Interface Adapter responds with a three-digit number as follows:

<p align="center">a b c</p>

Serial Altitude Data Resolution   TxD2 Protocol
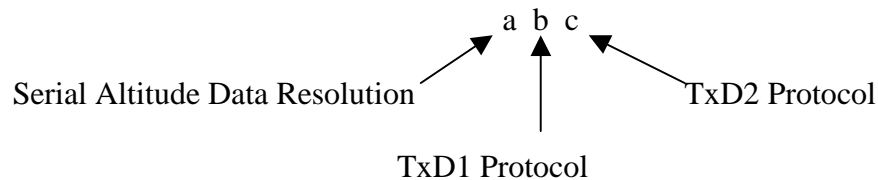
<p align="center">TxD1 Protocol</p>

(a) The first digit represents the serial altitude data resolution.
       0 = Use D-Sub connector protocol hardware jumpers.
       1 = 100 foot resolution on TxD1 and TxD2.
       2 = 10 foot resolution on TxD1 and TxD2.

(b) The second digit represents the protocol selection for TxD1.
       0 = Use D-Sub connector protocol hardware jumpers.
       1 = UPS Aviation Technologies. 1200 bps.
       2 = Trimble/Garmin. 9600bps.
       3 = Northstar. 2400bps.
       4 = Magellan. 1200bps.
       5 = ARNAV. 9600bps.

(c) The third digit represents the protocol selection for TxD2.
       0 = Use D-Sub connector protocol hardware jumpers.
       1 = UPS Aviation Technologies. 1200 bps.
       2 = Trimble/Garmin. 9600bps.
       3 = Northstar. 2400bps.
       4 = Magellan. 1200bps.
       5 = ARNAV 9600bps.

Example:
       Type **P212<enter>**   Defined as **10 foot** resolution on TxD1 and TxD2.
                                     UPS Aviation Technologies protocol transmitted
                                     on TxD1. **Trimble/Garmin** protocol transmitted on
                                     TxD2.
       Type **Q** twice to exit the adjustment mode.

4.5 SSD120-(XX)M Calibration Adjustment Procedure

This procedure is used to match the encoder/digitizer output to the flight altimeter.

1. Construct a wiring harness per the **Wiring Harness Diagram 881668**. (This harness may be ordered directly from Trans-Cal Industries. Part Number 881668 please specify 9 pin or 25 pin PC connector.)

2. Connect the digitizer, computer and altimeter as shown in the **Calibration Block Diagram 881669**, and energize. Set the altimeter barometric reference to 29.92In.Hg. 1013.25MB.

3. Open the **Hyper Terminal** program as described in **§ 4.3**.

4. The digitizer output should now be displayed on the PC screen with 10 footresolution.

(You may use the **Hyper Terminal "Clear Screen"** function to remove any extra characters that may be cluttering the screen. Click on **Edit** then click on **Clear Screen**.)
Note: Backspace does not function in **Hyper Terminal**. If a typing error occurs, hit **<enter>** and begin again.

5. Change the input pressure to -1000 feet and begin to compare the altitude digitizeroutput, as displayed on the computer, to the altimeter reading at every 1000 foot mark. When the digitizer output begins to differ from the altimeter by more than ±30 feet begin to change the digitizer error curve. (**§ 4.7** provides a table to give the technician a record of changes required and implemented.)

(Note: no digitizer correction is possible at the -1000 foot mark.)
The following procedure allows changes to the error curve of the digitizer.

6. Connect the encoder/digitizer as shown in the **Calibration Block Diagram 881669.**

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

Adjust the input pressure until the altimeter is exactly reading a 1000 footmark. Note the difference between the digitizer and the altimeter. For example:

Adjust the input pressure until the altimeter is reading 10,000 feet.
In this case the altimeter reads 20,000 feet and the encoder/digitizer
reads 20,080.
Type "**ADJ<enter>**" the computer should now display "**A=**"
Type "**S20 <enter>**"
(**S20** represents **Save 20,000feet**)

4.5 SSD120-(XX)M Calibration Adjustment Procedure (continued)

The digitizer will now output 20,000 based on the altimeter reading. And the PC will display the altitude at which the digitizer will make this change. In the example above the PC would display **>20000.**

Proceed to the next 1000 foot mark and repeat the procedure as in step 3above until the entire operating range of the altimeter encoder/digitizer is complete.

(Note: If no correction is required at an altitude simply do not enter a correction.)

After completing the above procedure you may look at the corrections entered into the error table. Type "**D<enter>**" to dump the error data and read the current error curve on the PC screen. The following error table should appear:

00= 000	01= 000	02= 000	03= 000	04= 000	05= 000
06= 000	07= 000	08= 000	09= 000	10=-080	11= 000
12= 000	13= 000	14= 000	15= 000	16= 000	17= 000
18= 000	19= 000	20= -080	21= 000	22= 000	23= 000
24= 000	25= 000	26= 000	27= 000	28= 000	29= 000
30= 000	31= 000	32= 000	33= 000	34= 000	35= 000
36= 000	37= 000	38= 000	39= 000	40= 000	41= 000
42= 000	43= 000	44= 000	45= 000	46= 000	47= 000
48= 000	49= 000	50= 000	51= 000	52= 000	53= 000
54= 000	55= 000	56= 000	57= 000	58= 000	59= 000
60= 000	61= 000	62= 000	63= 000	64= 000	65= 000
66= 000	67= 000	68= 000	69= 000	70= 000	71= 000
72= 000	73= 000	74= 000	75= 000	76= 000	77= 000
78= 000	79= 000	80= 000	81= 000	82= 000	83= 000
84= 000	85= 000	86= 000	87= 000	88= 000	89= 000

>current altitude

The first two digits represent altitude x1000 feet and the last three digits after the equal sign represent the amount of error introduced at the altitude in feet.

Type **Q** twice to exit the **ADJ** mode.

4.6 Configuration and Calibration Command List

Following is a list of commands which will operate in this Calibration mode.
Top Level Menu
ADJ <enter> Enter adjustment mode.

        Q   **Quit command.** Returns to normal operation.

Sub-Menu

CLR <enter>	**Clear** command clears error table data.
D <enter>	**Dump** to list all error table data.
P<enter>	**Port status** command, displays the current port status. See **§ 4.4.**
Pabc<enter>	**Port command,** sets the serial port resolution and protocol. See **§4.4.**
Q	**Quit command.** Returns to top level menu.
Saa<enter>	**Save** to error table, 1000 foot altitude (aa) mark at current input pressure.

NOTES:

1.   Backspace does not function. If a typing error occurs hit **<enter>** and begin again.

2.   A maximum error of ±499 feet may be introduced at any one altitude.

3.   **CLR** clears all error data in the EEPROM.

4.7 Error Correction Table

Altitude	Correction	Altitude	Correction		Altitude	Correction
-1000		24000			51000	
0		25000			52000	
1000		26000			53000	
2000		27000			54000	
3000		28000			55000	
4000		29000			56000	
5000		30000			57000	
6000		31000			58000	
7000		32000			59000	
8000		33000			60000	
9000		34000			61000	
10000		35000			62000	
11000		36000				
12000		37000				
13000		38000				
14000		39000				
15000		40000				
16000		41000				
17000		42000				
18000		44000				
19000		45000				
20000		46000				
21000		47000				
22000		48000				
23000		50000				

Encoder/Digitizer / Transponder Interconnections

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

Table I

SSD120 26 Pin Conn.	Function	King KT76/78 Pin Number	King KT-76A/78A Pin Number	King KXP Pin Number
N	D2	$**_1$	$**_1$	$**_1$
L	D4	$**_1$	$**_1$	V
K	A1	6	M	G
J	A2	7	K	H
H	A4	9	J	J
G	B1	4	E	K
F	B2	1	C	L
E	B4	2	B	M
D	C1	3	D	P
C	C2	8	L	R
B	C4	10	H	S
A	Strobe (Signal Common)	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.
a	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.
b	Ground	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.

Data for this connection is not available at this time.

Table II

SSD120 26 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	Garmin GTX 327 Pin Number
N	D2	**2	**2	**2	**2
L	D4	10	**2	**2	18
K	A1	14	7	2	3
J	A2	13	6	4	5
H	A4	15	8	8	6
G	B1	19	12	9	9
F	B2	17	10	10	11
E	B4	16	9	11	12
D	C1	21	14	1	10
C	C2	18	11	3	4
B	C4	20	13	5	7
A	Strobe (Signal Common)	11	5	12	13 or 25 or aircraft ground.
a	14 to 28VDC Input	9	18	13	14 to 28VDC Input
b	Ground	Connect to aircraft ground.	Connect to aircraft ground.	14	Connect to aircraft ground.

Serial Data Connection for the Garmin GTX327 Transponder

SSD120-(XX)M 26 Pin Connector	Function	GTX 327 25 Pin Conn.
U or X	TxD to RxD	19
R or W	Ground	13 or 25
Configure the SSD120-(XX)M for Trimble/Garmin protocol. See § 4.4.		

To allow the **Garmin GTX 327** transponder to communicate with the SSD120-(XX)M go to the **Setup Page** and set the **Altitude Source** (ALT SRC) to receive data in the Icarus RS232 format.

Table III

SSD120 26 Pin Conn.	Function	Edo-Air RT-777 Pin Number	Genave Beta 5000 Pin Number	Collins TDR950 Pin Number	Radair 250 Pin Number
N	D2	**3	**3	**3	**3
L	D4	15	0	3	15
K	A1	7	4	12	7
J	A2	5	5	10	6
H	A4	3	6	7	13
G	B1	12	7	6	9
F	B2	13	8	5	10
E	B4	14	9	4	11
D	C1	8	10	8	14
C	C2	6	11	11	16
B	C4	4	12	9	12
A	Strobe (Signal Common)	2	3	Connect to aircraft ground.	19
a	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
b	Ground	2	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.

Table IV

SSD120 26 Pin Conn.	Function	Bendix TPR-2060 Pin Number	Bendix TR641 A/B Pin Number	Wilcox 1014A pin Number	UPS AT Apollo SL70 Pin Number
N	D2	**[4]	**[4]	**[4]	**[4]
L	D4	0	N	c	35
K	A1	4	A	k	13
J	A2	6	B	C	31
H	A4	8	C	W	12
G	B1	9	D	T	33
F	B2	10	E	L	14
E	B4	11	F	D	32
D	C1	3	H	P	16
C	C2	5	J	f	34
B	C4	7	K	Z	15
A	Strobe (Signal Common)	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.
a	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.
b	Ground	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.	Connect to aircraft ground.

Serial Altitude Data Connection for the Apollo SL70 Transponder

SSD120-(XX)M 26 Pin Connector	Function	UPS AT SL70
U or X	TxD to RxD	4
R or W	Ground	3

To allow the **UPS AT SL70** transponder to accept serial data from the SSD120-(XX)M-RS232 go to the **Test Mode** on the **SL79 Conf** page and set the **Altitude Source (ASrc)** to receive **Serial (Ser)** data. On the **BAUD** page select **1200**. See **§ 4.4** for SSD120-(XX)M protocol assignment data.

Data for this connection is not available at this time.

26 Pin Connector Assignments

Table V

Pin	Function	Pin	Function
A	Common (Strobe) #28AWG Green External Wire	P	+28VDC Vibrator #28AWG Red External Wire
B	C4	R	Serial Ground
C	C2	S	Baro. Set (+) #28 AWG Yellow External Wire
D	C1	T	Baro. Set Signal #28 AWG Blue External Wire
E	B4	U	TxD2
F	B2	V	RxD
G	B1	W	Serial Ground
H	A4	X	TxD1
J	A2	Y	Program
K	A1	Z	Baro. Set (-) #28 AWG Brown External Wire
L	D4	a	+28VDC Encoder Power
M	Vibrator Ground #28AWG Black External Wire	b	Encoder Ground
N	D2	c	+28VDC Flag Power #28AWG Orange External Wire

GPS Connection Data

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

UPS Aviation Technologies (IIMorrow)

Apollo Model GX50, GX60, GX65

Apollo GX50, GX60, GX65 Signal	Apollo 37 Pin D-Sub Connector	SSD120-(XX)M 26 Pin Connector
RxD2	21	U or X
Ground	20	R or W
		Optional, configure the SSD120-(XX)M for 10' resolution. See § 4.4.

Apollo GX50, GX60, GX65 Software Configuration

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

Apollo Model MX20 Multi Function Display

Apollo MX20 Signal	Apollo 37 Pin D-Sub Connector	SSD120-(XX)M 26 Pin Connector
RxD2	21	U or X
Ground	3	R or W
		Optional, configure the SSD120-(XX)M for 10' resolution. See § 4.4.

Apollo MX20 Software Configuration Under External Data Source set altitude source to **Port 2**.

<p style="text-align:center"><u>Trimble</u> 2101 Approach Plus GPS Receiver</p>

Trimble Signal	Trimble 2101 Port 1	Trimble 2101 Port 2	SSD120-(XX)M 26 Pin Connector
RxD+	7	24	R or W
RxD	8	36	U or X
Ground	3 or 20	3 or 20	R or W
			Configure the SSD120-(XX)M for Trimble/Garmin protocol. See § 4.4.
			Optional, configure the SSD120-(XX)M for 10' resolution. See § 4.4.

Trimble 2101 Approach Plus GPS Receiver Software Configuration - Installation Setup

Access the 2101 installation setup submenu and go to the SERIAL I/O SETUP. Select the GPS serial port which is to receive the pressure altitude data,
 SERIAL-1 IN or **SERIAL-2 IN.**

 Set data format to **ENCODER**.
 2101 I/O Approach Plus GPS Receiver

Trimble Signal	Trimble 2101 I/O Serial Port 1	Trimble 2101 I/O Serial Port 2	SSD120-(XX)M 26 Pin Connector
RxD+	J1-7	J1-24	R or W
RxD-	J1-8	J1-36	U or X
Ground	J1 - 3 or 20	J1 - 3 or 20	R or W
			Configure the SSD120-(XX)M for Trimble/Garmin Protocol. See § 4.4.
			Optional, configure the SSD120-(XX)M for 10' resolution. See § 4.4.

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

Access the 2101 installation setup submenu and go to the SERIAL I/O SETUP.

Select the GPS serial port which is to receive the pressure altitude data,

SERIAL-1 IN or **SERIAL-2 IN.**

Set data format to **ENCODER**.

Garmin International Garmin 400 Series GPS Devices

Garmin 78 Pin Conn. (P4001)	Function	SSD120-(XX)M 26 Pin Connector
57	TxD	U or X
77 or 78	Ground	R or W
		Configure the SSD120-(XX)M for Trimble /Garmin Protocol. See § 4.4.
		Optional, configure the SSD120-(XX)M for 10' resolution. See § 4.4.

Garmin 400 series GPS software configuration

To allow the **Garmin 400 series GPS** to communicate with the SSD120-(XX)A-RS232 go to the Main RS232 Config page and set channel 1 input to Icarus-alt.

26 Pin Connector Cutout 881667

FNAME 881667.dwg
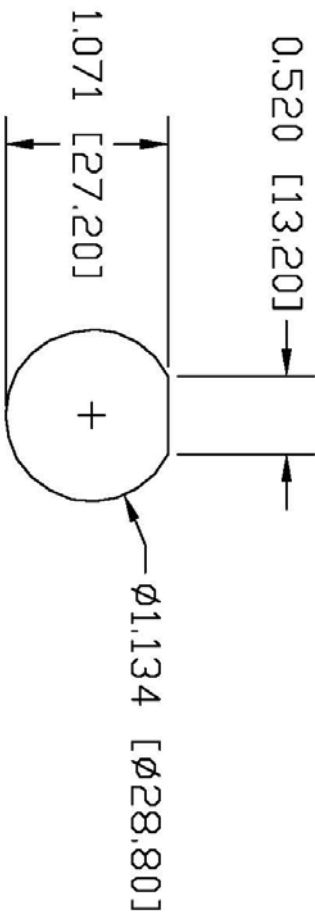
Notes:

1. Minimum panel material thickness: 0.062"[1.57MM]
   Maximum panel material thickness: 0.125" [3.17MM]

0.520 [13.20]

1.071 [27.20]

Ø1.134 [Ø28.80]

Trans-Cal Industries, Inc.

Title: Connector Panel Cutout

SIZE: A

DWG NO. 881667

SCALE None

Units Inch [MM]

SHEET 1 of 1

Drawn: H. Smith 07/00
Chkd: G. Pannullo 07/00
Engineer: J. Ferrero 07/00
Tolerances:
Decimals: .XX ±.010"
.XXX ±.005"
Angles: ±0°0'30"

Used on: SSD120-(XX)M

DO NOT SCALE DRAWING

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED

REV

Wiring Harness Diagram 881668

Calibration Block Diagram 881669

Outline Drawing Modular Altitude Digitizer SSD120-(XX)M

REVDATE 09/00   FNAME SSD120-(XX)M
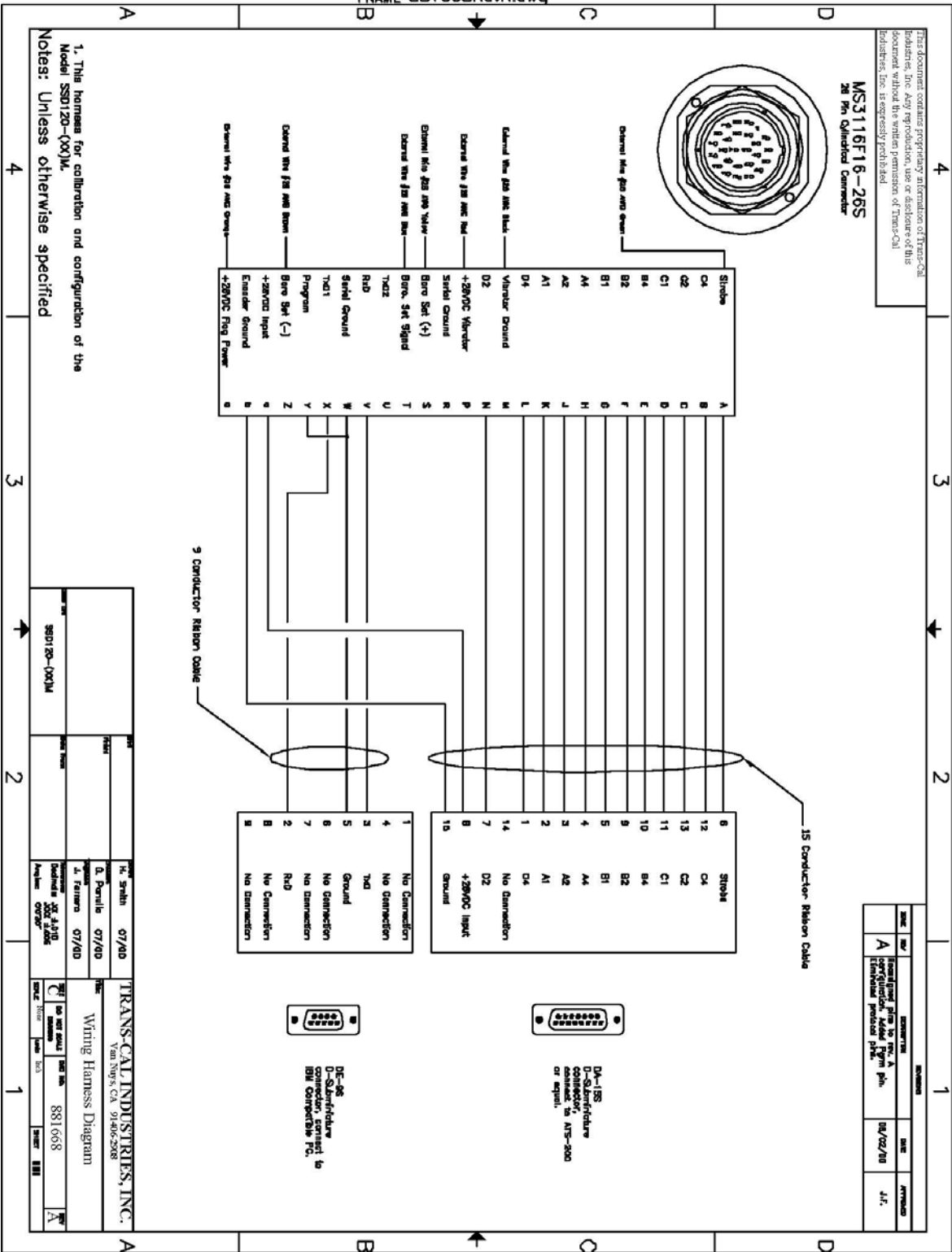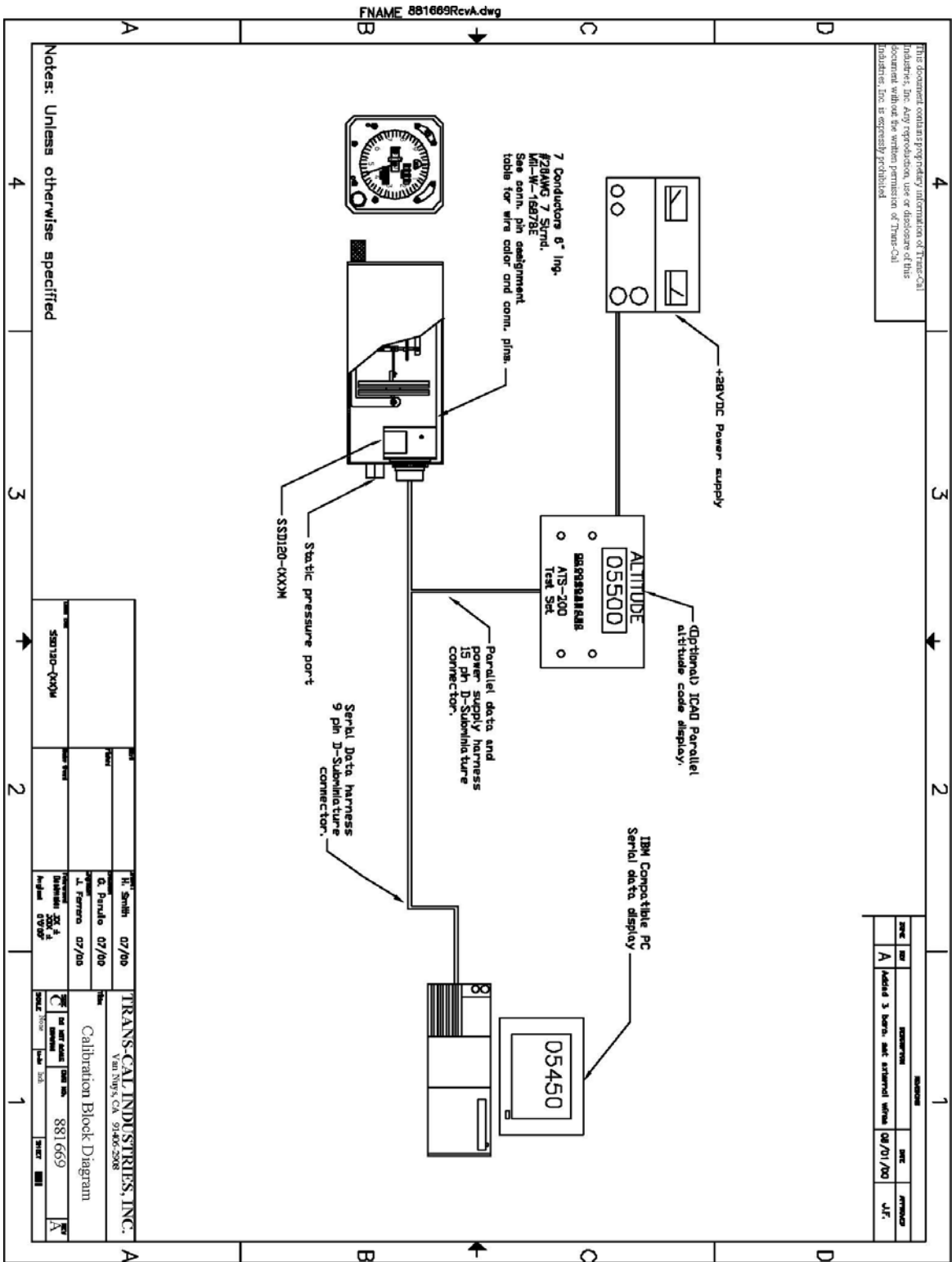
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Connector Pin Assignments

A	Strobe (Green)	P	+28VDC Vibrator (Red)
B	C4	R	Serial Ground
C	C2	S	Baro. Set (+) (Yellow)
D	C1	T	Baro. Set Signal (Blue)
E	B4	U	TxD2 (RS232)
F	B2	V	RxD (Programming Only)
G	B1	W	Serial Ground
H	A4	X	TxD1 (RS232)
J	A2	Y	Program (RS232)
K	A1	Z	Baro. Set (−) (Brown)
L	D4	a	+28VDC Input
M	Vib. Gnd. (Black)	b	Circuit Ground
N	D2	c	+28VDC Flag (Orange)

Hermetic Jam Nut Connector (MS3114-H16C-26PN or commercial equiv.)

(Mating Connector MS3116F16-26S or commercial equiv.)

Wiring Bundle

0.20 [5.08]

10° ±5°

80° ±5°

Wiring Egress

Ø0.05 [1.27] Static Port

[24.13] 0.950

Nameplate

1.50 Max. [38.10]

Ø1.90 [48.26]

Installation Example Not to Scale

Notes: Unless otherwise specified

1. Approved under TSO-C88a.

	REVISIONS			
ZONE	REV	DESCRIPTION	DATE	APPROVED
	C	Redrawn in entirety.	09/00	JF

Dwn	H. Smith	09/00
Engr	J. Ferrero	09/00
Chk	G. Pannulla	09/00
Mfr.		

Trans-Cal Industries, Inc.
Van Nuys, CA 91406-2908

Title: Outline Drawing Modular Altitude Digitizer

SIZE B   DO NOT SCALE DRAWING   DWG NO. SSD120-(XX)M   REV C

SCALE None   Units: Inch [MM]   SHEET 1 of 1

Used on SSD120-(XX)M

Tolerances: Unless otherwise specified.
Decimals: Angles ±0°30'
.XX±.010
.XXX±.005

Metric (SI) equivalents, based on 1"=25.4MM rounded to the same number of significant figures as the English units.

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Wiring Diagram 101802

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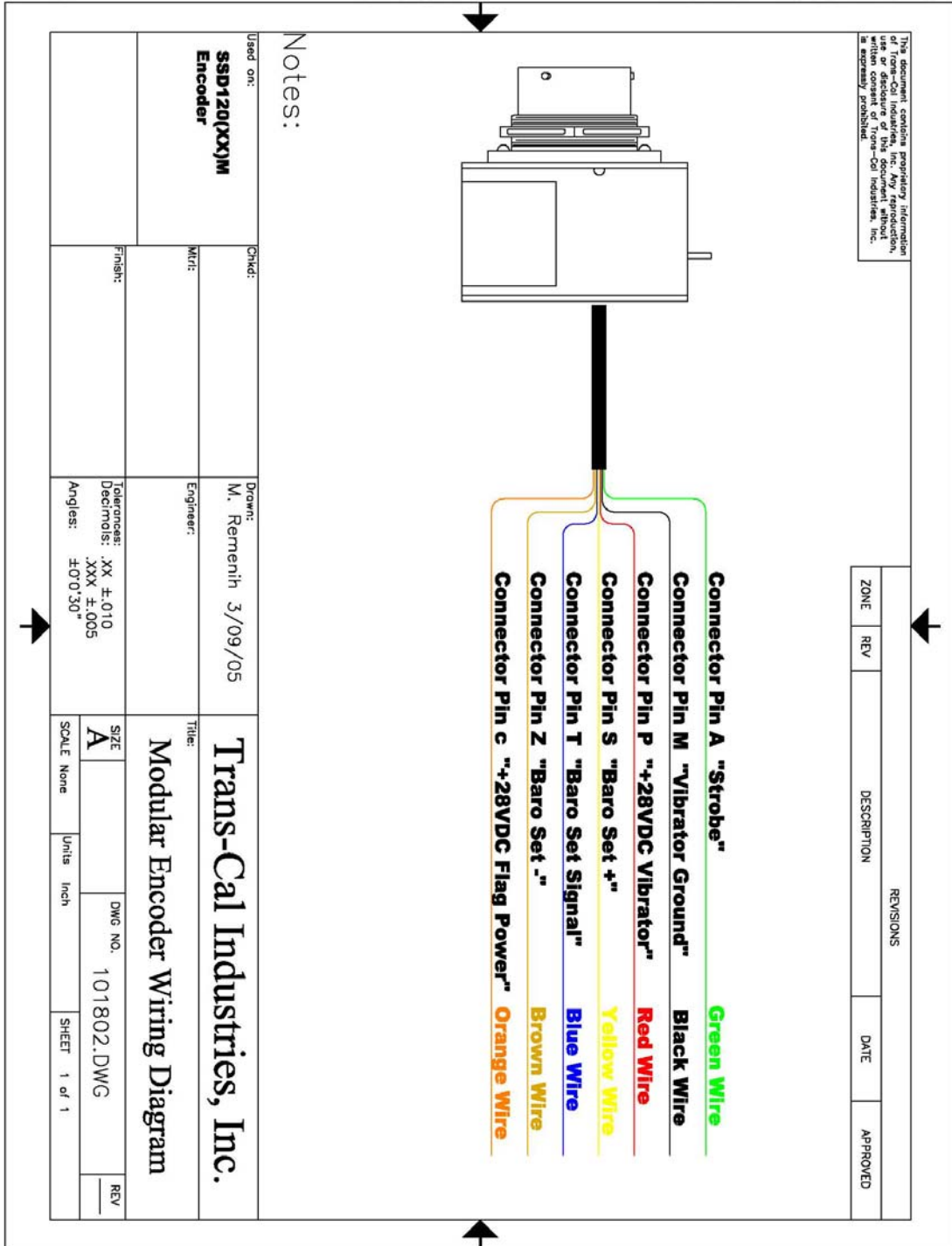
Notes:

Used on:
SSD120(XX)M Encoder

Chkd:

Mtrl:

Finish:

Drawn: M. Remenih 3/09/05

Engineer:

Tolerances:
Decimals: .XX ±.010
.XXX ±.005
Angles: ±0°30"

Trans-Cal Industries, Inc.

Title: **Modular Encoder Wiring Diagram**

SIZE A   DWG NO. 101802.DWG

SCALE None   Units Inch   SHEET 1 of 1   REV

ZONE	REV	DESCRIPTION	DATE	APPROVED
		REVISIONS		

Connector Pin A "Strobe" — **Green Wire**

Connector Pin M "Vibrator Ground" — **Black Wire**

Connector Pin P "+28VDC Vibrator" — **Red Wire**

Connector Pin S "Baro Set +" — **Yellow Wire**

Connector Pin T "Baro Set Signal" — **Blue Wire**

Connector Pin Z "Baro Set -" — **Brown Wire**

Connector Pin c "+28VDC Flag Power" — **Orange Wire**

WARRANTY REGISTRATION

Trans-Cal Industries warrants each Model SSD120-(XX)M Solid State digitizer / serializer to be free of defects in workmanship and materials for a period of 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-(XX)M   SERIAL NO: M-_____

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:_____