Trans-Cal Industries, Inc.

Model SSD120-100N-SDR
Serial Data Repeater

Owner/Installation Manual
FAA TSO-C88a and 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.	SSD120-100N-SDR	Serial Data Repeater
1 ea.	882203	Owner/Operation Manual
1 ea.	DA-15S	15 Pin D-Subminiature Mating Connector
1 ea.	DP-15C/P	15 Pin back shell
1 ea.	DB-25S	25 Pin D-Subminiature Mating Connector
1 ea.	DP-25C/P	25 Pin back shell
1 ea.	108004	Plug

History of Revision

Revision	Date	Description
N/C	1/2009	Prototype release.
A	02/2009	Production release.

Table of Contents

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
Lbs.	Weight in pounds
$^{L}_{F}$	Line Feed
LSB	Least Significant Bit
LED	Light Emitting Diode
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
W	Watt
Ω	Electrical resistance measured in Ohms.
°C	Temperature in degrees centigrade.
±	Plus or minus.
§	Section

Section 1.0 General Description

1.1 Scope

This manual provides detailed physical, mechanical and electrical characteristics as well as the installation and operating instructions for Trans-Cal Industries' Model SSD120-100N-SDR Serial Data Repeater.

1.2 Equipment Description

Approved under FAA TSO-C88a and EASA ETSO-C88a, the Model SSD120-100N-SDR is an all solid-state Serial Data Repeater. RS232 has become a popular data format for transmitting altitude data in the aircraft; however the RS232 standard allows only one receiver per output, and typical avionics installations require multiple altitude inputs. The SSD120-100N-SDR is designed to fill the need for additional altitude data distribution in the RS232 format. This device will accept two RS232 compliant data inputs and optionally, one RS485 input. The input data may be routed to a fan out of up to ten RS232 compliant output ports, and these ports may be configured to transmit as one group of ten or two groups of five. Power, ground and data I/O are provided on an industry standard 25-pin D-Subminiature connector, while data distribution is controlled by strapping on the 15 pin D-Subminiature connector.

Tested and conforming to MIL-STD-704E and RTCA DO-160E the SSD120-100N-SDR is a low power device operating at +10 to 33Vdc and requiring just 70mA max. This device provides a simple and robust means of transmitting serial altitude data to multiple aircraft systems.

1.3 General Specifications

Operating Voltage:	+10 to 33Vdc
Operating Power Requirements:	0.065 Amps
Operating Temperature:	-40° to +70°C
Storage Temperature (non-operating):	-55° to +85°C
Humidity	95% Non-Condensing at 50°C
Weight:	6 oz.
Operating Altitude Range	-1200 to +100,000 feet

1.4 RS-232 I/O Data Port Specifications

Logic Levels:	0= +9 Vdc. 1= -9 Vdc typ.
Driver Output Voltage, Open Circuit:	25V Max.
Output Voltage Swing:	±5V Min. ±9V Typ.
Receiver Input Voltage Swing:	±30V
Max. Data Rate:	120 kbps
Transmitter Short-Circuit Duration:	Continuous
RS-232 Input Resistance:	5kΩ typ. ±2kΩ
Transmitter Output Resistance:	300Ω
Number of receivers per output	1
Maximum Load Capacitance	50 pf per driver
Maximum Cable Length	50 ft.

1.5 RS-485 I/O Data Port Specifications

Logic Levels:	0= +5 Vdc. 1= -5 Vdc.
Communication System:	Simplex
Output Voltage Swing:	-8V Min. +12V Max. ±6V Typ.
Driver Output Short-Circuit Current	±250mA
Driver Common-Mode Voltage R_L=54Ω	±3V
Max. Data Rate:	2.5 Mbps
Receiver Sensitivity -7V<V_{CM}<12V	±200mV
RS-485 Input Resistance:	12kΩ typ. ±2kΩ

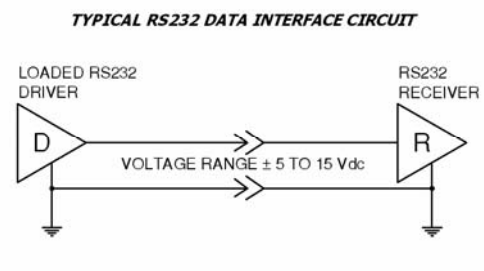
Section 2.0 Serial Altitude Data Communication

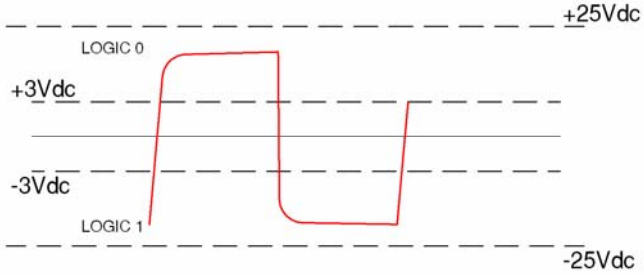
The RS232 data bus standard is one of the most popular serial communication bus designs. Originally specified by EIA in 1962 as a communication standard between computing equipment and modems, it has become common to use RS232 to transmit altitude data in resolutions exceeding that of the ICAO parallel altitude transmission code.

2.1 RS-232 Overview

RS-232 is a single-ended (unbalanced) communication method, with all signals referenced to ground. The RS-232 signal is designed for one transmitter (driver) and one receiver with a maximum cable length of 50 feet. Typically the standard specifies the driver output levels as -5V to -15V for a Logic “1” and +5V to +15V as Logic “0.” Voltage levels between -3V and +3V are undefined. This wide voltage swing and center undefined voltage region is designed to provide a high level of noise immunity.

The cable length limit is due to the distributed capacitance of a longer cable, which can degrade slew rates by exceeding the maximum specified load (50pF). Because RS-232 was designed as a point-to-point rather than a multidrop interface, its drivers are specified for single loads from 3kΩ to 7kΩ.





2.2 Serial Communication Format

Model SSD120-100N-SDR carries out serial communication asynchronously and there are no handshaking or other control lines provided. This device simply redistributes the input serial data stream to one or two groups of five RS-232 drivers based on the jumpers installed. The signal protocol, baud rate, number of data bits, number of stop bits and parity are defined by the input device.

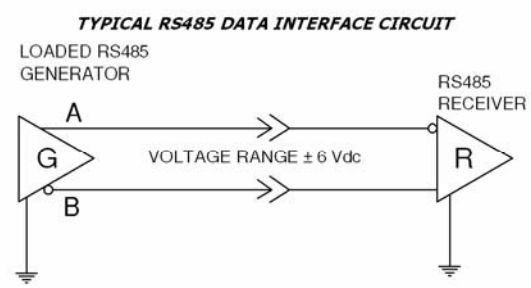
2.3 RS-232 and Ground Loop Cautions

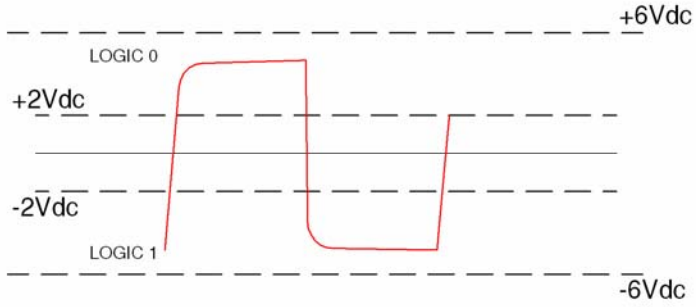
Two systems separated by several meters may not operate at the same electrical potential. Ground loops may occur when a system utilizes multiple ground paths. Because of this difference in potential, unintended current will flow and may damage components. In addition, electrical surges and noise may be coupled into cable wiring through induction. Long cable runs are especially susceptible. These induced voltages can result in transients and corrupt the serial data message stream. Careful thought and planning is advised when considering the cabling in an RS-232 environment.

2.4 RS-485 Overview

The SSD120-100N-SDR will convert RS-485 signals into the RS-232 electrical format. RS485 is a balanced (differential) transmission method; where each signal has a dedicated pair of wires, where the voltage on one wire is equal to the complement of the voltage on the other. The receiving device monitors the difference between these voltages to determine the signal. This transmission format has additional immunity to noise, and will support up to 32 receivers with a maximum cable length of 4000 feet.

The differential RS-485 transmissions produce opposing currents and magnetic fields along each segment (wire) of a twisted-pair cable, thus minimizing the emitted electromagnetic interference (EMI) by cross-canceling the opposing fields around each wire.





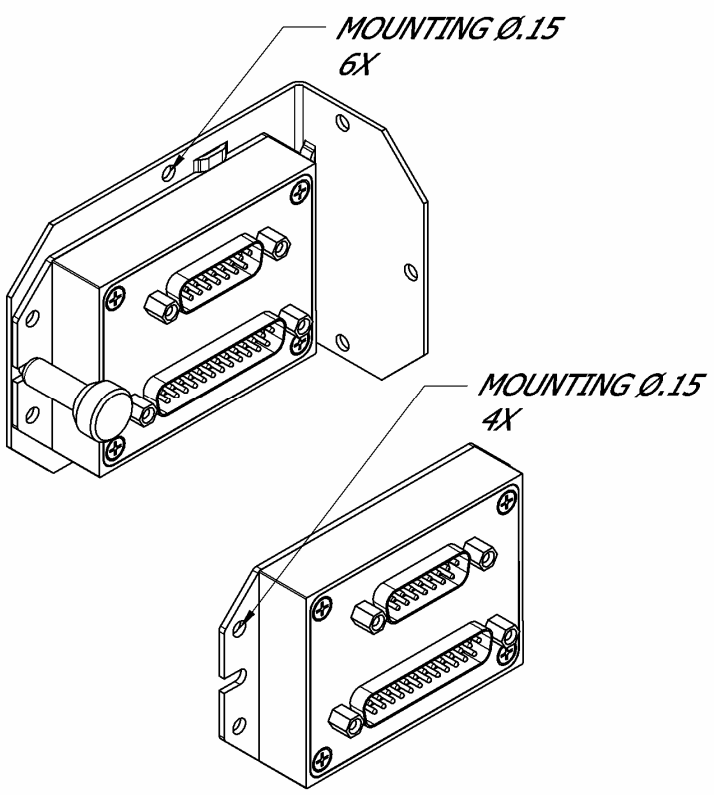
2.5 RS-485 Serial Communication Format

Just as with the RS-232 inputs the Model SSD120-100N-SDR carries out RS-485 serial communication asynchronously and there are no handshaking or other control lines provided. This device simply redistributes the RS-485 serial data stream to one or two groups of five RS-232 drivers based on the jumpers installed. The signal protocol, baud rate, number of data bits, number of stop bits and parity are defined by the input device.

Section 3.0 Installation, Connection and Applications

3.1 Mechanical Installation

The SSD-120-100N-SDR Serial Data Repeater is designed to be mounted within a pressurized or non-pressurized, but temperature controlled area within aircraft operating up to 100,000 feet MSL. The device may be mounted in any attitude within the aircraft structure. Using industry standard techniques, attach either the mounting tray or the unit itself to the aircraft in a location that provides for a short wiring harness and access to the device. Refer to the outline drawing for the mounting dimensions.

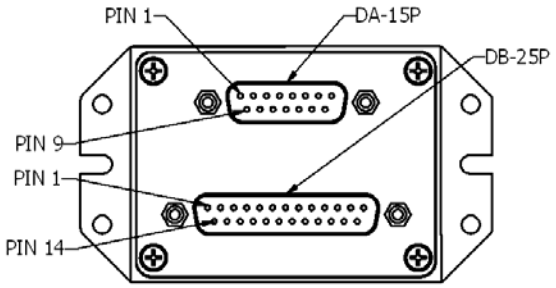


3.2 Electrical Installation

The SSD120-100N-SDR should be connected to the avionics buss through a ¼ amp fuse on pin 1 of the DB-25P connector. The SSD120-100N-SDR is ***NOT*** internally fused. A mating solder cup connector is provided, but any industry standard D-Subminiature connector will function. For power and ground connections, use #22AWG wire appropriate for use in aircraft applications. Cable for serial data connections should be shielded and #28AWG minimum. Jumpers to distribute serial data should be #28AWG min.

3.3 DA-15P Data Distribution Connector

Pin	Function	Pin	Function
1	RxD1 Out	**9**	RS485 Input TxA(-)
2	RxD1 Out	**10**	RS485 Input TxB(+)
3	RxD2 Out	**11**	RS485 Out
4	RxD2 Out	**12**	RS485 Out
5	Group A Input	**13**	Spare
6	Group A Input	**14**	Spare
7	Group B Input	**15**	Data Common
8	Group B Input		



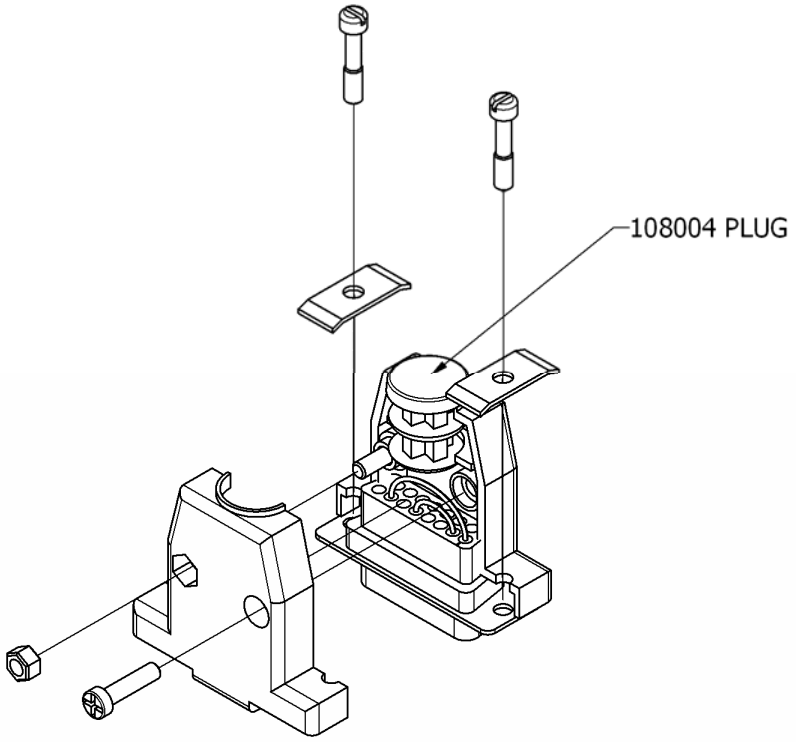
3.4 DB-25P Data I/O and Power Connector

Pin	Function	Pin	Function
1	+Vdc Power Input	**14**	TxD5 Group A
2	Data Common	**15**	Data Common
3	RxD1 RS232 Input	**16**	TxD6 Group B
4	RxD2 RS232 Input	**17**	Data Common
5	Data Common	**18**	TxD7 Group B
6	TxD1 Group A	**19**	Data Common
7	Data Common	**20**	TxD8 Group B
8	TxD2 Group A	**21**	Data Common
9	Data Common	**22**	TxD9 Group B
10	TxD3 Group A	**23**	Data Common
11	Data Common	**24**	TxD10 Group B
12	TxD4 Group A	**25**	Circuit Ground
13	Data Common		

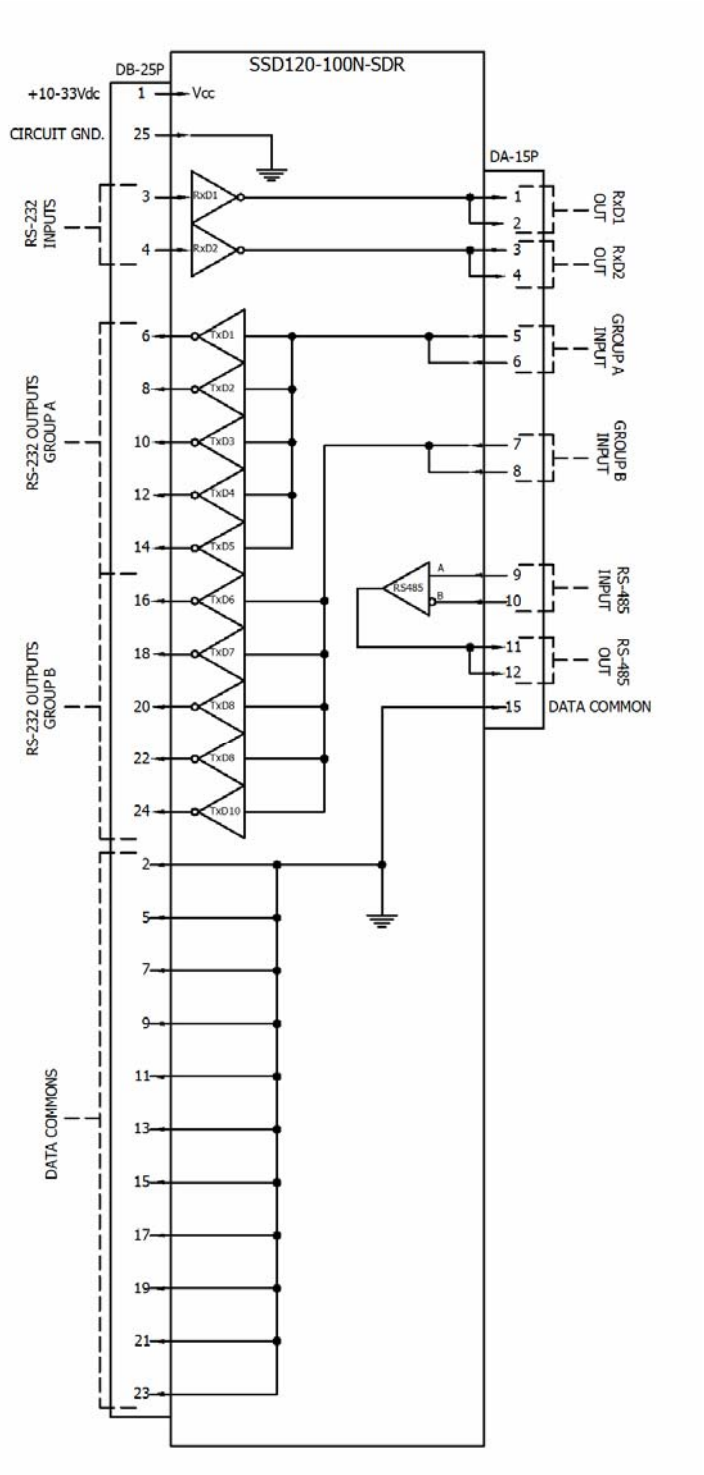
CAUTION Connect this device to the avionics power buss protected by a fuse or circuit breaker rated at ¼ A.

3.5 DA-15 Connector Back Shell and Plug

Wire jumpers to distribute serial data should be #28AWG min. After connecting the jumpers on the 15 pin distribution connector, assemble the connector back shell and include plug 108004 to protect the connections and prevent contaminants from entering the connector.

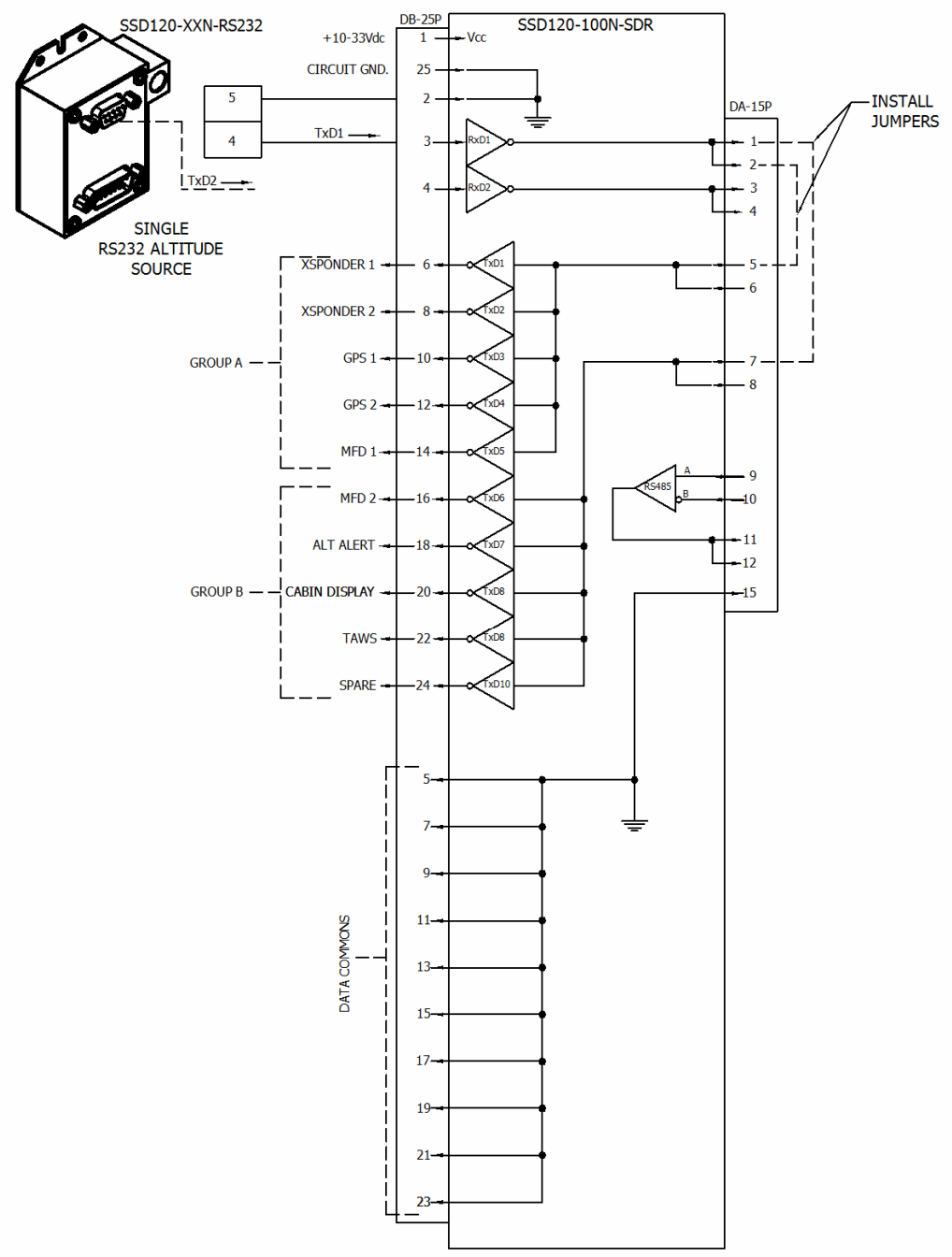


3.6 Function Block Diagram



3.7 Application Example - Single Altitude Data Source

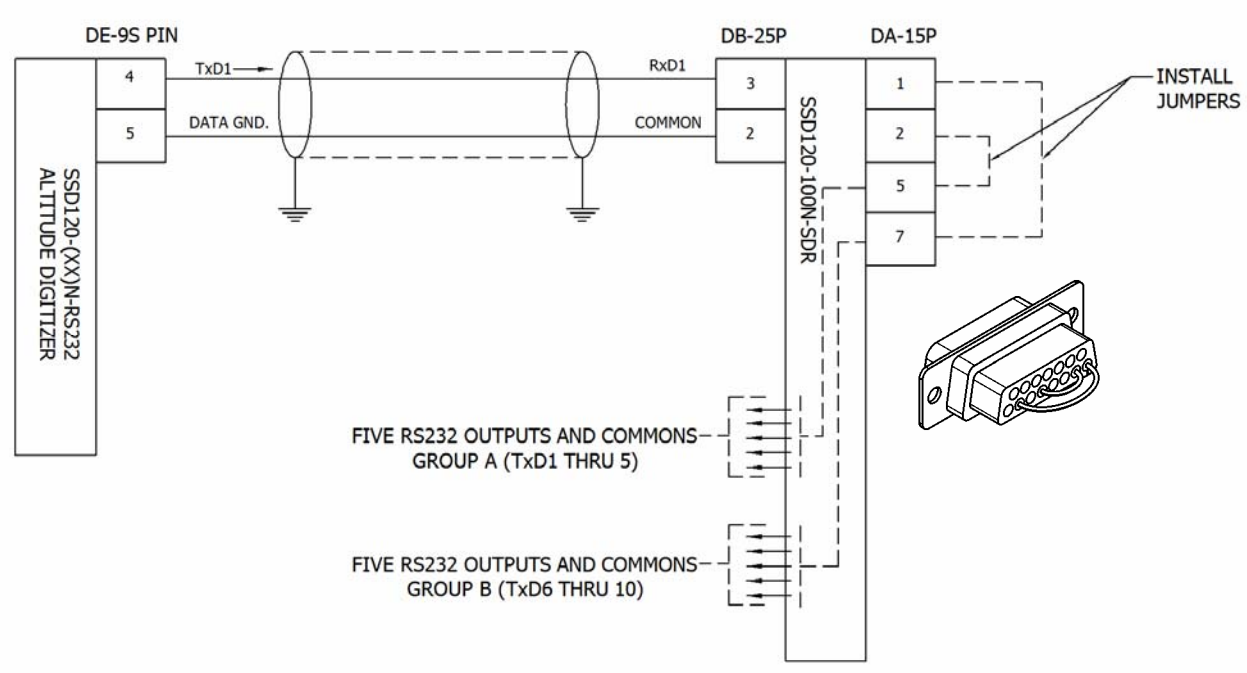
Illustrated here is a block diagram of the Serial Data Repeater using one altitude source to drive ten RS-232 transmitters.



3.8 Wiring Diagram Example - Single Altitude Data Source

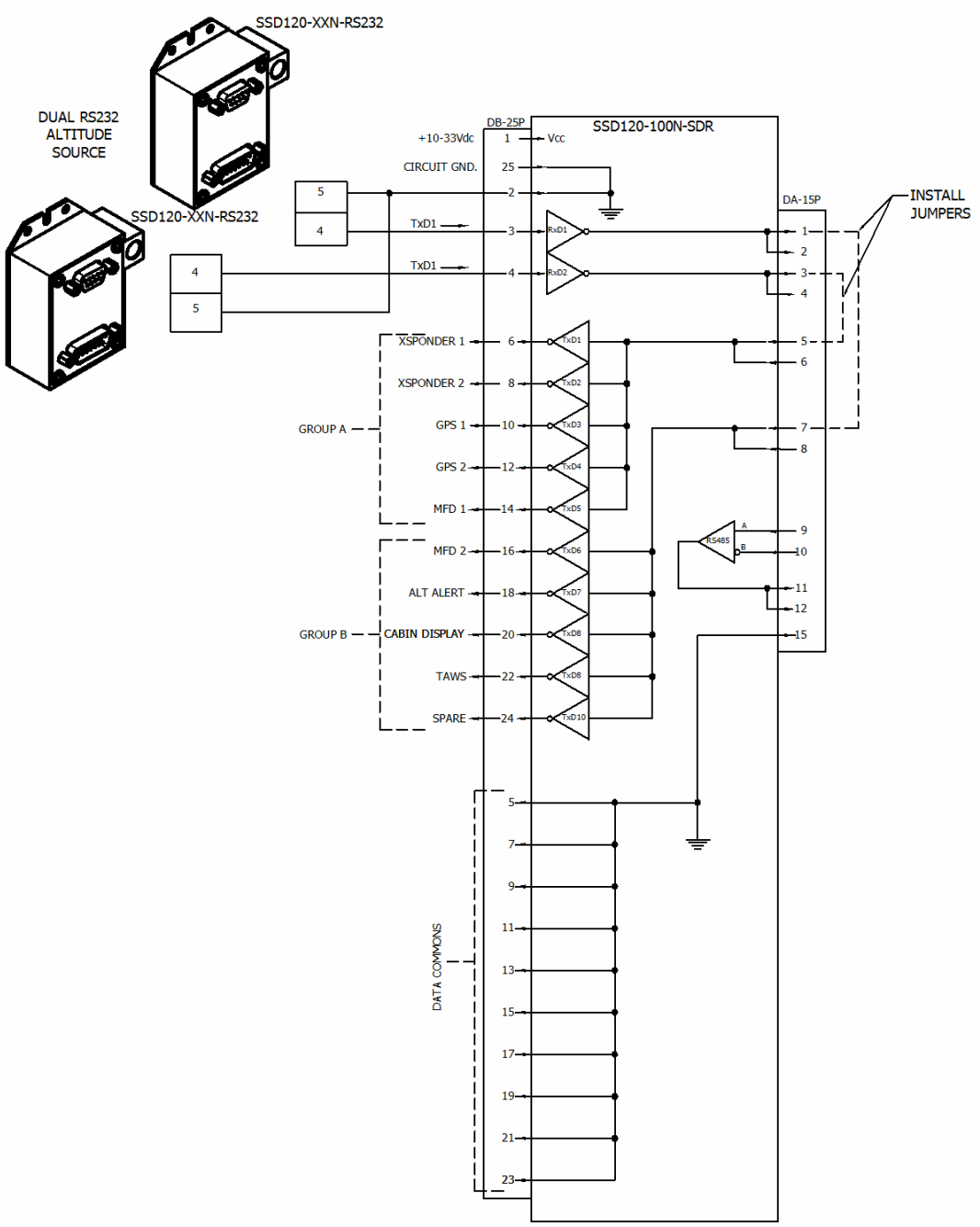
A common installation using a Trans-Cal altitude encoder connected to the Serial Data Repeater through a shielded cable is detailed below. Serial data is received through pin 3 of the 25 pin connector and routed through jumpers installed on the 15 pin connector distributing the data to both groups of five RS-232 drivers.

Terminating the shield to ground at both ends is typical; however, terminating the shield at only the repeater end is sometimes advised to direct EMI away from the altitude encoder. The shield termination scheme will vary depending upon the EMI environment in which the devices are installed.



3.9 Application Example - Dual Altitude Data Source

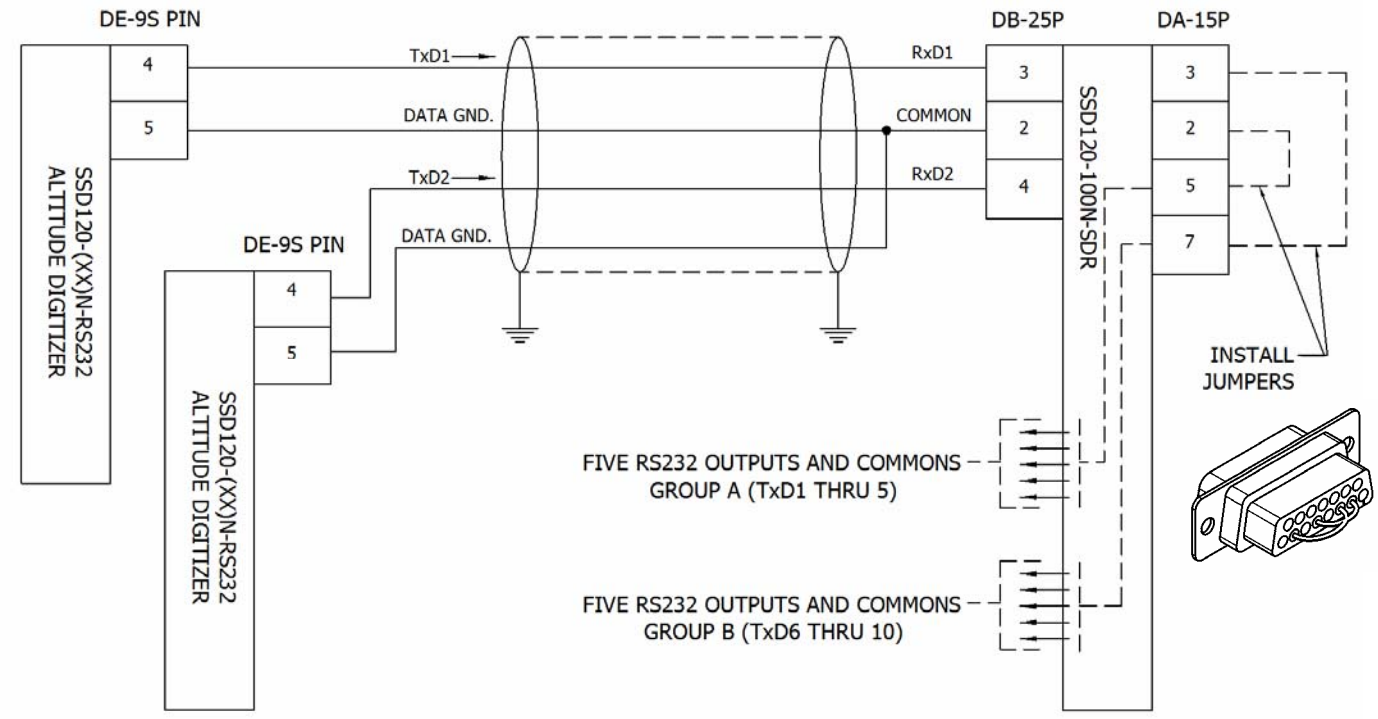
Illustrated here is a block diagram of the Serial Data Repeater using two altitude data sources to drive two groups of five RS-232 transmitters.



3.10 Wiring Diagram Example - Dual Altitude Data Source

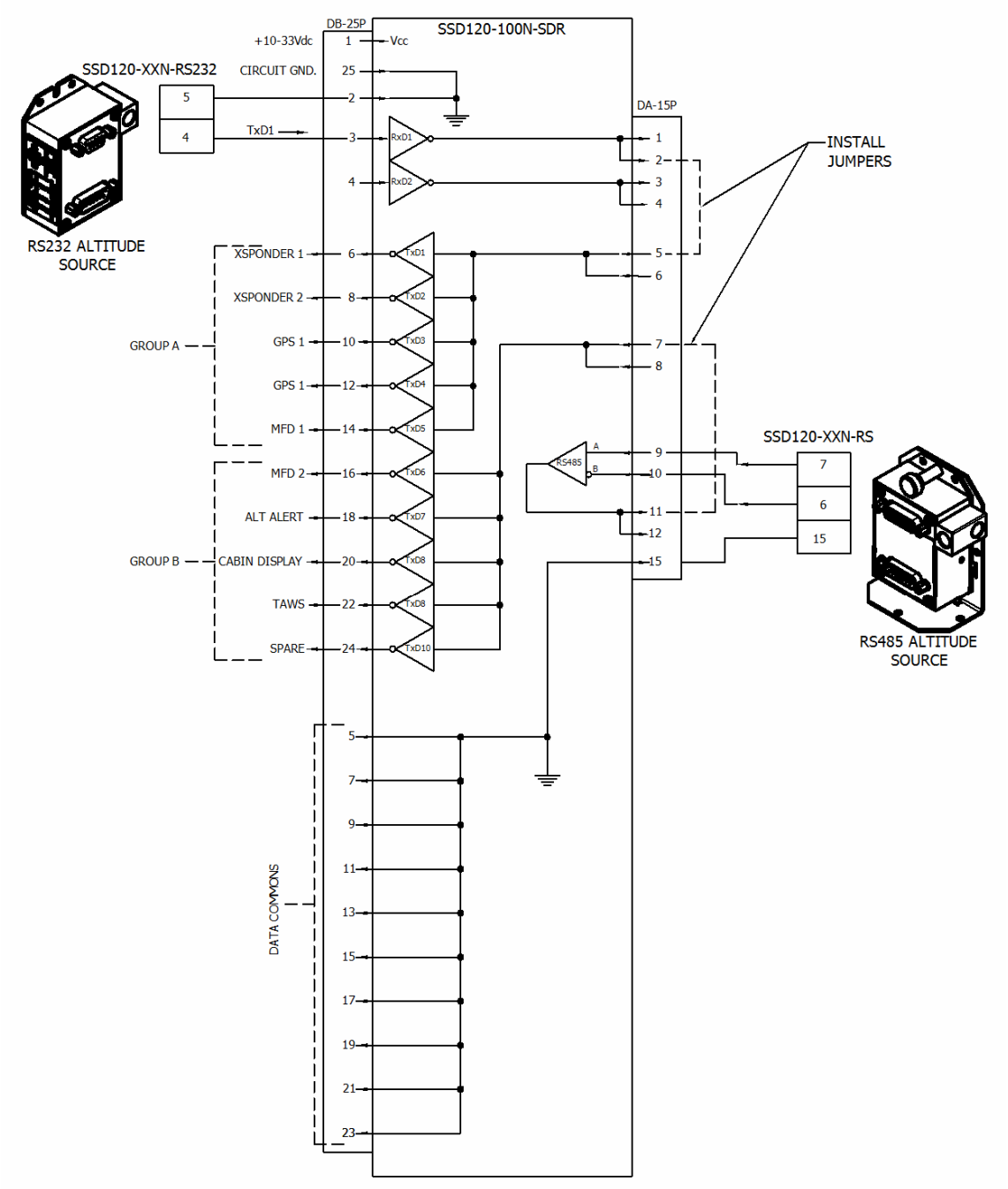
Illustrated below is a common wiring diagram detailing two Trans-Cal altitude encoders connected to the Serial Data Repeater through a shielded cable. Serial data from the first altitude encoder is received through pin 3 of the 25 pin connector and routed through jumpers installed on the 15 pin connector distributing the data to the first five RS-232 drivers labeled Group A TxD1 through TxD5.

Data from the second altitude encoder is received through Pin 4 of the 25 pin connector and routed through jumpers on the 15-pin connector to the second group of five RS-232 drivers labeled Group B TxD6 through 10.



3.11 Application Example - One RS-232 & One RS-485 Altitude Data Source

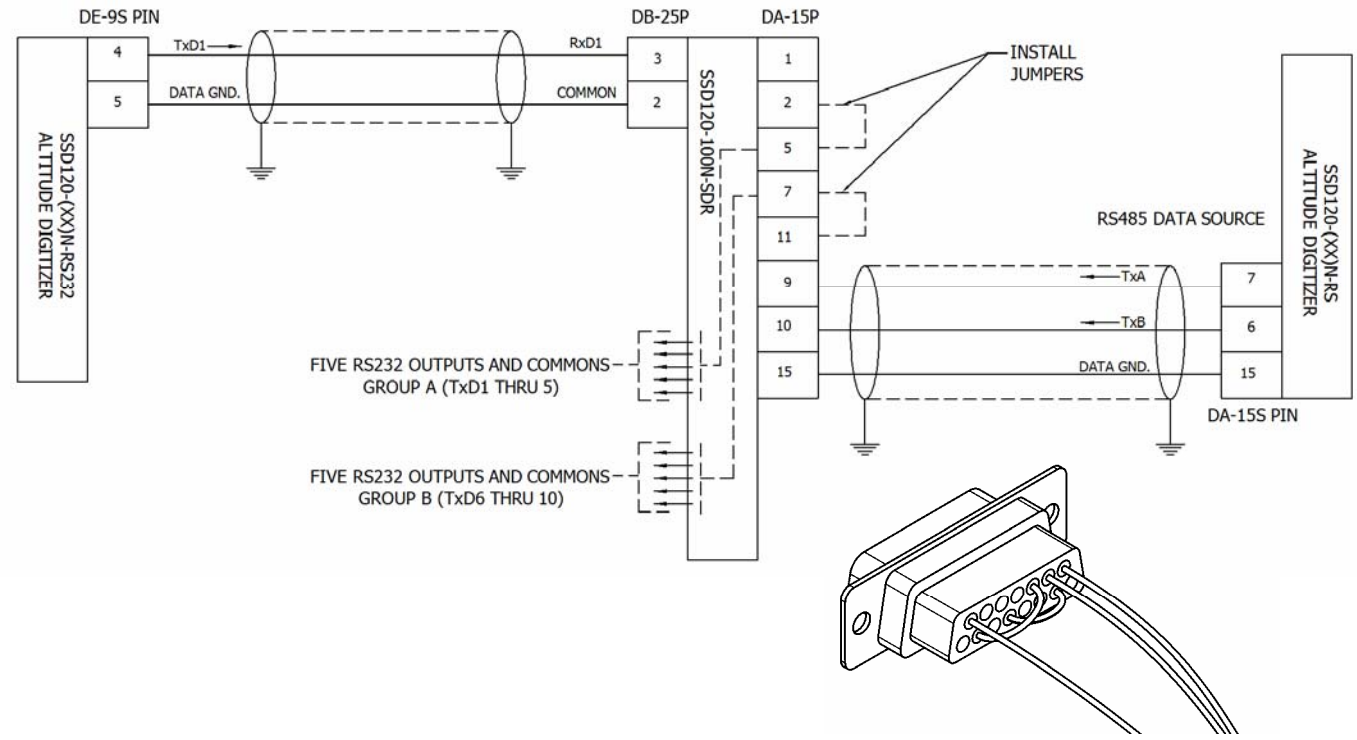
Illustrated here is a block diagram of the Serial Data Repeater using two altitude data sources. One source inputs RS-232 formatted data to drive the first group of RS-232 drivers, and the other source inputs RS-485 formatted data to drive the second group of five RS-232 transmitters.



3.12 Wiring Diagram Example - One RS-232 & One RS-485 Source

Illustrated below is a common wiring diagram detailing two Trans-Cal altitude encoders connected to the Serial Data Repeater through a shielded cable. Serial data from the first altitude encoder is in the RS-232 format and is received through pin 3 of the 25 pin connector and routed through jumpers installed on the 15 pin connector distributing the data to the first five RS-232 drivers labeled Group A (TxD1 through TxD5.)

Data from the second altitude encoder is in the RS-485 format and is received through Pins 9 and 10 of the 15 pin connector and routed through jumpers on the 15-pin connector to the second group of five RS-232 drivers labeled Group B (TxD6 through 10.)



Section 4.0 Operation

The Serial Data Repeater is fully automatic in operation. The serial data outputs are controlled by the input device(s) and transmit asynchronously. (Half duplex, talk only.)

4.1 Operating Instructions

Apply power to the Serial Data Repeater and to the serial data source. In some installations the repeater will automatically be supplied power, and power to the repeater may also be supplied through a separate circuit breaker.

The serial data communication is fully automatic and transmission begins immediately upon receiving a signal.

Section 5.0 Serial Data Transponder Connection Tables

The following 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 manufacturer.

Serial Data Connection for the Bendix/King KT 73 Transponder

SSD120-100N-SDR 25 Pin Conn.	Function	KT 73 24 Pin Conn.
TxD Outputs	TxD to RxD	7
Data Common Lines	Ground	1 or A

Serial Data Connection for the Garmin GTX327 Transponder

SSD120-100N-SDR 25 Pin Conn.	Function	GTX327 25 Pin Connector
TxD Outputs	TxD to RxD	19
Data Common Lines	Data Ground	13 or 25

Serial Data Connection for the Garmin GTX330 and 330D Transponder

SSD120-100N-SDR 25 Pin Conn.	Function	GTX330 62 Pin Connector
TxD Outputs	TxD to RxD	24 (RS232 In 2)
Data Common Lines	Data Ground	Data Ground

To allow the **Garmin GTX 327, 330 and 330D** transponders to communicate with the serial data altitude encoders go to the **Setup Page** and set the **Altitude Source (ALT SRC)** to receive data in the appropriate format.

Serial Altitude Data Connection for the Apollo SL70 Transponder

SSD120-100N-SDR 25 Pin Conn.	Function	UPS AT SL70
TxD Outputs	TxD to RxD	4
Data Common Lines	Ground	3

To allow the **UPS AT SL70** transponder to accept serial data serial altitude encoders go to the **Test Mode** on the **SL70 Conf** page and set the **Altitude Source (ASrc)** to receive **Serial (Ser)** data at the correct baud rate.

Serial Altitude Data Connection for the Trig TT31 Transponder

SSD120-100N-SDR 25 Pin Conn.	Function	Trig TT31
TxD Outputs	TxD to RxD	7
Data Common Lines	Ground	A or 1

Section 6.0 Serial Data GPS/MFD Connection Data

Given the speed with which new GPS and MFD 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 or MFD manufacturer.

6.1 UPS Aviation Technologies (IlMorrow)

Apollo Model GX50, GX60, GX65

Apollo GX50, GX60, GX65 Signal	Apollo 37 Pin D-Sub Connector	SSD120-100N-SDR 25 Pin Conn.
RxD2	21	**TxD Outputs**
Ground	20	**Data Common Lines**

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	SSD120-100N-SDR 25 Pin Conn.
RxD2	21	**TxD Outputs**
Ground	3	**Data Common Lines**

Apollo MX20 Software Configuration

Under External Data Source set altitude source to **Port 2**.

6.2 Trimble

Trimble 2101 Approach Plus GPS Receiver

Trimble Signal	Trimble 2101 Port 1	Trimble 2101 Port 2	SSD120-100N-SDR 25 Pin Conn.
RxD+	7	24	**TxD Outputs**
RxD-	8	36	**Data Common Lines**
Ground	3 or 20	3 or 20	

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	SSD120-100N-SDR 25 Pin Conn.
RxD+	J1-7	J1-24	**TxD Outputs**
RxD-	J1-8	J1-36	**Data Common Lines**
Ground	J1 - 3 or 20	J1 - 3 or 20	

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**.

6.3 Garmin International

Garmin 400 and 500 Series GPS Devices (Includes 430W and 530W)

Garmin 78 Pin Conn. (P4001)	SSD120-100N-SDR 25 Pin Conn.
57	TxD Outputs
77 or 78	Data Common Lines

Garmin 400 series GPS software configuration

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

Garmin GNC 300 GPS/Comm

GNC 300 37 Pin Connector J101	Function	SSD120-100N-SDR 25 Pin Conn.
17	RxD to TxD	TxD Outputs
13 or 25	Data Ground	Data Common Lines

To allow the **Garmin 300 series GPS/Comm** to communicate with the Altitude Digitizer go to the **I/O Test Page** and set channel 1 input to **Icarus-alt.**

6.4 ARNAV Systems, Inc.

ARNAV Systems 5000 Series Multi-Function Display

ARNAV 5000 25 Pin Connector	SSD120-100N-SDR 25 Pin Conn.
15	TxD Outputs
13 or 25	Data Common Lines

ARNAV Systems GPS-505/506/512 GPS Sensor

ARNAV GPS-505/506/512 DB-25 Connector	SSD120-100N-SDR 25 Pin Conn.
8	TxD Outputs
9	Data Common Lines

ARNAV Systems DR-100 WxLink Receiver/ Multiplexer

ARNAV DR-100 25 Pin Connector	SSD120-100N-SDR 25 Pin Conn.
10	TxD Outputs
13 or 25	Data Common Lines

Section 7.0 Calibration and Continued Airworthiness

The SSD120-100N-SDR is an all solid-state device that requires no periodic maintenance or calibration. The Serial Data Repeater may be function tested using TCI Model ATS-400 or a PC with serial data capture software and an open RS-232 port. The SSD120-100N-SDR contains no field serviceable parts. If an encoding error is detected, then the unit is to be factory repaired. Contact Trans-Cal Industries for further information.

Section 8.0 Frequently Asked Questions

1. *How often must the SSD120-100N-SDR to be calibrated; is there periodic maintenance required to maintain airworthiness??*

There is no periodic maintenance required. The SSD120-100N-SDR is an all solid-state device. The output of the RS232 and ports may be tested using the Trans-Cal's ATS-400 or using a PC with an open RS-232 port and serial data capture software.

2. *How many devices may be driven off of each RS232 port?*

One device may be driven off each serial transmitter (driver). The SSD120-100N-SDR provides two groups of five RS232 transmitters. The device may be configured to transmit the same data in one group of ten or two groups of five transmitters.

3. *Can the Trans-Cal Serial Data Repeater transmit two different serial data protocol messages at the same time?*

Yes. The Repeater will repeat whatever data protocol message is input. The ten outputs may be divided into two groups of five.

4. *What is the maximum length of an RS232C wiring harness?*

50 feet.

5. Do I need to connect unused RS232 outputs or inputs to ground?

No. Unconnected transmitters and receivers are internally clamped and may be left open.

6. *I have connected the serial data from the SSD120-100N-SDR to my GPS device, why does the GPS display a "No Pressure Altitude" message?*

There are several possible problem sources.

Electrical Ground Imbalance
RS232 operates in an "unbalanced" (single-ended) transmission method; where the receiving device monitors the difference between the signal voltage and a common ground. If a significant difference in electrical ground potential between the Serial Data Repeater and the receiving device exists, then the RS232 signal levels may be adversely affected. Verify the Serial Data Repeater and the receiving device grounds are referenced together by connecting one of the data common pins on the Serial Data Repeater to the receiving device's ground.

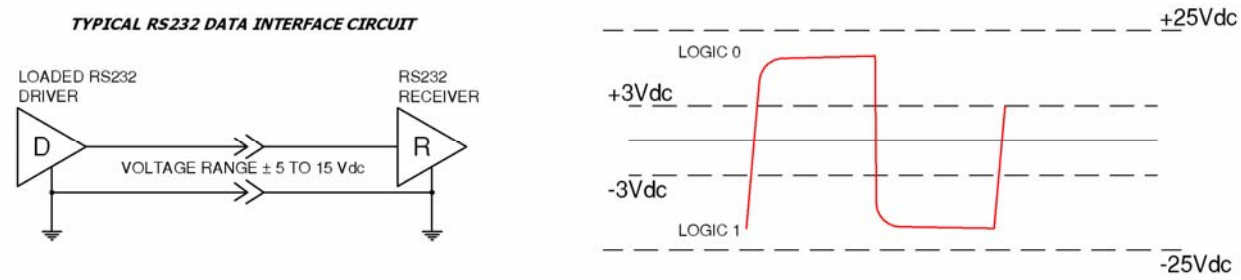
Receiving Device Configuration
The receiving device is looking for a specific message at a specific baud rate and parity. These messages, baud rates and parity vary from manufacturer to manufacturer. A mismatch on any one of these items will cause a communication failure. In addition, many devices are capable of software configuration to accept RS-232 data on different connector pins. Verify the following:

a. RS-232 data is routed to the correct connector pin on the receiving device.

b. The receiving device is software configured to accept data on that connector pin.
c. The receiving device is software configured to accept the correct message protocol at the correct baud rate and parity.
d. The serial data source device is transmitting the same message, baud rate and parity as configured in item c above.

7. *How can I verify the RS232 data message, baud rate and parity transmitted from the Serial Data Repeater?*

a. Use the Trans-Cal ATS-400 Test Set to display the RS232 data.
b. Use a PC with an open RS232 port and serial data capture software. Some possible software solutions include: HYPER TERMINAL (Windows® 95 & 98 & XP), SOFTWARE WEDGE™, PROCOMM™, VERSATERM™.
c. Use a dedicated serial data test box such as the BLACK BOX™ RS232 MONITOR.
d. An oscilloscope may be used to view the 9Vdc square wave typically transmitted about 2/second on Trans-Cal encoders.



8. Can I use a Computer with a USB port to read the RS232 data?

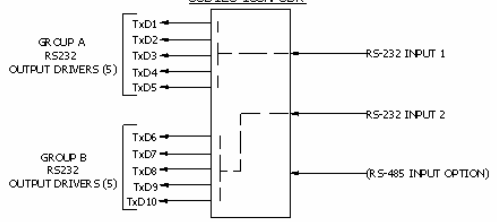
No. Although USB stands for "Universal Serial Bus", the USB interface does not work anything like the standard RS-232 serial port. Like RS232 serial ports, the USB ports on a PC are designed for interfacing external devices, however any device that is designed to connect to a USB port must come with a Windows device driver that essentially informs the operating system when the device is connected or disconnected to the PC and also provides a software interface to the device.

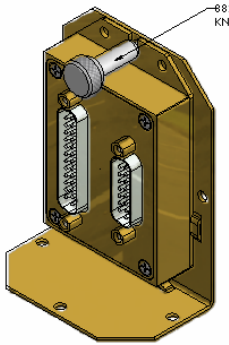
In the case of USB to RS232 converters, the drivers that come with them emulate some standard RS232 communications parameters, but not all.

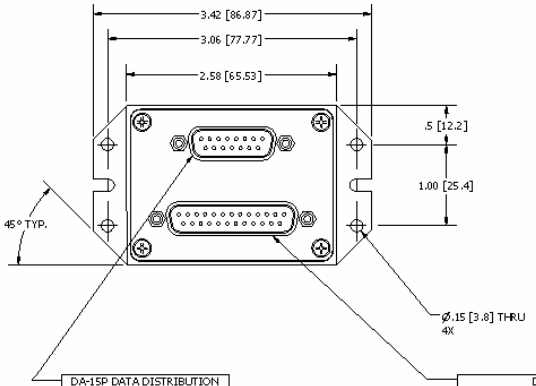
Outline Drawing

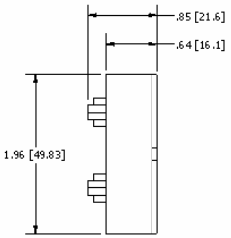
REVISION HISTORY			
REV	DESCRIPTION	DATE	APPROVED
A	PRODUCTION RELEASE	1/15/2009	J. Ferrero

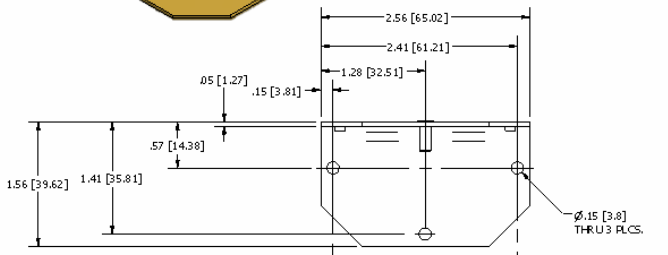
FUNCTIONAL BLOCK DIAGRAM
SSD120-100N-SDR

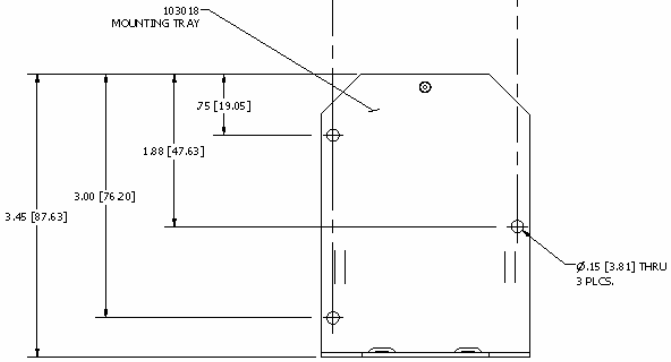












DA-15P DATA DISTRIBUTION	
PIN	FUNCTION
1	RxD1 OUT
2	RxD1 OUT
3	RxD2 OUT
4	RxD2 OUT
5	GROUP A INPUT
6	GROUP A INPUT
7	GROUP B INPUT
8	GROUP B INPUT
9	RS485 INPUT TxA(-)
10	RS485 INPUT TxB(+)
11	RS485 OUT
12	RS485 OUT
13	SPARE
14	SPARE
15	DATA COMMON

DB-25P SERIAL DATA CONNECTOR			
PIN	FUNCTION	PIN	FUNCTION
1	+Vdc POWER	14	TxD5 GROUP A
2	DATA COMMON	15	DATA COMMON
3	RxD1 RS232 INPUT	16	TxD6 GROUP B
4	RxD2 RS232 INPUT	17	DATA COMMON
5	DATA COMMON	18	TxD7 GROUP B
6	TxD1 GROUP A	19	DATA COMMON
7	DATA COMMON	20	TxD8 GROUP B
8	TxD2 GROUP A	21	DATA COMMON
9	DATA COMMON	22	TxD9 GROUP B
10	TxD3 GROUP A	23	DATA COMMON
11	DATA COMMON	24	TxD10 GROUP B
12	TxD4 GROUP A	25	CIRCUIT GROUND
13	DATA COMMON	--	--

4. OPERATING TEMPERATURE RANGE -40° TO +70°C.
3. OPERATING ALTITUDE RANGE -1100 TO +100,000 FEET.
2. APPROVED UNDER FAA TSO-C88A AND EASA ETSO-C88A.
1. ALL GROUNDS ON THE SERIAL DATA PORT ARE INTERNALLY CONNECTED TO GROUND.

NOTES:

TOP ASSY NUMBER
103001

TOLERNCES,
UNLESS OTHERWISE NOTED
Decimals: Angles ±1°0'
.X±.03
.XX±.010
.XXX±.005

THIRD ANGLE PROJECTION

DRAWN	H. Smith	1/9/2009
CHECKED	M. Remenih	2/3/2009
QA	J. FERRERO	10/17/2007
MFG	C. Herrera	2/6/2009
APPROVED	J. Ferrero	2/2/2009

METRIC [SI] EQUIVALENTS BASED ON 1"=25.4MM.

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

TITLE
Outline Drawing, SSD120-100N-SDR
Serial Data Repeater

SIZE	DO NOT SCALE DRAWING	DWG NO	REV
C		Outline SSD120-100N-SDR	A

SCALE 1:1 | UNITS: INCH [MM] | SHEET 1 OF 1

Environmental Qualification Form

Nomenclature: Altitude Digitizer
Model No.: SSD120-100N-SDR FAA TSO-C88a and EASA ETSO-C88a
Manufacturer: Trans-Cal Industries, Inc., 16141 Cohasset St. Van Nuys, CA 91406
DO-160E Tested: January 2009

Conditions	Section	Description of Tests Conducted
Temp. and Altitude	***§4.0***	Tested to Category E1.
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 Conducted 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 Altitude testing ceilings were extended to 100,000 feet.
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**
Serial Data Repeater	**-SDR**

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 SSD120-100N( )-SDR 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( )-RS232 SERIAL NO: SDR-_____

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:_____