



## RS-232 Data Acquisition Module and Digital to Analog Conversion Module / Optional 4-20mA Current Loop Output

Models: 232SPDA 232SPDACL

### Description

The 232SPDA provides a low-cost, easy-to-use solution for serial port data acquisition. The 232SPDA offers 7 channels of 12-bit A/D inputs, 4 channels of 8-bit D/A outputs, 1 digital output and 2 digital inputs. With these features, the module can be used to sense a variety of external conditions, to output analog voltages, and to control a wide range of devices. The 232SPDA comes with a demo program in QuickBASIC. A data logging utility is included to provide a simple way to import data into other programs and spreadsheets (such as Excel). An RS-485 version is available (485SPDA). An optional two-wire, 4-20 mA current loop output is available in place of one of the D/A channels in both the 232SPDACL and 485SPDACL modules.

### Features

- 7 channels of 12-bit A/D
- 0.610mV A/D resolution (with 2.5Vdc Reference)
- 4 channels of 8-bit D/A with 232SPDA
- 3 channels of 8-bit D/A and one two-wire, 4-20mA current loop output with 232SPDACL
- 2 digital inputs (-30Vdc to +30Vdc)
- 1 digital output (0Vdc to 5Vdc)
- Automatic baud rate detection

### Commands

There are only four commands required to control the 232SPDA: the read A/D command, the read digital I/O command, the output analog voltage command and the set output states command. The command string consists of four to six bytes: the "!" character, the "0" (zero) character, two command characters, and one or two data bytes (if required).

232SPDA Commands

Function	Command	Response
Read A/D Channels	!0RA{#}	{ch#msb}{ch#lsb}{ch(#-1)msb}... {ch0msb}{ch0lsb}
Read Digital I/O	!0RD	{I/O states}
Output Analog Voltage	!0SV{#}{#}	no response
Set Output States	!0SO{#}	no response

**NOTE:** Each {...} represents one byte.

### A/D Converter

The 232SPDA has 7 channels of 12-bit A/D inputs. The full-scale voltage can be set anywhere from 2.5Vdc to 5.0Vdc. A 5Vdc reference is available to provide a 0 to 5Vdc range without any external components. The A/D converter has a conversion time around 10 microseconds, however the sampling rate is limited by the serial communications. The actual sampling rate for a single channel is around 120 samples per second (at 9600 baud). This rate drops to 37 samples per second when sampling all of the channels. The A/D inputs are available on a DB-25S (female) connector.

### D/A Converter

The 232SPDA has 4 channels of 8-bit D/A outputs, and the 232SPDACL has 3 channels of D/A outputs and one 4-20mA output channel. The D/A channels can produce an analog voltage between 0V and 4.4V. One D/A channel is internally set to provide a full-scale voltage of 4.4V (232SPDA only). The other three channels' full-scale voltage can be set anywhere between 0V and 4.4V. The D/A outputs are available on a DB-25S (female) connector.

## 4-20mA Current Loop Output (Model 232SPDAACL only)

A current loop is useful in situations where information must be sent over long wire runs. The 232SPDAACL uses D/A Output 0 to control a two-wire 4-20mA current loop output. Since D/A Output 0 is used to control the current loop, it is not available on an I/O pin. Instead, the current loop output is provided on I/O pin 22. The second wire in the current loop is the GND wire which is provided on I/O pin 7. The maximum load resistance for the current loop is 500Ω (resistance of wire must be included).

## Digital I/O Lines

The 232SPDA has 2 digital inputs and 1 digital output. The digital output is CMOS compatible. The digital inputs are CMOS/TTL compatible and can handle voltages from -30Vdc to +30Vdc. The digital I/O lines are available on a DB-25S (female) connector.

I/O Connector Pinout

DB-25S Pin #	Function	DB-25S Pin #	Function
1	GND	14	D/A Ref. 1
2	+12Vdc Output*	15	D/A Ref. 2
3	Digital Output #0	16	D/A Ref. 3
4	Digital Input #0	17	+5Vdc Output
5	Digital Input #1	18	A/D Ref. Input +
6	Digital GND	19	A/D Ref. Input -
7	Analog GND	20	No connection
8	A/D Input #0	21	A/D Input #6
9	A/D Input #1	22	D/A Output 0**
10	A/D Input #2	23	D/A Output 1
11	A/D Input #3	24	D/A Output 2
12	A/D Input #4	25	D/A Output 3
13	A/D Input #5		

\*Actual output is equal to power supply input minus 0.7Vdc

\*\*Pin 22 is used for the 4-20mA current loop output in the 232SPDAACL module.

## Communications

The 232SPDA connects to your computer's RS-232 serial port through a DB-25S connector. The unit automatically detects baud rates from 1200 to 9600. A data format of 8 data bits, 1 stop bit and no parity is used. The 232SPDA is configured as a DCE device.

RS-232 Connector Pinout

DB-25S Pin #	Signal	Direction to 232SPDA	Notes
2	Transmit Data (TD)	Input	Connection is required
3	Receive Data (RD)	Output	Connection is required
4	Request to Send (RTS)	Input	May be used to power unit if kept high
5	Clear to Send (CTS)		Internally looped back to RTS
6	Data Set Ready (DSR)		Internally looped back to DTR
7	Signal Ground (SG)	-	Connection is required
8	Data Carrier Detect (DCD)		Internally looped back to DTR
20	Data Terminal Ready (DTR)	Input	May be used to power unit if kept high

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## Specifications

### Analog to Digital Converter

Resolution:	12 bit
Channels:	7
Reference Range:	5.0 Vdc max. (1.221 mV per bit) 2.5 Vdc min. (0.610 mV per bit)
A/D Ref. Input -	0 Vdc to 2.5Vdc
A/D Ref. Input +	2.5 Vdc to 5.0 Vdc
Input Voltage Range:	-0.3 Vdc to 5.3 Vdc
Total Unadjusted Error:	+/- 1.75 LSB max.

A/D input channels must be driven from a source impedance less than 1 k $\Omega$ .

### 5 Volt Reference

Output Voltage:	4.975 Vdc to 5.025 Vdc (5.0 Vdc typ.)
Accuracy:	+/- 0.5 %
Maximum Output Current:	5 milliamps max.

### Digital to Analog Converter

Resolution:	8 bit
Channels:	4 (3 in the 232SADCL Module)
D/A References:	-0.3Vdc to 5.3Vdc (D/A Ref. 0 internally set to 5Vdc in 232SDA12 Module)
Output Voltage Range:	0Vdc to 4.4Vdc
Total Unadjusted Error:	+/- 0.07V for voltages less than 3.83V +/- 0.14V for voltages greater than 3.83V

D/A output channels must have a resistive load greater than or equal to 10 k $\Omega$  and a capacitive load less than or equal to 100 pF.

### 4-20mA Current Loop Output (232SPDA CL Module only)

Resolution:	8-bit
Channels:	1
Output Range:	4 mA to 20 mA
Reference:	internally set to 2 VDC
Maximum Load:	500 ohms (Resistance of wire included)
Total Unadjusted Error:	0.2 mA

### Digital Inputs

Channels:	2
Voltage Range:	-30 Vdc to 30 Vdc
Low Voltage:	-30 Vdc to 1.0 Vdc
High Voltage:	2.0 Vdc to 30 Vdc
Leakage Current:	1 microamp max.

### Digital Output

Channels:	1
Low Voltage:	0.6 Vdc @ 8.7 milliamps
High Voltage:	4.3 Vdc @ -5.4 milliamps

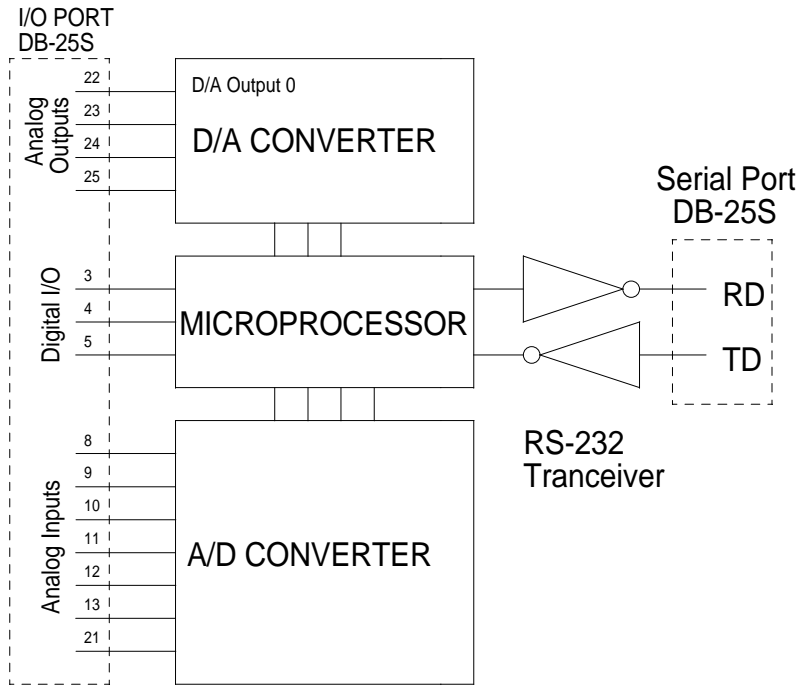
### Power Supply

Input Voltage:	12Vdc to 18Vdc @ 35 milliamps (This is specified for the 232SPDA CL. The 232SPDA will require less current. This does not include power consumption of external devices.)
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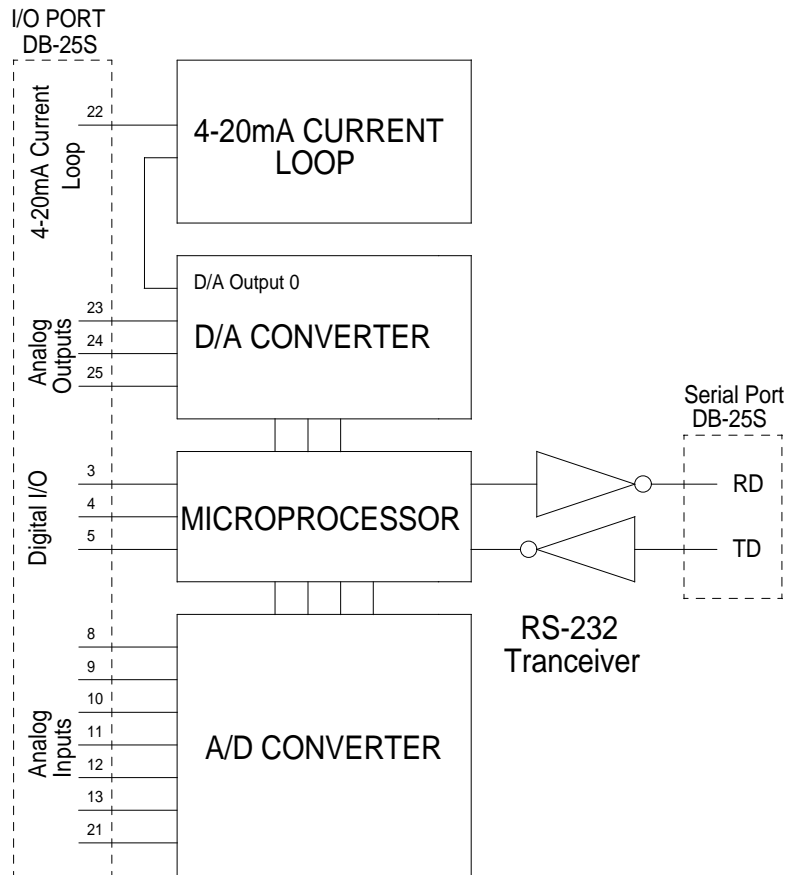
Connection: 2.5 mm jack

### Communications

Standard:	RS-232 (unit is DCE)
Baud Rate:	1200 to 9600 (automatic detection)
Format:	8 data bits, 1 stop bit, no parity
Connector:	DB-25S (female)



**232SPDA Block Diagram**



**232SPDA CL Block Diagram**

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