SENSOTEC

Dual Output Pressure Sensor

Model DS

User's Manual

008-0627-00

Version 1.10

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1. INTRODUCTION

1.1 Overview

The Model DS Pressure Sensor combines high performance with the versitility of both analog and digital outputs. The high accuracy pressure readings are fully temperature compensated across the entire operating temperature range of the transducer. In addition the Model DS Pressure Sensor maintains a maximum update rate of 2500 times a second for both digital and analog outputs.

The Model DS provides a configurable analog ouput of 0 to 5 VDC. In default operation, the fully temperatrue compensated voltage output is proportional to the pressure applied to the pressure port. Alternately the analog output may be configured for independent control by the user through the digital interface.

The Model DS provides a digital output of either a RS-232 full duplex interface or a RS-485 half duplex interface which allows for multi-unit operation. Each transducer has an universal address for setup and an user defined address for multidrop operation. In addtion to pressure readings, all operating parameters of the transducer are accessible through the digital interface. For example, user adjustment of span and offset are provided for each output independently through the digital interface.

The following chapters detail the features and operating parameters of Model DS Pressure Sensor.

1.2 SPECIFICATIONS

Power Requirements:	15 - 28 VDC 50 mA typ. 75 mA peak (during RS-485 operation)
Pressure:	
Accuracy:	
Digital:	± 0.05% of F.S. typ. ± 0.10% of F.S. max.
Analog:	± 0.10% of F.S. typ. ± 0.20% of F.S. max.
Resolution:	
Digital:	0.05% or 5 significant digits
Analog:	1.4 mV steps
Operating Temperature Range:	-40 to 180 Degree F

Digital output:	RS-485 Half Duplex, or RS-232 Full Duplex
Baud Rates:	1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K, 115.2K
Data Framing:	1 start bit, 8 data bits, 1 stop bit
Parity:	No parity
Addressing;	User assigned 1 null address (address not assigned)
Bus operating mode:	Response to a designated unit request (Master/slave)
Pressure Units:	Shipped as PSI, field selectable
Update Rate:	2500 updates per second, maximum
Mechanical Shock:	TBD
Thermal Shock:	TBD
Vibration:	TBD
Long term stability:	TBD
Media Compatibility:	Exposed surfaces are 316L stainless steel

2. Command Summary

2.1 System Commands

Detailed descriptions of each system command is given in alaphabetical order in Chapter 4.

Command Code	Description	Write Enable Required	Typical Response
DC	Display Temperature (Centigrade)	No	sddd<CR>
DP	Display User Defined String	No	xxxxxxxxxxxxxxxx<CR>
DR	Display Errors	No	Err_x<CR>
DT	Display Temperature (Fahrenheit)	No	sddd<CR>
FC	Read Calibration Date	No	dd/dd/dd<CR>
FE	Read Serial Number	No	dddddd<CR>
FR	Restore Factory Default Settings	Yes	OK<CR>
FT	Test Data Storage Checksum	No	OK<CR>
II	Set Update Rate	Yes	OK<CR>
R4	Read Unit Address	No	dd<CR>
R5	Read Full Scale Range	No	sd.dddddEsdd<CR>
RM	Read Mfg. Part Number	No	xxxxxxxxxxxx<CR>
RR	Read Software Revision	No	ddd-dddd-dd d.dd<CR>
SP	Set User Defined String	Yes	OK<CR>
W1	Write Baud Rate	Yes	OK<CR>
W4	Write New Address	Yes	OK<CR>
WE	Write Enable	No	OK<CR>

Typical Response Key: d - decimal digit
s - sign indicator: "+" or "-"
x - any valid ASCII character
<CR> - Carriage Return
All other characters and punctuation appear as is.

2.2 Digital Output Commands

Detailed descriptions of each digital output command is given in alaphabetical order in Chapter 5.

Command Code	Description	Write Enable Required	Typical Response
D0	Display Digital Pressure Reading	No	sd.dddddEsdd<CR>
DB	Display Digital Zero Adjustment	No	sd.dddddEsdd<CR>
DE	Display Eng. Units Conversion Factor	No	sd.dddddEsdd<CR>
DM	Display Digital Span Adjustment	No	sd.dddddEsdd<CR>
R6	Read Engineering Units Label	No	xxxx<CR>
SB	Set Digital Zero Adjustment	Yes	OK<CR>
SE	Set Eng. Units Conversion Factor	Yes	OK<CR>
SM	Set Digital Span Adjustment	Yes	OK<CR>
W6	Write Engineering Units Label	Yes	OK<CR>

Typical Response Key: d - decimal digit s - sign indicator: "+" or "-"
x - any valid ASCII character <CR> - Carriage Return
All other characters and punctuation appear as is.

2.3 Analog Output Commands

Detailed descriptions of each analog output command is given in alaphabetical order in Chapter 6.

Command Code	Description	Write Enable Required	Typical Response
DA	Display Analog Output Voltage	No	sd.ddd<CR>
RN	Read Analog Output Offset	No	sd.dddddEsdd<CR>
RO	Read Analog Output Scaling Factor	No	sd.dddddEsdd<CR>
SA	Set Analog Output	No	OK<CR>
SS	Select Analog Output Source	Yes	OK<CR>
SV	Set Analog Output Default Value	Yes	OK<CR>
SY	Read Analog Output Default Value	No	sd.dddddEsdd<CR>
WN	Write Analog Output Offset	Yes	OK<CR>
WO	Write Analog Output Scaling Factor	Yes	OK<CR>

Typical Response Key: d - decimal digit
s - sign indicator: "+" or "-"
x - any valid ASCII character
<CR> - Carriage Return
All other characters and punctuation appear as is.

3. COMMAND FORMAT

3.1 Serial Protocol

The Model DS pressure transducer uses either a half duplex RS-485 or a full duplex RS-232 hardware interface for serial communications. All serial communication is in ASCII format using 8 data bits, one start bit, one stop bit and no parity bits. Baud rates of 1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K and 115.2K are available. As shipped from the factory, the baud rate is set to 9600 baud, the default baud rate.

3.2 Command Format

Each command is a string of ASCII characters. The following represents the general format of the transducer commands:

`#aaccxx...xx<cr>`

`#`	The pound sign is the start of command character.
`aa`	This two byte field is the unit address.
`cc`	This two byte field is the command.
`xx...xx`	The data field is an optional field of up to 18 characters.
`<cr>`	The carriage return is the end of command character.

3.2.1 Start of Command

The pound sign, '#', ASCII code 35 decimal, indicates the start of a command. The transducer continually monitors the serial communication bus, ignoring all characters until the pound sign is detected. Once the pound sign is detected the transducer enters receive mode and begins looking for a valid address.

3.2.2 Unit Address

The unit address is a two character field of ASCII alphanumeric characters. The address may be any combination of numerals or letters and is case sensitive.

Each transducer supports two addresses. The first is an universal address to which all transducers respond. The address of 'ff', (ASCII codes 102 decimal, 102 decimal) is reserved as the universal address. This universal address should not be used when multiple transducers are setup as a RS-485 network. All

transducers on the network will respond to this address at the same time resulting in corrupted responses.

The second address is an unique, user defined address to which only the specific transducer will respond. The user must define this unique address using the W4 command. As shipped from the factory, the default value for this address is ‘00" (ASCII codes 48 decimal, 48 decimal).

After the transducer detects the start of command character and enters receive mode, it monitors the serial communications port for a valid address. If the address found is the universal address or the transducer’s unique address, the transducer will continue to process the serial communications for a command.

If the address found is not the universal address or the transducer’s unique address, the transducer will exit receive mode and will return to monitor the serial communication for a start of command character. If characters received after the start of command character are not ASCII alphanumeric characters, the transducer also exits receive mode.

3.2.3 Command

A command is comprised of two ASCII alphanumeric characters. Commands are not case sensitive; either upper or lower case letters may be used. The following chapters offer a detailed explanation of each command.

3.2.4 Data Field

The data field is an optional field of up to 16 ASCII characters. This field contains the data for commands which write data to the transducer. Valid characters for the data field include all alphanumerics, decimal point, plus sign, and minus sign.

3.2.5 End of Command

The carriage return, ASCII code 13 decimal, indicates the end of a command. If a command requires no additional data, the end of command character follows the two character command. If a command requires additional data, the end of command character follows the data field.

The transducer does not process a command until it receives an end of command character. If the transducer does not receive a end of command character within approximately 5 seconds after receiving a start of command character, the command is aborted.

3.3 Command Response

The digital transducer transmits only in response to a command which uses its unique address (or the universal address of ‘ff'). The transducer itself never initiates a transmission.

There are two basic types of responses. The transducer will transmit an ASCII string in response to commands which request data. This ASCII string is terminated by a carriage return. For commands which do not request data, the transducer acknowledges the command with ‘OK’ followed by a carriage return. Examples of the typical response for each command are included in the following chapters.

NOTE: Commands which change the operating parameters of the transducer are implemented immediately. Changes are written to nonvolatile memory with each command issued. Nonvolatile memory is guaranteed for 20,000 writes. A checksum command is available to test the integrity of the nonvolatile memory.

The transducer indicates the following error conditions:

Response	Description
`Err_NaC`	Not a Command: The command was not recognized as a valid command by the transducer.
`Err_AcD`	Access Denied: The required Write Enable command did not preceed the present command.
`Err_NaN`	Not a Number: The data accompanying the command do not represent a valid number.
`Err_InF`	Invalid Format: The data accompanying the command do not represent a valid option for the command.
`Err_CsF`	Checksum Error:This response to the FT command indicates a checksum error in data storage.
`Err_OvR`	Over Range: This response to the D0 command indicates the input pressure is approximate 6 % above the full scale range of the transducer.
`Err_UnR`	Under Range: This response to the D0 command indicates the input pressure is approximately 3 % below the range of the transducer.

4. SYSTEM COMMANDS

4.1 DC Display Temperature (Centigrade)

DESCRIPTION

The DC command reads the temperature at the transducer's sensing element. This value is provided as a diagnostic tool. The accuracy of this value is not guaranteed but is typically within ±2 degrees Centigrade.

The response to this command is a varible length string representing the temperature in degrees Centigrade.

EXAMPLE

```
#00DC
```

This command, followed by a carriage return, returns the temperature in Centigrade of the transducer with the address of '00'.

Typical responses to this command illustrating the varible length of the response include:

```
43
8
-5
-14
```

4.2 DP Display User Defined String

DESCRIPTION

The DP command displays the character string set by the SP command. This character string is 16 characters in length. The default value for this character string is 16 blank spaces (ASCII code 32 decimal).

EXAMPLE

```
#00DP
```

This command, followed by a carriage return, reads the character string set by the SP command from a transducer with the address of '00'.

The transducer transmits a response to this command similar to:

```
Part # 456-1003P
```

For this example the transducer transmits the character string set by the SP command example below.

4.3 DR Display Errors

DESCRIPTION

At power up the Model DS performs a complete checksum test of all stored data. During operation the checksum test is repeated periodically. Also during operation the transducer continually monitors the pressure and temperature signals for out of range conditions. The DR commands displays the results of these test.

When an error occurs, the transducer sets the appropiate bit of a status byte to 1 to indicate the presence of an error. Bits set to 0 indicate the absense of an error. This status byte is available as the last character of the response to this command.

The following is the bit assignment of this status byte:

bit 0	Temperature over range error
bit 1	Temperature under range error
bit 2	Pressure over range error
bit 3	Pressure under range error
bit 4	1
bit 5	1
bit 6	Checksum error
bit 7	0

(Bit 0 is the least significant bit of the status byte. Note that three of the bits are constants; this ensures that the status byte is an ASCII printable character.)

Error bits set in the status byte are nonvolatile: bits indicating errors will remain set after the error condition ceases to exist. Using the DR command to read the error status will clear all error indications. Removing power from the transducer will also clear all error indications.

EXAMPLE

```
#00DR
```

This command, followed by a carriage return, returns the error status of the transducer with the address of ‘00'.

In response to this command, the transducer transmits the following:

```
Err_0
```

In this case, the last character of the response is the ASCII character for zero, 30 hexadecimal. The binary value of this character is 0011 0000 indicating that no errors have been detected since the last time the error status was read.

As another example, the response to this command could be

```
Err_4
```

In this case the last character of the response is the ASCII character for the numeral 4, 34 hexadecimal. The binary value of this character is 0011 0100. Bit 2 is set to a one indicating a pressure over range error was detected since the last time the error status was read.

4.4 DT Display Temperature (Fahrenheit)

DESCRIPTION

The DT command reads the temperature at the transducer’s sensing element. This value is provided as a diagnostic tool. The accuracy of this value is not guaranteed but is typically within ±4 degrees Fahrenheit.

The response to this command is a varible length string representing the temperature in degrees Fahrenheit.

EXAMPLE

```
#00DT
```

This command, followed by a carriage return, returns the temperature in Fahrenheit of the transducer with the address of ‘00'.

Typical responses to this command illustrating the varible length of the response include:

```
145
```

```
67
5
-2
-23
```

4.5 FC Read Calibration Date

DESCRIPTION

The FC command reads the transducer's date of calibration. This date is set at the factory and can not be changed by the user.

EXAMPLE

```
#00FC
```

This command, followed by a carriage return, requests the date of calibration from a transducer with the address of '00'.

The transducer transmits a response to this command similar to:

```
06/14/01
```

The format of the response is month/day/year. For this example, the date of calibration is June 14, 2001.

4.6 FE Read Serial Number

DESCRIPTION

The FE command reads the transducer's serial number. The serial number is set at the factory and can not be changed by the user.

EXAMPLE

```
#00FE
```

This command, followed by a carriage return, requests the serial number from a transducer with the address of '00'.

The transducer produces a response to this command similar to:

```
123456
```

For this example, the transducer’s serial number is ‘123456'.

4.7 FR Restore Factory Default Settings

DESCRIPTION

The FR command restores all factory default settings to the transducer. The transducer reinitializes all operating parameters with the default settings. All changes made by the user are lost. This command must be preceded by the WE command.

EXAMPLE

```
#00FR
```

This command , followed by a carriage return, restores all default settings to a transducer with an address of ‘00'.

In response to this command, the transducer transmits the following:

```
OK
```

4.8 FT Test Data Storage Checksum

DESCRIPTION

The FT command performs a checksum test on all stored data within the transducer. The reponse to this command returns the result of this test.

The transducer performs a checksum test at power up and periodically during operation. This command allows the user to perform a checksum test on demand. If this command detects a checksum error, the appropiate bit of the status byte reported by the DR command is set also.

EXAMPLE

```
#00FT
```

This command, followed by a carriage return, instructs the transducer with the address of ‘00' to perform a checksum test.

In response to this command, the transducer transmits

```
OK
```

to indicate no checksum errors, or

```
Err_CsF
```

to indicate a checksum failure.

4.9 II Set Update Rate

DESCRIPTION

The II command controls the update rate of the transducer. The transducer calculates primary updates to the digital reading and the analog output voltage at a maximum rate of 2500 times per second. These primary updates may be averaged together to implement a simple averaging filter. This command controls the number of primary updates averaged together to generate the digital reading and the analog output voltage. As the number of primary updates averaged increases, the update rate of the digital reading and of the analog output voltage decreases. The default value for the command is no averaging enabled which provides the maximum update rate for the transducer.

This command requires a data field of one character. The table below lists the valid values and the resulting approximate update rates .

Data Field Value	Updates / Second	
0 (zero)	2500	(averaging disabled)
1	1250	
2	625	
3	312	
4	156	
5	78	
6	39	
7	19	
8	9	

This command must be preceded by the WE command.

EXAMPLE

```
#00II2
```

This command, followed by a carriage return, instructs the transducer with the address of ‘00' to average output results at a rate of 625 updates / second.

In response to this command, the transducer transmits the following:

```
OK
```

4.10 R4 Read Unit Address

DESCRIPTION

The R4 command displays the unique two character user defined address assigned to the transducer by the W4 command.

EXAMPLE

```
#ffR4
```

This command, followed by a carriage return, requests the user defined address of the transducer using the universal address of ‘ff'.

The transducer transmits a response to this command similar to:

```
33
```

For this example, the user defined address is 33.

4.11 R5 Read Full Scale Range

DESCRIPTION

The R5 command reads the transducer’s full scale pressure range in units of PSI. This value is set at the factory and can not be changed by the user. The response to this command is presented in scientific notation.

EXAMPLE

```
#00R5
```

This command, followed by a carriage return, reads the full scale pressure range of a transducer with the address of ‘00'.

The transducer transmits a response to this command similar to:

```
+1.00000E+02
```

For this example the full scale pressure range is 100 PSI.

4.12 RM Read Manufacturer's Part Number

DESCRIPTION

The RM command reads the Sensotec Part Number of the transducer. This value is set at the factory and can not be changed by the user. The response is an 11 character ASCII string representing the part number.

EXAMPLE

```
#00RM
```

This command, followed by a carriage return, reads the Sensotec part number of the transducer with the address of '00'.

The transducer transmits a response to this command similar to::

```
060-G769-01
```

For this example the Sensotec part number is 060-G769-01.

4.13 RR Read Software Revision

DESCRIPTION

The RR command reads the transducer's software part number and software revision level.

EXAMPLE

```
#00RR
```

This command, followed by a carriage return, requests the software revision level from a transducer with the address of '00'.

The transducer produces a response to this command similar to:

```
084-1406-03 1.00
```

The software part number is '084-1406-03'. The software revision level is '1.00'.

4.14 SP Set User Defined String

DESCRIPTION

The SP command writes an user defined ASCII character string to the transducer. This command requires a data field of up to 16 characters. The user may use this command to store custom information in the transducer. The default value for this command is 16 spaces (ASCII code 32 decimal).

Information stored in the transducer with this command is maintained when power is removed from the transducer. Information stored in the transducer with this command may be read by the DP command. This command must be preceded by the WE command.

EXAMPLE

```
#00SPPart # 456-1003P
```

This command, followed by a carriage return, writes “Part # 456-1003P” to a transducer with the address of ‘00'.

In response to this command, the transducer transmits the following:

```
0K
```

4.15 W1 Write Baud Rate

DESCRIPTION

The W1 command changes the transducer’s baud rate for serial communication. This command requires a data field of one numeric value to indicate the new baud rate. A list of the available baud rates and the corresponding value to be placed in the data field follows.

Baud Rate	Data Field Value
1200	1
2400	2
4800	3

9600	4
19.2 K	5
38.4 K	6
57.6 K	7
115.2 K	8

The change to the new baud rate takes place immediately after the transducer acknowledges the command. This command must be preceded by the WE command. The default baud rate is 9600.

EXAMPLE

```
#00W15
```

This command, followed by a carriage return, changes the baud rate of the transducer with the address of ‘00' to a baud rate of 19.2K for subsequent serial communication.

Before changing to the new baud rate, the transducer transmits the following:

```
0K
```

4.16 W4 Write New Address

DESCRIPTION

The W4 command writes a user defined address to the transducer. This command requires a data field of two characters representing the new address. The address may be any two alphanumeric characters and is case sensitive. This command must be preceded by the WE command. The default value of this address is ‘00'.

EXAMPLE

```
#00W4EE
```

This command, followed by a carriage return, writes a new user defined address of ‘EE’ to the transducer addressed with the default address of ‘00'.

In response to this command, the transducer transmits the following:

```
0K
```

4.17 WE Write Enable

DESCRIPTION

All commands which write data to the transducer or which change the operating parameters of the transducer must be preceded by the Write Enable command. The Write Enable command is valid for the next single command only. Each command which writes data to the transducer must be preceded by a separate Write Enable command.

EXAMPLE

```
#00WE
```

This command, followed by a carriage return, enables a transducer with the address of ‘00' to process the next command which writes data to the transducer.

In response to this command, the transducer transmits the following:

```
OK
```

5. DIGITAL OUTPUT COMMANDS

5.1 D0 Display Digital Pressure Reading

DESCRIPTION

The D0 (D, numeral 0) command displays the most recently computed temperature compensated pressure reading. The pressure reading is presented in scientific notation as a string of ASCII characters. If the most recent pressure reading is out of range or a checksum error has been detected, the transducer will respond to this command with an error indication. See Section 3.3.

EXAMPLE

```
#00D0
```

This command, followed by a carriage return, reads the pressure reading of a transducer with the address of ‘00’.

The transducer transmits a response to this command similar to:

```
+6.24250E+01
```

For this example, the pressure reading is 62.4250.

5.2 DB Display Digital Zero Adjustment

DESCRIPTION

The DB command displays the value of the digital zero adjustment in scientific notation.

EXAMPLE

```
#00DB
```

This command, followed by a carriage return, reads the digital zero adjustment of a transducer with an address of ‘00'.

The transducer transmits a response to this command similar to:

```
-2.50000E-01
```

For this example, the digital zero adjustment is -0.25%, which reduces the digital zero reading by -0.25%.

5.3 DE Display Engineering Units Conversion Factor

DESCRIPTION

The DE command displays the transducer’s engineering units conversion factor.

EXAMPLE

```
#00DE
```

This command, followed by a carriage return, reads the engineering units conversion factor from a transducer with an address of ‘00'.

The transducer transmits a response to this command similar to:

```
+2.76790E+01
```

For this example, the engineering units conversion factor is ‘27.679'.

5.4 DM Display Digital Span Adjustment

DESCRIPTION

The DM command displays the value of the digital span adjustment in scientific notation.

EXAMPLE

```
#00DM
```

This command, followed by a carriage return, reads the digital span adjustment of a transducer with an address of ’00'.

The transducer transmits a response to this command similar to:

```
+9.98000E+01
```

For this example, the digital span adjustment is 99.8% of the unadjusted span.

5.5 R6 Read Engineering Units Label

DESCRIPTION

The R6 command reads the four character engineering units label.

EXAMPLE

```
#00R6
```

This command, followed by a carriage return, reads the engineering units label of a transducer with the address of ‘00'.

The transducer transmits a response to this command similar to:

```
PSIG
```

For this example, the engineering units label is ‘PSIG’, (Pounds per Square Inch Gage).

5.6 SB Set Digital Zero Adjustment

DESCRIPTION

The SB command is used to adjust the zero of the digital output only. The command requires a data field of up to 16 characters. Data field values may be positive or negative and are entered as an integer, a decimal number, or in scientific notation. This command must be preceded by the WE command.

The units for the SB command is percentage. A data field value of 0.00000 is the default value for this parameter and represents no zero adjustment.

EXAMPLE

```
#00SB-0.25
```

This command, followed by a carriage return, sets the digital zero adjustment of a transducer with an address of ‘00' to -0.25%. This would result in a 0.25 percent reduction in the zero reading of the transducer.

In response to this command, the transducer transmits the following:

```
0K
```

5.7 SE Set Engineering Units Conversion Factor

DESCRIPTION

The SE command is used to set the engineering units conversion factor. This conversion factor is used in the calculation of the digital output only and determines the engineering units of the digital output. This command requires a data field of up to 16 characters. Data field values may be entered as integers,

decimal numbers, or scientific notation. Data field values for common conversion factors are listed below with their corresponding engineering units. This command must be preceded by the WE command.

NOTE: It is the user's responsibility to ensure that the engineering units label written with the W6 command correctly corresponds to the appropriate engineering units conversion factor.

Engineering Units		Data Field Value
CMWC	centimeters of water column	70.304
INHG	inches of mercury	2.0360
INWC	inches of water column	27.679
KPA	kilopascal	6.8948
MBAR	millibar	68.948
MPA	megapascal	0.0068948
PSI	pounds per square inch	1.0000

EXAMPLE

```
#00SE27.679
```

This command, followed by a carriage return, writes the engineering units conversion factor of '27.679' to a transducer with the address of '00'. The engineering units of the transducer's digital output will be INWC (inches of water column) after the transducer acknowledges the command. **(The W6 command should be used to set the engineering units label to 'INWC'.)**

In response to this command, the transducer transmits the following:

```
0K
```

5.8 SM Set Digital Span Adjustment

DESCRIPTION

The SM command is used to adjust the span of the digital output only. The command requires a data field of up to 16 characters. Data field values may be entered as integers, decimal numbers, or scientific notation. This command must be preceded by the WE command.

The units for the SM command is percentage. A data field value of 100.0 is the default value for this parameter and represents no span adjustment.

EXAMPLE

```
#00SM99.80
```

This command, followed by a carriage return, reduces the digital output span of a transducer with the address of ‘00' by 0.2 %.

In response to this command, the transducer transmits the following:

```
OK
```

5.9 W6 Write Engineering Units Label

DESCRIPTION

The W6 command changes the four character engineering units label associated with the digital output of the transducer. The command requires a four character data field to specify the new engineering units label. This command does not change anything mathematically. The SE command changes the actual engineering units conversion factor. The label may be read by the R6 command. This command must be preceded by the WE command.

EXAMPLE

```
#00W6PSIG
```

This command, followed by a carriage return, changes the engineering units label of the transducer with the address of ‘00' to ‘PSIG''.

In response to this command, the transducer transmits the following:

```
OK
```

6. ANALOG OUTPUT COMMANDS

6.1 DA Display Analog Output Voltage

DESCRIPTION

The DA command reads the actual voltage present at the transducer's analog output pin. This value is provided as a diagnostic tool. The accuracy of this value is not guaranteed but is typically within ±0.5 percent of the output voltage.

The response to this command is a fixed length string beginning with a plus or minus sign. The voltage value is presented with three decimal places.

EXAMPLE

```
#00DA
```

This command, followed by a carriage return, reads the voltage at the analog output pin of a transducer with the address of '00'.

The transducer transmits a response to this command similar to:

```
+3.425
```

For this example, the analog output voltage is approximately +3.425 volts.

6.2 RN Read Voltage Output Offset

DESCRIPTION

The RN command reads the value of the analog voltage output's offset adjustment. The response to this command is presented in scientific notation. The units are percentage.

EXAMPLE

```
#00RN
```

This command, followed by a carriage return, reads the voltage output's offset adjustment for a transducer with the address of '00'.

The transducer transmits a response to this command similar to:

```
+1.00000E-01
```

For this example, the voltage output zero adjustment is set to +0.1 percent.

6.3 RO Read Voltage Output Scaling Factor

DESCRIPTION

The RO (R, letter O) command reads the value of the analog voltage output span adjustment. The response to this command is in scientific notation.

EXAMPLE

```
#00RO
```

This command, followed by a carriage return, reads the voltage output span adjustment for a transducer with the address of ‘00'.

The transducer transmits a response to this command similar to:

```
+9.85000E+01
```

For this example, the voltage output span adjustment is 98.5 %.

6.4 SA Set Analog Output

DESCRIPTION

The SA command provides the value for the analog output when the transducer is configured to use the digital interface to control the analog output. (See the SS command.) This value is in units of percentage of full scale.

This command requires a data field of up to six characters. Data field values may be entered as integers or decimal numbers and range from 0.00 to 100.00.

NOTE: The analog output scaling factor and offset values set by the WO and WN commands respectively apply to the value set by this command.

EXAMPLE

```
#00SA50.0
```

This command, followed by a carriage return, sets the analog output voltage of a

transducer with the address of ‘00' to 50 percent of full scale, i.e. 2.5 Vdc.

In response to this command, the transducer transmits the following:

```
0K
```

6.5 SS Select Analog Output Source

DESCRIPTION

The SS command selects the source from which the analog output is generated. The analog output may be derived from either of two sources. The default source for the analog output is the sensor at the pressure port of the transducer. The alternate source is a discrete value provided by the user through the digital interface.

This command requires a one character data field.Valid values for the data field are:

Analog Output Source	Data Field Value
Pressure Port	0
Digital Interface	1

This command must be preceded by the WE command.

When switching from the pressure port to the digital interface as the source for the analog output, the initial value for the analog output is set by the SV command. All subsequent values are provided by the SA command.

EXAMPLE

```
#00SS1
```

This command, followed by a carriage return, configures the analog output of a transducer with the address of ‘00' to use values provided through the digital interface. The transducer immediately uses the value set by the SV command to set the analog output voltage.

In response to this command, the transducer transmits the following:

```
0K
```

6.6 SV Set Analog Output Default Value

DESCRIPTION

The primary use of the SV command is to provide the default value for the analog output when the transducer is first configured to use the digital interface to control the analog output. (See the SS command.) It is also the value used at power up when the transducer's analog output is controlled by the digital interface.

The secondary use of the SV command is to provide a default value for the analog output to indicate a checksum error. When the analog out is under control of the pressure port and a checksum error is detected, the value set by this command is used to set the analog output.

This command requires a data field of up to six character. Data field values may be entered as integers or decimal numbers and range from 0.00 to 100.00. This value is in units of percentage of full scale. This command must be preceded by the WE command.

NOTE: The analog output scaling factor and offset values set by the WO and WN commands respectively apply to the value set by this command.

EXAMPLE

```
#00SV0.0
```

This command, followed by a carriage return, sets the default analog output voltage of a transducer with the address of '00' to 0 percent of full scale, i.e. 0.0 Vdc.

In response to this command, the transducer transmits the following:

```
OK
```

6.7 SY Display Analog Output Default Value

DESCRIPTION

The SY command reads the default value for the analog output set by the SV command.

EXAMPLE

```
#00SY
```

This command, followed by a carriage return, reads the default analog output value of a transducer with the address of ‘00'.

The transducer transmits a response to this command similar to:

```
+5.0000E+01
```

For this example, the default analog output value is 50 %, or 2.5 Vdc.

6.8 WN Write Voltage Output Offset

DESCRIPTION

The WN command is used to adjust the offset of the analog voltage output only. The command requires a data field indicating the amount of zero offset desired. The data field represents the percentage of full scale reading by which the zero offset should be changed and may be entered as integers, decimal numbers, or scientific notation. This command must be preceded by the WE command.

The zero of the analog voltage output is inversely related to this command’s data field value. Increasing this value will lower the analog output voltage; decreasing this value will raise the output voltage. Any zero adjustment of the voltage output should be made before adjusting the span. The default value for this parameter is 0.0 and represents no offset adjustment.

EXAMPLE

```
#00WN-0.2
```

This command, followed by a carriage return, adjust the offset of the analog voltage output by -0.2 % of full scale for a transducer with the address of ‘00'. In effect this inceases the analog output voltage by 0.2 %.

In response to this command, the transducer transmits the following:

```
OK
```

6.9 WO Write Voltage Output Scaling Factor

DESCRIPTION

The WO (W, letter O) command is used to adjust the span of the analog voltage

output only. The command requires a data field indicating the amount of span adjustment desired. The data field represents the percentage of full scale reading by which the span should be changed and may be entered as integers, decimal numbers, or scientific notation. The command must be preceded by the WE command.

The span of the analog voltage output is inversely related to this command's data field value. Increasing this value will decrease the analog output span; decreasing this value will increase the analog output span. The default value of this parameter is 100.0 representing no analog output span adjustment.

EXAMPLE

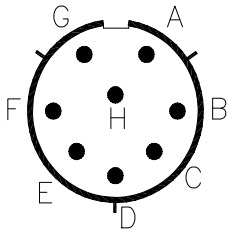
```
#00WO98.5
```

This command, followed by a carriage return, adjusts the span of the analog output by +1.5 % of full scale for a transducer with the address of '00'.

In response to this command, the transducer transmits the following:

```
OK
```

7. ELECTRICAL CONNECTIONS

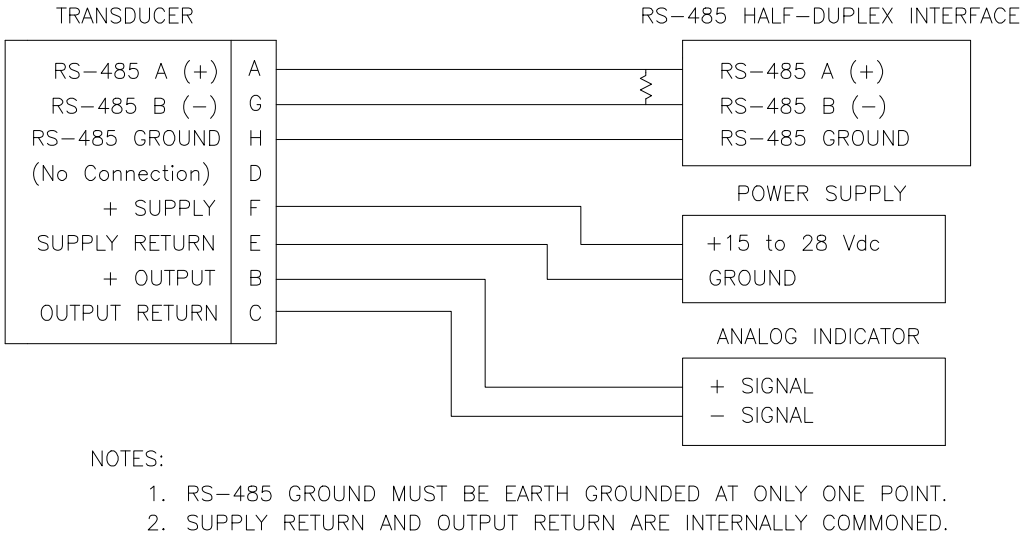


TOP VIEW

PIN ASSIGNMENT

PIN	SIGNAL NAME
A	RS−485 A (+) / RS232 TxD
G	RS−485 B (−) / RS232 RxD
H	RS−485 GROUND / RS−232 GROUND
B	+ OUTPUT (0 to 5 VDC)
C	OUTPUT RETURN
F	+ SUPPLY
E	SUPPLY RETURN (GND)
D	NO CONNECTION

Figure 7.1 Electrical Connector Pin Assignments



NOTES:

1. RS−485 GROUND MUST BE EARTH GROUNDED AT ONLY ONE POINT.
2. SUPPLY RETURN AND OUTPUT RETURN ARE INTERNALLY COMMONED.

Figure 7.2 - Typical Transducer Connections, RS-485 Interface

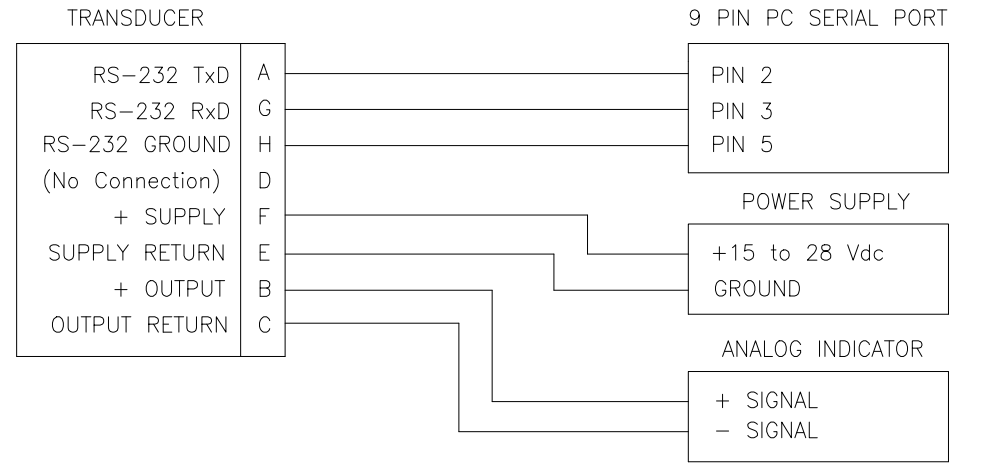


Figure 7.3 - Typical Transducer Connections, RS-232 Interface