



# ASR DBO433 Differential Barometer Altimeter OEM Module User Manual

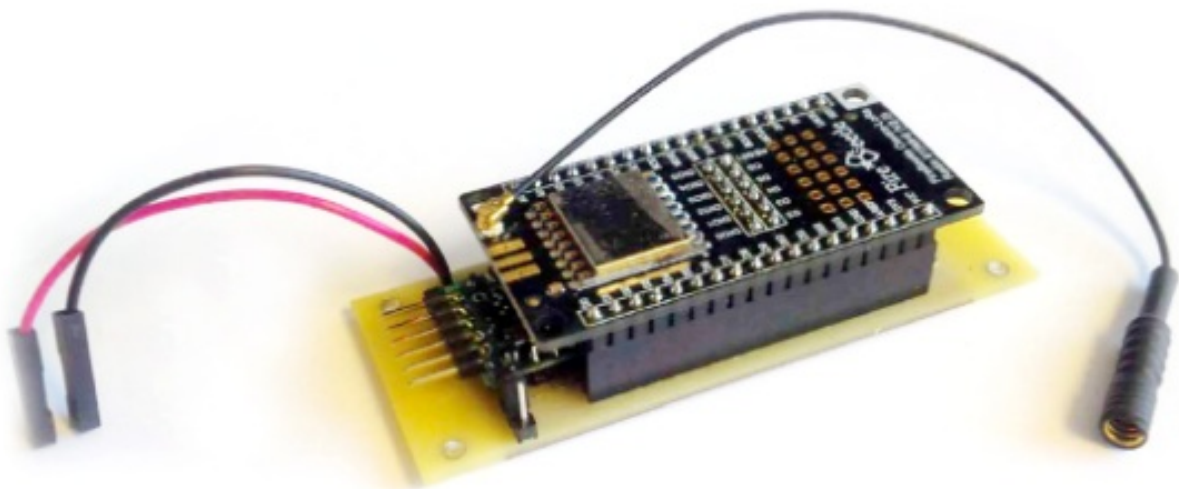
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## ASR DBO433 Differential Barometer Altimeter OEM Module



## Features

- Integrated MCU
- Corrected atmospheric pressure readings
- Derived elevations with customizable datum
- Temperature readings
- Multi-node capable
- Simple serial interface
- Metric or Imperial output units

## Application Examples

- Indoor elevations
- Building pressurization monitoring
- Multi-node telemetry networks
- Altitude reference for UAVs

## Overview

The DBOxxx series differential barometer/altimeter (patent pending) OEM module provides atmospheric pressures and derived elevations at a rover using corrections transmitted from a stationary base. In traditional systems elevations are calculated based on pressure readings for a stand-alone unit and are subject to the errors inherent with environmental changes in pressure. This versatile engine offers three modes of operation detailed below.

## Modes

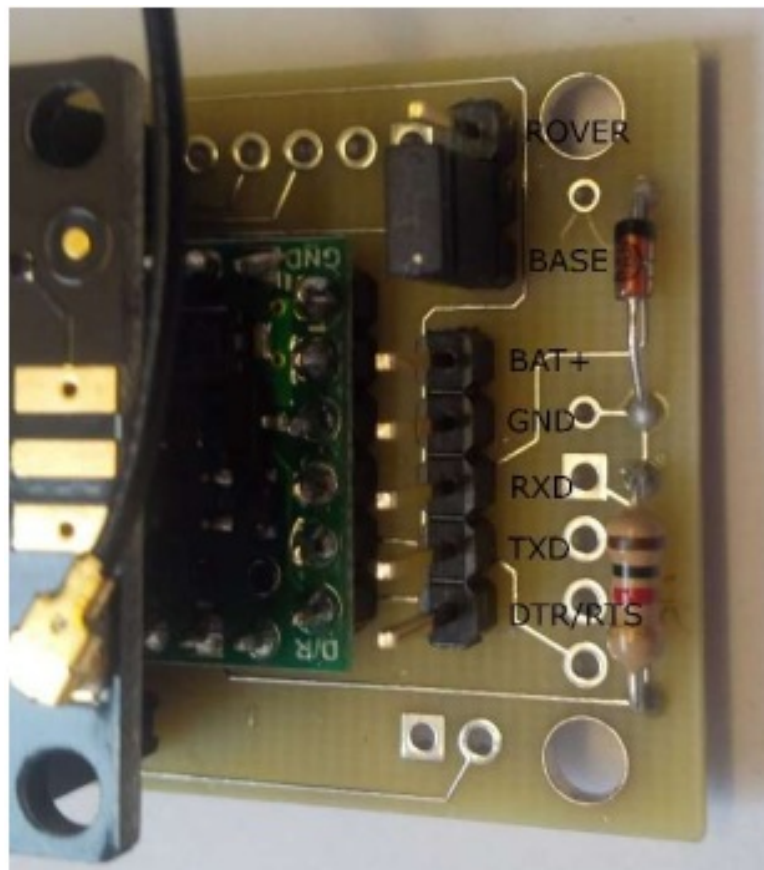
1. Determining floating rover elevations based on corrections (black arrow) from a fixed base. In this application, the rover outputs a corrected elevation as it is raised or lowered relative to the ambient atmospheric pressure (blue arrows). When used inside an enclosed space such as a building both units must be located within. Multiple rovers can use the same base.
2. Determining a fixed rover pressure difference based on corrections (black arrow) from a fixed base. In this application, the rover outputs a corrected pressure (grey arrow) inside an enclosed space such as a building (grey rectangle) relative to the ambient atmospheric pressure (blue arrows). The base must be located outside the enclosed space. Multiple rovers can use the same base.
3. Multi-node telemetry. In this application, the rover receives remote uncorrected pressure and temperature from multiple bases. The pressure data is absolute and not differentially corrected.

## Specifications

- **Differential Pressure Accuracy:** +/- 0.028 mbar (+/- 25cm) RMS
- **Absolute Pressure Accuracy:** +/- 2 mbar
- **Temperature Accuracy:** +/- 1 C
- **Operating Temperature:** -20C to 70C
- **Current:** 20-120mA peak @ 5VDC (DBO433/DBO915), 20-130mA peak @ 5VDC (DBO868)
- **Dimensions:** (L x W x H): 82mm x 32mm x 18mm
- **Range:** 1Km (DBO433/DBO915), 5Km (DBO868)

- **Voltage:** 3.8 – 15 VDC
- **Weight:** 30g

## Pinout

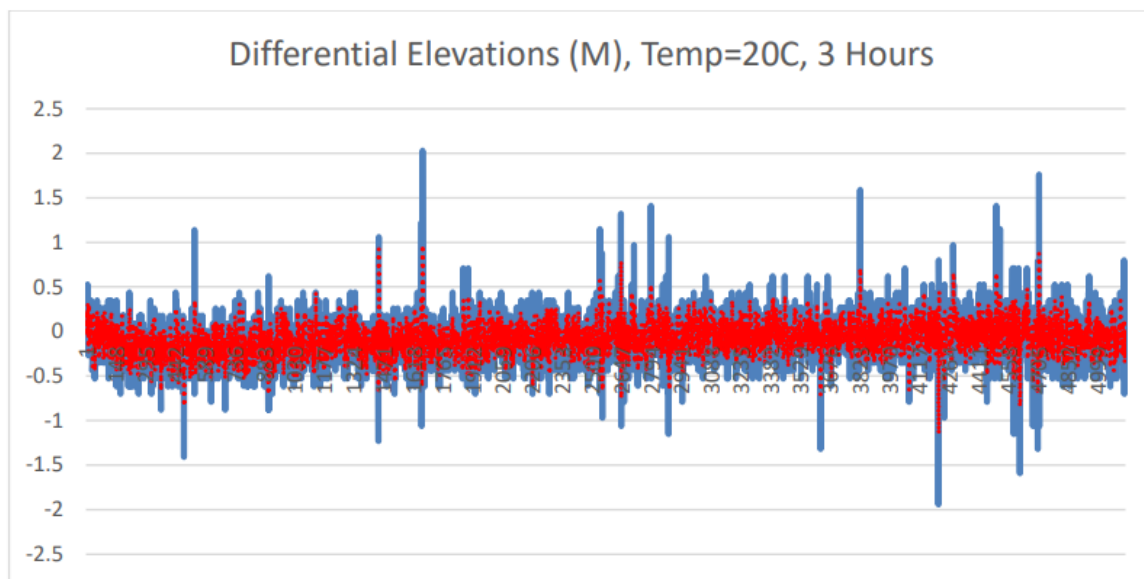
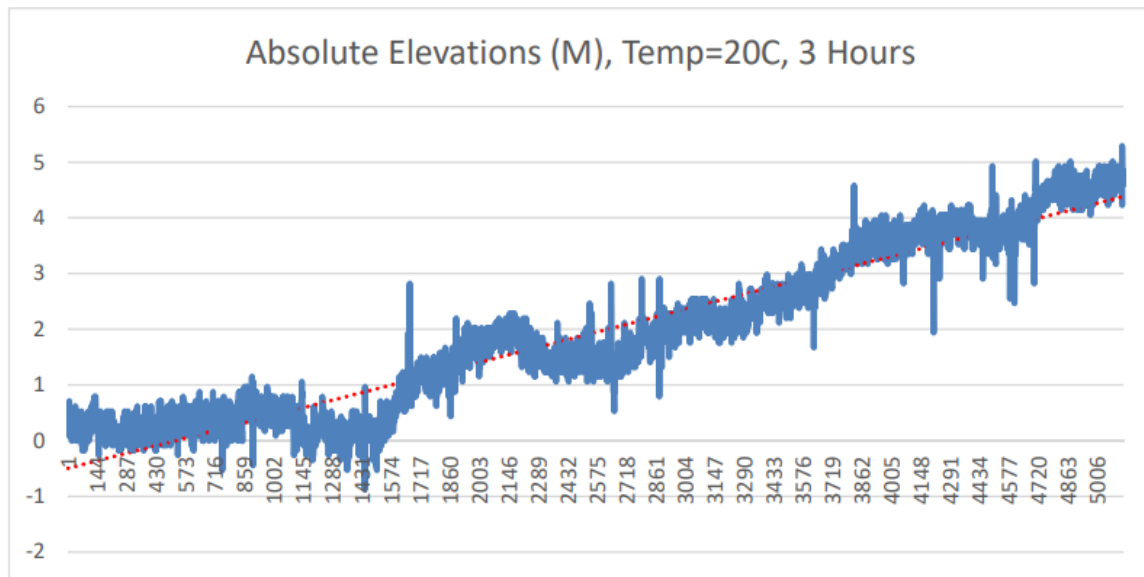


Pin	Description
ROVER	Rover mode jumper selection
BASE	Base mode jumper selection
BAT+	Battery supply (3.8 – 15 VDC)
GND	Ground
RXD	Serial data in
TXD	Serial data out
DTR/RTS	Serial flow control

Serial communication parameters are 9600bps (N,8,1). The DTR/RTS signal pin is only required to update the firmware.

## Typical Characteristics

Modules were stationary for testing at a set fixed datum elevation of 0m.



## Commands

The general command syntax is a command,{x{,y}} followed by CR+LF.

Command	Description
1,x	Set <i>NetID</i> , both base and rover must match. Valid range is x=1 to 999.
2,x	Set <i>NodeID</i> , every <i>NodeID</i> on <i>NetID</i> must be unique. Valid range is x=1 to 999.
3,x	Set <i>Units</i> . Metric x=0 (mb,m, C), Imperial x=1 (inHg,ft, F)).
4,x,y	Average <i>Elevation Datum</i> and <i>Base NodeID</i> (differential mode preset, rover only). Valid <i>Elevation Datum</i> range is x=-9999.99 to 9999.99. Valid <i>Base NodeID</i> range is y=1 to 999.
5,	Set <i>Elevation Datum</i> and <i>Base NodeID</i> from 4 (differential mode , rover only).
6,	Clear <i>Elevation Datum</i> (absolute mode, rover only).
7,	Resume differential mode if previously set (rover only).
8, x	Set inverse elevations (differential mode, rover only). Disabled x=0 (default), Enabled x=1.
9, x	Ping <i>Base NodeID</i> (rover only). Valid <i>Base NodeID</i> range is x=1 to 999.

## Output

On initialization the unit will send the string ASR DBOxxx v y.y where:

- xxx model number (433,868 or 915 MHz)
- y.y firmware revision number

### Base output format is as follows:

NetID,NodeID,B,Units,Local Pressure, Local Elevation, Local Temperature\*Checksum

### Rover output (absolute mode default) format is as follows:

NetID,NodeID,R,Units,Local Pressure, Local Elevation, Local Temperature\*Checksum

### Rover output (base telemetry ping response) format is as follows:

NetID,BaseNodeID,T,Units,Remote Pressure, Remote Elevation, Remote Temperature\*Checksum

### Rover output (differential mode) format is as follows, output will be ,A, (preset) until set:

NetID,NodeID,D,BaseNodeID,Units, Differential Pressure,Pressure Residual, Local Elevation Datum, Differential Elevation, Elevation Residual, Local Temperature,Remote Temperature\*Checksum

Checksum is a hex value calculated by applying XOR on each character in the string up to but not including the asterisk (\*). Base NodeID must be an available node in the rover telemetry stream output for commands 4 and 5 to output differential results. Command 8,1 is used to inverse the differential elevations at the rover when the base is moving relative to a stationary rover in mode A. When enabled the BaseNodeID in the differential output will be preceded by a negative sign. Sending 8,0 will set the module back to noninversed output (default). This would be useful in an application such as an altitude reference for a UAV where the base is onboard and transmitting results to a stationary rover on the ground.

## SETUP

The following is the initial setup procedure:

1. Select BASE jumper position on the base.
2. Send 1, NetID to base.
3. Send 2, NodeID to base.
4. Select ROVER jumper position on the rover.
5. Send 1, NetID to the rover.
6. Send 2, NodeID to the rover.
7. Send 3, Units to the rover.
8. Send 4, Elevation Datum, Base NodeID to the rover.
9. Send 5, to the rover (once datum residuals are acceptable in step 8).

NetID, NodeID, and Units settings are persistent and will be retained when power cycled. Only steps 8-9 above are required for a differential solution on subsequent power-ups. Do not move the modules during the calibration in step 8.

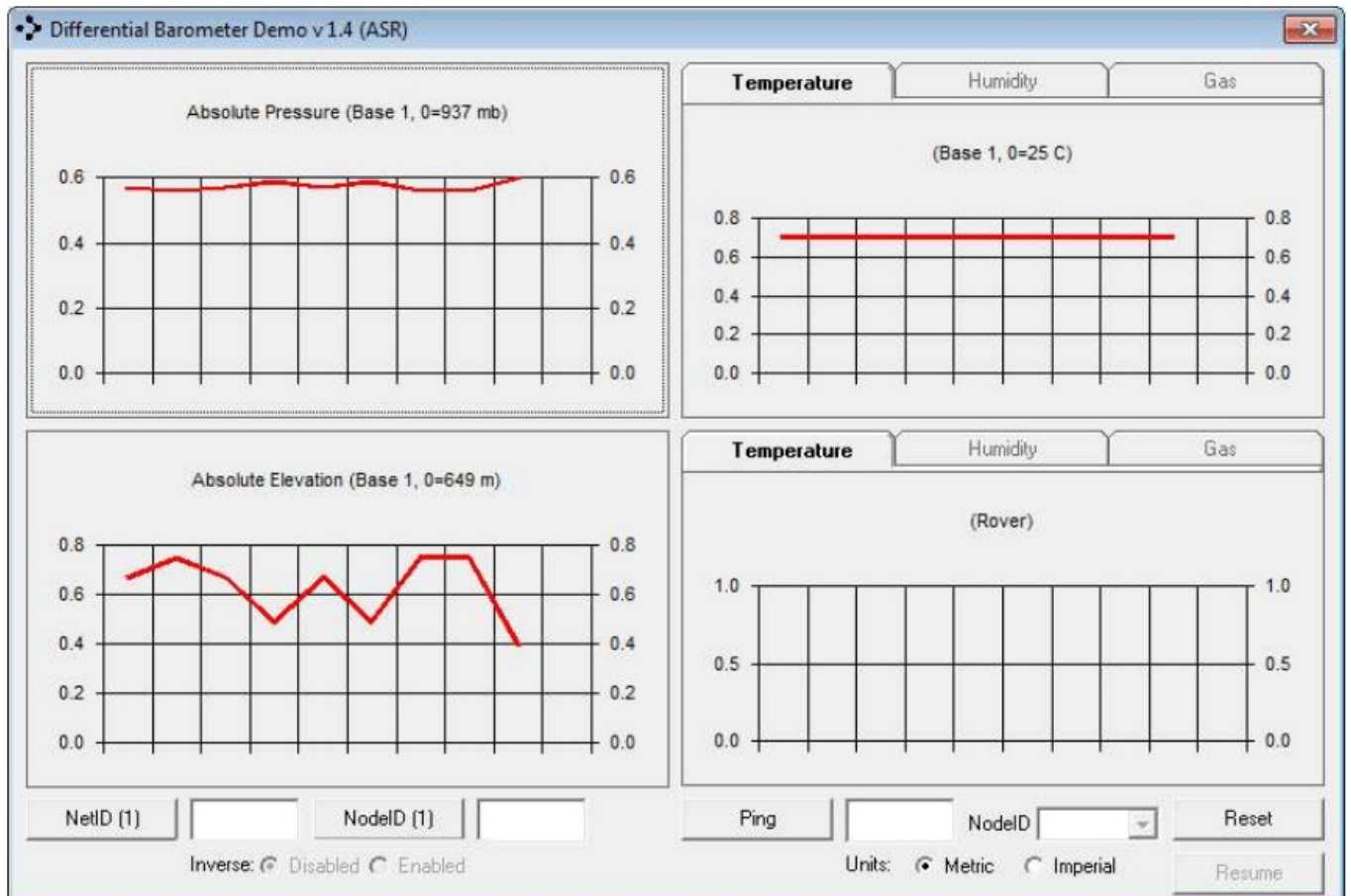
### Demo Software

The Differential Barometer Demo software is available for download on our website at <https://www.asr-web.com/support> and allows users to evaluate the capabilities of the system.

After installation edit the settings.txt file in the program installation directory to set the parameters.

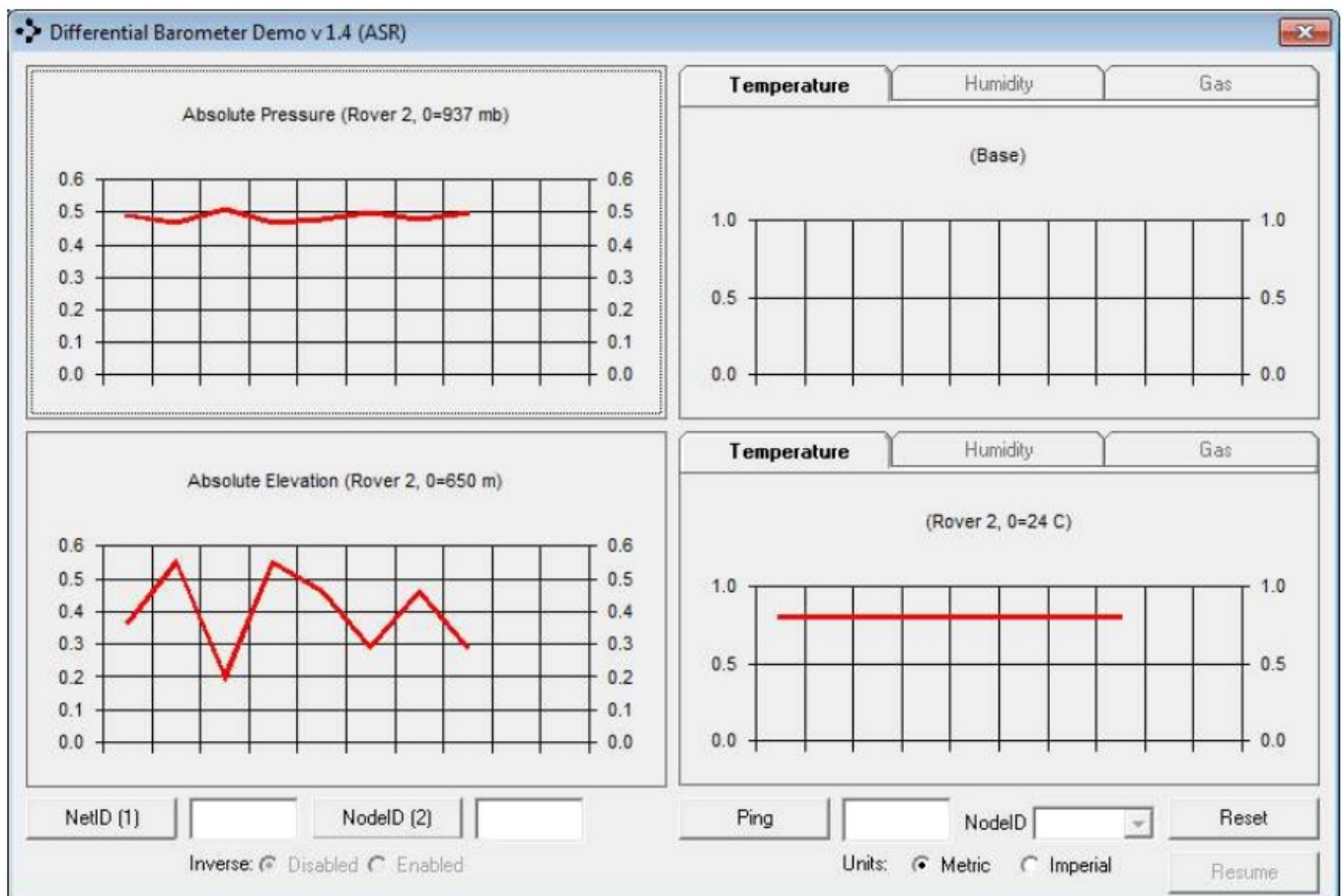
### Line 1: port number

When connected to the base, pressure and elevation graphs are absolute readings. Only the base temperature is displayed in this mode. The range corresponding to 0 on the graphs is shown in brackets in each title. The left buttons on the bottom left will be labeled NetID (x) where x is the current NetID and NodeID (y) where y is the current NodeID . To set a new NetID or NodeID enter it into the corresponding text box and click the button. The current Units can be changed on the bottom. In this mode the Datum button and NodeID combo box are disabled. The Reset button the right will clear the graphs.



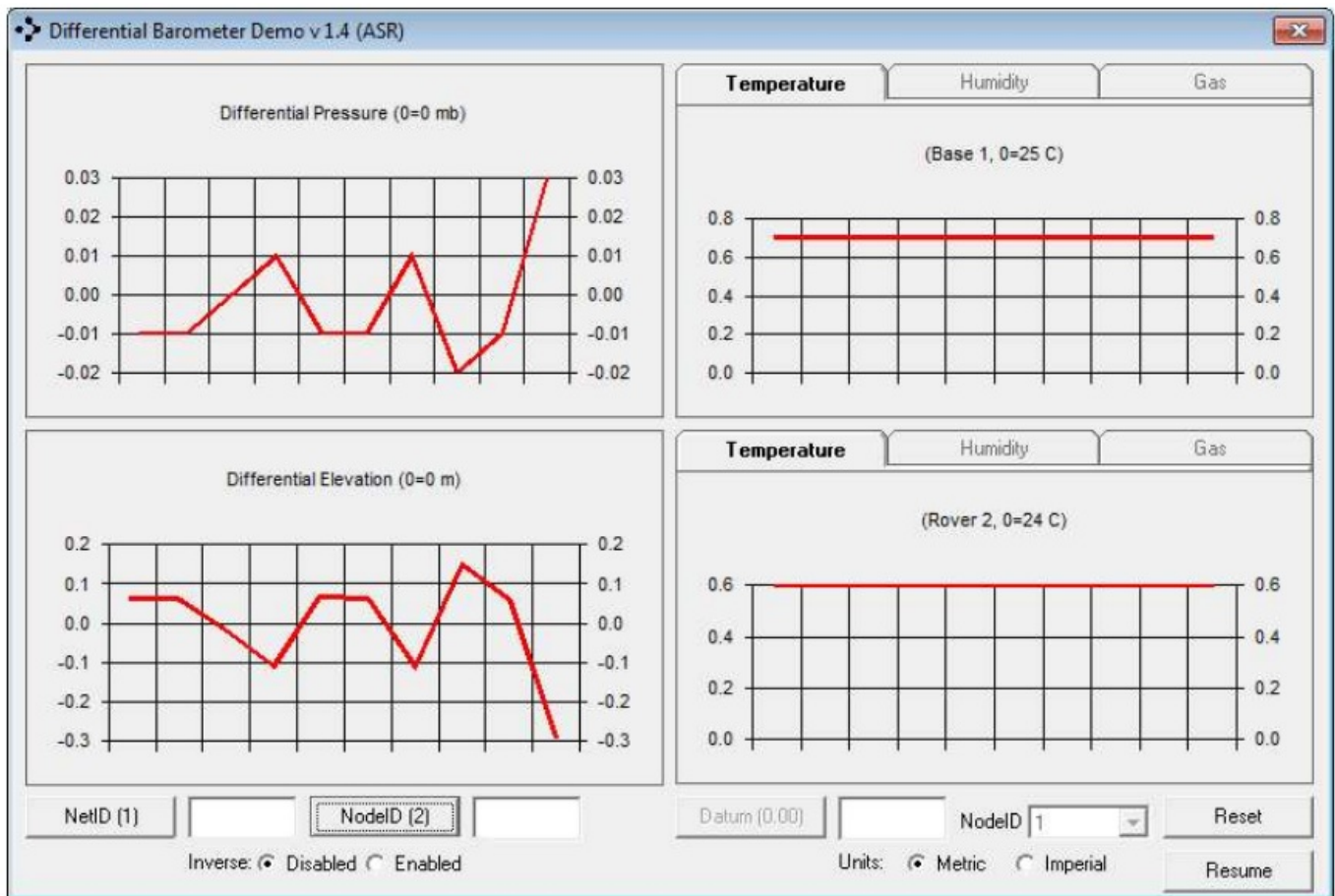
When connected to the rover, pressure and elevation graphs are absolute readings until a datum is set. Only the rover temperature is displayed in this mode. The range corresponding to 0 on the graphs is shown in brackets in each title. The left buttons on the bottom left will be labeled NetID (x) where x is the current NetID and NodeID (y) where y is the current NodeID. To set a new NetID or NodeID enter it into the corresponding text box and click the button. The current Units can be changed on the bottom. In this mode the Datum button and NodeID combo box on the bottom right are disabled until base telemetry is received on the same NetID. The Reset button to the right will clear the graphs.





When base telemetry is available the Datum button and NodeID combo box on the bottom right will become enabled. Absolute readings for available base telemetry can be viewed by choosing the Base NodeID using the NodeID combo box. To set the Elevation Datum enter it into the text box and click the Datum button. After the Datum button is clicked it will change to Adjust (x) where x is the current Elevation Residual as an average deviation from the preset datum, do not move the units during the calibration. To set the Elevation Datum click the Adjust (x) button and the label will change to Datum (y) where y is the current Elevation Datum and differential data will be displayed. In this mode both base and rover temperatures are displayed. The Reset button to the right will clear the graphs and return to absolute mode. The Resume button will continue with the previously defined differential solution.





A log.txt file in the application directory stores the output with a date/time stamp.

```

08/18/2021 1:47:57 PM,1,2,R,0,937.44,650.82,24.8,,*44
08/18/2021 1:47:58 PM,1,2,R,0,937.47,650.55,24.8,,*4D
08/18/2021 1:47:59 PM,1,2,R,0,937.46,650.64,24.8,,*4E
08/18/2021 1:48:00 PM,1,1,T,0,937.53,650.02,25.7,,*41
08/18/2021 1:48:01 PM,1,2,R,0,937.45,650.73,24.8,,*4B
08/18/2021 1:48:02 PM,1,2,R,0,937.49,650.37,24.8,,*47
08/18/2021 1:48:05 PM,1,2,A,1,0,0.00,0.00,0.00,0.00,0.00,24.8,25.7,,,*4E
08/18/2021 1:48:08 PM,1,2,A,1,0,-0.01,-0.01,0.00,0.09,0.04,24.8,25.7,,,*43
08/18/2021 1:48:11 PM,1,2,A,1,0,-0.01,-0.01,0.00,0.09,0.06,24.8,25.7,,,*41
08/18/2021 1:48:31 PM,1,2,A,1,0,-0.03,-0.02,0.00,0.27,0.19,24.8,25.7,,,*42
08/18/2021 1:48:33 PM,1,2,A,1,0,0.00,-0.02,0.00,0.00,0.18,24.8,25.7,,,*68
08/18/2021 1:48:36 PM,1,2,A,1,0,-0.03,-0.02,0.00,0.26,0.18,24.8,25.7,,,*42
08/18/2021 1:48:39 PM,1,2,A,1,0,-0.07,-0.02,0.00,0.62,0.22,24.8,25.7,,,*4F
08/18/2021 1:48:42 PM,1,2,A,1,0,-0.03,-0.03,0.00,0.27,0.22,24.8,25.7,,,*4B
08/18/2021 1:48:45 PM,1,2,A,1,0,-0.04,-0.03,0.00,0.36,0.23,24.8,25.7,,,*4D
08/18/2021 1:48:48 PM,1,2,D,1,0,0.02,0.01,0.00,-0.14,-0.09,24.8,25.7,,,*44
08/18/2021 1:48:50 PM,1,2,D,1,0,0.01,0.00,0.00,-0.05,0.00,24.7,25.7,,,*6D
08/18/2021 1:48:53 PM,1,2,D,1,0,0.03,0.02,0.00,-0.23,-0.18,24.7,25.7,,,*4D
08/18/2021 1:48:56 PM,1,2,D,1,0,0.03,0.03,0.00,-0.23,-0.27,24.7,25.7,,,*40

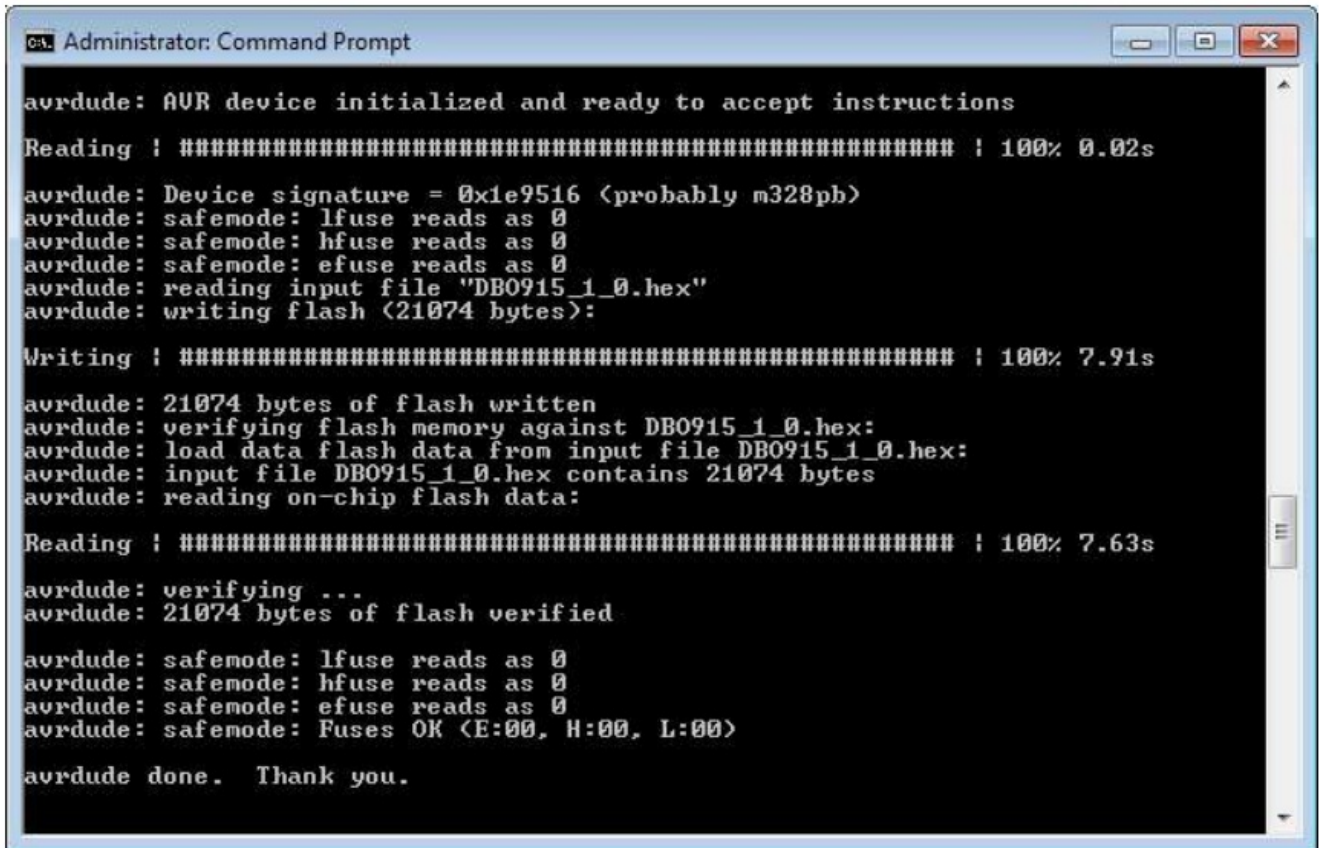
```

## Firmware Updates

Firmware updates are available for download on our website at <https://www.asr-web.com/support>.  
The following is the firmware update procedure:

1. Connect the OEM module to a USB-serial converter, the DSR/DTR line must be used.
2. Connect USB-serial converter to a port on your local machine.
3. Unzip the package.

4. Launch a command window.
5. Change the directory to the location of the package.
6. Invoke update.bat with a single parameter that specifies the serial port number to use.



```

Administrator: Command Prompt

avrdude: AVR device initialized and ready to accept instructions

Reading : ##### : 100% 0.02s

avrdude: Device signature = 0x1e9516 (probably m328pb)
avrdude: safemode: lfuse reads as 0
avrdude: safemode: hfuse reads as 0
avrdude: safemode: efuse reads as 0
avrdude: reading input file "DB0915_1_0.hex"
avrdude: writing flash (21074 bytes):

Writing : ##### : 100% 7.91s

avrdude: 21074 bytes of flash written
avrdude: verifying flash memory against DB0915_1_0.hex:
avrdude: load data flash data from input file DB0915_1_0.hex:
avrdude: input file DB0915_1_0.hex contains 21074 bytes
avrdude: reading on-chip flash data:

Reading : ##### : 100% 7.63s


avrdude: verifying ...
avrdude: 21074 bytes of flash verified

avrdude: safemode: lfuse reads as 0
avrdude: safemode: hfuse reads as 0
avrdude: safemode: efuse reads as 0
avrdude: safemode: Fuses OK (E:00, H:00, L:00)

avrdude done. Thank you.

```

## Documents / Resources

	<p><a href="#">ASR DBO433 Differential Barometer Altimeter OEM Module</a> [pdf] User Manual            DBO433, DBO868, DBO915, Differential Barometer Altimeter OEM Module</p>
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## References

- ➦ [Advanced Sensor Research Ltd. | Home | Whitehorse, YT](#)
- ➦ [Advanced Sensor Research Ltd. | Support | Whitehorse, YT](#)