ACOUSTIC DATA

Real Time Well Technology

AD250 USER MANUAL

USAGE INSTRUCTIONS FOR THE AD250 SYSTEM

Document Number: AD250-MAN-0001-02

Date: 09/Dec/2012

AD250

REVISION HISTORY

Revision	Author	Checked	Date	Notes
01	M Waters	M Tolley	5th Dec 2012	First Release
02	M Waters	M Tolley	9th Dec 2012	Fix Typo and Pagination

CONTENTS

1. GENERAL INFORMATION

1.1. Use of this Manual

This manual contains important safety and operating instructions for the safe and effective operation, maintenance and avoidance of causing minor malfunctions of the AD250.

Every person who works on or with the AD250 must be completely familiar with the contents of this manual, and he/she must carefully follow the important operating and safety instructions contained herein.

The English version has 26 pages.

1.2. Validity of this Manual

All of the specifications, provisions and instructions contained in this manual apply solely to standard versions of the AD250 delivered by Acoustic Data.

User manuals are available in electronic form from our website www.acousticdata.com.au

1.3. Use of Pictograms

Safety instructions and warnings are marked in this manual by the following pictograms.

WARNING
A WARNING refers to possible injury to the user or significant material damage to components of the AD250 system if the user does not (carefully) follow the procedures.

CAUTION!
Special data, restrictions and rules with regard to preventing damage

A procedure, circumstance etc which deserves extra attention

1.4. Liability

Acoustic Data can accept no liability for:

- Consequential damage due to use of the AD250.
- Possible errors in the manuals and the results thereof.

2. IMPORTANT SAFETY INSTRUCTIONS

WARNING!

This chapter describes important safety and operating instructions for use of an AD250 system in an oilfield environment.

2.1. General

1. Before using the AD250, read all instructions relating to the AD250 decoder, pickup and gauge.
2. To reduce the risk of electric shock, do not expose AD250 Receiver Unit to rain, snow, spray, moisture, excessive pollution and condensing environments.
3. Use of an attachment or spare part not recommended or sold by Acoustic may result in a risk of fire, electric shock, or injury to persons.
4. The AD250 decoder is designed to be permanently connected to an AC and/or DC electrical system. Installation of and work on the AD250 system, may be carried out only by a qualified, authorised and trained technician or electrician in compliance with the locally applicable standards and regulations.
5. Make sure all wiring is properly installed and in good electrical condition; and that the wire size is large enough for the AC ampere rating of the AD250 decoder. Check the wiring on a regular basis, at least once a year. Do not use the AD250 if the wiring is damaged.
6. Do not operate the AD250 Receiver Unit if it has received a sharp blow, been dropped, or otherwise damaged in any way; take it to a qualified serviceman.
7. Except for the Downhole Gauge battery section, the AD250 Gauge, Wellhead Sensor or Receiver Unit may not be opened or disassembled. There are no serviceable parts inside the housing. Take it to a qualified, authorized and trained serviceman when service or repair is required. Incorrect reassembly risks damage to equipment or facilities. Only qualified electricians are authorized to open the housing.
8. To reduce the risk of electric shock, disconnect the AD250 decoder from the AC / DC and pickup electrical systems before attempting any maintenance or cleaning.

9. The Zener Barrier must be provided with an appropriate equipment grounding connection. Grounding and all other wiring must comply with local codes and ordinances.
10. In case of fire, you must use the fire extinguisher that is appropriate for electrical equipment.
11. If applied in a marine application in the United States, external connections to the AD250 shall comply with the United States Coast Guard Electrical Regulations (33CFR183, Sub part 1)

2.2. Warnings regarding use of the Gauge

1. The AD250 Downhole Gauge is ***not*** an intrinsically safe instrument. During installation, or for any period where the gauge will reside within a hazardous zone, a suitable risk assessment or 'hot work' permit should be used in accordance with local working practices.
2. The AD250 gauge contains Lithium Sulfuryl Chloride, or Lithium Thionyl Chloride batteries. The maximum working temperature of these batteries should be observed at all times. Do not place or leave the gauge near extreme sources of heat. The gauge will be installed with either high temperature batteries or in some instances may be fitted with 'standard' industrial temperature versions. The maximum working temperatures are shown below:

Battery	Max Temp
Electrochem PMX150	150°C
Electrochem PMX165	165°C
Standard Lithium Thionyl Chloride (e.g. Saft, Tadiran etc)	80°C - 85°C

3. It is the operator's responsibility to observe the maximum safe working temperature of these batteries at all times.
4. The AD250 gauge is designed to operate in temperatures from -20°C to 125°C[1] . Operation of the equipment in temperatures lower or higher than this may cause the equipment to malfunction, to fail to record or store data, or to lose data previously obtained. Prior to running into the wellbore, store the gauge where it can be protected from extreme heat and cold.

2.3. Guarantee Specifications

1. Acoustic guarantees that this unit has been built according to applicable standards and specifications. Should work take place that is not in accordance with guidelines, instructions and specifications contained in this user manual, then damage may occur and/or the unit may not fulfil its specifications. All of these matters may mean that the guarantee becomes invalid.
2. The guarantee is limited to the costs of repair and/or replacement of the product. Costs for unit recovery, installation labour or shipping of the defective parts are not covered by this guarantee.

[1] The maximum operating temperature of the gauge and its associated electronics is 125°C. If a lower temperature is dictated by the type of batteries installed then this lower temperature limit must apply.

3. THE DOWNHOLE GAUGE

The AD250 Downhole Gauge is a device designed to measure Pressure and Temperature (P&T) in Oil and Gas wells. These data are then sent to the surface acoustically using our proprietary signalling technique.

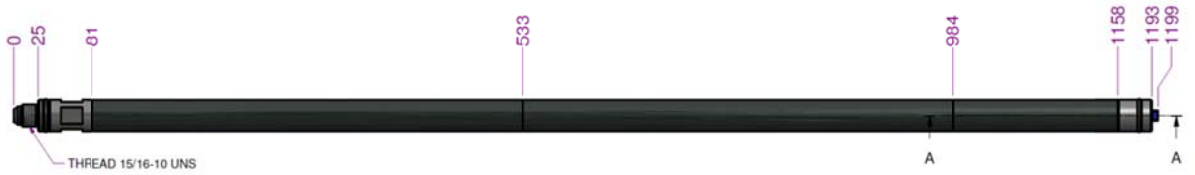


Figure 3.1 – The AD250 Downhole Gauge Important Dimensions

Physical	
Diameter	33.4 mm
Length	1199.0 mm
Housing material	Super Duplex (UNS S32760)
Deployment	Tubing Mounted (Collar or Weld on mount) or Wireline Hanger

Environmental	
Temperature rating	-20°C to 125°C
Pressure rating	10,000 psi
Battery life (storage)	3% loss in capacity per year at 25°C
Battery life (downhole)	Temperature and data rate dependent Predicted life at 125°C ≈2 years, at 50°C>3 years See example battery life prediction.
Battery Type	2x'C' cell, Lithium Sulfuryl Chloride or Lithium Thionyl Chloride

Operational	
Transmission range	2500m (maximum for low noise observation well) 2000m (predicted for average operational well)
Pressure Sensor Type	Piezo resistive, Keller
Pressure Accuracy	0.2% Full Scale (Over full temperature and pressure range)
Pressure Resolution	0.01 psi
Temperature accuracy	+/- 1 °C
Temperature Resolution	0.01 °C
On-board memory	32 Mb
Data Sets stored	>250,000

Table 3-1 – Downhole Gauge Specification

3.1. Gauge Installation

Any installation method must allow the gauge to be firmly mounted to the production tubular. This mounting must allow an acoustic signal to couple into the tubular successfully. We currently offer three methods of deployment depending on the design and economics of the well(s) concerned. The mounting method should be decided well in advance of gauge deployment. Speak to members of the Acoustic Data team to make sure the selected mounting method is correct for your situation. The following description of methods is not designed to be exhaustive.

3.1.1. WELDED GAUGE MOUNT

The simplest mounting method is to use our welded gauge mount. This allows the gauge to be mounted externally on the production tubular. In this instance the internal diameter of the casing must be large enough to accommodate both the production tubular and the gauge.

Figure 3.2 – Welded Gauge Mount

Consult drawings [1] and [2] for more information (available form Acoustic Data upon request).

The Welded Gauge Mount is Suitable when:

- The Gauge can be run in hole on the tubing during a well completion or work-over
- When measurement of annular pressure is required.
- When the most economical solution must be sought.
- If Gauge retrieval is not required during life of deployment

3.1.2. INLINE COLLAR MOUNT

Figure 3.3 – Inline Collar Gauge Mount

The Collar Mount is Suitable when:

- The Gauge can be run in hole on the tubing during a well completion or work-over
- When measurement of internal tubing pressure is required
- If Gauge retrieval is not required during life of deployment

3.1.3. WIRELINE DEPLOYMENT

The AD250 can be installed in a well via a wireline operation. This method allows wells that are not scheduled for workover to be retrofitted with an AD250 Gauge, for example to replace a failed Permanent Downhole Gauge.

Wireline deployment is Suitable when:

- The Gauge must be retrofitted to a well
- When measurement of internal tubing pressure is required
- If Gauge retrieval ***is*** required during life of deployment

3.2. Gauge Operating Schedule

The timing of Pressure and Temperature measurement is controlled by the Gauges on-board Microcontroller. This manages the internally programmed Gauge Schedule. Presently this schedule must be programmed by Acoustic Data before deployment. In due course, tools and training will be available to dealers and users to program the gauge anywhere. The Gauge Schedule may be reprogrammed by sending the unit back to Acoustic Data.

Up to 8 measurement schedules are currently programmable. The primary options that may be programmed in each schedule are indicated in Table 3-2 below.

Function	Description
Schedule Switch Time	The time at which the next schedule should start. Time is expressed in days, hours, minutes and seconds.
Measurement Interval	The time between P&T measurements expressed in days, hours, minutes and seconds. All measured data are stored on the gauges on-board memory. They are not necessarily transmitted acoustically to surface however.
Measurement Send Interval	This is the number of measurements that are taken before a Measurement is transmitted acoustically to surface. For instance an interval of 1 indicates that every measurement is sent, whilst an interval of 10 means that every 10th measurement would be sent. This allows the gauge to take many more readings than are transmitted and is useful in recording data during pressure build up tests. The gauge holds separate measurement intervals for both pressure and temperature. This means that energy efficiency may be maximised as not every temperature measurement is always needed

Table 3-2 – Primary Schedule Options

To demonstrate what is possible with the Gauge Schedule consider the schedule outlined in Table 3-3 below.

Schedule Number	Schedule Switch Time	Measurement Interval	Pressure Send Interval	Temperature Send Interval
1 **Initial Deployment**	0 schedule 1 must start immediately	10 minutes	1 send every pressure measurement	1 send every temp measurement
2 **Long Term Monitoring**	1 day	6 hours	1 send every pressure measurement	28 send only 1 in 28 temp measurements
3 **Scheduled Pressure Build-up**	1 Year	10 seconds	60 send a pressure measurement every 10 minutes	0 do not send temperature in this schedule
4 **Back to Long Term Monitoring**	1 Year, 1 Day and 12 Hours	6 hours	1 send every pressure measurement	10 send only 1 in 10 temp measurements

Table 3-3 - Example Gauge Schedule

In this instance the Gauge is initially setup to take and send a reading every 10 minutes. This is useful during deployment so that signal integrity can be monitored as the tool is 'run in hole'.

The second schedule starts after 1 day (24 hours). At this point the gauge switches to a much lower data rate to provide the best battery life, and only sends a temperature measurement once per week (24*7 / 6).

The third schedule provides a period of faster data rate. Pressure and Temperature are measured every 10 seconds and stored to memory, whilst the gauge sends a pressure measurement every 60 samples (10 minutes) and does not send Temperature data. In this manner a prescheduled pressure build up test may be monitored and the entire pressure build-up can be downloaded from the gauge when it is retrieved (at some future well work over)

After 36 hours the fourth schedule puts the gauge back into long term monitoring mode for the rest of its life, or if programmed, until the next Schedule occurs.

3.3. Turning the Gauge On

Once the measurement schedule has been advised by the user, and the downhole gauge units programmed accordingly by Acoustic Data, activation of a gauge at wellsite is a simple process. The bleed screw / activation switch on the end of the gauge is turned clockwise using an 8mm spanner until tight. The gauge is then installed onto its mount.

Tightening the bleed screw simultaneously seals the gauge and connects the gauge battery pack. The gauge will then start working through the Gauge Schedule, the first signal occurring after 1 minute.

WARNING

The bleed screw is a critical safety device of the AD250 Downhole Gauge. By necessity it opens a path from the Gauge internals to atmosphere to allow internal gasses or fluids to be released in the event of a battery failure or a body leak. Failure to tighten the bleed screw before deployment will result in a failure of the pressure integrity of the Downhole Gauge – i.e. it will leak immediately.

3.4. Retrieving the Gauge after deployment

WARNING

Safe work procedures of the wellsite operator must be adhered to. No instruction in this User Manual (expressed or implied) shall relieve the user of their responsibility to perform their own risk assessment in accordance with local standards.

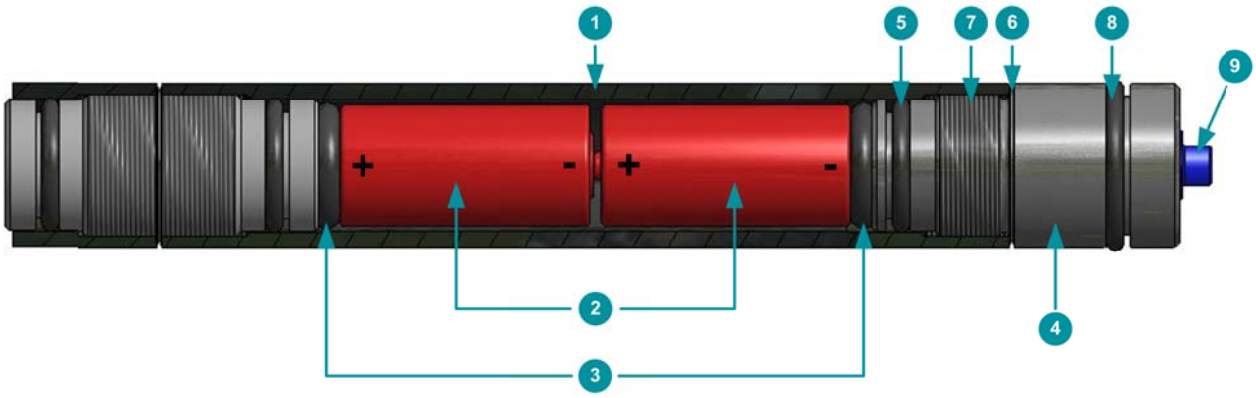
When a Gauge is retrieved from the well it is important to ensure that the gauge is made safe for transport.

- Make sure the area that the Gauge is to be unloaded into is safe at the time of retrieval. This is typically performed under a ‘hot work permit’ or similar local standard.
- CHECK! Was the Gauge known to be working when retrieved from the well; are there any signs of damage to the gauge upon first inspection; is there any reason to suspect that the Gauge may have leaked? If so open the bleed screw with caution.
- The bleed screw must be opened before the Gauge can be considered safe to transport. This should only be performed by a person with adequate personal protective equipment. This should include as a minimum, a full face visor, hand and arm protection.
- Make sure the gauge is opened in a well-ventilated area.
- Open the bleed screw slowly until at least 5mm of thread are visible.
- If any gas or liquid is released the batteries should be considered damaged and handled in accordance with local ordinances regarding vented Lithium Metal batteries. The manufacturer’s websites have more information on this.
- In any instance a damaged Lithium Metal battery is forbidden to be shipped on aircraft of any type.

3.5. Battery Installation or Replacement

The Downhole Gauges batteries may be replaced by the user if required. It is preferable that the Gauge is sent back to Acoustic Data to perform this process as the Gauge may be functionally tested at the same time. We understand however that where deployments are frequent the user may wish to perform this function themselves. If a battery replacement is to be performed the following equipment will be required:

- A clean and well lit workshop environment.
- A pipe vice or similar with shaped jaws that will allow the tubular section of the gauge containing the batteries to be held securely without damage. A standard vice is not suitable for this operation.
- An Acoustic Data Battery Compartment tool that will allow the Battery Endcap to be removed. Do not use Stilsons or similar for this operation as damage will result.
- An Acoustic Data seal replacement kit. This comprises a replacement O-ring, Metal to Metal C-seal and Parker TL22 Anaerobic Threadlocker, and Battery Compartment Tool.
- Replacement Battery Kit, comprising of two batteries sourced from Acoustic Data, or from an authorised representative of the recommended battery company.



Item	Description
1	Battery Tubular Section
2	Lithium Metal Batteries
3	Battery Location O-ring
4	Battery Endcap
5	Battery Endcap O-ring Seal
6	Battery Endcap Metal to Metal C-seal
7	Battery Endcap Thread
8	Gauge Mount Centralising O-ring
9	Bleed Screw / Activation Switch

Figure 3.4 – The AD250 Battery Pack Assembly & Key

The following procedure assumes that the tool had been safely retrieved from the well, the bleed screw opened and no gas and or liquid released from the vent.

- Secure the tubular section of the gauge containing the batteries in a pipe vice.
- Using the Battery Compartment Tool, unscrew the Battery Endcap in a counter clockwise direction. Significant force may be required to break the existing Threadlocker in the endcap. Once movement has started the Endcap should turn relatively easily with no tight spots.
- ⚠ CAUTION! Super Duplex and Inconel materials are both prone to galling. If the Endcap tightens and becomes hard to turn, **stop immediately** as any extra force will likely only make matters worse. The gauge should be sent back to Acoustic Data at this point for recovery.
- Once removed, clean the existing Threadlocker from the Battery Endcap thread. This may be performed with a brass wire brush and IPA alcohol.
- Inspect the thread and sealing areas for any signs of damage. Damaged units should not be reassembled due to the probability of leakage.
- Inspect the O-ring seal and replace if necessary.
- In any instance the Metal to Metal C-seal ***must*** be replaced.
- Remove the old batteries and Battery Location O-rings and dispose of the batteries at an approved site.
- Re-install the first Battery Location O-ring
- Insert the new batteries (referring to Figure 3.5). The AD250 is capable of receiving batteries in either orientation (but they must be installed in series positive to negative). Lithium Batteries typically have a greater capacity when their positive connection is placed upright with respect to gravity.
    - If the Gauge is to be deployed ‘Head down’ (i.e. with the battery end closest to surface) the Batteries should be placed into the device negative end first.
    - If the Gauge is to be deployed ‘Head up’, then batteries should be inserted positive end first.
- Insert the second Battery Location O-ring
- Slip the Metal to Metal seal over the end cap
- Screw the Battery Endcap into the battery tube with a small amount of Parker TL22 Threadlocker on the Endcap thread. To apply the right amount, place four lines of Threadlocker from the top of the thread to the bottom equispaced at 90° around the thread.
- Tighten the Endcap until the Metal to Metal seal is crushed to 1.0mm ±0.05mm.
- Allow the Threadlocker to set for 24h before deployment.

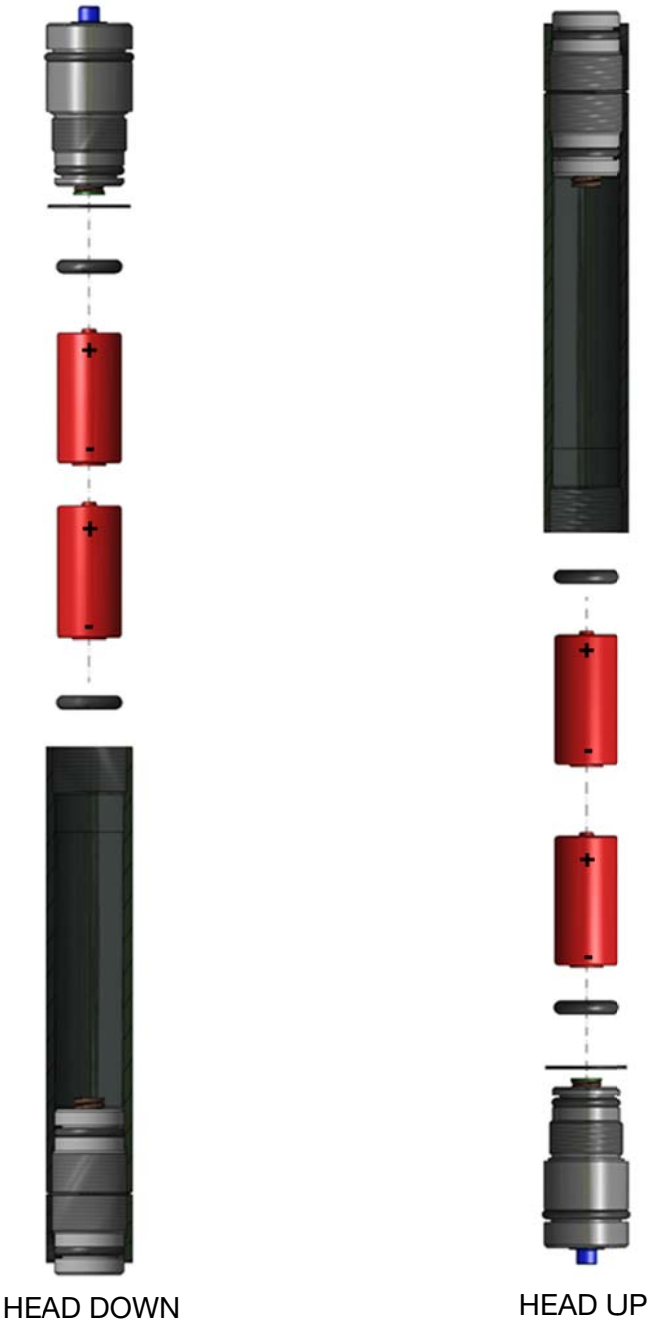


Figure 3.5 – Battery Compartment Re-assembly & Battery Orientation

3.5.1. SUITABLE BATTERIES

Table 3-4 contain a list of the batteries currently approved for use in the AD250 Downhole Gauge.

Battery	Cell Size	Mft Part No.	Chemistry	Temperature Range
Electrochem PMX150	C	3B3700	Sulfuryl Chloride	-20°C to 150°C
Electrochem PMX165	C	3B5100	Sulfuryl Chloride	-20°C to 165°C

Table 3-4 – Suitable Batteries

4. THE WELLHEAD SENSOR

Signals from the Downhole Gauge are received at surface by the Wellhead Sensor. This comprises an intrinsically safe ATEX certified accelerometer mounted vertically, in most instances, to the tubing hanger section of the wellhead via a mounting plate.

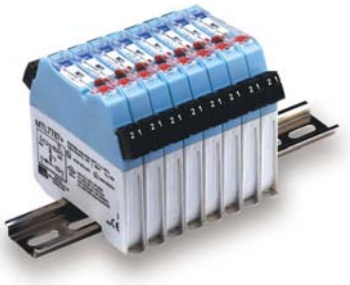
Wellhead Sensor	Zener Barrier
	

Figure 4.1 – Wellhead Sensor and Zener Barrier

Physical	
Type	Accelerometer, Monitran MTN/1100IC
Height	41 mm
Diameter	25 mm
Hazardous Zone Rating	ATEX & IECEx Certified Group II Intrinsically Safe Accelerometer to Ex ia IIC T6
Cabling	Overbraided twin core screened ETFE cable.
Cable length	10 m (Extensions may be made by use of junction box and cable glands - available on request)
Mounting	Metal Plate fixed to a wellhead bolt or optional Magnetic Mount MM001

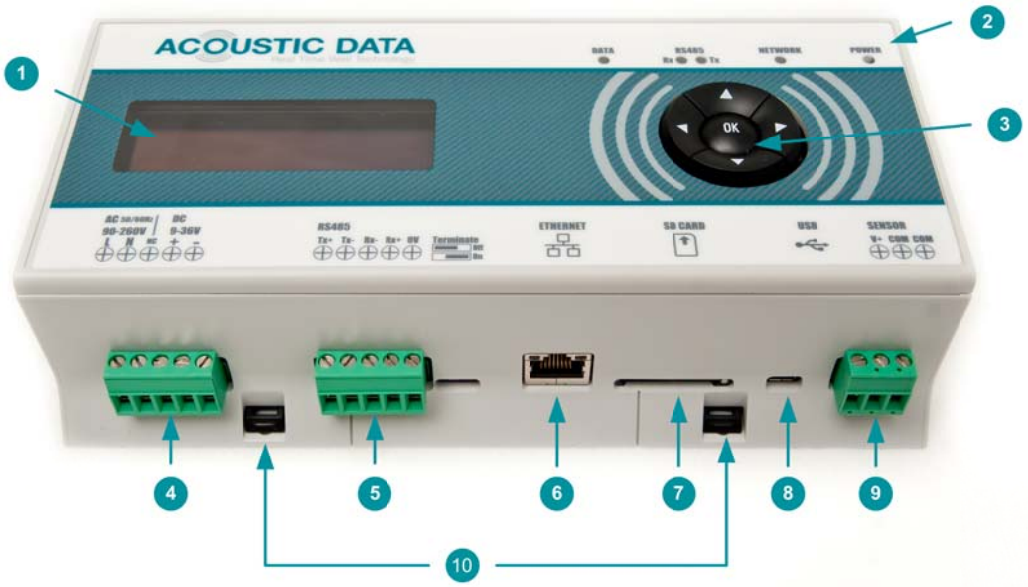
Environmental	
Temperature rating	T6 (-55°C ≤ Ta ≤ +65°C)
IP rating	IP67

Table 4-1 – Wellhead Sensor Specifications

4.1. Sensor Wire Routing

The sensor wire should be routed to the location of the Receiver Unit by which ever means is appropriate under local ordinances and appropriate to whichever hazardous zone the accelerometer is mounted in (this varies around the world, but is usually an ATEX Zone 1 environment).

5. THE RECEIVER UNIT



Number	Description
1	OLED Display
2	LED Indicators for Power, Network (Ethernet), RS485 and Acoustic Data
3	Menu Navigation Keypad
4	Power Terminal (Mains and DC)
5	RS485 Terminal (Isolated)
6	Ethernet Network Connector
7	SD Card Slot
8	USB Connector
9	Wellhead Sensor Terminal
10	Din rail clips

Figure 5.1 – The AD250 Receiver Unit and Key

Physical	
Width	110.0 mm
Length	210.0 mm
Depth	53.5 mm
Mounting	DIN rail
Display	4x20 line OLED
SCADA data link	MODBUS RTU (RS485) Ethernet
Hazardous Zone Rating	None
Onboard memory	4 GB SD Card as per 5.4.2.2
Data Sets stored	>2,500,000

Environmental	
Temperature rating	-40°C to 80°C
IP rating	None. Recommend installation into typical DIN rail IP65 enclosure with Zener barrier. (Outer enclosure with DIN rail mounting and cable gland entry optional)
Power Supply	90-260Vac or 9 – 36Vdc Consumption 3W max

Table 5-1 – Receiver Unit Specifications

5.1. Suitable Housings

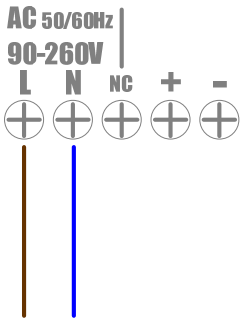
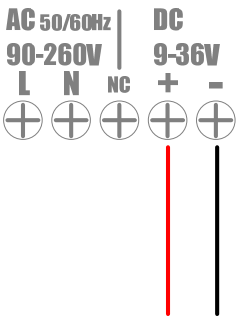
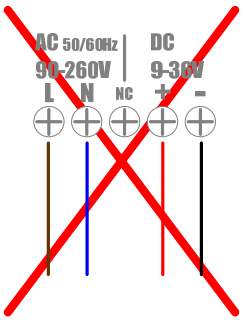
The AD250 Receiver Unit has been designed to be mounted in an industrial standard DIN rail housing. This allows maximum compatibility with existing wellsite SCADA infrastructure. If there are no existing housings then the Receiver Unit should be mounted in an enclosure with appropriate IP protection for the mounting position.

External Housings are available from Acoustic Data upon request.

5.2. Electrical Connections

5.2.1. POWER

The AD250 Receiver Unit may be powered from a range of power supplies. Both Mains AC and DC supplies can be used. It is recommended in any application that a low voltage DC supply (12-24V) is used to reduce the risk of electric shock.

Mains AC Supply	DC Supply	Do not use
		
WARNING When using mains inputs adequate protection must be provided to prevent operators contacting the live mains ternminals		CAUTION! Damage may result from wiring both an AC and a DC power supply
Input Isolation: 3kVAC	Input Isolation 1.5kVDC	

5.2.1.1. DC input isolation bypass

In instances where the AD250 Receiver Unit is powered from a Solar Panel and backup battery arrangement, it is useful to monitor the backup batteries voltage. The AD250 unit is capable of doing this and reporting the information both on screen and via the MODBUS® interface.

To perform this function however the DC input isolation must be bypassed by jumpers located within the unit itself. This must be performed at the factory and users must specify this requirement prior to delivery.

5.2.2. RS 485 MODBUS RTU

Electrical Connection to the AD250 Receiver Units isolated RS485 port should be made as described in Figure 5.2

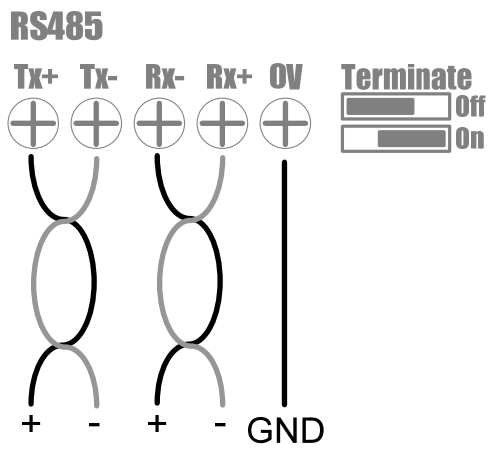
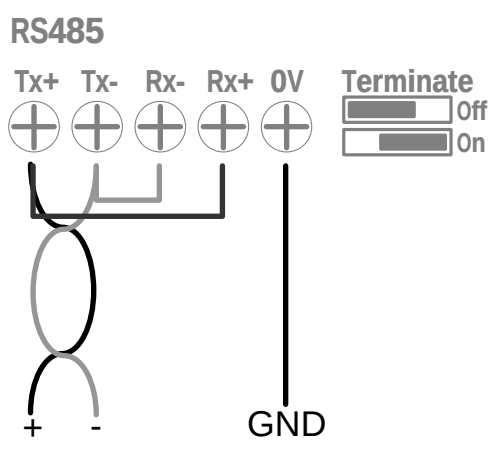
4W Configuration (5 Wires)	2W Configuration (3 Wires)
	
Wire: Twisted Pair 2 Pair (e.g. Belden 9842) Size: 24 AWG Characteristic Impedance: 100-120Ω	Wire: Twisted Pair 1 Pair (e.g. Belden 9841) Size: 24 AWG Characteristic Impedance: 100-120Ω

Figure 5.2 – RS458 Electrical Connections

For more information on the AD250's MODBUS® implementation, including full port specifications and the associated MODBUS® map, please consult [3] (available from Acoustic Data on request)

5.2.3. ETHERNET MODBUS TCP

The Ethernet networking operation of the AD250 receiver unit is currently under development and is expected to be supported (via a firmware update) in the near future.

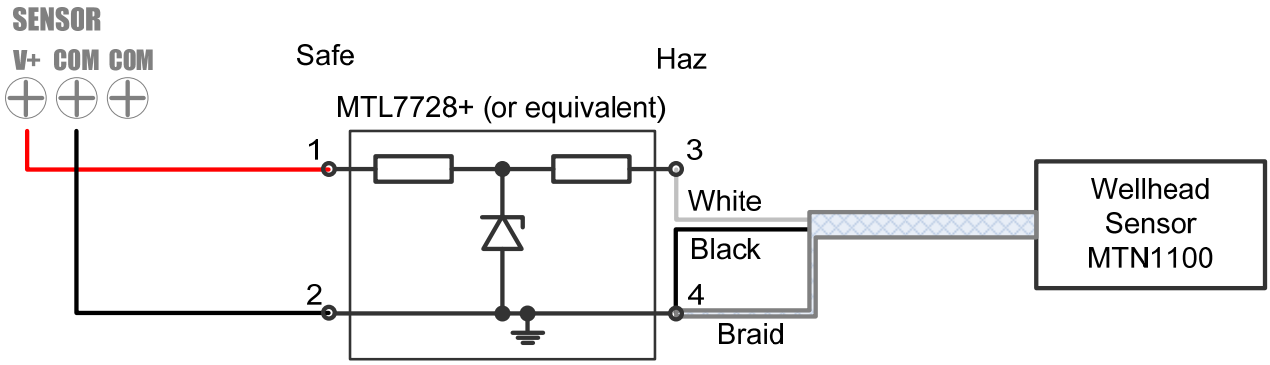
5.2.4. USB

The USB PC link function of the AD250 receiver unit is currently under development and is expected to be supported (via a firmware update) in the near future.

5.2.5. WELLHEAD SENSOR VIA ZENER BARRIER

Connection to the Wellhead Sensor is made via an MTL7728+ (or equivalent) Zener Barrier. The Zener Barrier and Wellhead Sensor form an 'intrinsically safe' (IS) circuit that is suitable for installation into hazardous zones[2].

Wellhead Sensor Connection Via Zener Barrier



WARNING

An adquate earth terminal must be provided within the AD250 Receiver Units external enclosure. If this is not provided or is inadequate the protection afforded by the Zener Barrier will be invalidated.

If an adequate earth terminal is not available connection may be made using a Galvanic Barrier. Please consult Acoustic Data.

Figure 5.3 – Wellhead Sensor Connection Via Zener Barrier

5.3. The Config.txt file

The AD250 offers a flexible means of setting default values that will be loaded upon a unit's power cycle (i.e at boot-up). The unit uses a 'Config.txt' file that contains a human readable interface to set default settings

Use of this file means that default settings can be changed by an Acoustic Data engineer and simply transferred to the appropriate unit without the need to perform more complex menu functions at wellsite.

Before starting any installation, check that the Config.txt file is present on the SD card.

[2] It is the operator's responsibility to assess the certifications provided for any equipment rated for use in a hazardous zone. Please check that certification provided is suitable for local ordinances and applicable hazardous zone legislation.

5.4. Receiver Unit Operation

The following descriptions are provided when using the Receiver Units OLED screen and Navigations buttons. For MODBUS® functionality consult [3]

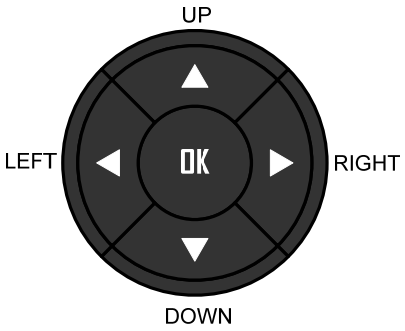
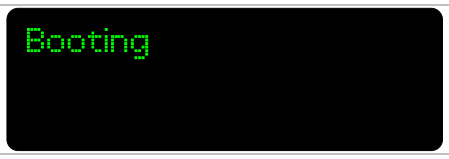
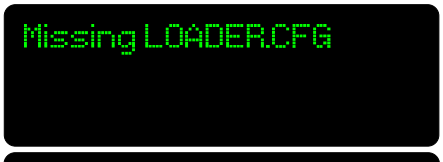
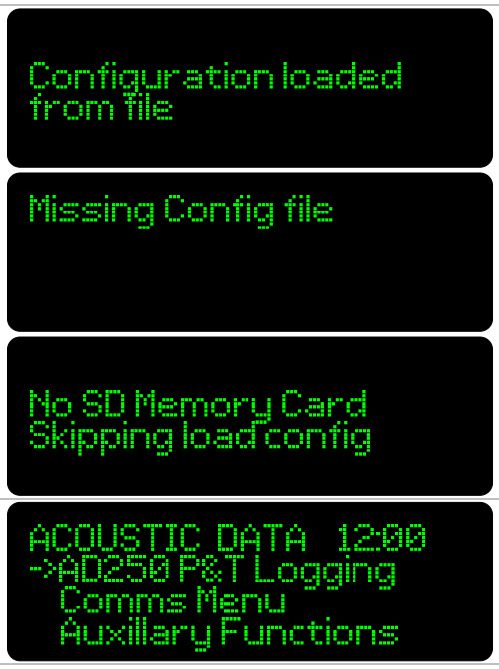
The OLED Screen	The Navigation Buttons
	
Menu Display: Three menu items are displayed at one time. The arrow on the left indicates the currently selected option. When pressing UP and DOWN keys: If there are only two options the arrow will move up and down. If there are three or more items the arrow will remain stationary and the text will cycle through the selections	General Menu Navigation: UP: Menu Selection Up, Increase selected value DOWN: Menu Selection Down, Decrease selected value LEFT: Go back a Menu layer without executing RIGHT: Execute highlighted item OK: Execute highlighted item

Figure 5.4 – General Menu Navigation

5.4.1. POWER-UP SEQUENCE

When power is first applied to the unit the power LED will flash three times, and the following screens will be displayed.

The unit is checking for the presence of an SD Card and for any new firmware present on that SD card. Display time: Approx 2 secs	
Missing LOADER.CFG – No firmware found on SD card (this is the most likely option in a factory delivered state) Firmware Unchanged – Firmware present on SD Card, but has already been loaded. If new firmware has been found then the device will enter the firmware update application. No user input is required; simply wait for the operation to complete.	 

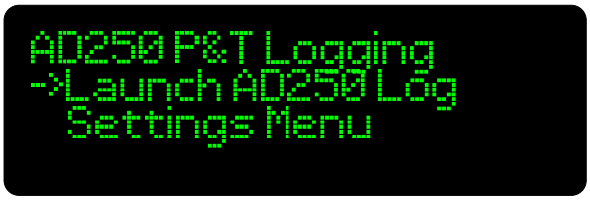
The next phase indicates whether the device has found a Config.txt file on the SD Card. Configuration loaded from file – File was found and default settings have been changed to match the file. Missing Config file – No Config file was found – default application values will be used. No SD Memory Card Skipping load config – No SD card inserted – default application values will be used	
Default screen - booting complete	

5.4.2. AD250 P&T LOGGING APPLICATION

To run the AD250's main application simply press OK or RIGHT keys to select the AD250 P&T Logging menu. 'Launch AD250 Log' will appear.

Press OK or RIGHT keys again to run the AD250 P&T logging application, or press DOWN and OK or RIGHT keys to enter the application settings menu.

For the most part changes to the application settings should only be made by a qualified Acoustic Data Technician or by a qualified technician.



AD250 Settings Menu	Description	Default Values
Display Units	Change display units for Pressure and Temperature	Pressure = bar (absolute) Temperature = °C
Manual Mode	Allows detection threshold to be set manually. Acoustic Data Technicians only	Off
Streaming Mode	Serial Data streaming. Acoustic Data Technicians only	None
Signal Settings	Automatic Gain Control Settings Acoustic Data Technicians only	Various
Detection Settings	Detection Threshold Settings Acoustic Data Technicians only	Various
Packet Settings	Signal Encoding Settings Acoustic Data Technicians only	Various
Filter Settings	Filter and Noise Reduction settings Acoustic Data Technicians only	Various

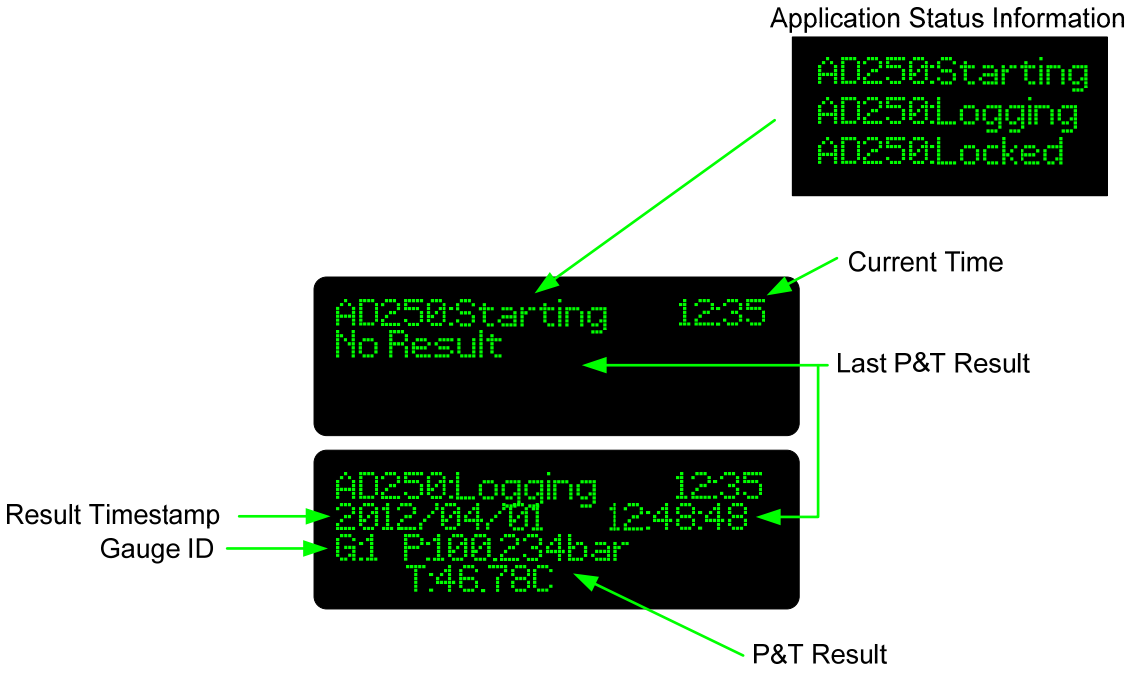


Figure 5.5 – AD250 Application's Main Screen

5.4.2.1. Understanding the AD250 application flow

The AD250 P&T logging application is (by default) fully automatic and should cope with most background noise conditions (including changeable conditions). In the majority of installations the user will simply start the application and wait for data to arrive.

With reference to Figur 5.4, when the logging application is first started, the data light will illuminate for about 3 seconds. The application status information will display 'Starting'. After starting, the application status information will display 'Logging'.

During the initial period the unit will adjust various internal settings to optimise the unit for the prevailing noise conditions. During this time the unit will set the optimum detection threshold possible to retrieve low strength signals.

The system will wait for an acoustic data packet to be received and successfully decoded. Once successfully decoded the system learns from the received data and will adjust its internal settings accordingly. The application status information will change to 'Locked'. Internal settings are now optomized and set.

The system is capable of adjusting its internal settings in the 'locked' state to cope with any changes in noise condition and/or signal strength.

Once the system has decoded a pressure and temperature data packet, the main screen will update from displaying 'No Data' to display the information contained in the last received packet. Previously received data may be reviewed by pressing the Left and Right Navigation Buttons. The last 10 readings are available by scrolling.

Whilst the AD250 application is running, the Navigation Buttons have the following functionality.

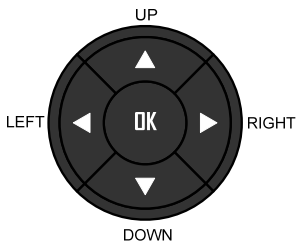
AD250 Application Navigation Buttons	
	UP: None DOWN: Remove Threshold Lock (Press twice to remove) LEFT: Cycle through last 10 received packets RIGHT: Cycle through last 10 received packets OK: Exit application (Press twice to exit)

Figure 5.6 – AD250 Application Navigation Buttons

5.4.2.2. SD Card Data Storage

SD Card Specification	Description
Size	4GB
Class	10 or better
Temperature	-40 to 80°C
Example	SANDISK Extreme and Extreme Pro cards 4GB to 16GB

Figure 5.7 – Minimum SD Card Specification

All data received and decoded by the AD250 Receiver Unit are logged to the SD Card. Whilst the application is running the SD card must remain inserted. The application can be stopped at any time and the SD card may be removed and read by any standard PC with an SD card slot (or USB card reader).

Three files are created every time the AD250 application is run. The file name will start with the date and time that the application was first run with the following names appended to each file:

File Name	Description
2012-12-01-20-05-40-DAT.txt	Pressure and Temperature Data File
2012-12-01-20-05-40-STA.txt	Gauge Status Log File – contains useful information received from the Downhole gauges status packet
2012-12-01-20-05-40-PAC.txt	Packet Log – Useful for Acoustic Data Technicians

Figure 5.8 – AD250 Application File Names

The data layout is designed to import easily into Excel or similar spreadsheet program.

5.4.3. COMMUNICATIONS MENUS

The 'Comms Menu' (see Figure 5.3) allows MODBUS® variables to be changed and saved. To be saved the SD card must contain an appropriate Config.txt file. Changes will be made without an SD card inserted or without the appropriate file but they will not be saved. Any loss of power in this instance will cause the unit to revert to default values.

Comms Menu	Description	Default Values
Enable MODBUS RS485	Enable MODBUS communications on RS485 port	Off
MODBUS Address	Set address (1-247)	1
Baud Rate	MODBUS baud rate 9600 or 19200	19200
Parity	Even, Odd, None	Even

5.4.4. AUXILIARY FUNCTIONS

The Auxiliary Functions menu (see Figure 5.3) contains further applications to assist in the diagnosis of background noise conditions and system function:

Auxiliary Functions Menu	Description
Full Noise Survey	Measure the background noise and stream the result to a data file on the SD Card. This application will take a variety of 'Single Noise Records' with varying settings and will override any settings in the Noise Settings menu.
Single Noise Record	Measure the background noise and stream the result to a data file on the SD Card. This will perform a single record using settings taken from the Noise Settings menu. This program can also be used to record the strength of received signals for later diagnosis by an Acoustic Data Technician.
Noise Settings Menu	Contains settings for the Single Noise Record
System Monitoring	Allows the monitoring of Receiver internal system temperature and input voltage (if the input isolation is bypassed). This is a test program that is used in the factory to qualify units, and is left enabled should logging of the internal temperature be required by the user.
Serial Streaming	Application to stream Wellhead sensor data to the RS485 port Acoustic Data Technicians only  Do not select this option whilst the unit is connected to an RS485 MODBUS network.

5.4.4.1. Full Noise Survey

From the Auxiliary Functions menu select ‘Full Noise Survey’.

Whilst performing this function the AD250 Receiver Unit ***does not*** receive or decode incoming data from Downhole.

The Full Noise Survey simply runs a selection of ‘Single Noise Records’ with defined parameters. See 5.4.4.2 for more details.

5.4.4.2. Single Noise Record

From the Auxiliary Functions menu select ‘Single Noise Record’.

Whilst performing this function the AD250 Receiver Unit ***does not*** receive or decode incoming data from Downhole.

Figure 5.9 – Noise Recording Screen

A Noise Monitoring file will be produced, one for each noise record. The filename will start with the date and time the file was started and will have the extension ‘.dat’.

Progress is indicated by percentage indicator that increments in 10% steps.

5.4.4.3. Noise Settings Menu

The Noise Settings menu allows users to set the parameters used for a single noise record.

Noise Settings Menu	Description	Default Values
Analog Gain	The Analog input gain (x1 to x64)	x1
Sample Rate	Set the sampling rate (2,000 SPS to 30,000 SPS)	7500 SPS
Record Duration	Set the record time (1 Minute to 10 Hours)	1 Minute

5.4.4.4. System Monitoring

From the Auxiliary Functions menu select ‘System Monitor’.

Whilst performing this function the AD250 Receiver Unit ***does not*** receive or decode incoming data from Downhole.

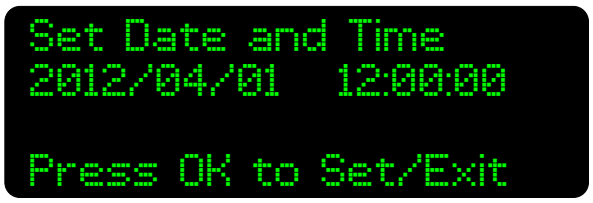
If an SD card is inserted the core temperature and battery voltage will also be logged to a text file.

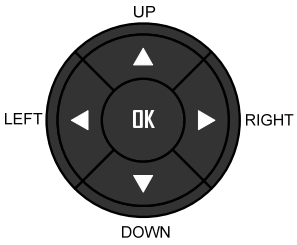
The Core temperature is typically 3-4°C above ambient. Battery Voltage will only be displayed if the DC input isolation is bypassed. This function may be of use if the units internal temperature is of interest or in diagnosing possible problems with Solar Panel and backup battery installations.

5.4.5. SET DATE AND TIME

From the main menu select ‘Set Date and Time’.

It is neccessary to set the date and time every time power to the unit is lost.

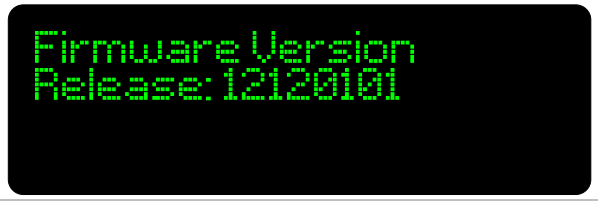


Set Date and Time Navigation Buttons	
	UP: Increase selected item DOWN: Decrease selected item LEFT: Move cursor left RIGHT: Move cursor right OK: Set time and exit

5.4.6. FIRMWARE VERSION

From the main menu select ‘Firmware Version’.

You may be asked to make a note of this by an Acoustic Data Technician



6. REFERENCES

The following documents are available from Acoustic Data upon request.

[1] Acoustic Data, *1000-DGA-0037-01 Mounted Gauge (Welded),* 2012.

[2] Acoustic Data, *1000-DGA-0038-01 Mount Setup (Welded),* 2012.

[3] Acoustic Data, *8000-IST-0002-02 - AD250 MODBUS Map & Implementation Guide,* 2012.