SHAW
MOISTURE METERS

Model SDHmini-Ex

Dewpoint Meter

Instruction Manual

3001 SDHmini-Ex User Manual - Iss 4.3

SHAW
MOISTURE METERS

EU Declaration of Conformity

We	Shaw Moisture Meters
Of	Len Shaw Building, Bolton Lane, Bradford, England, BD2 1AF
Declare that	
Model Name:	Dewpoint Hygrometer SDHmini-Ex
ATEX	Ex II 1 G Ex ia IIC T4 Ga
IECEx	Ex II 1 D Ex ia IIIB T60°C T_{50}80°C Da (-20°≤Ta +50°C)

Description: Battery powered moisture analyser comprising a sensor contained within a drying chamber mounted on a transportable instrument casing.

Conforms to the following Directives:
2014/34/EU ATEX Directive
2014/30/EU The Electromagnetic Compatibility Directive

And has been designed and manufactured to the following standards:
EN 60079-0:2079-0:2018 +A11:2013 Electrical apparatus for potentially explosive atmospheres. General requirements
EN 60079-11:2012 Electrical apparatus for potentially explosive atmospheres intrinsic safety 'i'

BS EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements.

I hereby declare that the aforementioned equipment has been designed to comply with the relevant sections of the above referenced specifications.

10th February 2021

Andrew Coulton
Calibration & QA Manager

Part Ref	Full Title	EMC	ATEX	CERT No.
SDHmini-Ex	SHAW DEWPOINT HYGROMETER	Y	Y	Baseefa15ATEX0212 IECEx BAS 15.0148

Notified body for ATEX & IECEx:
SGS Fimko Oy, Takomotie 8, FL-00380 Helsinki, Finland Notified body No: 0598

CP12A Issue 8

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1 Introduction

1.1 Unpacking Your Shaw Moisture Meters SDHmini-Ex

Please examine the SDHmini-Ex package for any damage or mishandling. If any damage is evident please notify the carrier and the Shaw Moisture Meters representative from where this unit was purchased.

You should have received (if ordered):

- 1 model SDHmini-Ex instrument
- 1 carry case
- 1 Allen key
- 1 two metre length of PTFE tubing
- 1 USB charging cable
- 1 Fir Tree fitting plus 1 x fittings as ordered
- 1 AC/DC adaptor
- 1 pressure dewpoint circular calculator
- 1 USB flash drive with Shaw SDHmini User Tool software
- 1 instruction manual
- 1 Shaw SDHmini User Tool Manual

If anything is missing please contact your distributor immediately.

1.2 General Description

The SDHmini-Ex is an intrinsically safe, micro-controller based battery operated dewpoint hygrometer with state of the art features and enhancements with support of USB and Bluetooth interfaces for communicating with PC and also support for thermal printer over Bluetooth.

It is a fully self-contained unit incorporating the moisture sensor, signal conditioning circuitry, memory management, graphics display, membrane keyboard, real time clock, on-board battery and charger circuit.

The graphical user interface features three main viewing screens, digital, graphical (historical readings in a scrolling strip chart) and a meter (a traditional moving coil). There is also a secondary display in the top right which allows display of readings in alternative units of measurement.

The unit operates with the following 10 language options: English, German, French, Spanish, Portuguese, Russian, Italian, Chinese, Japanese and Korean.

A full colour graphics LCD display with 320 x 240 resolution landscape and a 6 key input including an on/off key.

The displayed units can be changed on both the primary and secondary displays for the selectable moisture unit e.g. °C, °F, g/m^3, ppm(v), ppm(w) and lbs/MMscf.

The SDHmini-Ex settings can be adjusted by a user-friendly software interface incorporating multiple menus, hot key combinations, information displays and control functions.

Use the supplied USB cable, attach between the PC and the instrument, an automatic connection over USB is established.
The USB port allows:

- Charging of the battery (Li-ion) when connected to PC or dedicated power supply (safe area only)
- Downloading of new firmware to the unit
- Downloading of setup data from dedicated PC software
- Downloading logged data files and real time data from the unit

Alternatively, to connect the instrument using Bluetooth, first ensure that the instrument's Bluetooth is switched on. There is no need to ask the instrument to search for devices as in this mode of communication it is the PC which initiates the pairing. Once connected over Bluetooth the connection status is shown in the bottom left of the view panel.

The view panel allows access to many of the features, settings and information pages within the instrument.

A micro SD card is fitted to the instrument, the contents of which can be explored by clicking the SD card icon in the bottom left of the view panel. The contents may include user manuals, service notes, calibration data sheets, firmware backups etc..

The inbuilt memory, stores in excess of 300,000 readings including moisture and pressure compensated moisture readings with user selectable logging intervals from five seconds to one hour and real-time data logging graphical formats.

Data is stored under customer generated file names and stored data files can be reviewed graphically on the unit. The rechargeable battery, when fully charged, has in excess of 150 hours logging capability on a minimum logging interval and is fully recharged in 12 hours.

2 Important Information

2.1 Hazardous Area Use - Safety

The SDHmini-Ex is certified intrinsically safe to ATEX, IECEx and UL standards:

ATEX: II 1 G Ex ia IIC T4 Ga
II 1 D Ex ia IIIB T60°C T_{50}80°C Da (-20°C ≤ Ta ≤ +50°C)

IECEx: Ex ia IIC T4 Ga
Ex ia IIIB T60°C T_{50}80°C Da
(-20°C ≤ Ta ≤ +50°C)

UL: Class I Division 1 Groups A, B, C and D T4

The equipment complies with the requirements of:
IEC 60079-0:2011 and IEC 60079-11:2011
UL 913 and CSA 157

It is the responsibility of the user to ascertain the suitability of the SDHmini-Ex for use in hazardous areas. Risk assessments should be carried out prior to use, taking into account the SDHmini-Ex certifications, location and the gas being monitored.

2.2 Bluetooth Certifications

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment - Contains FCC ID:QOQWT41/QOQWT41u.

This device complies with Industry Canada licence-exempt RSS standard(s) - Contains IC:5123A-BGTWT41/5123A-BGTWT41u.

WT41 meets the requirements of the standards below and hence fulfils the requirements of EMC Directive 89/336/EEC as amended by Directives 92/31/EEC and 93/68/EEC within CE marking requirement.

WT41 has modular certification with certification number R 209-J00047/J00231.

2.3 Symbols Table

2.4 Lithium-ion Cell - Battery

The SDHmini-Ex is powered by a single lithium-ion cell. The cell is not field replaceable by the user as it is completely enclosed within the instrument. However, the cell may be exchanged by an authorised agent who has received the necessary training, support systems and accreditation. It is recommended to only use the USB power supply supplied with the instrument.

Please note: Charging of the SDHmini-Ex should only be carried out in the SAFE AREA.

It is recommended that the SDHmini-Ex be put on charge overnight when the unit is first received.

To attain maximum cell life the SDHmini-Ex should always be charged at room temperature. The discharging cell life (hours of use from a fully charged cell) will reduce when used in cold conditions. Switch on the instrument to check if fully charged.

The symbol indicates that the device contains a battery which may be charged via the USB connector.

Rating of instrument is less than 1 W in operation. Charging voltage is 5 V nominal. Charging input is however additionally protected to Um 250 Vrms.

2.5 Pressure Exposure

The maximum pressure to which the telescopic measuring head is exposed should not be more than

0.3 bar, 4 psi

Exposing the measuring head to higher pressures may damage the instrument and result in injury to the operator or other personnel in the area.

2.6 USB Communication Performance

Note: The USB communication channel and charging power port within the instrument is highly optimized by default for safety. It is particularly well protected electrically so that subsequent safe use in hazardous areas is not compromised by events in the safe areas. Its many safety components may result in not all connections to all USB ports on all PCs or laptops being entirely successful. Many USBs ports even within the same PC or laptop differ from each other in electrical hardware or firmware implementations whilst still broadly complying with the overall USB standards giving rise to a variety of situations which may manifest in a reduced connection experience. It is recommended that if a particular port is not connecting as expected then the user ought to try an alternative port within the PC or laptop or employ a USB Hub device which would effectively isolate the problematic PC or laptop USB port from the instrument.

3 Installation

3.1 Gases to Avoid

The SHAW moisture sensors are suitable for many different industrial and research applications. Most gases can be checked for their moisture content with no need for the calibration to be altered when changing between different gases, as the sensor operates only with reference to the water vapour content.

There are however, some gases that must be avoided as they are not compatible with the material of construction of the sensor. Ammonia (NH_3), Ozone (O_3) and Chlorine (Cl_2) must be avoided at all times, even in small quantities. Hydrogen Chloride (HCl) also attacks the sensors very quickly. Some, less aggressive acidic gases such as Sulphur Dioxide (SO_2) can be monitored as long as the moisture content is low, generally less than 100ppm(v). If in doubt, please ask your supplier.

Sulphur Hexafluoride (SF_6) has no effect on the sensor. If the gas has been exposed to arcing, however, it is possible that various acidic species will have been formed that will corrode the sensor. When testing SF_6 that may have been arced, therefore, an acidity test should be carried out first; if the gas proves to be acidic then the moisture test should not be carried out.

3.2 Installing the Air/Gas Sampling System

The *Piping Installation Schematic* diagram (see section 3.3) shows all components, which could be used in a dry gas measurement application. Although not all the items shown will be required for every installation.

The main principle when considering the presentation of the gas sample to the SDHmini-Ex dewpoint meter is to keep the sample system as simple as possible and of minimum swept volume, so that it has the least possible influence on the gas sample.

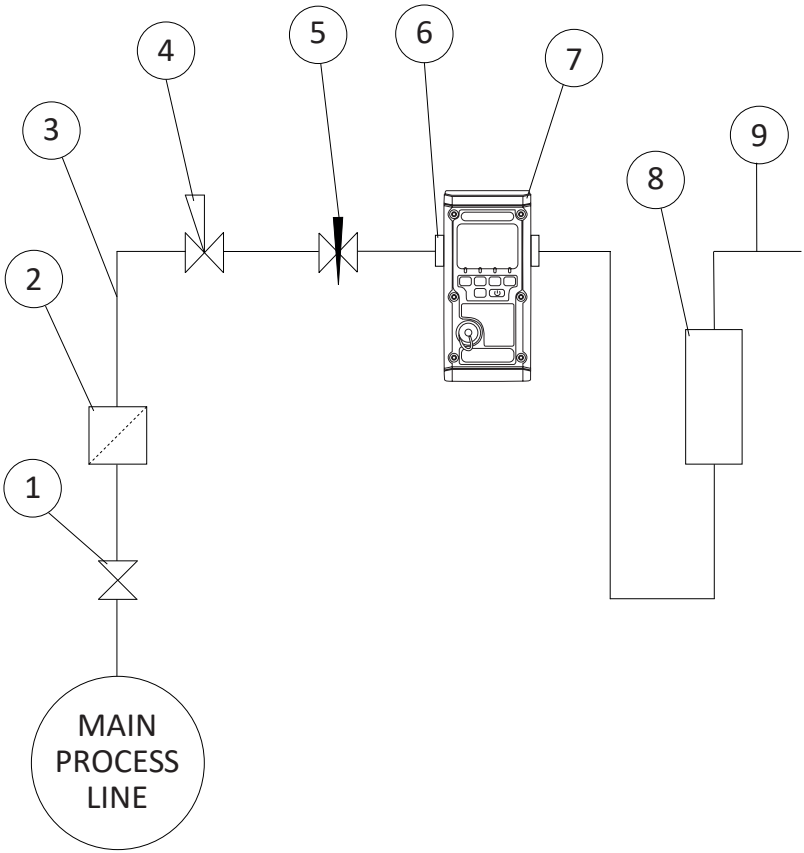
The SDHmini-Ex should be placed on a stable surface prior to connecting to the sample pipework. Care should be taken to ensure that the sample presented to the SDHmini-Ex is not contaminated with any component that will damage, contaminate or affect in a way that will impair the unit's accuracy.

The flow rate, although not critical to the sensor measurement, should be low enough to avoid abrasion to the sensor surface without being so low as to extend

the SDHmini-Ex response time to an unacceptable level. In general, a flow rate of between 2 and 5 litres/min at normal temperature and pressure will give the right balance.

The SDHmini-Ex is designed to operate at atmospheric pressure with a maximum of 0.3 bar.

3.3 Piping Installation Schematic



Notes

a. The sample point should be on the upper surface of the horizontal pipe or from a vertical section of pipe, wherever possible.
b. The sample tube should run upwards from the sample point. If this is not possible, then an inspection port or drain tap should be installed at the lowest point in the sample system.

3.4 Piping Schematic Component Index

1. **Sample Isolation Valve** - This is a recommended item as it allows access to the sample system without interrupting the main process line.
2. **Filter Unit** – A filter unit is recommended when the samples are likely to contain particulate matter. If the air/gas sample contains heavy hydrocarbon condensate, the filter must be of the coalescing type with a drain. The filter unit should be positioned as close to the sample point as practical.
3. **Sample Tube** – This should be stainless steel for dry air or gas applications but copper or carbon steel can be used where wetter gases are to be measured. If any section of the sample tube must be flexible then PTFE should be used. In most cases, 3 mm OD (⅛") is sufficient as it provides good system response time with minimum flow. 6 mm OD (¼") tube can be used where pressure drops across the 3 mm tube are too high.
4. **Pressure Reduction Valve or Pressure Regulator** – the sample is measured at atmospheric pressure requiring that valve 4 is fitted to the system.
5. **Flow Control Valve.**
6. **Sample Connection.**
7. **SDHmini-Ex.**
8. **Flow Indicator** – The recommended sample flow is 2 to 5 L/min.
9. **Sample Exhaust** – The exhaust is vented to atmosphere or returned to an atmospheric pressure line.

3.5 Purging the Sample Connection

Refer to the *Piping Installation Schematic* in section 3.3.

It is advisable to carry out an initial purge of the sample loop without connecting the instrument, in order to avoid the possibility of sensor damage on start-up.

Open the sample isolation valve (1) slowly, until there is a small flow of air/gas at atmospheric pressure from the pressure reduction valve (4). Allow the air/gas to exhaust through the sample connection (9).

Continue this for two minutes to remove any residual moisture from the sample pipe work and components. Check that no liquid or particulate contamination, which could damage the sensor, is passing through the sample pipe. Directing the sample onto a piece of white paper (such as a filter paper) will make it easier to see any dust or oil mist in the sample.

Connect the SDHmini-Ex. The SDHmini-Ex is not flow sensitive, however, the sample flow needs to be enough to fill the sensor head with gas effectively, so anything less than 1 litre/min would mean that the instrument would take too long to settle to a stable reading. The flow should not be so high that the gas velocity could physically damage the sensor or cause back-pressure in the sensor head, so should not exceed approximately 10 litres/min.

3.6 Using the SDHmini-Ex to Take a Moisture Reading

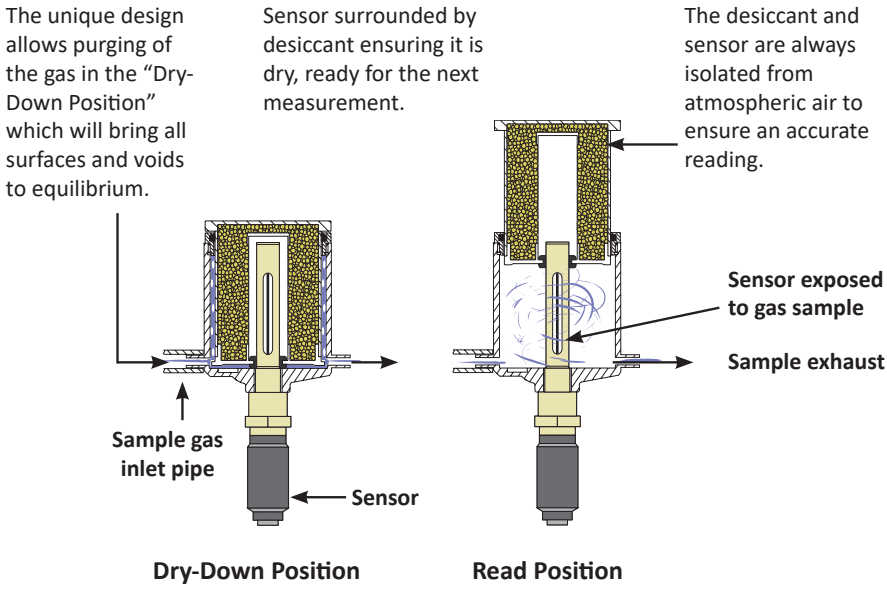
The first purpose of the SDHmini-Ex is to provide a rapid, easy and reliable means of carrying out moisture content measurement of gases. To ensure rapid response the sensor is kept dry by surrounding the sensor with desiccant in the head assembly when it is not in use.

After purging the system to be monitored fit the SDHmini-Ex sample pipe to the sample connection (6). Allow the gas to purge for a further two minutes with the head down. Restrict the outlet of the SDHmni-Ex (7) by placing a finger over the sample exhaust (9), so that the pressure of the sample lifts the telescopic head. As soon as the head is fully extended remove the finger, to prevent pressure build up. Pull gently on the head to make sure it is fully extended. If there is not enough pressure to lift the head assembly, assist it by pulling it up, do this very slowly so that ambient air is not drawn in through the outlet.

The sensor will respond to the moisture level present in the sampled gas. The displayed moisture value will continue to change until the sensor reaches equilibrium at which point the displayed value is representative of the moisture level in the sampled gas. When a reading has been taken and the test is finished, push down the telescopic head fully, carefully turn off the sample flow and disconnect the sample pipe. With the head in the down position the desiccant will dry the sensor, ready for the next test.

Note: It is important that the head assembly is either fully up or fully down to keep the desiccant isolated from the ambient air so avoiding wetting it. When the instrument is not in use it should be stored with the head in the down position.

3.7 Desiccant Dry-Down Technology



Keeping the sensor dry between tests ensures that the SDHmini-Ex is ready to carry out rapid spot checks. The unique design of the desiccant head achieves this by surrounding the sensor with desiccant, keeping the sensor dry. The head is then lifted for sampling, exposing the sensor to the sample gas.

Between tests the sensor is not allowed to come into contact with ambient air. The chamber is designed so that the void space and chamber wall surfaces are purged with sample gas before exposure of the sensor, giving faster, more accurate and reliable results.

3.8 Sample Connections

The SDHmini-Ex is supplied with two connections: a Fir Tree on one side and a Swagelok compression fitting for ¼", ⅛", 6 mm OD pipe or another Fir Tree fitting (as specified on your order) on the other. Either can be used as the inlet connection (6).

PTFE and stainless steel are recommended materials for sample pipes. Some specialist flexible tubing may be suitable as sample pipe but common flexible tubing such as PVC, nylon, polythene or rubber, should not be used, as they are permeable and water vapour from the atmosphere will diffuse through them into the sample gas.

A 2 m PTFE sample pipe is supplied for use with the Fir Tree connection. The first time this is used it is advisable to warm the end that will go over the Fir Tree for a few seconds with a heat source to soften it slightly, which helps to get a gas tight seal.

3.9 Pressure and Flow Control

In most cases the gas to be sampled will be at a positive pressure, which will need to be reduced to atmospheric pressure. At low pressures, up to around 8 barg, this can be done by including a simple needle valve (5) to control the flow and thereby the pressure dropping across it. Ideally this would be the isolation valve (1) on the sample point, thus keeping the number of joints and glands, which are points of potential moisture ingress to a minimum.

At higher pressures it is advisable to reduce the pressure across a pressure regulator (4). Any regulator used should be stainless steel and of a low swept volume. Typical laboratory or welding type regulators are not suitable because they have elastomeric diaphragms which are permeable to water vapour and the high swept volume will be slow to purge.

3.10 Particulate Contamination

If the sample gas is likely to contain particulate material this should be kept away from the sensor by including a small inline particle filter (2) in the sample system.

If the surface of the sensor becomes partly coated with particles it will not affect the calibration of the sensor but will restrict the movement of water molecules across the surface so increasing the time it takes for the sensor to come to equilibrium with the water vapour concentration around it. If the solid material is hygroscopic, such as desiccant dust, whenever there is a change in the moisture concentration in the sample, this material must come to equilibrium with the moisture content before the sensor can respond to the change, which will cause delays in obtaining accurate results.

3.11 Liquid Contamination

If the sample gas may contain liquid contamination, such as oil mist, this should be kept away from the sensor by including a coalescing filter or an appropriate membrane filter (2) in the sample system.

If the surface of the sensor becomes partly coated with liquid, again, it will not affect the calibration of the sensor. It will restrict the movement of water molecules across the surface so increasing the time it takes for the sensor to come to equilibrium with the water vapour concentration around it. If the liquid is hygroscopic, such as glycol, the buffering effect described for desiccant dust may be so great that the sensor becomes too slow to use.

4 Normal Operations

4.1 Powering On/Off

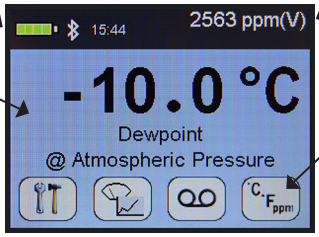
To switch on (and off), press the SDHmini-Ex briefly displays a splash screen showing instrument status, error information and firmware version number.

4.2 Graphical Viewing Options

The start up screen is soon replaced by the normal measurement mode screen (see below) displaying the current moisture measurement in a variety of views. The last used or last selected mode will be utilised automatically.

Top Bar
Battery Status - Bluetooth Status - Time

Viewing Portal
Main display resides here but can also show alternative Measurement Data, Information Screens, Configurations and Logged Data in a variety of formats.



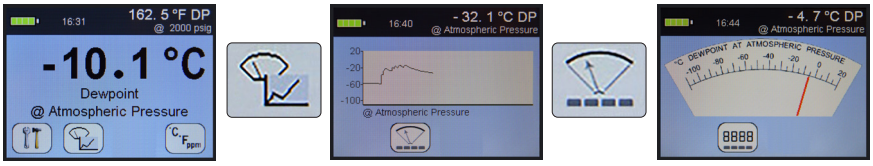
Top Bar
Secondary Display or Measurement Value

Button Icon Area
These are soft keys which are always visible to assist users in navigating through the graphical screens.

4.3 Display Options

The display can be changed by pressing the following keys to cycle through all of the graphical views and will take you to the home screen.

Here is a view starting as a digital number followed by simulated strip chart and moving coil instruments.



The digital display mode has the benefit of showing the moisture measurement in main choice of engineering units but also a secondary display with perhaps alternative engineering units. This mode also allows application of pressure dewpoint to evaluate the measurement in other samples pressures.

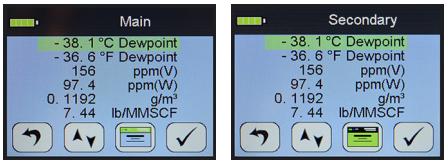
4.4 Choice of Units

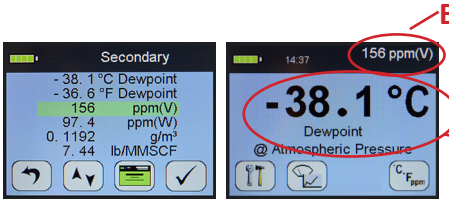
In normal measurement mode. The secondary display is the measurement displayed in the top bar on the right hand side (**A**). It allows alternative engineering units or concentrations to be displayed alongside those chosen in the main display.

To choose the engineering units to be displayed, select the units key from the main digital view.

You will be presented with the following screen to select engineering units for the main and secondary displays. You may toggle between adjusting the main and secondary displays by pressing the key 3.

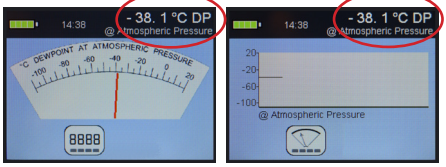
Use the key to move to the desired measurement type and press to select it. Pressing will exit the current screen without making any further changes.





Here the secondary display is being changed to ppm(v) engineering units (**B**).

Please note: when you change the display to either the moving coil meter or the strip chart the secondary engineering units display is replaced with the primary units (**C**).



This continues to allow high precision measurement whilst having the benefit of the graphical display.

5 Calibration

Field calibrations of the SDHmini-Ex may be performed periodically, every two to three months, to ensure accuracy between laboratory calibrations by checking the span of the instrument and correcting for any deviation. These functions can be used to verify operation of the SDHmini-Ex if confirmation of an unexpected result is required.

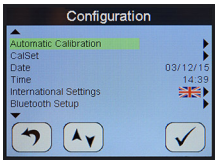
This may be accomplished by two similar in built calibration functions, namely *AutoCal* and *CalSet*.

5.1 Auto Calibration (AutoCal)

The *AutoCal* facility uses the fact that each sensor is designed and manufactured to give no further increase in response when it reaches its maximum moisture level. **For example** a SDHmini-Ex with a full scale value of 0 °C dewpoint will read 0 °C dewpoint when exposed to a gas with this moisture concentration and will continue to read 0 °C dewpoint as the moisture concentration rises above 0 °C dewpoint.

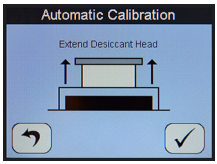
The SDHmini-Ex can therefore be adjusted to read 0 °C dewpoint on any gas with a moisture concentration wetter than 0 °C dewpoint, ambient air for instance, thus setting the span to match the original calibration.

NOTE: For instruments with a dewpoint range above 0 °C, e.g. the Blue range, -80 to +20 °C, please refer to section *5.2 Calibration Setpoint (CalSet)*.

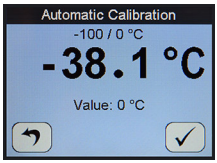


Select *AutoCal* from the *Configuration Menu*.

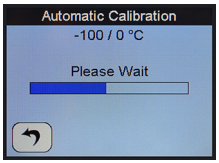
Please ensure that the inlet and outlet valves are open to atmosphere.

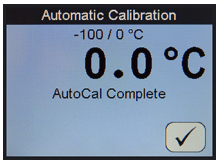


Extend the desiccant head on the instrument (as illustrated on the instrument screen) noticing that the value of the full scale moisture level has already been automatically preselected as a target of 0 °C. You may need to lift the head two to three times to allow ambient air through to the chamber ensuring inlet and outlet are unrestricted. Press ✓.

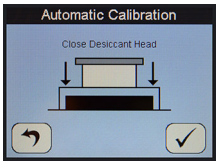


The SDHmini-Ex will display a moving bar until it assesses that the sensor has stabilised (please allow up to ten minutes for this to occur).



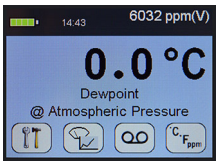


The SDHmini-Ex will now display the full scale value of the unit, either -20 °C or 0 °C depending on the sensor range.



Close the desiccant head when instructed and press ✓.

Pressing ↩ during the *AutoCal* aborts the process.
Press ✓ to accept.



The value present at the start of the aborted *AutoCal* process is reinserted.

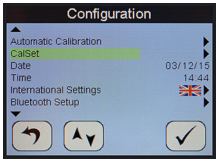
The SDHmini-Ex will return the instrument to normal measurement mode.

NOTE: Avoid carrying out the *AutoCal* procedure on a SDHmini-Ex with a full scale value of 0 °C dewpoint on days when the ambient may be below this value, for example a dry day when the ambient temperature is below approximately 12 °C.

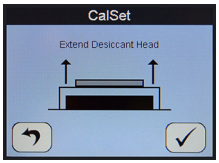
The entered *AutoCal* value must not be pressure compensated.

5.2 Calibration Setpoint (CalSet)

The function *CalSet* is suitable for sensors with an upper range limit of +20 °C dewpoint, for example the Blue range -80 to +20 °C dewpoint, where this upper range limit will exceed typical ambient conditions.

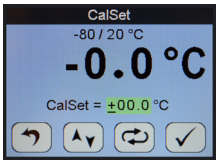


The unit may be checked against a known moisture level, for example from a moisture generator or other reference standard, such as a chilled mirror hygrometer or a psychrometer using the function *CalSet*.



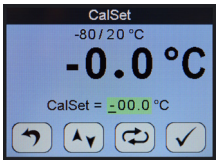
Select *CalSet* from the *Configuration Menu.*

Extend the desiccant head and press ✓.



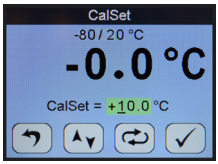
Whether the instrument is being checked against the measured ambient level or against a known calibration standard from a moisture generator, ⇄ and ▲▼ are used to set the value accordingly.

Selecting +10 °C for instance, involves changing the sign and number by use of both keys.

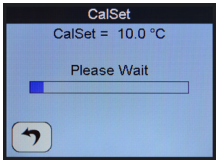


The entered *CalSet* value must not be a pressure compensated one and must be within the range of the sensor.

Press ✓ when done.

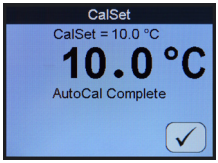


The SDHmini-Ex will display a moving bar until it assesses that the sensor has stabilised (up to 10 minutes).

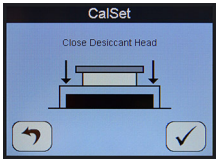


The full scale value, 10 °C dewpoint, is now displayed.

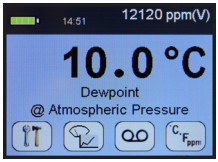
Press ✓ when complete.



Close the desiccant head when instructed to do so and press ✓.



Pressing ↩ during *CalSet* aborts the process and the value present at the start of the aborted *CalSet* process is reinserted.



Press ✓ to continue/accept changes.

The SDHmini-Ex will return to the normal operational mode.

5.3 Calibration Procedure Error Messages

If the instrument fails calibration, a message will be displayed on the screen until acknowledged by the user, e.g.

AutoCal Failed
Sensor Open Circuit
or
AutoCal Failed
Sensor Short Circuit

This will mean replacing the sensor or its interconnecting cable in some cases.

6 Sensor Related Settings

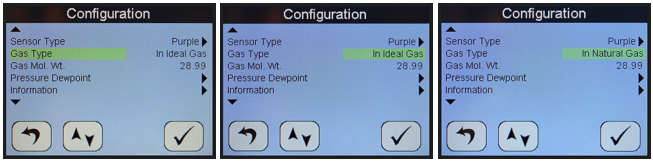
On the configuration screens there exists a collection of measurement settings associated with the sensors and its environment.

6.1 Sensor Type

Here you may view the type of sensor installed in the SDHmini-Ex and its range.

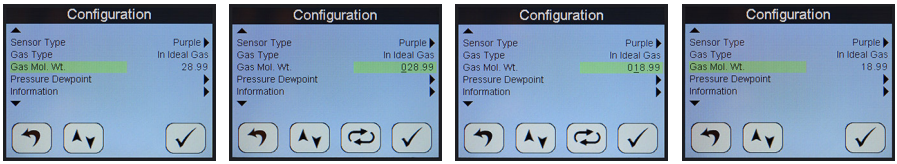
6.2 Selecting Gas Types

The SDHmini-Ex default setting is for ideal gas behaviour, however, there is an option to change the setting to natural gas which uses the appropriate calculation.



6.3 Selecting Gas Molecular Weights

The SDHmini-Ex default setting is for air (molecular weight 28.99), however, this function allows the molecular weight to be set appropriately for other sample gases, for example 18.99.



6.4 Pressure

This sub-menu has, for both the primary and secondary displays, five options allowing the user to select either *atmospheric pressure* or one of four *pressure engineering units* and *applied pressure*.

When this function is selected, the main and secondary display screens will display the pressure at which the dewpoint reading is calculated.

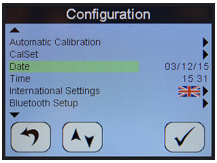
The SDHmini-Ex requires that a numerical pressure value be entered in the selected units at the bottom of the units selection section, for example selecting pressure dewpoint of 2,000 psig on secondary display.

Warning: This function is purely an internal calculation and **DOES NOT** allow an elevated pressure to be applied to the measuring head.

7 Non Measurement Related Configuration Functions

7.1 Changing the Date

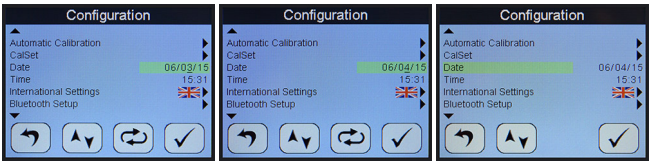
In order to change the present date press the arrow key to select the *Date* function from the *Configuration* menu. Press ✓.



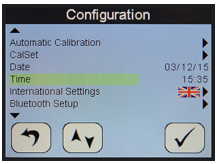
Use ▲▼ and ⟲ to change the date.

Here for example the date is changing from 06/03/15 to 06/04/15.

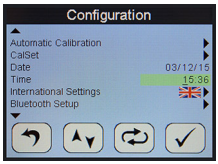
Press ✓ to enter new date or ↶ to abort changes.



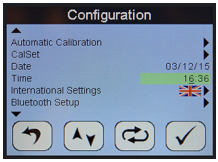
7.2 Changing the Time



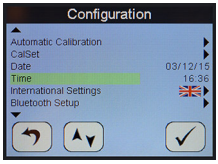
In order to change the present time press to select the *Time* function from the *Configuration* menu.



To change the time use and .



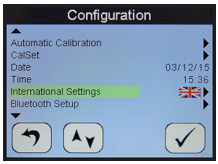
Here for example the time is changing from 10:48 to 11:48.



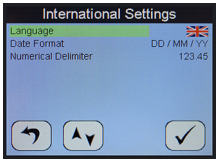
Press to enter new time or to abort changes.

7.3 Changing International Settings

Use the selection cursor to select options to change the settings for *Language*, *Date Format* and *Numerical Delimiter*.

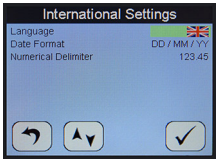


Select *International Settings* from the *Configuration* menu.



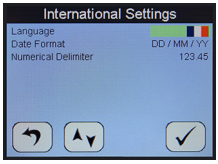
To change the *Language* option select .

The language choice area is highlighted. A flag of a country most associated with one of the pre-installed languages indicates which language is currently selected. The SDHmini-Ex operates with the following 10 language options: English, German, French, Spanish, Portuguese, Russian, Italian, Chinese, Japanese and Korean.



Use the to select the flag required.

And to accept the choice.



The *Date Format* i.e. DD/MM/YY or MM/DD/YY is also chosen from within the *International Settings* menu.

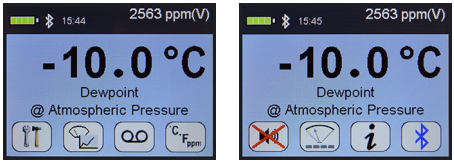
And finally, numbers can be presented 123.45 or 123,45.

Note: These settings are carried through to any data files and printer outputs where appropriate.

7.4 Hotkeys

To access the hotkeys from the main screen, press key 5 on the keypad.

The four soft keys are replaced by a new set of hotkeys for a short while. These are available for rapid access to certain areas of the menu structures or functions.



Turns ON and OFF the inbuilt sounder.

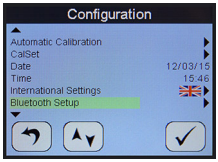
Accesses the alternative moving coil graphical viewing screen

Takes the user to the *Information* screen

Takes the user to the *Bluetooth Setup* screen

If the SDHmini-Ex is connected to a PC then the second hotkey is replaced by an SD card symbol

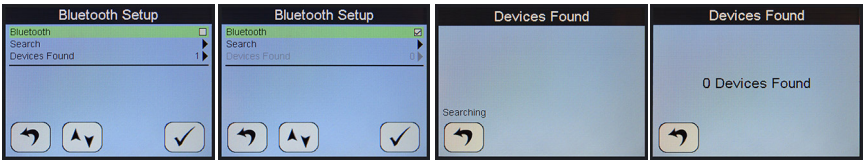
8 Bluetooth Printer Configuration



In the *Configuration* menu select *Bluetooth Setup.*
Press ✓ .

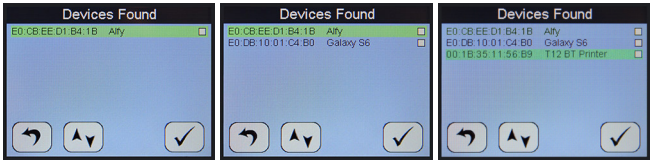
And again, to search for Bluetooth devices.

Ensure that the Bluetooth device is switched on. If not, go back and repeat until the device is found using the ↩ key.

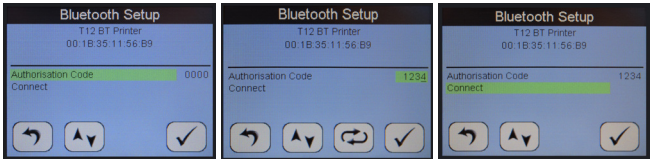


You may not find any devices and may have to restart the search.

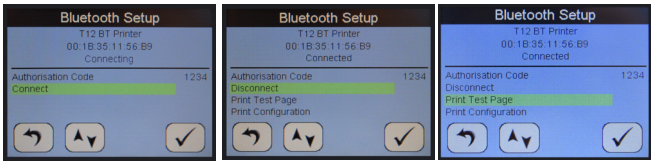
If more than one device is found, (as per example image shown) select the device you wish to pair with using ▲▼ and press ✓ to begin the pairing process.



Enter the pairing authorisation code for the device and press ✓ to connect.



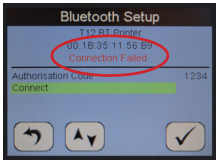
The message will say *Connecting* and finally *Connected*.



If a problem exists then the message will turn red and say Connection Failed.

This maybe due to:

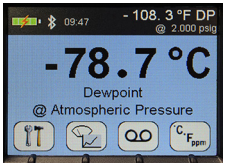
- An incorrect authorisation code
- The external device has powered down
- The external device is out of range
- The external device is not suitable to pair with

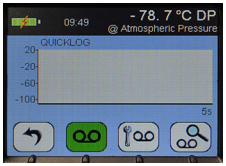


Repeat the *Bluetooth Printer Configuration* setup.

As confirmation, you may print a test page of the instrument settings to the printing device. You may also *Disconnect* from a device. Leaving the message status now empty.

9 Data Logging

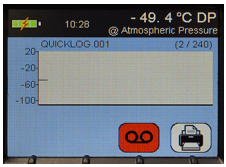




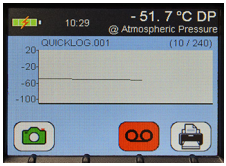
Press on your data logging instrument to start the data logging.

You will now see the following on the instrument screen which is reminiscent of a traditional strip chart recorder. Please note the default sample rate is shown on the right hand side of the screen below the horizontal time axis. Also note that the default file name is shown at the top.

9.1 Quicklog



Pressing will instigate a data logging event where the data is captured every five seconds and saved in a file named QUICKLOG *** (*** is a sequential number from 000 to 099). The file will contain 240 samples if left to complete its log, making the default duration of a *Quicklog* event 20 minutes long. The screen is being updated three times per second so detail may be visible on the strip chart that may not be recorded in the logging event.



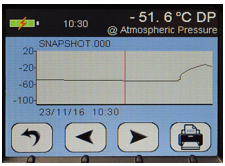
The printer icon on the right hand side may appear with a white background to indicate that the printer is not attached via Bluetooth. However, pressing the printer icon key will take the user to the Bluetooth Setup screen to connect. Once connected the Bluetooth icon will appear in the notification area and the background will appear green.

If the printer key is pressed again then the printer will print the samples as they occur.

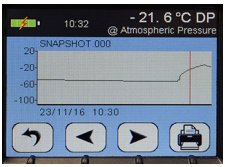
Note: When the printer icon has a RED background, this indicates to the user to press the printer key to stop printing.

9.2 Snapshot

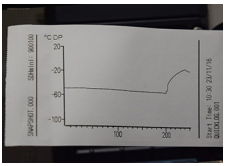
You may notice that when the strip chart has traversed more than half of the way across the screen then another icon appears, this time on the left hand side. It is called the *Snapshot* function icon.

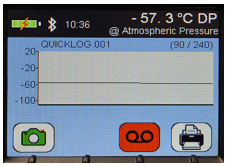


Pressing the *Snapshot* key will not stop the data logging event but will show a snapshot of the current chart line.



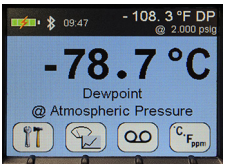
Use the arrow keys to move along the trace and monitor the measurement at any point on the displayed trace. The instantaneous measurement and the time is displayed along with the sequential file name for the snapshot.



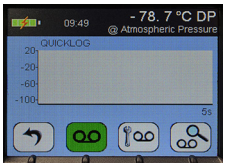


The *Snapshot* image may also be printed out at this stage using the print icon - if connected as before or escape to go back to the main logging event, which may be continuing in the background.

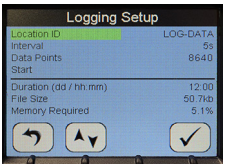
9.3 Advanced Data Logging



From the home screen press .

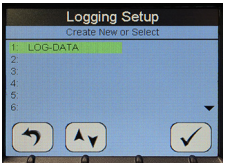


To run data logging events with different durations and sample rates to the default setting and with the ability to attach alternative names or Location IDs, press the *Configure Data Logging* key to enter the *Logging Setup* screen. The *Location ID* or file name may be specified here as well as the sample interval and the number of data points.

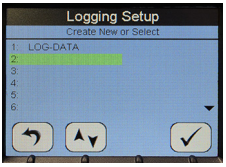


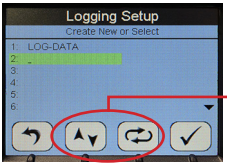
There is provision for 20 *Location ID*s to be held on the SDHmini-Ex. Here is an example of how to create a new Location ID called TEST.

Select Location ID and press ✓.

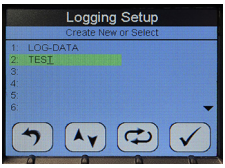


Select an empty slot or overtype an old one.



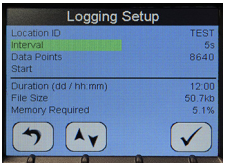


Use these keys to edit a new Location ID.

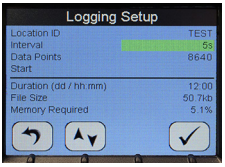


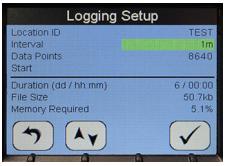
Press ✓ when done.

Setting up the sample interval requires a little thought as to how fast or slow the sampling needs to be captured and what is important.

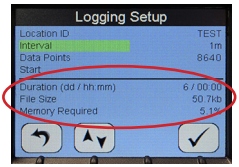


Here the sample rate/interval is being adjusted from 5 seconds to 1 minute.

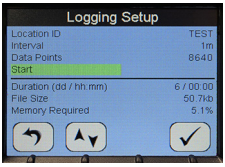




In a similar way you can adjust the number of data points also.

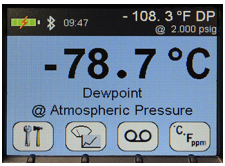


The SDHmini-Ex automatically calculates the *Duration* and displays it below the line along with the expected *File Size* and *Memory Required*. For Location ID "TEST", the number of data points potentially collected is set to be 8640, giving 6 days duration of the logging event.

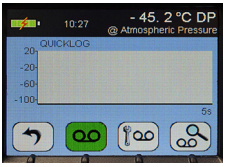


When the *Start* command is accepted the logging will proceed with the *Logging Setup* chosen.

9.4 Logged Data Review

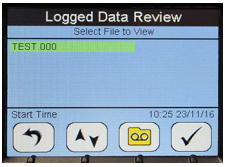


On this screen the user can review not only the *Logged Data* but also examine any instantaneous *Snapshot* screens saved during data logging.

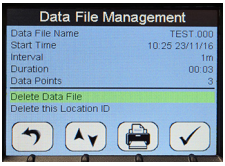


To examine data logging events press to instigate logged data review.

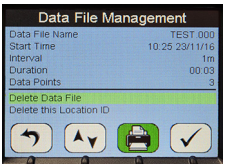
In order to inspect the files select the appropriate type of data by using and press .



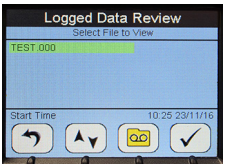
Using , move the selection cursor to the data to inspect and press to inspect file attributes and perform other actions by starting *Data File Management* function.

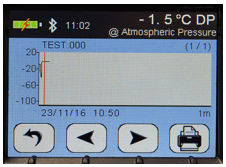


The *Data File Management* function allows the user to inspect how the data was captured and other file attributes. It also allows the possibility to delete the file and also ALL files associated with the *Location ID* but not the *Location ID* itself which will be saved ready for another logging event.

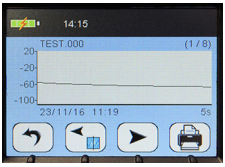


You may also print the data file using the printer icon key, provided as before, that the Bluetooth connection has been maintained or established.





Alternatively, press ↩ to return to the *Logged Data Review* screen then continue viewing the data log file on the strip chart by selecting ✓.



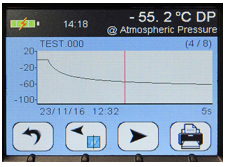
The value of the current measurement at the red cursor line is shown on the right side of the top bar area.

The strip chart shows the data contained in the file graphically in the centre of the viewing portal below the top bar.

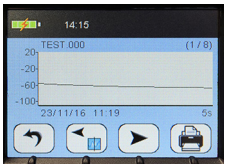
- The *Location ID* file name is shown with its sequence number (TEST 000) on the top left.
- The current screen number and total number of screens within the file are shown top right.
- The date and time of the measurement point is shown bottom left.
- The measurement or sample interval for the data logging file is shown bottom right.

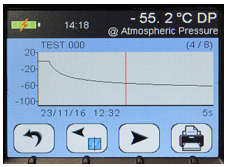
Press the ◄ and ► keys to scroll the vertical red line cursor through the data.

However, where more than one screen of logged data exists to review, the ◄ and ► keys are replaced by an alternative set - ◄▯ and ►.



Pressing key 2 (◄▯) or 3 (►) will move the screens left and right, for instance screen 1 of 4 is replaced by screen 2 of 4 by pressing key 3 under the ► key icon.





You will notice that the vertical red line cursor is missing and the corresponding measurement value is also missing from the top bar.

However, if in the selected screen of data is the one of interest then pressing the key will switch on the red cursor vertical line and the measurement value will appear.

Pressing the and will move the cursor left and right to select other data points.

9.5 Data Logging Storage

Data File Type	Number of Sample Data Points (n) per Data File	Maximum Number of Data Files	Total Sample Data Points Storage
Logged Data	1 < n < 125,000	1,000 per Location ID = 20,000	286,000
Quicklog Data	1 < n < 240	100	24,000
Snapshot Data	120 < n < 240	50	12,000
			322,000

10 Additional Information

10.1 Temperature

Typical ambient variations experienced throughout the world are quite acceptable but avoid placing the instrument in direct sunlight or near a source of radiant or convected heat. In countries that experience extremes of temperature, always carry out the automatic calibration with the instrument at its operating temperature.

10.2 Response Time

The response time of any water vapour pressure detector will naturally be very much quicker from dry to wet, than from wet to dry. This is the reason that the SHAW SDHmini-L is so successful. The sensor is kept in a dry condition when it is not in use and therefore results are obtained in the quickest possible time.

To check whether a particular instrument is within specification, carry out the automatic calibration procedure, close the instrument head and note the reading ten minutes later. If the unit has not dried down to -40 °C after this ten minute period, the instrument should be returned to your supplier/authorised distributor for examination.

10.3 Guarantee

All SHAW products are guaranteed for two years from the date of purchase, some exclusions are as follows:

Removing protective guard from any sensor, subjecting sensor to shock or black list gases e.g. caustic and acidic gases like ammonia and chlorine, tampering with any internal electronics, subjecting to excessive flow rate, contaminants and general misuse.

If you suspect a fault which you feel needs to be attended to under guarantee please contact us for assistance hopefully to help fault find and effect a remedy and if this is not successful, to give precise instructions for the return for inspection.

No equipment will be replaced or repaired without having been returned for inspection either to ourselves or an authorised distributor.

10.4 Basic Definitions

Water Vapour Pressure
The pressure exerted by the water vapour contained in any mixture of gases. The total pressure exerted by the gas mixture is the sum of the pressures exerted by its components – including the water vapour. Water Vapour Pressure varies in direct proportion to the total gas.

Dewpoint Temperature
The temperature to which the gas must be cooled in order that it should be saturated with water vapour (i.e. 100% relative humidity). For practical reasons it is referred to dewpoint above 0 °C and frostpoint below 0 °C.

Parts Per Million by Volume
ppm(v) is the ratio of the water vapour pressure to the total gas pressure.

Parts Per Million by Weight

ppm(w) is the ratio of the molecular weight of water vapour to the molecular weight of the carrier gas mixture.

Relative Humidity

The ratio of the actual water vapour pressure in the gas to the saturation water vapour pressure at the same temperature.

10.5 Problem Guide

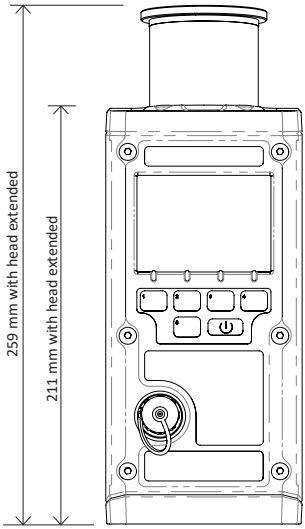
Fault	Explanation	Required Action	Notes
Unit does not turn on. Screen remains blank and back light off.	Battery low level.	Connect a battery charger unit for a minimum of 12 hours charging.	
AutoCal failure.	Sensor sensitivity too low.	Repeat AutoCal.	If AutoCal fails, contact supplier to replace sensor.
Unit always reads lower limit.	Sensor cable broken.	Repair cable.	
Unit will not dry down to lower limit.	Sieve wet.	Perform service on unit using Service Kit.	Service Kit available from supplier.
'O' ring failure.		Perform service on unit using Service Kit.	Service Kit available from supplier.
Battery has short life between charges.	Battery reaching end of life.	Return to supplier/ authorised distributor for battery replacement/ exchange.	Order from supplier.
Keypad damaged.	Check function of keypad electrically.	Contact supplier.	

11 SDHmini-Ex Specifications

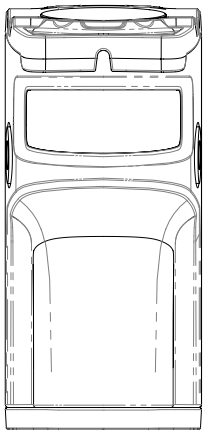
Accuracy:	±2 °C (±3.6 °F)
Type:	Battery powered hygrometer complete with carrying case. For use with desiccant chamber for rapid readings. Certified intrinsically safe to ATEX, IECEx and UL standards: ATEX: II 1 G Ex ia IIC T4 Ga II 1 D Ex ia IIIB T60°C T_{50}80°C Da (-20°C ≤ Ta ≤ +50°C) IECEx: Ex ia IIC T4 Ga Ex ia IIIB T60°C T_{50}80°C Da (-20°C ≤ Ta ≤ +50°C) UL: Class I Div 1 Groups A, B, C and D T4 The equipment complies with the requirements of: IEC 60079-0:2011 and IEC 60079-11:2011 UL 913 and CSA 157 FCC ID:QOQWT41/u IC:5123A-BGTWT41/u EMC Directive 89/336/EEC as amended by Directives 92/31/EEC and 93/68/EEC within CE marking requirement WT41 has modular certification with certification number R 209-J00047/J00231
Dimensions:	97 mm (w) x 211 mm (h (259 mm head extended)) x 147 mm (d) 3.8 in (w) x 8.3 in (h (10.2 in head extended)) x 5.8 in (d)
Weight:	1.75 kg (3.8 lbs)
Display:	Full colour graphics LCD. 320 x 240 resolution. Three main viewing - digital, graphical and a traditional moving coil. Secondary display in the top right for display of readings in alternative units of measurement.
Sensor Connection:	Internal
Power Supply:	Single lithium-ion cell
Sampling:	Pressure: Atmospheric with flow rate of 2 - 5 litres/minute
Operating Temperature:	-20 °C to +50 °C (-4 °F to +122 °F)
Storage Temperature:	-30 °C to +70 °C (-22 °F to +158 °F)
Operating Humidity:	95% RH non-condensing
Calibration:	AutoCal on all (but Blue range)
Accessories/Options:	Bluetooth Printer, Portable Sample System, Service Kit
Sensor Type (r):	Sensor Range
Purple (P):	-100 °C to 0 °C dewpoint, 0 - 6000 ppm(v)
Red (R):	-80 °C to -20 °C dewpoint, 0 - 1000 ppm(v)
Grey (G):	-80 °C to 0 °C dewpoint, 0 - 6000 ppm(v)
Blue (B):	-80 °C to +20 °C dewpoint, 0 - 23000 ppm(v)
Silver (S):	-100 °C to -20 °C dewpoint, 0 - 1000 ppm(v)
Gold (Gl):	-110 °C to 0 °C dewpoint, 0 - 6000 ppm(v)
Sensor:	Operating Principle: SHAW Ultra High Capacitance Aluminium Oxides Sensor

12 SDHmini-Ex General Assembly Diagram

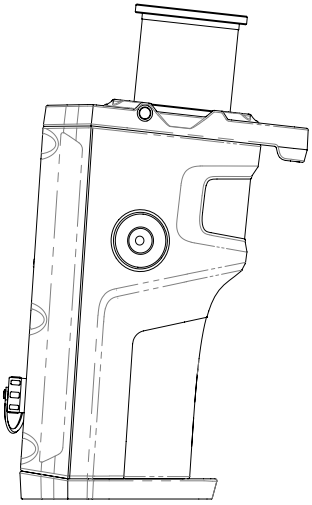
FRONT VIEW



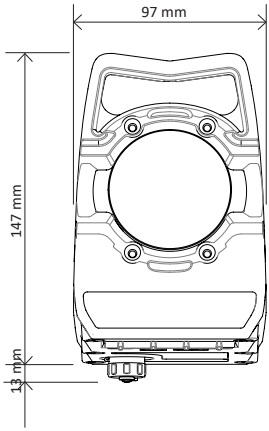
REAR VIEW



SIDE VIEW



TOP VIEW



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