DS4000

Advanced Dewpoint Hygrometer

User Manual

English

This manual should be kept with the DS4000

Please read this manual carefully from the beginning.

You must observe the safety information on pages 6 and 11 before installation.

For Full Menu Navigation, Refer to Appendix B, C & D on Pages 35, 36 & 37.

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Contents

1. General information:

The DS4000 is the next level in online dewpoint hygrometry for multi-species gases and natural gas. With powerful functions and features available that allows the user to set detailed configurations and parameters for continuous measurement and control. The DS4000 has the following features and benefits

- Input from any 4-20mA Dewpoint transmitter.
- Large easy to read 5-digit, 8 segment, 15mm RED LED display
- Four-button membrane keypad
- Selectable engineering units in °C, °F, ppm(v), ppb, g/m^3, lb/MMSCF & ppm(w)
- Three hot keys to enable rapid access
- Two visual alarms/relay LEDS
- Fully-controllable linear selectable 0-20mA or 4-20mA output for process retransmission
- RS485 port for digital output
- Option for external alarms
- User-controllable password system
- AC or DC powered models available

Component list of a DS4000 Dewpoint Hygrometer:

- DS4000 panel dewpoint hygrometer
- Four connectors for wiring
- Ferrite Bead for power cable (supplied with AC units)
- Mounting Gasket
- 2 panel retaining screws
- User Manual
- Declaration of Conformity

Optional Extras

- 4-20mA Transmitter
- Transmitter cable
- Transmitter/Sensor holder

2. Safety Information and Warnings

These safety instructions and guidelines must be followed.

The **DS4000** is designed to be connected to hazardous electric voltages (90-250V). The power supply must be protected by a **1 amp** fuse.
The DS4000 must be earthed.

Check to establish that all wiring and connections are not damaged. If damage is observed to any electrical wiring or damage to the apparatus they must not be connected to the power supply but returned to the supplier for rectification.

Before powering up the unit, check that the connecting plugs at the back of the unit have been wired correctly. Observe the wiring diagrams in section **5.2**.

Do not connect the **DS4000** to the power supply until it is in a permanent position.

Risk of electric shock - Do not open any part of the **DS4000** whilst connected to the power supply.

Remove the power supply and isolate before any maintenance is carried out.

The power supply terminals and associated internal circuitry are isolated from all other parts of the equipment in accordance with EN61010-1 for connection to a category II supply (pollution degree2).

Any terminals or wiring connected to the input or outputs, which are accessible in normal operation, must only be connected to signals complying with the requirements for Safety Extra Low Voltage (SELV) circuits.

Hazardous voltages may be present on instrument terminals. The equipment must be installed by suitably qualified personnel and the instrument must be mounted in a position that provides protection behind the panel to at least IP20.

Ignoring this safety information can result in severe personal injury and/or damage to the unit. The product specifications **must not** be exceeded at any time as this may cause damage to the apparatus or cause risk of damage or fire.

Ensure that the **DS4000** does not come into direct contact with water or any other liquids.

Cleaning:

Disconnect the power supply first. To maintain the instrument, never use harsh abrasive cleaners or solvents. Wipe the instrument only with a soft cloth slightly dampened with warm soapy water.

Maintenance:

There are no serviceable parts in a DS4000

3. QUICK START Guide

To get started quickly there is no need to go through all the menus on the DS4000 at this stage.

Follow these step by step instructions below for a fast set up and quick start to measuring.

1. Unpack the Control Unit and Transmitter only when they are ready to be installed.
2. Read the safety instructions in **section 2, page 6.**
3. Make a location for the DS4000. For dimensions see **section 5.1, page 9.**
4. Make ready and seal all pipework for sampling.
5. Unpack and wire up the DS4000 display unit, see **section 5.2, page 9/10. DO NOT** power up at this stage
6. Unpack and very carefully insert the transmitter into the Transmitter/Sensor holder and connect to the DS4000 display unit.
7. Purge the gas to be sampled through the pipework and sensor holder see **sections 6** and **6** for full details, page 15 to 17.
8. Re-check all connections and wiring - NOW power up the DS4000
9. The screen will now look like this for example:

10. If the display is still changing, allow this to settle before taking final reading.

    Note: Time to settle can vary between a few minutes and several hours dependant on the condition of the sample tubing on start up. Time can be affected by for example, temperature, pressure, sample moisture content and other factors. Take a final reading when the display is static.

11. If alarms are to be set at this stage see **section 8.6.**
12. To set up passwords see **section 8.8.**

4. Outline Specification

4.1 Limits

Moisture Range and Units limits:

		Upper	Lower
C	°C dewpoint	30.0	-130.0
F	°F dewpoint	86.0	-202.0
P	ppm(v)	41915	<0.0001
b	ppb	99999	<000.1
g	g/m^3	31.8	0
L	lb/MMSCF	1984	0
Ξ	ppm(w)	26300	<0.0001

Temperature Range:

Electronics -10°C to +60°C

4.2 Enclosure DIN Style.

Mounting flange 144 x 72 mm and enclosure extends 108 mm deep from front of mounting panel but not including cabling needs.

5. Installation

5.1 Mechanical installation into a panel

Make a cut-out in the donor panel 138.0 x 68.0 mm (DIN 43700).

The maximum panel thickness is 8mm. If an effective IP65 weatherproof seal is required, the minimum recommended panel thickness is 2.5 mm.

Pass the instrument case through the cut-out in the donor panel and attach the two retaining screws to the studs on either side of the case making use of the supplied gasket.

Tighten the retaining screws onto the back of the donor panel until the instrument is clamped securely in position. The screws must be tightened sufficiently to affect a seal between the front of the donor panel and the back of the instrument bezel, but never over tightened.

5.2 Electrical installation

- **Power Supply**

  Connect the power supply cable to the 3 terminals of connector C4

- **Transmitter Cable**

  Connect the transmitter to connector C1, route the cable to the intended site of the transmitter.

- **Alarm Cable**

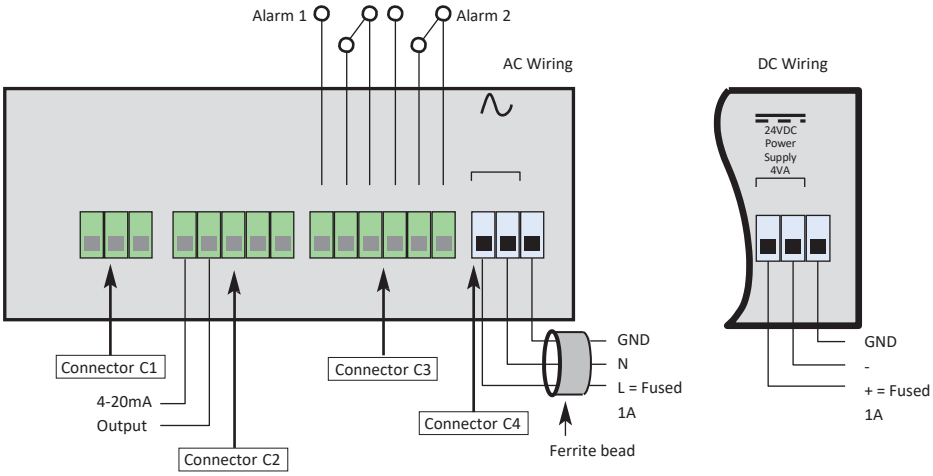
  Make the appropriate connections, noting the normally open and normally closed relay contact positions on connector C3

- **Analog Output and Serial Communications Cable**

  Make the appropriate connections, ensuring that the correct polarity and the maximum load specification are strictly observed on connector C2.

- **Rear Connections:**

  Viewed from the rear (see **section 5.3** for AMT connection)



There are four banks of wiring connections points organized into groups named C1, C2, C3 and C4.

- **Connector C1 – 4-20mA Transmitter interface**
  - Connect to mA and 24V for 2 wire transmitters
- **Connector C2 - Analog Output and Serial Communications**
  - Connect to + and – for 4-20 mA Analog Output.
    Max Load 800Ω (Ohm)
  - Connect to A, B and COM for Serial Communication.
- **Connector C3 - Alarms**
  - Alarms: Two independent SPCO volt free contacts rated 10A/240 VAC.
- **Connector C4 – AC or DC Power**
  - Universal 90 – 250 VAC 50/60 Hz, or, 24 VDC version dependent on factory set option.

- **Important Notes for both AC and DC powered units.**

The power supply to the instrument must be protected by a **1A** fuse

A local isolation switch is advisable for ease of isolation during maintenance to reduce the possibility of electric shock or damage to the instrument.

The power supply ground GND terminal must be wired to a suitable permanent ground point.

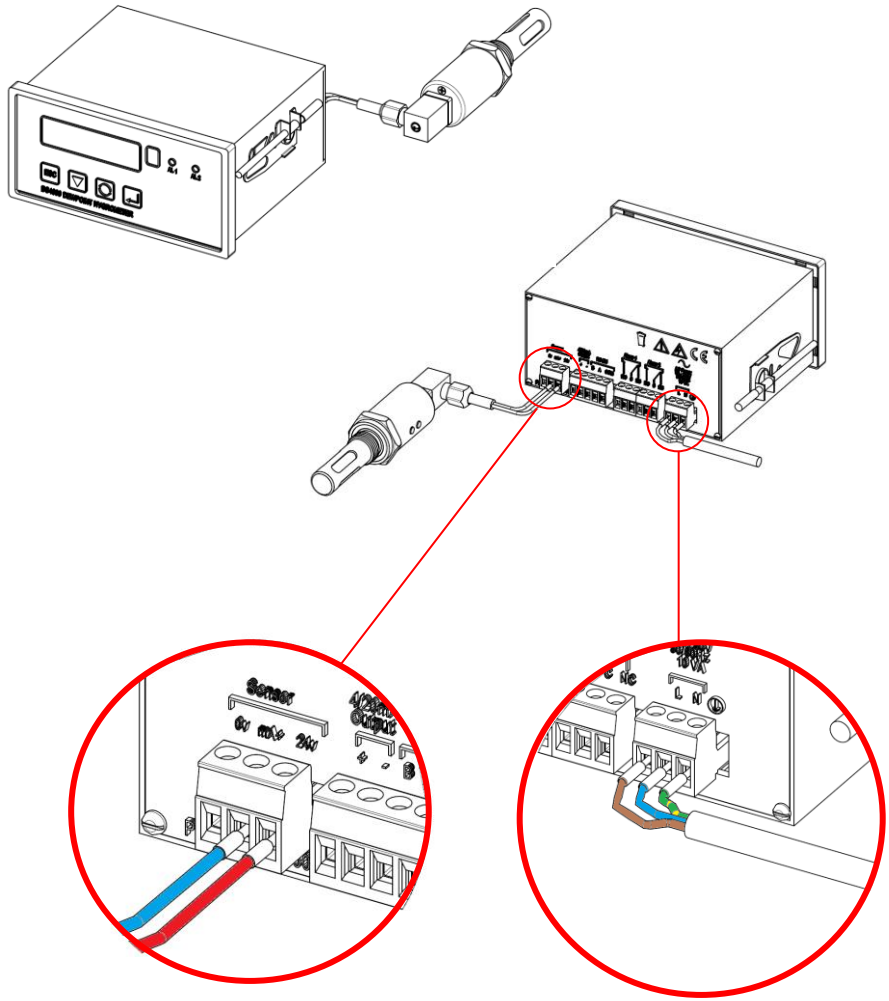
For AC wiring only, the supplied ferrite bead must be installed on the power supply cable approximately 50 mm from the connector using the tool supplied with the instrument.

The power supply wires are retained by screws and care should be taken to ensure that the exposed section of the wire is fully inserted and that no loose strands are exposed.

Cables should to be properly supported and segregated.

5.3 Connecting a Non-Ex AMT Dewpoint Transmitter to a DS4000

- The DS4000 displays a linear readout of the 4 to 20mA input signal received from an attached transmitter in the pre-selected moisture units.

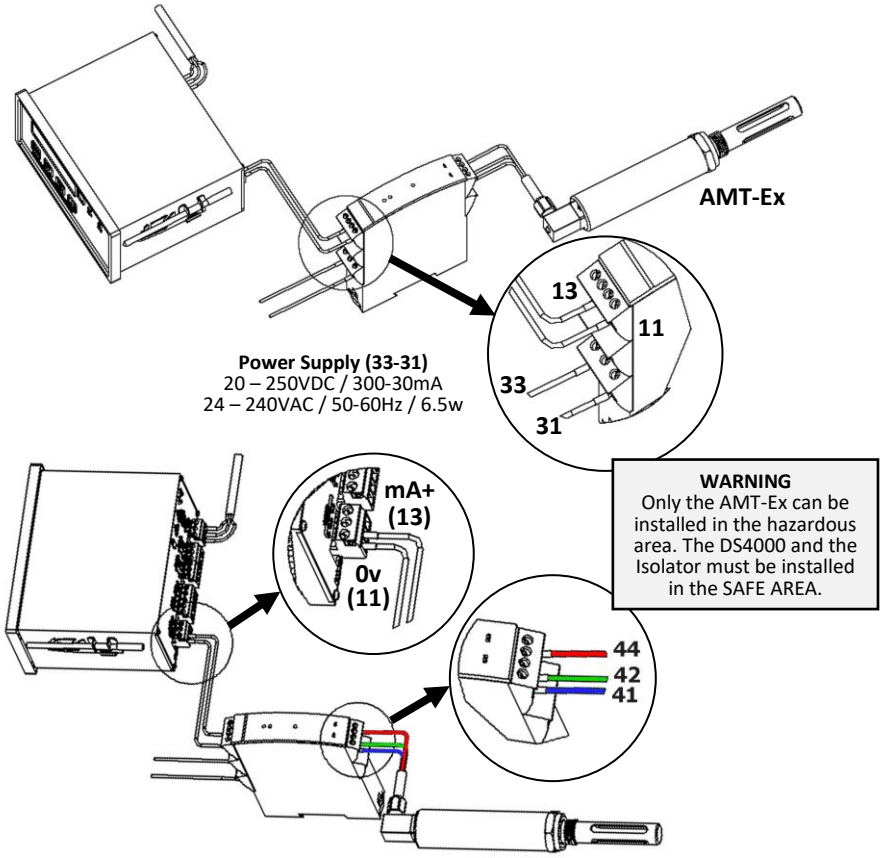


mA+ = BLUE wire
24v = RED wire

Mains Power Supply = Brown (**Live**), Blue (Neutral) & Green/Yellow (Earth)

5.4 Connecting an AMT-Ex Dewpoint Transmitter and Isolator to a DS4000

AMT-Ex Wiring	Terminal	DS4000 to Isolator Wiring	Power on Isolator
BLUE	41	0V to Terminal 11 on Isolator	Terminal 31 and 33 has no polarity
GREEN	42	mA+ to Terminal 13 on Isolator	
RED	44		



6. Installing the air/gas sampling system

The piping installation schematic diagram (see **section 6.1**) shows all components that could be used in a dry gas measurement application. Not all the items shown will be required for every installation.

Care should be taken to ensure that the sample presented to the measuring sensor is not contaminated with any component that will damage, contaminate or affect the sensor in a way that will impair the system accuracy.

It is strongly recommended that the sample should not contain particulate matter, oil or other heavy hydrocarbon condensate. If these components contaminate the sample system and/or the measuring sensor, the system response time will be lengthened, although the sensor calibration will not be affected.

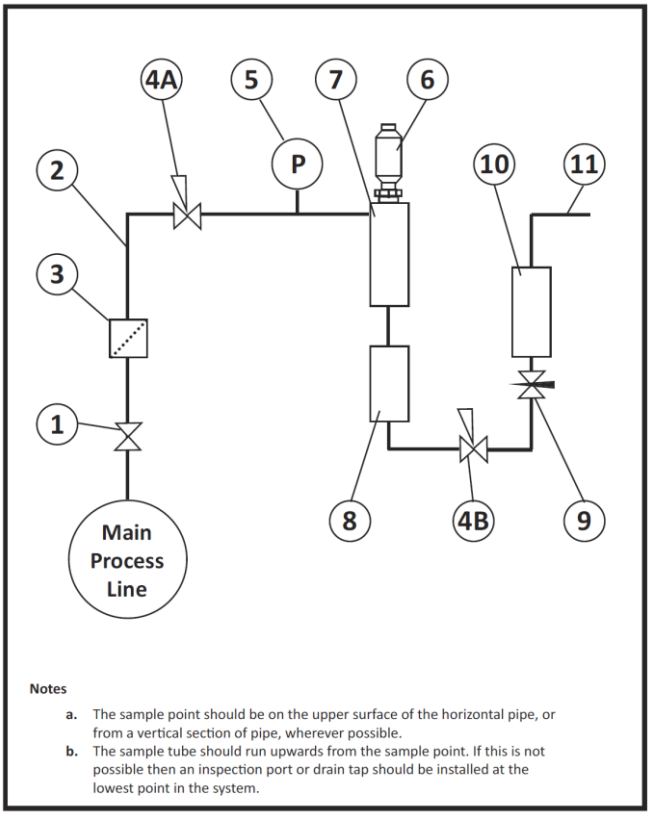
Corrosive Gases: The Sensor should not be exposed to corrosive gases (or corrosive contaminants in the gas sample) as these can chemically attack the sensor, impairing calibration accuracy and/or damaging it beyond economic repair. Examples of such gases are mercury (Hg), ammonia (NH_3), chlorine (Cl_2) etc. Strong oxidising agents such as ozone (O_3) should also be prevented from coming into contact with the sensor.

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 system response time to an unacceptable level. In general, a flow rate of between 2 and 3 litres/min at NTP will give the right balance.

The sensor is a variable capacitor, which is directly affected by changes in partial pressure of water vapour. These changes that are proportional to the dew/frost point temperature are displayed on the instrument indicator.

The measuring sensor can be installed directly into the process line, but this does create problems with access for maintenance and calibration. It is for these reasons that we recommend that the sensor be installed in a bypass, fast loop or total loss sample system where the sensor is accessible without interrupting the main process flow line.

6.1 Piping installation schematic



6.2 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) **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, 3mm OD (1/8”) is sufficient as it provides good system response time within minimum flow. 6mm OD (1/4”) tube can be used where pressure drops across the 3mm tube are too high.

3) 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.
4) Pressure Reduction Valve or Pressure Regulator – If the sample is to be measured at atmospheric pressure then the valve 4A should be fitted and 4B omitted from the system. If the sample is to be measured at full line pressure and the exhaust vented to atmosphere, then valve 4B should be fitted and 4A omitted from the system. If measurements are to be taken at full line pressure and the sample is to be returned to a part of the main line or a vent, which is at a pressure higher than atmospheric, and the input to that line needs a controlled pressure, then both 4A and 4B will be required.
5) Sample Pressure Gauge – This is not a critical part of the moisture measurement but may be required if Dew/Frost point measurements are to be made at higher than atmospheric pressure.
6) Measuring Transmitter.
7) Sensor Holder.
8) Desiccant Chamber – This item is required when the sampling is to be intermittent. When installed, it prevents the ingress of wet air to the sample system while the sample is not flowing, improving the response time.
9) Flow Control Valve – This can be a separate item or combined with the flow indicator.
10) **Flow Indicator** – The recommended sample flow is 2 to 3 litres/min at NTP.
11) Sample Exhaust – The exhaust can be vented to atmosphere or returned to the process line as discussed above.

7. Installing and commissioning the transmitter

It is advisable to carry out an initial purge routine of the sample loop before installing the sensor. This is to remove the possibility of sensor damage on start-up.

Refer to the sample system schematic in **section 6.1.** Open the inlet isolation valve slowly until a small flow of air/gas (at atmospheric pressure) flows through the

inlet pipe work to the sensor holder, exhausting through the sensor entry port of the sensor holder.

Allow this purge to continue for about 15 to 20 minutes to remove any residual moisture from the sample pipe work and components.

Close the inlet isolation valve and install the transmitter into the sensor holder.

Open the inlet valve slowly, by opening all valves after the sensor holder, allow a low-pressure purge through the whole sample system.

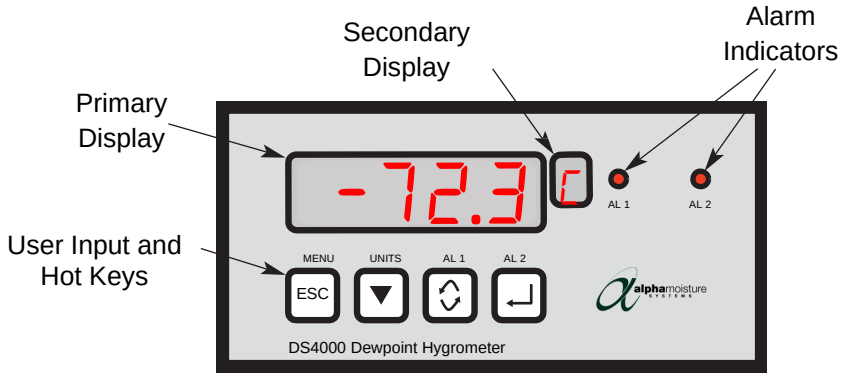
Note: If a closed by-pass loop is installed, this section of the procedure is not possible.

Set the required flows within the sample loop.

This completes the installation and commissioning, but on initial start-up, it could take several hours for the system to reach equilibrium. At equilibrium the DS4000 will indicate the dewpoint of the air/gas surrounding the sensor, and the analogue output will be giving a mA signals proportional to the indicated dewpoint.

8. DS4000 User Interface and Controls

Consists of a membrane keyboard with four user input keys and also four visual indication elements or windows: the primary five character LED, a single character secondary LED for unit indication, and two alarm LEDs.



In normal operation, the DS4000 will display the current moisture value of the connected transmitter in the Primary Display.

The engineering units are indicated in the Secondary Display.

The Alarm LED's (AL 1 & AL 2) will light **RED** whenever an alarm condition occurs and only turn off when the alarm condition clears, unless the alarms are latched.

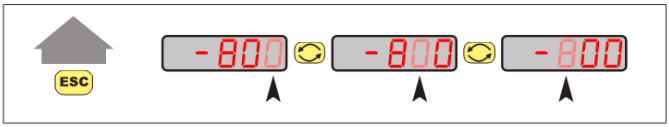
Remote signalling of an alarm condition is provided by separate internal changeover relays that trigger at the same time as the Alarm Indicators.

Keys	Function
ESC	Returns the user to the previous screen, without changing any variables.
▼	Used to decrease the selected digit when setting a numerical variable.
⟳	Used to select the next digit when setting a numerical variable or to scroll through the options available.
↵	Used to confirm a numerical variable or the selection of a chosen option.

PLEASE NOTE: Refer to Appendix B, C & D, Pages 35, 36 & 37 for full menu navigation.

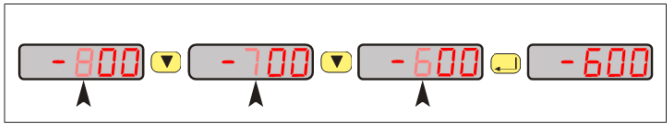
When a numerical value has to be entered into the DS4000 the following procedure should be used.

The right most character of the main display flashes to indicate it is active for editing. If required press the ⟳ key repeatedly to select the number or sign which needs to change.



The ESC key allows the user to leave a part of the menu without changing any settings.

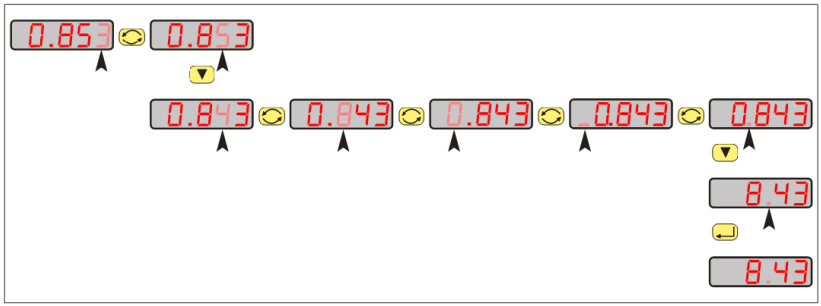
Use the ▼ key to change the required number between 0 and 9.



Pressing the ↵ key at any point sets the numerical value. Continue this process until all characters are entered.

In the case of numbers associated with units which use non integer numbers such as ppm(v), pressing the ⟳ key repeatedly beyond the fifth character makes the decimal point (“.”) flash and therefore active.

For example in order to change the alarm level from 0.843 to 8.43 ppm.



Use the ▼ key to position the decimal point in the required position.

Pressing the ↵ key at any point confirms the numerical value.

The numbers associated with use of °C & °F units are fixed to 1 decimal place e.g. -43.8°C.

8.1 Hot Keys

Panel Function

The 'Units' and 'Alarms' Hot Keys can be restricted using the 'Panel' function in the Setup Menu so that the Units and Alarms settings may only be inspected rather than adjusted using the Hot Keys. If the user tries to set an Alarm when the 'Panel' function is set to 'ON' the user will set the message rOnLY to indicate that the parameter is "Read Only"

While PAnEL is displayed, press the ↵ key to enter the subroutine. The main display will now display On or OFF. Use the ⟳ key to select On or OFF.

Press the ↵ key to confirm selection.

Units Hot Key

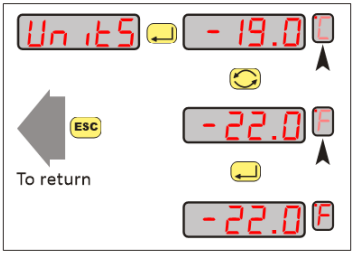
The ▼ 'Units' Hot key allows the user to view and alter the displayed units.

To review the moisture in alternative units, press the ▼ (Units) key for longer than 3 seconds. The main display will then show the message Un itS.

Press the ↵ key to enter the routine. Pressing the ⟳ key displays the current moisture level in each of the moisture units in turn. Press the ↵ key at any time sets the currently displayed units as the DS4000 active unit.

For example:

To change from a 'dewpoint °C' to a 'dewpoint °F'
While Un itS is displayed press the ↵ key to enter the subroutine.



The secondary display now shows the unit type flashing.

Use the key to scroll through to the next unit type is displayed e.g. °F

Press the key to select the new unit.

Note: Pressing the ESC key at any time escapes the hot key function and returns to the measurement display without saving any changes.

Alarms Hot keys

The two alarm Hot keys **'AL 1'** and **'AL 2'** allow the user to review and set the Alarm trigger points.

To review the alarm trip point press the (AL1) or (AL2) key momentarily. The primary display will show the set trip point for 1 second before reverting back to the moisture reading.

To change the trip point press and hold the (AL1) or (AL2) keys for longer than 3 seconds. The main display will then show the message AL 1 or AL 2. Press the key to enter the routine. Use the ▼ and keys to display the required alarm trip point.

Press the key to set the trip point.

8.2 Using the DS4000 Setup Menu

To enter the Setup Menu press and hold the ESC key for 3 seconds. This displays the SEtuP message on the main display.

Pressing the key takes the user to the rAnGE function in the Setup menu structure.

Note 1: If the user has a setup menu password, then the user is prompted to enter the correct password before continuing to the rAnGE function

Note 2: Most of the screens within the menu have an active 10-second timeout. Therefore, if no keys are pressed within this period the unit reverts automatically

to normal operation. In most cases where the 10-second timeout occurs, changes will not have been saved.

Table 1 Setup Menu contents.

Sensor Range	Contains a list of available ranges.
Configuration	Contains submenus for choosing engineering units and choice of gas types.
Analogue output	Contains submenus to allow the user to fully configure the Analogue output.
Alarms	Contains submenus to fully control behaviour of two independent alarms.
Communications	Contains submenus for changing baud rate and address of the instrument's RS485 communication port.
Security	Contains submenus to set up passwords to control or limit access certain features from unauthorized changes.

8.3 Using the High and Low Sensor Range Point Function

The rAnGE option allows the user to select a High range point between +30 to -20dp, and a Low range point between -40 to -130dp for the sensor range required. See Sensor Range Point Table on next page for available ranges. Pressing the key while rAnGE is displayed will display the first selectable range from the table. Use the key to scroll through the table. Press the key to select the displayed range. Continue to scroll through the available options using the . See Appendix B on page 35 for more information.

Sensor Range Point Table:

High:	-20	0	+20	+30				
Low:	-130	-120	-110	-100	-80	-65	-60	-40

8.4 Configuration Parameters (See Appendix A, B & C)

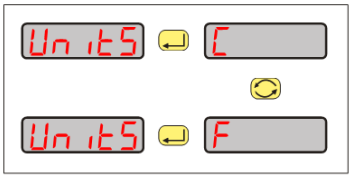
8.4.1 Choosing Moisture Units

The Un iTS submenu allows the user to alter the displayed units. While Un iTS is displayed press the ↵ key to enter the submenu. The currently selected unit is displayed. Select a different moisture unit by repeatedly pressing the ⟳ key to scroll through each of the moisture units.

Press the ↵ key to set the chosen moisture units.

For example.

To change from a 'dewpoint °C' to a 'dewpoint °F'



Note: Pressing the ESC key at any time reverts back to the Un iTS submenu without saving any changes.

8.4.2 Choosing the Pressure Units

The PUn iT submenu within SEtuP allows the user to alter the units for the pressure parameters

The choices are:

Pascal x 10^3	PA E3
psi gauge	PS i9
bar gauge	bAr 9

8.4.3 Choosing the Temperature Units

The tUn it submenu allows the user to alter the units for the temperature parameters.

The choices are:

°F	F
°C	C

8.4.4 Entry of Pressure at Sensor

The PI n routine allows entry of pressure at sensor. See Appendix C page 33.

8.4.5 Entry of Pressure at Display

The Pd iSP routine allows entry of a pressure at which to display the dewpoint.

8.4.6 Entry of Standard Pressure

The PStd routine allows entry of a standard pressure (Default 101.3 x 10^3 Pa, 0 psig, 0 barg)

8.4.7 Entry of Standard Temperature

The tStd routine allows entry of standard temperature. (Default 60°F, 15.56°C)

8.4.8 Entry of Gas Type

The GAS routine allows entry of a type of gas for ppm(w) calculations.

Air	Air
Argon, Ar	Ar
Methane, CH4	CH4
Carbon Dioxide, CO2	CO2
Hydrogen, H2	H2
Nitrogen, N2	n2
Sulphur hexafluoride, SF6	SF6
Custom molar mass	VALUE

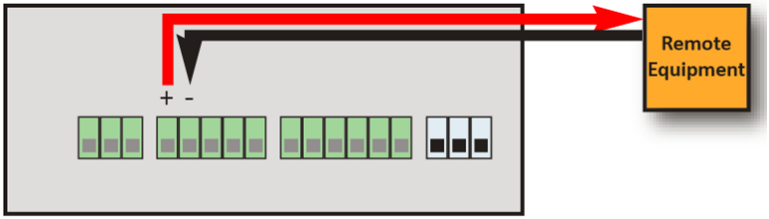
8.4.9 Natural Gas measurements

nt9AS requires a Yes or No response to turn on or off the Natural Gas correlation. If Yes, then the sensor linearization follows a modified curve defined in the Natural Gas correlation. If No, the sensor follows the ideal gas linearization.

8.5 Analog Output

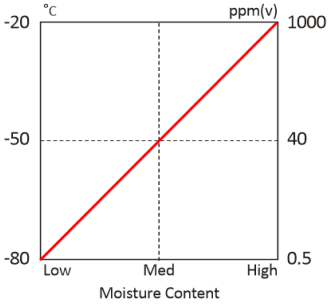
The DS4000 features an analogue output port which the user may use to retransmit the moisture reading to another system. The output benefits from galvanic isolation and segregation by isolated electrical circuits.

The analogue output is a current output. It is always enabled and care should be exercised therefore to ensure that during installation the two terminals are not shorted and have a load attached more than 200 Ω for optimum performance.



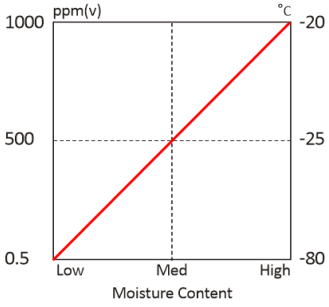
The mA output is linear over the range selected.

OUTPUT - Linear in °C



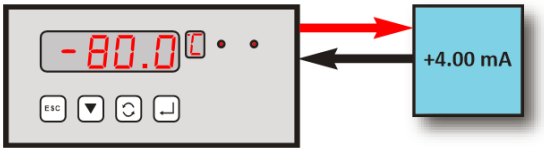
Also linear in °F

OUTPUT - Linear in ppm(v)

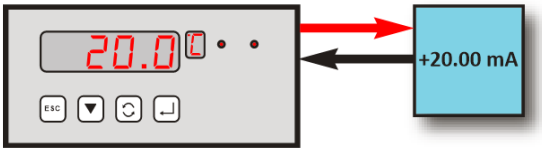


Also linear in g/m³ or lb/MMSCF

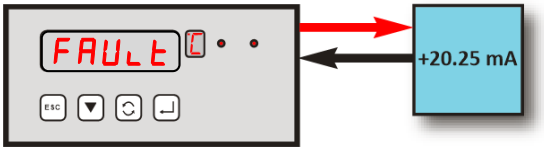
For example:
For a range of -80°C to + 20°C dewpoint the analogue output will be at its minimum when the reading is at -80°C dewpoint and at its maximum when the reading is at +20°C dewpoint.
Furthermore the factory default configuration is that the output current ranges from 4 to 20 mA. Therefore using the above example the port will output 4mA when the DS4000 displays -80°C dewpoint.



And 20mA when the Transmitter displays +20°C dewpoint.



If a sensor is detected as short circuit then the current output will rise to +20.25mA.



If required there is facility to change the output current calibration points at either end of the scale to attain a more focused signal. **For Fault Guide See Section 10.**

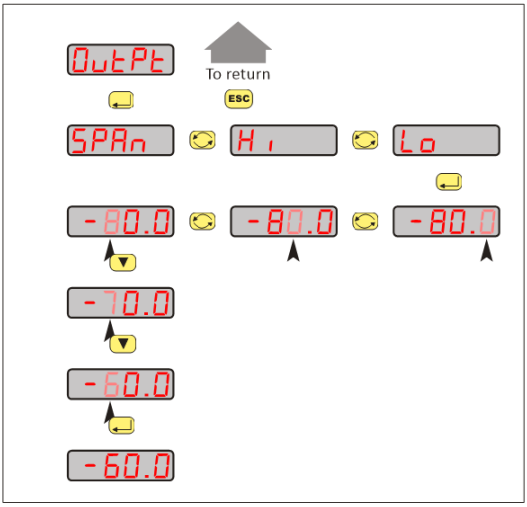
8.5.1 Spanning the mA Output

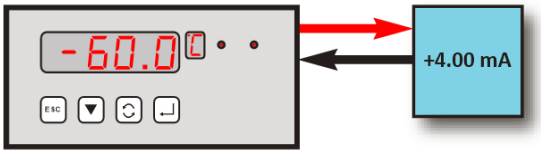
It is possible to change the output current calibration points at either end of the range to attain a more focused retransmitted signal.

For example: See next page.

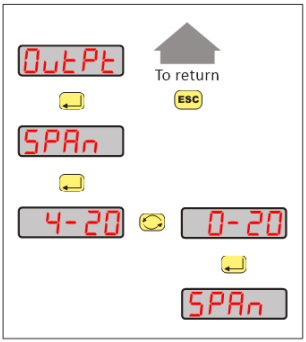
Moving the lower scale point from -80°C dewpoint to –60°C may be desirable and can be achieved by the following entry to the instrument configuration.

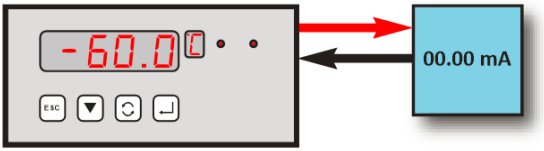
When OutPt is displayed press the ↵ key to enter the routine displaying SPAn. Use the ⟳ key to select either the Hi or Lo mA setting. Press the ▼ key to display the current set point, use the ⟳ and ↵ keys to display the new value and ↵ key to set the value.





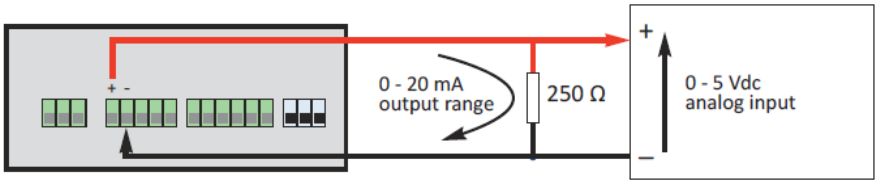
It is also possible to select a 0-20mA output range instead of the standard 4–20mA.





8.5.2 Voltage Output

Selecting this range is useful to provide a convenient method of providing a 0-5 Vdc voltage output to the remote equipment when used in conjunction with a suitable 250 Ω resistor.



8.6 Alarms

The two independent alarms options (1 and 2) allow the user to setup configurable alarm events by setting the trip points, direction of trigger, relay enable energized-on-event command, latching on-event command and hysteresis.

While AL 1 or AL 2 are displayed press the ↵ key to enter the submenu. The unit displays SEtPt. Use the ⟳ key to select the required function and then press the ↵ key.

Note: Pressing the ESC key reverts back to the display AL 1 or AL 2 message screen.

The following functions can be performed:-

SEtPt	Enter the alarm set point.
tYPE	Select if the alarm is to activate on a rising signal Hi, falling signal Lo or OFF.
rELAY	Select if the relays are Energized En or de-energized dE-En
LAtch	Set if the alarm is Latch YES or not latching no.
HYSt	Enter the hysteresis value.

Note: Pressing the ↵ key sets the alarm parameters they will **not** revert to the previous setting even if the 20 second timeout occurs or the ESC key is pressed.

8.7 Digital Communication

The rS485 submenu allows the user to set the address and baud rate used in communicating with a PC using RS485 communications. See Appendix E.

A RS485 interface and cable are required.

All transmission are binary NOT ASCII characters. 8 Bit, 1 start bit, 1 stop bit, No parity and No Flow control.

A single instrument may be connected using the universal address of 0.

Up to 32 instruments may be connected using addresses 0 to 32.
Note: Do not use the universal address "0" when more than one transmitter is connected.

The instrument is the slave and must be polled for data.

There is only one command and returns the process value in the units that have been set in the secondary display.

Alarm state and a sensor short are returned in a 2-byte status word.

While rS485 is displayed press the ↵ key to enter the submenu and Addr is displayed. Use the ⟳ key to select either Addr, or bAUd then press the ↵ key.

If the Addr option is selected the screen will display the current address value.

Use the ⟳ & ▼ keys to enter the new value. Press the ↵ key to set the new address.

Legal addresses are 1 to 32.

Note: Once the key is pressed to set the address or baud rate, that value is committed and will not revert to the previous value even if the 10 second timeout occurs or the ESC key is pressed.

If the bAUd option is selected, use the ⟳ key to select the required baud rate. Select between:

9600
4800
2400
1200

Press the ↵ key to confirm selection.

Refer to Appendix **E** for communications protocol.

8.8 Security Passwords

The PASS function allows the user to protect certain functions within the DS4000.

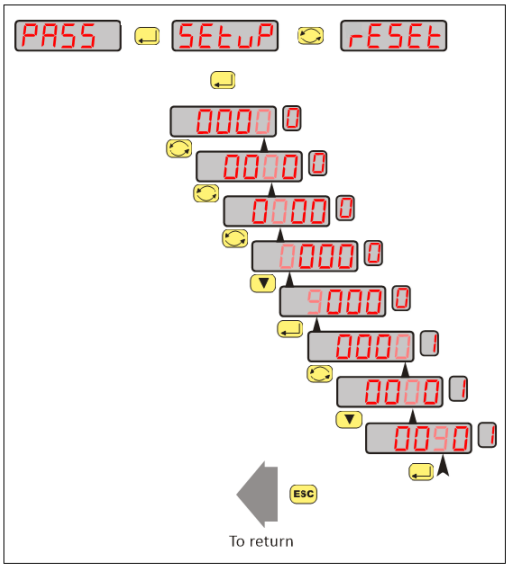
While PASS is displayed press the key to enter the submenu. The unit displays SEtPt. Use the key to select the required function and then press the key. The unit will display 0000 and the secondary display will show a 0. The user must enter the current password using the & keys. Pressing the key then displays 0000 while the secondary display will show a 1. Enter the new password pressing to confirm.

8.8.1 Password to control access to the Setup Menu

The user may set a password to secure the SEtUP menu. The default password is 0000.

8.8.2 Password to control access to the Reset Command

The user may set a password to secure the rESEt menu. The default password is 9000.



8.9 Panel

The panel option allows the user to restrict the function of the front panel Hot Keys. If the option is selected, the Hot Keys are restricted.

While PAnEL is displayed press the  to enter the submenu. The main display now displays either on or oFF. Use the  key to select the required status. Press  to confirm selection.

8.10 Reset

The rESEt submenu allows the user to reset the instrument back to factory default settings. If the option is protected the user will be required to enter the password.

NOTE: All user settings will be erased when this function is applied.

9. Monitoring the System

The system is designed to operate continuously with a minimum amount of operator input.

It is, however, advisable to inspect the sample loop periodically to ensure that the required flows are being maintained.

The number and type of items employed in the sample loop will determine what, if any, routine checks should be made. If, for instance, a filter is used, the filter element should be inspected periodically and changed when necessary.

The instrument should not require any routine maintenance, but if any malfunction is suspected, it is advisable to contact your local dealer.

Should it be necessary at any time or for whatever reason, to change either the instrument or sensor, it should be noted that the instrument and sensor are completely interchangeable.

10. Error Messages

Message	Description
FAULt	Sensor or sensor cable is short-circuited. The current output will drive to 20.25 mA. Please contact your local dealer.
rOnLY	Attempt was made to change displayed units or Alarm Setpoint when Hot Key settings editing is prevented by PANEL submenu. Refer to **Section 12** for more information.
A IOFF	Attempt was made to enter alarm Hot key when alarm is switched off.
Error	High-priority unspecified error during value entry Limit a float of invalid subtype Set a float with invalid sign Please contact your local distributor for advice.
OuEr	Attempted to adjust a value over its high range calculation limit
UndEr	Attempted to adjust a value under its low range calculation limit
SPAn-	Set loop current range with Hi Lo end points reversed
SPAnO	Set loop current range with Hi Lo end-points too close together
nol n	No sensor connected, polarity of sensor is wrong
Short	Over maximum milliamps (mA)

11. Appendix A - Default Instrument Configuration

Configuration	Contains submenus for choosing engineering units, and choice of gas types. **Defaults are:** • the moisture content in °C dewpoint • the ppm(w) calculations use the gas type as Air • the model for natural gas is disabled • the pressure units are bar g • the temperature units are °C • the standard temperature and pressures are reset to 15.56°C (60°F) and 0 Barg
Sensor Range	Contains submenus to choose the range of sensor. **Defaults are:** • The sensor range is -100/0°C • The viewing of the instrument's internal ACU readings are disabled.
Analog output	Contains submenus to allow the user to fully configure the analogue output. **Defaults are:** • Output range is set to 4-20mA • Output range is set to the full span of the selected moisture range e.g. 4 mA = -100°C and 20 mA = 0°C for default range.
Alarms	Contains submenus to fully control behaviour of two independent alarms. **Defaults are:** • Both alarms set points are set to 0°C • Both alarms are set to trigger when rising above the upper limit. • The relays are de-energised in a non-event state • The alarms events are not latching • The alarm hysteresis is set to 0.1°C or the equivalent in other units
Communications	Contains submenus for changing baud rate and address of the instrument's RS485 communication port. **Defaults are:** • The instrument will communicate with a baud rate of 9600. • The address will be 00.
Security	Contains submenus to set up passwords to control or limit access certain features from unauthorised changes. **Defaults are:** • The setup password is reset to 0000 and as such is not requested unless changed. • Other security password codes are defaulted (and on a reset set) to 9000. • Panel submenu is enabled allowing changes via hot keys

15. Appendix E - Communications Protocol

RS485 REQUEST Protocol (as seen by Model DS4000)		
Byte	**Description**	
0, first	Preamble	255
1		255
2		255
3		255
4		255
5	Master-to-Slave	2
6	Address	0 to 32
7	Command	24
8	Data Length	1
9	Data Bytes	0
10, last	Checksum	8-bit arithmetic XOR of byte 5 onwards

RS485 REPLY Protocol (as seen by Model DS4000)		
Byte	**Description**	
0, first	Preamble	255
1		255
2		255
3		255
4		255
5	Slave-to-Master	6
6	Return Address	8-bit with MSbit set to 1
7	Command	24
8	Data Len	6
9	Status	bits 15 - 8
10		bits 7 - 0
11	Data	Process Value, Single Precision (4-Byte Float), IEEE 754 Format, Big-endian (first byte = ms)
12		
13		
14		
15, last	Checksum	8-bit arithmetic XOR of byte 5 onwards

REPLY Status	
Bit	**Description**
15 (ms)	Not used
14	
13	
12	Alarm 2 requires user to clear
11	Alarm 1 requires user to clear
10	Alarm 2
9	Alarm 1
8	In fault: reports all errors (no input, open-circuit, short-circuit and generic fault)
7	Units code
6	
5	
4	
3	
2	
1	
0 (ls)	

Example of communication using universal address 0

Request message sent to Model 6020	255 255 255 255 255 2 0 24 1 0 27
Reply message from Model 6020	255 255 255 255 255 6 128 24 6 0 0 <4 bytes of single float> <1 byte of checksum>