MICHELL Instruments
A PST BRAND

Pura
Advanced Online 2 Hygrometer
User Manual

97628 Issue 1
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Please fill out the form(s) below for each instrument that has been purchased.

Use this information when contacting Michell Instruments for service purposes.

Product Name	
Order Code	
Serial Number	
Invoice Date	
Installation Location	
Tag Number	

Product Name	
Order Code	
Serial Number	
Invoice Date	
Installation Location	
Tag Number	

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Order Code	
Serial Number	
Invoice Date	
Installation Location	
Tag Number	

Pura Advanced Online 2 Hygrometer

For Michell Instruments' contact information please go to
www.ProcessSensing.com

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Safety

The instrument is designed to be completely safe when installed and operated correctly in accordance with the information provided in this manual.

This manual contains all the required information to install, operate and maintain this product. Prior to installation and use of this product, this entire manual should be read and understood. Installation and operation of this product should be carried out by suitably competent personnel only. The installation and operation of this product must be in accordance with the instructions provided and according to the terms of any associated safety certificates. Incorrect installation and use of this product other than those described in this manual and other than its intended purpose will render all warranties void.

This product meets the essential protection requirements of the relevant EU & UK directives. Further details of applied directives may be found in the product specification.

Electricity and pressurized gas can be dangerous. This product must be installed and operated only by suitable trained personnel.

No user serviceable parts inside

Where this hazard warning symbol appears in the following sections, it is used to indicate areas where potentially hazardous operations need to be carried out and where particular attention to personal and personnel safety must be observed.

Where this symbol appears in the following sections it is used to indicate areas of potential risk of electric shock.

This product is intended for use only under the following conditions:

a. indoor use

b. altitude up to 2 000 m

c. temperature 5 °C...40 °C

d. maximum relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 %, relative humidity at 40 °C

e. MAINS supply voltage fluctuations up to ±10 % of the nominal voltage

f. TRANSIENT OVERVOLTAGES up to the levels of OVERVOLTAGE CATEGORY II

g. TEMPORARY OVERVOLTAGES occurring on the MAINS supply

h. applicable POLLUTION DEGREE 2 of the intended environment

Electrical Safety

Ensure electrical safety is complied with by following the directions provided here and observing all local operation & installation requirements at the intended location of use.

This product is completely safe when using any options and accessories supplied by the manufacturer of this product for use with it. Refer to Section 2 (Installation) of this manual for further details.

Pressure Safety

For this product to operate satisfactorily, pressurized gas must be connected to it. Observe all the information contained within this manual and all local operation & installation requirements at the intended location of use. Refer to Section 2 (Installation) of this manual for further details.

Hazardous Materials (WEEE, RoHS3 & REACH)

This product does not contain or release any prohibited chemicals listed on the SVHC (Substances of Very High Concern) Candidate List. During the intended normal operation of this product it is not possible for the user to come into contact with any hazardous materials. This product is designed to be recyclable except where indicated.

Repair and Maintenance

The instrument must be maintained either by the manufacturer or an accredited service agent. For contact information visit the website at www.ProcessSensing.com.

Calibration

Periodic re-calibration is recommended in order to maintain the highest quality of measurement in your application. Michell Instruments recommends that you have your Pura M12 transmitter re-calibrated annually unless it is used in a mission-critical application or in a contaminated environment, in which case the calibration interval should be reduced accordingly.

Michell Instruments can offer a variety of re-calibration and exchange transmitter schemes to suit your specific needs. A local representative will be pleased to provide detailed custom advice.

Safety Conformity

This product meets the essential protection requirements of the relevant EU & UK directives. Further details of applied standards may be found in Appendix C.

Abbreviations

The following abbreviations are used in this manual:

AC	alternating current
atm	pressure unit (atmosphere)
barg	pressure unit (=100 kP or 0.987 atm)
ºC	degrees Celsius
ºF	degrees Fahrenheit
DC	direct current
dp	dew point
ft	foot (feet)
g	gram(s)
Hz	Hertz
"	inch(es)
lb	pound
l/min	liters per minute
m	meter(s)
µm	micro-meter
mA	milliampere
max	maximum
min	minute(s)
MPa	megapascal (Pascals $x10^6$)
Nl/min	normal liters per minute
Nm	Newton meter
ppm_v	parts per million (by volume)
rh	relative humidity
scfh	standard cubic feet per hour
V	Volts
Ω	Ohms

1 INTRODUCTION

The Pura Advanced Online 2 Hygrometer is easy to install and configure; this versatile touch screen hygrometer can measure and display dew point and moisture content and indicate pressure. This display provides analog, digital and 4 programmable relay alarm outputs with front screen or software app display configuration.

It has been developed as a premium-performance hygrometer system for use in a wide variety of applications.

It can display data in °C or °F dew point, ppm_V, lb/mmscf or g/m^3, from -120 up to -40 °C (-184 up to -40 °F), at pressures up to 240 bar (3481 psi).

To calculate moisture content from dew point, it is necessary to know the system pressure. This hygrometer can either compensate for pressure change by using a live pressure sensor input, or accept a fixed pressure input value.

1.1 Features

The Pura Advanced Online 2 Hygrometer offers customers the following features:

- Measures down to -120 °Cdp (-184 °Fdp) (1 ppb_V)
- Stable and repeatable measurement
- Fast response
- Economical and advanced monitor solutions
- Dew-point or moisture content output
- 4...20 mA and Modbus RTU over RS485 outputs
- Traceable 7-point calibration certificate
- 1/2”, 1/4” male VCR process connections
- M12 electrical connectors
- Sensor exchange program

2 INSTALLATION

It is essential that the connection of electrical and gas supplies to this instrument be undertaken by competent personnel.

2.1 Unpacking the Instrument

2.1.1 Unpacking Pura Advanced Online 2 Hygrometer

The Pura instruments and accessories are packed into a box and the method of unpacking is shown as follows:

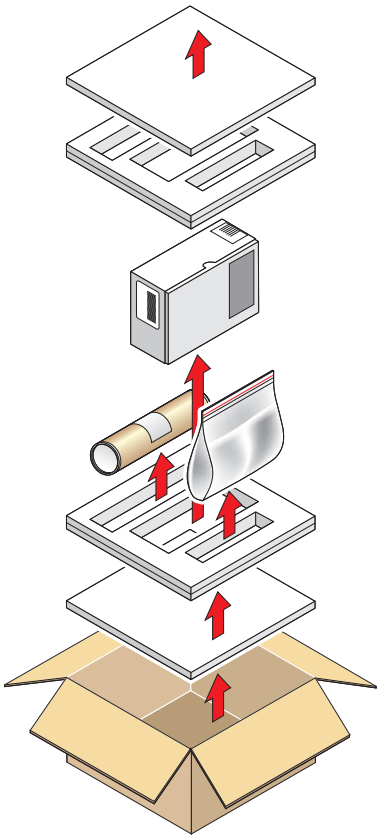


Figure 1 *Unpacking – Monitor and Pura SEN, no block version*

NOTE: Packaging specifications are subject to continuous improvement, as we reduce our use of plastics and move to cardboard packing systems.

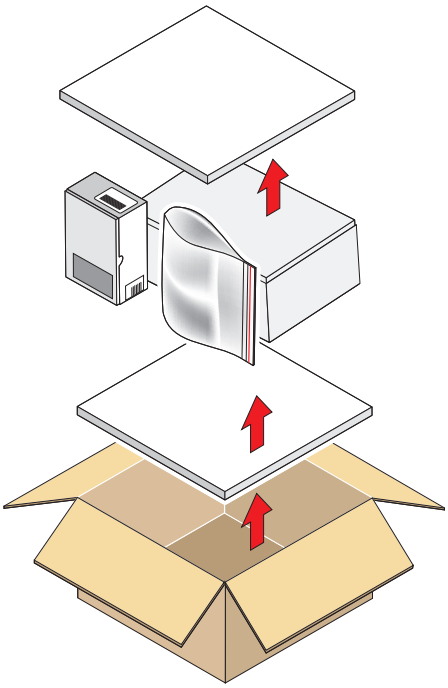


Figure 2 *Unpacking – Monitor and Pura OEM / PRM*

2.1.2 Unpacking Pura SEN (transmitter, no block version)

Unpack the dew-point transmitter from the rectangular cardboard box.

NOTE: The transmitter sensing element is protected while in transit by a red cover containing a small desiccant capsule. This plastic item is not required for the operation of the transmitter.

NOTE: Keep the electrical connector in a safe place until the transmitter is ready for wiring.

2.1.3 Unpacking Pura OEM-single bag, PRM-double bag versions

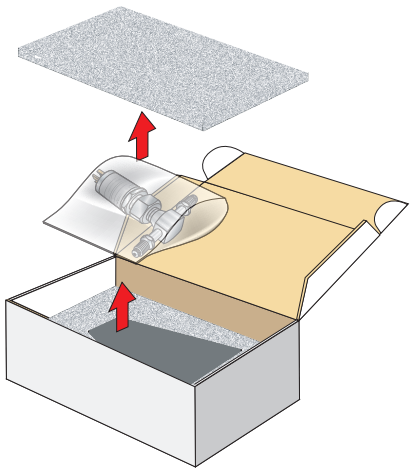


Figure 3 *Unpacking – Pura OEM & PRM – Single / Double Bag*

2.1.4 Unpacking the Process Monitor

The Process Monitor is packed in a cardboard box, together with its fixing clamps.

2.2 Pura Advanced Online 2 Components

On delivery please check that all the following standard components are present in the packing box. Report any shortages to Michell Instruments, immediately.

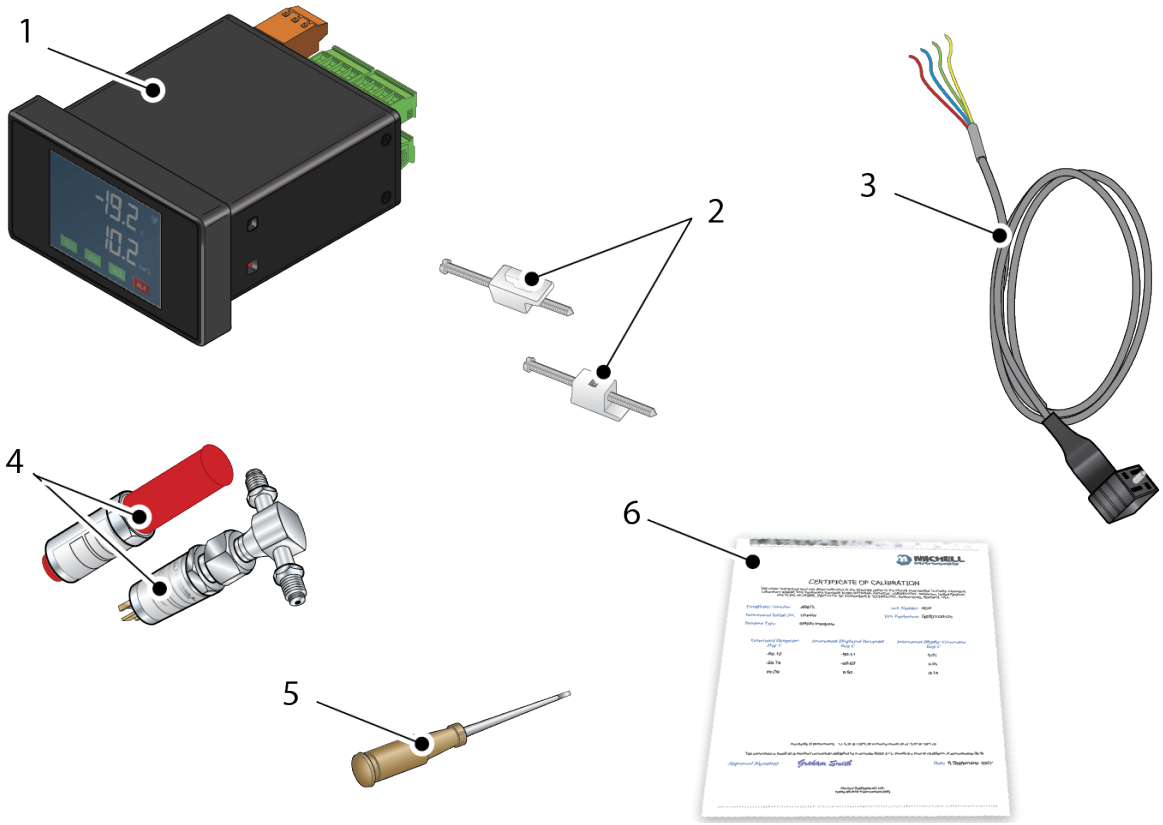


Figure 4 *Pura Advanced Online 2 Components*

1. PURA Monitor
2. Clamps
3. Sensor cable assembly
4. Pura Transmitter (SEN) OR

   Pura Transmitter (OEM) or (PRM)
   Leak test certificate included
5. Screwdriver
6. Calibration certificate

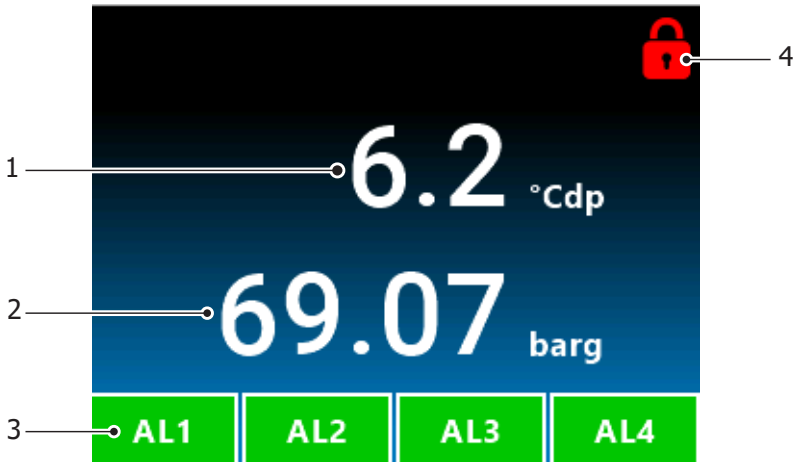
2.3 Process Monitor Display

The display within the Process Monitor is an LCD 320 x 240 pixel software driven, touch screen color display.

2.3.1 Process Monitor Display Layout

In normal operation, the display screen will appear as below.

The display shows a moisture or pressure value, the status of four alarms and a display locked/unlocked symbol, which is all explained in detail in *Figure 5* below.



1	Dew Point or Moisture Content value referenced to its configured scale
2	Pressure Indication value or ppm_V referenced to its configured pressure scale
3	Alarm Status of the 4 relay outputs
4	Security code protected Unlock button to access the configuration menu

Figure 5 *Monitor Display in Normal Operation*

2.3.2 Electrical Connections

Electrical connections to the Pura Advanced Online 2 system are as follows:

- AC power supply input, 85...265 V AC (7.5 VA)
- Alternative low-voltage DC input is also available: 18...28 V DC (170 mA @ 24 V DC)
- Dew-Point Sensor Modbus RTU over RS485 digital input (24 V DC loop power provided by monitor)
- Pressure Sensor 2-wire 4...20 mA current loop (24 V DC loop power provided by monitor) input (optional)
- Modbus RTU over RS485 digital communications interface
- 3 x programmable 4...20 mA analog outputs for assigning to dew point, moisture content and pressure parameters
- 2 x Form A, 2 x Form C Namur compliant programmable relay outputs for process and fault conditions

The power supply voltage is indicated on the connection detail label located on the Process Monitor. As the Process Monitor is provided for continuous operation, it does not have an ON/OFF switch.

The power supply to the Process Monitor may be one of the following, dependent on the type ordered.

NOTE: Connect 0 V to local or remote Earth depending upon installation.

2.3.2.1 High-Voltage Power Supply Input

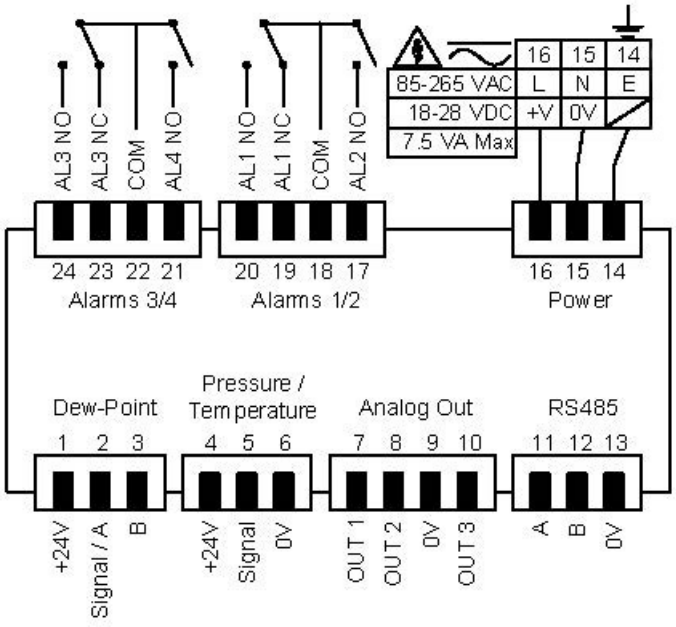


Figure 6 *Electrical Wiring Schematic*

For high-voltage powered display

- 85...265 V AC 50/60 Hz

It is essential that the connection of electrical supplies to this instrument is undertaken by competent personnel.

Connect the power supply to the monitor as shown in *Figure 6* above.

PIN 14 – Earth
PIN 15 – Neutral
PIN 16 – Live

2.3.2.2 Low-Voltage Power Supply Input (Alternative)

For low-voltage DC powered display

- 18...28 V DC

Connect the power supply to the DC version Process Monitor as shown in *Figure 6* above.

PIN 15 – 0V DC
PIN 16 – 18...28 V DC

2.3.2.3 Dew-Point Sensor Modbus RTU over RS485 Digital Input (Required)

For AC or DC voltage powered display version

Connect the Dew-Point Sensor to the Process Monitor as shown in *Figure 6*.

PIN 1 – +24 V DC Power
PIN 2 – RS485 A digital comms
PIN 3 – RS485 B digital comms
PIN 6 – 0 V DC Power

2.3.2.4 Pressure Sensor Input (Optional)

For AC or DC voltage powered display version

Connect the Pressure Sensor to the monitor as shown in *Figure 6*.

PIN 4 – +24 V DC Power
PIN 5 – 4...20 mA signal return
PIN 6 – 0 V DC Power

2.3.2.5 Analog Outputs

For AC or DC voltage powered display version

PIN 7 – 4...20 mA Current Source Output 1
PIN 8 – 4...20 mA Current Source Output 2
PIN 9 – Common
PIN 10 – 4...20 mA Current Source Output 3

2.3.2.6 Modbus RTU Output

For AC or DC voltage powered display versions

PIN 11 – RS485A digital comms
PIN 12 – RS485B digital comms
PIN 13 – 0 V DC Power

2.3.2.7 Relay Outputs

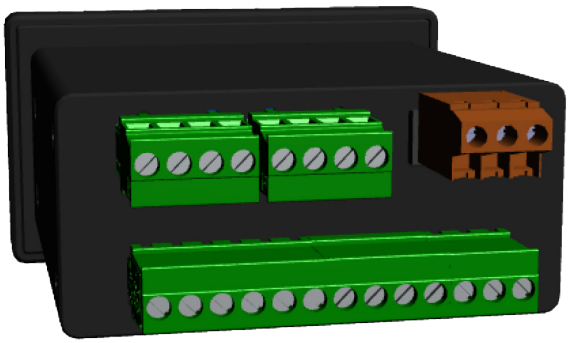
For AC or DC voltage powered display versions, the relay outputs are as shown in *Figure 6*.

Alarms 1/2
PIN 17 – AL2 normally open
PIN 18 – Common
PIN 19 – AL1 normally closed
PIN 20 – AL1 normally open

Alarms 3/4
PIN 21 – AL4 normally open
PIN 22 – Common
PIN 23 – AL3 normally closed
PIN 24 – AL3 normally open

2.3.2.8 Transmitter Connections

Connect the Pura M12 dew-point sensor as shown in the table in *Figure 6*.



2.4 Mounting the Process Monitor

The Process Monitor is designed for panel mounting and requires a panel cut-out of 44 x 92 mm (1.73 x 3.62″). The recommended panel thickness is 2...5 mm (0.08...0.2″).

To mount the unit, proceed as follows:

1. Pass the Process Monitor through the front of the panel.
2. Support the Process Monitor and attach mounting fixing brackets onto the side of the monitor.
3. Tighten the fixing screw finger tight, against the back of the panel. Recommended maximum torque is 30 cNm using a 1.5 mm Allen key.
4. Ensure that the Process Monitor is sitting flush to the front of the panel and tighten the fixing screws evenly against the back of the panel.

Caution: Do not overtighten the screws as this could cause the case to crack.

2.5 Pura SEN

NOTE: For environmental and operating conditions, refer to Appendix A: Technical Specifications.

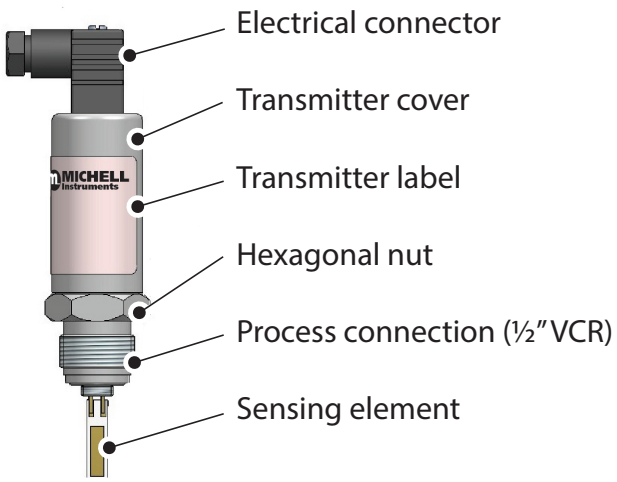


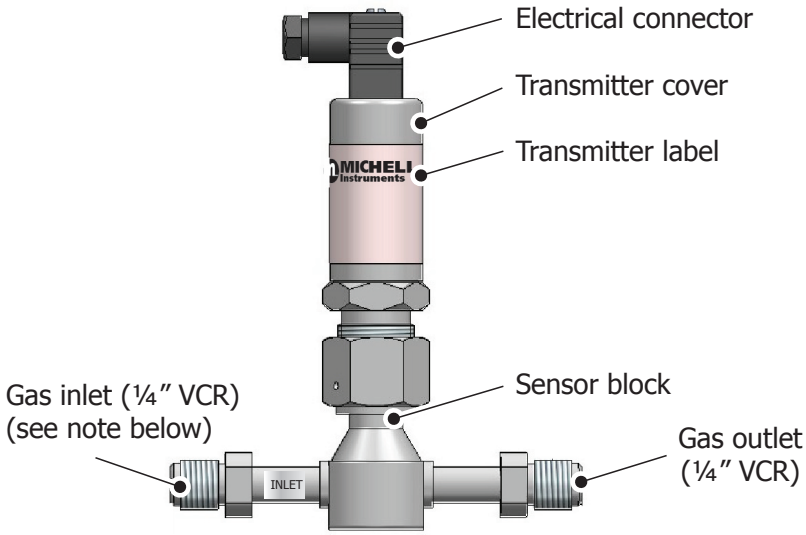
Figure 7 *Pura SEN*

NOTE: M12 connector supplied.

2.6 Pura OEM, PRM

NOTE: For environmental and operating conditions, refer to Appendix A: Technical Specifications.

NOTE: The OEM and PRM transmitters are protected in transit by putting in a plastic bag filled with nitrogen. The Pura OEM has single-bag protection and the Pura PRM has double-bag protection.



NOTE: The Pura has a uni-directional connection and must be connected so the upstream flow is connected to the inlet port of the Pura block (marked with a silver label).

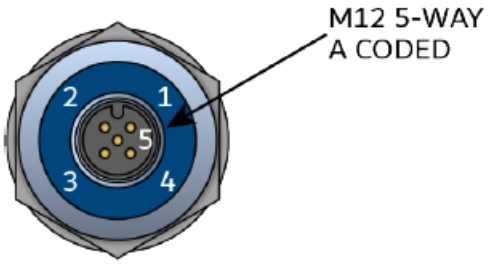
Figure 8 *Pura OEM, PRM*

NOTE: M12 connector supplied.

2.6.1 Pura M12 Connector Version

The following sections apply to the M12 connector version of the transmitter shown below.

2.6.1.1 Electrical Connections



Sensor Connector Pin	Michell Standard Conductor Color	Function	Process Monitor Connection Pin No.
1	Brown	Modbus A	2
2	White	Modbus B	3
3	Blue	4...20 mA Signal Return (Power Supply -ve) (not used – see note)	6
4	Black	Power Supply +ve	1
M12 connector sensor housing	Grey	Ground, Cable Screen Connection This wire connects directly to the metal casing of the transmitter, but not to the transmitter electronics, and is intended for cable screening only.	Selected ground connection point

Figure 9 *Sensor Connector Installation*

NOTE: The sensor cable is supplied as standard. Replacement pre-wired cables can be obtained by contacting your local Michell Instruments representative or assembled by the user according to instructions in the following section.

NOTE: The sensor transmits its output to the Process Monitor via the RS485 Modbus RTU Communications signal on Pins 1 and 2.

2.6.1.2 Pura M12 Cables

The cable connector should be installed by aligning the locating pin on the transmitter with the slot on the cable. The connector can then be pushed into place and rotated until finger tight.

Cables with moulded M12 connectors are available from Michell Instruments in the following lengths:

- 2 m
- 5 m
- 10 m

The other end of the sensor cable is unterminated, for straightforward connection into the Process Monitor.

If longer cable runs are required, off-the-shelf 5-pin M12 cables can be connected between the Pura M12 Transmitter and the Process Monitor.

2.6.2 Cable Selection for Self-Assembled Cables

It is recommended to use 4-core screened cable. For short runs, a cable with individual conductor sizes of 24 AWG / 0.21mm$_2$ would be a typical choice.

2.7 Transmitter Mounting

2.7.1 Pura SEN - Sample Block (Optional)

Prior to installation of the transmitter, unscrew and remove the red plastic cover and retain for future use. Take care to prevent any contamination of the transmitter before installation – **handle the transmitter by the main body only, avoiding contact with the sensing element**.

The recommended gas flow rate, when mounted in the optional sampling block, is 1...5 Nl/min (2.1...10.6 scfh). However, for direct insertion applications, gas flow should be from static to 10 m/sec (32.8 fps).

The following procedure must be carried out by a qualified installation engineer.

To mount the transmitter into the sensor block (preferred method), proceed as follows (see *Figure 10)* :

1. Remove the red protective cover (2) from the tip of the transmitter (1).
2. Fit the ½" VCR gasket (3) over the threaded part of the transmitter body.

WARNING: Under no circumstances should the filter guard be handled with the fingers.

3. Screw the transmitter (1) into the sensor block (4) and, holding the Pura transmitter stationary with a spanner/wrench, tighten the gas line nut 1/8 of a turn using a second spanner/wrench. **NOTE: Use the flats of the hexagonal nut and not the transmitter body.**

4. Fit the transmitter cable/connector assembly to the plug located on the base of the transmitter and tighten the fixing screw.

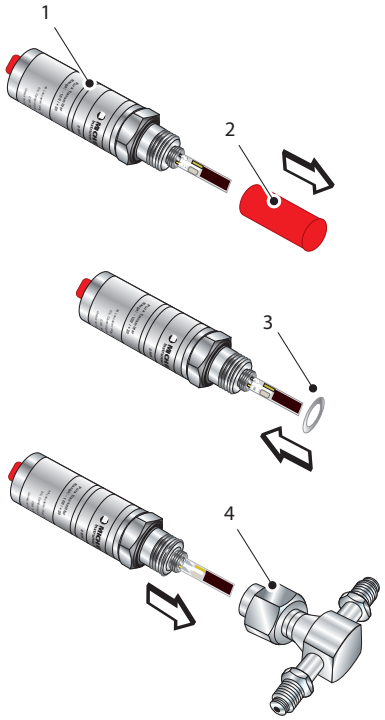


Figure 10 *Sensor Block Connection*

2.7.2 Pura OEM & PRM Connection

The Pura OEM and PRM have been assembled and packaged within a Class 100 clean-room environment. To maintain this level of cleanliness the packaging should only be opened within the same, or cleaner, environment.

Michell Instruments recommends the use of Swagelok® retained gasket assemblies, containing silver plated, stainless steel ¼" VCR gaskets, when connecting the Pura into a gas line. The distance between the inlet and outlet gas connection ports is set at a pitch of 120mm (4.7").

1. Install the sealing gasket onto the VCR connections on either the Pura or the connecting gas lines. Ensure that the Pura is offered into the gas line with reference to the gas flow direction and the inlet port, as indicated on the Pura body.

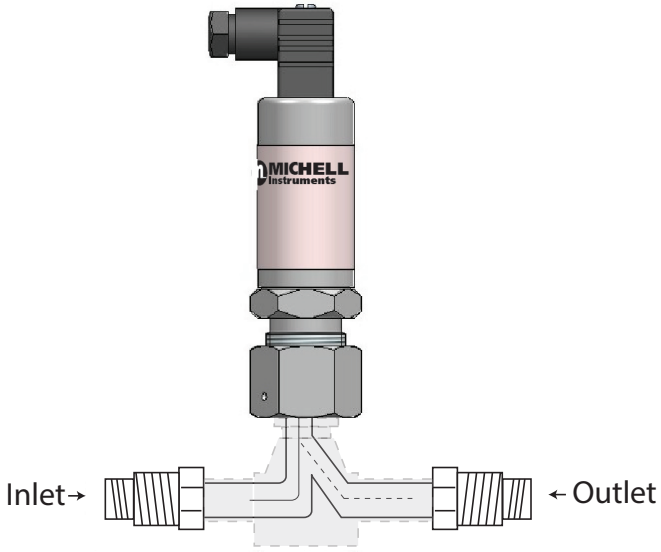


Figure 11 *Inlet/Outlet Identification*

NOTE: M12 connector supplied.

NOTE: In order to identify the Inlet and Outlet without dismantling the instrument it is necessary to look through the Inlet/Outlet holes. Looking through the INLET hole a shiny end can be seen, looking through the OUTLET hole an elongated shape can be seen.

2. Tighten the female nut firmly, finger tight.
3. Hold the Pura transmitter stationary with a spanner/wrench and tighten the gas line nut 1/8 of a turn using a second spanner/wrench.
4. Repeat this operation on the remaining gas connection port.

CAUTION: Over-tightening the nuts can cause irrecoverable damage to the seals and seatings.

2.7.3 Pura SEN - Direct Pipeline Connection

The transmitter may be directly mounted into a pipe or duct.

CAUTION: Do not mount the transmitter too close to the bottom of a bend where any condensate in the pipeline might collect and saturate the probe.

The pipe or duct will require a ½" VCR male process connection thread to match the transmitter body thread. Fixing dimensions are shown in *Figure 12.* For circular pipework, to ensure the integrity of a gas tight seal, a mounting flange will be required on the pipework in order to provide a flat surface to seal against.

Procedure

The following procedure must be carried out by competent personnel.

1. Ensure that the red protective cover has been removed from the tip of the transmitter.

WARNING: Under no circumstances should the filter guard be handled with the fingers.

2. After first checking that the pipeline has a wide enough bore to accept the transmitter's process connection, screw the transmitter into the pipe. Tighten enough to obtain a gas tight seal. (Torque will depend upon the pipeline material.)

Michell Instruments recommends the use of Swagelok® retained gasket assemblies, containing silver plated, stainless steel ½" VCR gaskets, when connecting the Pura into a gas line.

NOTE: Do not overtighten or the thread on the pipework may be stripped.

3 OPERATION

3.1 Process Monitor Configuration

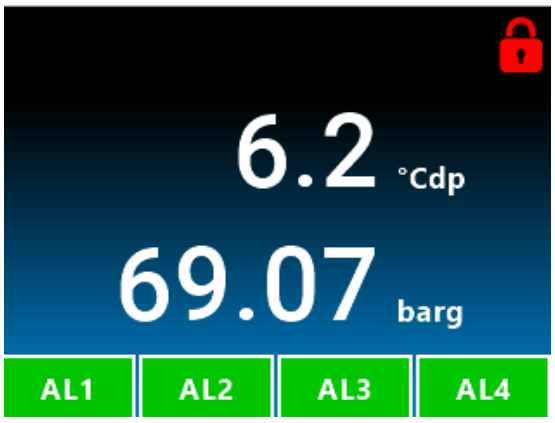
When you receive your Pura Advanced Online 2 Hygrometer system it will be configured to match your ordered dew-point range, with all other settings at a factory default. You will then need to configure the Process Monitor to meet your own requirements.

Set-up can easily be undertaken in less than 10 minutes, using either of the following two methods:

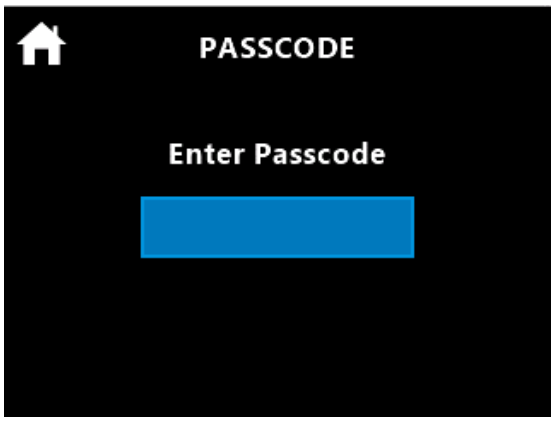
- Front-panel touch screen configuration
- Set-up via the RS485 monitor interface, using the Process Monitor Application Software, available on the product page for the Pura Advanced Online 2 Hygrometer (visit www.processsensing.com), and a standard RS485-to-USB interface (RS485 convertor specified in spares list if required).

3.2 Front Panel Configuration Menu Access

1. Press the red **Lock** icon on the top right-hand side of the display, to access the security code entry screen.

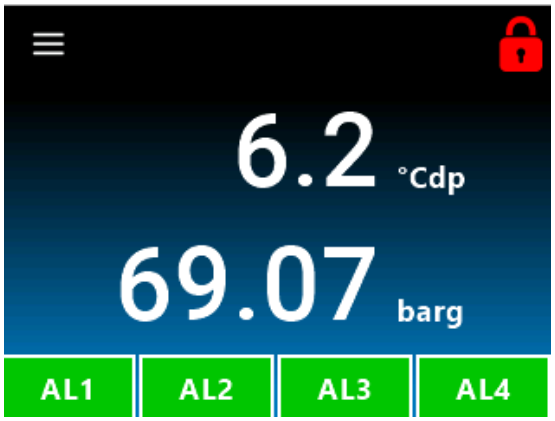


2. The security code entry screen will appear.



3. Enter the fixed security code 5618 to access the configuration menu.

4. Click on the **Menu** icon on the top left-hand side of the display.

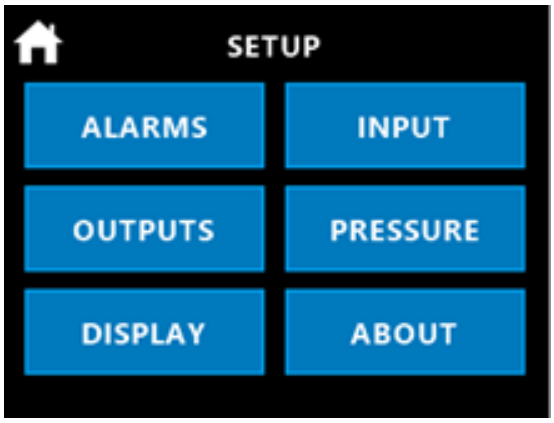


3.3 Configuration Menu Explained

Clicking on the **Menu** icon will give you access to the Process Monitor configuration menu. For most customers, you will only have to set this up once and your configuration will be saved and will not then need to be reconfigured.

WARNING: If the output signals from the Process Monitor are used within your own control system, you need to ensure good instrumentation practice is followed and no unauthorized reconfiguration is undertaken which could impact your own control system operation.

The **Configuration Menu** screen will appear:



Alarms There are 4 programmable alarm outputs, which can be assigned to dew point, moisture content and pressure parameters.

Outputs There are 3 programmable 4...20 mA analog outputs, which can be assigned to dew point, moisture content and pressure parameters.

Display Access to selection of temperature scales, Modbus address setting, pressure scales, moisture content tables, display and brightness is via this menu.

Input On the Pura Advanced Online 2 Process Monitor, this menu is fixed and no variables can be entered.

Pressure Access to selection of a live pressure sensor or a fixed pressure value can be entered.

About Confirms the installed Process Monitor Firmware and Monitor product type.

3.4 Setting Up the Process Monitor Configuration

This section looks at each menu configuration and explains, simply, how to set them up. Please note, if there are multiple identical set-ups within one menu (e.g. 4 programmable relay outputs), these are explained using one example.

3.4.1 Alarms Configuration

The Process Monitor incorporates dual relays, each with 2 outputs, providing 4 alarm outputs. In *Figure 17*, the relay outputs confirm this arrangement.

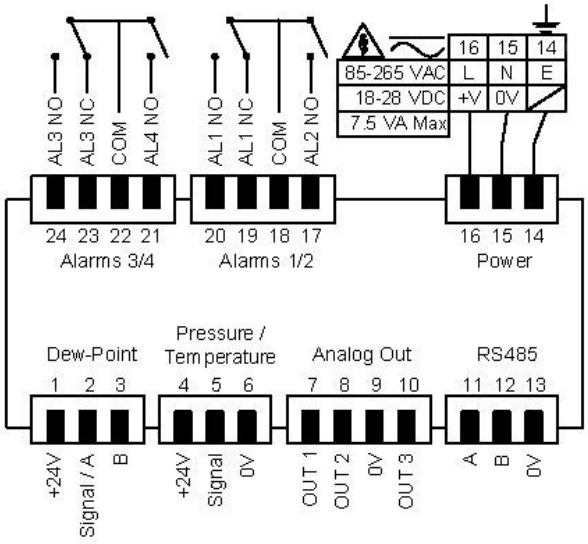
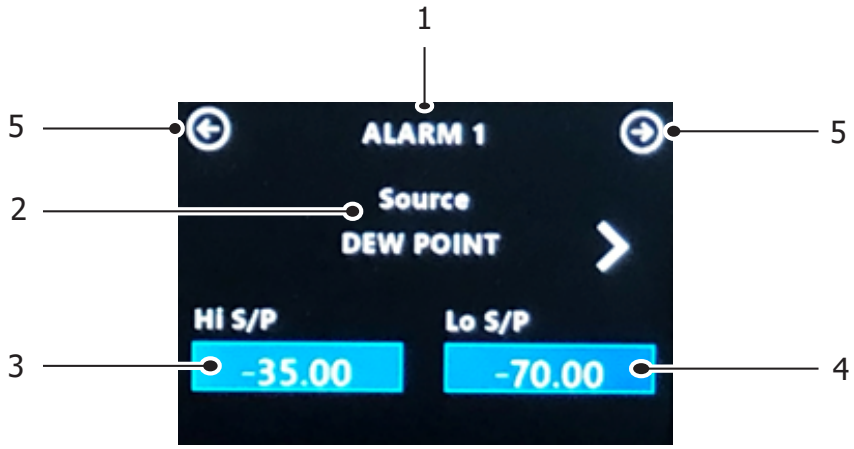


Figure 12 *Electrical Wiring Schematic*

Clicking on the **Alarms** button will take you to the screen shown below in *Figure 13*.



1	Confirms which alarm output is being set
2	Selects the parameter signal for control of the relay output: dew point, moisture, pressure, fault condition
3	Sets the energizing changeover point of the relay
4	Sets the de-energizing changeover point of the relay
5	Toggles forward or back in the menu structure

Figure 13 *Alarm Configuration Screen Explained*

Each set point (e.g. **Hi S/P** or **Lo S/P**) has a built-in fixed % hysteresis value to create a small dead band below the set-point value, to ensure the relay does not constantly energize and de-energize when the measured or calculated value oscillates around the set-point value. This is standard practice when using relays in control systems.

The hysteresis dead-band calculation is 0.5 % of the set-point value, as shown in the below example:

An alarm is **ON** when the **measured value** is > Hi_alarm_setpoint or the **measured value** is < Lo_alarm_set point.

An Alarm is **OFF** when the **measured value** is > Lo_alarm_setpoint + Lo Hysteresis AND the **measured value** is < Hi_alarm_setpoint – Hi Hysteresis.

Say, for example, Lo_alarm_setpoint is 1.0 and Hi_alarm_setpoint is 15.0.

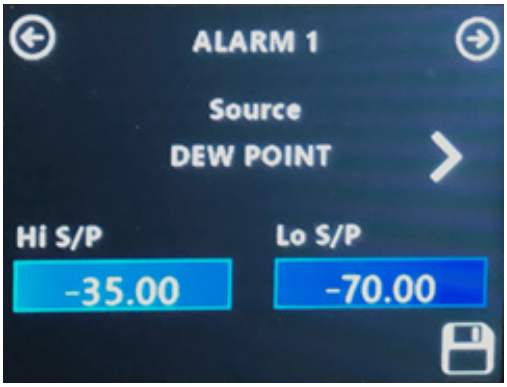
Lo Hysteresis value = Lo_alarm_setpoint * (0.5/100.0) = 1 * 0.005 = 0.005
Hi Hysteresis value = Hi_alarm_setpoint * (0.5/100.0) = 15 * 0.005 = 0.075

The alarm will trigger when **measured value** reaches or exceeds 15.0 or when the **measured value** is less than **1.0**.

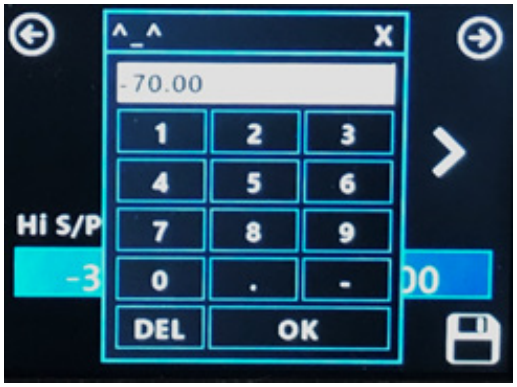
The alarm will switch off when the **measured value** is > 1.0 + 0.005 AND **measured value** ia < 15.0 – 0.075, so as you decrease the input below 15.0, the alarm will switch off again around **14.925**.

1. Click on **Hi S/P**, then enter your required relay switch set point and press **OK**.

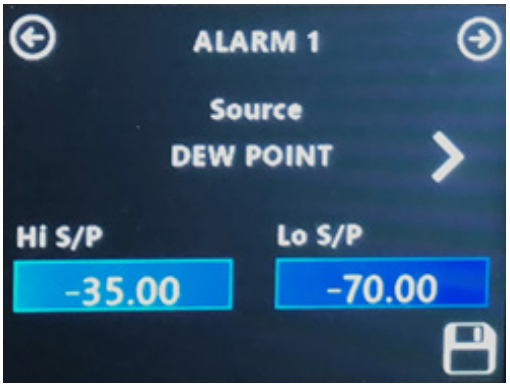
2. Click on the **Save** icon and the programmed value will be stored.



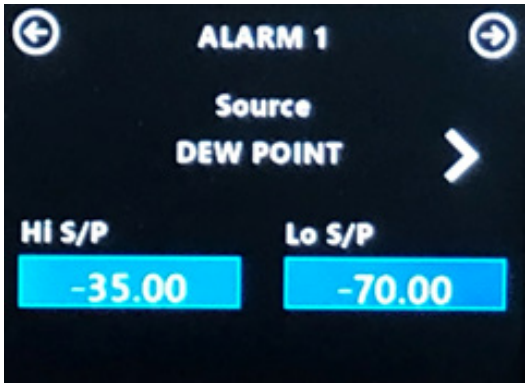
3. Click on **Lo S/P**, then enter your required relay switch set point and press **OK**.



4. Click on the **Save** icon and the programmed value will be stored.



5. You are now back on the **Alarm 1** screen, which confirms your entered configuration.



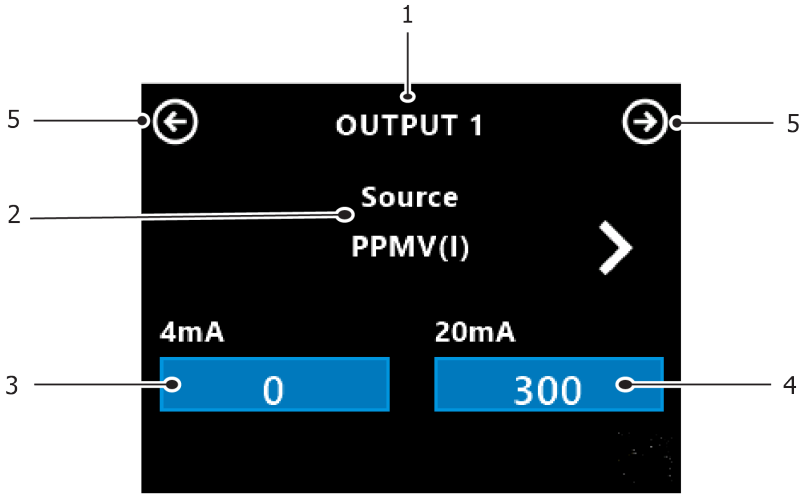
Using the top right-hand scroll button, you can now set up the other three alarm outputs to any required configuration, using the method described above.

3.4.2 Analog Outputs Configuration

There are three analog 4...20 mA outputs that can be configured to any measured or calculated parameter within the Process Monitor.

Selecting the **Outputs** button will take you to the screen shown below in *Figure 15*.

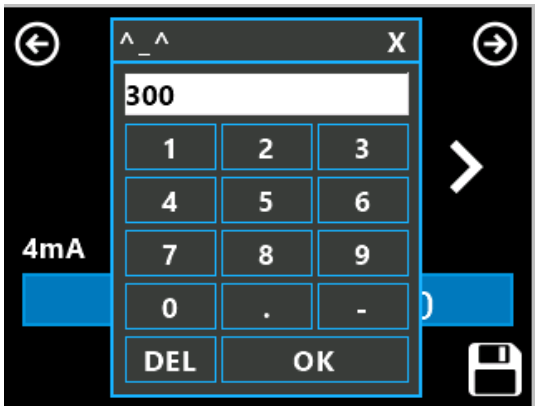
The following explains how to set up Analog Output Channel 1.



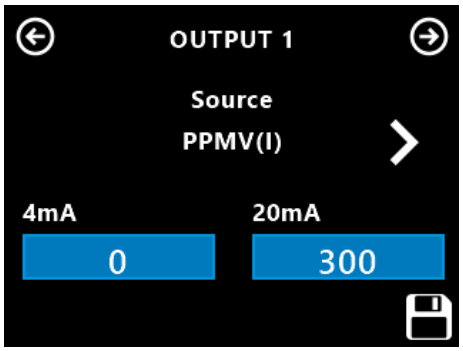
1	Confirms which 4...20 mA output is being set
2	Selects the parameter signal for analog outputting: dew point, moisture, pressure
3	Sets the 20 mA full-scale parameter value
4	Sets the 4 mA zero parameter value
5	Toggles forward or back in the menu structure

Figure 14 *Analog Outputs Configuration Screen Explained*

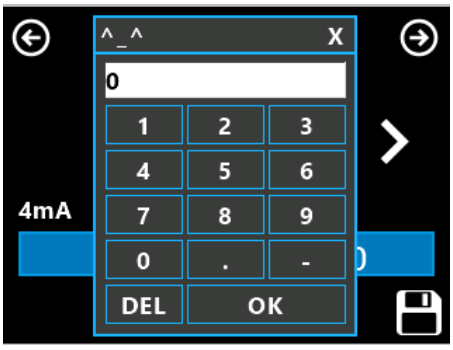
1. Click on the **20 mA** box and the **Enter** box will appear. Enter your required full scale value, then press **OK**.



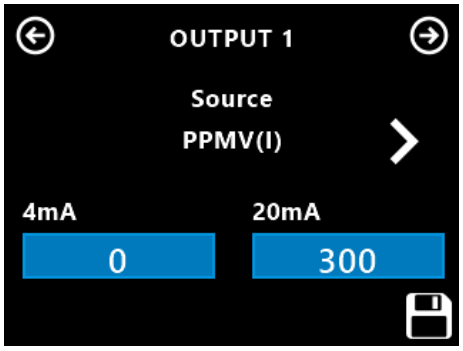
2. Click on the **Save** icon and the programmed value will be stored.



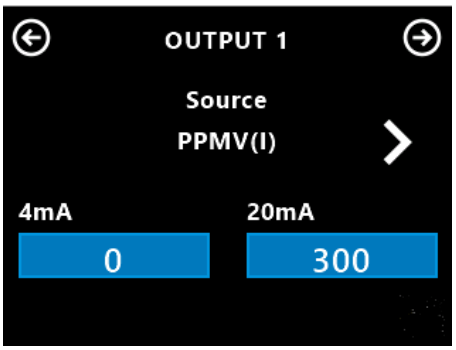
3. Click on the **4 mA** box and the **Enter** box will appear. Enter your required zero value, then press **OK**.



4. Click on the **Save** icon and the programmed value will be stored.



5. You are now back on the **Output 1** screen, which confirms your entered configuration.



Using the top right-hand scroll button, you can now set up the other two analog outputs to any required configuration, using the method described above.

3.4.3 Display Configuration

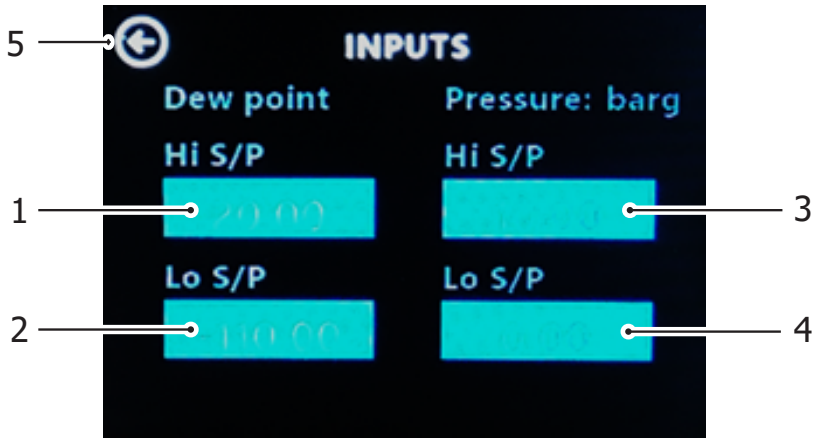
This is a simple menu screen that allows you to configure basic monitor settings and scalings as shown in *Figure 16* below.

1	Selects the required temperature scale for the dew-point parameter
2	Sets the Modbus address for the Process Monitor RS485 digital communications
3	Selects the required pressure scale for the indicated pressure parameter
4	Selects the required moisture content calculation table
5	Adjusts the brightness of the Process Monitor display

Figure 15 *Display Configuration Screen Explained*

3.4.4 Input Configuration

This is a simple menu screen displaying the measured or fixed inputs to the Process Monitor, as shown below in *Figure 17*.



1	Displays the highest measurement value of the dew-point sensor input
2	Displays the lowest measurement range of the dew-point sensor input
3	Displays the highest indicated or fixed input of pressure
4	Displays the lowest indicated or fixed input of pressure
5	Toggles back in the menu structure

Figure 16 *Input Configuration Screen Explained*

Dew point and pressure are the two parameters inputted in the Process Monitor within the hygrometer system. These are displayed on this screen in different forms, as explained:

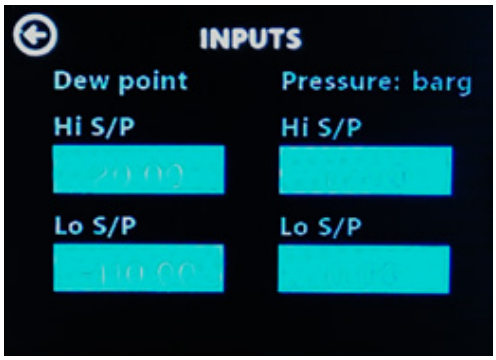
Dew Point The Pura M12 Dew-Point Sensor outputs a Modbus RTU over RS485 signal into the Process Monitor and that sensor, irrespective of its ordered dew-point range, is digitally scaled to measure any dew point within the band of -110...+20 °C dp. The **Hi S/P** and **Lo S/P** boxes are greyed out; they confirm this -110...+20 °C range and this cannot be adjusted.

Pressure Section 3.4.5, Pressure Configuration, explains that pressure indication can be inputted into the Process Monitor either with a live pressure signal from an external 4...20 mA pressure sensor or through a fixed pressure value entry on the Process Monitor.

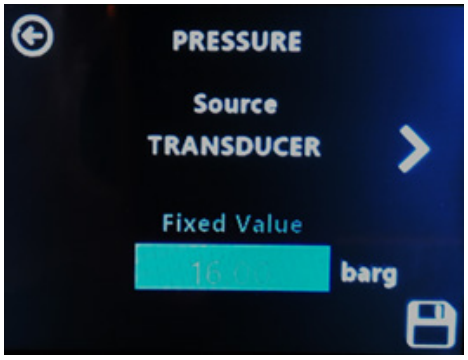
Dependent on this selection, the **Input Configuration** screen changes mode, as follows:

1. When a fixed pressure entry value is selected in the Pressure Configuration screen, the value is entered and saved.

2. If you go back to the **Input Configuration** screen you will see the display below, with the Pressure **Hi S/P** and **Lo S/P** boxes greyed out, confirming that no live pressure signal is being inputted to the Process Monitor.



3. Go back to the **Pressure Configuration** screen and select **Transducer** (sensor), then save your selection.



4. Go back to the **Input Configuration** screen and enter the **Hi S/P** value equating to 20 mA, then the **Lo S/P** value equating to 4 mA value of the external pressure sensor. Save this input.

In the example below, a 0...10 bar (4...20 mA) pressure sensor is being used to input a live pressure signal into the Process Monitor.

3.4.5 Pressure Configuration

Pressure indication can be inputted into the Process Monitor either with a live pressure signal from an external 4...20 mA pressure sensor or through a fixed pressure value entry on the Process Monitor. To calculate moisture content from dew point, it is necessary to know the system pressure and this pressure indication input is then used for that purpose.

NOTE: This function is only relevant to moisture content calculation and is not applicable for dew-point measurement.

The two screens used to select live pressure input or fixed value input are shown below, along with a brief explanation of use.

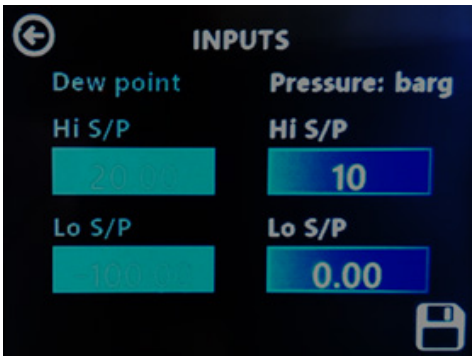
1. Click on **Pressure**, then on the next screen select **Fixed Value** as the source input for Pressure.

2. Enter the fixed value, then save your entry.

3. Click on the ⇦ arrow, then select Transducer (sensor) as the source input.

4. Go back to the **Input Configuration** screen, then enter the **Hi S/P** value equating to 20 mA and the **Lo S/P** value equating to 4 mA value of the external pressure sensor. Save this input.

In the example below, a 0...10 bar (4...20 mA) pressure sensor is being used to input a live pressure signal into the Process Monitor.



3.4.6 About Menu

This is an information screen that confirms the product name, main PCB firmware and display firmware.

4 MAINTENANCE

4.1 Maintenance and Calibration

Routine maintenance of the Pura M12 Transmitter is confined to regular re-calibration. For most applications, annual re-calibration ensures that the stated accuracy of the Pura M12 Transmitter is maintained.

Specialist calibration instrumentation is required to calibrate the transmitter and a true calibration can only be performed by exposure of the dew-point sensor to a reference gas of known dew point.

Calibration services are offered by Michell Instruments at their accredited calibration laboratories. All calibrations are traceable to national standards either via the National Physical Laboratory (UK) or the National Institute of Standards and Technology (USA).

The Pura M12 transmitter can be returned to Michell Instruments either directly or via the authorized distributor, for calibration.

Alternatively, Michell Instruments can provide an exchange transmitter. Prior to re-calibration, an exchange transmitter can be ordered from Michell Instruments or an authorized distributor.

Once the replacement transmitter and calibration certificate have been received, the original transmitter can be disconnected and the replacement transmitter fitted in its place. The original transmitter should be packed in its original packing, if possible, and returned to Michell Instruments, either directly or via an authorized agent.

4.2 Fault Conditions

There are 2 conditions stated below, which will cause a **FAULT** message to be displayed for the dew-point or moisture content parameter on the display.

- The sensor cable connecting the Pura M12 sensor to the Process Monitor is disconnected or damaged.
- The Pura M12 sensor flags a fault condition from the measurement technology to the sensor registers, which is then transmitted to the Process Monitor.

If the **FAULT** message is displayed, it is recommended that the electrical wiring system between the Pura M12 sensor and Process Monitor is checked for connectivity.

5 MEASUREMENT GUIDE

5.1 Sampling Considerations

There are two basic methods of measuring a sample with the Pura M12 Transmitter:

- In-situ measurements are made by placing the transmitter inside the environment to be measured.
- Extractive measurements are made by installing the sensor into a block within a sample handling system, and flowing the sample outside of the environment to be measured through this system.

Extractive measurements are recommended when the conditions in the environment to be measured are not conducive to making reliable measurements with the product.

Examples of such conditional limitations are:

- Excessive flow rate
- Presence of particulates matter
- Presence of entrained liquids
- Excessive sample temperature

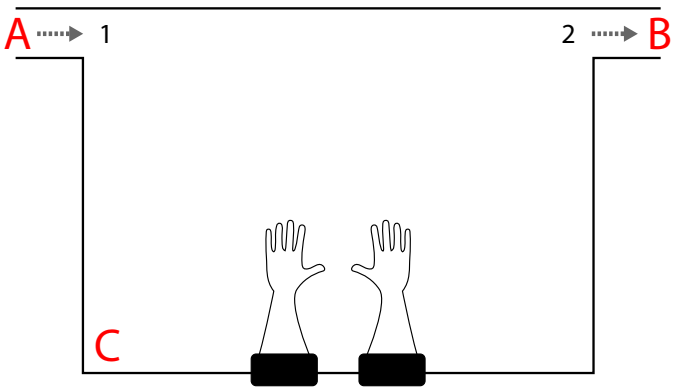
The basic considerations for each measurement type are as follows:

In-Situ

1. **Dew-Point Sensor Position** – will the sensor see an area of the environment that is representative of what you want to measure?

For example, if the sensor is to be mounted into a glove box, there are three different positions in which it could be installed – each giving a different measurement:

- Position A is on the purge inlet. In this position the sensor will confirm the dew point of the gas entering the glove box, but will not detect any leaks in the glove box itself, or any moisture released from the work piece.
- Position B is on the gas outlet. In this position the sensor will be exposed to the gas leaving the glove box, and will therefore be detecting any moisture which has entered into the system (e.g. ingress/leaks), or has been released by the work piece.
- Position C is in the glovebox itself, in this position the sensor will be only detecting any moisture in its immediate vicinity. Leaks not in close proximity to the measurement point may not be detected as this moisture could be drawn directly to the outlet.



1. Purge Inlet
2. Gas Outlet

Figure 17 *Installation Location*

If the transmitter is to be mounted directly into a pipe or duct, then consider that the installation point should not be too close to the bottom of a bend where oil or other condensate may collect.

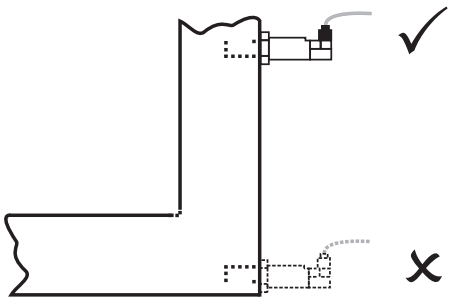


Figure 18 *Installation Location*

2. **Gas speed** – if you are planning on installing the sensor in a duct, consider how fast the sample gas is moving through it.

   If the gas speed is very low, or occasionally static, then the moisture content through the length (and width, if it is more than a few cm across) of the duct is unlikely to be uniform.

   Extremely high gas speeds can cause damage to the sensor. Direct insertion is not recommended in gas speeds in excess of 10m/s (32.8ft/s).

3. **Particulates** – Particulates travelling at speed can cause severe and irreversible damage to the sensor. At low velocity they can cling to the sensor, reducing its' surface area, and therefore response speed.

   The sensor is provided with a basic level of particulate protection in the form of a sintered guard; either HMWPE (10µm pore size) or Stainless Steel (80µm pore size). If the sample stream contains smaller particulates than this, or generally large amounts of dust; extractive measurement is recommended to accommodate proper in-line filtration.

4. **Sample Temperature** – Although the Pura M12 can be operated at sample temperatures up to 60 °C, it is advisable to keep the sample temperature as close to ambient, and as stable as possible to keep adsorption & desorption characteristics as consistent as possible (see Section 5.2, Sampling Hints, for more information).

Extractive

If the sensor is to be mounted into a sample conditioning system, then the above points are still of relevance, but it is important to consider the extraction point itself – make sure that the chosen extraction point is representative of the process, i.e. that the sample of interest is flowing past the extraction point, and it is not being pulled from a dead volume.

5.2 Sampling Hints

Measurement of moisture content is a complex subject, but does not need to be difficult. This section aims to explain the common mistakes made in measurement situations, the causes of the problem, and how to avoid them. Mistakes and bad practices can cause the measurement to vary from the expectation; therefore a good sampling technique is crucial for accurate and reliable results.

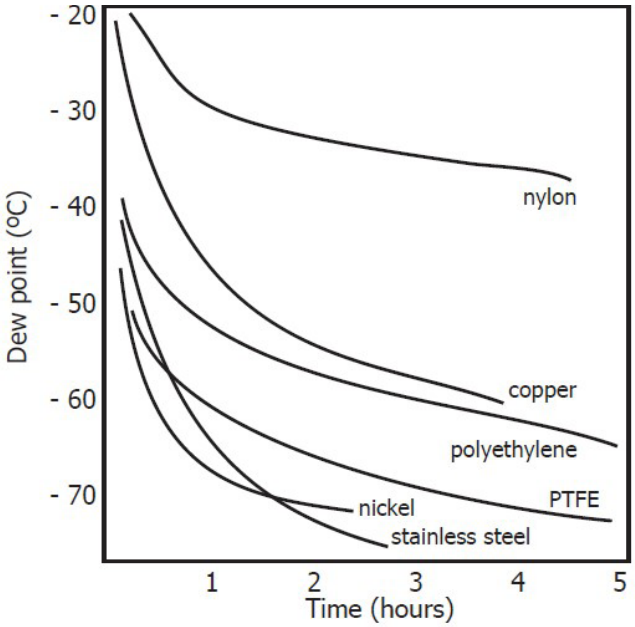


Figure 19 *Material Permeability Comparison*

All materials are permeable to water vapor, as the water molecule is extremely small compared to the structure of solids, even when compared to the crystalline structure of metals. The graph above shows the dew point inside tubing of different materials when purged with very dry gas, where the exterior of the tubing is in the ambient environment.

Many materials contain moisture as part of their structure, particularly organic materials (natural or synthetic), salts (or anything which contains them) and anything which has small pores. It is important to ensure that the materials used are suitable for the application.

If the partial water vapor pressure exerted on the outside of a compressed air line is higher than on the inside, the atmospheric water vapor will naturally push through the porous medium causing water to migrate into the pressurised air line. This effect is called transpiration.

Adsorption and Desorption

Adsorption is the adhesion of atoms, ions, or molecules from a gas, liquid, or dissolved solid to the surface of a material, creating a film. The rate of adsorption is increased at higher pressures and lower temperatures.

Desorption is the release of a substance from or through the surface of a material. In constant environmental conditions, an adsorbed substance will remain on a surface almost indefinitely. However, as the temperature rises, so does the likelihood of desorption occurring.

In practical terms, as the temperature of the environment fluctuates, water molecules are adsorbed and desorbed from the internal surfaces of the sample tubing, causing small fluctuations in the measured dew point.

Sample Tubing Length
The sample point should always be as close to the critical measurement point as possible, in order to obtain a truly representative measurement. The length of the sample line to the sensor or instrument should be as short as possible. Interconnection points and valves trap moisture, so using the simplest sampling arrangement possible will reduce the time it takes for the sample system to dry out when purged with dry gas.

Over a long tubing run, water will inevitably migrate into any line, and the effects of adsorption and desorption will become more apparent. It is clear from the graph shown above that the best materials to resist transpiration are stainless steel and PTFE.

Trapped Moisture
Dead volumes (areas which are not in a direct flow path) in sample lines, hold onto water molecules which are slowly released into the passing gas; this results in increased purge and response times, and wetter than expected readings. Hygroscopic materials in filters, valves (e.g. rubber from pressure regulators) or any other parts of the system can also trap moisture.

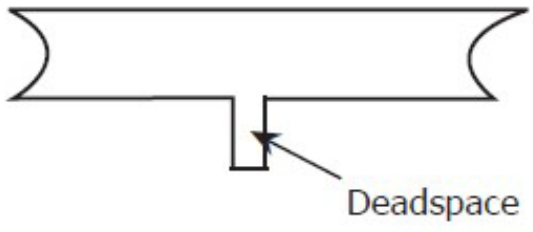


Figure 20 *Dead volume*

Sample Conditioning
Sample conditioning is often necessary to avoid exposure of sensitive measuring components to liquids and other contaminants which may cause damage or affect the accuracy over time, depending on the measurement technology.

Particulate filters are used for removing dirt, rust, scale and any other solids that may be in a sample stream. For protection against liquids, a coalescing filter should be used.

The membrane filter is a more expensive but highly effective alternative to a coalescing filter. It provides protection from liquid droplets, and can even stop flow to the analyser completely when a large slug of liquid is encountered.

Condensation and Leaks
Maintaining the temperature of the sample system tubing above the dew point of the sample is vital to prevent condensation. Any condensation invalidates the sampling process as it changes the water vapor content of the gas being measured. Condensed liquid can alter the humidity elsewhere by dripping or running to other locations where it may re-evaporate.

The integrity of all connections is also an important consideration, especially when sampling low dew points at an elevated pressure. If a small leak occurs in a high pressure line, gas will leak out but vortices at the leak point and a negative vapor pressure differential will also allow water vapor to contaminate the flow.

Flow Rates

Theoretically flow rate has no direct effect on the measured moisture content, but in practice it can have unanticipated effects on response speed and accuracy. The optimal flow rate varies depending on the measurement technology, and can always be found in the instrument or sensor manual.

An inadequate flow rate can:

- Accentuate adsorption and desorption effects on the gas passing through the sampling system.
- Allow pockets of wet gas to remain undisturbed in a complex sampling system, which will then gradually be released into the sample flow.
- Increase the chance of contamination from back diffusion: ambient air that is wetter than the sample can flow from the exhaust back into the system. A longer exhaust (sometimes called a pigtail) can also help alleviate this problem.
- Slow the response of the sensor to changes in moisture content.

Appendix A

Technical Specifications

Appendix A Technical Specifications

A.1 Transmitters

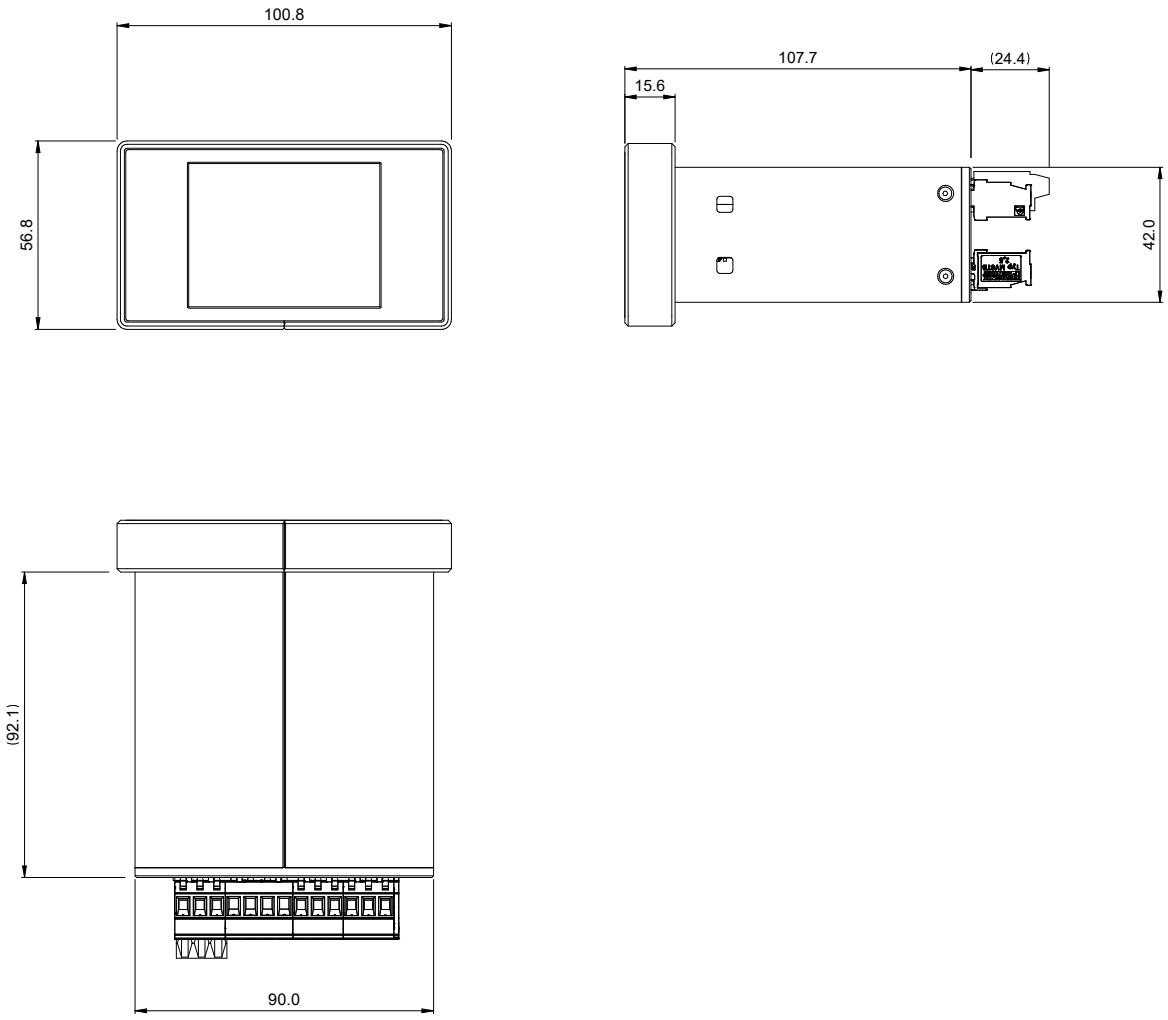
Product	Pura 2-wire, 3-wire & Digital Transmitters	Pura I.S. Transmitter
Performance Specifications		
Measurement Range	-120...-40 °Cdp (-184...-40 °Fdp); non-standard ranges available on request	
Accuracy	±1 °C from -40 to -60 °Cdp (±1.8 °F from -40 to -76 °Fdp) ±2 °C from -60 to -100 °Cdp (±3.6 °C from -76 to -148 °Fdp) ±4 °C from -100 to -120 °Cdp (±7.2 °C from -148 to -184 °Fdp (extrapolated)	
Calibration	Traceable 7-point calibration certificate	
Electrical Specifications		
Output Signal	4...20 mA (2-wire connection, current source) 4...20 mA (3-wire connection, current sink) **Pura M12:** Modbus RTU over RS485 **Pura 3-wire PUR-AOL-SEN-D:** Michell Mnet digital	4...20 mA (2-wire connection, current source)
Output	Dew point or moisture content (ppm_v, ppb_v)	
Analog Output Scaled Range	**Dew point:** -120...-40 °C (-184...-40 °F) **Moisture content in gas:** 0...127 ppm_v	
Supply Voltage	**Pura 2-wire/3-wire & Pura I.S.:** 12...28 V DC **Pura M12:** 5...28 V DC (digital)*	
Load Resistance	Max 250 Ω @ 14 V (500 Ω @ 24 V)	
Current Consumption	23 mA max, depending on output signal	
Compliances	CE & UKCA	
Operating Specifications		
Operating Temperature	-40...+60 °C (-40...+140 °F)	
Compensated Temperature Range	-20...+50 °C (-4...+122 °F)	
Storage Temperature	-40...+60 °C (-40...+140 °F)	
Operating Pressure	Minimum 10^{-7} Pa (10^{-9} torr); Maximum 24 MPa (240 barg/3481 psig)	
Flow Rate	1...5 l/min mounted in standard sampling block; 0...10 m/sec direct insertion	
Mechanical Specifications		
Ingress Protection	IP66 in accordance with standard BS EN 60529:1992; NEMA 4 protection in accordance with standard NEMA 250–2003 **Pura M12**: IP65	
Intrinsically Safe Area Certificates		ATEX/UKCA: II 1 G Ex ia IIC T4 Ga (-20...+70 °C) IECEx: Ex ia IIC T4 Ga (-20...+70 °C) TR CU: 0Ex ia IIC T4 Ga (-20...+70 °C) cQPSus: Class I, Division 1, Groups A, B, C & D, T4 Class I, Zone 0, AEx ia IIC T4 Ga, Ex ia IIC T4 Ga Tamb +70 °C
Housing Material	316 stainless steel	
Dimensions	Please refer to the dimensional drawings on page 4 of this datasheet	

Packaging	**Pura Premium:** Double bagged and sealed in UHP inert gas **Pura OEM and Pura Sensor:** Single bagged in 1000 gauge polythene **All options:** shipped individually in a profiled cardboard carton Sensor version supplied with protective guard over sensor technology for transportation and handling	
Process Connection	**Pura Premium (PRM):** 2 x 1/4" male VCR **Pura OEM (OEM):** 2 x 1/4" male VCR **Pura Sensor (SEN):** 1/2" male VCR	
Weight	**PRM and OEM versions:** 450 g (0.99 lb) **SEN version:** 180 g (0.4 lb)	
Electrical Connections	**Pura:** MiniDIN 43650 form C **Pura M12:** M12 5 Pin (A coded)	MiniDIN 43650 form C
Mating Electrical Connectors	Mating connector supplied as standard **Pura M12:** optional 0.8, 2, 5 metre (2.62, 6.56, 16.4 foot) M12 A coded connector/cable available	
Diagnostic Conditions (factory programmed)	Sensor fault: 23 mA Under-range dew point: 4 mA Over-range dew point: 20 mA	
Approved Galvanic Isolators		KFD2-CR-EX1.20200 KFD2-CR-EX1.30200 KFD0-CS-EX1.50P KFD0-CS-EX2.50P KFD2-STC4-EX1.H MTL5041 MTL5040

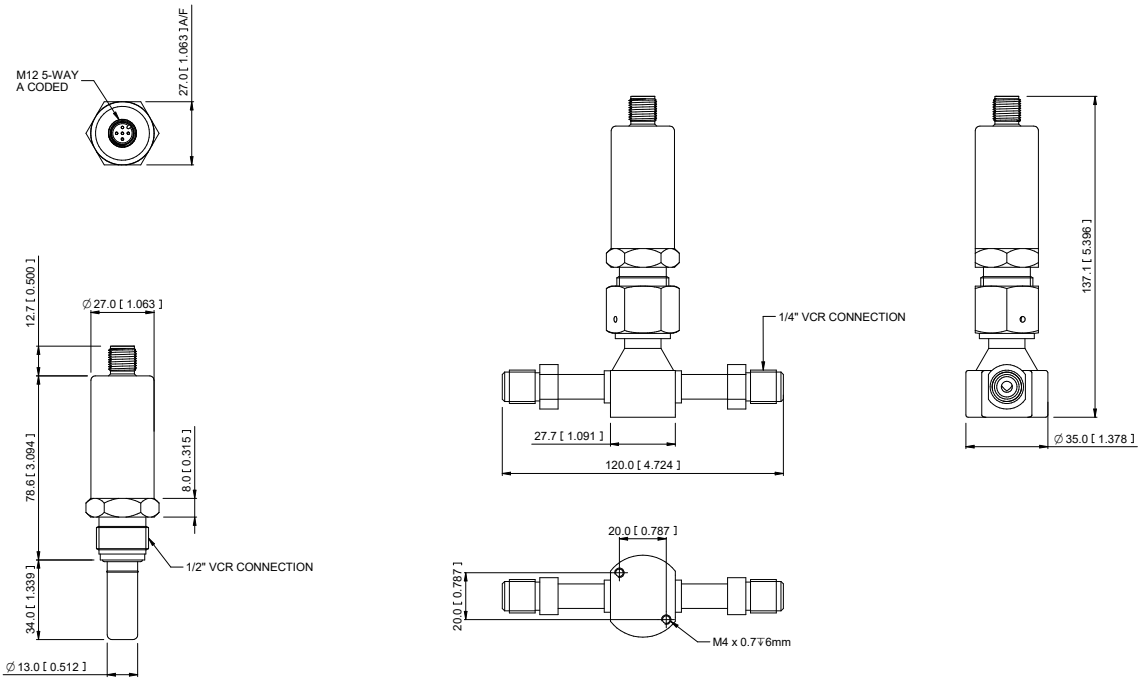
* Applicable on digital Modbus RTU output only

A.2 Monitors

Product	Pura Advanced Online 2	Pura Online
Online Range	-120...-40 °Cdp (-184...-40 °Fdp)	
Online Resolution	51/2 digit	4 digit
Auxiliary Pressure Input	Maximum 24 MPa (240 barg/ 3481 psig)	Not available
Pressure Compensation	Live 4 ...20 mA pressure transmitter or fixed programmable value	Not available
Moisture Content Scales	Automatic compensation for ppm_v, lbs/MMscf, g/m^3 units	Dew-point and ppm_v ranges available
Relay Alarm Type/Rating	2 x Form A, 2 x Form C 30 V DC 5A Namur compliant programmable relay outputs for process and fault conditions	Alarm 1 relay: single pole make contact, rating 3 A @ 250 V AC Alarm 2 relay: changeover contacts, rating 5 A @ 250 V AC
Sensor Input Signal	Modbus RTU over RS485	4...20 mA
Online Output Signals (analog)	3 x 4...20 mA fully user-configurable and scalable	1 x 4...20 mA or 0...20 mA fully user-configurable and scalable
Online Output Signals (digital)	Modbus RTU over RS485	Modbus RTU over RS485
Online Supply Voltage	85...265 V AC 18...28 V DC	85...265 V AC 24 V DC
Online Power Consumption	AC Power: 7.5 VA DC Current: 170 mA @24 V DC	60 mA max.
Electrical Safety	BS/EN61010-1: 2010	
Operating Temperature	0...+50 °C (+32...+122 °F)	
Storage Temperature	0...+60 °C (+32...+140 °F)	-10...+60 °C (+14...+140 °F)
Ingress Protection	IP54 & NEMA Type 2 & 12K front panel only	IP65 front panel IP20 rear panel



Pura Advanced Online 2 Process Monitor



Pura M12 Sensor with sensor cable included

Appendix B

Process Monitor Register Map

Appendix B Process Monitor Register Map

This is a register map for all firmware versions of the Process Monitor. Some registers are not applicable to the Pura Advanced Online 2 Hygrometer.

Serial Port Settings: 9600 Baud Rate, 8 Data Bits, 1 Stop Bit, No Parity Bit, No Flow Control

Address	Function Description	Read/ Write	Default Value	Register Configuration	Notes
0	Modbus Address	R/W		A1	1...32
1	Alarm Configuration	R/W		D	
2	mA output Configuration	R/W		E	
3	System Configuration	R/W		C	
4	O/p 1 low s/p hi word	R/W		FLOAT32	
5	O/p 1 low s/p lo word	R/W		FLOAT32	
6	O/p 1 high s/p hi word	R/W		FLOAT32	
7	O/p 1 high s/p lo word	R/W		FLOAT32	
8	O/p 2 low s/p hi word	R/W		FLOAT32	
9	O/p 2 low s/p lo word	R/W		FLOAT32	
10	O/p 2 high s/p hi word	R/W		FLOAT32	
11	O/p 2 high s/p lo word	R/W		FLOAT32	
12	O/p 3 low s/p hi word	R/W		FLOAT32	
13	O/p 3 low s/p lo word	R/W		FLOAT32	
14	O/p 3 high s/p hi word	R/W		FLOAT32	
15	O/p 3 high s/p lo word	R/W		FLOAT32	
16	I/p 1 min. hi word	R/W		FLOAT32	
17	I/p 1 min. lo word	R/W		FLOAT32	
18	I/p 1 max. hi word	R/W		FLOAT32	
19	I/p 1 max. lo word	R/W		FLOAT32	
20	I/p 2 min. hi word (n/a for Oxygen only)	R/W		FLOAT32	
21	I/p 2 min. lo word (n/a for Oxygen only)	R/W		FLOAT32	
22	I/p 2 max. hi word (n/a for Oxygen only)	R/W		FLOAT32	
23	I/p 2 max. lo word (n/a for Oxygen only)	R/W		FLOAT32	
24	Fixed pressure input value hi word (n/a for O_2 only)	R/W		FLOAT32	

Address	Function Description	Read/ Write	Default Value	Register Configuration	Notes
25	Fixed pressure input value lo word (n/a for O_2 only)	R/W		FLOAT32	
26	Liquid Selection	R/W		G	
27	Liquid Mix Ratio (% of Mixed Liquid 1)	R/W		A1	
28	User Cs Table 1, Cs Value at -20 °C	R/W		A1	
29	User Cs Table 1, Cs Value at -10 °C	R/W		A1	
30	User Cs Table 1, Cs Value at 0 °C	R/W		A1	
31	User Cs Table 1, Cs Value at 10 °C	R/W		A1	
32	User Cs Table 1, Cs Value at 20 °C	R/W		A1	
33	User Cs Table 1, Cs Value at 30 °C	R/W		A1	
34	User Cs Table 1, Cs Value at 40 °C	R/W		A1	
35	User Cs Table 1, Cs Value at 50 °C	R/W		A1	
36	User Cs Table 1, Cs Value at 60 °C	R/W		A1	
37	User Cs Table 1, Cs Value at 70 °C	R/W		A1	
38	User Cs Table 2, Cs Value at -20 °C	R/W		A1	
39	User Cs Table 2, Cs Value at -10 °C	R/W		A1	
40	User Cs Table 2, Cs Value at 0 °C	R/W		A1	
41	User Cs Table 2, Cs Value at 10 °C	R/W		A1	
42	User Cs Table 2, Cs Value at 20 °C	R/W		A1	
43	User Cs Table 2, Cs Value at 30 °C	R/W		A1	
44	User Cs Table 2, Cs Value at 40 °C	R/W		A1	
45	User Cs Table 2, Cs Value at 50 °C	R/W		A1	
46	User Cs Table 2, Cs Value at 60 °C	R/W		A1	
47	User Cs Table 2, Cs Value at 70 °C	R/W		A1	
48	Dew Point Channel – ADC Val 4 mA	R/W		A1	0...4095
49	Dew Point Channel – ADC Val 20 mA	R/W		A1	0...4095
50	Pressure (P) /Tempr (L) Channel – ADC Val 4 mA (n/a for O_2 only)	R/W		A1	0...4095
51	Pressure (P) /Tempr (L) Channel – ADC Val 20 mA (n/a for O_2 only)	R/W		A1	0...4095

Address	Function Description	Read/ Write	Default Value	Register Configuration	Notes
53	Analog Output 1 – DAC 4 mA Value	R/W		A1	0...65535
54	Analog Output 1 – DAC 20 mA Value	R/W		A1	0...65535
55	Analog Output 2 – DAC 4 mA Value	R/W		A1	0...65535
56	Analog Output 2 – DAC 20 mA Value	R/W		A1	0...65535
57	Analog Output 3 – DAC 4 mA Value	R/W		A1	0...65535
58	Analog Output 3 – DAC 20 mA Value	R/W		A1	0...65535
59	Display brightness	R/W		A1	0...100
60	Alarm 1 Low S/P Hi Word	R/W		FLOAT32	
61	Alarm 1 Low S/P Lo Word	R/W		FLOAT32	
62	Alarm 1 High S/P Hi Word	R/W		FLOAT32	
63	Alarm 1 High S/P Lo Word	R/W		FLOAT32	
64	Alarm 2 Low S/P Hi Word	R/W		FLOAT32	
65	Alarm 2 Low S/P Lo Word	R/W		FLOAT32	
66	Alarm 2 High S/P Hi Word	R/W		FLOAT32	
67	Alarm 2 High S/P Lo Word	R/W		FLOAT32	
68	Alarm 3 Low S/P Hi Word	R/W		FLOAT32	
69	Alarm 3 Low S/P Lo Word	R/W		FLOAT32	
70	Alarm 3 High S/P Hi Word	R/W		FLOAT32	
71	Alarm 3 High S/P Lo Word	R/W		FLOAT32	
72	Alarm 4 Low S/P Hi Word	R/W		FLOAT32	
73	Alarm 4 Low S/P Lo Word	R/W		FLOAT32	
74	Alarm 4 High S/P Hi Word	R/W		FLOAT32	
75	Alarm 4 High S/P Lo Word	R/W		FLOAT32	
77	Command register	W		H	
78	Number of alarms (not used)	R/W		A1	
80	Dew point in set unit (or O_2 for O_2 only)	R		B2	-3276.8 ...3276.7
81	Pressure (P) / Temperature (L) in set unit (n/a for O_2 only)	R		B2	-3276.8 ...3276.7
82	Moisture – ppm_W – Hi Word	R		FLOAT32	

Address	Function Description	Read/ Write	Default Value	Register Configuration	Notes
83	Moisture – ppm_W – Lo Word	R		FLOAT32	
84	Moisture – ppm_V (Ideal) – Hi Word	R		FLOAT32	
85	Moisture – ppm_V (Ideal) – Lo Word	R		FLOAT32	
86	Moisture – ppm_V (Nat Gas) – Hi Word	R		FLOAT32	
87	Moisture – ppm_V (Nat Gas) – Lo Word	R		FLOAT32	
88	Moisture – mg/m^3 (Nat Gas) – Hi Word	R		FLOAT32	
89	Moisture – mg/m^3 (Nat Gas) – Lo Word	R		FLOAT32	
90	Moisture – lb/mmscf (Nat Gas) – Hi Word	R		FLOAT32	
91	Moisture – lb/mmscf (Nat Gas) – Lo Word	R		FLOAT32	
92	Status Register	R		F	
93	Firmware version (Main Board)	R		A3	
94	Input CH1 (Dewp) Live ADC Count	R		A1	
95	Input CH2 (Pressr/Tempr)) Live ADC Count (n/a for O_2 only)	R		A1	
96	Product I.D.	R		A1	
97	Password (volatile)	R/W	4792	A1	
101	Dew point (or O_2) in set unit as float – Hi Word	R		FLOAT32	
102	Dew point (or O_2) in set unit as float – Lo Word	R		FLOAT32	
103	Pressure / Temp. in set unit as float – Hi Word (n/a for O_2 only)	R		FLOAT32	
104	Pressure / Temp. in set unit as float – Lo Word (n/a for O_2 only)	R		FLOAT32	

Register Configuration A

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

A1: Unsigned Short. Range = 0...65535
A2: Unsigned Short /10. Range = 0...6553.5
A3: Unsigned Short /100. Range = 0...655.35

Conversion: float*x = unsigned integer
Unsigned integer/x = float

Or cast:

float value to read= ((float) (value))/x;
unsigned short value to write= (unsigned short) (value*x)

Register Configuration B

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

B1: Signed Short. Range -32768...+32767
B2: Signed Short /10. Range -3276.8...+3276.7
B3: Signed Short /100. Range -327.68...+327.67

Most languages will cast from one type to another

Values to write into register manually:

if value is a negative number: (value*x) +65536
if value is 0 or a positive number: value*x

e.g. for type B3

(-5.39*100) + 65536 = 64997
(2.01*100) = 201

Or Cast:

(unsigned short) (value*x)

Reading values from register manually:

If value in register is greater than 32767: (value-65536)/x
If value in register is less than or equal to 32767: value/x

e.g. for type B3

(64997-65536)/100 = -5.39
201/100 = 2.01

Or Cast:
((float) ((signed short)value))/x;

Register Configuration C – System Configuration

Generic table – Pura monitor settings as identified.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
		PP	MOD	CA	PR	IT	IT		TU	PU	PU	N/A	MU	MU	MU

Pressure Units (PU) 00 = Bar.G (def) 01 = Psi.G 10 = Mpag 11 = Spare	Temperature Unit (TU) 0 = C (def) 1 = F
Main Unit 0 = Dp (O2 %) 1 = ppm_V(I) (O2 ppm) 2 = lbmmscf 3 = mg/m^3 4 = ppm_V(N)	Instrument Type (IT) – not used 00 = Promet IS 01 = Liquidew IS 10 = Pura 11 = O2
Pressure Source (PR) 0 = Sensor 1 = Fixed User	ISO or IGT calculations (CA) 0=IGT 1=ISO
Model (MOD) 0 = Promet 1 = Pura Advanced	Pressure or ppm_V (I) secondary parameter (PP) – Pura Advanced only 0 = Pressure 1 = ppm_V (ideal)

Register Configuration D – Alarm Configuration

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
A4	A4	A4	A4	A3	A3	A3	A3	A2	A2	A2	A2	A1	A1	A1	A1

Alarm1 Parameter (A1) 0000 = Dewpoint (O2) 0001 = Pressure/Temperature 0010 = ppm_W 0011 = ppm_V (Ideal) 0100 = ppm_V(Nat Gas) 0101 = mgm^3 0110 = lbmmscf 1000 = Fault	Alarm2 Parameter (A2) 0000 = Dewpoint (O2) 0001 = Pressure/Temperature 0010 = ppm_W 0011 = ppm_V (Ideal) 0100 = ppm_V(Nat Gas) 0101 = mgm^3 0110 = lbmmscf 1000 = Fault
Alarm3 Parameter (A3) 0000 = Dewpoint (O2) 0001 = Pressure/Temperature 0010 = ppm_W 0011 = ppm_V (Ideal) 0100 = ppm_V(Nat Gas) 0101 = mgm^3 0110 = lbmmscf 1000 = Fault	Alarm4 Parameter (A4) 0000 = Dewpoint (O2) 0001 = Pressure/Temperature 0010 = ppm_W 0011 = ppm_V (Ideal) 0100 = ppm_V(Nat Gas) 0101 = mgm^3 0110 = lbmmscf 1000 = Fault

Register Configuration E – mA Output Config

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
				O3	O3	O3	O3	O2	O2	O2	O2	O1	O1	O1	O1

Ouput1 Parameter (O1) 0000 = Dewpoint (O2) 0001 = Pressure/Temperature 0010 = ppm_W 0011 = ppm_V (Ideal) 0100 = ppm_V(Nat Gas) 0101 = mgm^3 0110 = lbmmscf	Output2 Parameter (O2) 0000 = Dewpoint (O2) 0001 = Pressure/Temperature 0010 = ppm_W 0011 = ppm_V (Ideal) 0100 = ppm_V(Nat Gas) 0101 = mgm^3 0110 = lbmmscf
Output3 Parameter (O3) 0000 = Dewpoint (O2) 0001 = Pressure/Temperature 0010 = ppm_W 0011 = ppm_V (Ideal) 0100 = ppm_V(Nat Gas) 0101 = mgm^3 0110 = lbmmscf	

Register Configuration F – Status Register

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
A4	A4	A3	A3	A2	A2	A1	A1							PS	DS

Relay Alarm Status flags (A1, A2, A3, A4) Example: A1 = 00=OK (relay de-energized) A1 = 01=High (or Fault)(relay energized) A1 = 10=Low (relay energized)	Dewpoint Sensor Status (DS) 0=OK 1=Fault (or not available)
Pressure/Temperature Sensor Status (PS) 0=OK 1=Fault (or not available)	

Register Configuration G – Liquid Selection

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	M2	M2	M2	M2	M2	M1	M1	M1	M1	M1	LQ	LQ	LQ	LQ	LQ

Liquid Selection (LQ)
0 = n-Butane
1 = n-Propane
2 = n-Hexane
3 = Cumene
4 = Benzene
5 = Toluene
6 = 1-butane
7 = Cyclohexane
8 = Oct-3-ene
9 = Ethylbenzene
10 = Dimethylbenzene
11 = Ethane
12 = Methylcyclohexane
13 = Butylbenzene
14 = Prop-1-ene
15 = But-1-ene
16 = Methane
17 = 2-Methylbutane
18 = USER1
19 = USER2
20 = MIXING

Mixed Liquid 1 (M1)
0 = n-Butane
1 = n-Propane
2 = n-Hexane
3 = Cumene
4 = Benzene
5 = Toluene
6 = 1-butane
7 = Cyclohexane
8 = Oct-3-ene
9 = Ethylbenzene
10 = Dimethylbenzene
11 = Ethane
12 = Methylcyclohexane
13 = Butylbenzene
14 = Prop-1-ene
15 = But-1-ene
16 = Methane
17 = 2-Methylbutane
18 = USER1
19 = USER2

Mixed Liquid 1 (M2)
0 = n-Butane
1 = n-Propane
2 = n-Hexane
3 = Cumene
4 = Benzene
5 = Toluene
6 = 1-butane
7 = Cyclohexane
8 = Oct-3-ene
9 = Ethylbenzene
10 = Dimethylbenzene
11 = Ethane
12 = Methylcyclohexane
13 = Butylbenzene
14 = Prop-1-ene
15 = But-1-ene
16 = Methane
17 = 2-Methylbutane
18 = USER1
19 = USER2

Register Configuration H – Instrument Setup and Command Register (Reg 30)

2 = Set Dewpoint Channel 4 mA ADC Value
3 = Set Dewpoint Channel 20 mA ADC Value
4 = Set Pressure/Temperature Channel 4 mA ADC Value
5 = Set Pressure/Temperature Channel 20 mA ADC Value

10 = Force Analog Output 1...4 mA
11 = Force Analog Output 1...20 mA
12 = Force Analog Output 2...4 mA
13 = Force Analog Output 2...20 mA
14 = Force Analog Output 1...12 mA
15 = Force Analog Output 2...12 mA
16 = Force Analog Output 3...4 mA
17 = Force Analog Output 3...20 mA
18 = Force Analog Output 3...12 mA

19 = All Alarm Relays de-energized
20 = Energize Alarm Relay1
21 = Energize Alarm Relay2
22 = Energize Alarm Relay3
23 = Energize Alarm Relay4

25 = Send Test String to Display Comms Channel

30 = Set control board to default register map values

31 = Enable Setup Mode (Alarms and Analog output updates disabled)
32 = Disable Setup Mode (Alarms and Analog output updates enabled)

Defaults (auto-loaded when PCB is brand new or forced via Modbus)

Pura

Modbus ID	1
System config.	Main unit = °Cdp Pressure unit = psig Pressure source = internal Fixed pressure = 0.00
Alarm config.	AL1 = dp (low = -120.0, high = -40.0) AL2 = dp (low = -120.0, high = -60.0) AL3 = FAULT (low = high = 0.0) AL4 = FAULT (low = high = 0.0)
Input scale	Pressure = 0.0...+100.0
Output config.	OP1 = dp (-120.0...-40.0) OP2 = Pressure (0.0...+100.0) OP3 = ppm_V (ideal) (0.0...+100.0)

Appendix C

Quality, Recycling & Warranty Information

Appendix C Quality, Recycling & Warranty Information

Michell Instruments is dedicated to complying to all relevant legislation and directives. Full information can be found on our website at:

www.ProcessSensing.com/en-us/compliance

This page contains information on the following directives:

- Anti-Facilitation of Tax Evasion Policy
- ATEX Directive
- Calibration Facilities
- Conflict Minerals
- FCC Statement
- Manufacturing Quality
- Modern Slavery Statement
- Pressure Equipment Directive
- REACH
- RoHS3
- WEEE2
- Recycling Policy
- Warranty and Returns

This information is also available in PDF format.

Appendix D

Return Document & Decontamination Declaration

Appendix D Return Document & Decontamination Declaration

Decontamination Certificate

IMPORTANT NOTE: Please complete this form prior to this instrument, or any components, leaving your site and being returned to us, or, where applicable, prior to any work being carried out by a Michell engineer at your site.

Instrument			Serial Number	
Warranty Repair?	YES	NO	Original PO #	
Company Name			Contact Name	
Address				
Telephone #			E-mail address	
Reason for Return /Description of Fault:				
Has this equipment been exposed (internally or externally) to any of the following? Please circle (YES/NO) as applicable and provide details below				
Biohazards	YES	NO		
Biological agents	YES	NO		
Hazardous chemicals	YES	NO		
Radioactive substances	YES	NO		
Other hazards	YES	NO		
Please provide details of any hazardous materials used with this equipment as indicated above (use continuation sheet if necessary)				
Your method of cleaning/decontamination				
Has the equipment been cleaned and decontaminated?	YES	NOT NECESSARY		
Michell Instruments will not accept instruments that have been exposed to toxins, radio-activity or bio-hazardous materials. For most applications involving solvents, acidic, basic, flammable or toxic gases a simple purge with dry gas (dew point <-30°C) over 24 hours should be sufficient to decontaminate the unit prior to return. **Work will not be carried out on any unit that does not have a completed decontamination declaration.**				
Decontamination Declaration				
I declare that the information above is true and complete to the best of my knowledge, and it is safe for Michell personnel to service or repair the returned instrument.				
Name (Print)		Position		
Signature		Date		

MICHELL Instruments

F0121, Issue 2, December 2011

NOTES

www.ProcessSensing.com