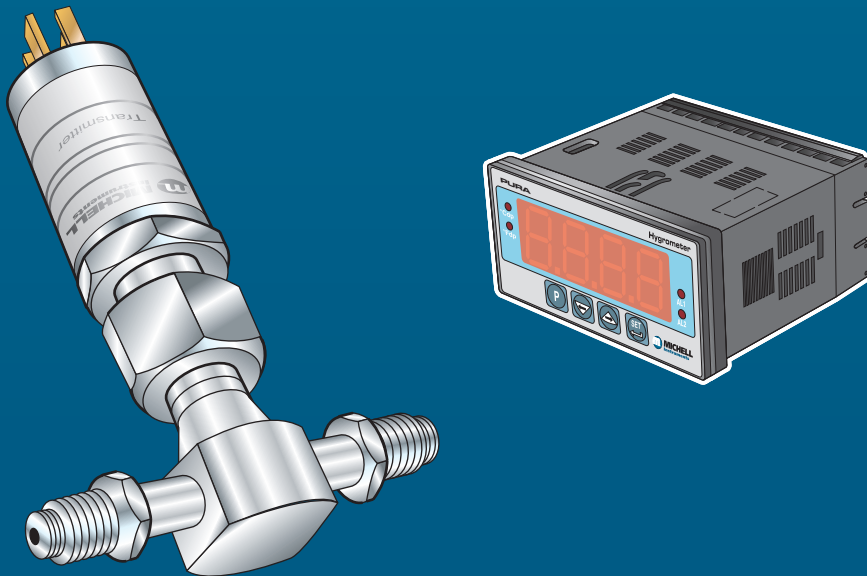




Pura Online Hygrometer User Manual



97303 Issue 2
January 2022

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Invoice Date	
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Pura Online Hygrometer

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Safety

The manufacturer has designed this equipment to be safe when operated using the procedures detailed in this manual. The user must not use this equipment for any other purpose than that stated. Do not apply values greater than the maximum value stated.

This manual contains operating and safety instructions, which must be followed to ensure the safe operation and to maintain the equipment in a safe condition. The safety instructions are either warnings or cautions issued to protect the user and the equipment from injury or damage. Use competent personnel using good engineering practice for all procedures in this Manual.

Electrical Safety

The instrument is designed to be completely safe when used with options and accessories supplied by the manufacturer for use with the instrument.

Pressure Safety

DO NOT permit pressures greater than the safe working pressure to be applied to the instrument. The specified safe working pressure is 30 MPa (300 barg/4350 psig).

Toxic Materials

The use of hazardous materials in the construction of this instrument has been minimized. During normal operation it is not possible for the user to come into contact with any hazardous substance which might be employed in the construction of the instrument. Care should, however, be exercised during maintenance and the disposal of certain parts.

Repair and Maintenance

The instrument must be maintained either by the manufacturer or an accredited service agent. Refer to Appendix B for details of Michell Instruments' worldwide offices' contact information.

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 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 & UKCA directives. Further details of applied standards may be found in the product specification.

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)
°C	degrees Celsius
°F	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)
mA	milliampere
max	maximum
min	minute(s)
MPa	megapascal (Pascals x10 ⁶)
NI/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

Warnings

The following general warnings listed below are applicable to this instrument. They are repeated in the text in the appropriate locations.



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.

1 INTRODUCTION

The Pura Online dew-point hygrometer is an instrument designed for the continuous online measurement of water dew point in gaseous sample streams, in a diverse range of applications.

The system comprises a programmable monitor configured to accept a 4...20 mA current loop signal from the Michell ceramic metal-oxide dew-point transmitter. The span of the transmitter is set to cover the dew-point range $-120\text{ }^{\circ}\text{C} \dots -40\text{ }^{\circ}\text{Cdp}$ ($-184\text{ }^{\circ}\text{F} \dots -40\text{ }^{\circ}\text{Fdp}$) at operating pressures up to 30 MPa (300 barg/4350 psig).

The monitor also has a re-transmission facility which buffers the transmitter output for onward transmission to other systems. The transmitter input to the monitor is configured as a 4...20 mA current loop signal and the re-transmitted output can be configured as either a 4...20 mA or a 0...20 mA current loop signal (ranged as per the input).

Two alarm outputs are provided for connection to external systems. Alarm 1 provides a set of single pole make contacts and Alarm 2 provides a set of changeover contacts. Both sets are potential free and Alarm 1 contacts (single pole make) are rated at 250 V, 3 A and the Alarm 2 contacts (changeover) are rated at 250 V, 5 A.

Figure 1 shows the monitor and the transmitter.

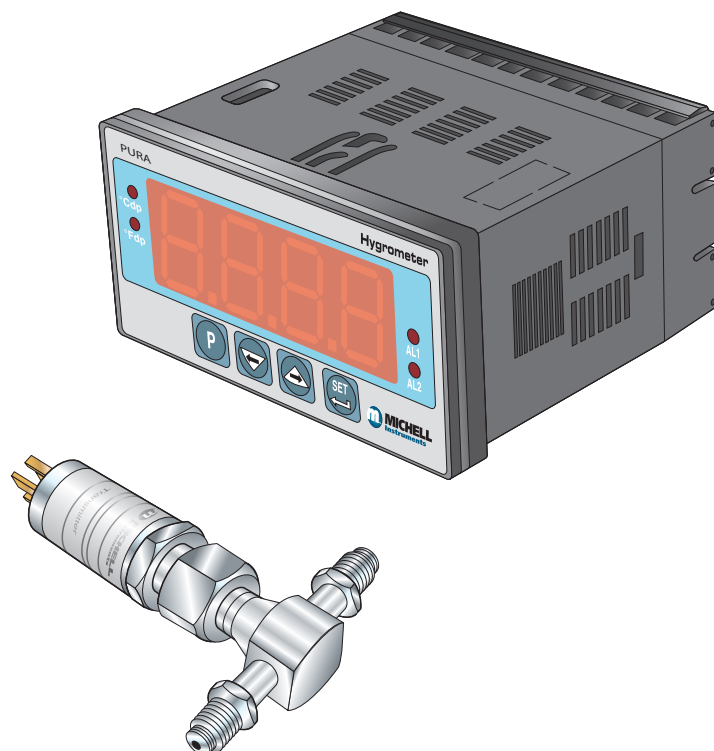


Figure 1 Pura Online Monitor and Transmitter

1.1 Features

The Pura Online Hygrometer is simple to use and install, and can be configured to meet specific needs.

- ¼" male VCR process connections for PRM and OEM version
½" male VCR process connection for Pura SEN version
- 4...20 mA – sensor signal
- Sensor block compliant with clean room standards
- Measurement range -120 °C...-40 °Cdp (-184 °F...-40 °Fdp)
- Up to ±1 °Cdp accuracy
- Calibration certificate (NPL, NIST)

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 Online Hygrometer

The Pura Hygrometer instrument and accessories are packed in a box and the method of unpacking is shown as follows:

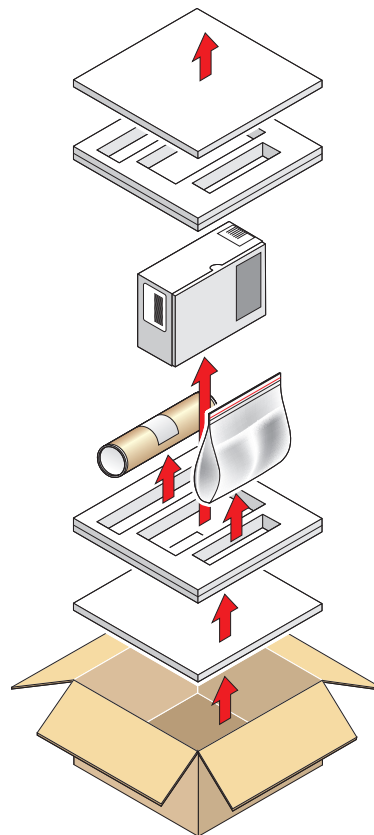


Figure 2 *Unpacking – Monitor and Pura SEN, no block version*

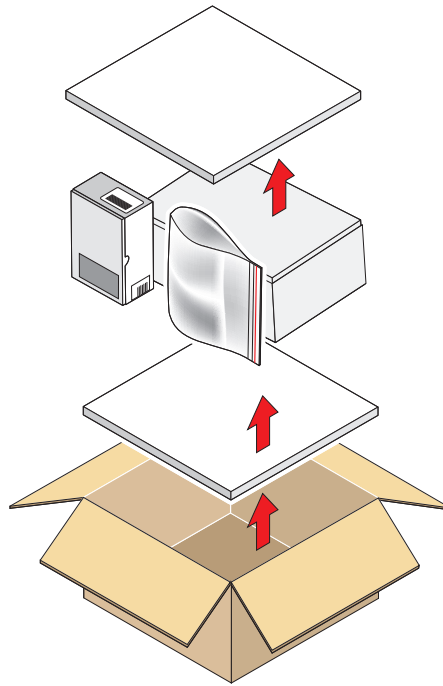


Figure 3 *Unpacking – Monitor and Pura OEM / PRM*

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

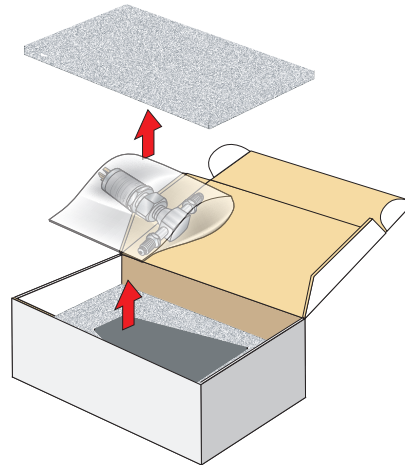


Figure 4 Unpacking – Pura OEM & PRM – Single / Double Bag

2.1.4 Unpacking the Monitor

The monitor (2) is packed, together with its fixing clamps (1) as shown below.

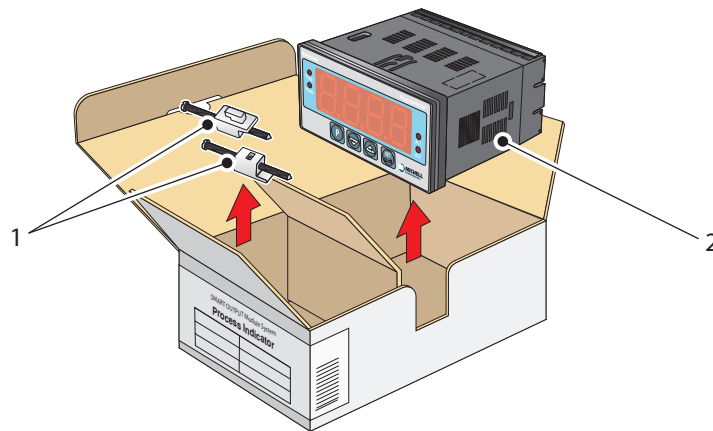


Figure 5 Monitor Unpacking Method

2.2 Pura Online Components

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

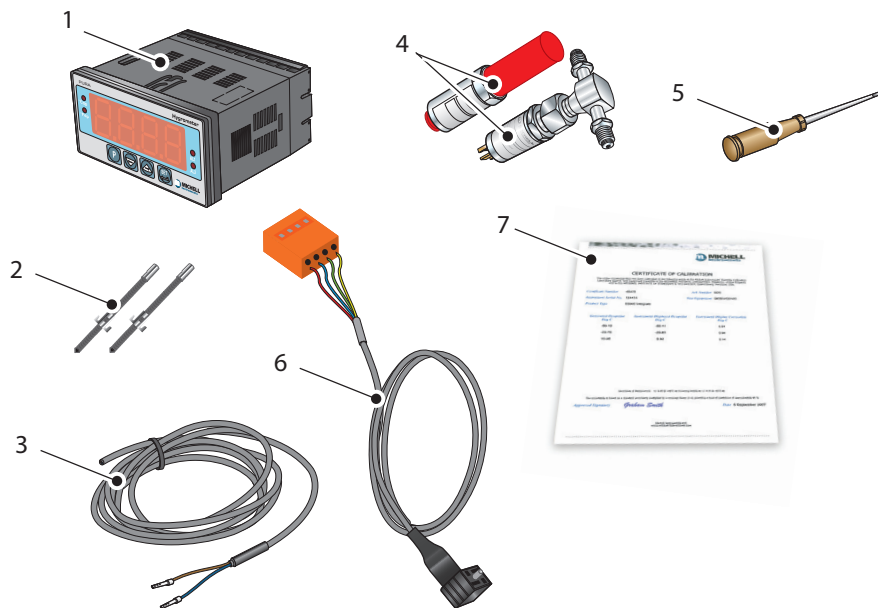


Figure 6 *Components*

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. Power cable
7. Calibration certificate

2.3 Pura SEN

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

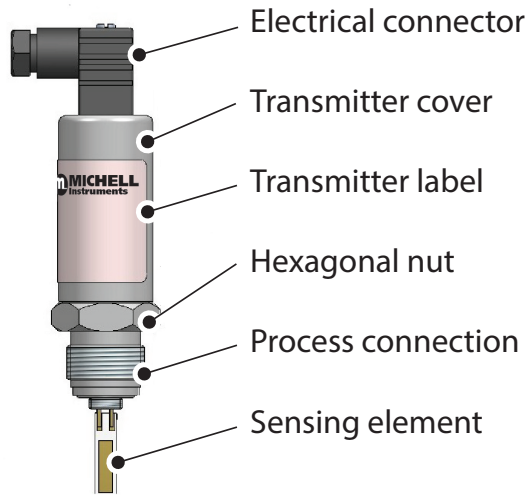
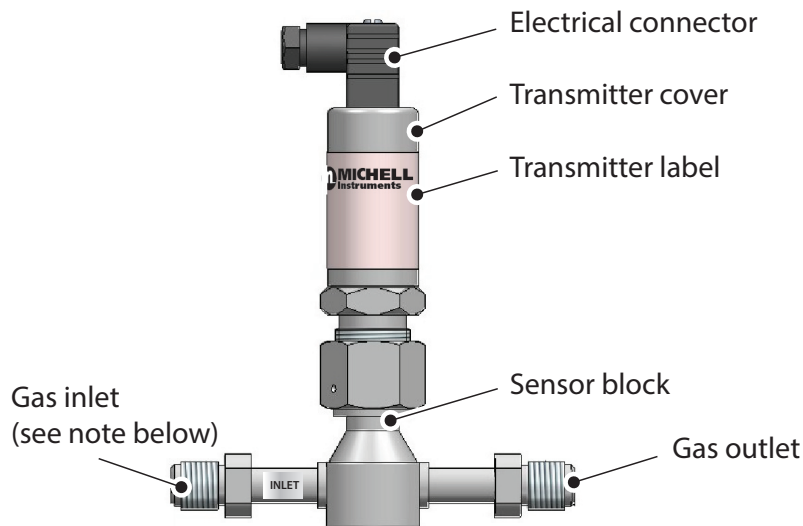


Figure 7 Pura SEN

2.4 Pura OEM, PRM

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

NOTE: OEM and PRM version transmitters are protected in transit by putting in a plastic bag filled with nitrogen. Pura OEM transmitter has single bag protection, Pura PRM transmitter 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

2.5 Monitor

The controls and indicators associated with the Pura Online are located on the front panel of the Process Indicator.

Connections to the Pura Transmitter, the RS485 communications port and the external power supply are all made to the rear panel of the Process Indicator (refer to Sections 3 and 4).

Figure 9 shows the layout of these controls and Table 1 describes their respective operational functions.



Figure 9 Process Indicator panel layout

2.5.1 Fault Conditions

Message Displayed	Cause	Action
ErrL	Sensor failure	Check power supply to transmitter. Check transmitter cable for continuity/damage. Rectify/replace cable
	Instrument failure	Refer to Michell or local representative for repair
Sbr	Sensor failure or break in sensor connection	Check transmitter cable for continuity/damage. Rectify/replace cable
ErrH	Gas is wetter than -40 °Cdp	Check gas source supply
	Sensor contaminated	Replace/re-calibrate transmitter
outR	Input out of range	Check gas source supply. Re-calibrate/replace transmitter
zurC	Reverse input connection	Swap input connections from the transmitter to the monitor

2.5.2 Monitor Controls and Indicators





Item	Description
1	<p>°F units indicator</p> <p>Indicates that the displayed dew-point reading is in degrees Fahrenheit.</p>
2	<p>°C units indicator</p> <p>Indicates that the displayed dew-point reading is in degrees Celsius. Note: if neither the °Cdp nor °Fdp LED is lit, ppm_v is selected.</p>
3	<p>Main reading display</p> <p>Displays the value measured by the connected transmitter, or flashes one of the status conditions shown in Section 2.5.1.</p>
4	<p>AL1</p> <p>Indicates alarm relay 1 is active, which by default is a LOW alarm.</p>
5	<p>AL2</p> <p>Indicates alarm relay 2 is active, which by default is a HIGH alarm. Section 3.3.2 details the setting up of AL2 trip points.</p>
6	<p>Item Description</p> <p>6.1 Program Key (P)</p> <p></p>
	<p>6.2 ← Left arrow (decrement)</p> <p></p>
	<p>6.3 → Right arrow (increment)</p> <p></p>
	<p>6.4 Set Key (P)</p> <p></p>

Table 1 Monitor Front Panel Controls and Indicators

2.5.3 Electrical Connections

Electrical connections to the Pura Online system are as follows:

Required:

- AC power supply, 100 to 240 V AC (-15 %, +10 %), 50/60 Hz, 6 VA. A low voltage (24 V DC) option is also available.

Optional:

- Transmitter current loop input, 4...20 mA (24 V DC loop power provided by monitor).
- Alarm 1 (Low), potential free contacts, single pole make. Contacts rated at 250 V, 3 A.
- Alarm 2 (High), potential free contacts, single pole changeover. Contacts rated at 250 V, 5 A.
- Re-transmitted input signal from the dew-point transmitter 4...20 mA or 0...20 mA.
- Modbus RTU over RS485 digital communications interface.

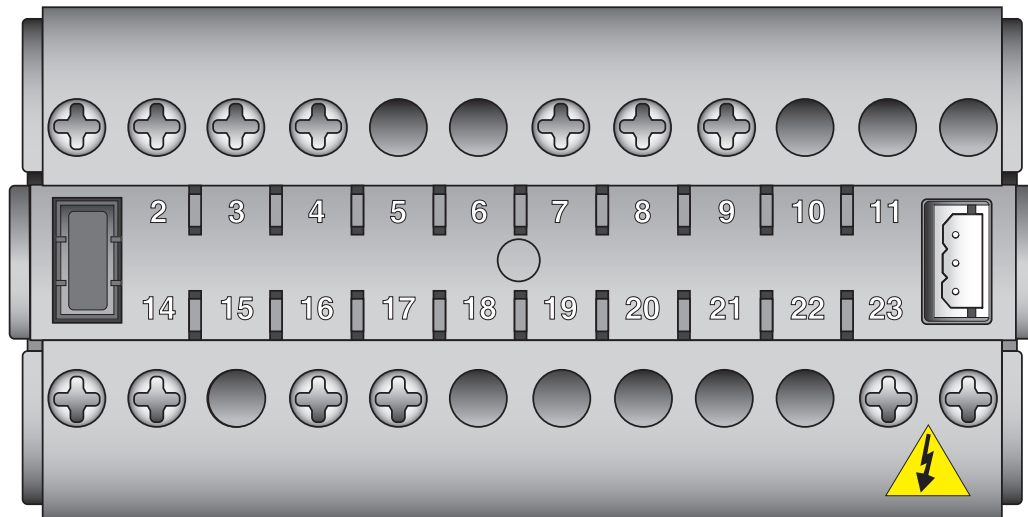


Figure 10 Monitor Rear Panel Connections

Terminal	Wire Colour	Signal	Supply Information
1	Blue	0 V (GND)	Transmitter Cable Screen
3	Green	4...20 mA loop return	
4	Red	Transmitter loop supply (+ve)	+24 V DC w.r.t. terminal 1
7	User defined	ALR2 (normally closed)	
8	User defined	ALR2 (normally open)	
9	User defined	ALR2 (common)	
13	User defined	Current loop out (-ve)	Default 4...20 mA
14	User defined	Current loop out (+ve)	Default 4...20 mA
16	User defined	ALR1 (common)	
17	User defined	ALR1 (normally open)	
23 (AC Version)	Blue	Power in (neutral)	100 – 240 V, 50/60 Hz
24 (AC Version)	Brown	Power in (live)	100 – 240 V, 50/60 Hz
23 (DC Version)	Blue	Negative (-)	0 V
24 (DC Version)	Brown	Positive (+)	24 V
<p>NOTE: There are no terminals in positions 5, 6, 10, 11, 12, 15, 18, 19, 20, 21 and 22</p>			

Table 2 Summary of Electrical Connections

2.5.4 AC Power Supply Input



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

Connect the AC power supply to the monitor as shown in *Figure 11*. Refer also to Table 4 which gives a summary of all the connections to the rear panel of the monitor.

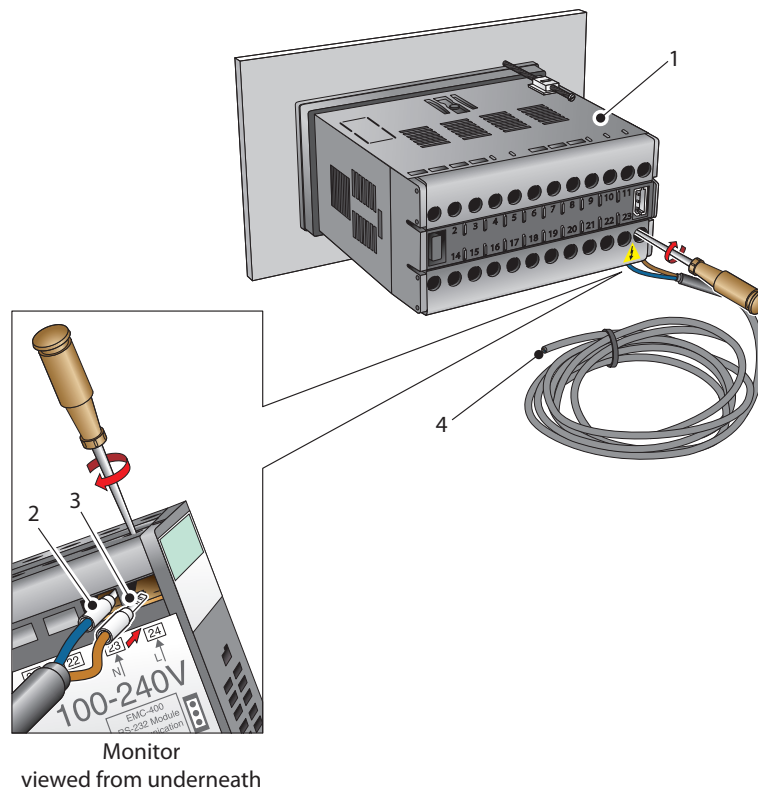


Figure 11 AC Power Supply Connections

1. Ensure that no power is connected to the mains lead.
2. Connect the blue (white – US standard) (neutral) lead (2) to terminal 23 on the rear panel of the monitor.
3. Connect the brown (black – US standard) (live) lead (3) to terminal 24 on the rear panel of the monitor.
4. Strip back the insulation on the free end of the power cable and wire to an appropriate power supply plug (brown lead to live supply terminal, blue lead to neutral supply terminal).
5. Check that the wiring has been completed correctly before connecting to a mains power supply.

2.5.5 DC Power Supply Input (Optional)

Connect the DC power supply to the monitor as shown in *Figure 12*. Refer also to Table 4 which gives a summary of all the connections to the rear panel of the monitor.

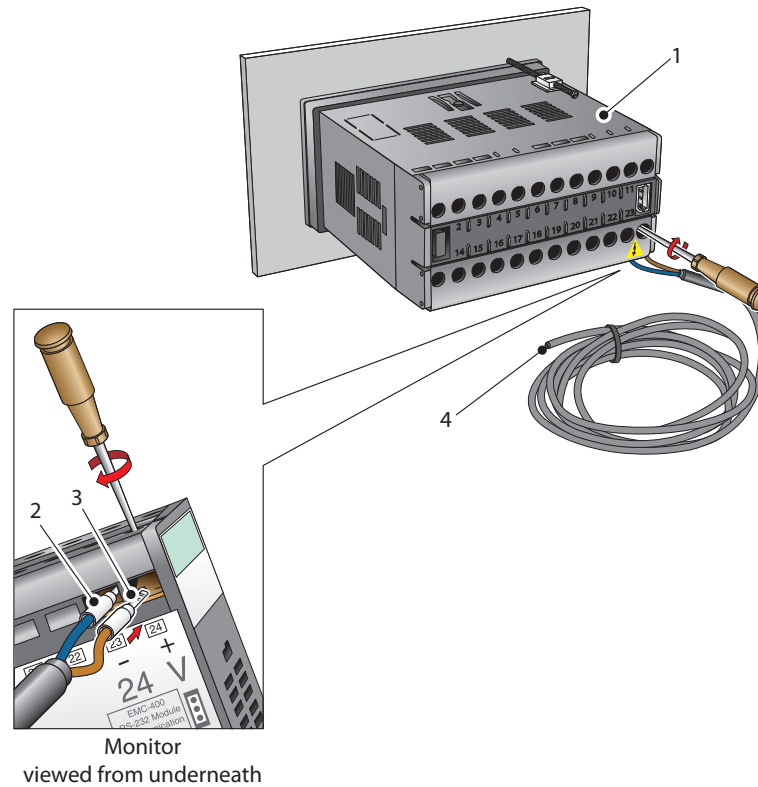
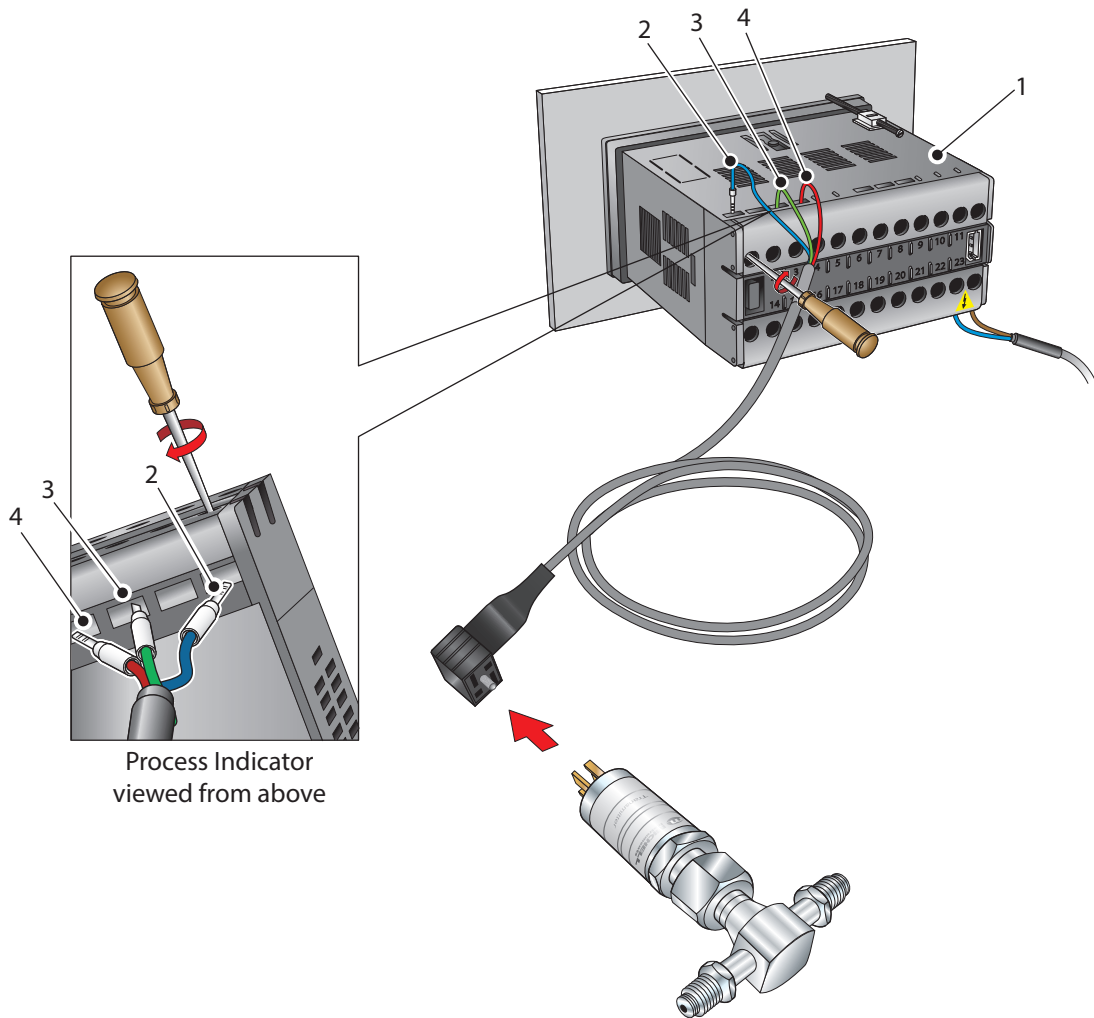


Figure 12 *DC Power Supply Connections*

1. Ensure that no power is connected to the mains lead.
2. Connect the blue (white – US standard) lead (2) to terminal 23 on the rear panel of the monitor.
3. Connect the brown (black – US standard) lead (3) to terminal 24 on the rear panel of the monitor.
4. Strip back the insulation on the free end of the power cable and wire to an appropriate power supply plug (brown lead to positive (+) supply terminal, blue lead to negative (-) supply terminal).
5. Check that the wiring has been completed correctly before connecting to a 24 V power supply.

2.5.6 Transmitter Connection

Connect the transmitter cable to the monitor as shown below:



Process Indicator
viewed from above

Figure 13 Transmitter Connections

1. Connect the blue wire (2) of the transmitter cable to terminal 1 on the monitor (1).
2. Connect the green wire (3) of the transmitter cable to terminal 3 on the monitor.
3. Connect the red wire (4) of the transmitter cable to terminal 4 on the monitor.
4. Check that the transmitter cable wiring has been completed correctly.

2.5.7 Signal Output Connections

The Pura Online system has four possible signal outputs: Alarm 1 (ALr1), Alarm 2 (ALr2), the re-transmitted input signal (4...20 mA or 0...20 mA current loop signal depending upon instrument configuration) and the digital communications interface.

2.5.7.1 Alarm Outputs

Alarm 1 is a single pole make contact. Connect incoming signal lines to terminal 16 (common) and terminal 17 (normally open). Alarm 1 contacts rated at 250 V, 3 A.

Alarm 2 comprises a set of changeover contacts. Connect incoming signal lines to terminal 9 (common), terminal 8 (normally open) and terminal 7 (normally closed). Alarm 2 contacts rated at 250 V, 5 A.



Alarm level signals could be at mains potential so it is essential that, before connecting these signal lines, checks are made to ensure that these inputs are not live and that it is safe to handle them.

2.5.7.2 Re-transmission Output

The re-transmission output is current sourcing. Connect the positive output to terminal 14 and the negative output to terminal 13. Use appropriately coloured wires e.g., red (positive), black (negative).

2.5.7.3 RS485 Modbus RTU Communications Port

On the right-hand side of the monitor is a digital communication port. To use this port requires cable P/N EA2-OL-MON-29739.

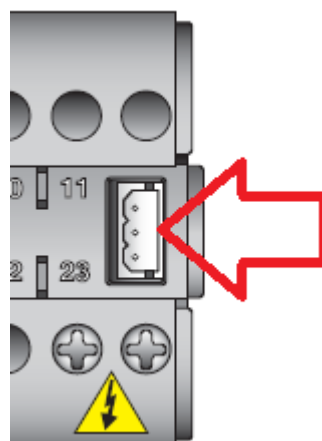


Figure 14 *Digital Communications Port*

2.5.8 Mounting the Monitor

The monitor is designed for panel mounting and requires a panel cut-out of 46 x 92mm (1.8 x 3.6"). The recommended panel thickness is 2 to 5mm (0.08 to 0.2").

To mount the unit, proceed as follows (refer to *Figure 15*):

1. Pass the monitor (1) through the front of the panel (2).
2. Support the monitor and insert the hook on the clamp (3) into the slot (4) located on top of the monitor casing.
3. Tighten the fixing screw (5) finger tight, against the back of the panel.
4. Insert the hook on the second clamp (6) into the slot located on the underside of the instrument casing and tighten the fixing screw, finger tight, against the back of the panel.
5. Ensure that the monitor is sitting flush to the front of the panel (2) 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.

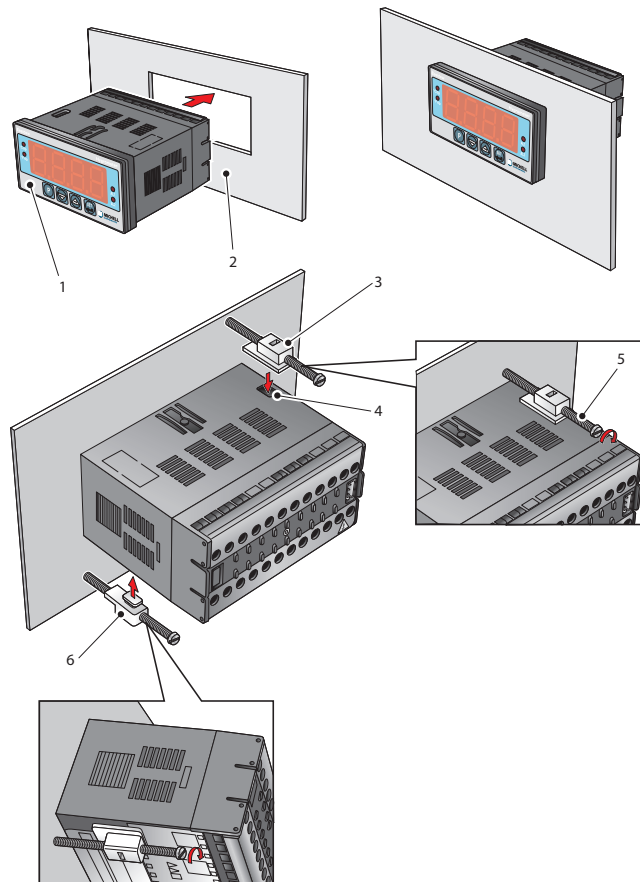


Figure 15 Mounting the Monitor

2.6 Preparation of the Transmitter Cable

2.6.1 Electrical Connections



Connector Pin	Michell Standard Conductor Colour	Function
1	Green	4...20 mA Signal Return (Power Supply -ve)
3	Red	Power Supply +ve
GND	Blue	Ground, Cable Screen Connection This pin directly connects to the metal casing of the transmitter, but not to the transmitter electronics, and is intended for cable screening only.

Warning: The sensor must be operated with the 4...20 mA signal return connected to a suitable load, or negative power supply connection. Leaving this pin unconnected may result in damage to the transmitter. Refer to wiring schematics later on in this document for connection examples.

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.

2.6.2 Sensor Cable Assembly

For guidance on type of cable refer to Section 2.6.3.

Assembly Instructions

1. Remove the screw from the rear of the DIN connector housing.
2. Lever the terminal block from the connector housing by inserting a small screwdriver in the notch on the front face of the terminal block.
3. Ensure the small sealing O-ring and washer and retained with the screw.

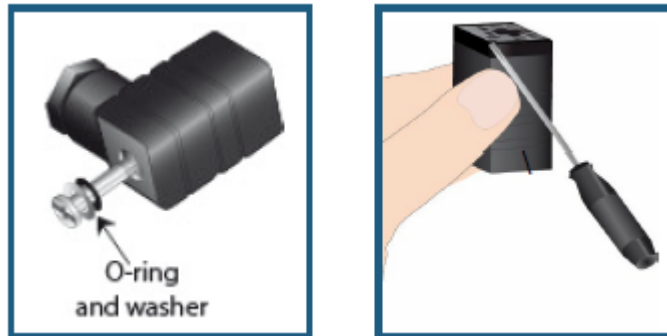


Figure 16 *Pura Transmitter*

4. Cable should be assembled according to *Figure 17*.

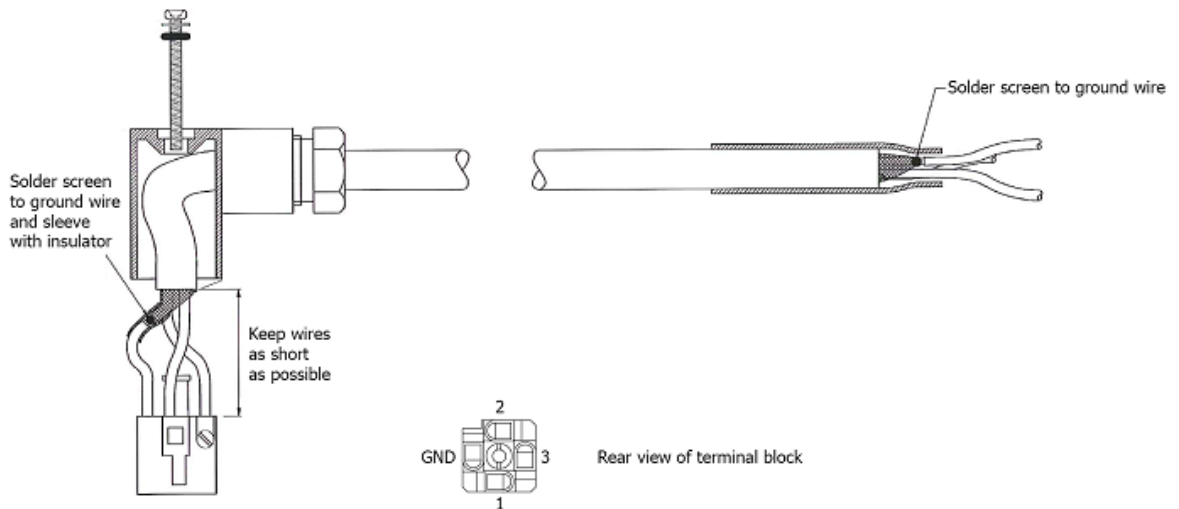


Figure 17 *Pura Transmitter*

2.6.3 Cable selection for self-assembled cables

It is recommended to use 3-core screened cable. For short runs, a cable with individual conductor sizes of 24 AWG / 0.21mm₂ would be a typical choice. A cable with larger conductors may be required to keep loop resistance within allowable limits. A chart of maximum loop resistance vs supply voltage is provided in the following section to aid in cable selection.

2.6.4 Maximum Loop Resistance vs Supply Voltage

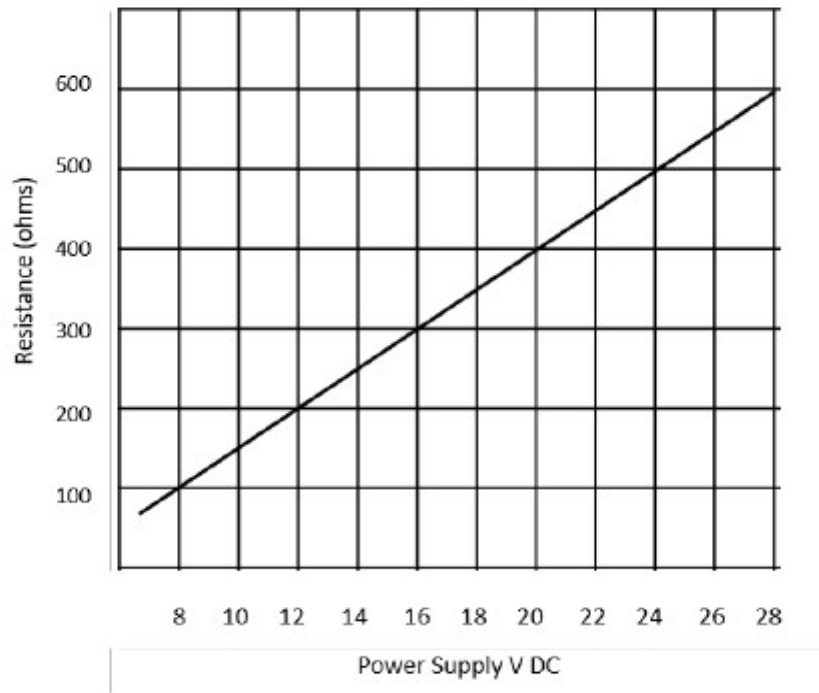


Figure 18 *Maximum Load of Pura – Including Cable Resistance*

NOTE: Cable resistance of the entire loop must be considered when calculating loop resistance.

2.6.5 Wiring Connection Between the Transmitter and the Monitor

When installing the connector, and to ensure that full ingress protection is achieved, the securing screw (with the O-ring and washer) must be tightened to a minimum torque setting of 3.4 Nm (2.5 ft-lbs). The sensor cable used must be a minimum diameter of 4.6 mm (0.2”).

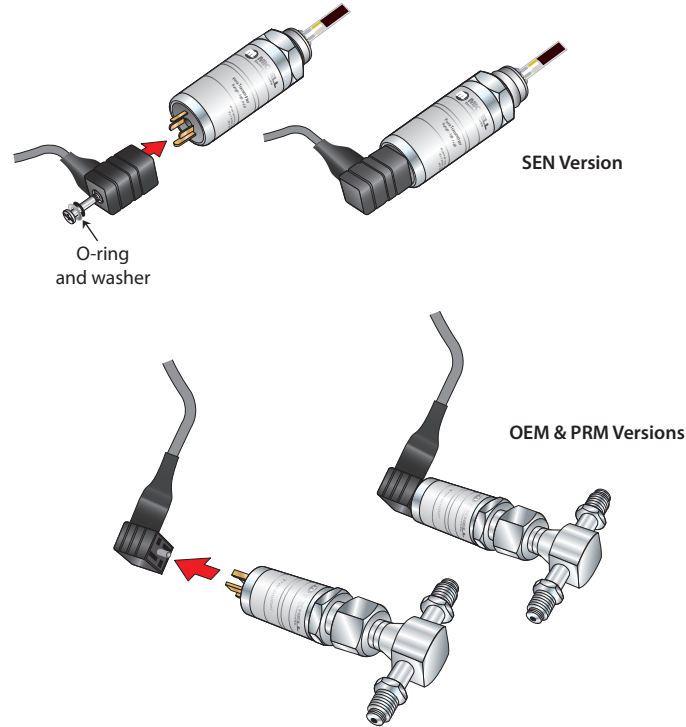


Figure 19 Connector Installation

2.7 Transmitter Mounting

2.7.1 Sensor Block Connection (Recommended Method)



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



WARNING: Under no circumstances should the sensing element be handled with the fingers.

To mount the transmitter into the sensor block, proceed as follows – refer to *Figure 21*.

1. Remove the red protective cover (2) from the tip of the transmitter (1).
2. Fit the 1/2" VCR gasket (3) over the threaded part of the transmitter body.
3. Screw the transmitter (1) into the sensor block (4) and tighten the gas line nut 1/8 (one eighth) of a turn using a second spanner/wrench. **NOTE: Use the flats of the hexagonal nut and not the sensor body.**
4. Fit the transmitter cable/connector assembly to the plug located on the base of the transmitter and tighten the fixing screw (see *Figure 20*).

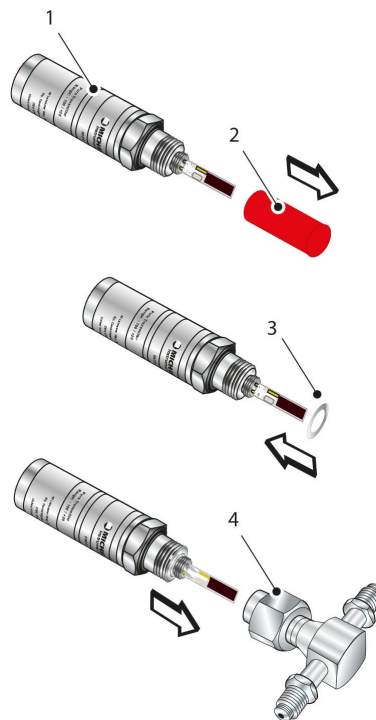


Figure 20 Sensor Block Connection

2.7.2 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 1/2" VCR male process connection thread to match the transmitter body thread. 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.



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

1. Ensure that the red protective cover has been removed from the tip of the transmitter.
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 1/2" VCR gaskets, when connecting the Pura into a gas line.

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

2.7.3 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 unpackaged 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 120 mm (4.7").



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

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

3 OPERATION

As supplied, the instrument is ready for operation and has been set-up with a set of default parameters. This section describes both the general operation of the instrument and the method of setting it up and changing the default parameters should this become necessary.

The default parameters are as follows:

- Span -120...-40 °Cdp (-184...-40 °Fdp)
- Temperature units °Cdp
- Current loop input, 4...20 mA (7.5 °C/mA or 13.5 °F/mA)
- Re-transmission current loop output, 4...20 mA (7.5 °C/mA or 13.5 °F/mA)
- Data communications, Slave address 1, Baud rate 9600, Parity None, Stop bits 1

For the supplied dew-point transmitter, the span and current loop input setting should not be changed. The span will require changing if the instrument is to be ranged in °F, if a different transmitter is employed, if the user chooses to re-range the Pura transmitter.

The instrument must also have been installed as detailed in Section 2 and connected to a sample gas supply that is representative of the process being monitored.

3.1 General Operational Information

Operation of the Pura Online is completely automatic and once set-up requires little or no operator intervention.

The sample gas is taken into the sample block via the Gas In port and, in flowing through the sample block, comes into contact with the dew-point transmitter which, in turn, produces a current loop output signal proportional to the measured dew-point temperature. This output signal is converted to a real time analog dew-point temperature reading by the monitor.

The gas flow through the sample block must be controlled outside the instrument, typically by means of a needle valve located in the sample gas input line.

3.2 First Time Operation

Prior to operation, the instrument must be connected to the correct electrical power supply and the relevant analog and alarm outputs connected to external systems as required and as described above.

To commence operation, proceed as follows:

1. Switch on the power supply to the instrument. The instrument display will now come on, typically showing the default parameters and units as detailed in *Figure 31*.
2. Check that the gas sample flow rate through the sample block or the pipeline in which the transmitter is located is within the operational limits:
 - 1...10 NI/min (2.1...21.2 scfh) (5 NI/min (10.6 scfh) optimum)
3. Adjust any external flow control valves, located in the gas sample input line to the instrument, to achieve the required flow rate.

The instrument is now operational and after a few seconds, in which all the segments of the display are tested, the process indicator will display the measured dew-point temperature as a steady reading within the range $-120...-40^{\circ}\text{Cdp}$ ($-184...-40^{\circ}\text{Fdp}$), depending upon how the instrument has been set-up. The default setting is degrees Celsius.

In the absence of any error indications the instrument will now be operational using the default parameters, typically as shown in *Figure 31*.



Figure 21 Typical display

If the display is flashing, a fault condition exists.

The following operational error conditions may be encountered:

- 'ErrL' If the display is alternately flashing (e.g.) 'ErrL' and '-120.3', this indicates that the measured dew point is outside the lower operational limit (-120°Cdp) and the numeric section of the display gives an indication of the actual measured reading.
- If the display is alternately flashing 'ErrL' and '-154.9', (or '-199.9' if set-up to read temperature in $^{\circ}\text{F}$), this could be an indication that the input current loop to the process indicator is open or that there may be a transmitter fault. Check that the transmitter is wired correctly as detailed in Section 2.5.6.

- 'ErrH' If the display is alternately flashing (e.g.) 'ErrH' and '-39.9', this indicates that the measured dew point is outside the upper operational limit (-40°Cdp) and the numeric section of the display gives an indication of the actual measured reading.

3.3 System Alarms

The Pura Hygrometer has two alarm outputs. As supplied, the default alarm set-points and the alarm switching logic are as follows (the default temperature units are degrees Celsius):

- Low Alarm - Alarm 1 (**AL1**) set to -20°Cdp
- High Alarm - Alarm 2 (**AL2**) set to -40°Cdp

Alarm 1 (Low Alarm) is set-up to switch ON when the temperature reading is lower (gas drier) than the alarm set-point value. For the default set-points therefore, the default switching logic for these alarms is as follows:

- Alarm 1 Temp < -20 Alarm 1 = ON
- Temp > -20 Alarm 1 = OFF

Alarm 2 (High Alarm) is set to switch ON when the temperature reading is higher (gas wetter) than its set- point value. For the default set-points therefore, the operation of this alarm would be as follows:

- Alarm 2 Temp < -40 Alarm 2 = OFF
- Temp > -40 Alarm 2 = ON

Depending upon the application, if required, it is possible to reverse the switching logic for either or both of the alarm channel outputs to provide the following alarm output configurations.

- Alarm 1 Temp < -20 Alarm 1 = OFF
- Temp > -20 Alarm 1 = ON

- Alarm 2 Temp < -40 Alarm 2 = ON
- Temp > -40 Alarm 2 = OFF

Section 3.3.1 describes the method for reversing the default switching logic and Section 3.3.2 describes the method for setting up individual alarm set-points.

3.3.1 Reversal of Default Alarm Switching Logic

As stated in Section 3.3, the switching logic for the alarm channels may, if required, be individually reversed. Starting at the default state, the method of reversing the switching logic for both alarms is as follows:

Figure 32 shows the operational key sequence.

For Alarm 1:

1. Press the 'P' key once and the display will read 'tECH'.
2. Press the 'SET' key and the display will flash between 'ConF' and 'PinP'.
3. Press the '⇒' key twice and the display will flash between 'ConF' and 'Alr1'.
4. Press the 'SET' key twice to display 'Alt1'.
5. Press the '⇒' key once to display a flashing 4 digit number. For the Alarm 1 default setting this will be 0001.
6. Press the '⇐' key once to change the display to 0000.
7. Press the 'SET' key to accept the new value. The default setting for Alarm 1 is now reversed.
8. Either press the 'P' key twice to return to the main display or press the 'P' key once followed by the '⇒' key to move to the 'Alr2' setting sequence from step 4 above.

To reverse the switching logic for Alarm 2 ONLY, proceed as follows:

1. Press the 'P' key once and the display will read 'tECH'.
2. Press the 'SET' key and the display will flash between 'ConF' and 'PinP'.
3. Press the '⇒' key three times and the display will flash between 'ConF' and 'Alr2'.
4. Press the 'SET' key twice to display 'Alt2'.
5. Press the '⇒' key once to display a flashing 4 digit number. For the Alarm 2 default setting this will be 0000.
6. Press the '⇒' key once to change the display to 0001.
7. Press the 'SET' key to store the new value.
8. Press the 'P' key twice to return to the main display. The default setting for Alarm 2 is now reversed.

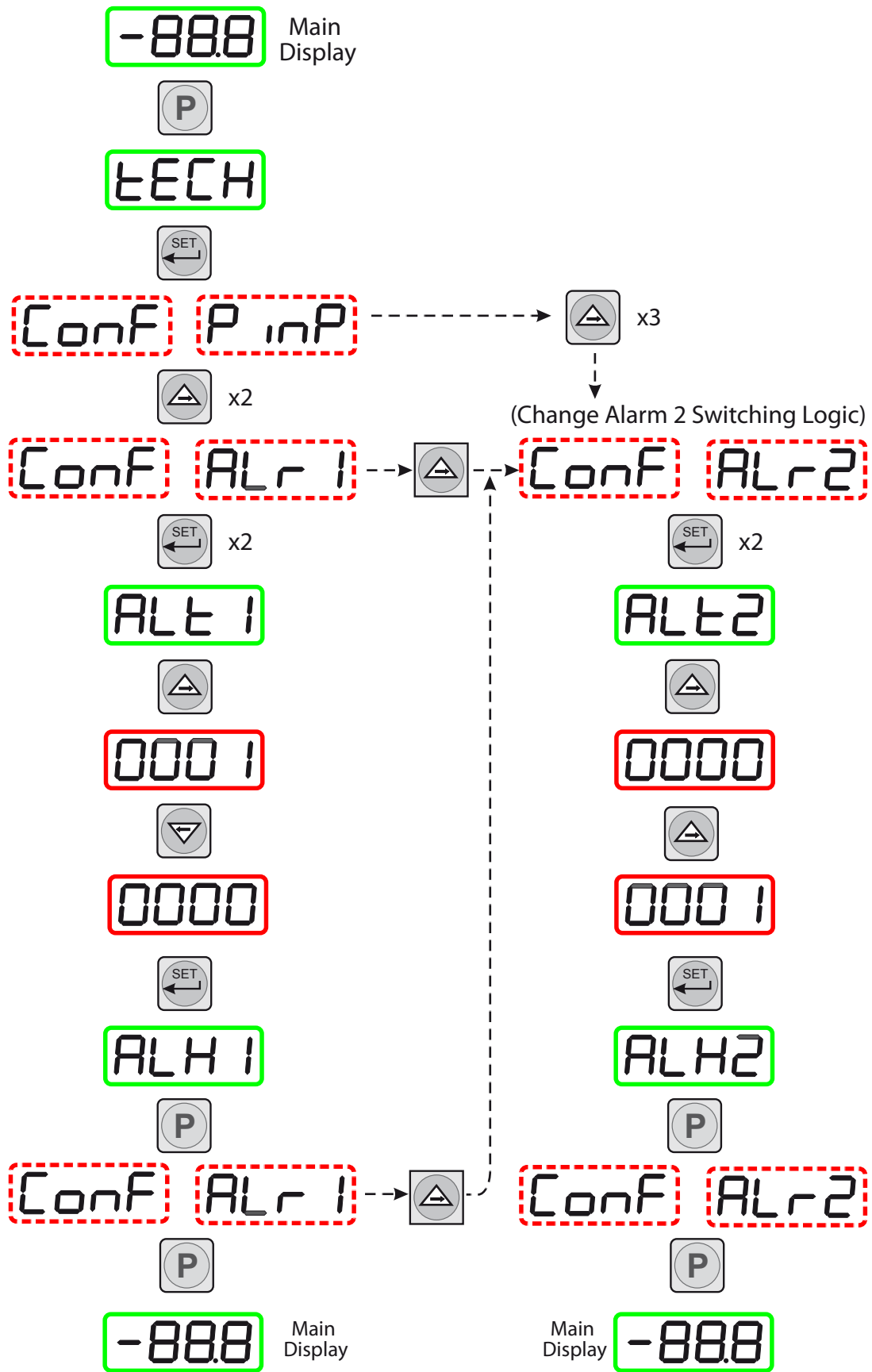


Figure 22 Change alarm switching logic

3.3.2 Set-up Alarm Levels

The alarm set-point levels are set-up from the program menu as follows (to exit to the main display without saving any new settings press the 'P' key):

Figure 37 shows the operational key sequence.

To set-up both alarm set-points:

1. Press the 'SET' key once, 'ALr1' will be displayed. (To set Alarm 2 only, press the 'SET' key twice and follow the Alarm 2 branch instead).
2. Press the '⇒' key to display the flashing current Alarm 1 set-point (-20°C in this example).
3. Use the '⇒' and '⇐' keys to set the required value (-25.5°C in this example).
4. Press the 'SET' key once to store the new (or existing) value for Alarm 1 and to enter the set-up menu for Alarm 2, 'ALr2'. (To exit to the main display without changing Alarm 2 set-point levels, press the 'P' key.)
5. Press the '⇒' key to display the flashing current Alarm 2 set-point (-40°C in this example).
6. Use the '⇒' and '⇐' keys to set the required value (-50°C in this example).
7. Press the 'SET' key once to store the new value for Alarm 2. The display then returns to the main dew-point temperature display.

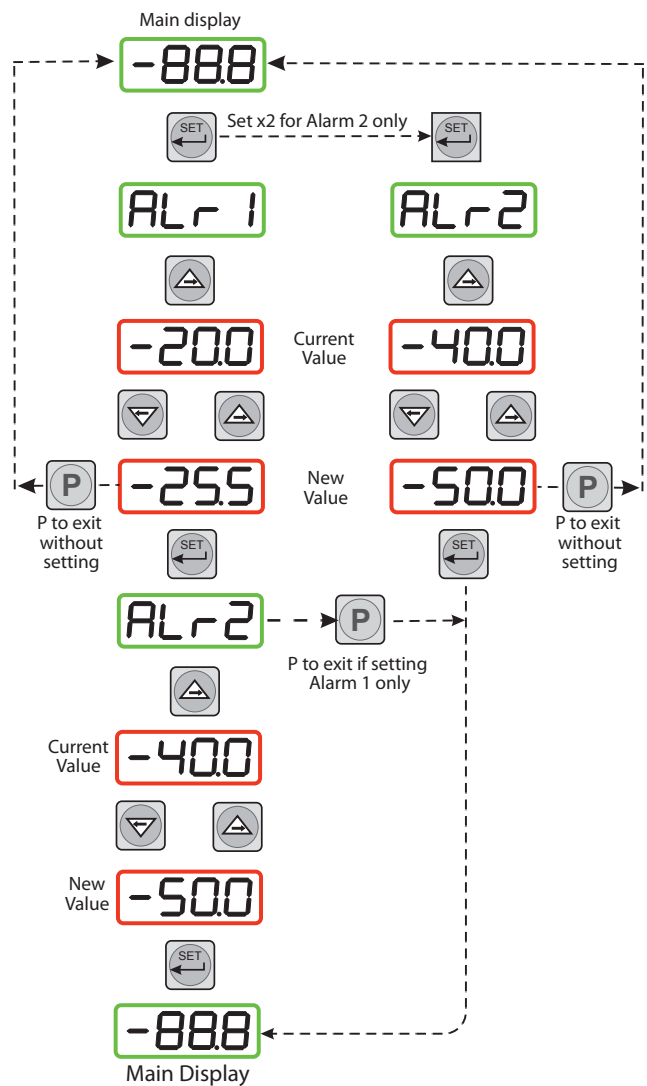


Figure 23 Set-up alarm levels

3.3.3 Configure Analog Output Current Loop

The Pura Hygrometer is provided with an analog current loop output module which buffers and re-transmits the current loop input signal from the dew-point transmitter.

By default, the re-transmission output is set as a 4...20 mA current loop (to exactly follow the input signal, i.e. 4 mA in, 4 mA out).

For certain system processes, a 0...20 mA current loop output may be required. The set-up method is as follows:

Figure 33 shows the operational key sequence.

Change output from 4...20 mA to 0...20 mA

1. Press the 'P' key once, the display will read 'tECH'.
2. Press the 'SET' key and the display will flash between 'ConF' and 'PinP'.
3. Press the '⇨' key and the display will flash between 'out1' and 'ConF'.
4. Press the 'SET' key to display 'oAt1'.
5. Press the '⇨' key once to display a flashing 4 digit number. For the default setting (4...20 mA) this will be 0001.
6. Press the '⇐' key once to change the display to 0000. This selects the re-transmission output to be 0...20 mA.
7. Press the 'SET' key to accept the new value. The output current loop is now 0...20 mA. The display will flash between 'out1' and 'ConF'.
8. Press the 'P' key once to return to the main dew-point temperature display,

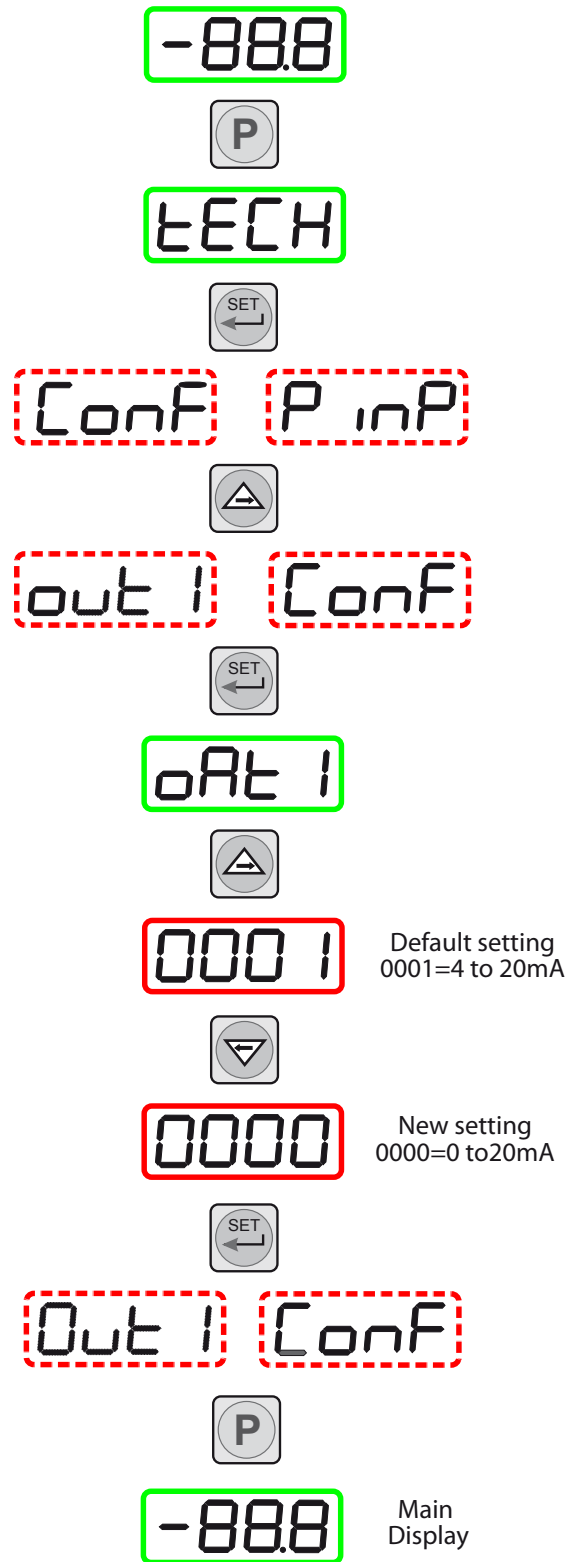


Figure 24 Configure analog output

3.4 Change Dew-Point Temperature Range

The default temperature unit for the Pura Hygrometer is degrees Celsius. This is indicated by the °Cdp LED indicator. The default settings associated with this temperature scale are as follows:

- Span -40 to -120°Cdp
- Upper and lower span limits -40 and -120 (display flashes outside this range)
- Minimum alarm set-point -120°Cdp
- Maximum alarm set-point -40°Cdp



To range the instrument for °F, all the above parameters need to be changed to their Fahrenheit equivalent values (-40 and -184 °F). It is not sufficient just to change the units.

After these parameters have been changed, the alarm level set-points will remain set at their previous levels -40 and -20 but will now represent °F. These will therefore probably require changing; refer to Section 3.4.2 for details.

3.4.1 Span and Unit Settings

To change the span and unit settings, proceed as follows. Figure 34 shows the operational key sequence.

1. Press the 'P' key once, the display will read 'tECH'.
2. Press the 'SET' key six times and the display will read 'tPoL'.
3. Press the '⇒' key and the display will flash with the current minimum span limit (-100.0).
4. Use the '⇒' and '⇐' keys to set the required equivalent Fahrenheit value (-148.0) and press the 'SET' key. 'tPoH' is then displayed.
5. Press the '⇒' key, the display will flash the current maximum span limit (020.0).
6. Use the '⇒' and '⇐' keys to set the required equivalent Fahrenheit value (068.0) and press the 'SET' key twice. 'unit' is then displayed.
7. Press the '⇒' key, the display will flash the current unit (°C).
8. Use the '⇒' and '⇐' keys to set the required scale units (°F in this example) and press the 'SET' key. 'LoL' is then displayed.
9. Press the '⇒' key and the display will flash with the current alarm lower range limit (-100.0).
10. Use the '⇒' and '⇐' keys to set the required equivalent Fahrenheit value (-148) and press the 'SET' key. 'uPL' is then displayed.
11. Press the '⇒' key, the display will flash the current alarm upper range limit (020.0).
12. Use the '⇒' and '⇐' keys to set the required equivalent Fahrenheit value (068.0) and press the 'SET' key. 'PUoF' is then displayed. Press the 'P' key twice to return to the main menu.
13. The maximum and minimum alarm level limits should now be changed to suit the new (Fahrenheit) unit values (refer to Section 3.3.2).

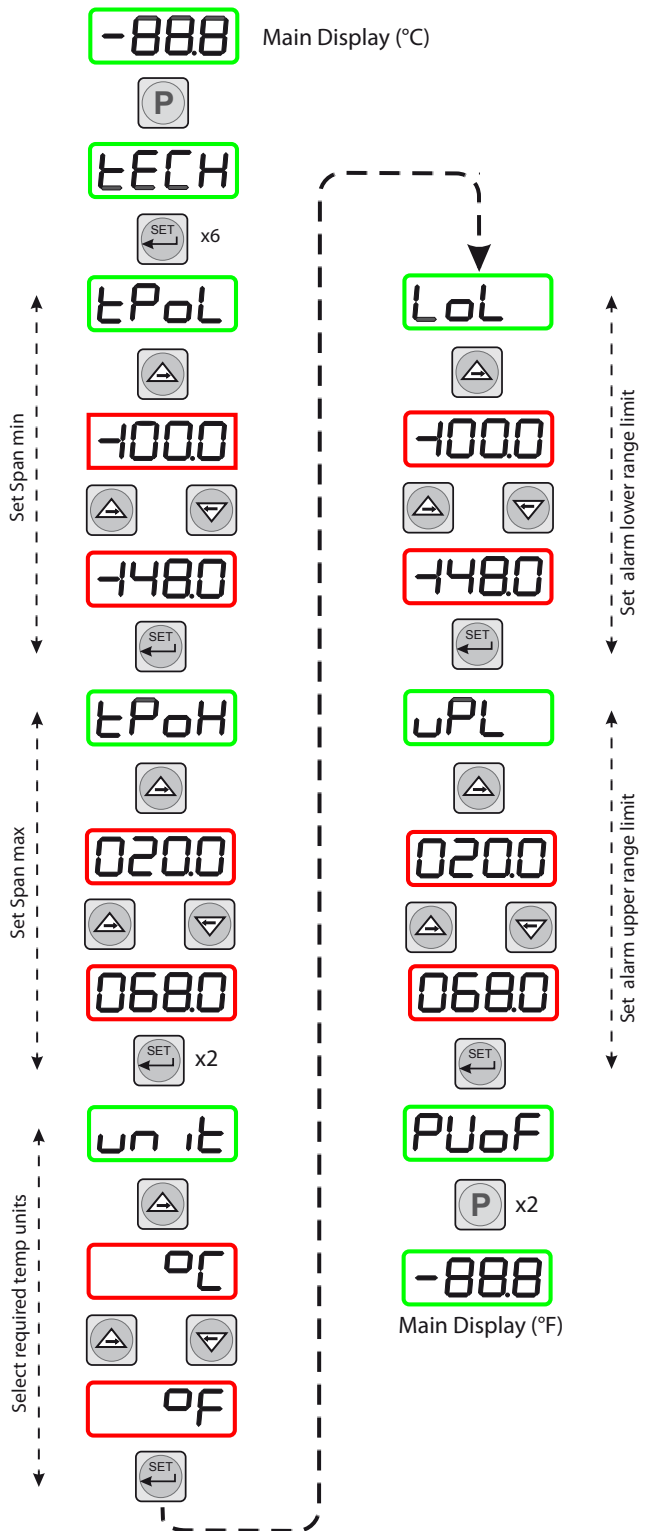


Figure 25 Span and unit settings

3.4.2 Configure Alarm Set-Point Limits

The following procedure is used to set limits to which the alarm levels can be set (usually after re-configuring the instrument's range for Fahrenheit readings).

Figure 35 shows the operational key sequence.

1. Press the 'P' key once, the display will read 'tECH'.
2. Press the 'SET' key once and the display will flash between 'ConF' and 'PinP'.
3. Press the '⇨' key four times and the display will flash between 'ConF' and 'GEnn'.
4. Press the 'SET' key once, the display will read 'SU-L'.
5. Press the '⇨' key once to display a flashing 4 digit number representing the current minimum alarm level setting. (The default setting for the °C range is -100.0).
6. Use the '⇨' and '⇦' keys to set the required new value (e.g. -148.0).
7. Press the 'SET' key to accept the new value. The display will read 'SU-u'.
8. Press the '⇨' key once to display a flashing 4 digit number representing the current maximum alarm level setting. (The default setting for the °C range is 020.0)
9. Use the '⇨' and '⇦' keys to set the required new value (e.g. 068.0).
10. Press the 'SET' key to accept the new value, followed by the 'P' key to return to the main display.

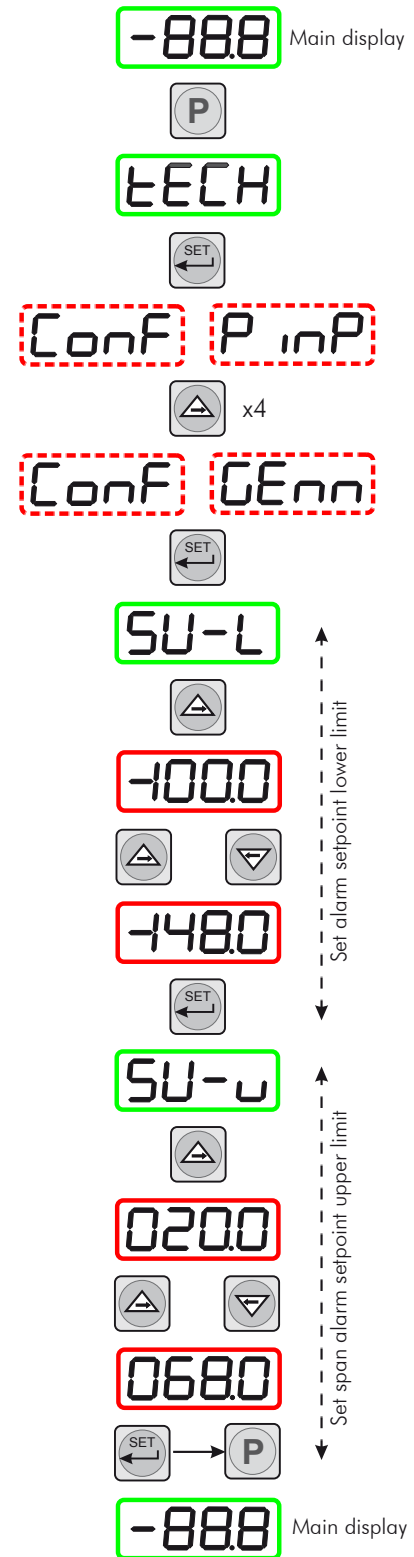


Figure 26 Set-up alarm set-point limits

3.4.3 Change Scale Units (to ppm_v)

To change the process indicator to read parts per million by volume (ppm_v) proceed as follows:

Figure 36 shows the operational key sequence.

Note: The dew-point transmitter must first be programmed to provide an output proportional to ppm_v by using the Michell application software. Contact Michell Instruments for information (for contact details see Appendix B).

1. Press the 'P' key once, the display will read 'tECH'.
2. Press the 'SET' key four times and the display will read 'dPnt'.
3. Press the '⇨' key, the display will flash the current decimal point position (0001).
4. Press the '⇨' key to set 0000 on the display (no decimal point), and press the 'SET' key twice. 'tPoL' is then displayed.
5. Press the '⇨' key, the display will flash the current minimum span limit (-1000)
6. Use the '⇨' and '⇦' keys to set the required ppm_v minimum reading (0000) and press the 'SET' key. 'tPoH' is then displayed.
7. Press the '⇨' key, the display will flash the current maximum span limit (0200).
8. Use the '⇨' and '⇦' keys to set the required ppm_v maximum reading (3000) and press the 'SET' key twice. 'unit' is then displayed.
9. Press the '⇨' key, the display will flash the current unit (°C).
10. Press the '⇨' key three times to set the display reading to ' _ ' (ppm_v) and press the 'SET' key. 'LoL' is then displayed.
11. Press the '⇨' key, the display will flash the current alarm lower range limit (-1000) (formerly -100.0 with no sign or decimal point showing).
12. Use the '⇨' and '⇦' keys to set the required alarm lower range limit (point where display starts to flash) (0 or different value), and press the 'SET' key. 'uPL' is then displayed.
13. Press the '⇨' key, the display will flash the current alarm upper range limit (0200) (formerly 020.0 with no decimal point showing).
14. Use the '⇨' and '⇦' keys to set the required alarm upper range limit (point where display starts to flash) (3000 or different value), and press the 'SET' key. 'PUoF' is now displayed.
15. Press the 'P' key twice and the main display, now reading ppm_v will show. **NOTE: Neither the °C nor the °F LED indicators on the front panel of the process indicator are now lit.**

On completion of the above procedure appropriate alarm levels, relevant to the new ppm_v scale, will need to be set-up (refer to Section 3.3.2).

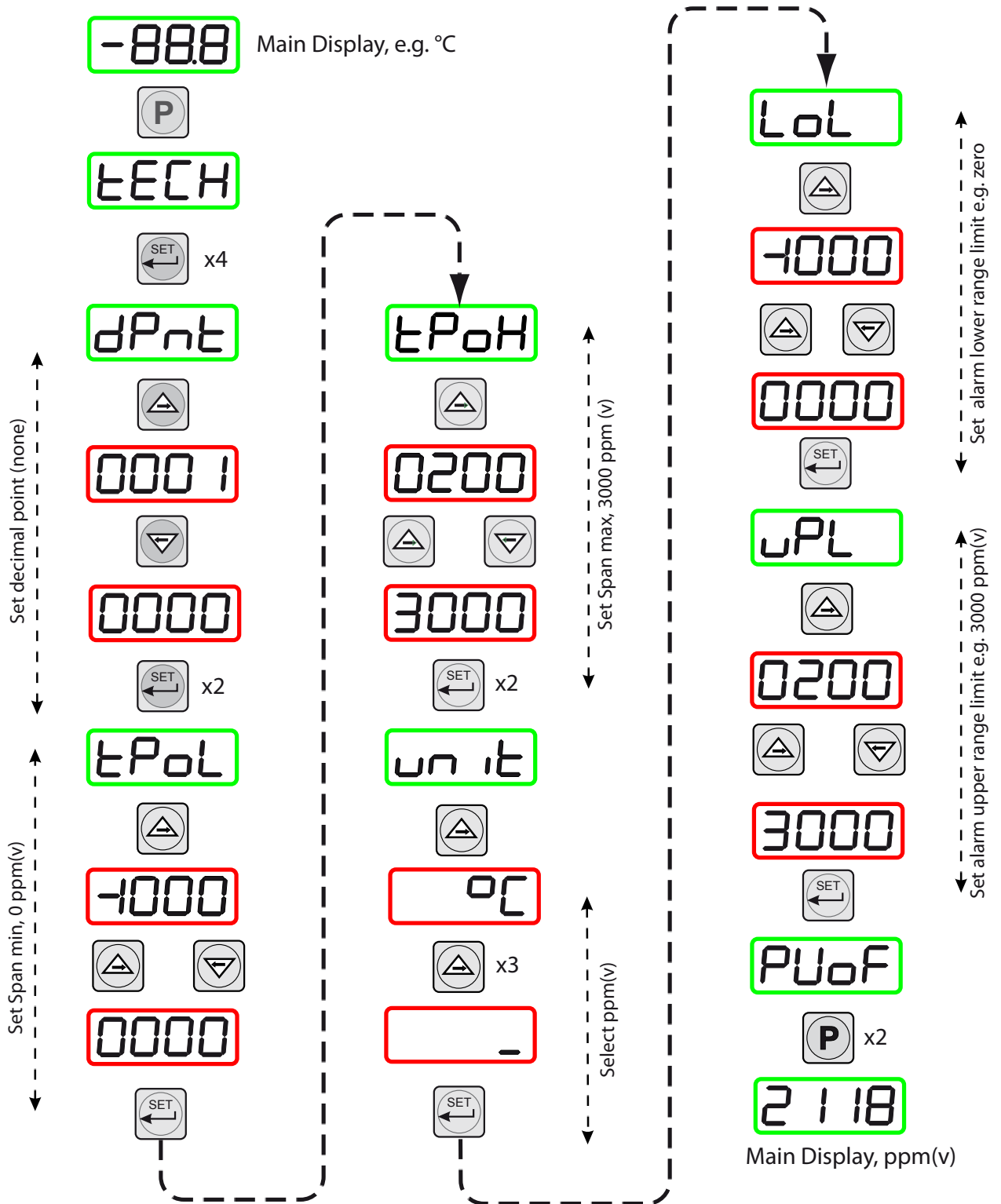


Figure 27 Set-up process indicator (to read ppm_v)

4 MEASUREMENT GUIDE

The Pura Online Hygrometer is designed to operate in a flowing gas stream and is suitable for the measurement of the moisture content of a wide variety of gases. In general, if the gas (in conjunction with water vapor) is not corrosive to ceramics or base metals then it will be suitable for measurement by the Pura Online.

4.1 General Operational Guidelines

General guidelines to be followed when setting-up a sampling system are as follows:

- **Operate with an appropriate flow rate**

When installed in a sample block, the optimum flow rate is 5L/min to ensure fast responses to changes in dew point. Sample gas flow should be regulated by a precision needle valve installed either on the inlet of the sample block (atmospheric dew-point measurement) or on the outlet of the sample block (pressure dew-point measurement). Avoid too much restriction on the inlet or outlet of the sample block, as this may cause an undesired pressure gradient across the block.

To avoid long sample transport times a fast-loop bypass may be desirable, especially for higher pressure samples.

- **Transmitter Positioning**

The sample point should be as close to the critical measurement point as possible. Also, never sample from the bottom of a pipe as entrained liquids may be drawn into the sensing element.

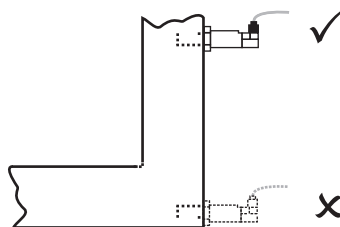


Figure 28 *Installation Location*

- **Avoidance of Dead Spaces**

Dead space causes moisture entrapment points, increased system response times and measurement errors, as a result of the trapped moisture being released into the passing sample gas and causing an increase in partial vapor pressure.

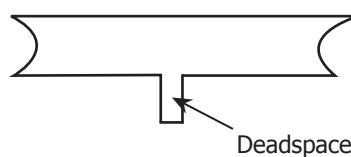


Figure 29 *Indication of Dead Space*

- **Particulate and Oil Removal**

Particulate matter at high velocity can damage the sensing element and similarly, at low velocity, they may 'blind' the sensing element and reduce its response speed. If particulate, such as degraded desiccant, pipe scale or rust is present in the sample gas, use an in-line filter.

- **High-Quality Tube and Fittings**

Michell Instruments recommends that, wherever possible, stainless steel tubing and fittings should be used. This is particularly important at low dew points since other materials have hygroscopic characteristics and adsorb moisture on the tube walls, slowing down response and, in extreme circumstances, giving false readings. For temporary applications, or where stainless steel tubing is not practical, use high quality thick walled PTFE tubing.

- **Complexity avoidance (tee pieces, in-line couplings, etc.)**

Sample pipework should, ideally, be specially designed for each application rather than adapted from that previously installed for another application. Dead space in sample lines increases response time by holding water molecules which are more slowly released to the passing gas sample.

- **Sample Gas Selection**

Generally, if the sample gas (in conjunction with water vapor) is not corrosive to base metals, it will be suitable for measurement by the Pura Online system. Gases containing entrained solids should be filtered before application to the sample block.

Care should be taken with gas mixtures containing potentially condensable components in addition to water vapor, e.g. oil, to ensure that only water vapor is present in the sample.

4.2 Maintenance and Calibration

Routine maintenance of the Pura Online Hygrometer is confined to regular re-calibration. For most applications, annual re-calibration ensures that the stated accuracy of the Pura Online Hygrometer 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 Easidew transmitter can be returned to Michell Instruments either directly or via the authorized distributor, for calibration at 13 points across the range -100...+20 °Cdp (-148...+68 °Fdp).

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 from the sample line and the monitor and the replacement transmitter fitted in its place. The original transmitter should be packed in its original packing and returned to Michell Instruments, either directly or via their authorized agent.

Easidew transmitters are fully interchangeable and can be used with any Pura Online monitor. Transmitter interchangeability is not affected by cable length.

4.2.1 Clean Monitor

The front panel of the monitor should be cleaned with a moist lint free cloth. Mild detergent may be used to remove any stubborn marks or stains but **DO NOT** use any type of solvent, e.g. acetone, which could damage the instrument.

5 MAINTENANCE

5.1 Maintenance and Calibration

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

VCR Gasket

VCR gaskets should be replaced every time any VCR connection is re-made. Replacement VCR gaskets can be obtained from Michell Instruments.

O-ring Seal

If the supplied O-ring seal is damaged or lost a pack of 5 replacement O-ring seals can be obtained by contacting your Michell Instruments representative.

5.2 Fault Conditions

Display	Cause	Action
OPEN	Transmitter failure	Check power supply to transmitter. Check sensor cable for continuity/damage. Rectify/replace cable
	Instrument failure	Refer to Michell or local representative for repair
FAIL	Transmitter failure	Replace transmitter
0.0	Gas is wetter than -40 °C (-40 °F) dew point	Check gas source supply
	Transmitter contaminated	Replace/re-calibrate transmitter

Appendix A

Technical Specifications

Appendix A Technical Specifications

Monitor	
Equipment Use	Process indicator – dew-point measurement
Housing & Mounting	48 x 96 x 86mm (1.9 x 3.8 x 3.4") Horizontal, DIN 43700 Plastic housing for panel mounting. Panel cut out is 46 x 92mm (1.8 x 3.6")
Protection	NEMA 12 (IP65 at front, IP20 at rear)
Weight	Approximately 260g (0.5lb)
Environmental Rating	Standard, indoor at an altitude of less than 2000m with non-condensing humidity
Operating / Storage Temperature	0...+50 °C / -40...+85 °C (+32...+122 °F / -40...+185 °F)
Operating / Storage Humidity	90 % max (non condensing)
Installation Over Voltage Category	III, distribution level, fixed installation category
Mode of Operation	Continuous
Supply Voltage	100...240 V AC (+10 %, -15 %), 50/60 Hz (Optional 24 V DC)
Alr 1 Relay	Single pole make contact, rating 3 A @ 250 V AC
Alr 2 Relay	Changeover contacts, rating 5 A @ 250 V AC
Analog Output (if installed)	4...20 mA (or 0...20 mA) over range -120...-40 °C (-184...-40 °F)
Process Display	20mm (0.8"), Red, 4 digit LED display
LED Indicators	AL1, AL2, °C, °F
Power Connection	2 wire, length 2m (6.6ft)
Transmitter Cable	Copper braid screened cable; 4 core 7 / 0.2 (0.22mm ²), stranded, tinned copper conductors, PVC, insulated, Melinex taped, Black PVC outer. Max length 800m (2,624 ft)

Transmitter									
Measurement Range (dew point)	-120...-40 °C (-184...-40 °F) dew point								
Accuracy (dew point)	±1 °C from -40 up to -60 °C ±2 °C from -60 up to -100 °C ±4 °C from -100 up to -120 °C (estimated)								
Repeatability	0.5 °C (0.9 °F) dew point								
Electrical Output/Input									
Output Signal	4...20 mA (2-wire connection, current source) User-configurable over range								
Output	Dew point, moisture content for ppm _v								
Output Range	Dew point: -120...-40 °C (-184...-40 °F)								
Supply Voltage	12-28 V DC								
Load Resistance	Max 250 Ω @ 12 V (500 Ω @ 24 V)								
Current Consumption	23 mA								
Supply Voltage Influence	±0.005 %rh/V								
Operating Conditions									
Operating Humidity	0–100 %rh								
Operating Temperature	-40...+60 °C (-40...+140 °F)								
Operating Pressure	30 MPa (300 barg/4350 psig) max								
Compensated Temperature Range	-20...+50 °C NOTE: The transmitter accuracy statement is only valid for the temperature range: -20/+50 °C								
Storage Temperature	-40...+60 °C (-40...+140 °F)								
Flow Rate	1...10 NI/min (2.1...21.2 scfh) (5 NI/min (10.6 scfh) optimum)								
Mechanical Specification									
Ingress Protection	IP66 in accordance with standard BS EN 60529:1992, and NEMA 4 in protection accordance with standard NEMA 250-2003								
Housing Material	Stainless steel								
Mounting Thread	¼" male VCR connection ½" male VCR connection								
Weight	Premium and OEM versions: 450g (15.87oz) Pura Sensor version: 180g (6.34oz)								
Interchangeability	Fully interchangeable transmitter								
Electrical Connections	Screw terminal								
Fault Conditions (factory programmed)	<table border="1"> <thead> <tr> <th>Condition</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Sensor fault</td> <td>23 mA</td> </tr> <tr> <td>Under-range dew point</td> <td>4 mA</td> </tr> <tr> <td>Over-range dew point</td> <td>20 mA</td> </tr> </tbody> </table>	Condition	Output	Sensor fault	23 mA	Under-range dew point	4 mA	Over-range dew point	20 mA
Condition	Output								
Sensor fault	23 mA								
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Appendix B

Quality, Recycling, Compliance & Warranty Information

Appendix B Quality, Recycling, Compliance & Warranty Information

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

www.michell.com/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 C

Return Document & Decontamination Declaration

Appendix C 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	

NOTES

www.ProcessSensing.com



<http://www.michell.com>