NTRON Gas Measurement
a DwyerOmega brand

USER MANUAL

OxyDew

Oxygen & Moisture Analyzer

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Revision History

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For Ntron contact information please go to
www.ProcessSensing.com

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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.

If the equipment is used in a manner not specified in this manual the protection provided by the equipment may be impaired.

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.

Do not apply power while the enclosure is open.

All wiring shall be completed with the supply isolated.

De-energise before opening the enclosure.

Pressure Safety

DO NOT permit pressures greater than the safe working pressure to be applied to the instrument. The specified maximum working pressure is 10 barg (147 psig). Refer to the Technical Specifications in Appendix A.

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.

Use of parts not specified by the manufacturer is not permitted.

Manufacturer contact information

Ntron Gas Measurements Ltd

Mullaghboy Industrial Park

Navan, Co. Meath

C15 VFP2

Ireland

Calibration

For calibration guidance, please refer to section 8 of this manual.

Safety Conformity

This product meets the essential protection requirements of the relevant UK, EU and US standards and directives. Further details of applied standards may be found in the Technical Specifications in Appendix A.

Abbreviations

The following abbreviations are used in this manual:

AC	alternating current
°C	degrees Celsius
°F	degrees Fahrenheit
DC	direct current
kg	kilogram
LPM	Liters Per Minute
mLPM	Millimeters Per Minute
mA	milliampere
Nm	Newton Metre
PLC	Programmable Logic Controller
ppm	parts per million
RTU	Remote Terminal Unit
MCU	Microcontroller Unit
DAC	Digital to Analog Converter
FSD	Full Scale Deflection
ID	Identification
ADC	Analog to Digital Converter
PC	Personal Computer
R/W	Read/Write
MS	Milliseconds

Warnings

The 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.

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

Where this symbol appears in the following sections, it is used to indicate surfaces that could be hot to touch.

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1 Introduction

The product is designed to provide point of use monitoring of pressurized clean gaseous streams for the parameters of oxygen and dew point.

1.1. Product overview

The product comprises the following elements

- Industry leading gaseous oxygen and dew-point measuring sensors.
- Electronic controller/human machine interface.
- Gas sample conditioning system.
- Integrated multi-voltage power supply.
- Wall mounting enclosure.

The Product electronic controller is mounted in the enclosure lid and is designed to meet international standards for electrical equipment. The electronic controller assembly provides alarm relays, which activate when the measured oxygen/dew point level breaches a pre-determined and configurable value to place the process or equipment under control into an alarm state or maintain a desired state.

The electronic controller assembly also provides a separate 4 mA to 20 mA analogue output for both oxygen and dew point concentration that can be used for monitoring the process or equipment under control.

The Product requires an external power source from which the internal Product power supply assembly derives its electrical power.

2 Measuring principle

2.1. Oxygen Sensor

The sensor element is an ion conduction zirconium oxide (ZrO2) with an electrical contact surface (electrode) of platinum on both sides. The ZrO2 material (electrolyte) is heated by an integral heating element (≈580 °C [1076 °F]). When at operating temperature, oxygen vacancies occur in the ceramic lattice (electrolyte) allowing oxygen ion transport across the solid material (electrolyte). If a voltage is applied across the electrodes, it then operates as a current source, the output current is dependent on the oxygen concentration of the measuring gas.

The relationship is described by the following formula

Is ([O2])=-k*ln(1-[O2]/100)

Where

Is ([O2])	Sensor current in the measuring medium
[O2]	Oxygen concentration in the measuring medium in %
K	Sensor specific constant.

Graphical depiction of sensor construction below

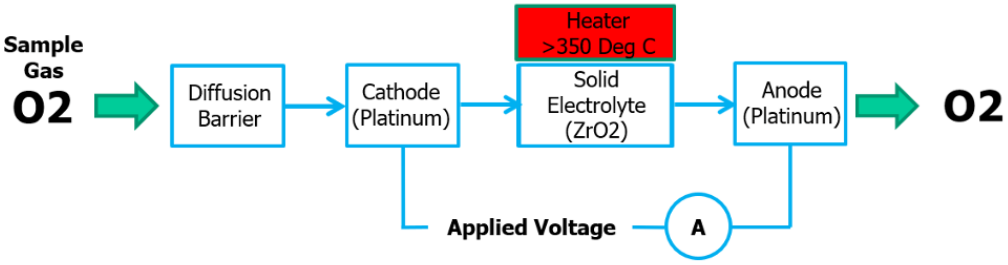


Figure 1 *Depiction of Oxygen Sensor Construction*

Caution
Due to the high operating temperature and use of platinum electrode material, the presence of reducing agents such as hydrocarbons, carbon monoxide, hydrogen etc interferes with the measurement of oxygen. In the presence of such gasses the analyser will display a lower than actual oxygen concentration.

For example....
2 H2 plus 1 O2 forms 2 H2O and thus reduces the O2 the analyser reads by a ratio of 0.5 for every 1 H2 molecule.

2 CO plus 1 O2 forms 2 CO2 which also reduces O2 0.5 for every 1 CO molecule. Data shows the hydrocarbons reduce O2 by ~0.1 for every hydrocarbon molecule. Care should be taken to use the sensor to measure inert gases only. Do not attempt to measure Sulphur gases like H2S. The sulphur reacts with the platinum electrode to form platinum sulphide which degrades the electrochemical properties of the sensor

2.2. Dew-Point Sensor

The dew-point sensor uses the measurement of ceramic impedance to detect sample gas dew point. It is constructed using thin and thick film ceramic techniques. The sensor absorbs water vapour onto a porous hygroscopic layer between two conductive layers built on top of a base ceramic substrate. Water changes the physical properties of the sensor layer resulting in a shift of the sensor impedance measurement of which provides representation of sample gas dew point.

Graphical representation of sensor construction below

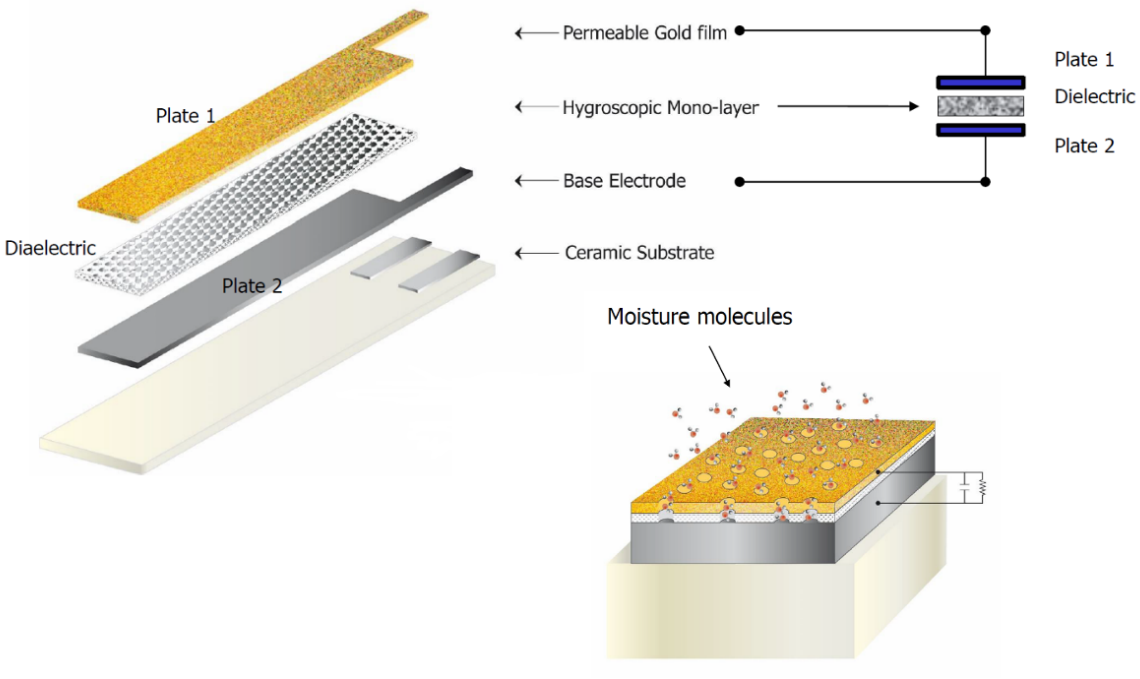


Figure 2 *Depiction of Dew-Point Sensor Construction*

Care should be taken to use the sensor to measure inert gases only. Avoid exposing the sensor to liquids and other contaminants which may cause damage or affect the accuracy over time.

3 Product Features

3.1. Product Functions

- The equipment covered by this manual is intended for use in applications requiring measurement of oxygen and dew point in clean gas streams only.
- The product electronic controller requires connection to an external power supply of 100 Vac to 240 Vac, 50 Hz/60 Hz, 60 Watts.
- The product is considered fixed apparatus only.
- The primary function of the product is to trigger an alarm relay when the measured oxygen concentration/dew point in the process or equipment under control crosses a pre-determined threshold defined by the user.
- The product has measuring ranges of 0 % to 25 % O2 and +20 °C to -100 °C (68 °F to -148 °F) dew point.
- The product has industry standard mountings.
- The product has a 4 mA to 20 mA analogue output proportional to the measured oxygen and dew point concentration.
- The product electronics controller has a tiered access barrier providing protection against parameter changing/adjustment by unauthorized persons.
- The sensor assembly may not be used in atmospheres containing materials (solids, liquids, vapours or gasses) that interfere with the correct operation of the product. See the "Caution" statement in Section 2 – Measuring principle.
- The product is not intended for use in potentially explosive atmospheres.

4 Specifications

4.1. Oxygen Sensor

Performance Parameter	Specification
Accuracy	±2 % of measuring range (25 % O2)
Response Times	t90 <15 Seconds
Warm up Time	10 Minutes
Ambient Temperature	5 °C to 55 °C (41 °F to 131 °F)
Relative Humidity	20 RH to 90 RH
Sensor Life Expectancy	≥2 Years (in clean gas)
Calibration Frequency	Annual

4.2. Dew-Point Sensor

Performance Parameter	Specification
Accuracy	±2 °C (±3.6 °F) dew point
Response Times	t95 = 5 min
Warm up Time	10 min
Ambient Temperature	5 °C to 55 °C (41 °F to 131 °F)
Relative Humidity	20 RH to 90 RH
Sensor Life Expectancy	≥2 Years (in clean gas)
Calibration Frequency	Annual

4.3. General

Performance Parameter	Specification
Power Supply	100 Vac to 240 Vac, 50 Hz/60 Hz, 60 Watts
Supply Voltage Specification	±10 %, and transient over voltages up to Overvoltage category II, POLLUTION DEGREE 2.
Relays	30 Vdc 5 A
Analogue Output	4 mA to 20 mA (250 Ohm max)
Enclosure	IP65
Sample Gas Input	G1/8, 20 bar (290 psig) (max)
Sample Flow	≈1.5 LPM
Sample Gas Output	G1/8, To free air vent (1 atm. max backpressure)
Ambient Temperature	5 °C to 55 °C (41 °F to 131 °F)
Altitude	2000 meters (max)
Relative Humidity	20 RH to 90 RH

5 System Components

5.1. External

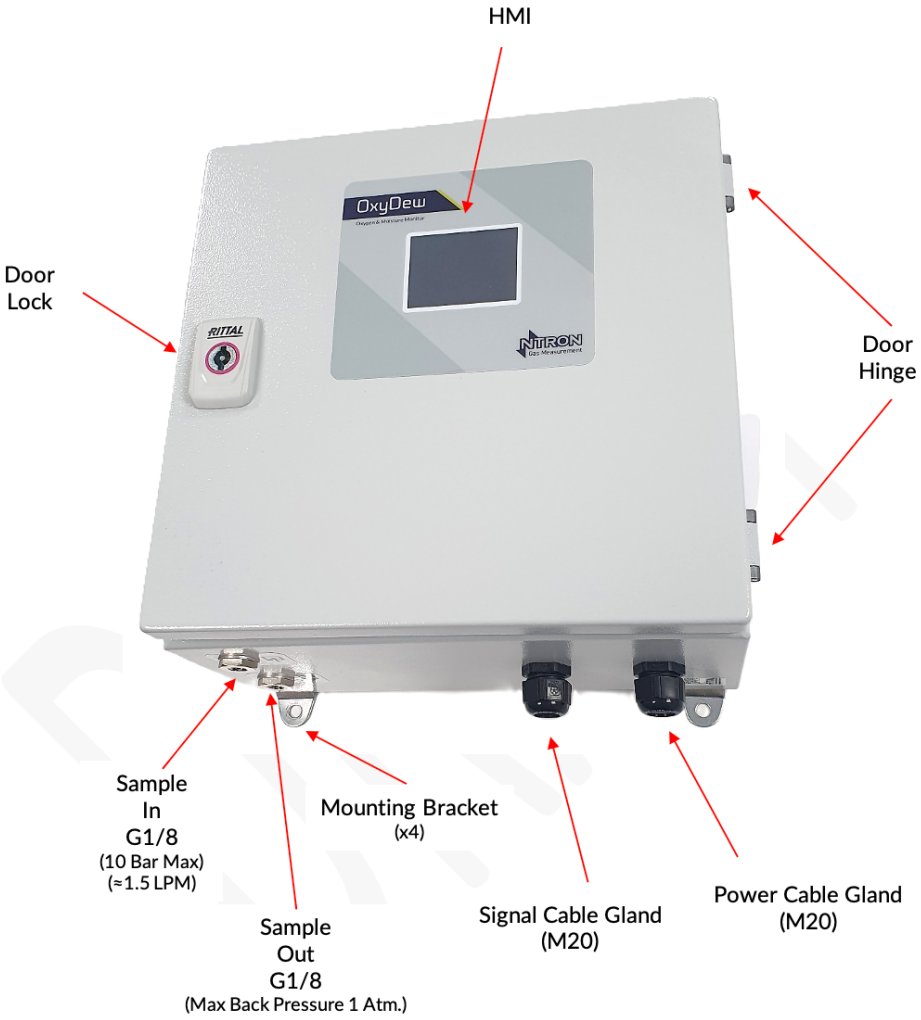


Figure 3 *External System Components*

Enclosure Specification	
Category	**Specification**
Material	Powder coated steel
Protection Category	IP65
Dimensions	300 mm (11.8 in) (W) x 300 mm (11.8 in) (H) x 155 mm (6.10 in) (D)
Mounting	4 x 8.2 mm (0.32 in) Diameter Holes 320 mm (12.6 in) x 260 mm (10.2 in) centres

5.2. Internal

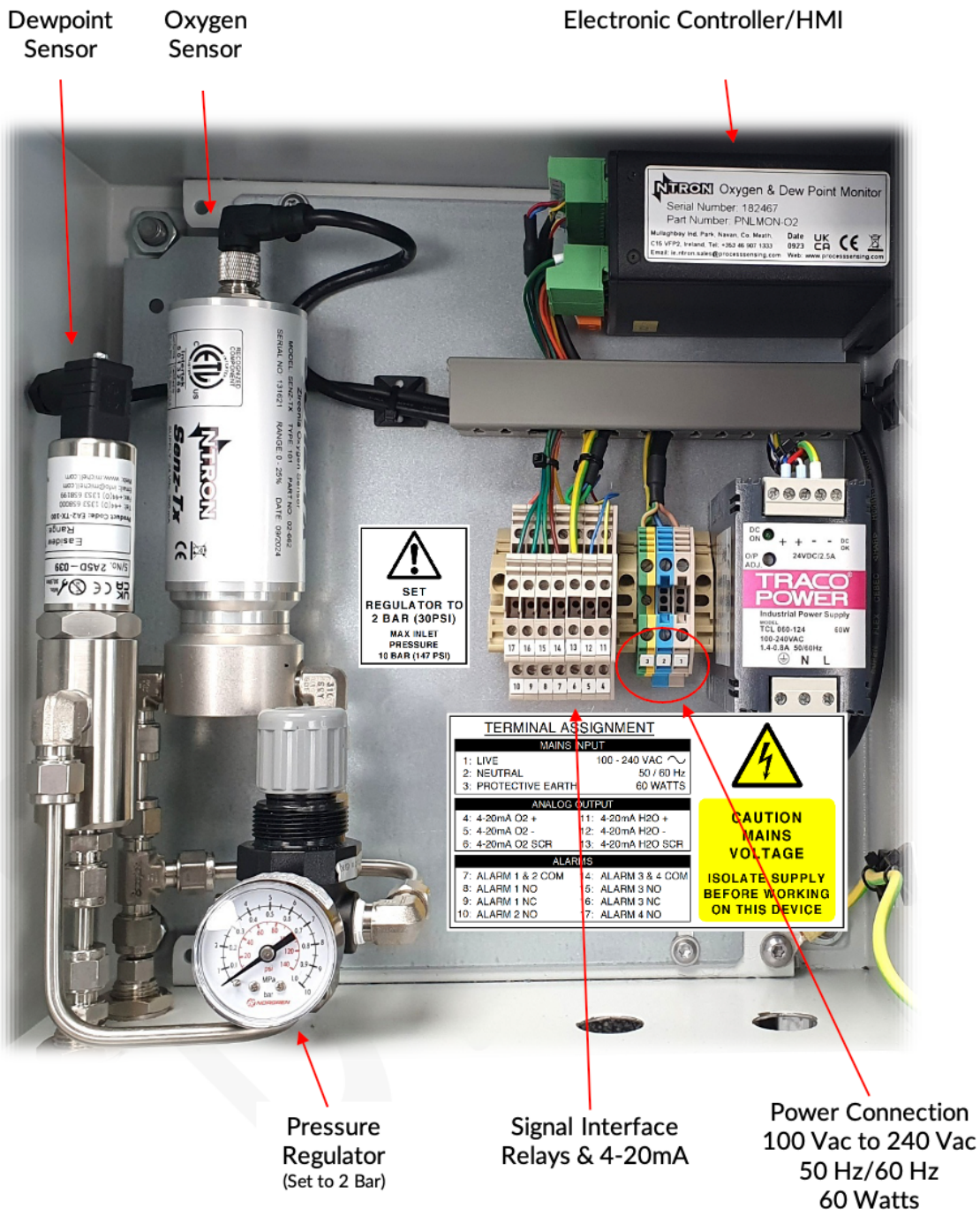


Figure 4 *Internal System Components*

5.3. Oxygen Sensor

The SenzTx uses a measuring cell made of Zirconium dioxide and is specific to oxygen. Due to the high temperature and the catalytic activity of the platinum coating of the sensor it has low cross-sensitivities to other gasses. The benefits of this technology give a long sensor life, and it should be noted that exposure to aggressive gaseous substances can reduce the operational life

5.4. Dew-Point Sensor

The Easidew uses market-leading ceramic metal-oxide moisture sensor technology coupled with latest-generation sophisticated microcontroller electronics to provide accurate and stable measurements.

5.5. Electronic Controller/HMI (human machine interface)

An advanced touch screen controller/HMI providing 2 analogue 4 mA to 20 mA outputs and 4 programmable alarm relay outputs with front screen configuration.

5.6. Power Supply

Line/Mains voltage AC/DC step down power supply/converter.

5.7. Pressure Regulator

A backpressure regulator with gauge for regulating pressure and controlling the flowrate through the system.

5.8. Customer Interface Terminal Group

Provides easy interface with the systems signal I/O.

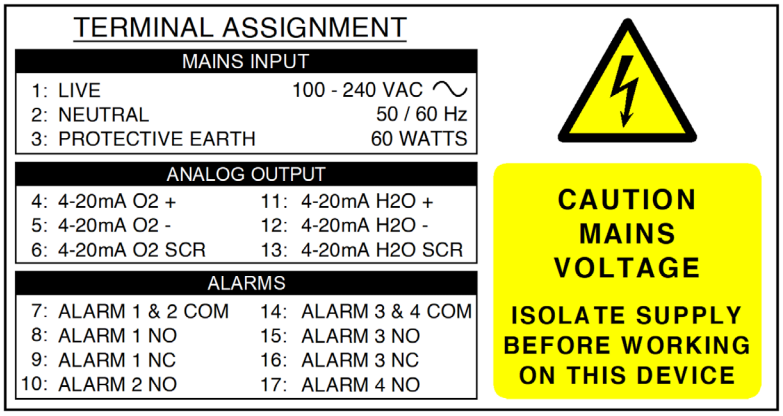


Figure 5 *Customer Interface Terminal Group*

6 Electronic Controller - HMI

6.1. Display

The display within the Process Monitor is an LCD 320 pixel x 240 pixel, touch screen colour display. During normal operation, process variable values are displayed as well as the state of the alarms. A password protected setup menu allows the configuration of the inputs and outputs.

6.2. Display Layout

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

Figure 6 *Display Layout*

1	Oxygen 1 Reading
2	Dew-point Reading
3	Alarm Status
4	Menu Password Protection Access

6.3. Accessing the Setup Menu

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

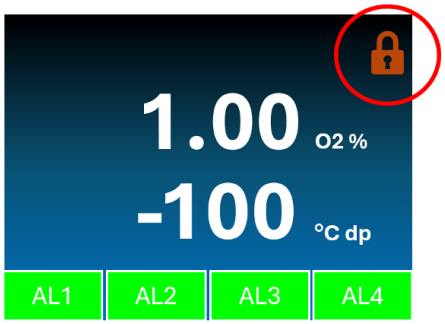


Figure 7 *Accessing Setup Menu*

The security code entry screen will appear.

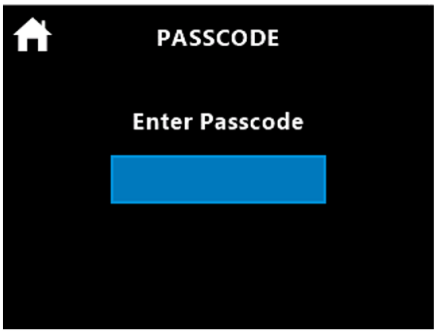


Figure 8 *Security Code Entry*

Press the blue box and enter the fixed security code 5618 followed by the OK button.

Figure 9 *Fixed Security Code*

Once the security code is accepted, the button to access the setup menu will appear on the main screen. Press the Menu icon on the top left-hand side of the display to access the setup menu.

Note: While in this unlocked state, the measurement unit can be toggled between available options by touching the reading value, e.g., touching the moisture value here will change the unit to ppmV.

Figure 10 *Setup Menu Icon*

The setup menu will appear. The home button in the top left corner will exit the menu.

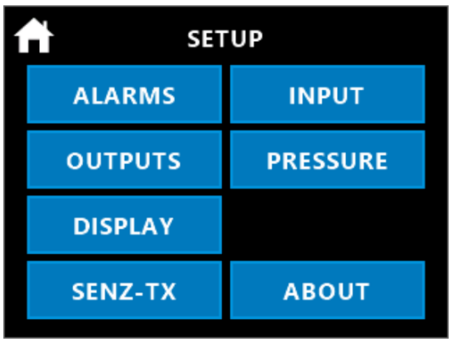


Figure 11 *Setup Menu*

6.4. Alarms Configuration

The OxyDew Process Monitor contains 4 programable alarms with assignable relay contacts. Alarms 1 & 3 comprise Form C contact configuration. Alarms 2 & 4 comprise Form A contact configuration. All contacts are rated 30 Vdc 5 A. The contact terminal assignment is outlined in section 5.8.

6.5. Accessing The Alarm Menu

Follow the process outlined in section 6.3 Accessing the Setup Menu. Once the menu is visible, press the ALARMS button and the alarm configuration screen will appear.

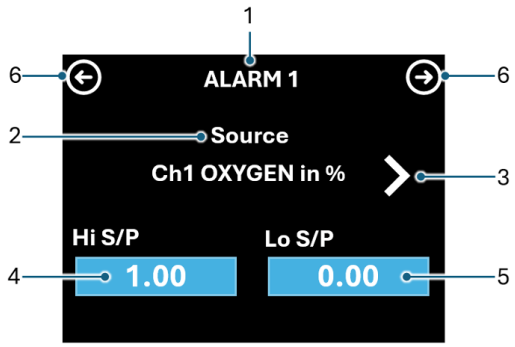


Figure 12 *Alarm Menu*

1	Indicates which alarm is being configured
2	Indicates which source parameter will control the alarm
3	Cycles between possible sources
4	Sets the high setpoint value
5	Sets the low setpoint value
6	Toggles forward or backwards in the list of alarms to be configured

6.6. Configuring an Alarm

Steps to configure an alarm:

Step 1: Select which alarm is to be configured by using the right and left arrows (6)

Step 2: Select the source parameter which controls the alarm (2) & (3)
Possible sources are:
Ch1 OXYGEN in %
Ch1 OXYGEN in ppm
Dew Point
PPMV(I)
FAULT

Step 3: Set the high setpoint (4) by touching the value and entering the required upper setpoint value.

Step 4: Set the low setpoint (5) by touching the value and entering the required lower setpoint value.

Step 5: Once a change is made to an alarm, it must be saved to commit the change to memory. When a change has been detected, a save icon will appear in the bottom right-hand corner of the screen. Pressing the save icon will save your changes. Note: You must save your changes before moving on to the next alarm or the changes will be lost.

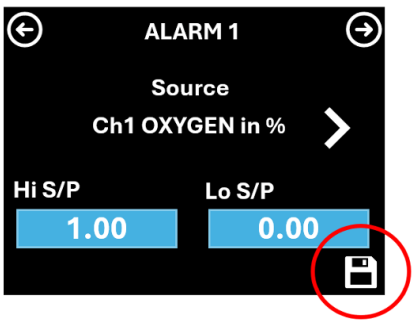


Figure 13 *Alarm Menu - Save Change*

Step 6: To exit the menu, scroll to ALARM 4 and once more press the right arrow (6). This will return to the main menu.

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.

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 S/P** or the measured value is < **Lo S/P** point.

An Alarm is OFF when the measured value is > **Lo S/P** + Lo Hysteresis AND the measured value is < **Hi S/P** – Hi Hysteresis.

For example, **Lo S/P** is 1.0 and **Hi S/P** is 15.0.

$$Lo\ Hysteresis\ value = Lo\ S/P\ \times \frac{0.5}{100} = 1 \times 0.005 = 0.005$$

$$Hi\ Hysteresis\ value = Hi\ S/P \times \frac{0.5}{100} = 15 \times 0.005 = 0.075$$

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 is < 15.0 to 0.075, so as you decrease the input below 15.0, the alarm will switch off again around 14.925.

6.7. Analog Output

The OxyDew features two analogue 4 mA to 20 mA outputs. The terminal assignment is outlined in section 5.8.

6.8. Accessing The Analog Output Menu

Follow the process outlined in section 6.3 Accessing the Setup Menu. Once the menu is visible, press the OUTPUTS button and the output configuration screen will appear.

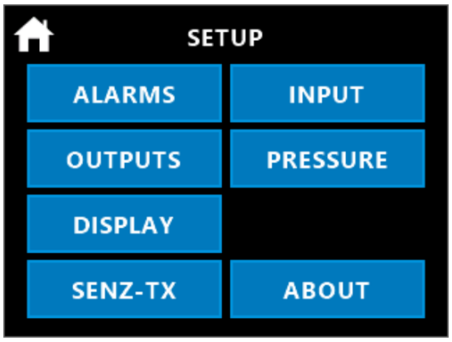


Figure 14 *Setup Menu*

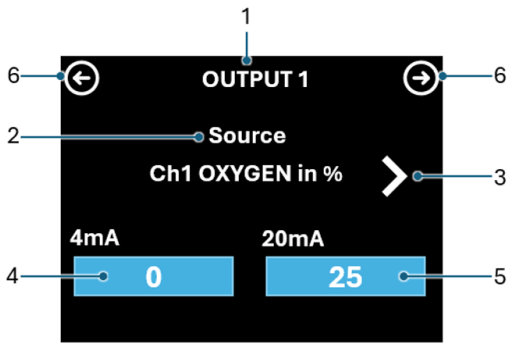


Figure 15 *Output Menu*

1	Indicates which 4 mA to 20 mA output is being configured
2	Indicates which parameter signal is assigned to the analog output
3	Cycles through available signals to assign to the output
4	Sets the 4 mA zero parameter value
5	Sets the 20 mA full-scale parameter value
6	Cycles forward or backwards through the outputs

6.9. Configuring an Analog Output

Steps to configure an analogue output:

Step 1: Select which 4 mA to 20mA output is to be configured by using the right and left arrows (6)
Note: Outputs 1 & 2 can be configured. Output 3 is listed but is unused.

Step 2: Select the source parameter which controls the output (2) & (3). Possible sources are:
Ch1 OXYGEN in %
Ch1 OXYGEN in ppm
Dew Point
PPMV(I)

Step 3: Set the 4 mA zero parameter value (4) by touching the value and entering the required value.

Step 4: Set the 20 mA full-scale parameter value (5) by touching the value and entering the required value.

Step 5: Once a change is made to an output, it must be saved to commit the change to memory. When a change has been detected, a save icon will appear in the bottom right-hand corner of the screen. Pressing the save icon will save your changes.
Note: You must save your changes before moving on to the next output or the changes will be lost.

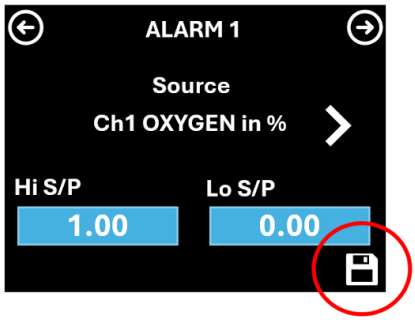


Figure 16 *Output Menu - Save Change*

Step 6: To exit the menu, scroll to OUTPUT 3 and once more press the right arrow (6). This will return to the main menu.

6.10. Calibration

The Process Monitor features a SenzTx configuration menu to allow changing of the Modbus address, viewing the ADC counts, and calibration of the oxygen reading.

6.11. Accessing The Calibration Menu

Follow the process outlined in section 6.3 Accessing the Setup Menu. Once the menu is visible, press the SENZ-TX button and the SenzTx configuration screen will appear.

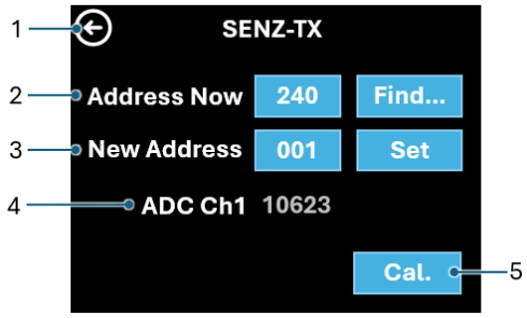


Figure 17 *SenzTX Menu*

1	Return to Main Menu
2	Current SenzTx Modbus Address
3	New SenzTx Modbus Address
4	Oxygen ADC Counts
5	Calibrate Menu

6.12. Changing the SenzTx Modbus Address

The Process Monitor requires the SenzTx Modbus address to be set to 1.
If replacing the SenzTx oxygen analyzer, it may be necessary to match the SenzTx Modbus address to that of the Process Monitor. The SENZ-TX menu provides that function.
If the current SenzTx address is unknown and cannot be determined via the SenzTx startup LED sequence, then the Find button may be used to scan for a connected SenzTx. The process will run until the correct SenzTx Modbus address is found. Alternatively, if the current address is known, then it may be entered in the field to the left of the Find button.

Example Scenario:

- A replacement SenzTx is to be fitted.
- It is received with the default address of 240.
- '240' is entered into the **Address Now** field.
- '1' is entered into the **New Address** field.
- Set button is pressed.
- **New Address Set OK** is displayed on the screen.

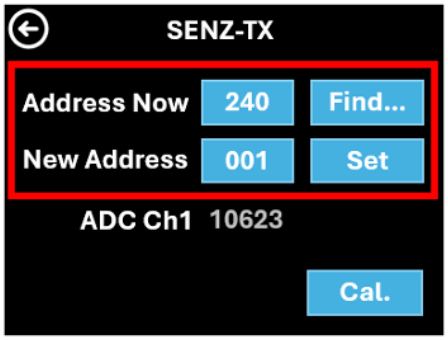


Figure 18 *SenzTX Addresses*

6.13. Viewing the Oxygen ADC Counts

The displayed value is a digital representation of the oxygen sensors output signal.

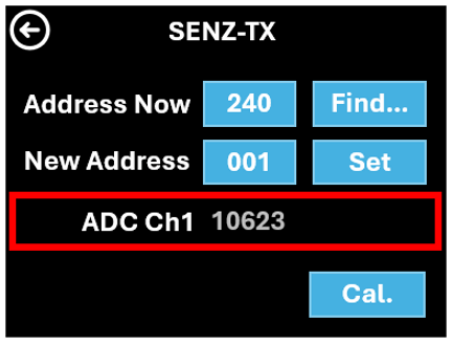


Figure 19 *Oxygen ADC Counts*

6.14. Performing a Calibration

To enter the calibration sub-menu, press the Cal. button on the SENZ-TX menu screen. The password to access this sub-menu is 1919.

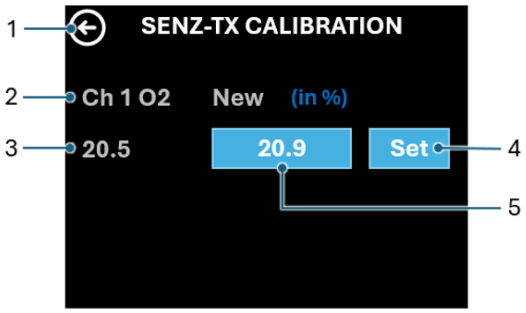


Figure 20 *SenzTX Calibration*

1	Return to SENZ-TX menu
2	Oxygen channel
3	Current oxygen reading
4	Calibrate button
5	Span gas value

Steps to perform a calibration of the oxygen analyzer:

Step 1: The current oxygen reading (3) is presented for reference.

Step 2: Press the span gas value field (5) and enter the oxygen value of the calibration gas as a percent by volume figure.
e.g., 20.918 % oxygen calibration gas is entered as 20.918
Press the Set button. The calibration will be carried out according to the span gas value provided.

Step 3: When complete, the current oxygen reading (3) will match the span gas value (5).

7 Installation & Start Up

7.1. Guidance

1. Mount the system enclosure in an appropriate location.
Preferably inside a building or if outside under a cover/rain canopy.
The mounting location should not impede access to any associated disconnecting devices.

2. With the electrical supply isolated, make the appropriate power supply connections noting the power requirements, 100 Vac to 240 Vac, 50 Hz/60 Hz, 60 Watts.

3. Make the necessary connections for the relay and 4 mA to 20mA outputs.

4. Connect the gas supply to be measured, note the requirements

   - Clean gas only
   - Supply pressure between 2 bar (30 psi) (min), & 10 bar (147 psi) (max).
   - System requires a flow rate of ≈1.5LPM minimum.
   - Use metal (stainless steel preferred) pipe to connect from the gas source to the system.

5. When the gas is connected and turned on, check the internal pressure regulator and if necessary, adjust to 2 bar (30 psi).

6. On completion of steps 1 to 5, the enclosure door must be closed before energising the electrical supply, thereafter the system is ready for operation.

8 Calibration

Warning: Calibration should only be attempted by an appropriately trained or suitably qualified person

8.1. Oxygen Sensor

There are some important considerations before proceeding to calibrate.

- A source of appropriately certified/traceable calibration gas will be required.
- This calibration gas must have the following constituents, 20.9 % Vol O2/N2 balance.
- The calibration gas will need to be regulated to a supply pressure within the limits of the system e.g., 2 bar (29.01 psi) to 10 bar (145.04 psi).
- Compressed air (air compressor source) must not be used.

Assuming the above conditions have been satisfied proceed as follows.

1. Isolate the normal source of sample gas.
2. Connect (in place of the normal source of sample gas) the calibration gas.
3. Check that the system pressure regulator is set for 2 bar (29.01 psi).
4. Leave the gas flowing for a minimum of 15 minutes.
5. Check for stability
   Observe the O2 concentration reported on the display of the HMI, it should be stable i.e., ±0.1 %.
6. Check for Drift
   Observe the O2 concentration, the reading displayed should be ±0.625 % of the calibration gas value. Example, if the calibration gas has a concentration of 20.9 % Vol O2 the reading reported by the display should be in the range 20.27 to 21.52.
7. If the sensor is outside of the tolerances (5 & 6), do not proceed further i.e., the sensor may need to be replaced, consult the factory.
8. If the sensor is within the tolerances (5 & 6) access the menu system tier/level 1, (see section 6.11, 6.13 & 6.14) to carry out a calibration, ensure the gas calibration value is set to 20.9.

8.2. Dew-Point Sensor

Specialist calibration instrumentation is required to calibrate the sensor, 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 the factory via an accredited calibration laboratory. 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 either directly or via the authorized distributor, for calibration.

Alternatively, a sensor can be provided as an exchange item. Prior to re-calibration, an exchange transmitter can be ordered via 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 either directly or via an authorized agent.

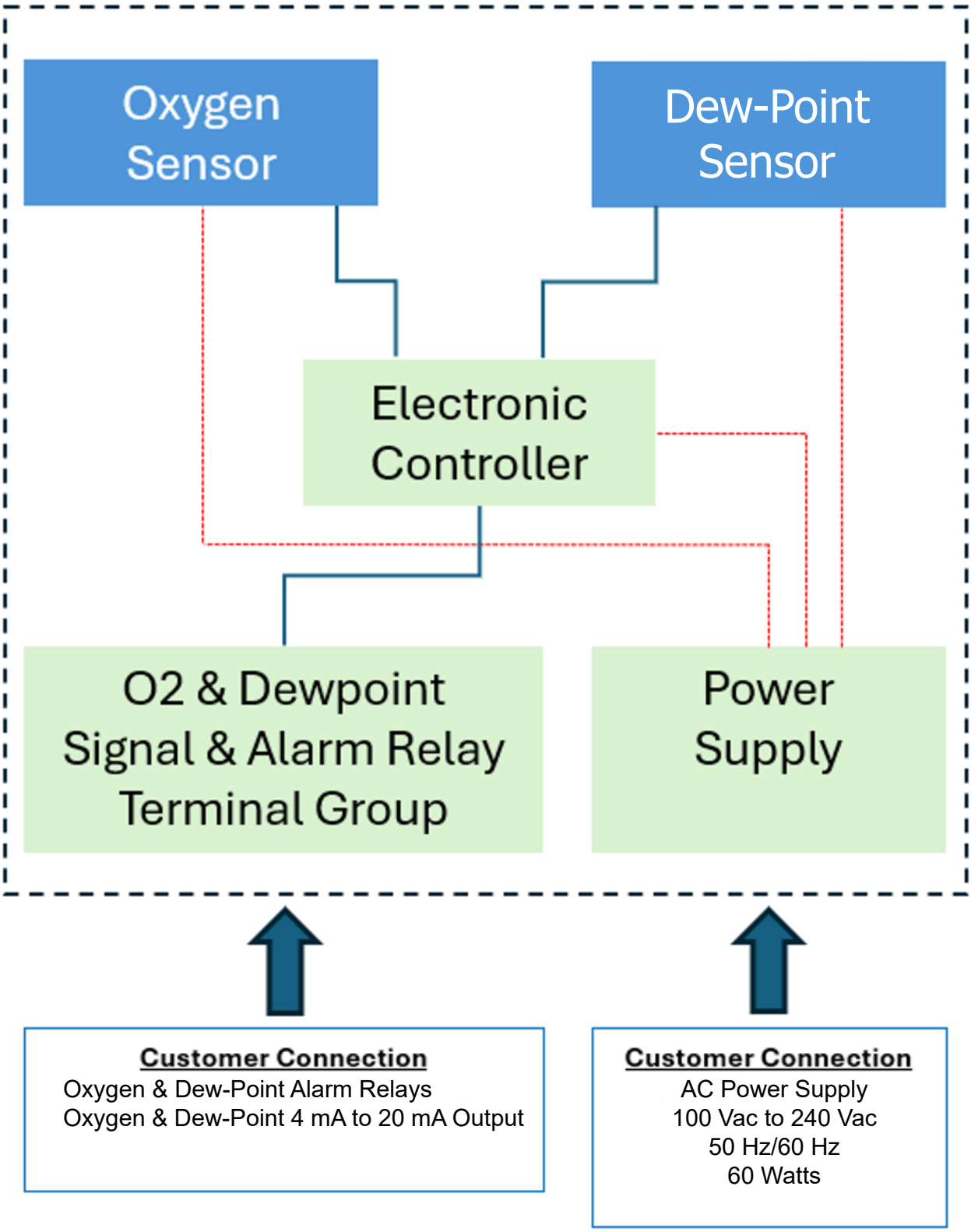
9 Sensor Replacement

Should a replacement sensor (oxygen or dew point) be required, consult with factory.

Appendix A

Electrical System Block Diagram

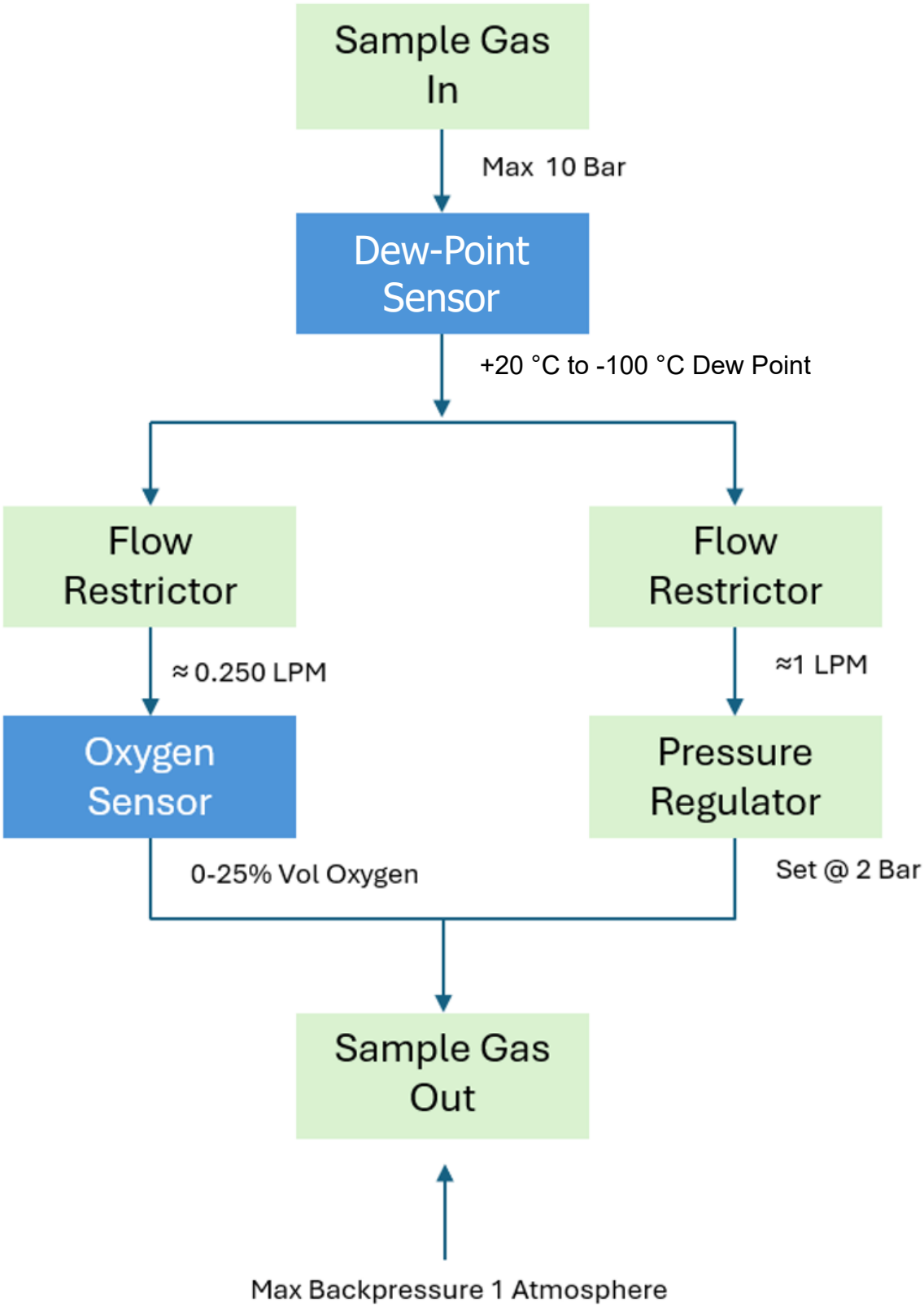
Appendix A Electrical system block diagram



Appendix B

Gas Sample Delivery System Block Diagram

Appendix B Gas sample delivery system block diagram



Notes

Ntron Gas Measurement Ltd
Mullaghboy Industrial Park, Navan, Co. Meath, C15 VFP2, Ireland

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