PST
PROCESS SENSING
TECHNOLOGIES

SenzTx Oxygen Transmitter
User Manual PST-UM-2000-EN-01

Revision Record

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Table of Contents

1 Definitions

The following definitions apply to WARNINGS, CAUTIONS, and NOTES used throughout this guide.

> ***WARNING:***
> ***The warning symbol is used to indicate instructions that, if they are not followed, can result in minor, serious, or even fatal injuries to personnel.***

CAUTION:
The caution symbol is used to indicate instructions that, if they are not followed, can result in damage to the equipment (hardware and/or software) or a system failure occurring.

NOTE: Highlights an essential operating procedure, condition, or statement.

2 Abbreviations

The following abbreviations are used in the manual:

AC	alternating current
ADC	analog to digital converter
atm	pressure unit (atmosphere)
barg	pressure unit (=100 kP or 0.987 atm)
°C	degrees Celsius
DAC	digital to analog converter
DC	direct current
°F	degrees Fahrenheit
FSD	full-scale deflection
Kg	kilogram
l/min	liters per minute
µm	micro-meter
mA	milliampere
max	maximum
min	minimum
MPa	megapascal (Pascals x106)
MS	Milliseconds
PLC	Programmable Logic Controller
PPM	parts per million
PPM_V	parts per million (by volume)
RH	relative humidity
RTU	remote terminal unit
R/W	read/write
MCU	microcontroller unit
SCFH	standard cubic feet per hour

3 Introduction

This manual should be read and understood prior to installation and use of the SenzTx transmitter.

This manual contains all the required information to install, operate and maintain the transmitter. The installation of this transmitter must only be carried out by suitably competent personnel and the operation of this product must be in accordance with the instructions provided and according to the terms of any associated safety certificates.

Electrical Safety
Ensure electrical safety is complied with by following the directions provided in this manual and by observing all local installation and operation requirements at the intended location of use.

This transmitter is completely safe when used in conjunction with any options and accessories supplied by the manufacturer. Refer to **Technical Specifications** of this manual for further details.

This transmitter is designed to be completely safe when installed and operated correctly in accordance with the information provided in this manual. Incorrect installation and application of this transmitter will render all warranties void.

Pressure Safety
Observe all the information contained within this manual and all local operation and installation requirements at the intended location of use. For this product to operate satisfactorily, refer to **Appendix B** for guidance on how to present an extracted gas sample to the transmitter.

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 F**

Unintended Use
The SenzTx transmitter can be used in a wide range of applications. If there are any concerns about the application or installation of the SenzTx transmitter, please contact **oxygen@processsensing.com**

Please be aware of the following CAUTION for SenzTx transmitters with electrochemical sensing technology

CAUTION:
The SenzTx transmitter should be stored in a way that environmental air may NOT reach the sensor. The process connections are supplied with gas plugs on the gas ports, and these should not be removed until installation. Exposing the sensor to ambient air will shorten the lifetime of the cell and should be avoided.
The package should not be unwrapped until the SenzTx transmitter is ready to be placed into service.

NOTE: The Calibration certificate for the transmitter is provided inside the packaging tube that houses the SenzTx. Do not discard the packaging tube without locating the Calibration certificate. If a duplicate is required, please contact **oxygen@processsensing.com**

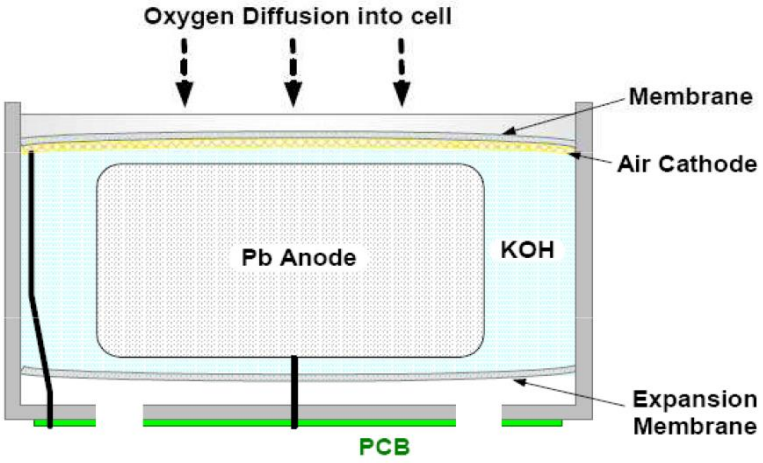
4 SenzTx Configuration

The SenzTx is a 4-wire transmitter that measures the presence of oxygen in a gas. The SenzTx can be configured with different measurement technologies, different process connections and different signal outputs. The SenzTx is a complete transmitter enabling an easy install or integration into a system and is provided with a traceable NIST calibration certificate.

4.1 Measurement Technology

4.1.1 Electrochemical Sensors

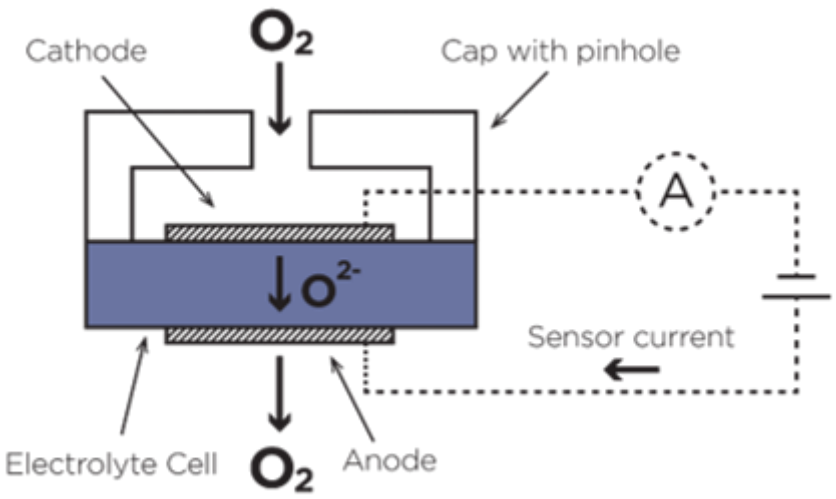
The key elements of the electrochemical sensors are a membrane, cathode, anode, electrolyte and measurement circuit. The sensing membrane (covering the cathode) is made of PTFE and is mounted over a metal perforated electrode. The space between the membrane and the electrode is filled either with an aqueous alkaline or an acid electrolyte. In normal operation, all portions of the anode and cathode are immersed in the electrolyte. As oxygen diffuses through the membrane into the electrolyte it causes a reaction between the cathode and anode generating an EMF. This current is proportional to the amount of oxygen present in the sample gas. In the absence of oxygen there is no output from the electrochemical sensor, meaning only one calibration is required.



CAUTION:
*Please see **Installation Guidelines** for guidance on use of the electrochemical sensor measurement technology*

4.1.2 Zirconia Sensor

The Ntron zirconia oxygen sensor is a non-depleting zirconia solid electrolyte sensor. A small capillary on the sensor controls the diffusion of oxygen into the sensor. When heated to over 400°C oxygen is electronically reduced causing current flow through the zirconia electrolyte. Zirconium oxide allows the movement of oxygen ions through the substrate from a high to a low concentration. The measurement of oxygen is determined by the current flowing through the electrodes.



WARNING:
The zirconia sensor is heated to operate. The gas flow block and sensor guard will be hot to touch and can cause personal discomfort.

CAUTION:
*Please see **Installation Guidelines** for guidance on use of the Zirconia sensor measurement technology*

4.2 Process Connection

4.2.1 KF-40 Flange

The KF40 flange configuration enables the SenzTx to be directly inserted into the gas stream or environment that requires measurement. The KF40 flange is a standard defined vacuum flange fitting often used on tubing, duct work or vessel. The KF40 flange configuration can be specified for both measurement technologies of the SenzTx.

NOTE: The electrochemical sensor cell has a diameter of 39mm which is larger than the standard KF-40 diameter. To mount the SenzTx with electrochemical sensor and the KF-40 flange a KF-40 mating process connection must have a minimum internal diameter of 40mm must be used.

CAUTION:
When mounting a SenzTx into a tube or vessel with a KF-40 flange please ensure the mounting location does not expose the transmitter to any contaminants and that the process parameters will enable the SenzTx to perform accurate measurements. (See the Technical Specifications section of this manual)

4.2.2 Flow Through Block

The flow through block is a gas body that screws on to the body of the SenzTx transmitter enabling a sample gas to be taken from a process and passed over the sensor while maintaining the gas integrity. The flow through block has 1/8" NPT female gas connections.

CAUTION:
The flow through block is direction specific. Please ensure the block is mounted correctly

4.2.3 Flow Through Block with Orifice

Flow through block with a fixed orifice located in the inlet port. The orifice will ensure the correct flow rate over the sensor when presented with a fixed inlet pressure of 2Barg (29Psig or 200KPag)

CAUTION:
The flow through block is direction specific. Please ensure the block is mounted correctly

4.3 Output Signals

The SenzTx can be specified with 4-20mA or 0-10V analog output signal at the time of ordering. RS485 is also provided. The 8-pin electrical connector on the rear of the SenzTx provides connection for power, analog, and digital connections. For details of the Register map for the RS485 please see **Appendix E**

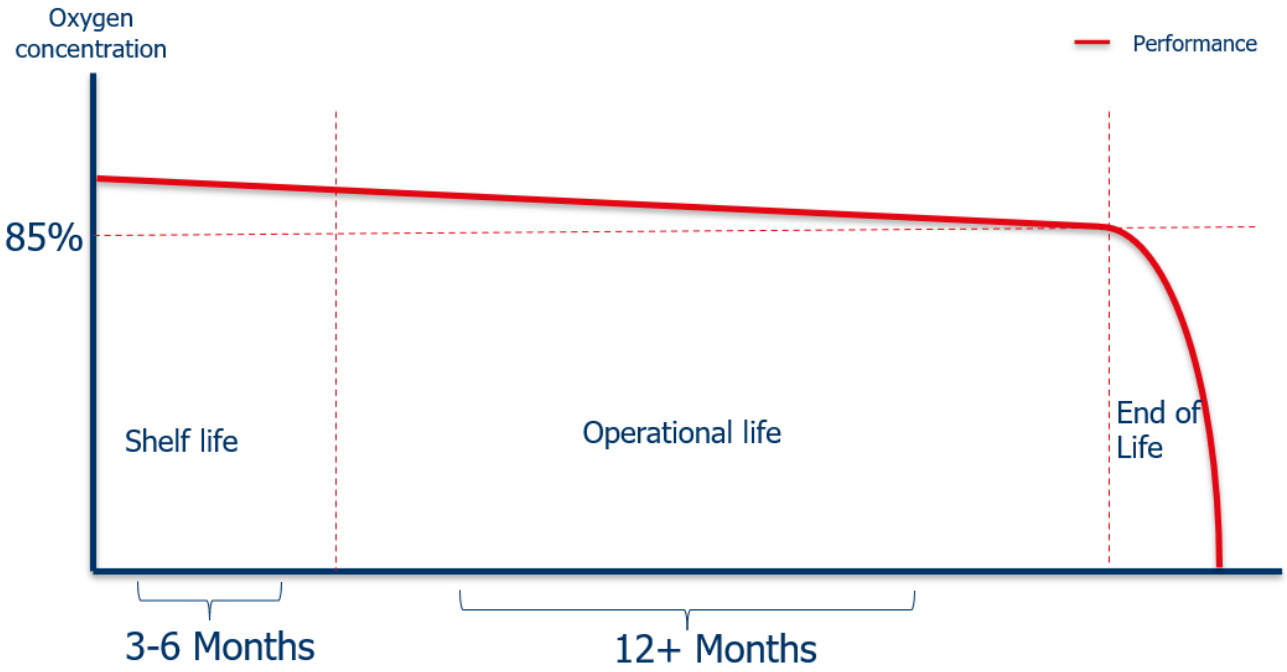
CAUTION:
The 4…20mA output is active (Source). The SenzTx is not a loop powered transmitter.

5 SenzTx Measurement Performance

5.1 Electrochemical Sensor

The electrochemical sensor does have a life and does deplete. The life of the sensor is determined by the concentration of the oxygen it sees and the amount of time it sees it – i.e., Oxygen hours

The graph below depicts the typical life of an electrochemical sensor



The SenzTx is supplied with the gas ports, or the gas aperture, plugged from ambient air. This reduces the exposure of the sensor to the ambient environment. If the SenzTx is stored in an environment with a stable temperature and the integrity of the sensor packaging is maintained, then a shelf life of 3-6 months is normal.

The operating life of the sensor is typically 12+ months but this can be much longer depending upon the application / amount of oxygen it sees.

The operating life will also be influenced by the gas temperature and moisture content that is being shown to the sensor. A hot dry gas can cause the electrolyte to dry out before depletion of the sensor cell.

The end life of the sensor is normally quick and pronounced. The reading will move away from normal over a short time. The electrochemical sensor can easily and quickly be replaced within minimal downtime. The SenzTx transmitter should be recalibrated upon installation of a new sensor. For assistance in this please see **Calibration of the Measuring Instruments**

The electrochemical sensing technology does enable measurement of Oxygen in flammable gas such as hydrogen and gas compositions that contain silicone and combustible vapors.

5.1.1 ppm(v) Sensor

Operating the ppm sensor at oxygen levels of >1000 ppm (e.g., in air) does not damage the sensor element irreversibly, but it should be avoided. If exposed to air, it will take several hours until the sensor will measure low oxygen levels correctly.

Longer exposure to high oxygen concentration will shorten the lifetime of the sensor.

CAUTION:
The SenzTx transmitter should be stored in a way that environmental air may NOT reach the sensor. The process connections are supplied with gas plugs on the gas ports, and these should not be removed until installation.
Exposing the sensor to ambient air will shorten the lifetime of the cell and should be avoided.
The package should not be unwrapped until the SenzTx transmitter is ready to be placed into service.

5.2 % Sensor

Operating the ppm sensor at oxygen levels of ambient air is possible and does not damage the sensor element. If left exposed to air when the application is to measure a process gas with a low % oxygen content the sensor life will be shortened.

CAUTION:
The SenzTx transmitter should be stored in a way that environmental air may NOT reach the sensor. The process connections are supplied with gas plugs on the gas ports, and these should not be removed until installation.
Exposing the sensor to ambient air will shorten the lifetime of the cell and should be avoided.
The package should not be unwrapped until the SenzTx transmitter is ready to be placed into service.

5.3 Zirconia Sensor

The zirconia sensor has an unlimited shelf life without the loss of calibration and has an expected life more than 5 years in operation, application dependent. The life of the zirconia sensor will be shortened if exposed to aggressive gases. If exposed to combustibles the sensor will be destroyed as the heated area immediately around the sensor element will cause a combustion killing the sensor.

6 Installation Guidelines

For the SenzTx to provide accurate measurement with confidence please be aware of the following guidelines.

6.1 General

NOTE: The Calibration certificate for the transmitter is provided inside the packaging tube that houses the SenzTx. Do not discard the packaging tube without locating the Calibration certificate. If a duplicate is required, please contact **oxygen@processsensing.com**

CAUTION:
Sample gas pressure presented to the SenzTx transmitter should be within +/-10% ambient pressure. (Typically for ambient pressure of 1013 mbar absolute)

The sample gas must not contain aggressive gases such as Hydrogen Sulfide (H2S) or Hydrogen Chloride (HCL) or solvents in the gas stream as such gases and vapors may cause irreparable damage to the sensing element. Aggressive vapors or substances should be removed before the gas is presented to the transmitter

The sample gas must not contain moisture, condensate, or liquid in the gas stream as moisture may cause irreparable damage to the sensing element. If wetting of the sensor whilst in an unpowered state is suspected, do not turn the power on until a dry gas, for example, Nitrogen (N^2), has been flowed through the sensor to dry out and remove any moisture or liquid.

6.2 Electrochemical Sensor

CAUTION:
The SenzTx should be mounted vertically to ensure the best measurement performance and operational life. Electrical connector at the top (12 o'clock position). The SenzTx should not be mounted upside down.

The SenzTx transmitter should be stored in a way that environmental air may NOT reach the sensor. The process connections are supplied with gas plugs on the gas ports, and these should not be removed until installation. Exposing the sensor to ambient air will shorten the lifetime of the cell and should be avoided.
The package should not be unwrapped until the SenzTx transmitter is ready to be placed into service.

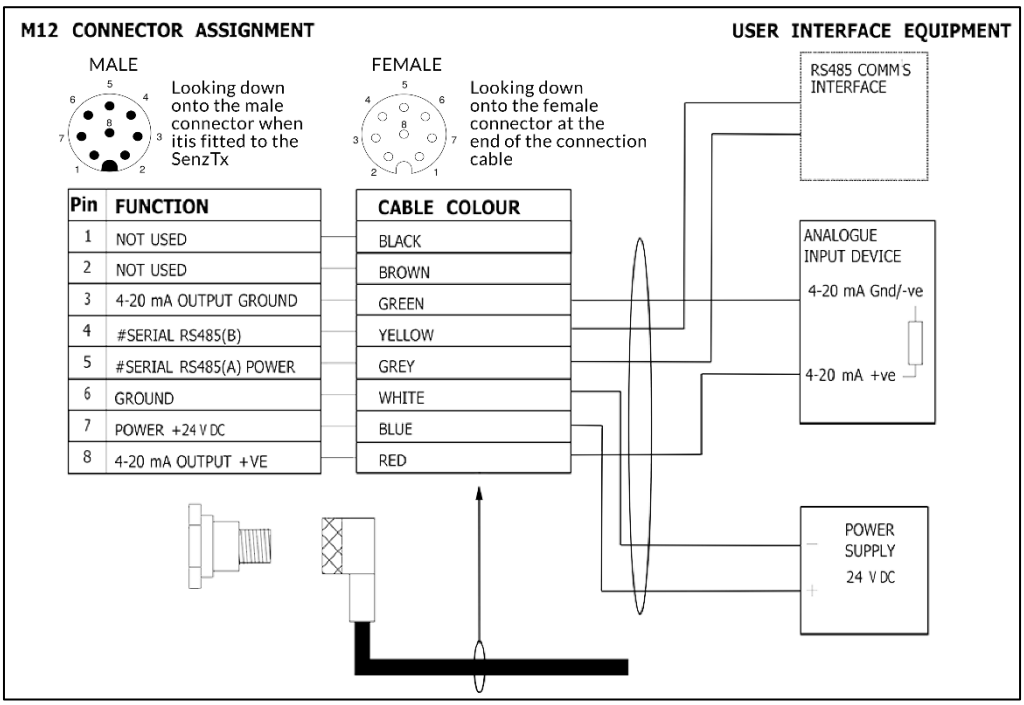
6.3 Zirconia Sensor

WARNING:
The zirconia sensor is heated to operate. The gas flow block and sensor guard will be hot to touch and can cause personal discomfort.

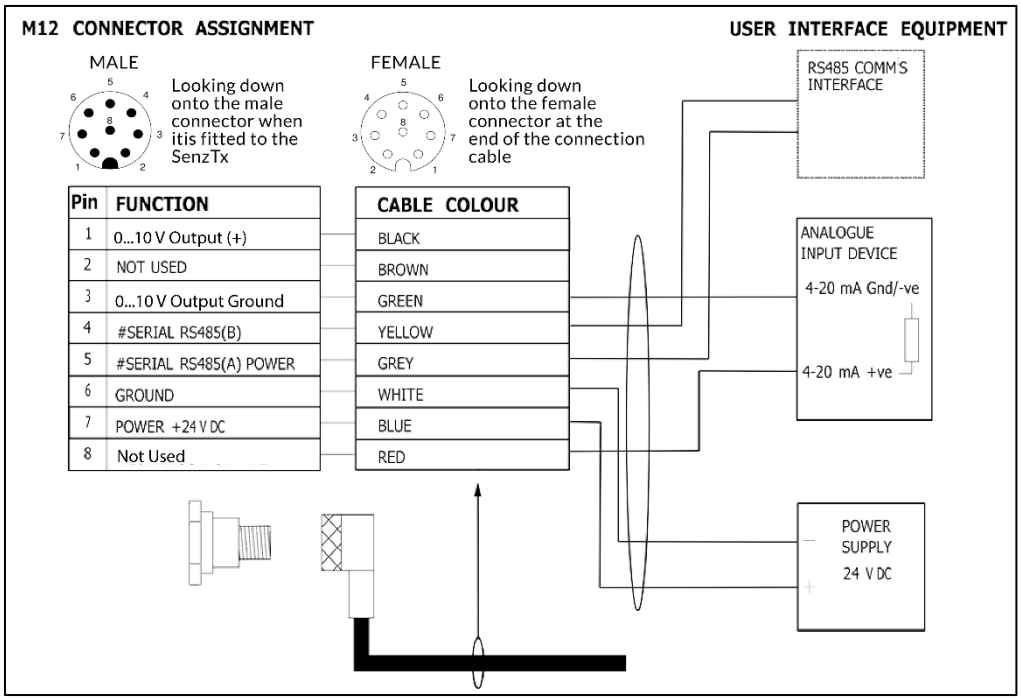
CAUTION:
The zirconia sensor is heated to operate. The gas passed over the sensor should not be flammable or contain any combustibles e.g., hydrocarbon vapors.

7 Electrical Connectivity

7.1 4…20 mA Connection Cable Wiring



7.2 0…10 V Connection Cable Wiring



Signal output 4...20 mA or 0...10 V (Active / Source)
The SenzTx transmitter is connected by an M12 x1.5 mm threaded connector. Unused cable cores must be suitably insulated. The cable is supplied.
RS485 register map and connection can be found in **Appendix E**

8 Technical Specifications

Technical Specifications

Performance		
Transmitter Model	**SenzTx**	
Measurement Technology	Zirconia (ZR)	Electrochemical (EC)
Measurement Range*	0...100, 0...1000ppm(v)	0...100, 0...1000ppm(v)
	0..1, 0...25, 0...96, 0...100%	0...1, 0...25%
Output Resolution (for %)	0.01 %	
Output Resolution (for ppm)	1ppm(v)	0.01 ppm(v)
Accuracy	+/-2% of reading (or 2ppm O_2) @ calibrated temperature and pressure	
Response Time (T90)	<10 seconds @ 25 °C (within selected range)	<30 seconds @ 25 °C (within selected range)
LDL (Sensitivity)	0.01% (when measuring %) / 1ppm (when measuring ppm)	
Temperature Range	-25 °C ...+55 °C	0° C ...+45 °C
Pressure Range	900 to 1100 $mBar_{abs}$	
Linearity	+/- 2 % of reading	
Life Expectation (application dependent)	3...5 years	1...2 years
Humidity	0-95 % RH non-condensing	
Shelf Life	No shelf life	3...6 months
Electrical Input / Output		
Power Supply	24 V DC +/- 10 %	
Power Consumption	200mA @ 24VDC	50mA @ 24VDC
Signal Output	0...10 V or 4...20 mA	
Digital Communications	RS485 Modbus protocol Multiple devices can be connected in a linear series	
Electrical Interface	M12 x 1.5 connection	
Cable Length	1 metre (supplied as standard) 3 meters / 5 metres (optional)	
Mechanical Specifications		
Weight	0.260kg (10oz)	
Process Connection	Flowthough - 1/8" NPT female Flowthough + Orifice - 1/8" NPT female KF-40 Flange	
Ingress Protection	Designed to meet IP66	
Housing Material	Chromated Aluminum	
Gas-wetted materials (excluding sensor)	Chromated Aluminum, Nitrile	
Certification		
Complies with EMC Directive 2011/65 /EU with conformity to EN50270:2015. cETLus UL61010-1 approved.		

** User specific ranges can be set using the TXI communicator*

[1] Different measurement ranges can be configured using TXi Communicator

[2] Application dependent

Contact **oxygen@processsensing.com** for further details.

9 Calibration of the Measuring Instruments

The SenzTx is supplied calibrated by the manufacturer. A traceable calibration is performed as standard, and a calibration certificate is provided. An ISO 17025 calibration can be provided upon request at an additional cost.

The SenzTx will require measurement verification or recalibration to ensure accurate and reliable measurements when in process. The calibration intervals will depend upon the measurement technology, the application of measurement and the gas composition that the sensor is exposed to.

The SenzTx can be calibrated with as found as left readings by PST to either a traceable or an ISO17025 standard. Please contact **oxygen@processsensing.com** with any questions regarding recalibration of your SenzTx.

9.1 Calibration Options

Calibration of the SenzTx can be achieved in two ways:

1. By use of the PST TXI communicator (See **Appendix C)** or
2. By use of the SenzTx RS485/Modbus via a user/host PC (See **Appendix D**)

The performance of a SenzTx can be achieved in situ using a certified cylinder gas of known oxygen content. The cylinder should be representative of an alarm set point or a typical process measurement to ensure the validation is appropriate to the application. Such cylinders are readily available from most gas companies.

To read the measurement from the SenzTx the TXi communicator can be used. See **Appendix C** for further information. Please note that the procedures used to verify the performance of a SenzTx will vary depending upon the measurement technology and the measurement range of the SenzTx in question. A basic procedure is provided below to give infield or maintenance calibration capability.

For SenzTx's with a KF-40 flange process connection a Calibration Gas Block will be required. Details of this can be found in **Appendix C**

Alternatively, if in-situ calibration is not practical, the SenzTx should be removed from the process and installed into a calibration rig, similar to the illustration in Appendix B.

9.1.1 Electrochemical

Single point Calibration.
A SenzTx ppm(v) calibration cannot be performed in-situ or on plant. The time taken for the stabilization of a sensor at ppm(v) levels of oxygen can be hours.

For the calibration of a ppm(v) electrochemical sensor cylinder of gas of known oxygen content is required. The cylinder should be certified or a reference instrument with current calibration should be used to provide an independent measurement. The oxygen content should be suitable for the measurement application of the sensor. The SenzTx should be exposed to the reference gas and adjustments made as required.

A % SenzTx calibration can be performed in air if no traceability is required. The SenzTx can be exposed to ambient air and adjustments using the TXi Communicator can be made as required. Settling time at ambient conditions should be 30 to 60 minutes.

Zero and Span Calibration.
A Zero UHP gas purge for the ppm electrochemical sensor should be for a minimum of 6-8hrs with a minimum flowrate 40-50ml/min.

For example, 0 – 1,000ppm measurement range, switch over to 100ppm after the minimum Zero gas purge time and set flow rate at 250ml/min for at least 30 minutes before the Span calibration on 100ppm. The Span points will vary depending on the configured SenzTx DAC FSD and overall applicable measurement range.

For a SenzTx with a measurement range 0 -1000ppm, a single span point calibration on 100ppm is typical.

For a SenzTx with a measurement range of 0-1%, a single span point of 1,000ppm is typical.

For a SenzTx with a measurement range of 0-25%, a single span point calibration of 20.9% is typical.
No Zero gas purge required

For a SenzTx with a measurement range of 0-96%, a single span point calibration of 95% is typical.
No Zero gas purge required

Flow rates are 250ml – 1L/min (Depending on calibration adapter) for a single SenzTx transmitter calibration with 30 minutes minimum span gas exposure time before span point calibration.

9.1.2 Zirconia

Zero and Span Calibration.
A Zero UHP gas for the Zirconia ppm sensor should be shown to for a minimum of 1-2hrs with a minimum flowrate depending on the number of transmitters being calibrated (250ml/min confined space calibration, 1L/min larger manifold).

The time taken for the stabilization of a Zirconia sensor at ppm levels before a span calibration can be 60mins approx.

For a SenzTx with a measurement range 0 -1000ppm, a single span point calibration on 100ppm is typical.

For a SenzTx with a measurement range of 0-1%, a single span point of 1,000ppm is typical.

For a SenzTx with a measurement range of 0-25%, a single span point calibration of 20.9% is typical.
No Zero gas purge required

For a SenzTx with a measurement range of 0-96%, a single span point calibration of 95% is typical.
No Zero gas purge required

Flow rates are 250ml – 1L/min (Depending on calibration adapter) for a single SenzTx transmitter calibration with 30 minutes minimum span gas exposure time before span point calibration.

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Appendix A Electrical and Sample Gas Connection Information

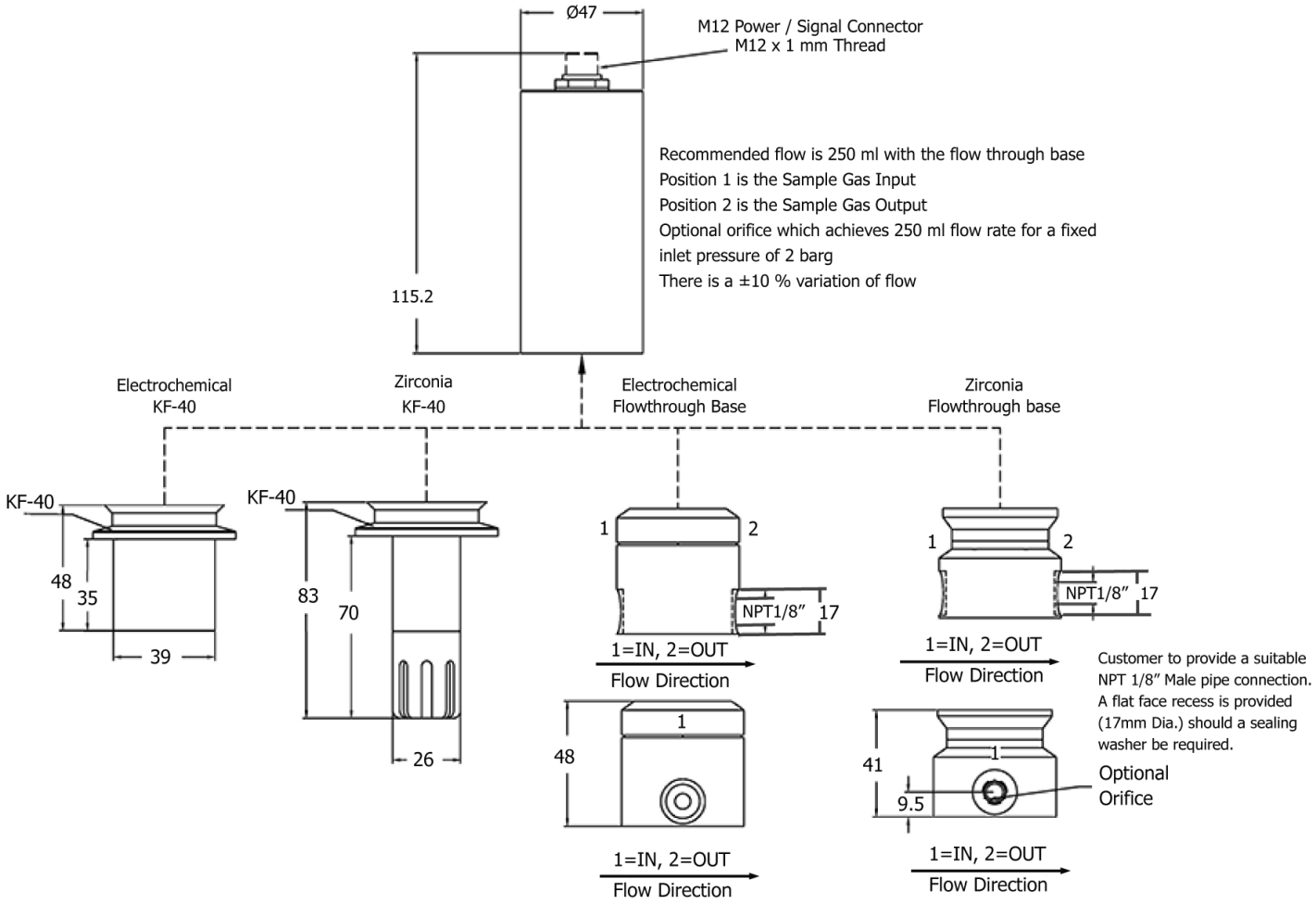
The following information contains installation and connection drawings for the SenzTx transmitter, including an example of a piping system for the application of the correct pressures and flow rates of a gas to be sampled by the zirconia or electrochemical model SenzTx.
Dimensions are in mm unless otherwise stated

LED Functionality

Orange LED
Modbus 485
Indicator

Green LED
Power Indicator

See **Appendix D** for explanation of LED functionality

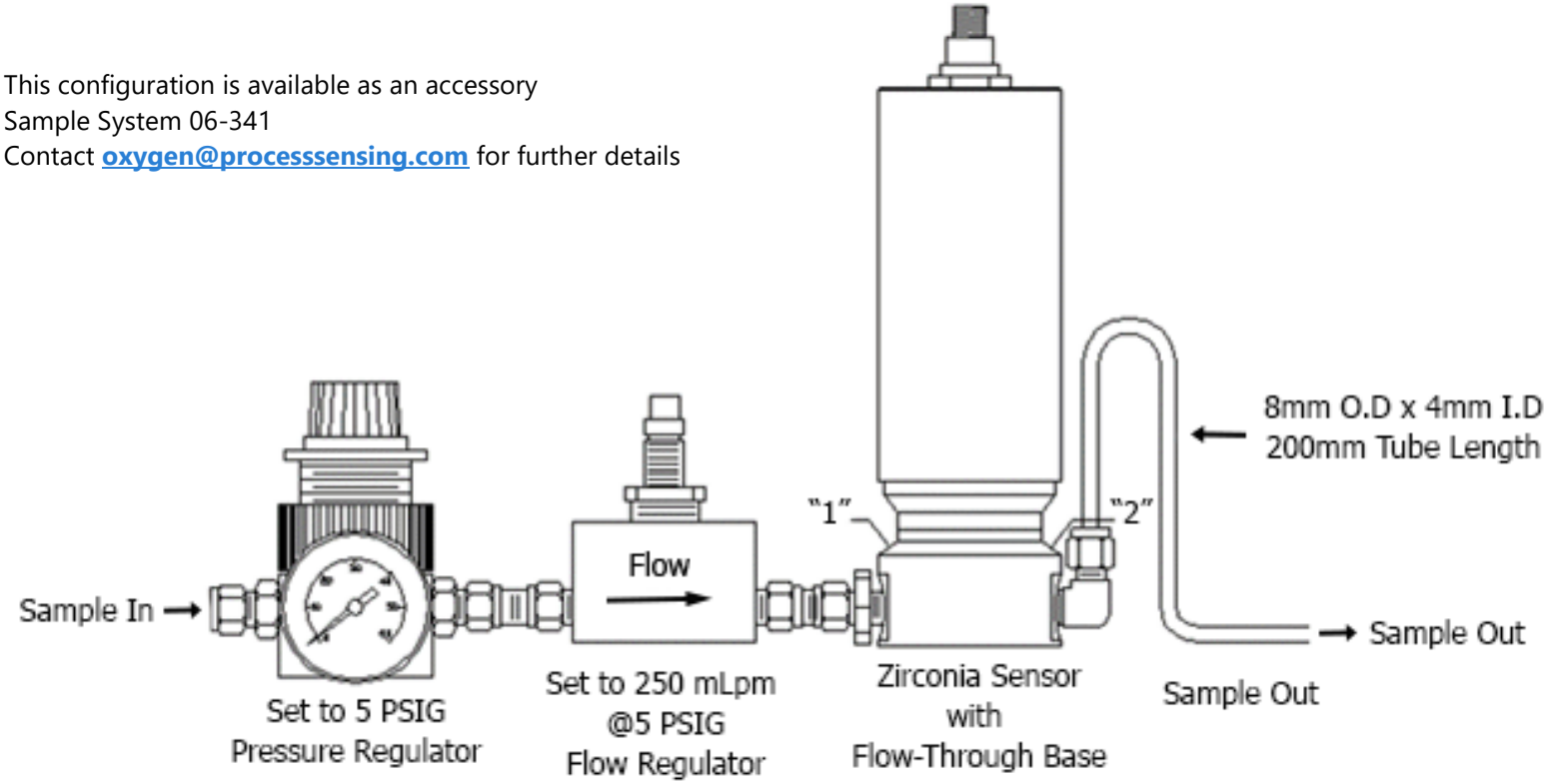


1 M cable with M12 connector supplied as standard
See **Section 7.0** for power and signal connections
For any additional detail please contact **oxygen@processsensing.com**

Appendix B Typical Sample System for a Flow Through Block SenzTx

This example is for a flow base without an integral orifice.

This configuration is available as an accessory
Sample System 06-341
Contact **oxygen@processsensing.com** for further details



NOTE: For a configuration with a ***Flow Through Block WITH Orifice*** – SenzTx should be presented with a sample at a gas pressure of 2Barg (29Psig, 200KPag). The orifice will then produce the correct flow rate for the SenzTx

Appendix C Accessories and Spares Information

Accessories

TXi Commuincator

Description	Order Code
TXi Communicator including inline cable	05-164

Calibration gas block for KF Flange configuration

Description	Order Code
Calibration block for KF-40 Flange	04-129

Spares

Replacement Electrochemical Sensor

Description	Order Code
0…1000 ppm(v) Sensor (OC-62)	04-066
0…25% Sensor (OC-61)	03-756

Replacement Zirconia Sensor

Description	Order Code
0…1000 ppm(v) Sensor (OC-70)	03-953
0…25% Sensor (OC-71)	03-954
0…96% Sensor (OC-72)	03-955
0…100% Sensor (OC-72)	03-955

Spare / Replacement Sensor Cables

Description	Order Code
1 M Sensor cable with connector fitted	03-577
3 M Sensor cable with connector fitted	03-588
5 M Sensor cable with connector fitted	05-437
Connector – loose	06-040

Appendix D TXi SenzTx Communications & Diagnostic Terminal

Introduction

The TXi terminal is a portable, handheld communication and diagnostic terminal to be used in combination with the SenzTx range of oxygen measurement transmitters.
The TXi terminal is used for displaying the Oxygen (O_2) concentration and for calibrating and adjusting the analog output settings of the SenzTx Marine Transmitter.
The TXi terminal uses a 2.8" touch screen display and full-color user interface enabling easy and efficient use in the field by service engineers.
The TXi terminal provides communication and diagnostics functions with a simplified 'Plug & Play' setup allowing the user access to the required information in seconds.

Connection

CAUTION:
To connect the TXi terminal, it will be necessary to disconnect the M12 connector from the SenzTx and, in doing so, will result in a loss of communication (RS485/Analog output) to the customer control system.
This disconnected status will remain until the connection is restored.

Power to the TXi Terminal

Remove the customer control system cable from the M12 connector on the SenzTx.

Install the removed M12 connector to the M12 socket of the TXi terminal. (Signal In port as shown)

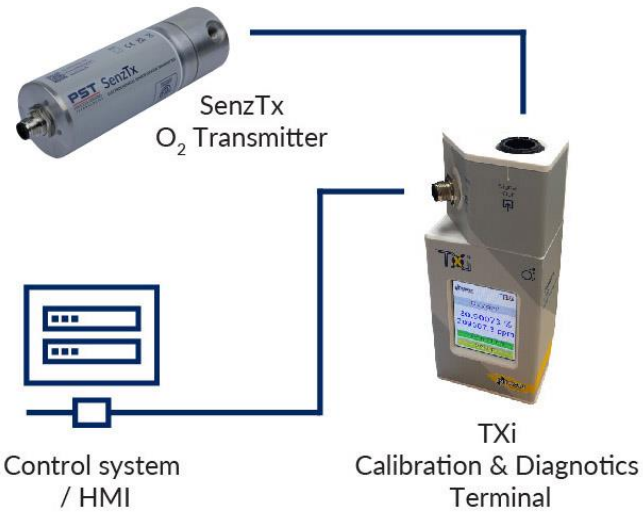
When the connector is suitably installed, the TXi terminal will power up, and the screen will illuminate.

Connection from the TXi Terminal to the SenzTx

To establish connection/communication with the SenzTx, connect the cable (supplied with the TXi) between the TXi Terminal and the SenzTx.

For reference, one end of this cable has an 8-pin M12 plug; connect this end to the SenzTx, the opposite end to the signal out port of the TXi Terminal.

The connection between the TXi terminal and the SenzTx is now complete.

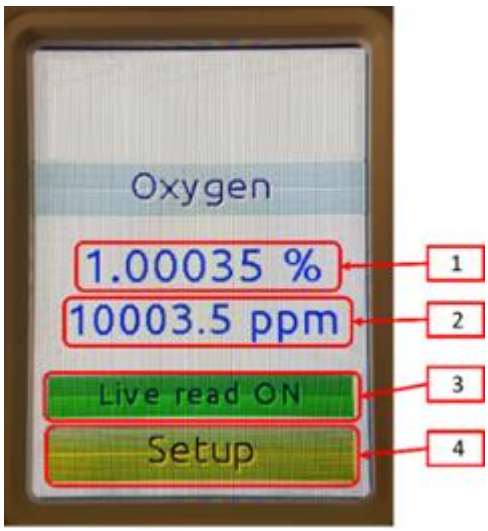


On-Screen Live Readings

Start-Up Sequence

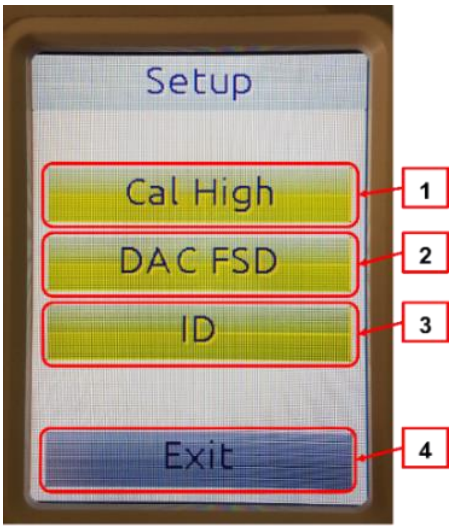
This screen shown below will be displayed after the start-up sequence.
It shows a Live Reading if a SenzTx is connected.

NOTE: The Live read ON button will automatically deactivate if the communication link between the SenzTx and TXi is broken.



1. Live reading expressed in %.
2. Live reading expressed in ppm
3. "Live read ON" toggle button activates/deactivates periodic readings from the SenzTx.
4. Setup directs you to the Setup screen

On-Screen Setup



The setup screen, shown below, allows the user to navigate the menu to reach the desired function.

1. The Cal High button allows navigation to a calibration function.
2. The DAC FSD button allows navigation to the DAC FSD function
3. ID will enable users to access the ID screen.
4. Exit will return you to the Live Reading screen

On-Screen Cal High

Cal High, shown below, is the Calibration function, which allows users to Calibrate the SenzTx.

NOTE: The default value of the Cal High setpoint is 20.90; this is a placeholder and requires to be modified by the user.

IMPORTANT: Ambient air calibration with the default 20.90 value is ONLY for the 0…25% measurement range.

This is a placeholder and needs to be retyped by the user to represent the actual certified O_2 gas concentration. This can be changed by using the backspace key and keypad.

Once the desired value is entered, press the Save button.
The Live reading will update, and the changes will be shown on the top line.

1. Live reading shows the current oxygen concentration in % value. Any changes will be visible here.
2. Cal High setpoint. This value is entered as a % representation of the actual value of calibration gas Oxygen concentration
   e.g., 20.90% for ambient air, (Entered as 20.90) typically for 0…25% measurement range
   e.g., 0.1% equals 1,000ppm (Entered as 0.1) typically for 0…1,000ppm measurement range
   e.g., 0.01% equals 100ppm, (Entered as 0.01) typically for 0…100ppm measurement range
3. The keypad is used to change the Cal High setpoint
4. The backspace button deletes the rightmost character
5. The Save button saves the changes to the SenzTx and executes the Cal High operation
6. The back button navigates to the Setup page
7. The exit button returns the user to the Live Reading page

On-Screen DAC FSD

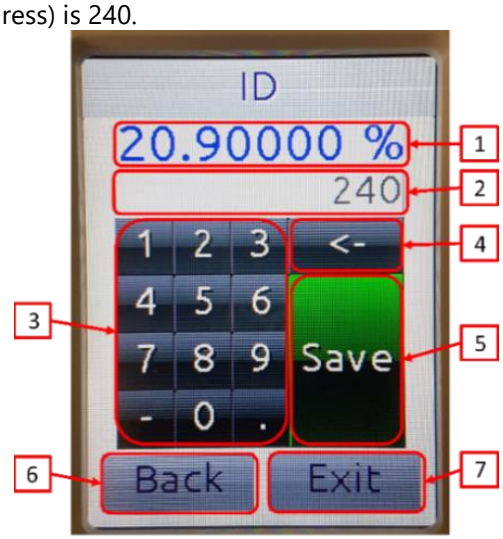
DAC FSD, shown below, is the digital to full-scale analog deflection. This is used to rescale the 4…20mA analog output from the SenzTx

1. Live reading shows the current oxygen concentration in % value
2. DAC FSD set point
3. The keypad is used to change the DAC FSD setpoint
4. The backspace button deletes the rightmost character
5. The DAC FSD setpoint value should be entered as a % value
   e.g., The number 25 value sets 0…25% measurement range
   Entered as 25 in DAC FSD set point
   e.g., The number 1 value sets 0…10,000ppm measurement range
   Enter as 1 in DAC FSD set point
   e.g., The number 0.01 value sets 0…100ppm measurement range
   Entered as 0.01 in DAC FSD set point
   The Save button saves the changes to the SenzTx and executes the DAC FSD set point
6. The back button navigates to the Setup page
7. The exit button returns the user to the Live Reading page

The DAC FSD setpoint function is *NOT A CALIBRATION* of the SenzTx.
The DAC FSD setpoint configures the 4…20mA analog output measurement range only
e.g., Entering 0.1 as the DAC FSD value sets 4mA as 0 and 20mA as 1,000ppm
To verify the output, check the analog output from the SenzTx.

On-Screen ID

Each Modbus protocol client-server has a unique address in the 1 to 247 range.
The default SenzTx ID (Server address) is 240.



1. Live reading shows the current oxygen concentration in % value.
2. Modbus Server ID.
3. The Keypad is used to change the ID
4. The backspace button deletes the rightmost character.
5. The Save button sends the Server ID to the SenzTx
6. The back button navigates to the Setup page.
7. The exit button returns the user to the Live Reading page.

Appendix E SenzTx Modbus RS485

Introduction

The Modbus RS485 protocol defines communication between the SenzTx (Client) and the Host (PC/Server) that allows querying of device configuration and monitoring. Modbus messages relay simple to read and write operations on 16-bit words and binary registers, often referred to as "coils." Client devices only respond to requests from the Host, which always initiates the conversation.

Overview

The SenzTx (Client) will write data to the Host registers (PC/Server) and read data from the Host registers (PC/Server).
A register address or register reference is always in the context of the client registers.

Coils

Coils are 1-bit registers and are used to control discrete outputs and may be read or written.
Discrete Inputs are 1-bit registers and are used as inputs and may only be read.
Input registers are 16-bit registers used for input and may only be read.

Registers

Registers are 16-bit registers used for input and may only be read.
Holding registers are the most universal 16-bit register, may be read or written, and may be used for a variety of things, including inputs, outputs, configuration data, or any requirement for "holding" data.

Specifications

General

Supported Protocol	Modbus-RTU
Supported Modbus Commands	0x03 Read Holding Registers 0x10 Write Multiple Registers 0x05 Write Single Coil 0x01 Read coils
Comms Interface	RS-485
Comms Mode	Half-Duplex
Valid Server ID Range	1 … 240 (Default 240)

Comms Settings

Baud rate	19200
Data bits	8
Parity	None
Flow control	None

Coils

Address	Description	R/W Type
0	Reset MCU	Write Only
2	Heater On/Off	Write Only
5	Restore Factory Defaults	Write Only
6	Save Config	Write Only
7	Set Cal High	Write Only
9	Set DAC FSD	Write Only
10	Simulate DAC	Write Only
11	Set Server ID	Write Only
12	Perform Live Reading	Write Only
15	Set Zero Offset	Write Only
51	Status: Heater On/Off	Read Only

Registers

Address	Variable Type	Description	R/W Type	Length	
				Registers	Bits
0	Float	Oxygen Concentration, %	Read Only	2	32
6	Float	Oxygen Offset, %	Read/Write	2	32
12	Float	DAC FSD*	Read/Write	2	32
18	Float	Cal Hi, %	Read/Write	2	32
61	Integer	Filter*	Read/Write	1	8
64	Integer	DAC Config	Read/Write	1	8
66	Integer	Server ID	Read/Write	1	8
90	Integer	ADC, Counts	Read Only	1	16
80	Integer	4 mA Setpoint	Read/Write	1	16

* Variable value depending on model and application.

Operation

Live Reading

NOTE: Coil 12 **must** be set prior to reading status information like oxygen concentration and status/error coils.
Typical Usage:

- Set coil 12 "Perform Live reading"
- Wait 100 mS
- Read status registers/coils:
    - register 0 "Oxygen concentration"
    - register 90 "ADC counts"
    - register 91 "Sensor voltage"
    - register 93 "Sensor uptime"
    - coils 32-52 (See Coils table)

Cal High

Typical Usage:

- Write Cal-Hi float variable to registers 18-19
- Set Cal High coil 7

Simulate DAC

Typical Usage:

- Set Simulate DAC coil 10

NOTE: The SenzTx (Client) will not respond to any communication requests while it is in the simulation cycle.

Set DAC FSD

Typical Usage:

- Write DAC FSD float variable to registers 12-13
- Set DAC FSD coil 9

Change Server/PC ID

Typical Usage:

- Write Server/PC ID integer variable to register 66
- Set Change Server/PC ID coil 11

NOTE: The power on, green LED indicates currently set Server/PC ID. For example, ID of 239 will flash two times, delay four times, delay nine times.

Reboot

Typical Usage:

- Set Reset MCU coil 0

Restore to Factory Defaults

Typical Usage:

- Set Restore to Factory Defaults coil 5

Save Config

This command/coil notifies the client (SenzTx) that the coil/register variable has changed.
The client (SenzTx) then stores a variable into non-volatile memory.
It must be used with the following variables to preserve value on the power cycle:

- Heater On/Off coil 2
- DAC config register 64
- Filter register 61
- Oxygen offset registers 6-7

Heater On/Off

Typical Usage:

- Set Heater On/Off coil 2 to true or false
- Set Save config coil 6

DAC Config

Typical Usage:

- Write DAC Config integer variable to register 64
- Set Save config coil 6

DAC Config integer variable may take one of the following values:

- 0: DAC Off
- 64: 0…20 mA
- 144: 0…10 V
- 128: 0…5 V

Filter

Typical Usage:

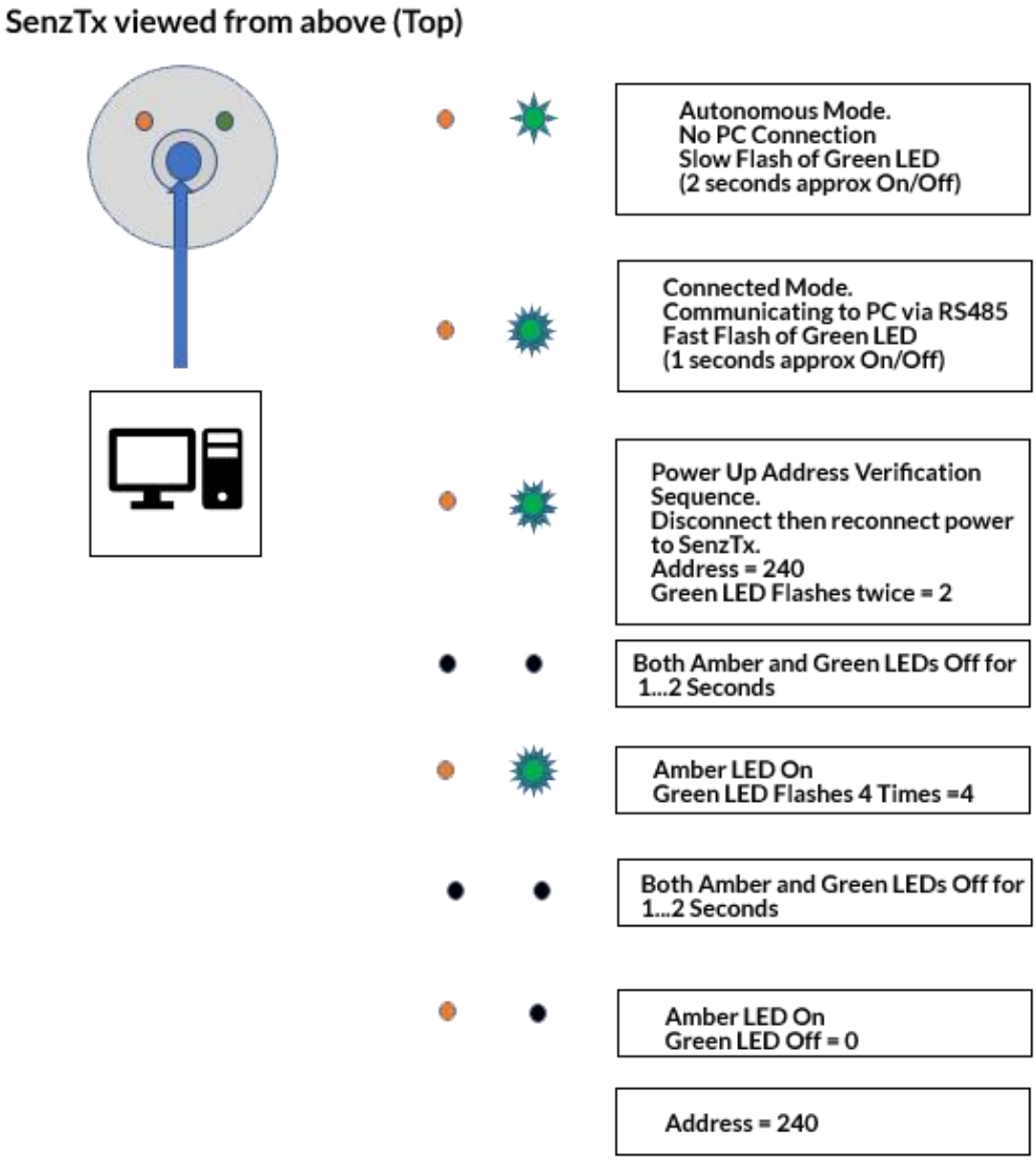
- Write Filter integer variable to register 61
- Set Save config coil 6

Zero Offset

Typical Usage:

- Write Oxygen Offset float variable to registers 6-7
- Set Zero Offset coil 15

LED Indications and Communications Address.



Appendix F Quality, Recycling & Warranty Information

The PST Oxygen group of companies, AII, Ntron, and SST, comply with applicable national and international standards and directives.

Full information can be found on our website at **O2 Compliance Documents (processsensing.com)**

The compliance site contains information on the following directives:

- ATEX (Equipment for explosive atmospheres)
- REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals)
- RoHS (Restriction of hazardous substances in electrical and electronic equipment)
- ETL (The ETL Mark is proof of product compliance to North American safety standards)
- WEEE (Waste electrical and electronic equipment recycling)
- Recycling Policy
- Warranty & Returns

www.ProcessSensing.com