Document Purpose

The purpose of this document is to present the performance specification of the intelligent iO2 oxygen gas sensor.

This document should be used in conjunction with the Product Safety Datasheet (PSDS 5). For guidance on the safe use of the sensor, please refer to the Communication Protocol (SDCS) and Sensor Mounting Application Note.

KEY FEATURES & BENEFITS

Digital interface
The sensor has a UART protocol to communicate with the instrument with chip select option as described in Communication Protocol (SDCS).

Interchangeable
All intelligent sensors have the same dimensions and communication protocol.

All sensors in the range will work with a supply voltage from 3.1 V to 3.3 V.

Digital traceability
Sensors contain the following data: serial number, manufacturing date, and gas type for quick and easy identification of the sensor.

OEM lock
Sensors have two levels of lock codes. The first one is an OEM specific code programmed in during manufacture and cannot be modified. This lock code is provided by the OEM. Instrument can check if the sensor has the unique code – if not the instrument can refuse the sensor. The second level of lock code is left blank and can be updated by OEM/Partners during sensor integration into the instrument as needed.

Pre-calibrated
Sensors will be calibrated during manufacturing and calibration data is written in the sensor. Sensor will output gas concentration when interrogated by instrument.

Predictive calibration
The recalibration alarm will be triggered when the countdown timer is reached.

End-of-life indication
The alarm will be flagged when the sensor has taken/lost a considerable amount of water (electrolyte concentration is above or below limits).

Fault indication
Intelligent sensors can detect several internal faults like drift/fault in reference electrode, electrolyte concentration out of range, counter electrode fault; therefore notifying the user to take corrective actions.

Designed to meet global performance standards

ATEX and IEC Ex Certified per EN IEC 60079-0 and EN IEC 60079-11
Designed to meet performance standards: BS EN 50104, ANSI / ISA 92.04.01 and AS/NZS 4641-2007

RoHS compliant   **5-year life**   **Compact form-fit**

TECHNICAL SPECIFICATIONS

MEASUREMENT

Operating Principle	Lead-free electrochemical
Target Gas	O_2
Range	0% to 25% vol. O_2 - The sensor can read up to 30% O_2
Accuracy† (over concentration range)	±3% vol. O_2
T90* Response Time (from air to N_2 (20.9%V/V)	<15 seconds, typ.
T50* Response Time (from air to N_2 (20.9%V/V)	<10 seconds at 20°C
Output	% O_2 (compensated for temperature)
R90 Recovery Time	<45 seconds (for -20°C to 60°C)
R95 Recovery Time	<60 seconds at 20°C
Measurement Interval	1 sample per second (1 Hz)
Resolution	0.1% O_2
Zero Current (Offset)	After 3 minutes N_2, <0.6% vol. O_2 equivalent Typically, <0.3% vol. O_2 equivalent
Repeatability*	±5% of measured value
Orientation Sensitivity	<0.2% vol. O_2 equivalent
Warm-up Time	Up to 60 minutes for accurate measurements (see iO2 characterisation note for details)
Serial Comunication	UART with Chip Select

ENVIRONMENTAL

Operating Temperature Range	-40°C to 60°C
Operating Humidity Range	5% RH to 95% RH (non-condensing)
Recommended Storage Temperature	0°C to 20°C in sealed container
Operating Pressure Range	600 mbar to 1200 mbar
Pressure Coefficient	<0.02% signal/mbar
Thermal Transient	Temp plunge 22°C to -20°C | -20°C to 22°C (No alarm is triggered) <19.5% vol. O_2, >23.5 % vol. O_2
Pressure Transient	60 cm H_2O step change <150% signal change
Flow Rate	Typical: 200 ml/min when using recommended gassing hood. (Consult iseries Sensor Mounting Application Note.)

LIFETIME

Long-Term Output Drift*	<5% signal life over operating life
Expected Operating Life	5 years in air

PHYSICAL CHARACTERISTICS

Weight	<6 g
Contact Material	Gold plated
O-Ring Material	FKM60 ±5 shore A
Outer Plastic Body Material	Modified PPO

* Specifications are valid at 20°C, 50% RH, and 1013 mbar using City Technology recommended circuitry. Performance characteristics outline the performance of sensors supplied within the first three months. Output signal can drift below the lower limit over time.

† For best accuracy, it is recommended that a 'baseline' calibration is performed in clean ambient air when a new sensor has been installed into the instrument.

Product Dimensions

20,0 (includes label)
10,0 ±0,2
10,0 ±0,2
Do not obscure
20,0 (includes label)
2
45°
Ø17,00
(19,76)

3,00 +0,10/-0,15
‡ (O-ring)
(10,3) (incl. top cover)
7,00 ±0,10
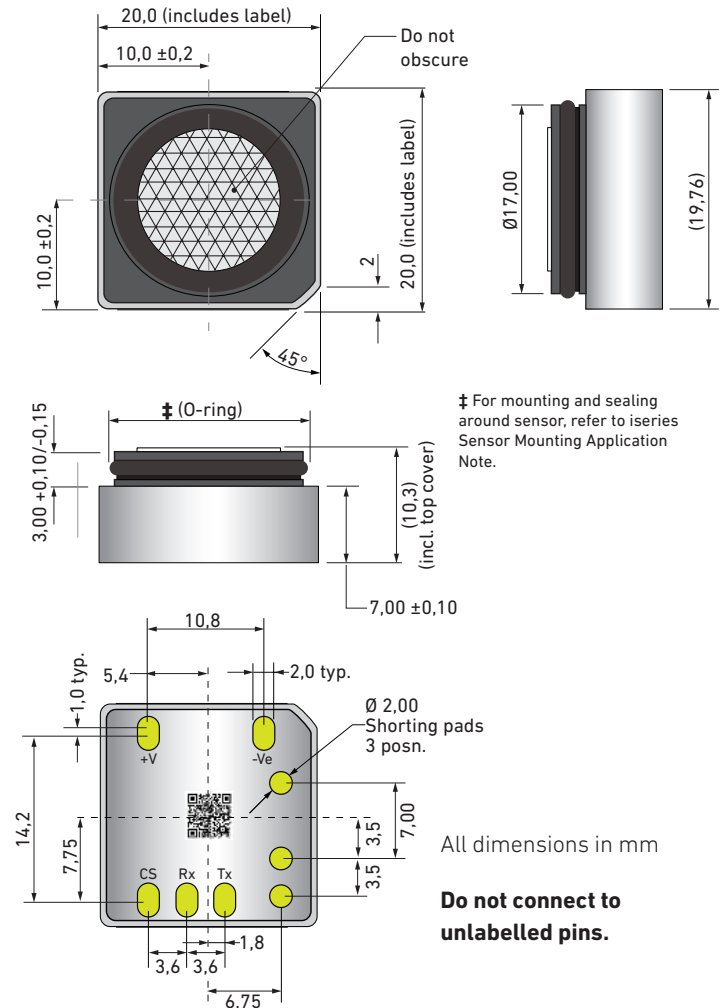
‡ For mounting and sealing around sensor, refer to iseries Sensor Mounting Application Note.

10,8
1,0 typ.
5,4
2,0 typ.
Ø 2,00 Shorting pads 3 posn.
+V
-Ve
14,2
7,75
7,00
3,5
3,5
CS   Rx   Tx
1,8
3,6   3,6
6,75

All dimensions in mm

Do not connect to unlabelled pins.

Electrical Specifications

	Min.	Max.	Typ.	Unit
Supply Voltage (Vdd)	3	3.6	3.3	Vdc
Voltage of any pin relative to ground	0	3.6	–	Vdc
Peak supply current (typ. volt)		25		mA
Current: at stand-by mode	–	–	140.08	µA
Current: at active mode	–	–	146.79	µA
Average power consumption	0.42	90	0.48	mW

For compatibility with the whole iseries range, the supply voltage should be between 3.1 V and 3.3 V.

Pinout

Pin	Description
+V	Positive power supply
-V	Ground
Rx	Data transmitted from instrument to sensor
Tx	Data transmitted from sensor to instrument
CS	Chip Select
Other Pads	Do not connect, shorting link contacts only

NOTE: Oxygen cells are shipped unbiased and unshorted. Shorting clip must not be applied to oxygen sensors.

iO$_2$ Parameters

iO$_2$ parameters	Default Values	Configurable Range	Customisable: Implemented by City Technology (Non-configurable through the communication protocol)	Configurable: The parameter can be changed through the communication protocol by users	Notes
OEM Lock — OEM code (First layer)	Password is customisable.* (**NoLock** will be set by default in case the OEM lock is not required)	No more than 6 characters (ASCII format)	✓		* OEM code will be set by City Technology during sensor manufacturing. Code to be provided by OEM
OEM Lock — Partner code (Second layer)	–	No more than 6 characters (ASCII format)		✓	Once this code has been set by user, it is not possible to change it.
User Factor	User factor 0: 100, User factor 1: 100, UF 2-3: Reserved, UF 4-9: Customisable —————— User factors can be added to include auto-compensation for using different membranes or instruments	10 allocated slots —————— 2 user factors are already implemented (no additional membrane and with recommended membrane), 2 are reserved and the remaining 6 can be customised	✓*	✓**	* User factor 0 and 1 programmed into the sensor during manufacturing. Additional User Factors can be added to the selectable list during the manufacturing process. This user factor has to be provided by the user. ** Users can select the desired user factor from the selectable list
Calibration — Zero (fresh air)	20.9% O$_2$			✓	Calibration is performed at two points throughout the operating range of the sensor. The calibration points are defined by the zero and span values. The zero value represent the response of the sensor in clean air (20.9 % O$_2$)
Calibration — Span	0% O$_2$			✗	Span is the calibration point that is done in the absence of oxygen (i.e. N$_2$)
Alarms — Low	19.5% O$_2$	Limit LOW lower: 0.5 / Limit LOW upper: 25		✓	Indicates a concentration level below clean air
Alarms — High	23.5% O$_2$	Limit HIGH lower: 0.5 / Limit HIGH upper: 25		✓	Indicates a concentration level above clean air
Predictive calibration — Countdown timer (Cal due days)	180 days			✓	The recalibration alarm will be triggered when the countdown timer is reached
End of Life — *The EoL alarm will be tiggered when the countdown or the future prediction conditions are met*					
End of Life — Future prediction algorithm				✗	The alarm is triggered when the sensor is too dry or too wet (electrolyte concentration is above or below limits)
End of Life — Countdown timer	1825 days			✗	The countdown timer is set for 1825 days, i.e. 5 years
Deadband — Active by default	✓			✓	With the deadband enabled the sensor will not read changes until the concentration reaches the deadband value. Is normally used to prevent measurement oscillations. The baseline of the deadband is 20.9 %O$_2$ (the reference is ambient air). This function can be configured to different limits
Deadband — Incoming	0.1% O$_2$	Whole measurement range		✓	Consult iseries appendix 1 (technical communication) section 4.2 for information about these parameters
Deadband — Outgoing	0.3% O$_2$	Incoming ≤ Outgoing		✓	
Bump Due Days	1 day			✓	A bump test is a brief exposure of the sensor to the target gas. The test has the objective of verifying that the sensor responds and the instrument acts accordingly. The sensor will tell the user when the bump interval has been exceeded

Intrinsic Safety	
Entity Parameters	Ui = 5.88 V, Ii = 1.1 A, Pi = 1.2 W, Ci = 13.14 uF, Li = 0 uH
Intrinsic Safety Rating	IIC T4, ia, 60°C
ATEX Marking	I M1 II 1G Ex ia I Ma Ex ia IIC Ga

Poisoning

Gas sensors are designed for operation in a wide range of environments and harsh conditions. However, it is important that exposure to high concentrations of solvent vapours is avoided, both during storage, fitting into instruments, and operation. When using sensors with printed circuit boards (PCBs), degreasing agents should be used before the sensor is fitted.

Do not glue directly on or near the sensor as the solvent may cause crazing of the plastic.

Under no circumstances should intelligent sensor pads be soldered to, as this can cause leakage of electrolyte. Connection should be made via a mounting socket and spring connector.

WARNING: SOLDERING TO PADS WILL RENDER YOUR WARRANTY VOID.

SAFETY NOTE

This sensor is designed to be used in safety-critical applications. To ensure that the sensor and/or instrument in which it is used, are operating properly, it is a requirement that the function of the device is confirmed by exposure to target gas (bump check) before each use of the sensor and/or instrument. Failure to carry out such tests may jeopardize the safety of people and property.

For more information
www.citytech.com

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