iNO M GAS SENSOR

002865
Issue 1

Nitric Oxide (NO) Intelligent Series Gas Sensor (iseries)

DOCUMENT PURPOSE

The purpose of this document is to present the performance specification of the Honeywell iNO nitric oxide 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.

PORTFOLIO

Compact, digital and intelligent gas sensors, iseries sensors are precalibrated, interchangeable and feature digital traceability. These sensors have a longer life and are designed to operate in many hazardous conditions.

1 YEAR WARRANTY
(12 months from date of shipment)

Nitric Oxide (NO)
Sensor: **iNO M**
Part Number: AF002-R00D

FEATURES AND BENEFITS

Digital interface – The sensor has a UART protocol to communicate with the instrument with chip select option as described in the 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

Pre-calibrated – Sensors will be calibrated during manufacturing .and calibration data is pre-loaded on the sensor. Sensor will output gas concentration when interrogated by instrument

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. If the lock code does not match, then the sensor can be rejected by the end-user's device. The second level of lock code is left blank and can be updated by OEM/ Partners during sensor integration into the instrument as needed

Predictive calibration*[1] – The sensors can typically alert when its accuracy levels diminish and a recalibration may be required.

End-of-life indication*[1] – The sensors can typically alert when its sensitivity levels have diminished to indicate the requirement of a potential sensor replacement.

Fault indication*[2] – The sensors can typically detect internal faults like drift/fault in reference electrode, electrolyte concentration out of range, counter electrode fault; therefore notifying the user to take corrective actions

Compact form factor

Three-year life

RoHS compliant

POTENTIAL USE

Inhaled Nitric Oxide Therapy

Notes

* [1] It is the responsibility of the end-user and the device manufacturer (i.e. the manufacturer of the device in which the sensor is incorporated) to determine when calibration and replacement is needed. The algorithms used do not necessarily detect all possible degradation and failure modes

* [2] The sensor's intelligent and fault indication features do not guarantee detection of all possible issues/faults.

Honeywell

INTELLIGENT SERIES M GAS SENSORS (iseries)
iNO M SERIES

TABLE 1. TECHNICAL SPECIFICATIONS	
MEASUREMENT	
Operating Principle	4 electrode electrochemical
Target Gas	NO
Range	0 to 100 ppm
Accuracy	± 20 % of actual ± 0.5 ppm (between 1 ppm and 20 ppm) ± 10 % of actual ± 0.5 ppm (above 20 ppm)
T90* Response Time	<30 seconds
Output	ppm output compensated for temperature
Overload (maximum concentration that can be reached before damaging the sensor)	150 ppm
Resolution	0.1 ppm
Measurement Interval	1 sample per second (1 Hz)
Orientation Sensitivity	None
Serial Comunication	UART with Chip Select
Maximum Start-up Time (suggested) (after 15 hours off power)	<60 minutes to meet accuracy specifications (longer off-power periods will extend the start-up)
ENVIRONMENTAL	
Operating Temp. Range	10°C to 45°C
Operating Humidity Range	Continuous: 20 %RH to 80 %RH Intermittent: 0 %RH to 99 %RH (non-condensing)†
Operating Pressure Range	Continuous: 800 mBar to 1200 mBar Intermittent: 600 mBar to 1200 mBar†
Recommended Storage Temperature	5°C to 20°C
Flow Rate	Typical: 125 ml/min when using recommended gassing hood. (Consult iseries Sensor Mounting Application Note)
LIFETIME	
Long-Term Output Drift	< 20% over three months when operated @ 20°C & 50 %RH *1 & *2
Expected Operating Life	3 years @ 35°C & 35 %RH from date of manufacture
PHYSICAL CHARACTERISTICS	
Weight	<6 g
Contact Material	Gold plated
O-Ring Material	FKM60 ±5 shore A
Outer Plastic Body Material	Modified PPO

*1 Based on performance data collected during design validation testing of the iNO sensors over continuous high temp/high humidity and high temp/low humidity operating conditions, (40°C @ 80 %RH, 40°C @ 20 %RH) with 50 ppm Nitric Oxide applied, it has been determined that the sensors show gas responses outside of the specified accuracy range after four weeks of exposure to these conditions. The initial drift can be corrected with a gas recalibration cycle at four weeks after which the sensors responses stabilize and the three month high gas recalibration interval is adequate to maintain accuracy

*2 Based on performance data collected during design validation testing of both the iNO and iNO2 sensors over continuous high temp /high humidity and high temp/low humidity operating conditions (40°C @ 80 %RH, 40°C @ 20 %RH), it has been determined that both sensor types experience baseline Offset shift outside of the specified accuracy range after four weeks. This shift is not permanent and can be corrected with a baseline (air blank) recalibration cycle at a minimum interval of four weeks

* Specifications are valid at 20°C, 50 %RH, and 1013 mBar using Honeywell recommended circuitry. Performance characteristics outline the performance of sensors supplied within the first three months

† Intermittent is defined as < 4 hours exposure

Product Dimensions

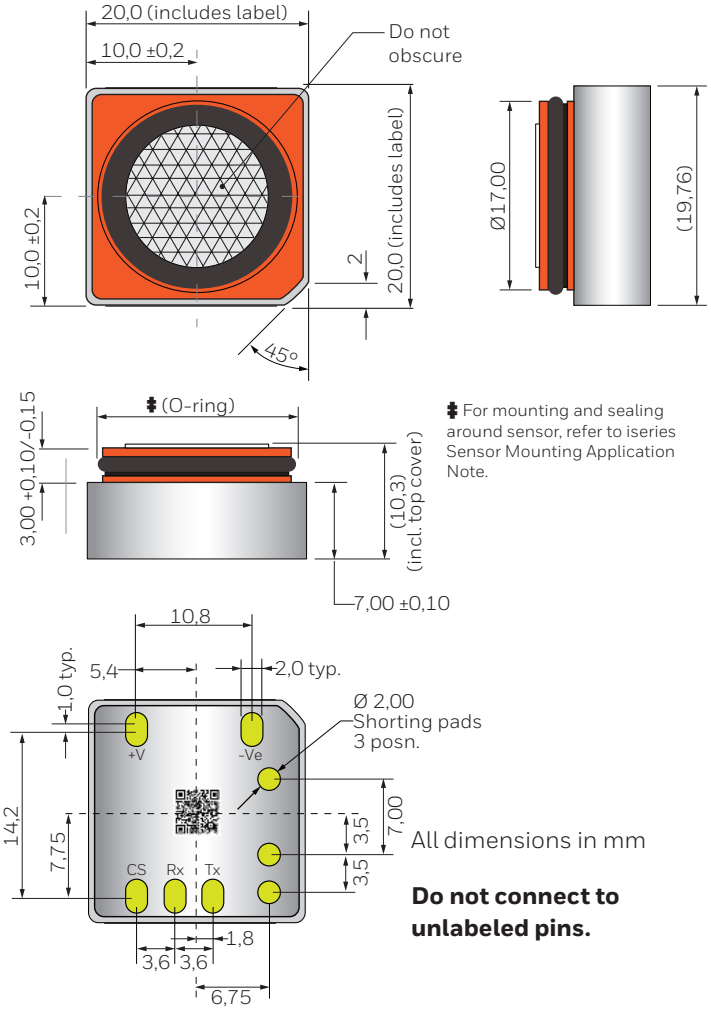

TABLE 2. ELECTRICAL SPECIFICATIONS				
	Min.	**Max.**	**Typ.**	**Unit**
Supply Voltage (Vdd)	3.1	3.6	3.3	Vdc
Voltage of any pin relative to ground	0	3.6	–	Vdc
Peak supply current (typ. volt)		25		mA
Current: at stand-by mode	11	15	13	µA
Current: at active mode	10	75	42.4	µA
Average power consumption	0.04	90	0.139	mW

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

TABLE 3. 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

INTELLIGENT SERIES M GAS SENSORS (iseries)
iNO M SERIES

TABLE 4. iNO M PARAMETERS

	iNO parameters	Default Values	Configurable Range	**Customisable:** Implemented by Honeywell (Non-configurable through the communication protocol)	**Configurable:** The parameter can be changed through the communication protocol by users	Notes
OEM Lock	OEM code (First level)	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 Honeywell during sensor manufacturing. Code to be provided by OEM
	Partner code (Second level)	–	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 UF 1-3: 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 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 (clean air)	0 ppm			×	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
	Span (target gas)	50 ppm for NO			✓	Span is the calibration point that is done in the presence of the target gas. The span concentration can be configured through the communication protocol
Predictive Calibration	***The recalibration alarm will be triggered when either the countdown or the accuracy threshold are reached (whichever is triggered first).***					
	Countdown timer (Cal due days)	90 days			✓	The alarm will be flagged when the countdown reaches 0. The countdown restarts when the sensor is calibrated
	Accuracy threshold	±20%	±10% to ±50%		✓	The predictive calibration estimation will depend on the accuracy of the sensor (this parameter can be configured by the user). The tighter the accuracy value, the more frequent calibration needed. The sensor will request a recalibration when the default accuracy (±20 % of measuring value) is reached
End of Life	***The EoL alarm will be triggered when either the countdown or the future prediction algorithm conditions are met***					
	Future prediction algorithm				×	The algorithm triggers an alarm when the sensitivity < 50 % of original sensitivity at minimum recent temperature
	Countdown timer	1095 days			×	The countdown timer is set for 1095 days, i.e. ~3 years from date of manufacture
Deadband	NOT active by default				✓	With the deadband enabled the sensor will read zero until the concentration exceeds the deadband value. Is normally used to prevent measurement oscillations. This function can be configured to different limits
	Incoming	5 ppm	Whole measurement range		✓	Incoming: As the reading decays down it will read zero once it has fallen below the incoming threshold
	Outgoing	5 ppm	Incoming ≤ Outgoing		✓	Outgoing: As the reading increases it will read zero until it exceeds the outgoing threshold

TABLE 5. INTRINSIC SAFETY CERTIFICATIONS	
Intrinsic Safety	
Entity Parameters	Ui = 5.88 V, Ii = 1.1 A, Pi = 1.2 W, Ci = 13.14 uF, Li = 0 uH

Poisoning

Gas Sensors are typically designed to be used 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.

Cross Sensitivity Table

Whilst iseries sensors are designed to be highly specific to the gas they are intended to measure, they will still respond to some degree to various other gases. The table below is not exclusive and other gases not included in the table may still cause a sensor to react.

IMPORTANT NOTE: The cross sensitivity data shown below does not form part of the product specification and is provided for awareness only. Values quoted are based on tests conducted on a small number of sensors and any batch may show significant variation. For the most accurate measurements, an instrument should be calibrated using the gas under investigation.

TABLE 6. CROSS-SENSITIVITY		
Gas	**Applied**	**Response (ppm)**
Nitrogen Dioxide (NO_2)	5 ppm	<1 ppm NO (equivalent)

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship during the applicable warranty period. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgment or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items that Honeywell, in its sole discretion, finds defective. **The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

While Honeywell may provide application assistance personally, through our literature and the Honeywell web site, it is buyer's sole responsibility to determine the suitability of the product in the application.

Specifications may change without notice. The information we supply is believed to be accurate as of this writing. However, Honeywell assumes no responsibility for its use.

⚠ WARNING
MISUSE OF DOCUMENTATION

- The information presented in this product sheet is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

Failure to comply with these instructions could result in death or serious injury.

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.

Under no circumstances should soldering be used to attach/install the sensors, as this can cause leakage of electrolytes. Connection should be made via a mounting socket and spring connector.

WARNING: SOLDERING TO PADS WILL RENDER YOUR WARRANTY VOID.

For more information

Honeywell Sensing & Safety Technologies services its customers through a worldwide network of sales offices and distributors. For application assistance, current specifications, pricing, or the nearest Authorized Distributor, visit sps.honeywell.com/ast or call:

USA/Canada	+302 613 4491
Latin America	+1 305 805 8188
Europe	+44 1344 238258
Japan	+81 (0) 3-6730-7152
Singapore	+65 6355 2828
Greater China	+86 4006396841

Honeywell Sensing & Safety Technologies
830 East Arapaho Road
Richardson, TX 75081
www.honeywell.com

ECN-00040945
002865-1-EN | 1 | 03/24

Honeywell